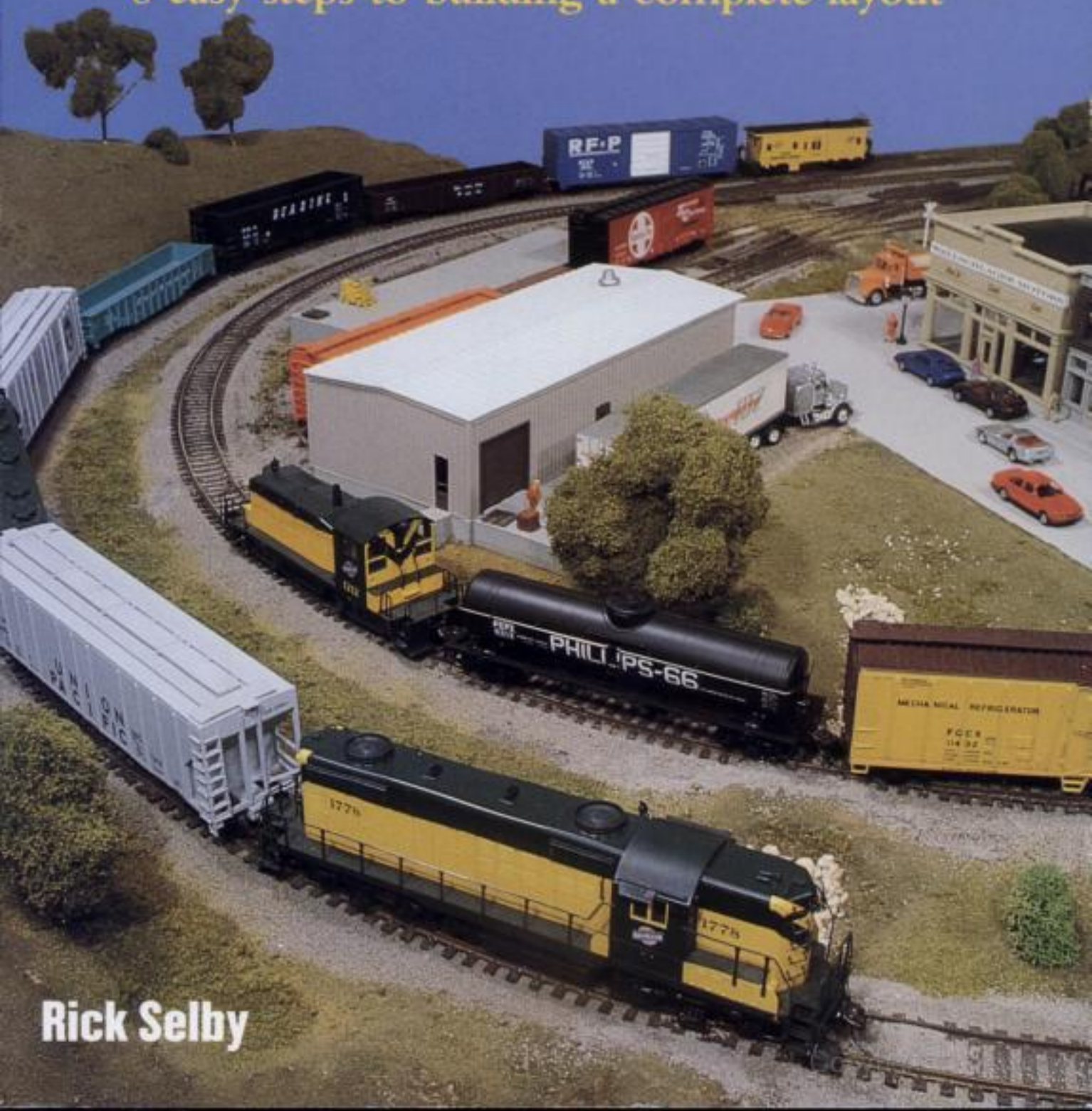


**Model
Railroader**
B O O K S

H0 Railroad from Set to Scenery

8 easy steps to building a complete layout



Rick Selby

HO Railroad From Set to Scenery

Rick Selby

KALMBACH  BOOKS

This One



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About the Author

Rick Selby has conducted *Model Railroader* Magazine's "Student Fare" column for nearly 6 years. As a teenager, Rick broadened his knowledge of model railroading by working in a San Jose, California, hobby shop. Now, as a columnist, he enthusiastically shares this knowledge with an audience of student-age, typically entry-level model railroaders. His ability to clarify some of the more confusing aspects of model railroading makes him an ideal author for this, his first Kalmbach book.

Having graduated from California State University, Chico, Rick now works as an instructional designer in Redmond, Washington. He is an NMRA member and has been an active model railroader for 20 years. With patience and understanding from his wife, Melissa, Rick also finds time to enjoy railfanning and photography.

Thank you to the owners and staff of Express Station Hobbies and The Inside Gateway for their help in completing this book.

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Contents

	Preface: Welcome to Model Railroading!	4
	Introduction: Getting Started in Model Railroading ..	5
	• Pre-Packaged Starter Sets • Assemble Your Own Starter Set • Working from a Track Plan	
STAGE 1	Starting the Layout	11
	• Building Benchwork • Laying Track • Basic Scenery	
STAGE 2	Beyond the Oval: Adding Spur Tracks and a Yard	26
	• Adding Turnouts • Hooking Up Electrical Wiring • Installing Kadee Couplers	
STAGE 3	Adding a Second Main Line for Two-Train Operation	38
	• Add an Elevated Outer Loop of Track • Wiring for Two-Train Operation • Ballasting Track	
STAGE 4	Building a Mountain and Tunnel	50
	• Add a Fascia Board around the Layout • Build a Mountain and Hills • Add a Tunnel	
STAGE 5	Building the Town of Callahan	61
	• Building Structure Kits • Constructing Streets • Adding Lighted Accessories	
STAGE 6	Get Your Feet Wet: Build a Creek	69
	• Building the Creek Bed • Modeling Water • Adding a Railroad Bridge	
STAGE 7	Adding On to the Callahan Central	76
	• Constructing More Benchwork • Using Flextrack • Adding More Scenery	
STAGE 8	Build a Better Control Panel	88
	• Design an Easy-to-Use Panel • Wiring Block Control Switches • Operating the Control Panel	
	Index	96



Many model railroaders look forward to building their own model railroad layout. Although running trains is enjoyable, the act of building can also provide hours upon hours of enjoyment for those who participate.

PREFACE

Welcome to Model Railroading!

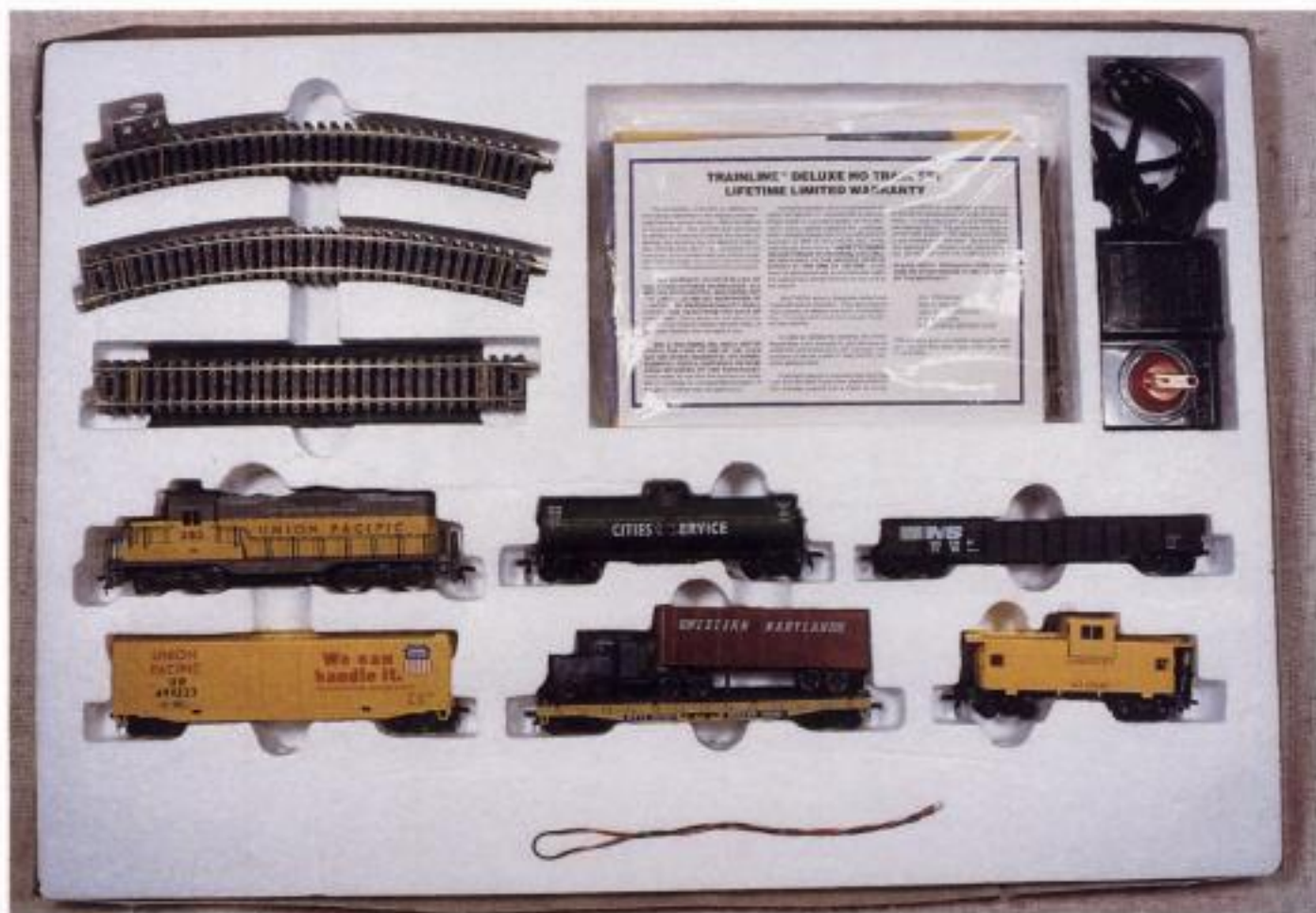
There are many activities to enjoy in the hobby of model railroading, but perhaps the most popular is constructing your own model railroad layout. While running trains can be plenty of fun, building a layout will provide hours of enjoyment. Unfortunately, beginners often lack the skills needed to build a complete layout. As a result, it can take many long, frustrating hours before the trains are up and running.

However, by assembling a layout in stages, you can slowly build your model railroad and enjoy operating the trains in as little as a few days or weeks. As explained in this book, the first stage begins with a train set, some lumber, and a few basic tools. No prior modeling experience is required, as the level of construction and explanation is aimed at beginning modelers. The book progresses in stages, each one building on the other.

Whenever you're ready to build, simply proceed to the next stage.

When you have progressed through the book and the last stage is complete, you'll have a full-featured model railroad and the knowledge, skills, and confidence needed to tackle more complex projects. They'll provide years of enjoyment and satisfaction.

Come along and start building your own HO model railroad from Set to Scenery. . . .



Prepackaged train sets come in many different shapes, sizes, and prices. This set is offered as part of Walther's Trainline Series. Most sets include everything you need to get started, including

track, power pack, locomotive, and cars. While this is a high-quality starter set, other prepackaged starter sets may not be as well made.

INTRODUCTION

Getting Started in Model Railroading

IF YOU'RE LIKE MOST beginning model railroaders, your first experience in the hobby will probably come from a train set. Nearly all model railroaders can remember the significance of their first train set. Regardless of how and when they received that first set, it marked their entrance into the hobby of model railroading, a hobby that offers so much opportunity for growth and enjoyment.

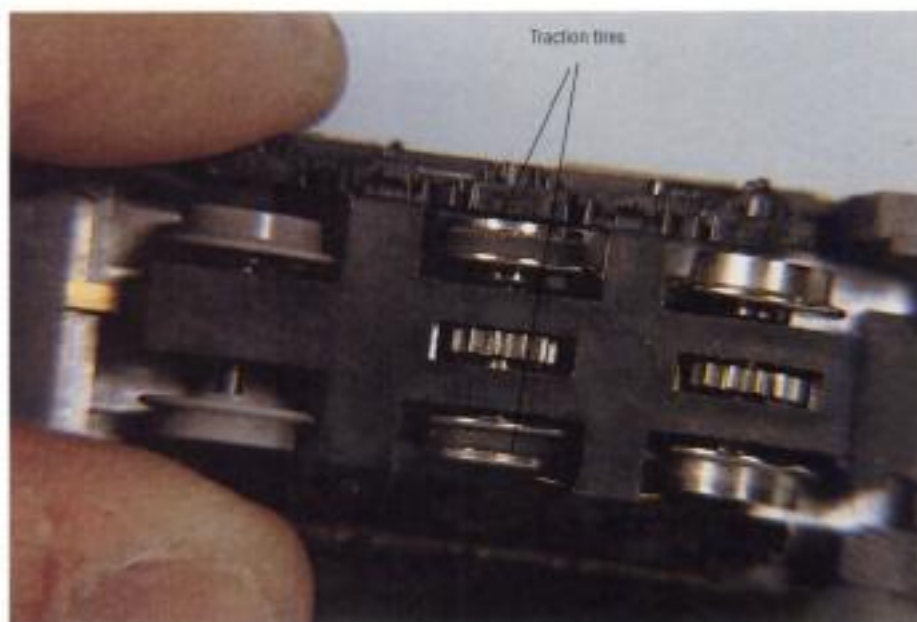
If you're shopping for your first train set, you may find it difficult to determine which is the best one to buy. There are a lot of confusing choices to make. This chapter will cover some of the features to look for, as well as some of the pitfalls to avoid, when you make that first purchase.

Perhaps you've already purchased your first train set and have begun operating it. You are now ready for the next step. Information in this chapter

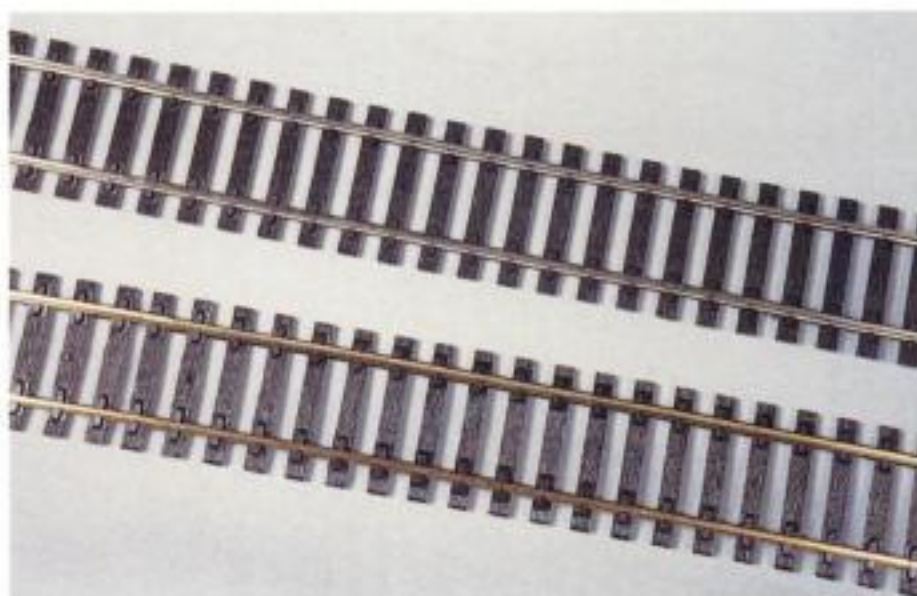
will help when you're ready to expand or upgrade your power pack, locomotive, and rolling stock collection.

Prepackaged Train Sets

When shopping for a train set, it's likely you'll come across the prepackaged sets sold in many toy and discount stores. Many beginners choose these sets because they include everything needed to get trains operating. Often



Traction tires are one of those items that beginners typically think are beneficial; but in reality they can cause operational problems. Their thickness often varies from one part of the wheel to the other, causing erratic and wobbly operation. What's more, the rubber prevents the wheelset from collecting electricity from the track.



Beginners can use two different types of track when starting out in model railroading—nickel-silver and brass. The nickel-silver track, shown at the top, is the better choice. As metals are exposed to air, they form an oxidation layer on the surface. The oxidation formed by nickel-silver conducts electricity, while that formed by brass does not. What all this means is that nickel-silver track will require far less cleaning than brass track.

these sets are priced attractively and are appealing because of their low cost.

While many prepackaged sets provide an inexpensive way into the hobby, some can be a source of frustration. As a consequence of their low price, prepackaged sets almost always have some inherent substandard

elements. Some of these can be easy to overcome, others will only be discouraging—and for the beginning model railroader, discouragement is definitely something to avoid.

Locomotives are the first element to consider. The drive mechanisms in starter set locomotives are often of lesser

quality than those found in separate-sale locomotives. While most train set locomotives operate satisfactorily when new, their inexpensive parts may not be very reliable or durable.

Consider selecting a set that contains a diesel locomotive. As a general rule, inexpensive steam locomotives don't run as well as inexpensive diesel locomotives. This may be bad news for steam enthusiasts, but once again, unreliable equipment can lead to discouragement.

Choose a set that has a locomotive without traction tires. Many manufacturers no longer put traction tires on their locomotives, but there are still some on the market. Traction tires may sound like a good idea, but they can cause problems. Often they are not of equal thickness around the wheel and can cause the locomotive to run erratically or derail. Besides, few locomotives need traction tires to pull a half-dozen cars around a small model railroad.

Look for a set that contains track made of nickel-silver rail instead of brass rail. It's easy to determine which material the track is made from. Brass track is gold in color and the nickel-silver track is—you guessed it—silver. The biggest benefit is that nickel-silver track stays clean longer, thereby providing more reliable operation with less track cleaning.

The power packs in starter sets are almost always rated lower than those available for separate sale. Often, the power output of these transformers is just barely adequate to run the train. These packs can easily overload when accessories are connected. What's more, comfortable controls and features are often eliminated. Most even do without a basic ON/OFF switch, requiring the user to pull the plug to shut the transformer off.

Bridges and trestle sets can also be bad news. These items are attractive features, but they sometimes cause operational headaches. Some of the bridge and trestle sets that come with train sets are poorly designed and are unstable when assembled. They also tend not to hold the track in alignment very well, which can lead to derailments.

The most important factor in buying a train set is the store where you make your purchase. Although starter sets are available at a variety of stores, the best place to purchase one is from your reputable neighborhood hobby dealer. You may save a few dollars making your purchase elsewhere, but if you have any problems or need advice down the road, the hobby dealer will be there to help. Think of the extra cost as insurance towards enjoyment of your new set.

A Better Alternative— Construct Your Own Starter Set

There is an alternative to pre-packaged sets for those who want to purchase high quality equipment. Most hobby shops can help you piece together individual items to build your first set. With some careful selection, the quality of these items will be superior to those available in a

pre-packaged set without much additional cost. This will be money well spent; after all, who doesn't like to have the best?

The locomotive is the first item to consider when piecing together a starter set. Several manufacturers offer good-quality locomotives for reasonable prices. Some of these manufacturers include Athearn, Bachmann Spectrum, Life-Like's PROTO 2000 Series, Walthers, and Kato, who sometimes manufactures locomotives for Atlas and Stewart Hobbies.

Whichever brand you choose, there are some important features to look for. First, make sure all the unit's wheels are geared to the motor. Second, check to see that all wheels pick up electrical power from the track. This makes the engine less sensitive to dirty rails. Finally, choose one that is capable of negotiating sharp-radius curves. Your local hobby dealer can help you select a locomotive that meets all these requirements.

Of course, a locomotive is not a train unless it has rolling stock (cars) in tow. Several companies offer good-quality, affordable car kits. Yes, most good-quality freight and passenger cars come in kit form.

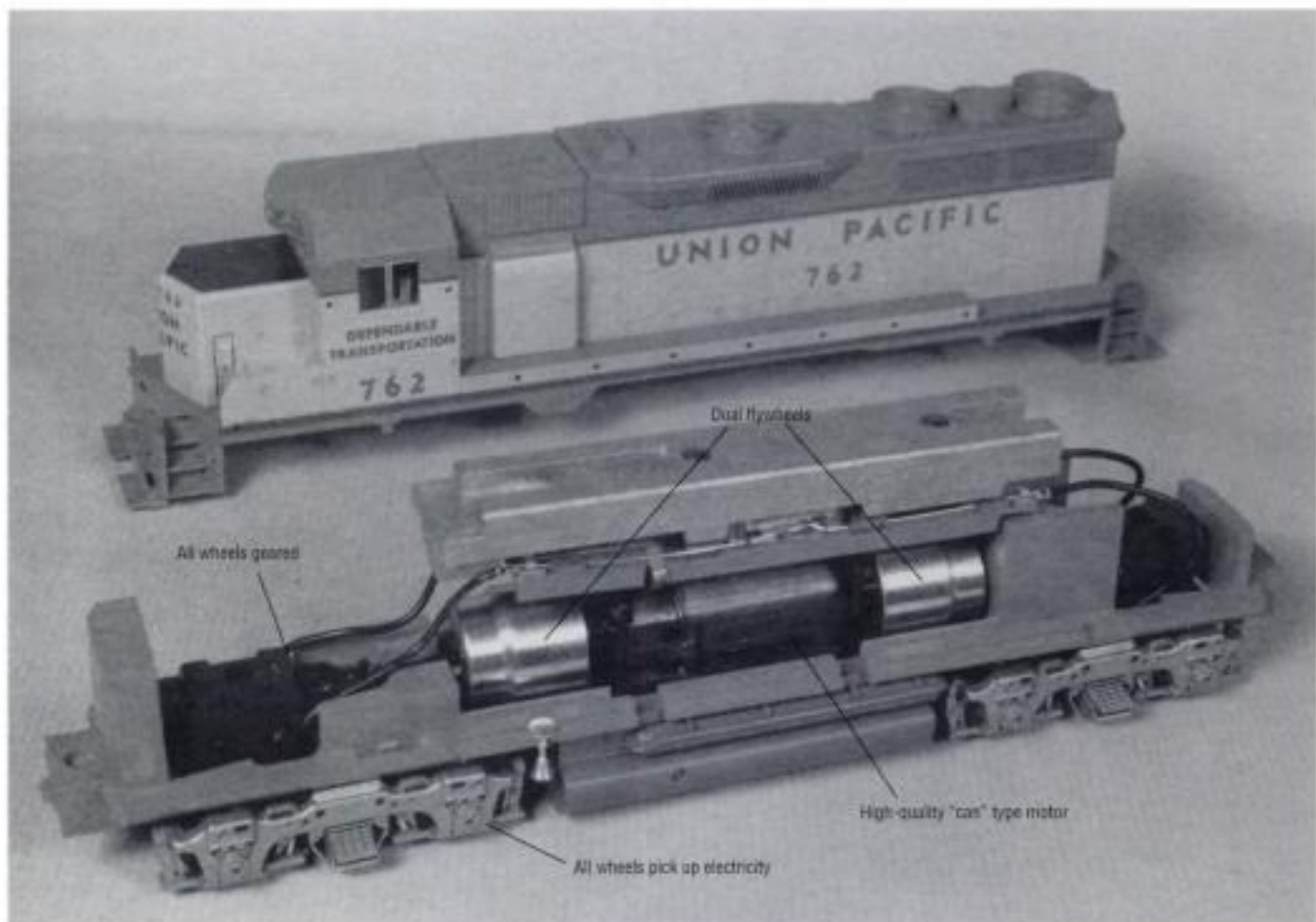
No need to fear, though, as Athearn, Model Die Casting (Roundhouse), Walthers, and others offer a wide variety of freight car kits that are easy to assemble.

These kits normally take anywhere from 5 to 30 minutes to assemble. Simple tools are all that is usually required to put everything together. Again, your hobby dealer can show you kits that are on your skill level.

Track is also an important piece of the starter set puzzle. There are several choices here. The long-time "standard" in beginner-level track components comes from Atlas. Atlas offers a wide range of different track pieces constructed with both brass and nickel-silver rail. Again, the nickel-silver track is preferred because it



A variety of well-made locomotives are available from different manufacturers and will provide years of operation. Shown clockwise from bottom right: Kato GP35, Walthers SW1, Life Like Proto-2000 GP18, and an Athearn F7.



What makes a good-quality locomotive? Here's a peek under the hood of a Kato GP35. This unit has a smooth-running, high-quality motor with flywheels that powers all the wheels. All the wheels pick

up electricity too, which makes the unit less sensitive to dirty track. Also note the heavy cast-metal frame for better electrical contact and pulling power.



Good-quality freight cars almost always come in kit form. This Athearn 50-foot double-door boxcar kit is typical of many HO freight car kits.

requires less cleaning. For a starter set, a simple oval of track is enough to begin with. When the time comes to expand your layout, Atlas track is easy to find; most hobby shops regularly stock it. Atlas track is used for most of the Callahan Central layout in this book.

The last crucial piece of the starter set is the power pack. There are several models and manufacturers to choose from. Model Rectifier Corporation is a long-time manufacturer of hobby power packs. They offer several power packs geared specifically for beginners. These units typically supply enough power to run the train and some accessories; they also offer basic features like an easy-to-use speed control and a master ON/OFF switch.

Aside from quality, one of the nice things about assembling your own starter set is that you get to select the

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locomotive and freight cars that appeal to you. You can also pick the accessories, such as buildings and scenery items.

This freedom of choice is one of the strongest arguments for assembling your own set for many new modelers—you don't have to settle for any items that may not be exactly what you want.

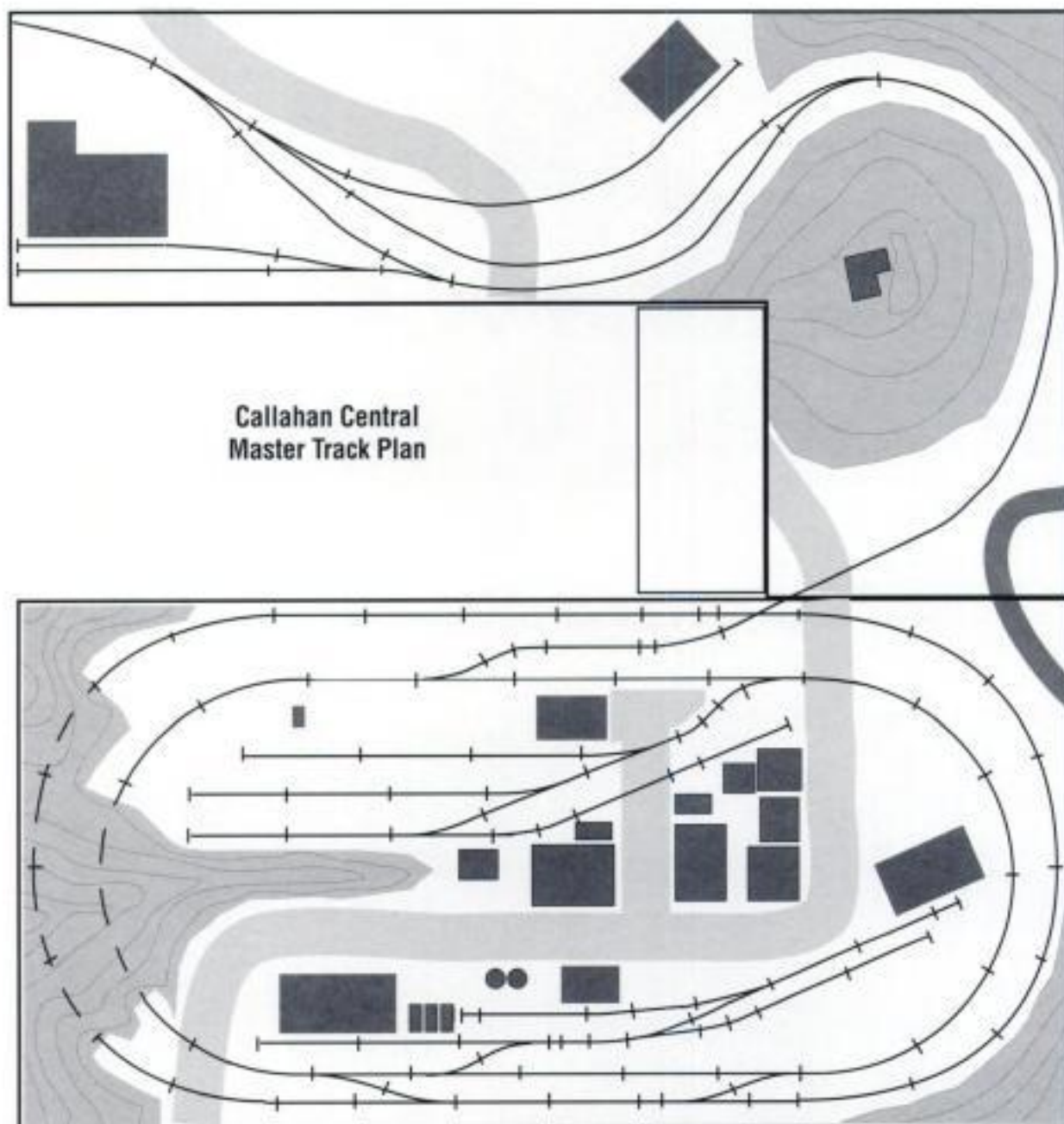
Remember, whether you buy a train set as a unit or choose it piece by piece, one of the best decisions you can make is to purchase your starter set equipment from a full-service hobby dealer. Your hobby dealer will become a valuable resource and friend as you progress through the stages of this book. The best move beginners can make is to find a hobby shop they feel comfortable with and use it as their source for model railroad equipment and advice.



Assembling car kits is not difficult—most can be completed in five minutes to half an hour. Glue, a hobby knife, a small screwdriver, and a file set are all that's usually needed to assemble freight car kits.



Here's a Model Die Casting (Roundhouse) hopper car kit. This car has a cast-metal underframe for added weight. Most cars of the same type are available painted for several different railroads.



**Callahan Central
Master Track Plan**

The Next Step—Building a Permanent Layout

Now that you've chosen your new train set, you need somewhere to set it up. The kitchen floor or an old Ping-pong table can work for the short term, but the next step is to build a permanent layout for your new model railroad.

That's precisely what's covered in the remainder of this book. Because building a model railroad is more than a one-weekend project, this book has been divided into stages that equal roughly a month's worth of work. Of

course, the time you have available will vary, so some stages may take you more time or less time to complete.

The track plan shown above is the master track plan for the Callahan Central. If you build your layout as described in the remainder of the chapters, it will resemble the one shown. Each stage includes a track plan listing the track components and other materials needed.

It's a good idea to stick with the plan unless you feel comfortable modifying it. Of course, you can make changes in the track plan or any other

part of the layout if you desire. After all, you're building this layout for yourself, and you may prefer to arrange things differently.

For now, maybe you just want to play with your starter set temporarily assembled on a floor or table. That's perfectly fine. The main objective of this hobby is to have fun! The time will soon come when you have the urge to build something more permanent. When you're ready for something more, turn the page and begin the experience of building your model railroad layout.



With a train set and some materials you can build a model railroad in about a month or two. While the finished layout is a lot of fun, it also makes a great foundation to build and expand upon later. In this chapter you'll find the information you need to make the construction easy.

STAGE

1

Starting the Layout

THERE IS A BIG DIFFERENCE between a toy train set and a model railroad. A train set assembled temporarily on the kitchen floor may be fun for a while, but it is not a model railroad. It takes one important ingredient—creativity—for a toy train set to be transformed into a model railroad. Your creativity, coupled with model railroad products and additional raw materials, are the prerequisites for building your own model railroad.

This chapter will show you how to combine creativity and your train set to build a model railroad. The first version of the Callahan Central layout is designed with the beginner in mind.

The layout is designed to occupy a 4 x 8-foot space, an ideal size for the beginner. This stage of the CC is designed to be completed in about a month and to provide beginning model railroaders with some almost-instant gratification for their efforts.

Most of the tools you need to build the Callahan Central can be found in almost any household. However, there are a few additional tools that you may want to purchase. A hobby knife is useful for a variety of modeling tasks and should be in every modeler's toolbox. You'll also want to purchase at least four C-clamps to provide you with some extra "hands" while assembling the benchwork. The rest of the tools

you'll need are listed in the table Tools Needed for Stage 1.

The track plan for Stage 1 of the layout appears in Figure 1 (page 13). From this plan you can see exactly how many and what type of track components you'll need. If you eventually plan to build the Callahan Central according to the Master Track Plan, follow the dimensions exactly. This will make it easy to install additional track components later on. Let's get started!

Build a Solid Train Table

A solid, well-built table is the literal foundation of any good model railroad. It's important to have a table that won't

BILL OF MATERIALS: STAGE 1

Train Table

Lumber:

1" x 2" x 8'	7
1" x 4" x 8'	7
2" x 2" x 8'	2
½" x 4" x 8' plywood sheet	1

Hardware:

1½" drywall screw	approx. 100
1" drywall screw	approx. 75
¼" x 2½" bolt	8
¼" x 2" bolt	8
¼" washer	32
¼" nut	16
¼" x 1" bolt	4
¼" T-nut	4

Miscellaneous:

white glue	1 bottle
rubber cement	1 bottle

Track and Roadbed

Roadbed:

cork, Midwest #3013 or equivalent	6 pieces
-----------------------------------	----------

Track:

Atlas Nickel-Silver Snap Track	
833 18" radius curve	12 (2 packages)
821 9" straight	10 (2 packages)
2540 track nails	1 package
170 rail joiners	1 package
842 terminal rail joiners	1 pair

Power Pack:

MRC Tech II 1400 or equivalent	1
--------------------------------	---

Miscellaneous:

spade lug connectors, 18–22 gauge	1 pair
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Scenery Materials

Ground Covering:

Woodland Scenics	1 bag
41 soil, fine	1 bag
42 earth, fine	1 bag
44 burnt grass, fine	1 bag
45 green grass, fine	1 bag
48 flowers	1 bag
49 green blend	1 bag
50 earth blend	1 bag
63 light green, coarse	1 bag
64 medium green, coarse	1 bag

Trees and Shrubs:

Woodland Scenics	
163 med. green lichen	1
1102 deciduous tree kit	1

Miscellaneous:

Atlas	
775 telephone poles	2

sag or sway under the weight of your HO scale empire. All too many model railroaders have created a masterpiece, only to see it sag and crumble several years later because of poor table construction. Time and money spent on a well-constructed table (commonly called "benchwork") will pay off for years to come.

The Callahan Central benchwork is based on the proven "L-girder" design shown in Figure 2. L-girder benchwork is very strong when completed, and the table shape and configuration can be built to fit almost any space. Because the pieces of lumber that go into this type of benchwork don't have to be precisely cut, construction is easy for modelers of all skill levels.

Start construction on the table by building two of the L-girder assemblies shown in Figure 3. Apply a bead of white glue along the edge of the 8-foot 1 x 4, then attach the 1 x 2. Use 1½" drywall screws, one about every 12" or so, to fasten the two pieces together. Pine lumber is fairly soft, so drill pilot holes to prevent the screws from splitting the wood. Let these two L-girder assemblies dry for about an hour while you move on to the next step.

Next, build two of the leg and cross-brace assemblies shown in Figure 4. First, cut four 2 x 2 legs. I built the Callahan Central at a tabletop height of 40". If you are building this layout for

TOOLS NEEDED for Stage 1

Power saw
Saber saw
Power screwdriver
Power drill
Hammer
Nail set
Socket wrench set
Box wrench set
Pliers
Flathead screwdriver
Wire strippers
C-clamps
Hobby knife
Carpenter's square
Marking pen
Level

**Fig. 1: Stage 1
Track Plan,
4 x 8 Sheet
of
Plywood**

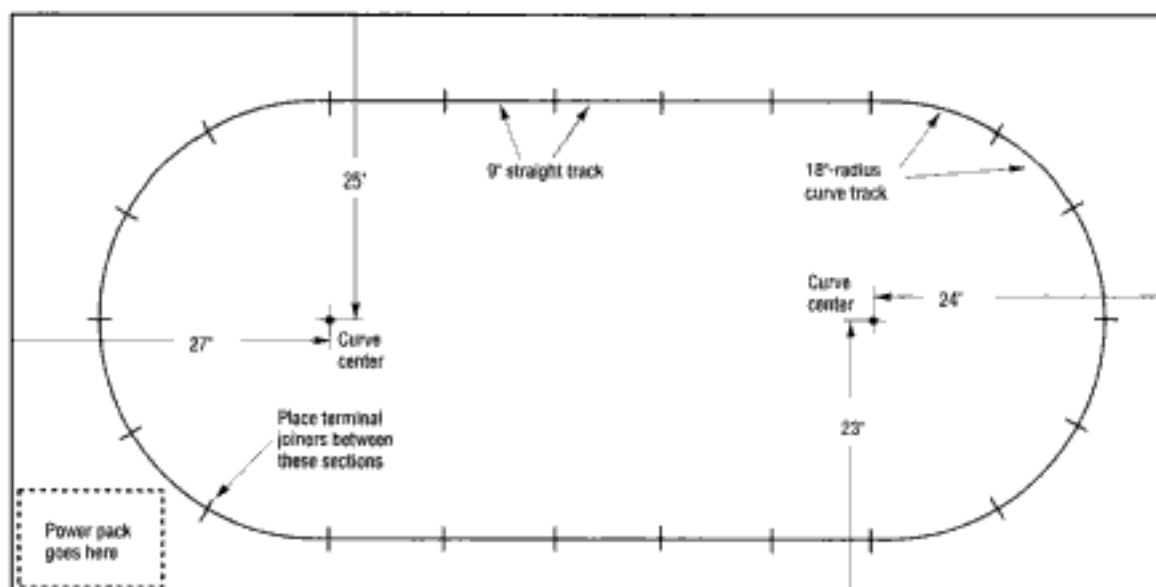
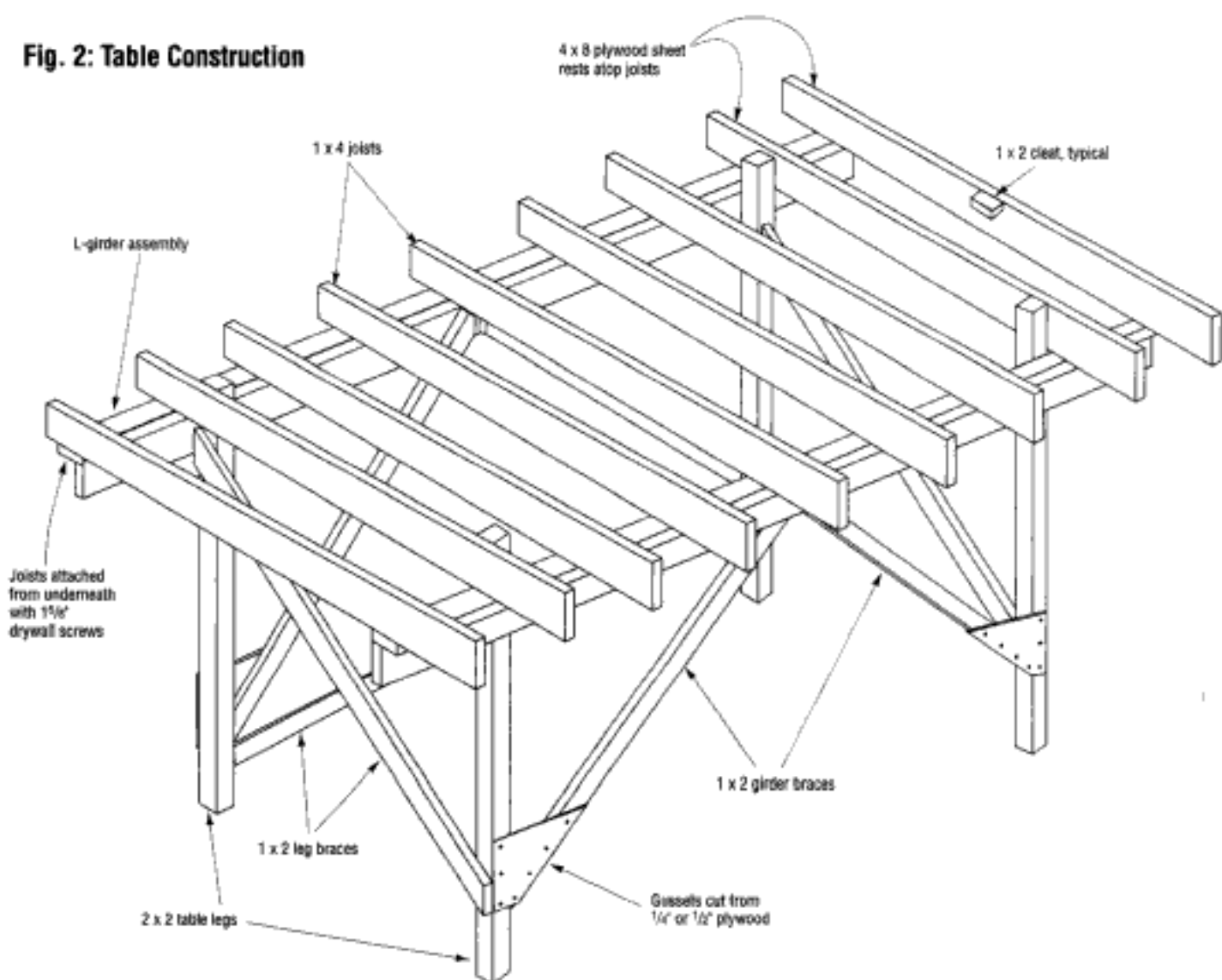
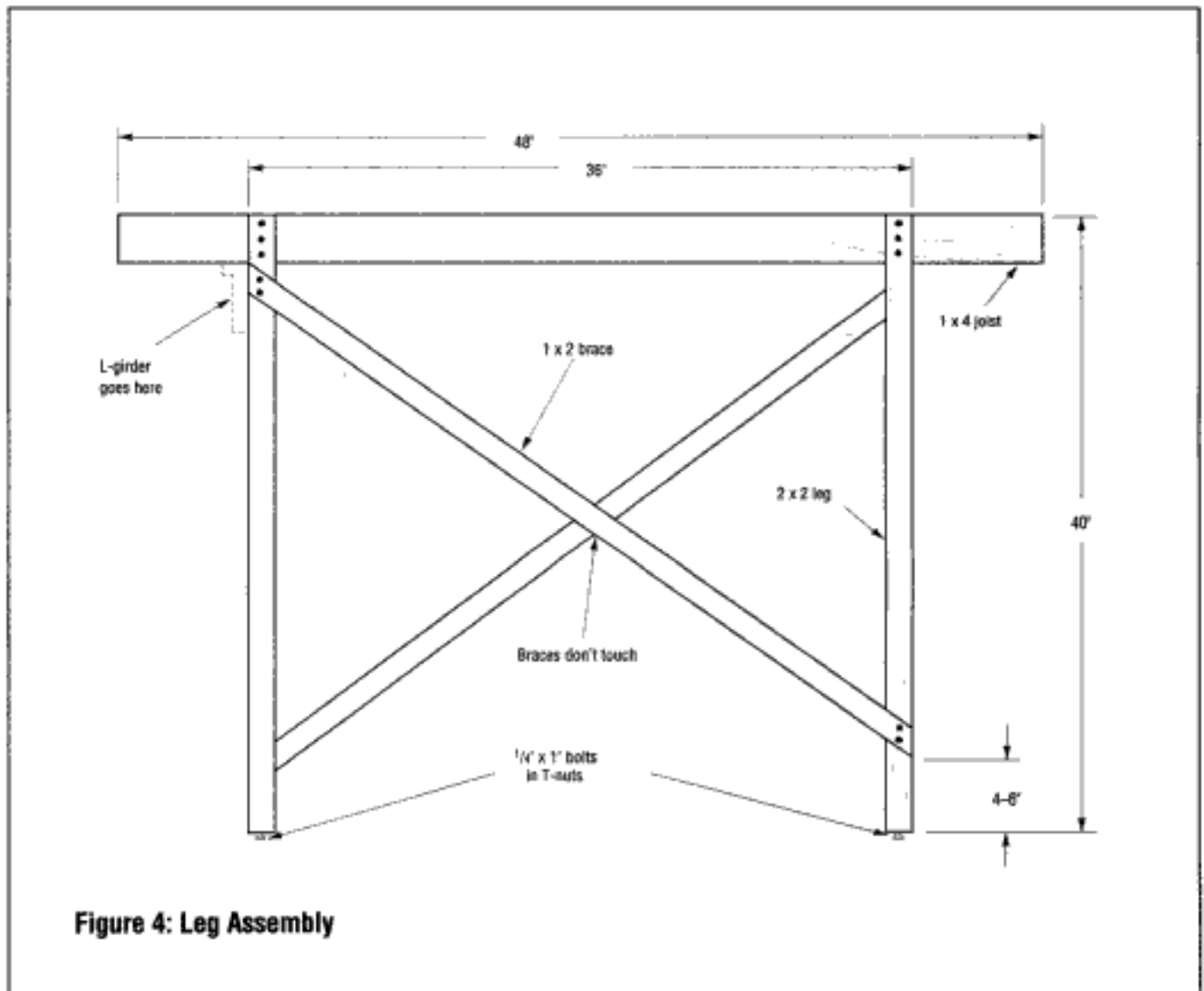
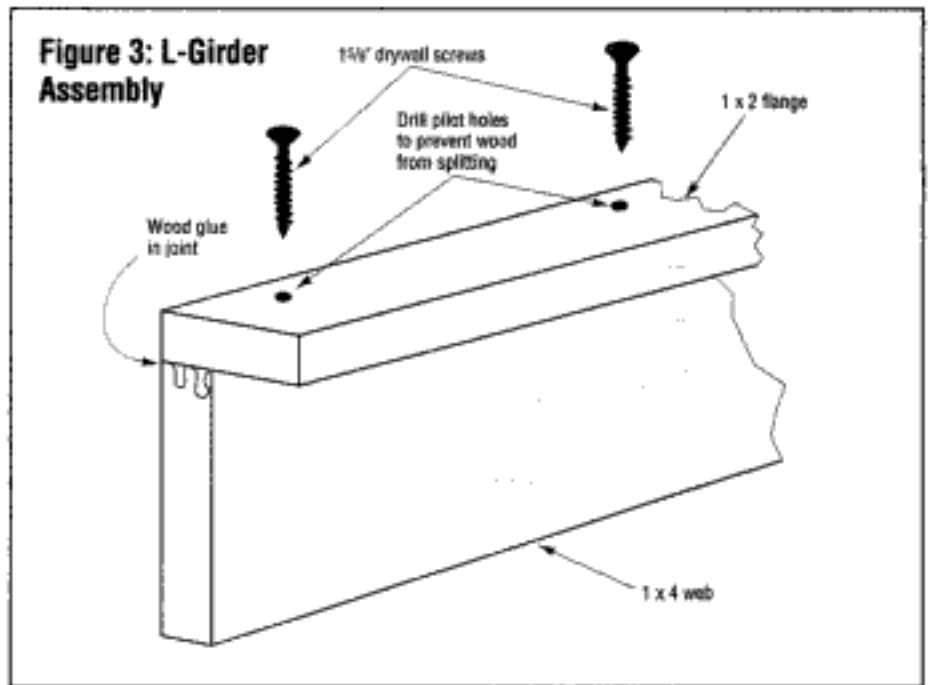


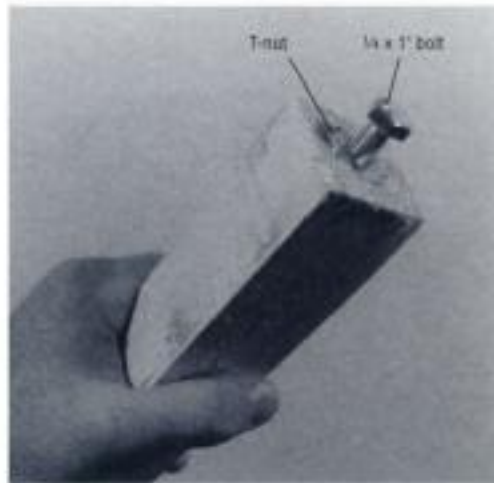
Fig. 2: Table Construction



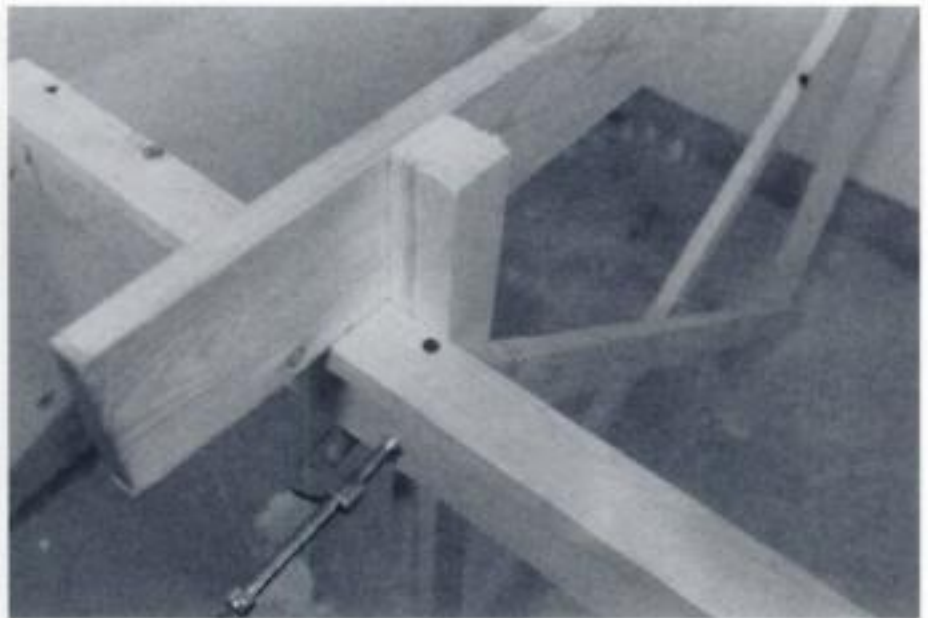
or with children, you may want to build it a little lower so they have a better view of the action. You can easily change the layout height by cutting the legs to a different length. Once you have cut the legs, drill holes in the center of the bottom end of each leg and insert a T-nut. Then thread a 1/4 x 1" bolt into the T-nut. These makeshift "feet" will allow you to level the layout to compensate for the uneven floors typically found in basements and garages.

Next, attach the 2 x 2 legs to the 1 x 4 joist. Make sure the tops of the legs are flush with the top of the joist. Using a carpenter's square, adjust the legs to a 90-degree angle to the joist, then attach them using three drywall screws per joint. These screws are only temporarily installed to hold the joist to the leg assembly. Do not glue these joints! If





ABOVE: Installing feet on the bottom of the legs allows you to level the layout. Insert a T-nut in a hole drilled in the bottom of the leg. Pound it in place with a hammer, then thread a bolt into it. Use a level and a box wrench to adjust the layout when the table is complete.



The L-girder fits under the joist on the L-girder assembly. C-clamps are indispensable when it comes to assembling benchwork.

you do, the legs will not be removable when the table is complete (more about this later). Finish the leg assemblies by adding the 1 x 2 cross braces as shown. Note that these braces do not touch each other where they cross.

Now on to the final assembly. Measure and mark 12" in from both ends of each L-girder. Using your C-clamps and some help from a friend, place the L-girder in position under the joist on each leg assembly, then clamp them together. The joists should be positioned just inside the 12" marks you made on top of the L-girders.

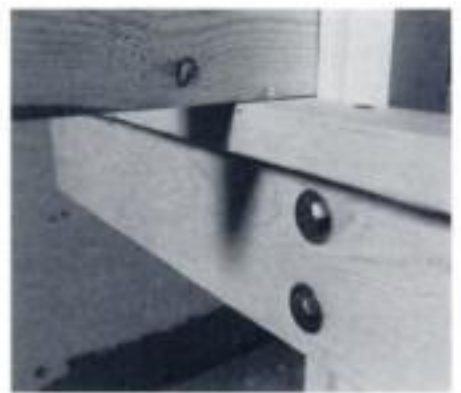
When all four corners are clamped in place, square the legs and drill two $\frac{3}{32}$ " holes through each leg and joist. Insert two $\frac{1}{4}$ x $2\frac{1}{2}$ " bolts with washers on each leg, then fasten everything together with $\frac{1}{4}$ " nuts. Do this for all four legs, then fasten everything tight.

When the legs are secure, attach the girder braces. One end of the brace should be positioned near the bottom of the legs, and the other near the middle of the L-girder. Cut four pieces of 1 x 2 to the proper length, test them to make sure they fit, then clamp them in place. Cut four brace gussets with your saber saw from $\frac{1}{4}$ " or $\frac{1}{2}$ " plywood. Attach the gussets to the legs and braces as shown in Figure 5 using 1" drywall screws. Where each brace joins the L-girder, drill two holes and insert two $\frac{1}{4}$ x 2" bolts and washers.

Fasten the brace to the L-girder with a nut and washer at the rear.

Now you can attach the remaining 1 x 4 joists. On the CC I placed a joist every 12". The exact placement of these pieces is not critical. Cut the remaining seven joists and attach them to the L-girders as shown in Figure 6. Drive drywall screws up through the L-girder flange to secure them in place. Be sure to fasten the leg joists to the L-girders in the same way.

When you're done, remove the drywall screws you used earlier to fasten the leg joists to the legs. The $\frac{1}{4}$ " bolts now secure the legs to the layout.



Attach the L-girder to the leg assembly with two $\frac{1}{4}$ x $2\frac{1}{2}$ " bolts per leg. Use a washer on each side. The legs are easy to remove from the layout after unfastening the bolts.

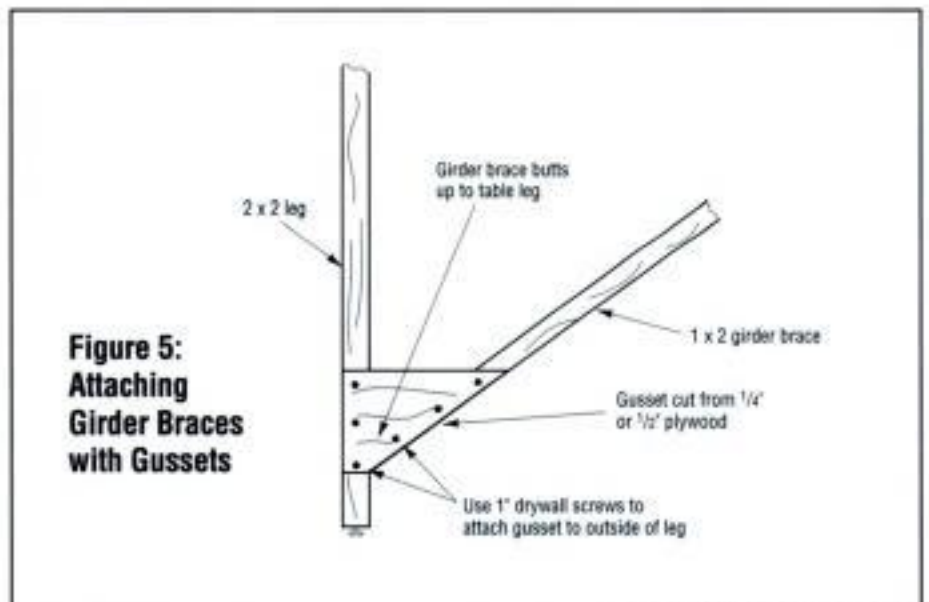
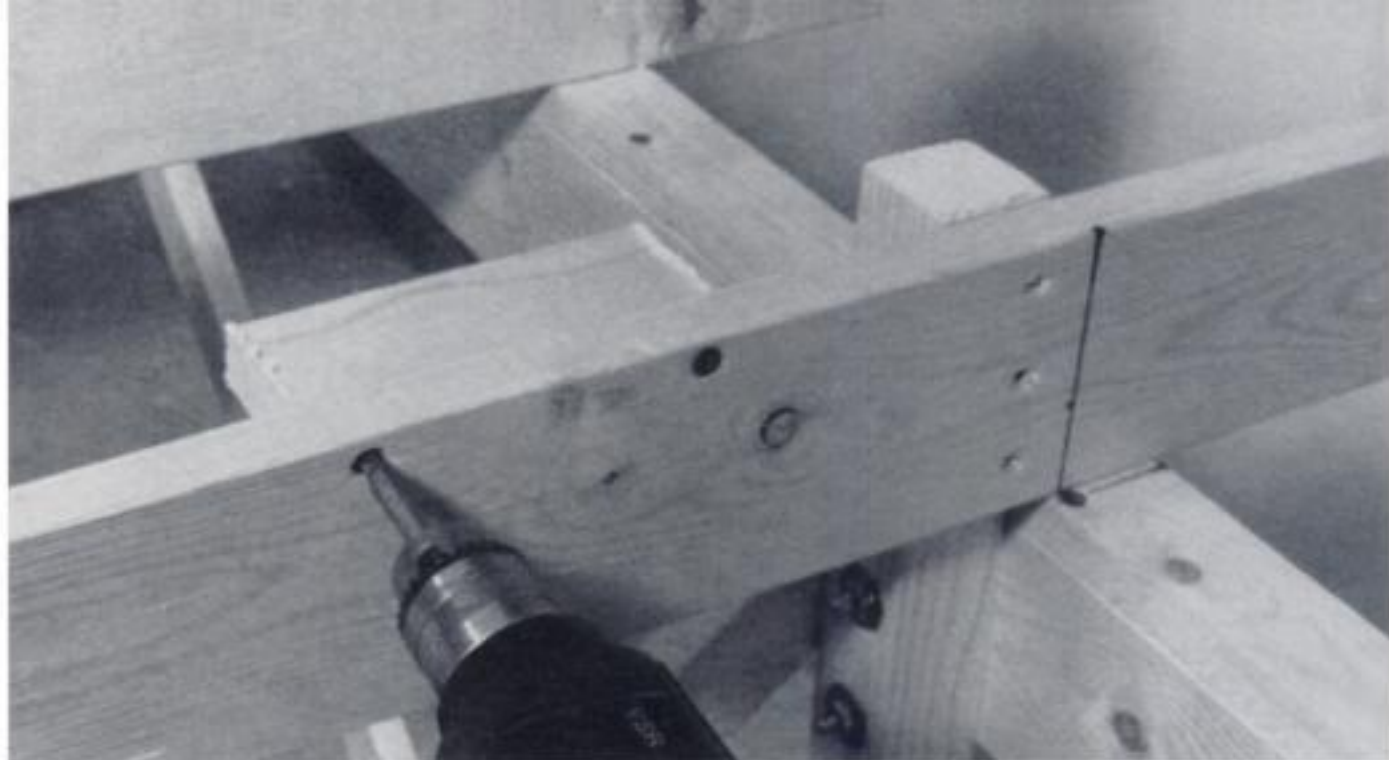
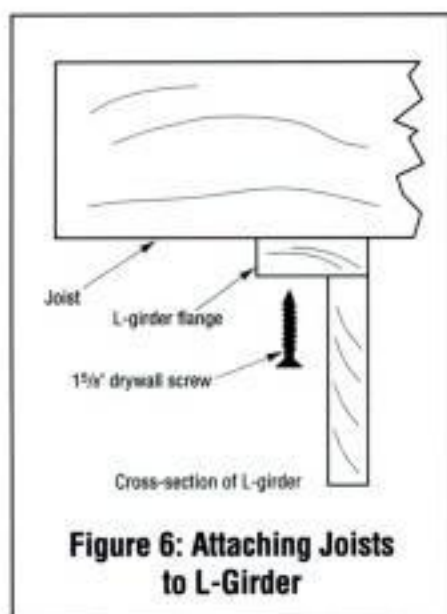


Figure 5:
Attaching
Girder Braces
with Gussets

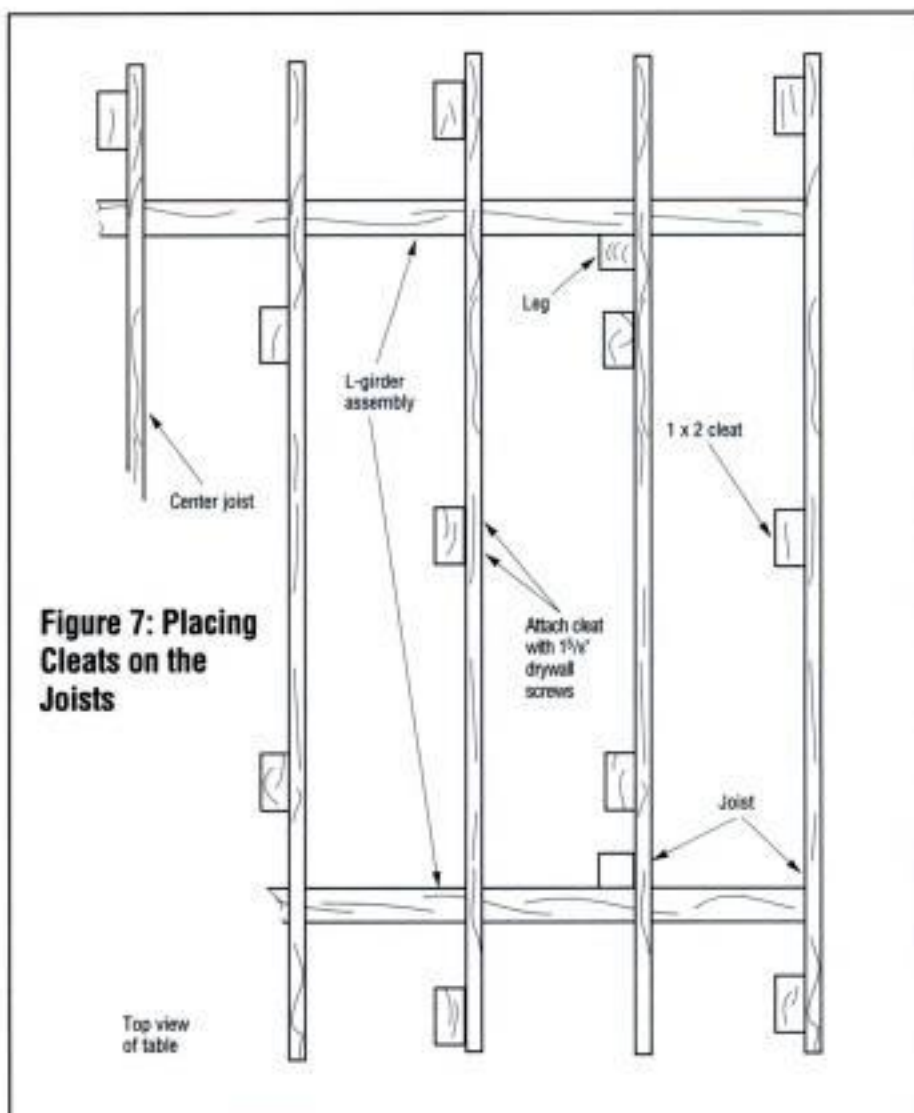


Cleats attached to the joists hold the screws that secure the plywood tabletop. Be sure to keep the cleats flush with the top of the joists.



Using bolts to attach the legs and braces to the L-girders makes it easy to remove the leg assemblies from the layout for moving or storage. When the legs are removed, the layout fits through a standard-sized doorway, perfect if you plan to put the layout in a spare bedroom.

With the main framework done, it's time to attach the plywood tabletop. First, cut 23 3" lengths of 1 x 2. These cleats will hold the screws that will be used to fasten the plywood in place. Fasten the cleats to the L-girders as



shown in Figure 7, using the 1 $\frac{5}{8}$ " dry-wall screws. Exact placement of these cleats is not critical; the only important thing is that you place them around the layout evenly so that the sheet of plywood will lie flat without warping or forming humps.

When you have the cleats in place, set the sheet of plywood on top of the table assembly. Line up all the corners and clamp the plywood in place. If everything was cut carefully, the corners of the plywood should match up with the ends of the outermost joists. If a corner does not line up, you can adjust the placement of the joists.

Using 1" drywall screws, fasten the plywood to the table by driving the screws up from the bottom through the 1 x 2 cleats. Again, drill pilot holes to prevent the wood from splitting. Inserting the screws from the bottom will allow you to get to them easily if you want to make any changes later. It also prevents having dozens of unsightly screwheads scattered around your tabletop.

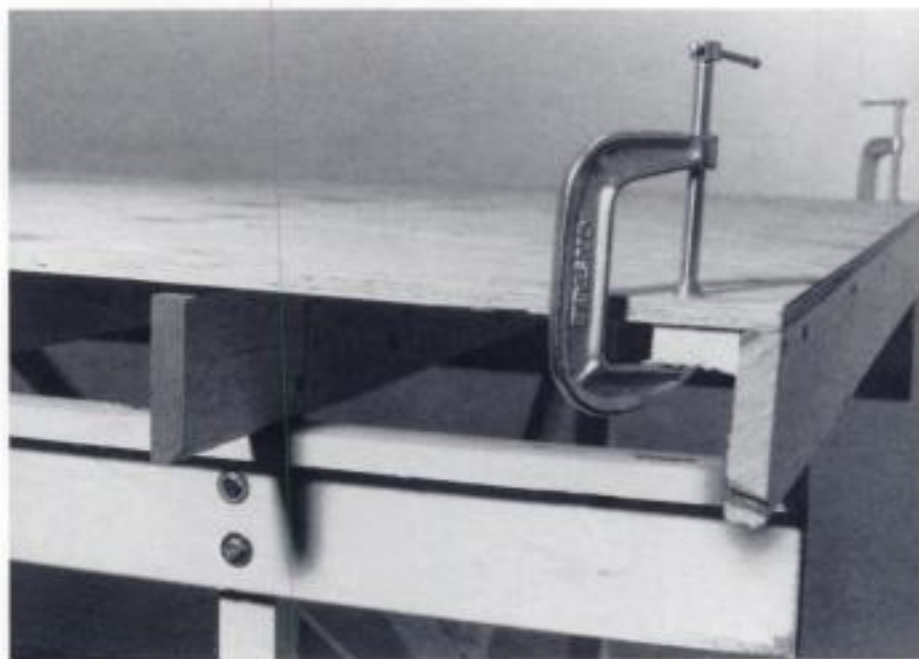
Well, there you have it—a train table that is strong enough to dance on. But instead of dancing, let's start laying some track!

Laying Track

The track plan in Figure 1 shows the track arrangement for Stage 1 of the Callahan Central. If you plan to build the layout according to the Master Track Plan, arrange the track exactly as shown to allow easy installation of additional track components later on.

I used the Atlas brand of sectional track for the CC. Atlas track has long been a standard choice for beginners. It offers good quality at affordable prices and can be purchased at almost any hobby shop. The track components needed for Stage 1 are shown in the Bill of Materials. If you use a different brand of track, be aware that the dimensions of the pieces may not match those shown on the track plan. This may require some extra fitting or trimming of track components later on.

Before laying the track, you need to draw the track center line around the layout. Drawing a center line allows you to place the track in exact locations



LEFT: Use C-clamps to secure the plywood tabletop to the layout while fastening it from below with the drywall screws. The corners of the plywood sheet should line up with the edges of the joists at the ends of the table. BELOW LEFT: The small pieces of pine used for the cleats split easily, so be sure to drill pilot holes for the screws. BELOW RIGHT: A power screwdriver helps greatly to speed up benchwork assembly, although a good ol' screwdriver and a little elbow grease work just as well.



on the tabletop. It also provides a guide to help you lay the track straight. To draw the curve center lines, make a radius template from a scrap of 1 x 2, as shown in Figure 8. This makeshift compass allows you to draw the center lines of the 18"-radius curves accurately. Start by locating the center of the curves on both ends of the layout. Draw the curve center lines as shown

and then connect them with straight lines, using a long straightedge.

Now lay the cork roadbed. This step is optional, but using cork does have advantages. It provides a realistic raised roadbed for the track to run on, and it helps deaden some of the sound and vibrations caused by running trains. If you decide to use cork, you will need six 3-foot strips.

Start laying the cork by placing a bead of glue along the track center line. Spread the glue evenly with your finger or a scrap piece of cork. Separate the cork strips as shown, and arrange the pieces so that the square edges butt up against each other. Then lay the cork strip along the center line. Carefully bend the cork strips around the curves. Use track nails or tacks to hold them in place while the glue dries.

When laying cork, stagger the joints between the sections to avoid the

formation of kinks in the curved portions of the roadbed. Lay the cork around the entire layout, then cut two short filler pieces as needed to finish the loop. Let the cork dry for about an hour, then remove the tacks.

Once the cork is in place, you are ready to lay track. Since Atlas track sections come without installed rail joiners, the first thing you must do is install the joiners—a simple job. Just cut them apart with a pair of wire cutters and slip them onto the ends of the

rails. Do this to all the track pieces needed for Stage 1 of the layout. You'll also need to install an Atlas terminal rail joiner on one end of two curved track pieces. The wires on these terminal joiners will be used later to connect the track to the power pack.

Next, assemble the track into several two- or three-piece sections. After assembling the subsections, join them and test-fit them on the layout. When you have fastened the track pieces together tightly, the track should lie in place, centered over the seam in the middle of the cork roadbed. Use care when assembling and handling the track because the rail joiners are easy to damage.

Next, start nailing the track sections in place. Begin by nailing down the straight sections of track on one side of the layout. Using a small hammer, drive the nails only partway down to the level of the ties. This makes it easier to remove nails if you have to realign a section or two of track.

As you go, fasten all the track sections together tightly and make sure they are in proper alignment. Also check to see that all the rails on the track sections are properly inserted into the rail joiners. Any kinks or irregularities between the sections are a potential source of derailments. Look down each rail in both the straight and curved portions of the layout. Take the time to check and double-check all the track joints as you go. Remember, the time you spend laying track now will more than pay for itself later in smooth operation.

When you come to the curved track sections with the terminal rail joiners, drill a $\frac{3}{32}$ " hole through the tabletop adjacent to each joiner. Carefully bend the wire stems on the joiners to a 90-degree angle, then feed the wires down through the table. Join the track sections together, then gently lay them on the cork, inserting the two wire stems into the holes. Nail the sections in place, then continue on to the rest of the track.

When you have made it all the way around and the track is in proper alignment, use a nail set or a spare bolt to drive the nails down the rest of the way. Drive the nails until they are just

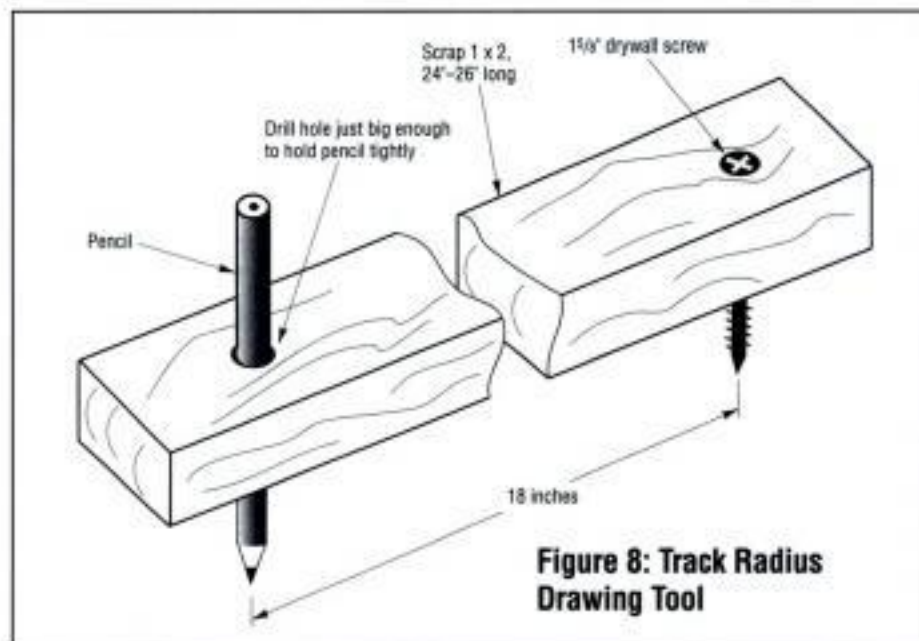
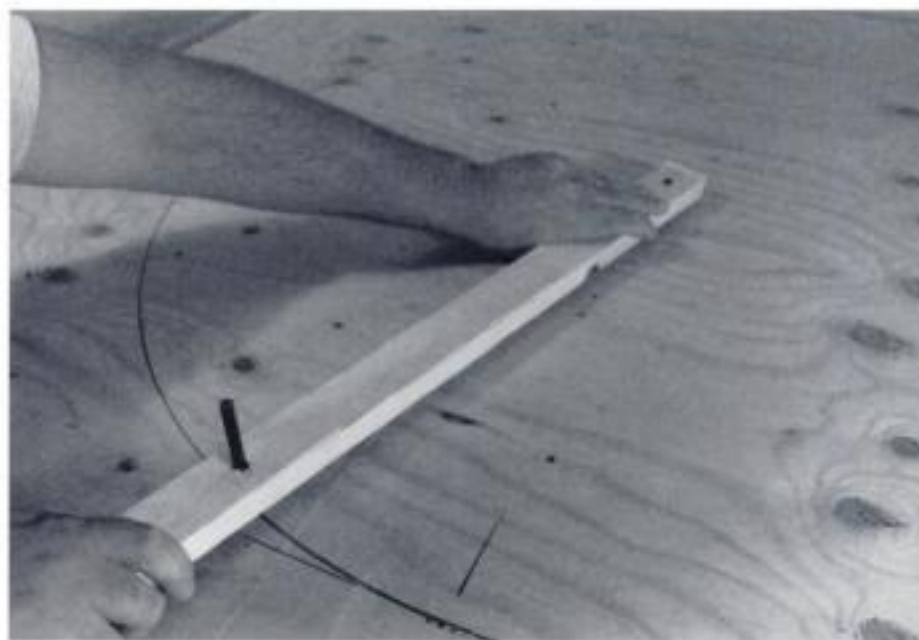


Figure 8: Track Radius Drawing Tool



Drawing the track center line in curves is especially helpful for laying track accurately. A scrap piece of 1 x 2 works well as a radius tool. Locate the centers of the two curves and you can easily lay down a center line for all the track on the layout.



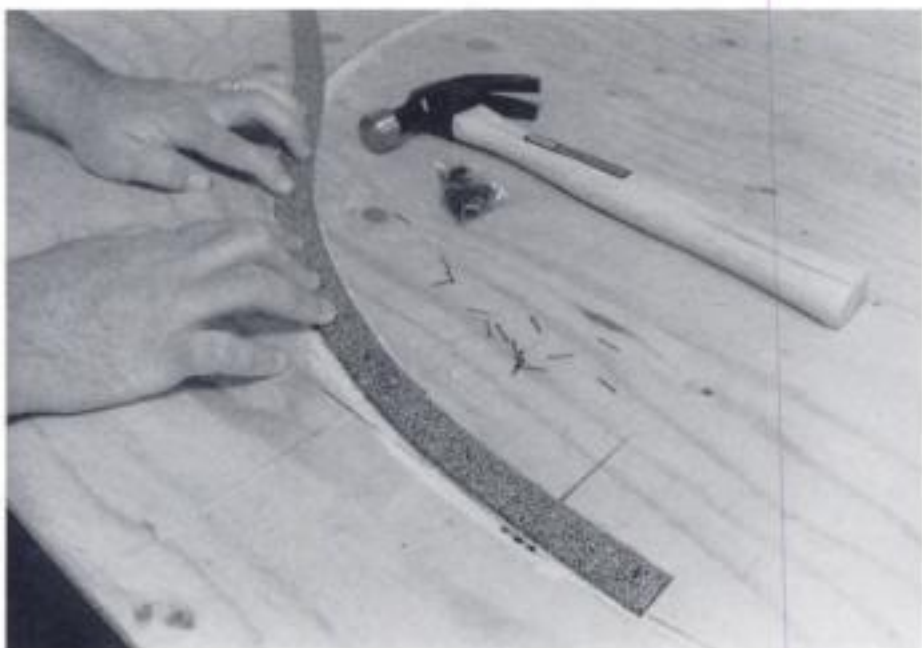
Use white glue to fix the cork in place. A bead of glue along the track center line is more than enough to hold everything in place.



Spread the white glue along the track center line. A scrap piece of cork works well for this purpose.



The cork comes from the manufacturer as one piece with a beveled cut down the middle. Separate the two halves, then flip one half around so that the square edges butt up against each other along the track center line.



The cork strips can be easily bent around curves. Place the square edge of the cork strip along the track center line.



Use track nails to hold the cork in place while the glue dries. To help prevent uneven joints, stagger the joints in the cork strips as you progress.

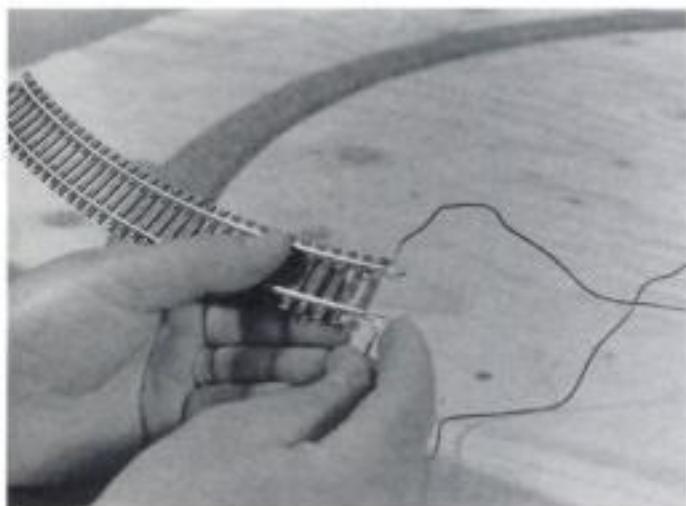
touching the surface of the plastic ties. Be careful not to drive them too far or you might damage the ties. On the other hand, however, if you don't drive them far enough, the track may shift out of alignment.

After you have nailed down all the track, connect the wires from the terminal joiners to the power pack. I placed the power pack on one corner of the layout for now, and I drilled a $\frac{1}{4}$ " hole in the tabletop to run the wires through. I also installed spade lug connectors on the wires, which makes it easier to attach

them to the power pack. When you hook the wires up, be sure to connect them to the proper terminals on your power pack. Your power pack should have one pair of terminals labeled "VARIABLE DC," "TRACK," or "TRAINS." I used a Model Rectifier Corporation Tech II Model 1400 power pack. The track terminals on this unit are labeled "VARIABLE DC." Hooking the track wires up to the terminal labeled "ACCESSORIES" or "AC" can damage the motor in your locomotive, so double-check your connections



Use a hobby knife to cut short filler pieces of cork to finish the loop. Check the cork to make sure it is not lifting or kinking.



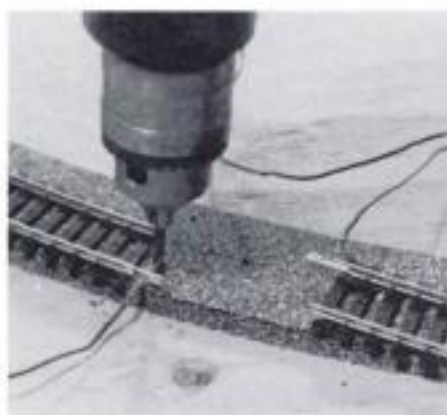
Attach a pair of terminal rail joiners between two of the curved track sections. Be careful handling these joiners. The stems where the wires are attached are fragile.



Use care when joining the track sections. Make sure that both rails are properly inserted into the joiners. The track pieces should fit together tightly, with no gaps or kinks between the sections.



Be careful when nailing down the track sections. The track can be damaged if the nails are driven too far. Don't drive the nails all the way just yet; leave them loose to allow minor track adjustments as you go.



The feeder wires attached to the terminal joiners are easy to conceal. A hole under each joiner allows the wires to run to the power pack via the underside of the table.



Bend the wire stems down to a 90-degree angle so they slip neatly into the holes. The joiners are barely visible on the installed track section. Use care when bending the stems, as they can break off easily.

before you turn the power pack on.

After you've laid the track and hooked up the power pack, you're ready to run the first train on your model railroad! Place your locomotive and a few freight cars on the track, turn on the power pack and move the throttle, and you are in the engineer's seat. Most likely, your locomotive and train are running properly and everything is staying on the track. If your train derails, inspect the track and make any necessary adjustments. If the train runs backward in relation to the direction switch on the power pack, simply reverse the wires on the back of the power pack. Now sit back, enjoy your efforts, and run some trains!



Once all the track sections are in place, go back with a nail set or a spare bolt and drive the track nails the rest of the way. Make sure the track sections are properly aligned first. The nail heads should just be touching the plastic ties.



Drill a 1/4" hole near the power pack for the terminal joiner wires. Be sure to attach the wires to the right pair of terminals on the power pack. Spade lug connectors can be used on the wires to make hookup easier and neater.

Adding Scenery and Buildings

With the track in place and the trains running, you may notice that the plywood tabletop is looking a little bare. I decided to add some simple scenery to Stage 1 of the new railroad. Many people (myself included) feel that scenery is one of the most enjoyable aspects of model railroading. This is where your HO scale empire starts to come to life. You can turn the "plywood plains" into lush green fields, tree-cluttered meadows, and pockets of urban civilization. The methods used for the first stage scenery are really quite simple, and what's more, they virtually guarantee good results.

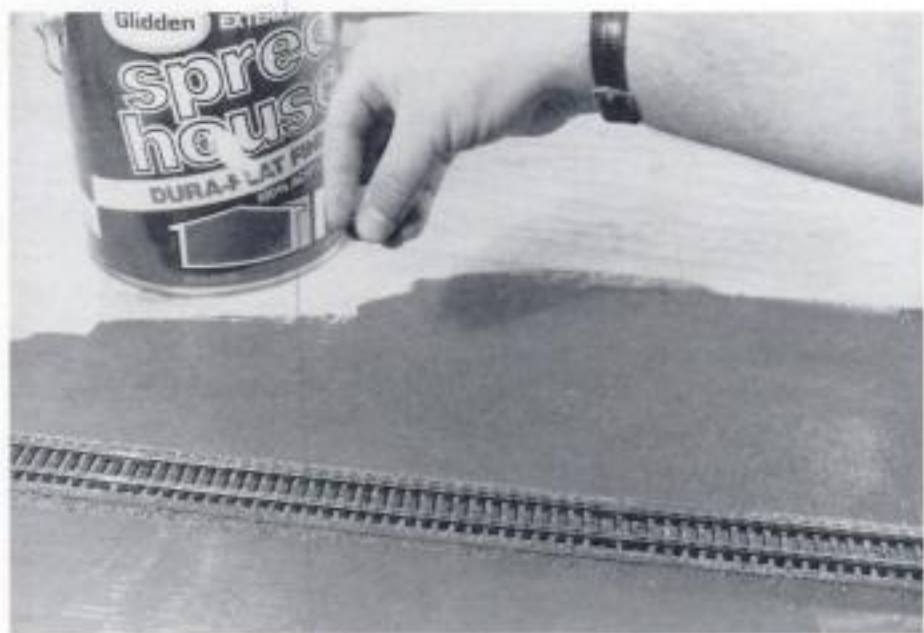
The first step in creating scenery is deciding what you want your landscape to look like. Since I plan to add more elaborate scenery later on, I just used some ground cover to hide the plywood tabletop. The easiest and most effective material to use for ground cover is the Woodland Scenics line of ground foam. It is available in a great variety of colors and textures and looks quite realistic when applied. You can find it at most hobby shops or well-stocked craft stores.

In addition to the ground cover, I chose to add several structure kits and a simple road network. I felt these items were enough to dress up the layout for the first stage. Of course, one of the great things about this hobby is the freedom to do what pleases you, so if you want to add more structures or change the layout of the town, go right ahead. However, if you plan to continue building the CC as shown in the master track plan, choose the location of your roads and structures so that they don't interfere with future track additions.

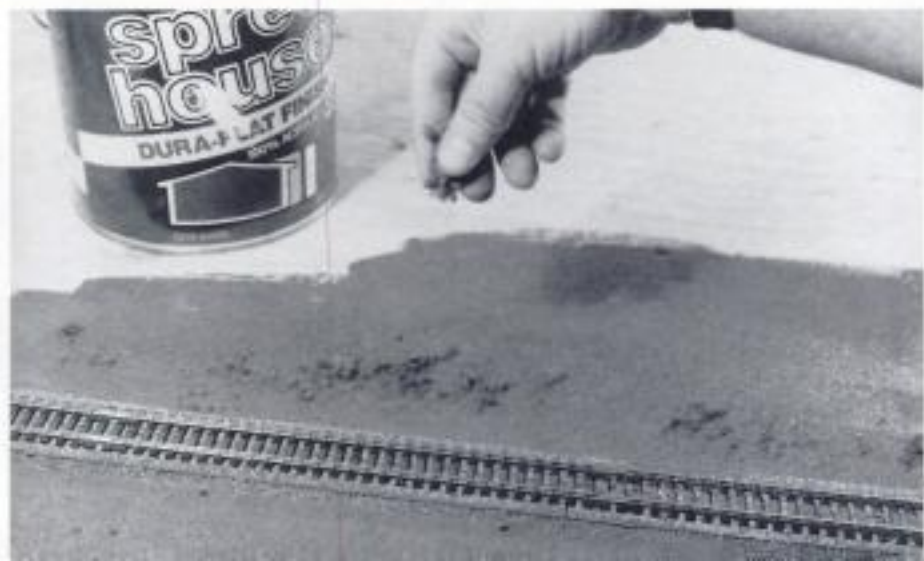
The building kits I used on this stage of the CC are listed in Structures Used for Stage 1, on the next page. They are all easy-to-build plastic kits that are readily available at most hobby shops. To keep things simple, I didn't paint the kits—I assembled them according to the manufacturers' instructions, leaving them in their natural colors. However, on several of the structures I did spray everything



Painting the tabletop with latex paint serves two purposes—it hides the plywood color and texture and it serves as an adhesive for the ground covering. Any brand of earth-tone color paint will work, but be sure to choose one that dries flat.

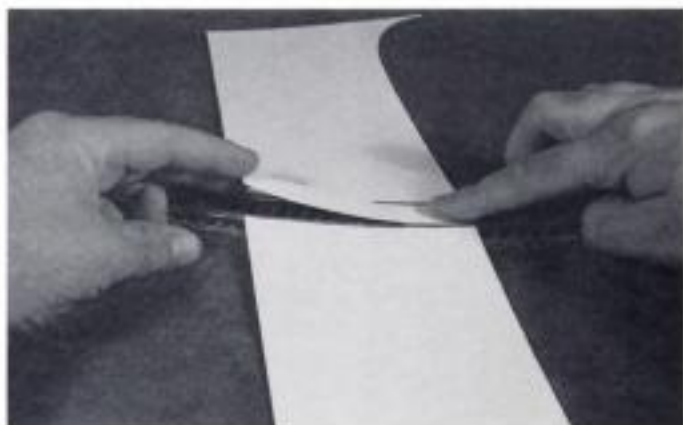


ABOVE: While the paint is still wet, sprinkle ground foam into it with your fingers. Work in an area about 1 foot square at a time, or else the paint will dry too soon and the foam won't stick. BELOW: Nature has many colors. Try to duplicate this on your layout. Use a variety of ground foam colors and textures to get the best effect.





Quick and easy road crossings can be built using posterboard. To form the sections around the track, lay the posterboard on top of the rail and press lightly. Cut along the resulting indentations to get the correct shape.



Make sure the piece that fits between the rails doesn't interfere with passing trains. Trim it with a hobby knife to get a proper fit, if necessary. Remember that it's better to trim too little than too much. Glue the center piece in place with rubber cement.



Ramps for the roadway along the tracks are made from posterboard scraps. Use rubber cement to glue the road pieces in place. Be sure to use this adhesive in a well-ventilated area.



Once the road pieces are glued in place, finish the scenery surrounding the pieces. Make sure the trains run through the finished crossing without hitting any of the pieces.

STRUCTURES USED for Stage 1

Atlas
702 trackside shanty
706 passenger station

Bachmann
35103 Lyric Theater

International Hobby Corp.
3508 general store and
billiards parlor

Model Power
487 Grandma's house

Walthers
3001 Gemini Building
3002 Bill's Glass Shop

(except the plastic "glass") with Testor's Dullcote to help eliminate the plastic sheen and tone down the colors slightly.

Before adding any structures or ground cover, paint the tabletop with a flat latex paint to hide the plywood. Latex paint in any earth-tone color will work, but be sure to choose a paint that dries flat. Painting the tabletop will prevent any plywood bare spots from showing through the ground cover.

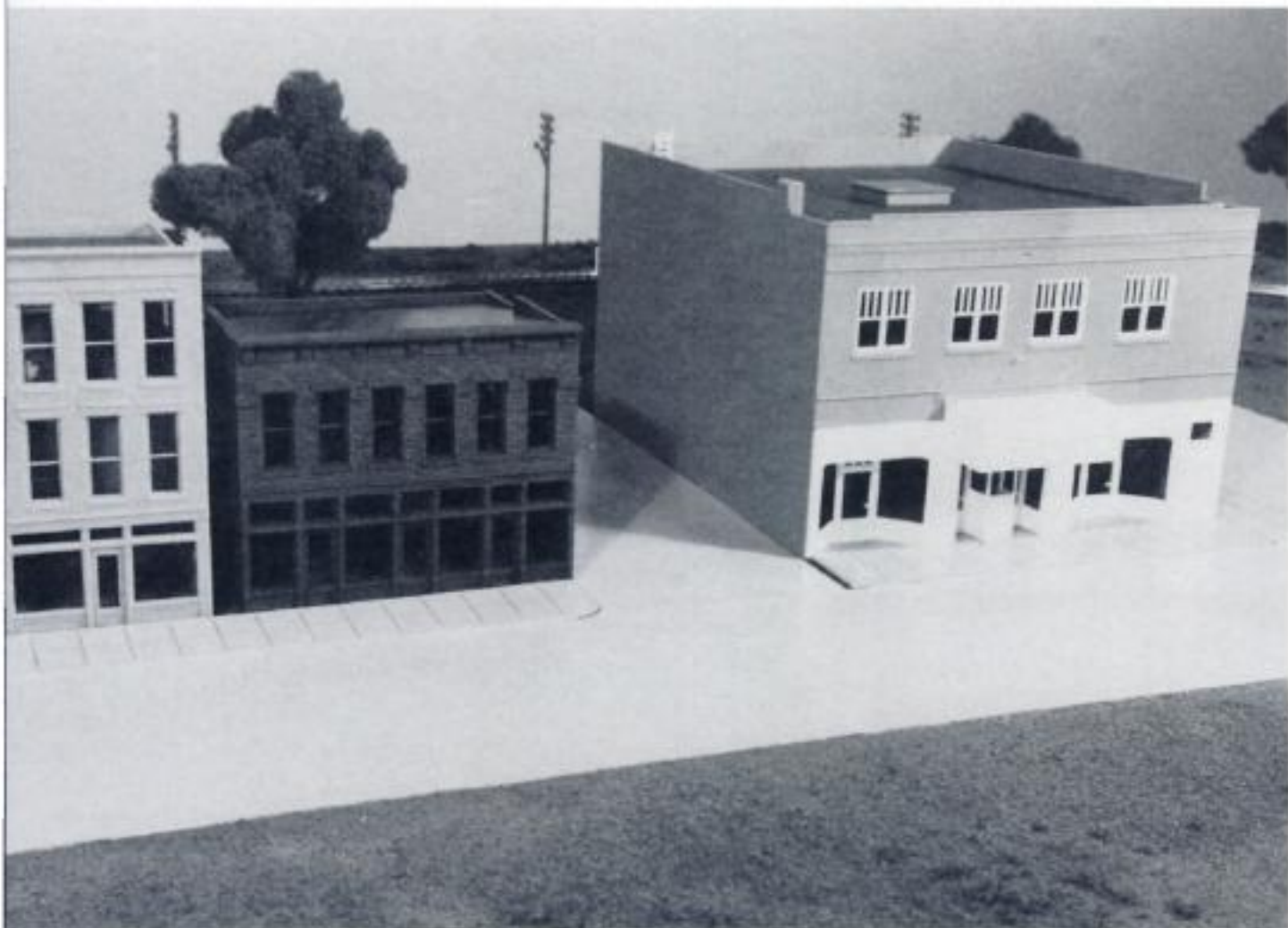
Some parts of the Stage 1 layout do not have any structures. In these areas, apply a heavy coat of latex paint and immediately sprinkle ground foam directly into the wet paint with your fingers. As the paint dries, it sticks the ground foam to the layout. When you use this method, be sure to work in an area of about 1 square foot at a time. If you work in too large an area, the paint

will begin to dry before you have a chance to apply the ground foam, and the ground cover won't stick well.

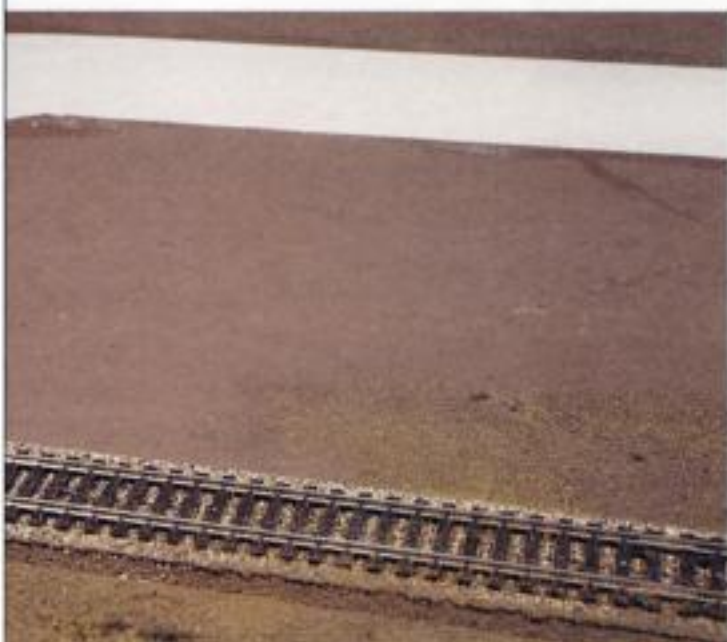
Apply a variety of ground foam colors and textures until you are happy with the appearance. If you happen to put on a little too much of one color, simply go back and cover it up with different colors or textures. Remember, nature has many colors. Use several different shades of foam to get the best appearance. When in doubt about what looks right, step outside and take a look around. I think you will find it is quite easy to duplicate nature in a realistic manner.

In the areas where structures, roadways, and the power pack will go, just paint the plywood tabletop and let it dry. Then you can start the road construction. Using a paper cutter, cut several strips of posterboard 4 inches wide.

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I built a variety of structures for the first stage of the Callahan Central. The structure kits were left unpainted for now to keep things simple. Extra sidewalk sections from the Bachmann theater kit line a section of the roadway.



With the roadways in place, you can finish the scenery. Spray the water mixture on the area to be scenicked. This helps hold the



ground foam in place while you apply the glue. Be careful not to spray the posterboard roadway with water.



Be sure to use a variety of colors and textures of ground foam. This may sound obvious, but in nature, the dirt is on the bottom. Construct your scenery in the same way. Lay down a layer of earth-colored foam (LEFT), then add some vegetation colors (LOWER LEFT). Finish by adding some large-texture foam to simulate small shrubbery (BOTTOM LEFT). If you make a mistake and use too much of one color, just go back and cover it with some other colors. Using ground foam for scenery almost guarantees good results, so experiment with it to find out what you like.



If you don't have a paper cutter, a sharp hobby knife and a yardstick will work just as well. Cut these strips to the right length and shape to form the roadways. You may find it helpful to record where each piece fits. When all the pieces are cut, spray-paint them light gray and let them dry.

To form the grade crossings, lay the posterboard on the track. Then apply pressure to the posterboard where it passes over the rails. This will put light indentations into the back of the posterboard. You can use these lines to cut the pieces to fit between and around the track. Use scissors to cut the posterboard, then use a hobby knife to trim the pieces to an exact fit. Once you've sized the pieces properly, paint them to match the rest of the road pieces and set them aside to dry.

After the paint on the road pieces dries, use rubber cement to hold the road piece between the rails. Use care when installing this piece to make sure that it lies flat and does not interfere with passing trains. You can test the fit by rolling a freight car over the crossing, making sure it rolls smoothly through the entire crossing without derailling or hanging up. Next, cut scrap pieces of posterboard to shim the pieces that sit on either side of the track, then glue them in place using rubber cement. Finish the roadways by installing the remaining pieces with rubber cement.

With the roadways in place you can fill in the rest of the scenery. Finish constructing the structure kits you have chosen to build, and decide where to place them. The Bachmann theater kit came with additional sidewalk sections, and I used them to line a section of Main Street. When you decide where



to put the structures, fasten them in place with white glue. White glue works best for this, as it holds the structures firmly in place, yet allows you to easily pop them loose if you want to move them later.

In the last step of this stage, finish covering any bare areas between the

structures and the roads. Since the latex paint in these areas has already dried, you'll have to use a different method to secure the foam in place. In this case, diluted white glue works great. Mix $\frac{1}{4}$ bottle of white glue and an equal amount of water into an old plastic container. Finish this mixture by

adding just a drop of liquid dishwashing detergent. This helps the glue mixture flow through the foam material when it is applied.

Next, take a plant spray bottle and fill it with water. Again, add just a drop of liquid dishwashing detergent. This mixture will serve as a wetting agent, which will help the glue mixture flow into the foam, as well as hold everything in place while you are gluing it down.

Lightly spray the area you are going to work on with the wetting agent. Dampen the area just enough to hold the foam in place. Again, work an area about 1 foot square at a time. After spraying the area, sprinkle the ground foam in place. Use a variety of colors and textures to suit your taste.

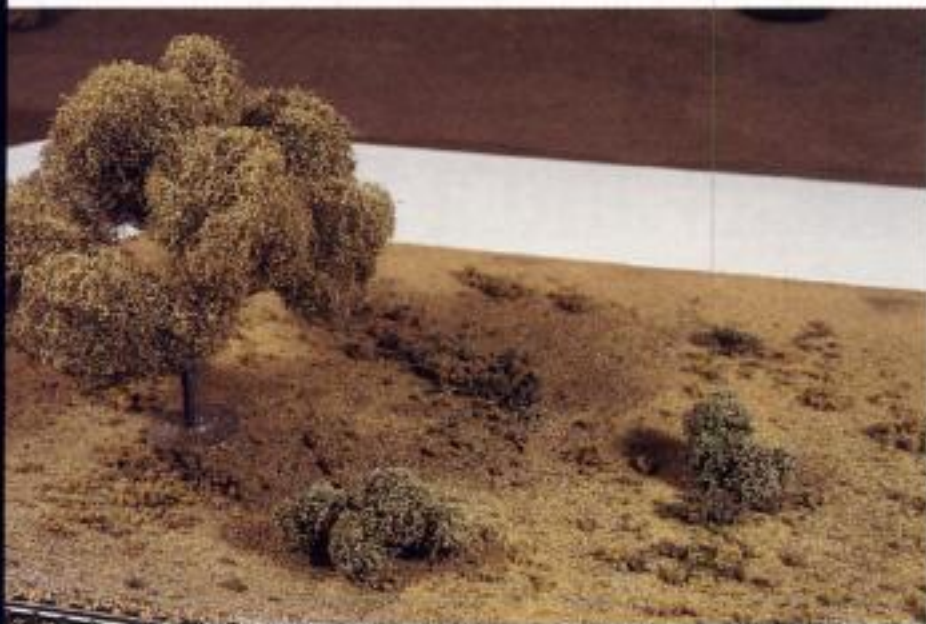
Next, fill an eyedropper with the diluted glue mixture. Spread this mixture over the ground foam and let it soak in. Be careful not to disturb the foam when applying the glue mixture. If you accidentally move the foam and reveal the plywood below, simply sprinkle more ground foam over the spot before the glue dries. After you have applied the glue mixture to the entire scene, let it dry overnight before touching it. You may notice that the glue mixture darkens the foam slightly when it is applied. Don't worry—the ground foam will return to its normal color when the glue dries.

After the glue dries, you can go back and add some final details to the scene. I purchased some Woodland Scenics trees in both kit and "ready-to-plant" form and placed them around the layout. I also planted some lichen to add color and vegetation. To fasten the lichen and trees, lay down a spot of white glue and place the foliage in the glue. Atlas telephone poles along the rail line also add interest. These are mounted in the same manner as the trees.

That's where I decided to stop landscaping Stage 1 of the Callahan Central. Once again, this is your railroad, so feel free to continue to add as much detail as you want. At this point, though, you have built an operating model railroad from a collection of lumber, track, and models. Be sure to enjoy the fruits of your efforts and have some fun running your train!



Apply the glue mixture with an eyedropper. Be careful not to disturb the foam when applying the glue. If you do, cover up the mistake with some additional foam.



Finish the scene by planting a tree and some lichen. Use a spot of undiluted white glue to plant the tree and the bushes. Instead of using all the lichen that comes in the bag, sort through it and select some of the finer pieces. Cut the small pieces from the clump with a pair of scissors to get a nice flat side for gluing.



With the addition of some more track and structures, the Callahan Central continues its growth from a train set to a model railroad.

STAGE 2

Beyond the Oval: Adding Spur Tracks and a Yard

Now that your model railroad is up and running, you may be growing tired of watching the locomotive chase its caboose around the layout. While a basic oval of track works for the beginning model railroader, most people soon want more track and more operating possibilities.

If you've reached this point, keep reading—this chapter will show you how to add some variety to the operation of your new model railroad. The track plan for Stage 2 is shown in

Figure 1. The plan was designed to provide numerous operating possibilities in the small space available. This section will show you how to add an industrial area where you can deliver freight cars, and a freight yard that's made for switching your trains.

In this chapter you'll also learn how to add new, more reliable couplers to your cars and locomotives.

Looking at the track plan, you may think that there's a lot of new track to add. If you prefer, you can split the process into two steps—the freight yard

and the industrial section (see the track plan). If you choose this strategy, there are plenty of other activities to keep you busy in between the two steps, such as building more scenery, building structure kits, and upgrading couplers on your engine and freight cars.

The equipment and supplies necessary for Stage 2 are shown in the Bill of Materials. Note that there are two types of turnouts mentioned in the list: remote control and manual. Remote control turnouts allow you to change the route of the train automatically

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with the push of a button. You change the route of a manual turnout by moving a lever on the turnout itself. Remote control turnouts are nice to have, but they cost more than the manual versions.

To keep costs down, this layout was designed to use remote control turnouts on the main line and manual turnouts on all the sidings and yard tracks. The two types of turnouts are completely interchangeable, however, so if you prefer, you can use all manual or all remote turnouts, or some other combination of the two. The rest of the track and materials needed is also shown in the Bill of Materials.

The first step is to lay the cork roadbed for the freight yard. However, in Stage 1, you applied ground cover to the table where the new track should go. Since you can't lay the cork on top of this material, first remove the ground cover from the new right-of-way.

To do this, assemble the new track sections as shown. Determine where you must remove the ground foam by laying the new track sections in place on top of the existing track. Then use a small screwdriver or other sharp item to scrape a line through the ground

BILL OF MATERIALS: STAGE 2

Track and Roadbed

Track:

Atlas Nickel-Silver Snap Track	
821 9" straight	15 (3 packages)
822 6" straight	2 (1 package)
835 1/3 section 18" radius	4 (2 packages)
847 track assortment	1 packages
850 left switch, remote	4
851 right switch, remote	1
860 left switch, manual	2
861 right switch, manual	3
55 insulated rail joiners	1 package
842 terminal rail joiners	2 pairs

Roadbed:

cork, Midwest #3013 or equivalent	10 pieces
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Electrical and Misc.

Atlas Electrical Components:

56 switch control box (incl. w/remote switches)	5
205 connector	1

Miscellaneous

phone cable, 4 conductor	1 roll
spade lug connectors, 18-22 gauge	1 pair

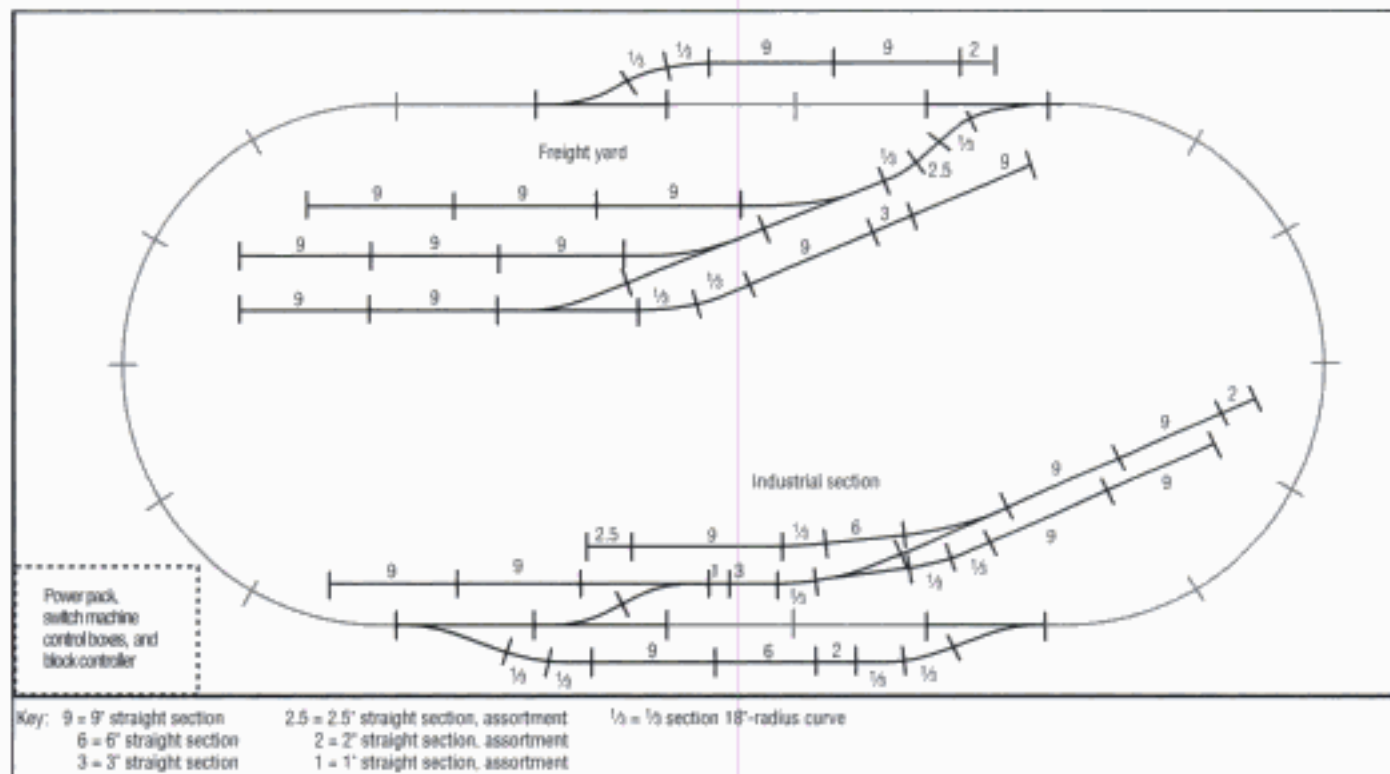
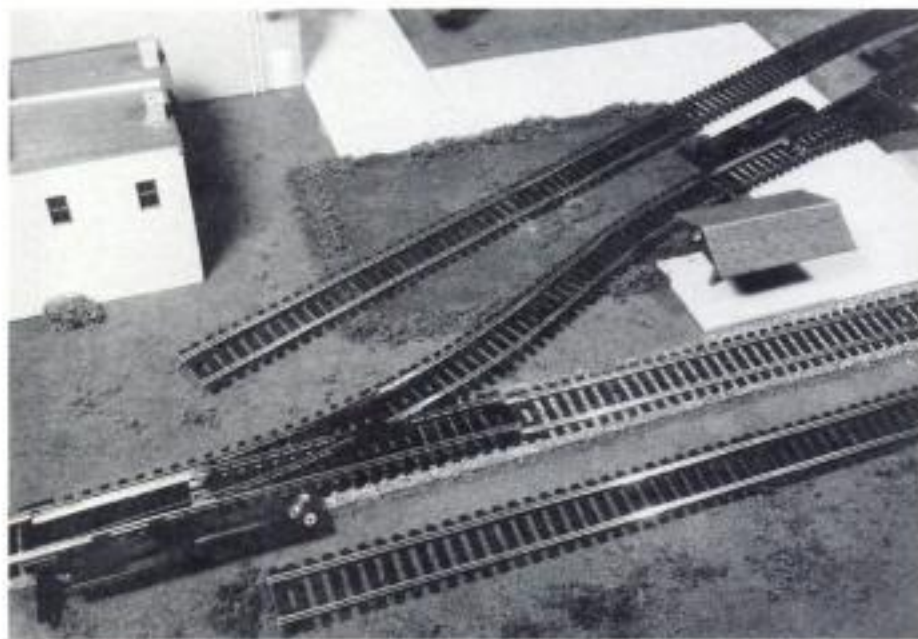
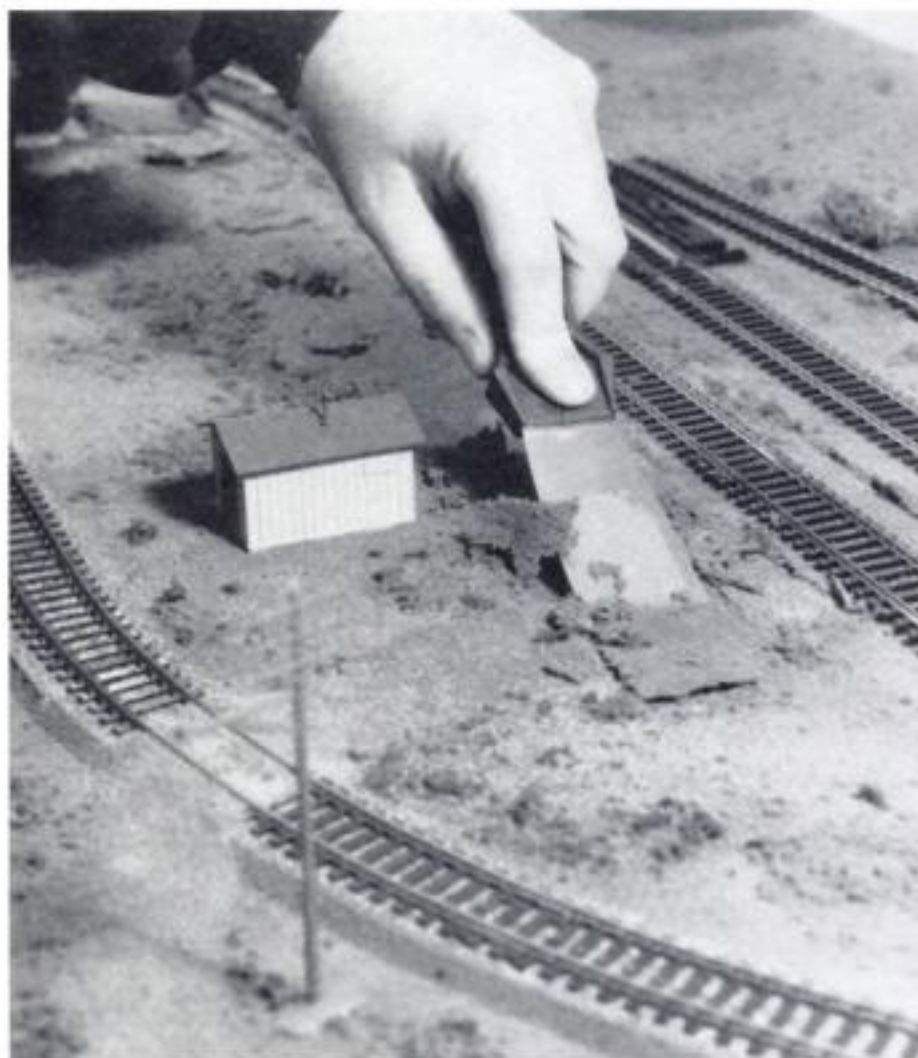


Figure 1: Stage 2 Track Plan



ABOVE: To help you determine where new track should go, first assemble the sections, then place them on top of the existing track. Use a screwdriver to scribe the location of the new track sections in the ground cover. **BELOW:** The cork roadbed must be installed on bare plywood. Remove the old ground cover from the new right-of-way with a putty knife. Use a hammer and chisel to remove any stubborn spots.



cover along both sides of the track sections. This marks the areas where the new track goes.

Next, scrape away the ground foam between the marks with a 1" putty knife. Remove all the foam from these areas, or the roadbed (and consequently the track) may not be level.

If you have trouble removing some of the dried white glue, gently chip away the glue with a hammer and chisel. Work slowly and wear eye protection when using the chisel!

Don't worry if you remove a little too much ground cover. You can always touch it up later after the new track is in place. After you scrape all the ground cover loose, be sure to vacuum the layout to clear up any debris.

Now install the cork roadbed. Start with the spur track, then proceed to the yard. Install the cork, using the methods described in Stage 1. With all the turnouts in this area, you'll have to do a fair amount of cutting and fitting to make all the roadbed pieces fit properly.

The cork material is very easy to cut; a sharp hobby knife works well here. Keep in mind that exact fit is not necessary. Small gaps in the roadbed won't be that noticeable, and they won't cause operating problems. Be sure to use a straightedge to align the straight sections, as it is easy to inadvertently allow slight bends to occur when gluing the cork roadbed.

After the cork is dry, install the new track sections. Start with the mainline remote control spur switch, then move on to the yard turnouts. For the freight yard, install the remote control mainline turnout, then assemble the manual turnouts, two right-hand followed by one left-hand, as shown. Remove the track nails from the sections adjacent to the new track. This allows you enough slack to remove the old track pieces.

Now carefully lift the track sections until the rail joiners separate. Remember, the rail joiners bend easily, so take care not to damage them. If you do accidentally bend one, replace it with a new one. Remove the 9" straight sections, then slip the mainline turnouts into place on top of the cork roadbed.

Next, assemble the rest of the yard tracks. Here you can install some special wiring that allows you to park a

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After scraping it loose, vacuum up the loose ground cover immediately, or it will get scattered around the layout in no time. The smaller bits of ground cover can even accumulate in the working parts of your locomotives and bring them to an unexpected halt.



Install the new cork roadbed with white glue. Be sure to install the cork straight where the track is straight and curved where the track is curved! Sight down the length of the roadbed to ensure that the straight sections are in fact straight.



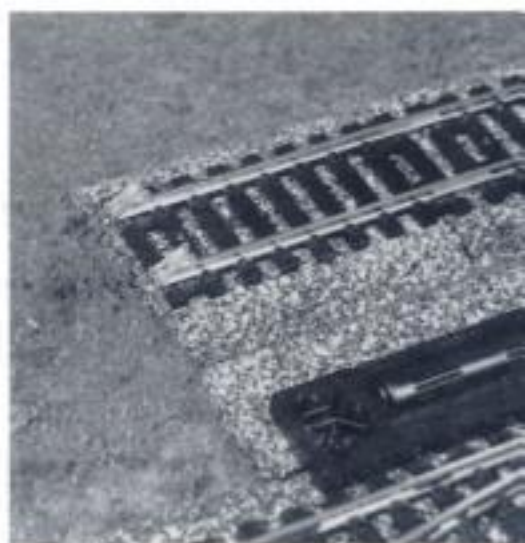
Drill $\frac{1}{16}$ " holes along the outside rail for the feeder joiner wire. Take care not to break the stem when you insert it into the hole. It's a good idea to have some extra feeder joiners around in case one breaks during installation.

locomotive in the yard while a train runs on the mainline. To do this, install an insulated rail joiner on the *outside* rail between the yard turnouts and the mainline turnout as shown. This isolates this rail electrically from the rest of the layout. Then install a feeder joiner to the outside rail at some convenient point in the yard.

Use the method described in Stage 1 to install this joiner. Drill a $\frac{1}{16}$ " hole next to the track joint, then carefully

bend the stem on the joiner to a 90-degree angle and feed the wire into the hole. Assemble the track sections around this piece and carefully set them in place, guiding the stem down into the hole. Leave the wire dangling below the table for now. It will be connected to a control switch later on.

Once all the yard track sections are in place, go back and carefully align everything. Check to see that the turnouts move properly. Each one



The spur tracks need something to keep the cars from rolling off the end of the track. Wheel stops from Custom Finishings were used on the Callahan Central, but there are other options. If you use these wheel stops, glue them directly to the top of the rail head with cyanoacrylate cement, more commonly known as "super glue."

should move back and forth without binding or stopping. If there is a problem, trim away some of the cork roadbed underneath the throw bar until it moves freely. When you are satisfied with the fit and operation of everything, fix the new track sections in place with track nails.

To keep cars from rolling off the ends of the spur tracks, you'll need to install some wheel stops. There are several options here. Atlas makes a



The control panel grows in this stage, too, with the addition of the control switches for the blocks and the remote control turnouts. Remove just enough ground covering to make room for the new switches.

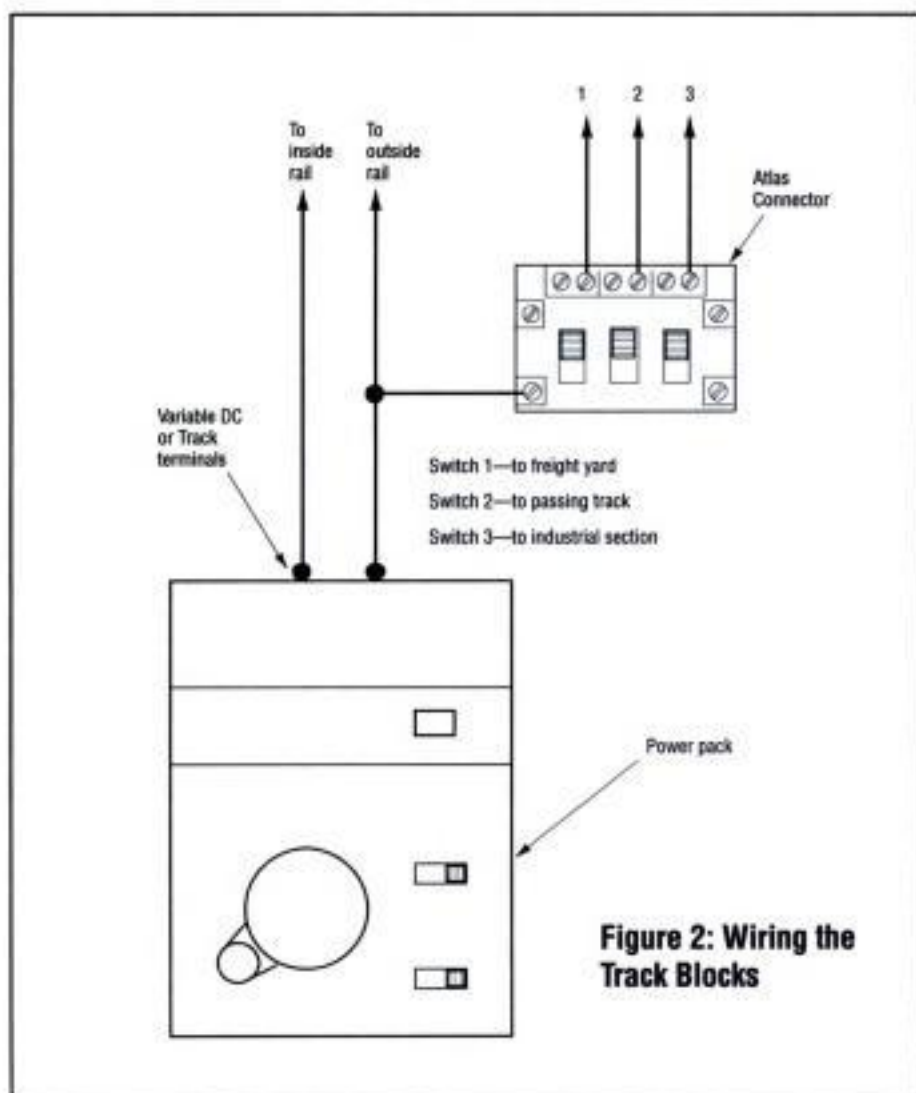


Figure 2: Wiring the Track Blocks

bumper (item number 843) that installs at the ends of the tracks. Since these bumper pieces are cast to a section of track, if you use bumpers, you'll have to change the track requirements shown in the track plan.

Another option is to use wheel stops from Custom Finishings. These items are nicer in appearance than the Atlas bumpers, and they are simple to install on any piece of track. Simply glue them to the rail heads using cyanoacrylate cement ("super glue") or five-minute epoxy. After the wheel stops are in place, paint them in a high-visibility color like yellow, orange or red.

Before you can run trains on the new track, you have to wire it. Connect the feeder wire installed earlier to an ON/OFF switch, and then connect the switch to the outside rail output from the power pack. An Atlas Connector makes these connections easy.

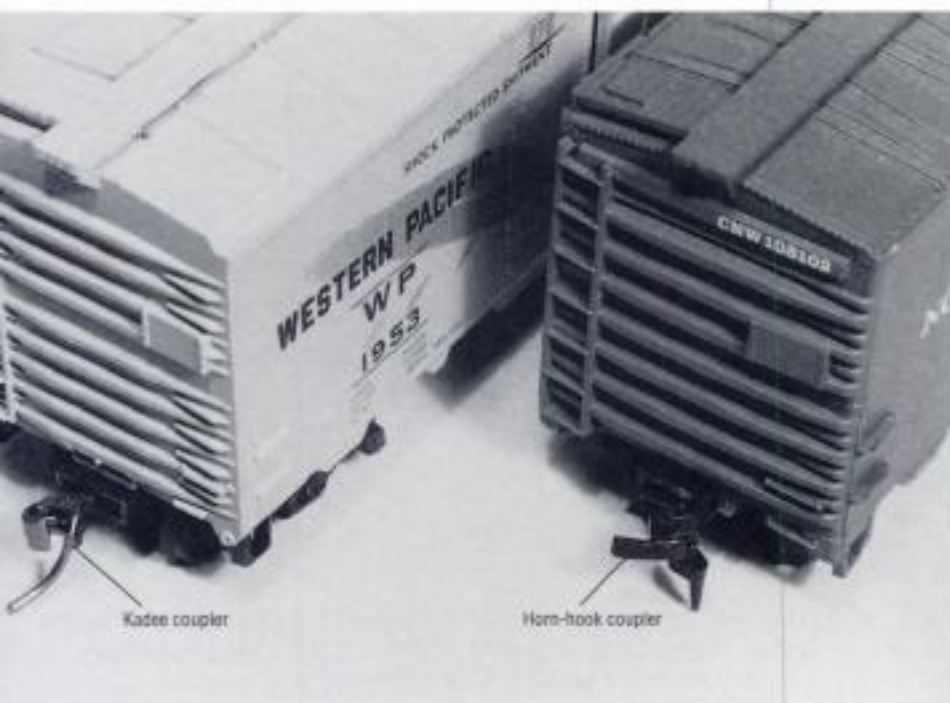
Start by mounting the Connector on the tabletop with screws. I had to remove some additional ground cover around the power pack to make room for the Connector. Next, run a length of wire from each feeder joiner to one of the positions on the Connector.

Be sure to hook up everything as shown in Figure 2 or the switch will not function properly. The number 1 switch position should control the yard section.

Once the feeder is attached to the Connector, run a wire from the outside rail output on the power pack to the terminal shown on the Connector. If you have an electrical voltmeter, use it to determine which terminal of the power pack supplies the current. Otherwise, trace the wires to see which one it is. You must connect the wire from the Connector to this output terminal. Install a new spade connector over both wires to make connections clean and neat.

With everything installed, the power to the yard section is routed through the connector. When you turn off the switch, it cuts power to the outside rail in this section and prevents the train from running.

Your new arrangement allows you to have two locomotives on the layout—one parked in the yard and the other running on the main line.



LEFT: Kadee couplers (left boxcar) operate much more reliably than the original-equipment horn-hook couplers (right boxcar). Most HO scale rolling stock is easy to convert to Kadee couplers. The Model Die Casting boxcar shown uses a number 5 coupler, as does the Accurail car, shown with its original coupler. **ABOVE:** The Kadee number 5 coupler is the most common coupler for converting HO rolling stock. These couplers come two pairs to a pack, enough for two cars. The coupler pockets shown at the bottom are not needed for most applications.

Installing New Couplers

Now that the yard section is complete, the freight cars in your train have somewhere to go. The yard allows you to pick up and set out cars from your train. You'll probably find that it's a lot of fun switching cars in and out of these tracks.

Unfortunately, after only a few minutes of operation, a problem arose with the locomotive and freight cars on my layout. The "horn-hook" couplers (officially known as XF2 Couplers) were the culprit. Several of them were hitting the railheads at the switches, causing the train to derail. Several others weren't pivoting freely as the train negotiated switches and curves. This also caused derailments or inadvertent uncouplings.

Luckily, there is an easy way to fix this problem—replace the horn-hooks with Kadee couplers. As the unofficial standard in the hobby, Kadee couplers are known for their reliable operation and realistic appearance. I had originally planned to introduce Kadee couplers later in the book, but this problem with the horn-hook couplers changed my mind.

Naturally, if you are happy with the way your horn-hook couplers operate, you may choose to wait to install Kadee couplers. But if you're ready to

switch, you need to choose the right couplers for your locomotive and rolling stock. Kadee offers a wide variety of couplers for a large number of applications. If you purchased Athearn, Model Die Casting or Walthers cars, you'll find that Kadee's popular number 5 coupler fits right into the coupler pockets on virtually all cars.

Cars from other manufacturers, as well as many locomotives, may require other models of couplers. Since there is such a wide variety of freight cars and locomotives, the best recommendation is to seek help at your local hobby shop. They should be more than willing to help you select the appropriate coupler for your rolling stock.

The instructions below, although general in nature, refer to the specific cars and locomotives used on the Callahan Central.

Generally speaking, most Athearn, Model Die Casting, and Walthers freight cars are easy to convert to Kadee couplers. The number 5 couplers come in two pairs to a package, enough for two cars. When you open the package, you will find four couplers, four bronze coupler springs, extra knuckle springs, plastic coupler pocket assemblies, and instructions. You do not need coupler pockets for the three types of cars named above.

Start by removing the cover of the coupler pocket. On Athearn cars, a

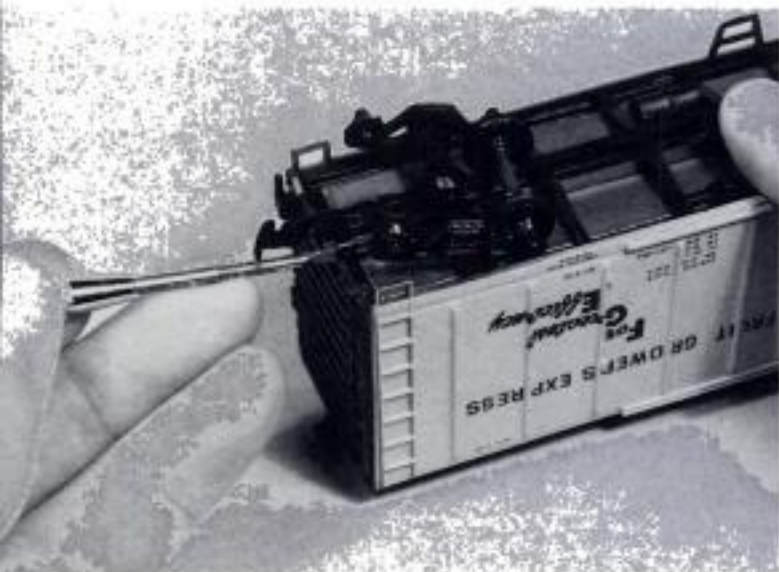
stamped metal clip holds the coupler in place. On MDC and Walthers cars, the couplers are secured in place by a cover and screw. After removing the clip or cover, discard the old coupler.

Next, insert the bronze coupler spring in the coupler pocket. This spring fits around the post in the middle of the coupler pocket. It should not bend or become deformed when inserted in the pocket. If it does, check for flash or burrs in the coupler pocket and carve them away with your hobby knife.

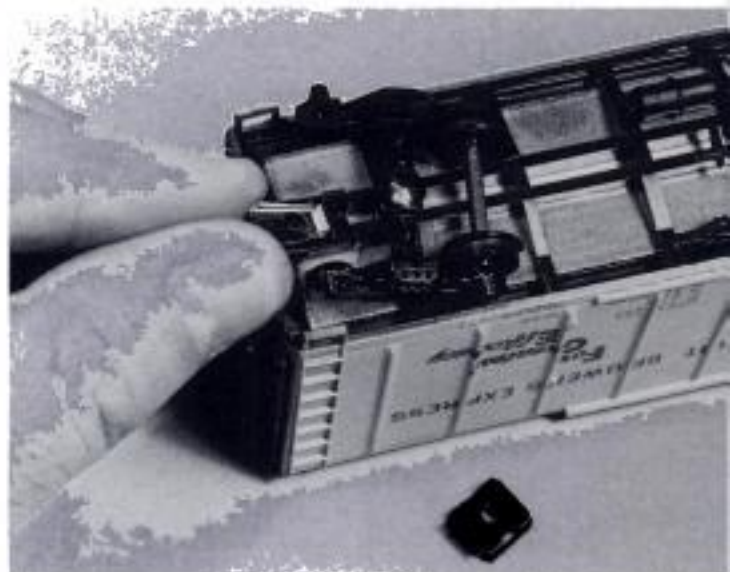
Now install the coupler into the pocket. The hole in the coupler shank fits around the post in the coupler pocket. The little fingers on the spring should fit alongside the shank. These fingers are what make the coupler return to center from either side. If the coupler is not inserted properly, it may not move freely or center itself properly in the coupler pocket.

While holding the coupler in place, reinstall the coupler clip or cover. Set the car on a section of track and test the movement of the coupler with your finger. It should move freely from side to side without binding.

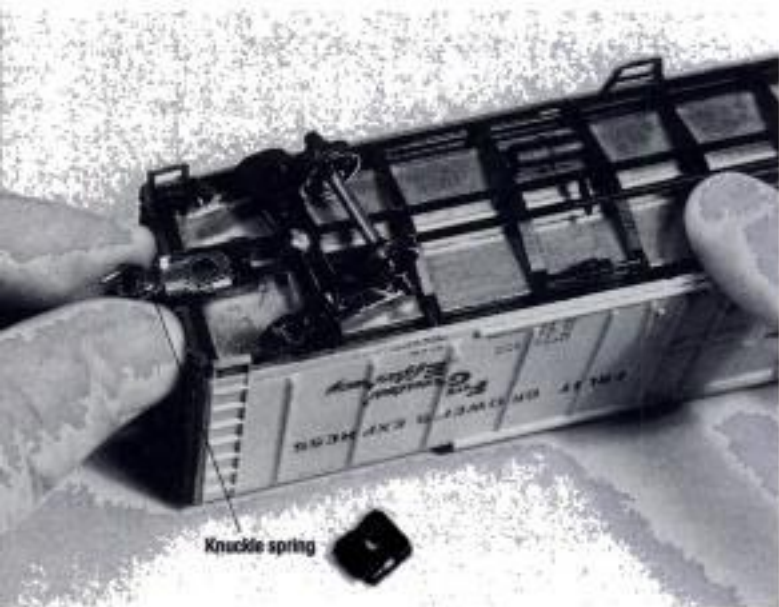
You'll also have to check the height of the trip pin using a Kadee coupler height gauge. Place the gauge on a piece of track and couple the car to it. If the trip pin catches on the bottom of



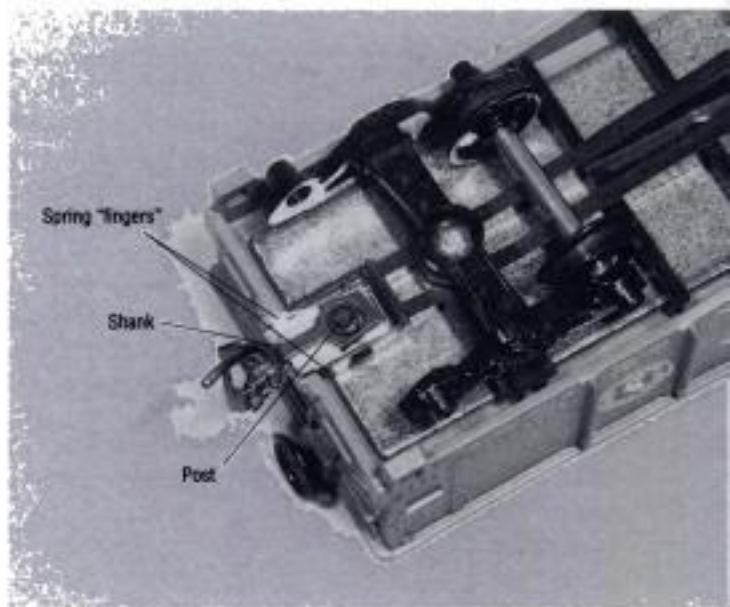
STEP 1: A small jeweler's screwdriver works well for removing Athearn coupler clips. Pop the clip loose, then remove and discard the old coupler.



STEP 2: Install the bronze spring in the coupler pocket as shown. There's no need to remove the truck from the car, but you'll have to remove one wheelset to reach the coupler.

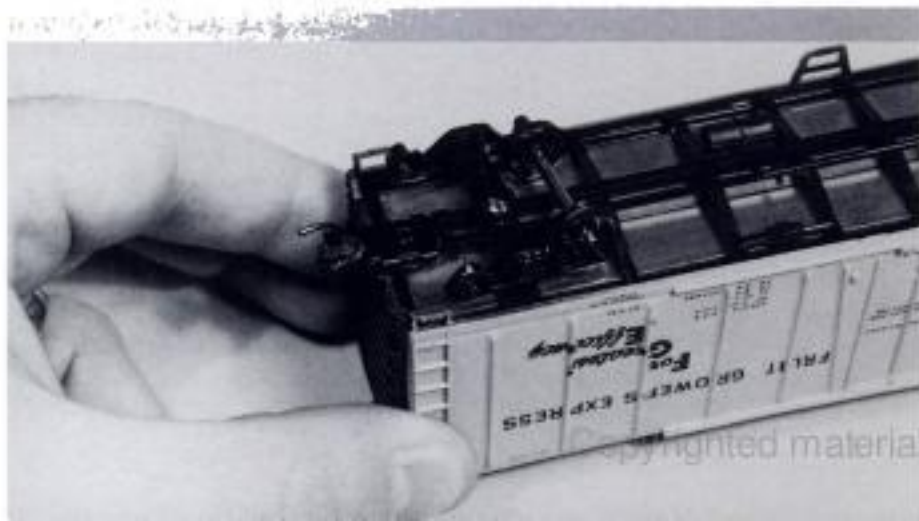


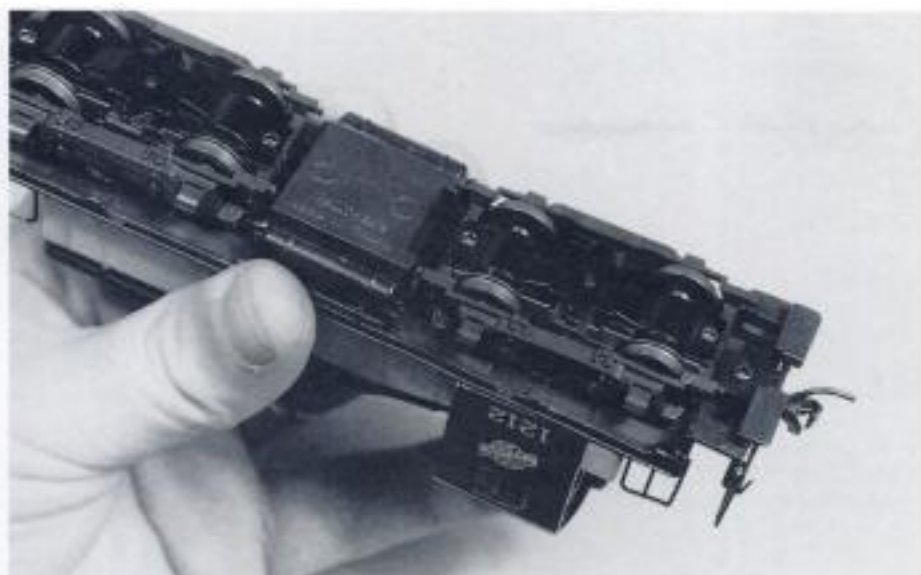
STEP 3: Install the coupler around the post of the coupler pocket. Be careful not to pop the knuckle spring loose while you're installing the coupler.



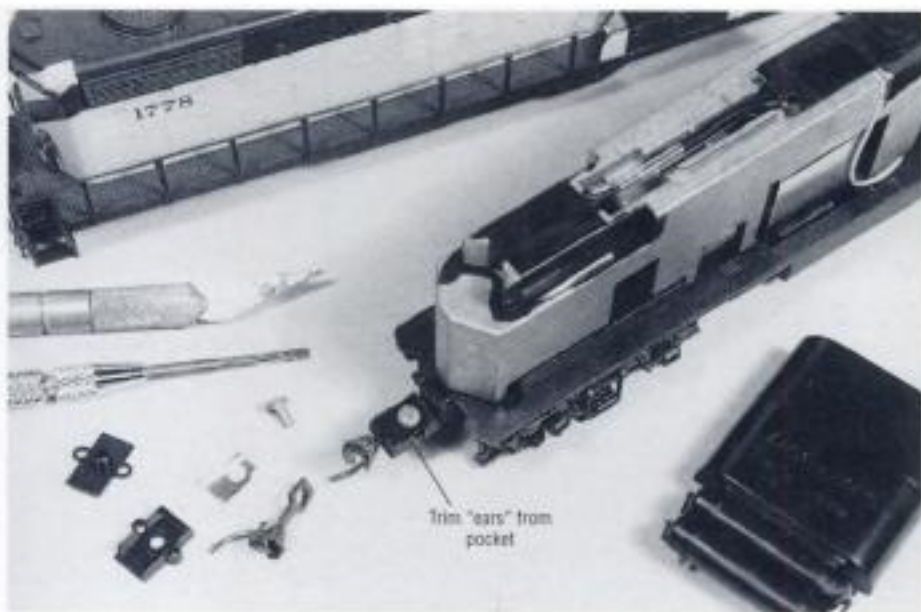
STEP 4: The fingers on the bronze spring must fit along the sides of the coupler shank. If these fingers are not in the proper position, the coupler will not center itself properly once the cover is installed.

STEP 5: After installing the couplers, replace the coupler cover. Check to see that the coupler swings freely from side to side and returns to the center when released.

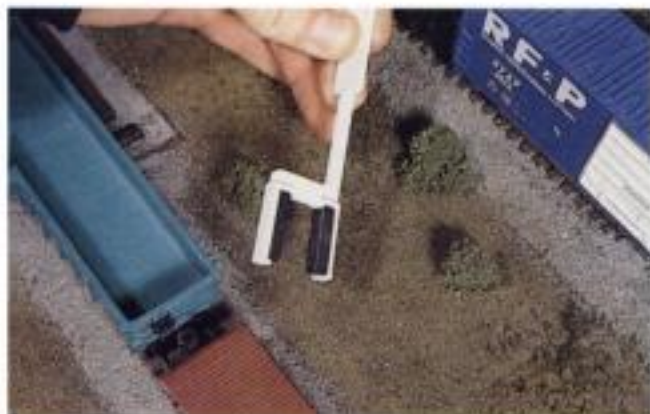




The Walther SW1 uses a number 5 coupler. For this application, you must use the coupler pocket that comes with the number 5. Cut the "ears" from the pocket to allow it to fit properly. The original screw holds everything in place.



Life-Like's Proto 2000 GP18 also uses a number 5 coupler and pocket. To mount the coupler, replace the clip with a 2-56 screw $\frac{1}{4}$ " long. This screw threads into the hole in the locomotive's coupler pad. Trim the ears from this pocket to enable the shell to fit.



Kadee couplers have another unique feature besides reliable operation—they uncouple from each other magnetically. This uncoupling tool from Rix Products reliably uncouples cars from each other. Simply insert the tool between the cars and the coupler knuckles open, uncoupling the cars.

the gauge as the car couples to it, the trip pin is too low and will catch on turnouts and road crossings. The Kadee height gauge comes with full instructions.

Locomotives are sometimes a little more difficult to convert to Kadee couplers. The Life-Like GP18 and Walther SW1 used on the CC both use a number 5 coupler. However, different locomotives require different couplers, so here again it's best to check with your local hobby shop to see which one you need.

Aside from reliable operation, there's another benefit to Kadee couplers. They are designed to uncouple from each other magnetically. You can activate this uncoupling feature in various ways. Kadee sells several styles of magnets that fit under or between the tracks to uncouple the cars. A few other companies make manual uncoupling tools that allow you to uncouple the cars anywhere you want. For a small layout like the Callahan Central, these tools are the best bet. Rix products makes one that operates reliably. Simply insert this tool between the cars. The couplers separate as the tool's magnets come in line with the couplers. Kadee couplers may take some effort to install, but their features and reliable operation make it time well spent.

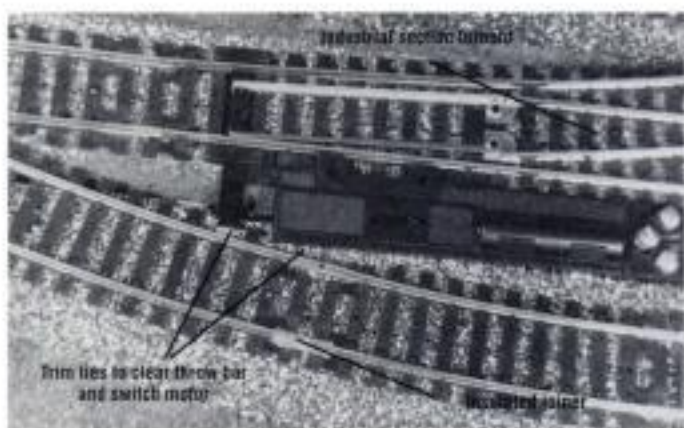
Adding the Freight Yard and Wiring the Switches

Now it's time to finish the rest of the track. Install the passing track and industrial section trackage as shown in the Stage 2 track plan. Use the same methods described earlier to lay out and mark the position of the track. Remove the ground cover from the new right-of-way and install the cork roadbed. Again, you'll have to do some cutting and fitting to make the roadbed fit under all the turnouts in this area. Cut everything to fit and glue the cork in place.

When the cork is dry, install the remainder of the new track. Install the three remote control mainline turnouts—two for the passing track and one for the industrial section. Then connect the rest of the track



Remove the ground cover from the right-of-way for the passing track and industrial section with a putty knife. Here the cork is already in place for the passing track. Note that an exact fit is not required.



Remove the ties from a few sections of the passing track so that it will fit alongside the industrial section turnout. Trim the throwbar for this turnout as well, so that the turnout can move completely in each direction. Note the insulated rail joiner for the passing track.



Be sure to line up all the track sections before you nail them in place. Make sure that the tracks are straight and that the pieces join tightly with no kinks or gaps.

sections to complete the passing track. Install the special wiring on the passing track too. Insert insulated rail joiners in the outside rail at both ends of the passing track, then place a feeder joiner somewhere in between. Note that you must use a 6" straight and a 2" piece from the track assortment pack (see the materials list).

In order to fit everything, you must trim the turnout throw bar and the ties from one of the $\frac{1}{3}$ curved sections. Doing so allows the turnout throw bar to move completely in both directions and the track to fit along the switch motor. Again, a sharp hobby knife works well. Remove only the tie edges that interfere with the movement of the throw bar and the switch motor.

Next, align the passing track parallel to the main line. However, do not nail

the track sections in place yet. This allows you to make minor adjustments after the rest of the track sections are in place.

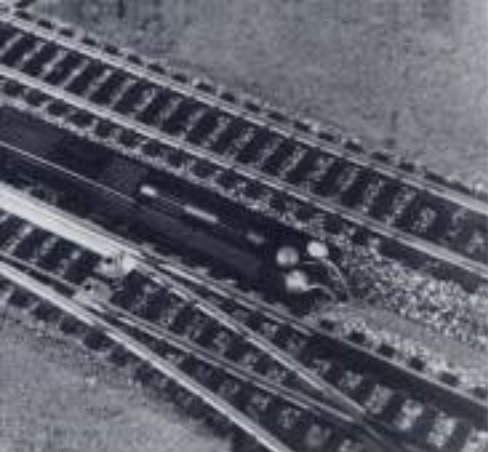
Now you'll finish the industrial section. First, install an insulated rail joiner in the outside rail just past the mainline industrial section turnout. Then install a joiner and feeder wire in the outside rail in the industrial area. Assemble the track sections just past the mainline industrial section turnout. Again, note that you must use several of the filler pieces from the track assortment pack.

Don't nail the track sections in place until all the pieces are assembled and aligned properly. Be sure that the sections are joined tightly and that there are no gaps in the rails where the pieces join. Also check to make sure that the turnouts move freely from position to

position. When you are satisfied with the fit and alignment, nail everything down using the Atlas track nails.

Next, hook up the feeder wires from the new sections to the Connector. Wire the passing track to the number 2 position on the Connector. The number 3 position controls the industrial section. When all wires are connected, test-run the train over the new track sections to make sure everything works properly. The locomotive and cars should operate through the turnouts and over the spur tracks without derailling or hanging up. If any problems exist, double-check the fit of the track sections in that area.

The last thing to do is wire the remote control turnouts. As you string wires from one side of the table to the other, try to run them parallel to the table joists whenever possible. This will



ABOVE LEFT: A 1/4" hole allows the wires for the switch machine to pass through from underneath the table. The black wire goes to the center terminal on the motor, while the red and green wires go to the other two terminals. You may have to switch these two wires to make the turnout operate in the right direction. ABOVE CENTER: Regular four-conductor

phone cable works well for wiring switch machines. The yellow conductor is not used and can be trimmed away. Phone cable is available from Radio Shack and other electronics or hardware stores. ABOVE RIGHT: Use spade lug connectors to hook the wires to the back of the power pack. Note the two wires from one connector for the block wiring.

help to keep everything neat and orderly underneath the tabletop. You may also want to use some wire ties to bundle everything together after the wiring is complete. There's nothing worse than trying to troubleshoot an electrical problem in a rat's nest of tangled wires.

Mount the control switches alongside the power pack on the corner of the layout. The Atlas control switches are designed to interlock end to end, which means that only one pair of wires from your power pack can supply power to all the control switches. Connect the two wires from the control switches to the accessories or AC terminal on the back of the power pack as shown. These switch machines must operate on alternating current (AC), so do not hook these wires up to

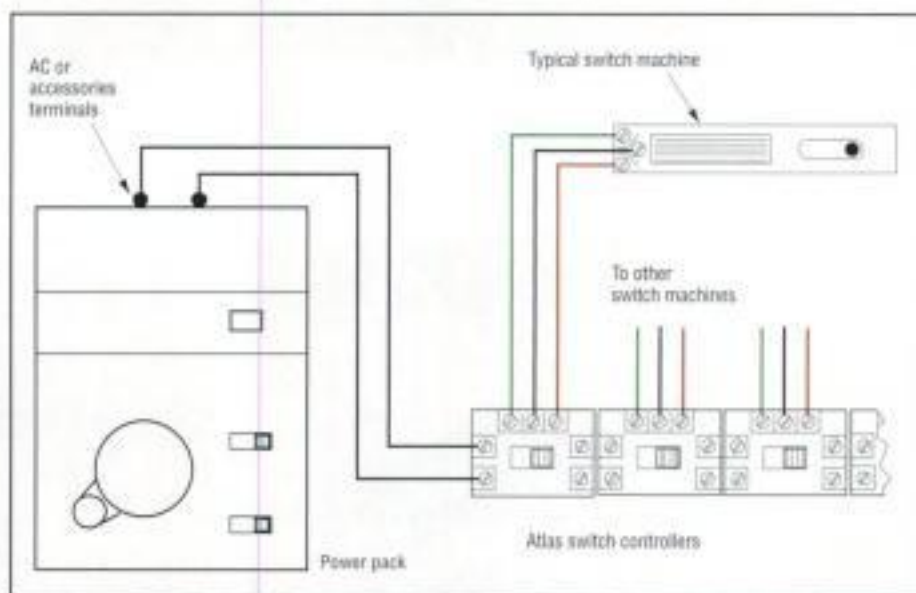
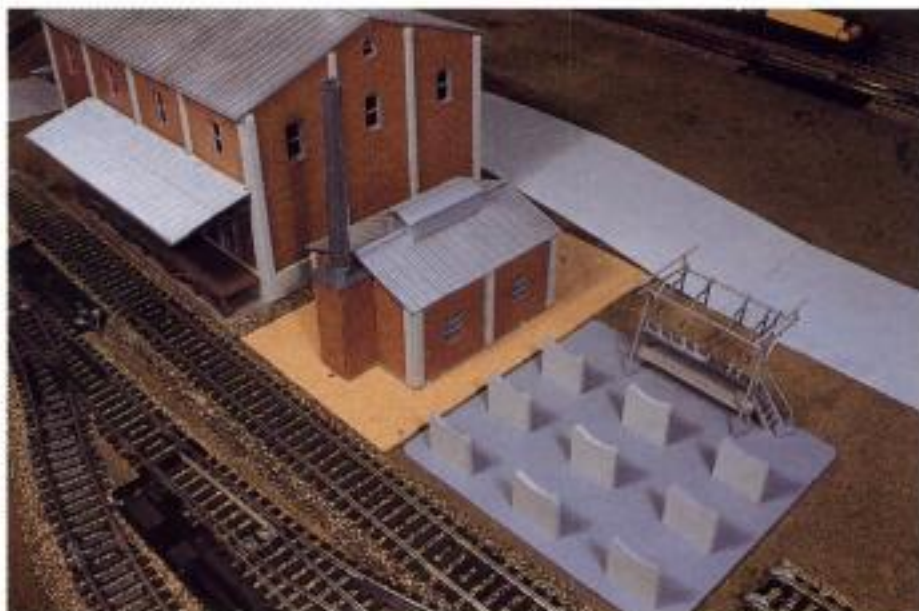


Figure 3. Wiring the Remote Control Turnouts



ABOVE LEFT AND RIGHT: Remove the ground cover from the areas where you want to install structures. Fasten the structure in place with

white glue. Since white glue doesn't stick permanently to plastic, this allows you to pop the building loose if you decide to move it later.



The Walther's Cannery structure is fixed on pieces of sheet cork so that a freight car can roll under the overhanging roof section. Pieces of sheet cork can be applied to the layout with white glue. Like the plywood tabletop, this cork can be covered with ground foam.

terminals labeled either "DC Accessories" or "Fixed DC" if your power pack has them.

Now run the wires from the control switches to each turnout. Drill $\frac{1}{8}$ " holes for the wires in the tabletop next to each remote control turnout and each control switch. The Atlas turnout packages include short lengths of three-conductor wire. In most cases, however, these lengths of wire won't be long enough to reach the turnouts, and you'll need to purchase additional wire. Four-conductor phone cable works well for wiring turnouts. You can purchase phone cable from Radio Shack or other electronics or hardware stores.

Feed the wire through the hole you drilled alongside each turnout. Strip the wire leads and attach them to the turnout terminals using the screws provided. Run the wires over to the



When the structure is installed, cover the base with ground cover to help it blend into the layout. Use diluted white glue to hold



everything in place. You can add some lichen to simulated shrubs alongside the structure.



You can make dirt roadways by sprinkling earth-colored ground cover on the layout and fixing it in place with diluted white glue. Where the roads cross the rails, be sure to not obstruct the



flangeways for the car and locomotive wheels. Run a freight car over the crossing several times before gluing the material in place.

control switches. Cut the wires to the correct length and feed them up through the table to the control switches. As you did before, strip the wire leads and connect them to the switches as indicated.

You may want to wire the turnouts in order with regard to the control boxes. Pick a turnout on the layout and designate it number 1; then number the turnouts in order as you proceed around the layout. On the Callahan Central, one of the passing track turnouts is number 1. This turnout is wired to the first control switch.

After all the turnouts are wired, turn on the power pack and try each turnout. To operate them, move the switch to one side and press it down for a moment. The turnout should throw instantly. Do not hold the button down for more than one second. If you do so, you run the risk of burning out the turnout motor. If any turnout doesn't work in either or both directions, double-check its wiring. When you get everything working properly, apply the supplied number decals to the control switches.

Finishing Touches: Ground Covering and Structures

Finish this stage of the layout by adding new structures and more greenery. The new industrial spurs will certainly need some new structures to go alongside them. Your local hobby dealer should have industrial building kits that look at home on the Callahan Central.

When installing new structures on the layout, you must remove the ground cover from the table where the building goes. Again, trace the outline of the structure's base with a small screwdriver and remove all the foam inside the lines. Vacuum up the loose ground cover, test-fit the building, and then use white glue to fix the buildings in place.

As the last step in this stage, go back over the entire layout and touch up the ground cover. Touch up any spots around the new track and buildings where you may have removed a little too much ground cover. Using the methods described in Stage 1, wet



After the track is complete and the scenery installed, it's time to have some fun and run some trains. Switching cars in the yard and industrial section makes operating your layout even more enjoyable!

the tabletop with the spray bottle, then sprinkle the ground cover in place. Apply diluted white glue with an eyedropper and let everything dry. Some buildings have simulated earth cast into their bases. These bases will look much better if you cover them with ground cover. After the glue has dried overnight, use an abrasive track

cleaning block to clean all the rails.

With all these steps complete, your model railroad now has additional operational possibilities. Instead of running your trains in circles, you now can switch trains in the yard or transfer cars on the industrial tracks. Your model railroad is well on its way to becoming a full-featured miniature railroad.



Two-train operation can add plenty of interest to a model railroad. An operator can share the fun with a friend or relative or take the challenge of keeping two trains operating smoothly from one track to the next.

STAGE 3 Adding a Second Main Line for Two-Train Operation

A layout with one train running is enjoyable. However, the desire to operate more than one train at a time eventually enters the minds of most model railroaders. Maybe you want to share the fun of operating your layout with a friend. Or maybe you simply want to get more operational variety by running two independently controlled trains on one layout.

In this stage of construction you will learn how to add two-train operation to your layout. The idea of

running two separately controlled trains on the same layout may sound complicated, but in reality it's quite easy. Follow the instructions, and in no time you'll have two trains plying the rails of your pike.

In order to run two trains on the Callahan Central, you'll need to install more track. In this stage the Callahan Central gains a second mainline loop. The track plan in Figure 1 shows the track arrangement for Stage 3. The outside loop of track uses 22"-radius curved track sections to fit around the

18"-radius curves of the inner track. The outer loop connects to the inner track through two switches where the passing track was connected to the main line in Stage 2. This converts the passing track into part of the outer main line.

The two separate loops of track allow you to operate two trains on the same layout without running one into the other. Special wiring, which is covered later, will allow you to control either train from one of two power packs. Let's get started!

Modifying the Tabletop

This stage of construction adds vertical variety to the layout by elevating one end of the new loop. A grade at one end of the table adds some visual excitement to what up until now has been a flat model railroad.

Figure 2 shows the part of the loop that is elevated. To raise it, you must cut a portion of the table away from the rest, then install riser blocks underneath to support the raised section. (If you prefer, you can build this stage of the layout without the raised section—it won't affect the track plan.)

First you must determine where the new track sections go and where the table must be cut. To do this, assemble the new track sections on top of the table as you did in Stage 2. Be sure to use the correct number and size of filler tracks as shown in the track plan, or the sections may not fit properly. With the track in place, scribe a line in the ground cover to mark the location for the new track sections.

Next, remove the track from the table and place it somewhere safe. Use a putty knife to scrape the ground cover

BILL OF MATERIALS: STAGE 3

Track and Roadbed

Track:

Atlas Nickel-Silver Snap Track	
821 9" straight	5 (1 package)
822 6" straight	3 (1 package)
833 18"-radius curve	1 (1 package)
836 22"-radius curve	16 (3 packages)
847 track assortment	1 packages
850 left switch, remote	1
851 right switch, remote	1
173 30-degree crossing	1
55 insulated rail joiners	1 package
842 terminal rail joiners	5 pairs

NOTE: Some of these track requirements can be met with leftover pieces from earlier stages.

Roadbed:

cork, Midwest #3013 or equivalent	6 pieces
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Scenery

Woodlands Scenics	
75 ballast, gray	3 bags

Electrical and Misc.

Atlas Electrical Components:	
215 Atlas Selector	3

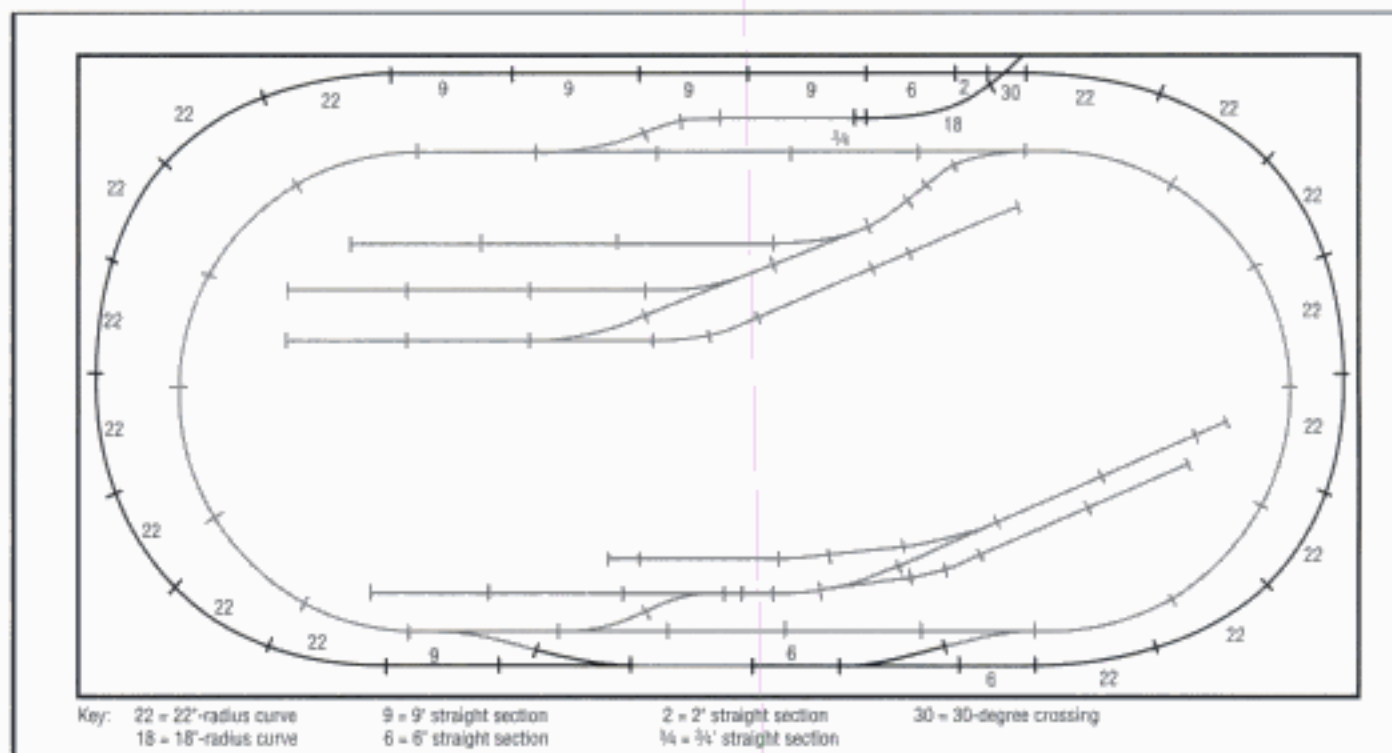
Power Pack

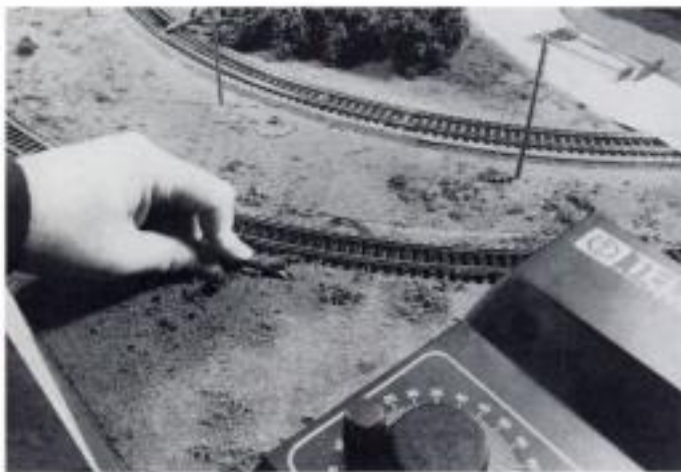
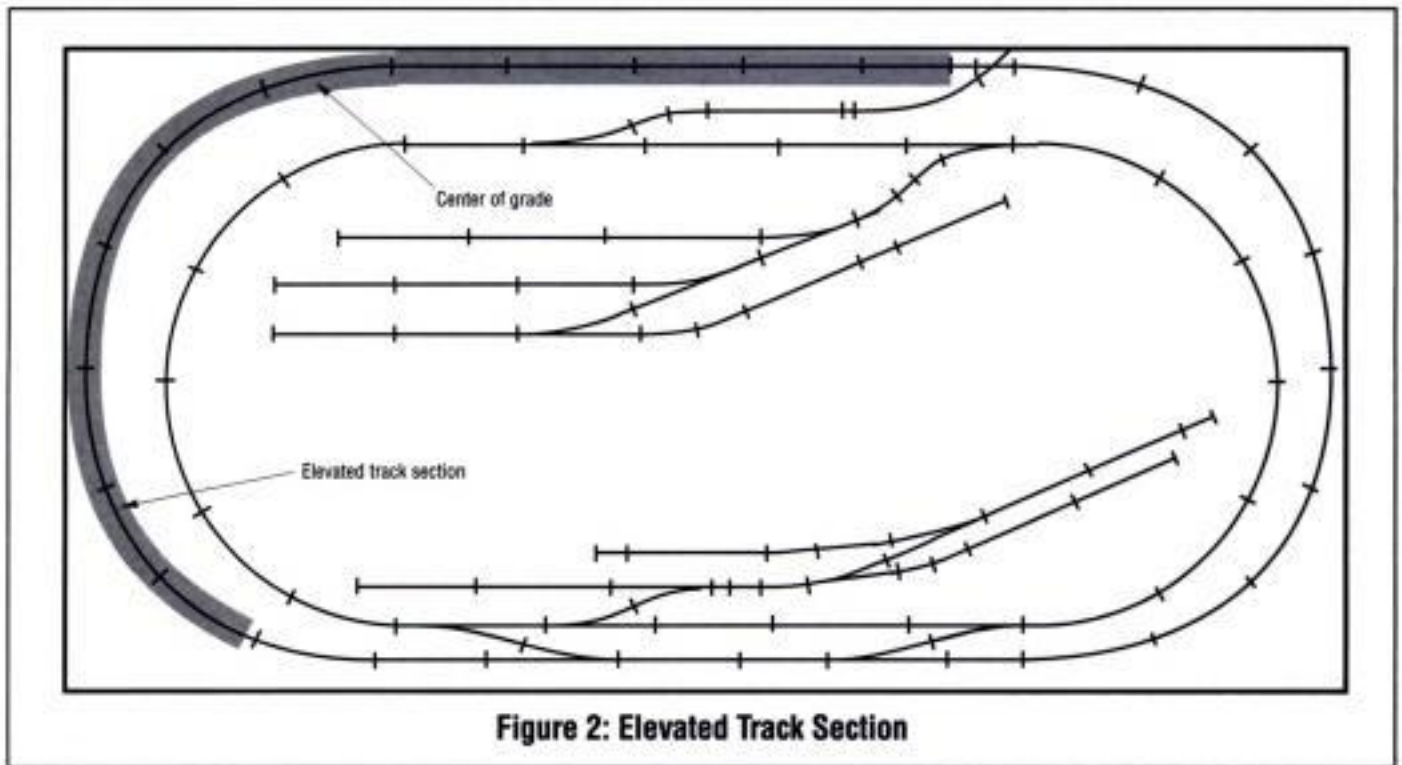
Model Rectifier Corporation 1500 Tech II Power Pack (or equivalent)	1
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Miscellaneous

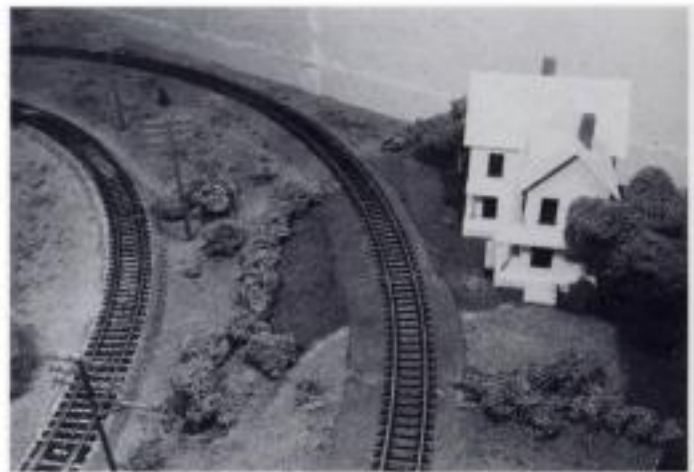
12" x 24" wood shelf	1
1" x 2" x 8"	2
plaster of paris	1 box
artists' acrylics, various	

Figure 1: Stage 3 Track Plan





Once you have laid the track out on the tabletop, outline the location of the pieces, using a screwdriver or other sharp object. Remove the foam from between the scribe lines, and the way is cleared for the new cork roadbed.



It seems nothing stands in the way of progress. Grandma's house has quietly occupied this corner of the layout since Stage 1, but now it must be removed to make room for the second loop of track. Of course, structures can be moved to a new location from time to time to add some variety.

from the new right-of-way. Remove a little extra ground cover around the elevated track sections. Vacuum up the mess and test-fit everything to make sure it all fits properly. Remove any additional ground cover if necessary, then disassemble the track and remove it from the layout.

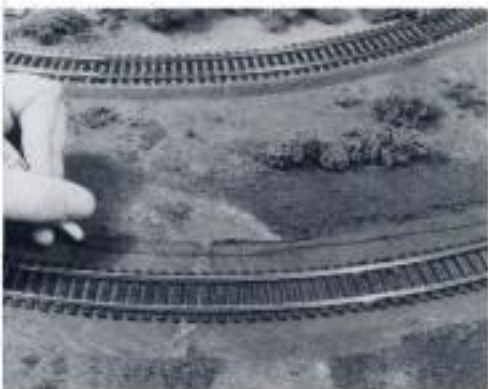
Now mark the section of the tabletop where the track should be elevated. Figure 2 shows the location. Use a felt-tip pen to mark the cut lines along this

section. Be sure to allow about $\frac{1}{2}$ " inch on each side of the track in order to attach scenery after the new track components are installed.

If you haven't already done so, remove the trains and any other loose items from the layout. Now, using a saber saw, carefully cut through the tabletop to separate the raised section of roadbed. Where you must cut across a joist, take care not to cut into it too deeply or you may weaken it. Tilt the

saw forward so the blade just cuts through the plywood tabletop. Also, be careful not to cut any wires on the underside of the layout. You won't need to cut the roadbed section free from the layout. As long as the cuts parallel to the track are complete, the sub-roadbed can bend upward into the proper position.

Be sure to vacuum up the sawdust when you finish cutting the tabletop. Next, remove the screws from the cleats



Use a felt-tip pen to mark the cut line for the raised subroadbed. Be sure to allow enough room to attach the scenery once the roadbed and track are in position.

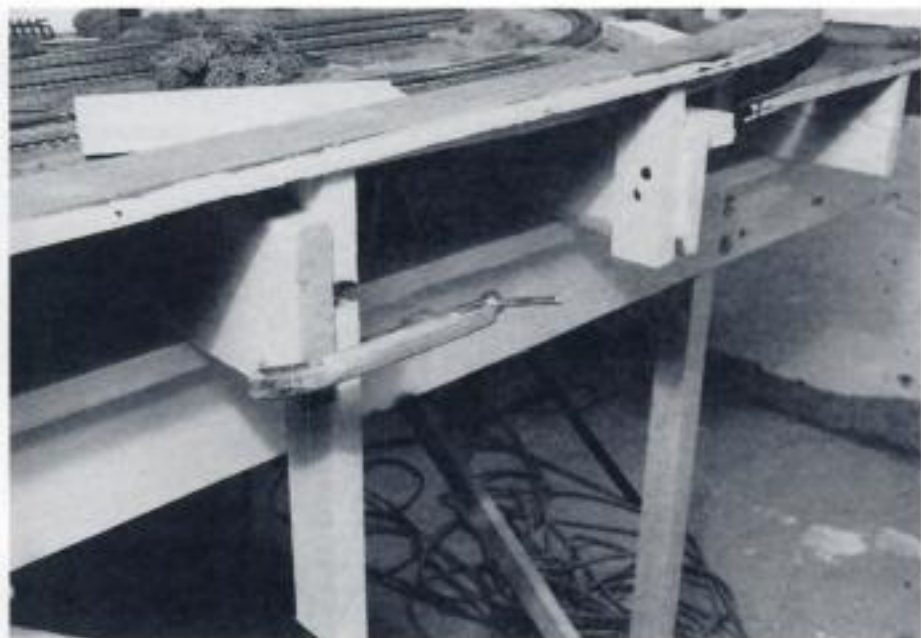


Use a saber saw to cut the raised subroadbed from the rest of the layout. The vibration from cutting the wood will cause anything that's loose to bounce around the layout—so remove the trains and any other loose items from the table to prevent them from falling off the edge of the layout.

holding the raised section in place. This will allow the subroadbed section to bend upward from the rest of the table.

Now, as illustrated, cut risers to support the subroadbed. Fasten one riser in position directly underneath the roadbed, to the second joist from the end of the table. This should be the center of the grade. Push the riser up until the roadbed is about $2\frac{1}{2}$ " above the tabletop. Be sure the roadbed is level on this riser. If it isn't, adjust the position of the riser, then fasten the riser to the joist with drywall screws. Be sure to cut any extra length from the bottom of the riser—anything extending below the layout can be hazardous.

Now work down the grade along the long edge of the layout. Use C-clamps to hold risers in place on the joists while adjusting the grade. The



This view shows the center riser installed on the second joist from the end. An additional riser is clamped into place to adjust the grade. Be sure to cut the extra length from the risers so you don't bump your head on them when wiring the layout.



Add cross braces between the two end joists to support the risers in this area. Lengths of 1 x 2 work well for these pieces. Be sure to drill pilot holes for the screws when you attach the cross braces, as the 1 x 2 lumber splits easily.

subroadbed should rise evenly from table level to the top of the grade. Again, make sure the roadbed is level on top of each riser. When everything is adjusted properly, fasten the risers to the joists with drywall screws.

Now cut the risers for the other end of the grade. There's an extra step to

installing the risers on this end. Since the curved track runs mostly between the two end joists, there is no place to attach risers. To overcome this problem, you must install several cross braces to support the risers. Lengths of 1 x 2 will work just fine. Measure and cut five pieces to fit between the two



A countersink drill bit allows the drywall screws to rest flush with the surface of the subroadbed. Make sure the subroadbed is level when you fasten it to the riser.

joists, then fasten them in place using drywall screws.

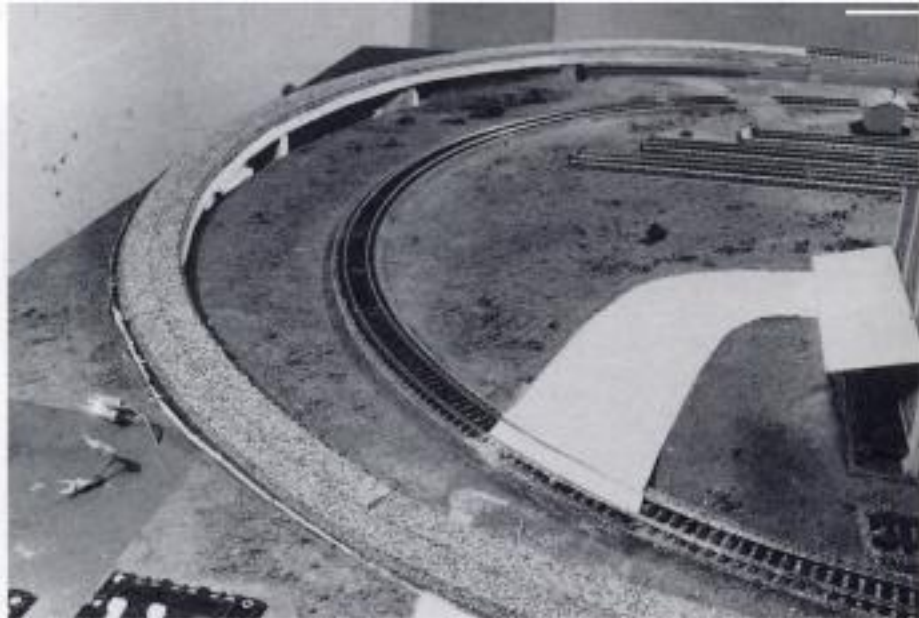
Next, attach the risers to the cross braces. Clamp them in place while making final adjustments. On the curved section of the grade, use extra care to ensure that the subroadbed sits level—it tends to lean to the inside of the curve. When you have adjusted the risers properly, fasten them in place on the cross braces with drywall screws.

Now attach the subroadbed to the risers. Using a countersink drill bit, drill two holes through the subroadbed and into each riser. Be sure to make the countersink deep enough that the screw head sits below the surface of the subroadbed. When you have drilled all the holes, fasten everything in place with short 1" drywall screws.

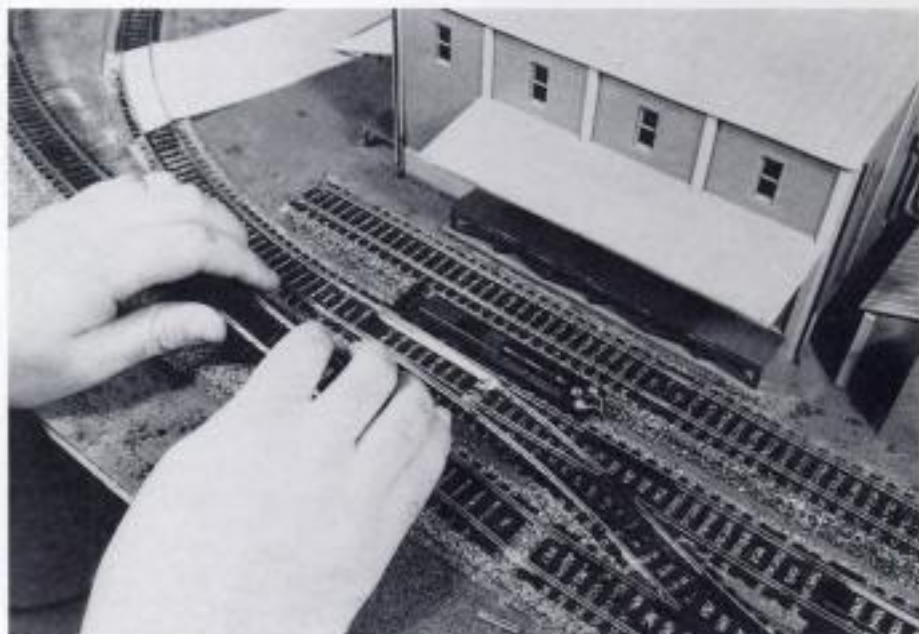
Installing the New Track

Now that the table is modified, start working with the cork roadbed and track. Use the techniques described in Stages 1 and 2 to lay the cork. Start at one end of the passing track. Cut the pieces to fit against the existing passing track roadbed and glue them in place. Proceed around the layout, finishing the cork at the other end of the passing track. You'll have to cut and fit the pieces around the interchange track. When you're done, let everything dry thoroughly.

Now it's time to install the new track. Start by pulling nails from the passing track sections, then remove the



Apply the cork roadbed using the techniques described in Stages 1 and 2. The road crossing here will be rebuilt with plaster once the track is installed.



Install the turnouts as illustrated in the track plan. Be sure to insert the insulated rail joiners as shown in Figure 3. Wait until all the pieces are in place before you nail the track sections down—you will need to align everything once all the track pieces are in place.

Trim the ties to allow the turnout throwbar to move in each direction. Use a sharp hobby knife to trim the offending ties away.



track pieces between each turnout. Next, set the new turnouts into place. Be sure to install the insulated rail joiners in the outside rail between each pair of turnouts as shown in Figure 3. Then lay the sections of track between the turnouts. Be careful not to break the stem of the passing track feeder wire installed in Stage 2. You will use it to power part of the new loop of track.

Now lay the track around the rest of the layout. Install plastic rail joiners in the outside rail at the locations shown in Figure 3. Also, install feeder wires in the outside rail between each pair of insulated rail joiners as shown. These electrical "blocks" are important for wiring the layout for two-train operation. As in the earlier stages, don't nail the sections down until all the new track sections are in place.

Finish by positioning the interchange track on the freight yard side of the layout. Install an insulated rail joiner in the outside rail of this track as shown, but do not install a feeder wire past this joiner. This creates a dead electrical section at the end of the interchange track and will help prevent an errant locomotive from accidentally running off the edge of the layout. After all the new track sections are

installed, align everything and nail the track in place.

Wiring for Two-Train Operation—A New Location for the Control Panel

The Callahan Central uses the common-rail wiring technique to run two trains independently. This wiring method is straightforward to install and allows the operator to run any train from either power pack on any part of the layout.

The way it works is simple. As you know, your train needs power from both rails in order to run. Electrons leave the power pack, run through one rail to the motor, then return to the power pack through the opposite rail. This closed circuit is what makes your locomotive run.

In common-rail wiring, you divide one rail of the layout into electrical "blocks" (or sections, if you prefer) with insulated rail joiners. On the CC, the outside rail is divided. You connect feeder wires from each of these blocks through toggle switches to one terminal on each of two power packs, called A and B. When thrown

in either position, the toggle switches route power from power pack A or B to a given block. You wire the other rail (the "common") directly to the same terminal on each power pack. See Figure 4.

If a toggle switch is set to the "A" position, the circuit from power pack A is closed in that block, and that unit runs any train in that block. At the same time, any blocks that are set to the "B" position receive power from power pack B. The common rail carries one side of the circuit for each power pack—hence the name of this technique. The toggle switches used on the CC also have a center-off position, which allows each block of track to be turned off altogether.

As I mentioned previously, in order to use common-rail wiring, you must divide the entire layout into electrical blocks. By following the instructions above, you have already completed the blocks for the outer loop. However, except for the yard and the industrial section, the inner loop is still one continuous electrical block. So the first step in setting up two-train operation is to install insulated rail joiners and feeder wires on the inner loop of track. See Figure 3.

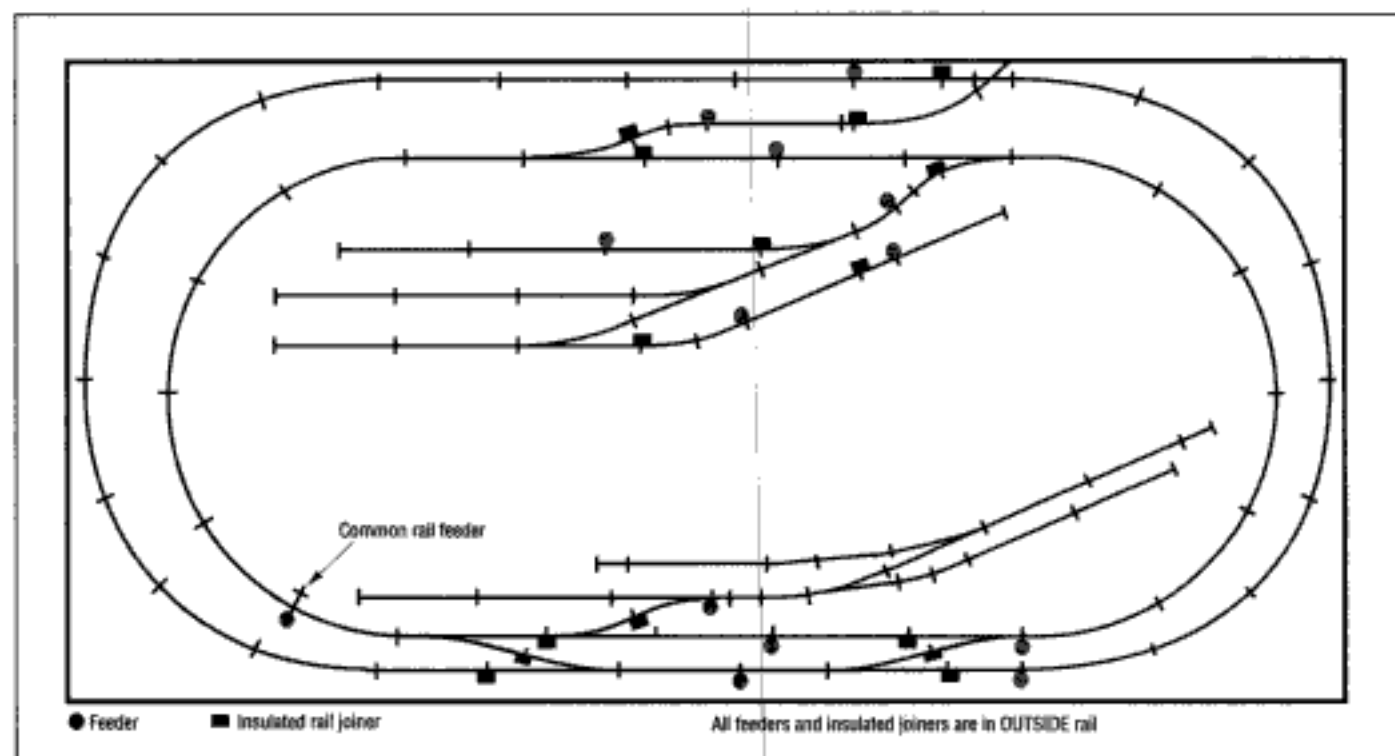
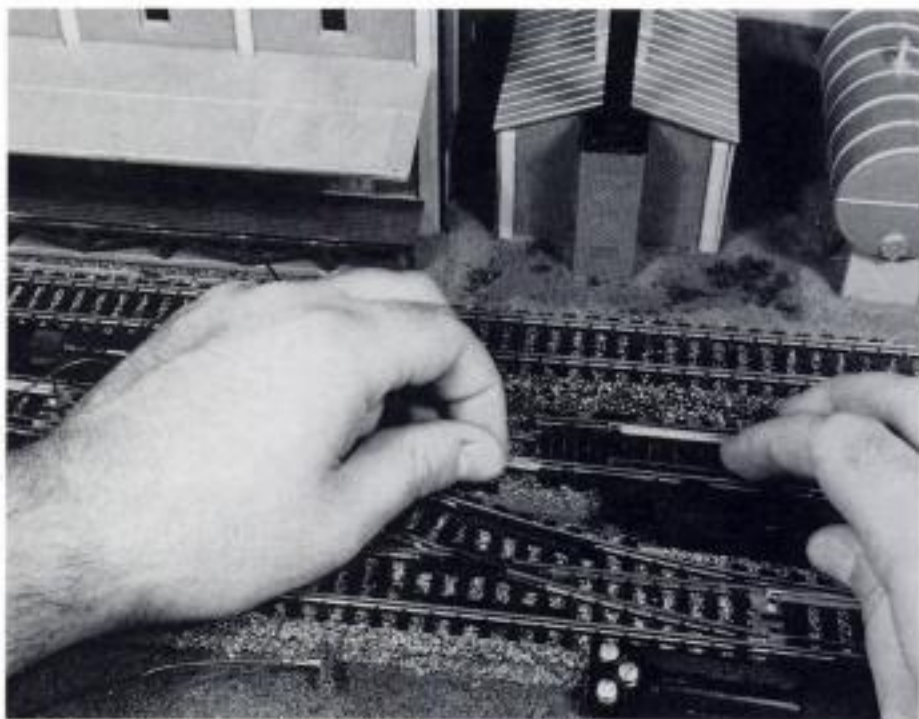


Figure 3: Placement of Feeders and Insulated Joiners



To wire the layout for two-train operation, install insulated rail joiners and feeder joiners as shown in Figure 2. Be careful not to damage the metal rail joiners as you remove the track pieces to insert the plastic joiners.

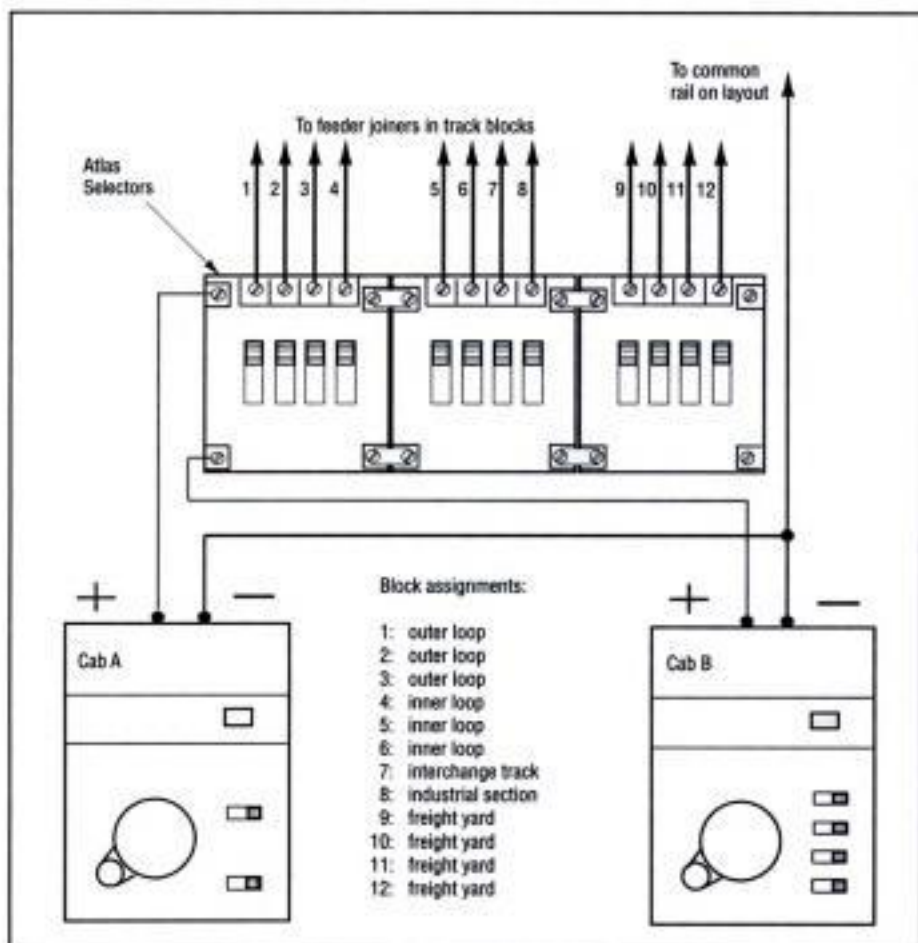


Figure 4: Wiring the Layout for Two-Train Operation

First, use a pair of needle-nose pliers to remove the track rails from the sections near the position of each insulated joiner or feeder. Cautiously lift the track sections straight up until the pieces separate. Be careful not to damage the metal rail joiners, and be sure to replace any joiners that accidentally get bent or damaged. Install the insulated joiner on the outside rail. You will also need to install additional insulated joiners and feeders in the yard section of the layout, as illustrated.

Next, install feeder wires on each of the blocks. Install the feeder wire joiner on the opposite end of the same track piece that has the insulated joiner—this will minimize the number of track sections you must remove. Just be sure to install a feeder joiner between each pair of insulated rail joiners. Remember, they must be installed on the outside rail.

After installing all the feeders, it's time to attach the feeder wires to the control switches. Counting both loops of track, the yard, and spurs, the CC has a total of 12 blocks. To power these blocks, you need three Atlas Selectors, since each selector has a total of four toggle switches. These



With the addition of new controls for two-train operation, the old control panel location is no longer adequate. A new control panel on the other side of the layout will provide plenty of room. Remove the power pack and control switches from the old control panel and move them to the new panel. The wires to the components now must extend to the new location.

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components are easy to install; see Figure 4 for more information.

With the addition of another power pack and the Atlas Selectors, the original control panel area is beginning to run short of space. To provide more room, you can construct a new control panel. The panel shown in Figure 5 attaches to the side of the layout with drywall screws. This panel is large enough to hold both power packs and all the selectors and switch controls you need.

Once the new panel is in place, you can wire the track blocks. First, assemble the power packs, selectors, and switch machine controls on the control panel, then mount them using the screws provided. Drill $\frac{1}{16}$ " holes for the wires in front of each terminal, then connect wires to the terminals and run them to the layout. Be sure to run the wires to the correct blocks. See Figure 4 for the block number identifications.

Finishing Touches—Scenery

The raised track section adds interest to the operation of the Callahan Central, but it leaves an unsightly hole underneath the roadbed. To cover this hole, you can construct a simple embankment around the elevated track using the hardshell scenery technique.

First, form the rough shape of the embankment by crumpling up newspaper and placing it under the raised roadbed. To help the newspaper stay in place, dampen it with water from a spray bottle. Position the newspaper pieces randomly to give the embankment a natural look.

When you are satisfied with the arrangement, you can then apply the plaster. First, cut several strips of newspaper about 2" wide by 10" to 12" long. A paper cutter makes this a quick process. Next, cover the track around the area where you're working. Dry plaster on and between the track is very difficult to remove.

Now you can begin to mix the plaster. Regular plaster of paris works fine for scenery. Slowly add water until you reach the desired consistency—about that of buttermilk. Don't mix a batch of plaster bigger than two cups,

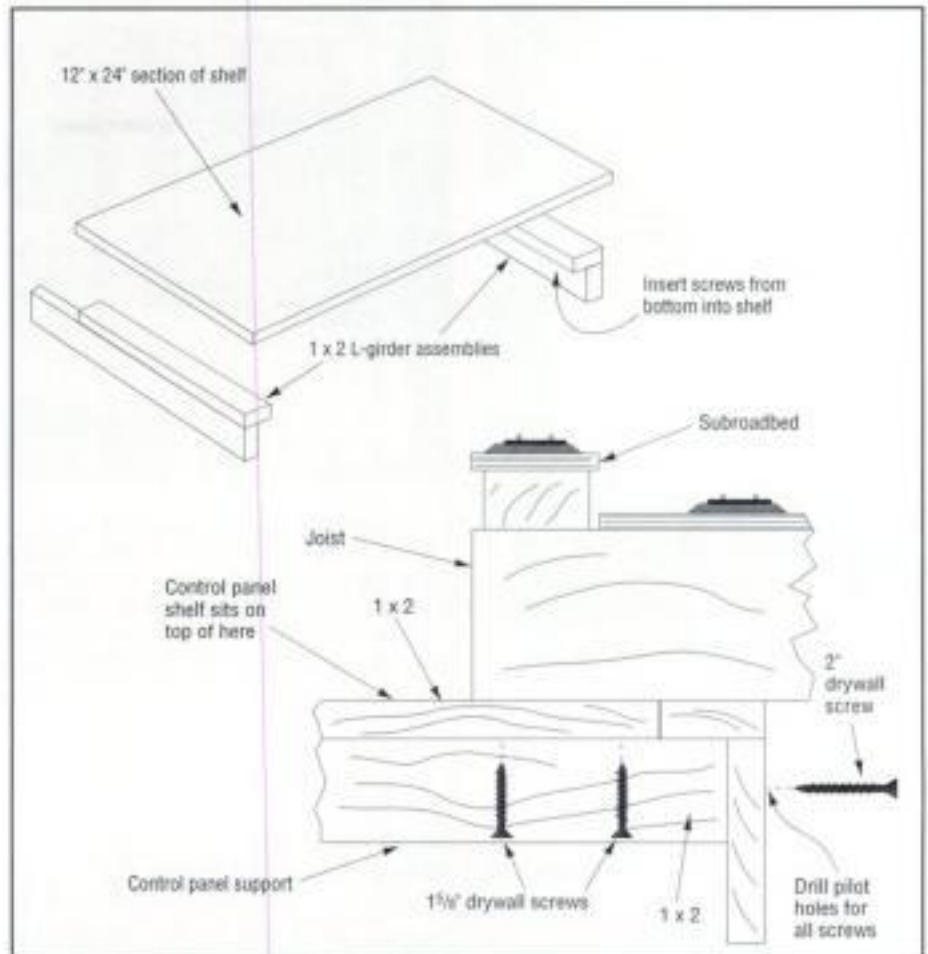
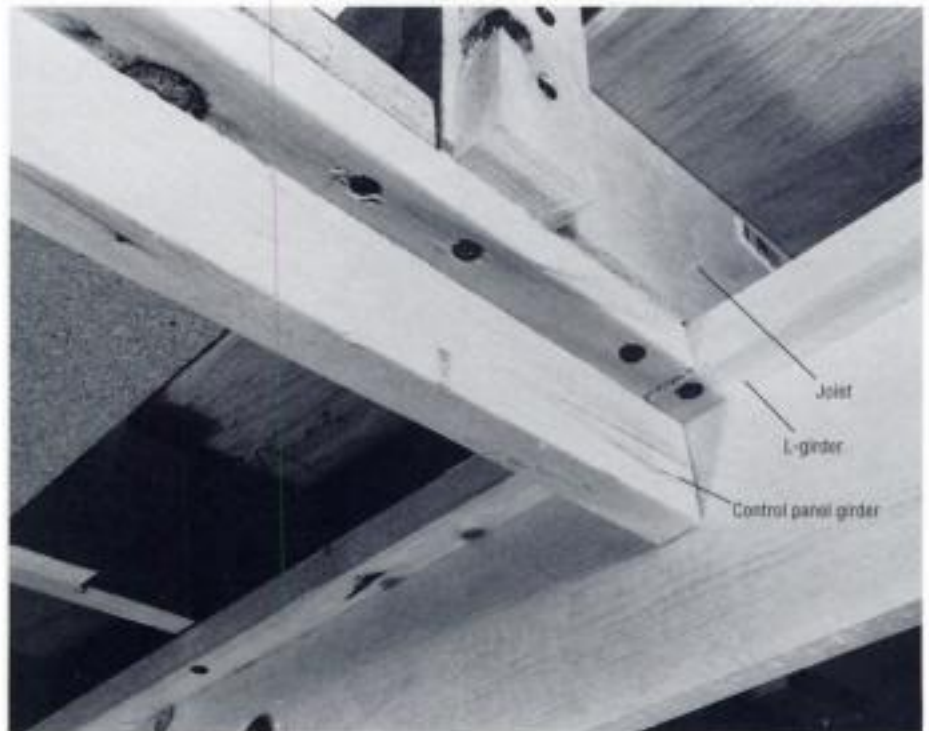
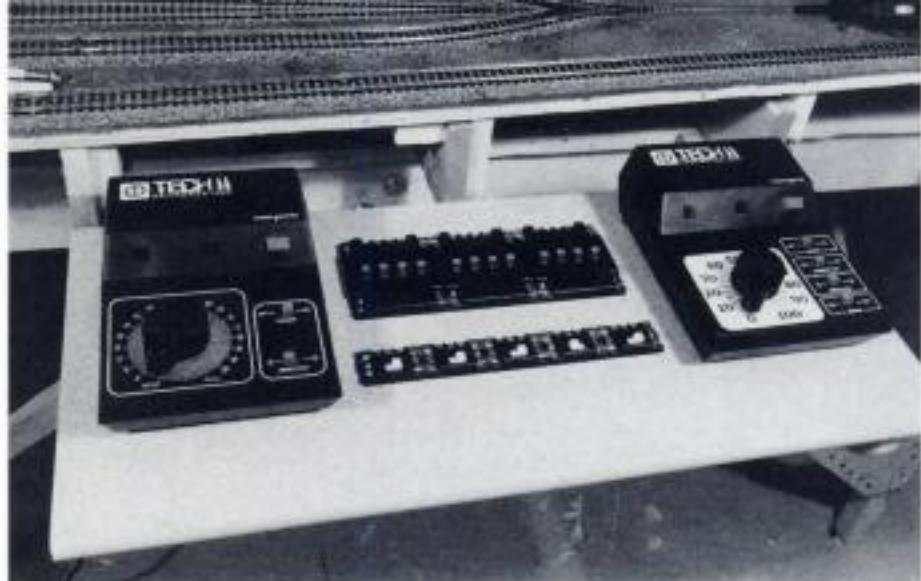


Figure 5: Attaching Control Panel to Layout



The control panel girders attach to the joists and L-girders in the middle of the layout. Several screws are all you'll need to mount the panel to the side of the layout.



LEFT: The MRC power packs on the CC rest in place on the control panel on top of screws. The power pack instruction sheets contain the dimensions that show the exact location of the screws. This method secures the packs, but it also allows you to remove the packs from the panel, should the need arise. **ABOVE:** This view shows the finished control panel with the selectors and switch controllers installed. This panel provides more work space and places the operator right in front of the yard for a better view of the action.

as it will most likely begin to set before you have a chance to use it all. Stir the plaster mix well to eliminate any lumps.

Next, take the newspaper strips and dip them in the mixture. Drape the plaster-soaked strips over the newspaper. Start at one end of the grade and work toward the other end. If the

plaster begins to set, stop using the newspaper strips and just spread the thickening plaster mix over the newspaper you've already applied. This will form a nice hard layer on the top of the scenery. Mix additional plaster as needed until you have covered the entire area. Let the plaster dry overnight before proceeding.

While you're working with plaster, you can also reconstruct the railroad crossing. The railroad crossing by the cannery building was removed to make way for the second loop of track. Rather than using posterboard for the crossing, reconstruct this feature with plaster, which provides a nicer-looking crossing. Start by preparing the track. To avoid filling in the flangeways, place strips of styrene plastic along the inside edge of each rail where the road crosses. These pieces will be pulled out after the plaster is applied, leaving nice flangeways for the passing wheels.

Remove the ground cover from the work area and mix some plaster. Here, you want a mixture that is about the consistency of cake frosting. Again, add water slowly until you have achieved the right consistency. When the plaster is mixed, apply it over and around the track with a putty knife. Smooth it to blend the plaster into the adjacent scenery, and then smooth the road surface until it is free from any uneven areas. A wet finger works well for putting the finishing touches on the road surface. After the plaster starts to set, pull the plastic strips out of the flangeways. To keep the plaster from chipping when you remove the strips, slide your wet finger along the strip as you pull it loose with the other hand.

When the landscape plaster is firmly set, apply the ground cover using the



Raising the track at one end of the layout left a hole underneath. Simple hardshell scenery plugs the hole and makes a realistic track embankment.



ABOVE LEFT: The crumpled pieces of newspaper determine the final shape of the embankment. Arrange the pieces to provide some variety in the terrain. Don't be afraid to rearrange them until you are happy with the appearance. **LEFT:** Spraying the newspaper with water will help eliminate the paper's tendency to "uncrumple." **ABOVE:** After the newspaper is in place, mix some plaster of paris. Mix the plaster fairly thin, about the consistency of buttermilk. Dip newspaper strips in the plaster, then apply them over the crumpled newspaper. When the plaster dries, you will have a nice embankment for the raised track.

same methods as in Stages 1 and 2. Apply a thick coat of earth-colored latex paint to hide the stark white color. While the paint is still wet, sprinkle the ground foam into it. Use a variety of different colors and textures, and don't be afraid to bring the scenery right up to the edge of the track. Work to blend the new scenery with the existing scenes; if you use the right colors, the new embankment will look as if it's been there from the beginning.

Next, when the road plaster is dry, you can apply the coloring using artists' acrylics. Use several shades of light gray to represent pavement. Dilute the paints with water and wash the color over the plaster, starting with the lightest color. Darker colors can be used to create highlights and bring out the texture of the surface. Carefully blend the colors with a wet brush, then let everything dry thoroughly. Touch up any

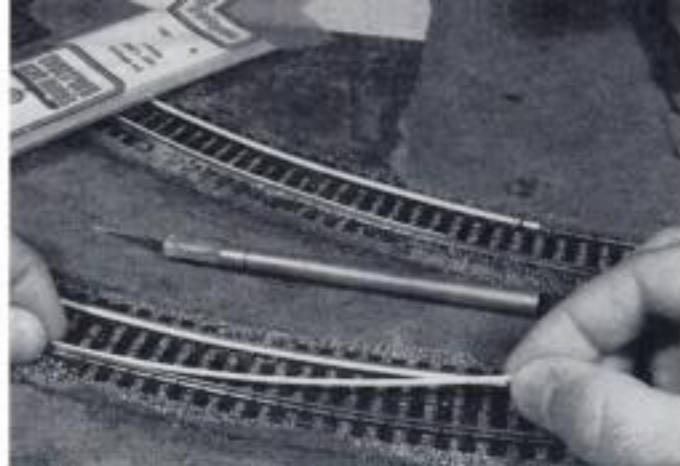
visible plaster later with ground cover.

Since all the track is in place, it can be painted and ballasted. Ballast gives the track a much more realistic appearance, especially if you paint the track beforehand. The simplest way to paint the track is to use an aerosol spray can. Floquil offers a wide variety of railroad colors in aerosol cans, several of which work well for painting track. I used Floquil Roof Brown to paint the track on the CC. You can use a piece of cardboard to protect the adjacent scenery from overspray as you move around the layout. Clean the rails after the paint dries using the track cleaning block.

Then sprinkle the ballast on the track. I used Fine Gray Woodland Scenics ballast on the CC, but the color choice is up to you. Use ballast with a "fine" size rating—anything larger will appear out of scale. Spread and shape the ballast using a dry paint brush.

Use care when applying ballast in and around a turnout, as ballast pieces caught in the mechanism can prevent the points from moving properly. Before applying ballast to a turnout, place a small amount of plastic-compatible oil on the moving parts. It will help prevent the white glue adhesive from fixing the points permanently in one position.

After distributing and shaping the ballast, spray a fine mist of water and detergent mix over the track. A few drops of detergent in the water serves as a wetting agent and helps the white glue mixture flow into the ballast. When the ballast is wet, apply diluted white glue along the track with an eyedropper. Be careful to not miss any spots as you proceed. Don't try to reshape the ballast after applying the glue—the material will stick to your fingers or brush and you'll end up with a mess.



Small styrene plastic strips preserve the flangeways for the wheels as you spread the plaster for the crossing. One product that works well is .040" by .060" strip from Evergreen Styrene. Evergreen styrene pieces are available at most well-stocked hobby shops.



Mix the plaster for the road crossings to about the consistency of cake frosting. Work the plaster down into the tracks using a putty knife. Smooth and shape it with a wet finger. Finally, pull out the styrene strips, and you'll have nice flangeways for the wheels.



ABOVE LEFT: Apply a thick coat of latex paint to hide the stark white of the plaster. Be sure to cover any plaster spills with paint as well.



ABOVE RIGHT: Sprinkle the ground cover directly into the wet paint. Apply the colors carefully so the new scenery blends in with the existing ground cover. If done carefully, the embankment will look as if it was always there!

Artists' acrylics are great for coloring the plaster roadways. Dilute these paints with water and wash them onto the surface of the road. Use darker colors to provide contrast and bring out the texture in the road's surface.



Let the ballast dry for at least 24 hours, then give the track a thorough scrubbing with a track cleaning block. Make sure the inside edge and top of the rails are free from ballast material. Now check the switches. To break the points free, use your finger to move them back and forth several times.

Once the points are free, use the lever on the turnout or push the control button to make sure that the turnout throws completely in both directions. If it still sticks, use your fingers to move the points until everything operates as it should.

All that's left to do is to replant the trees and add a few shrubs. Before you run your trains, vacuum the entire layout to remove the extra ground cover and plaster dust from the track. When you're done, replace the structures and



ABOVE: Ballasting the track adds greatly to the realism of the entire layout. Apply the ballast by pouring some on the track and spreading it with a dry paint brush. Apply enough ballast to cover the cork roadbed.



Switches and ballast can be a bad combination unless you take a few precautions. Apply some plastic-compatible oil to the moving parts of the switch before you apply the ballast and glue it in place. This will help prevent the white glue from bonding the turnout mechanism in one position.

other details, then put the trains back on the track.

Now you can really begin to enjoy your efforts. Set the block control switches and throttle up both trains. After a little practice, you should be able to keep both trains running smoothly around the layout. Now invite a friend or relative over and let him or her share the fun!



After wetting the ballast with a spray bottle, apply the diluted white glue with an eyedropper. Let the glue flow onto the track, being careful not to disturb the ballast. When the glue dries, the ballast will be nice and hard, yet still look loose.



With the second loop of track in place, the Callahan Central is really starting to shape up. It may take a few hours of operation to get the hang of setting the block switches properly, but before long you will be able to make the trains glide from track to track without a hitch!



In this chapter the Callahan Central is elevated to new heights! A hill and mountain add to the scenery as the railroad continues to grow.

STAGE 4 Building a Mountain and Tunnel

Nature usually isn't flat. Hills, mountains, valleys and river canyons break up the contours of the land. Even places on earth that are normally considered flat actually aren't, of course. Small undulations in the land are still present, the effect left by geological formations and years of erosion by rivers and wind.

But this side of nature has not been depicted in the Callahan Central up until now. With the exception of the raised track section covered in Stage 3, the CC is a flat railroad. Even though the existing scenery looks attractive, a little elevation would certainly add variety to the layout.

In this chapter the Callahan Central rises to new heights. First you'll add a fascia board around the edge of the entire layout to make the whole railroad look more finished. Then you'll add a hill and a mountain with tunnels running through it. With the addition of these items, the CC will take on a whole new appearance.

First Step—The Fascia Board

The first step in building the mountain is to construct the fascia board. "What is a fascia board?" you may ask yourself. Simply put, it's a panel that runs around the edge of the layout. This panel provides a smooth, fin-

ished appearance to the entire layout. This board serves double duty, for in addition to the cosmetic benefits, it also supports the mountain at the edge of the layout and helps define the final shape.

The mountain and hill illustrated in Figure 1 slope up from the table and off the edge of the layout. This gives the illusion that your model railroad—your depiction of the world—continues past the layout's edge. Scenery constructed in this manner requires additional support where the hill and mountain leave the layout's edge. The fascia serves this purpose.

The fascia is made from hardboard paneling, sometimes known as

Masonite. This material is easy to work with, and it looks attractive once installed and painted. On the Callahan Central, the fascia board drops 8½ inches below the tabletop to hide the wiring and table joists. Its lower edge is even with the bottom of the L-girders, which allows the layout, minus the legs, to rest on a flat surface for storage or moving.

The fascia itself requires a frame under the joists to support the bottom edge. The photo on page 52 shows how to build this frame assembly. Cut the pieces from lengths of 1 x 2 and attach them to the layout as shown. Use drywall screws to fasten everything together. Drill pilot holes for the screws to prevent the wood from splitting. Note that the fascia board does not continue around the bottom of the control panel.

When choosing the lumber to build the frame assembly, be sure to select pieces that aren't warped or bent. Bent pieces could cause the fascia to hang crooked.

After attaching the frame, cut the hardboard pieces as shown. When you're cutting these pieces, measure and mark them so that you have one continuous piece along each side of the layout. See Figure 2. This arrange-

ment eliminates seams that would have to be filled and sanded. Cut the fascia on the control panel side of the layout as shown to fit around the control panel assembly.

Once the panels are cut, attach each one to the appropriate side of the layout

using C-clamps. Line up the panels with the bottom of the frame. Next, use a pen to mark where you'll cut the panels for the mountains and tabletop. See Figure 2. If you're in doubt about where to mark the fascia for the mountain, leave some extra material. It can

BILL OF MATERIALS: STAGE 4

Lumber and Materials

1" x 2" x 8'	4
1" x 1" square molding, 8'	1
hardboard, 4' x 8' sheet	1
1" Styrofoam insulation, 4' x 8'	1
brass hinge set, small	1
brass pull knob	1
magnet latch set	1
1" x 1½" drywall screws	approx. 100 each
plaster of paris	1 box

NOTE: Some of these materials may be available as leftovers from earlier stages.

Scenery

Woodlands Scenics	
178 Polyfiber	1 bag
163 lichen	1 bag
164 lichen	1 bag
ground foam, various	
tree twigs, various	

Miscellaneous

white glue	1 bottle
spackling paste	1 jar
masking tape, 2" wide	1 roll

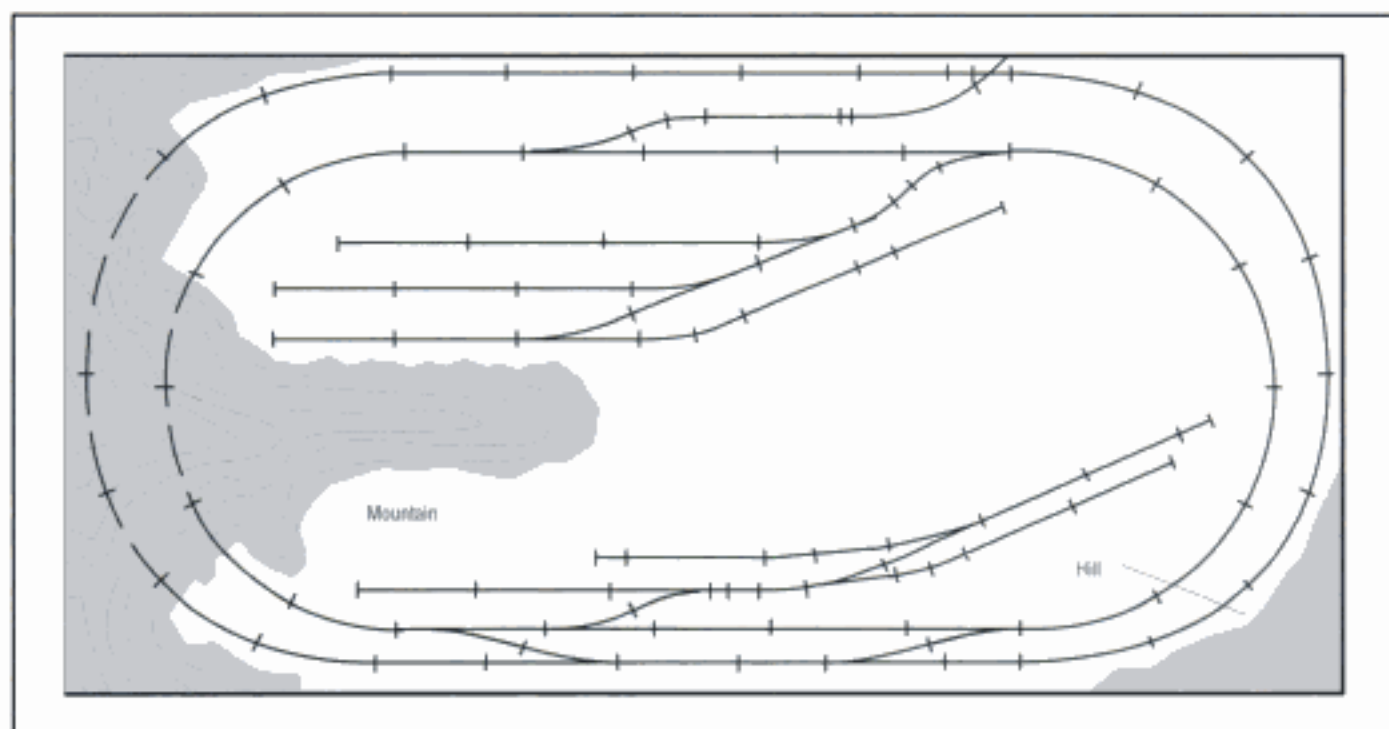
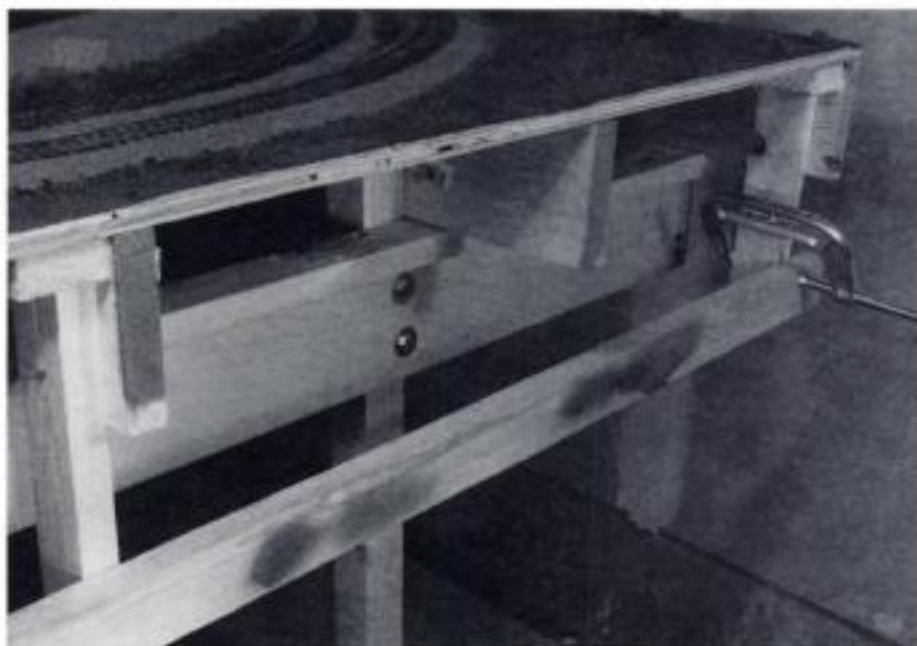
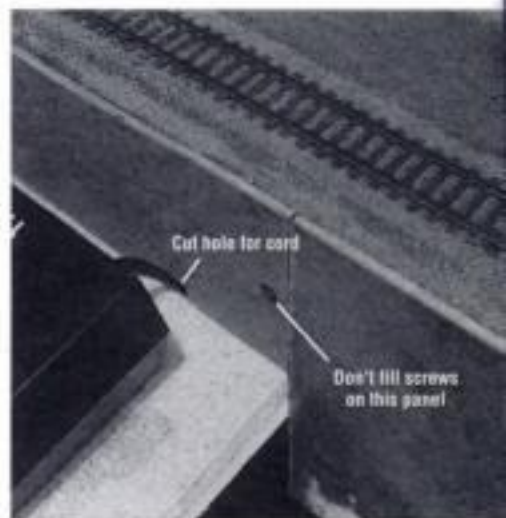


Figure 1: Location of Mountain and Hill



The frame for the fascia board is made from lengths of 1 x 2. The outer surface of the horizontal 1 x 2 should be even with the ends of the joists. Use C-clamps to hold the pieces to the table temporarily while you cut the wood and line everything up. Drill pilot holes and attach the pieces to the table with drywall screws.



The fascia board does not continue under the control panel. Cut a small piece of hardboard to fit between the control panel and the layout as shown. You must cut small holes in the panel for the cords from the power packs. Do not patch the screw heads, as it would then be impossible to remove the power packs from the layout without cutting the cords.

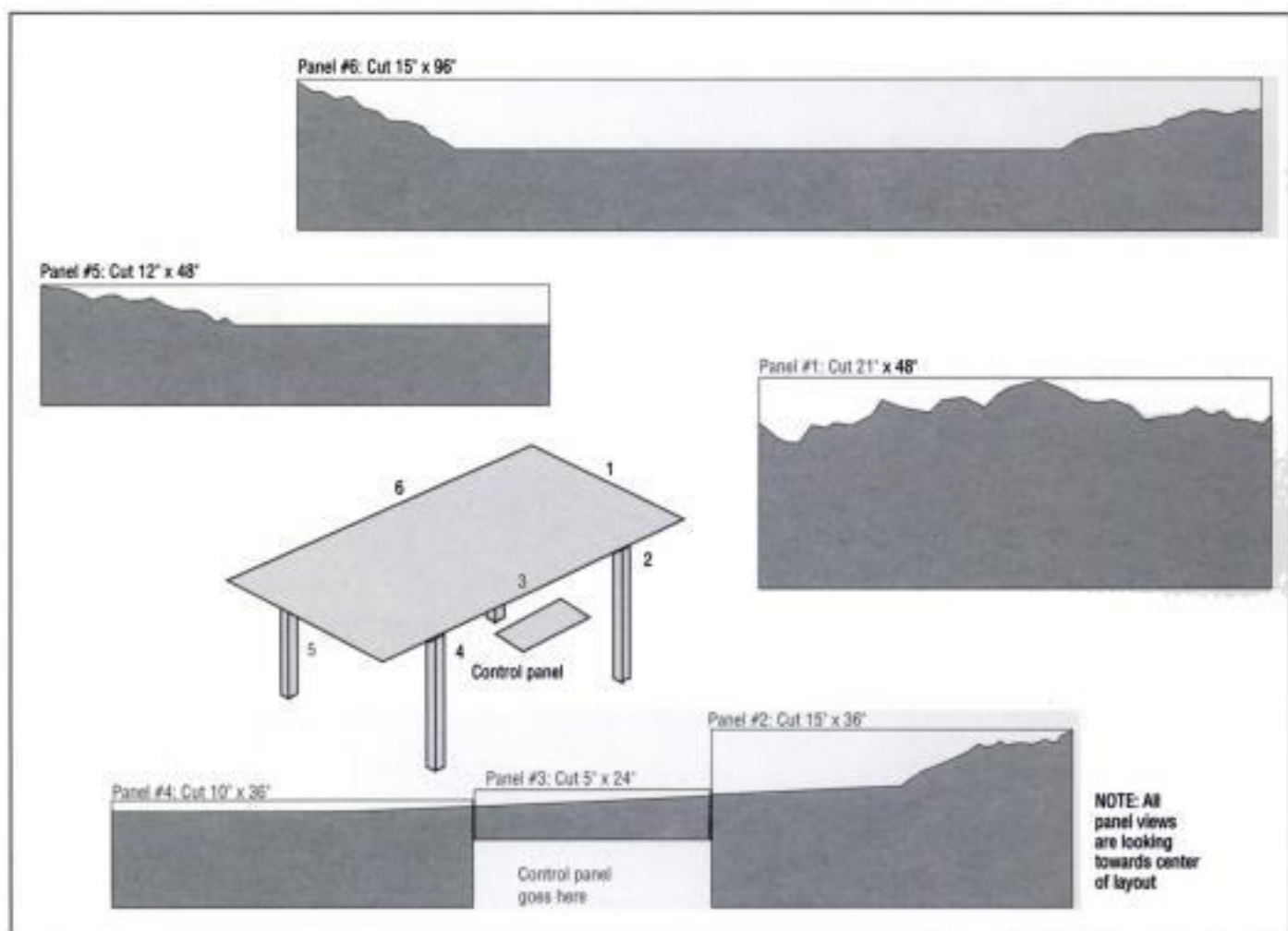
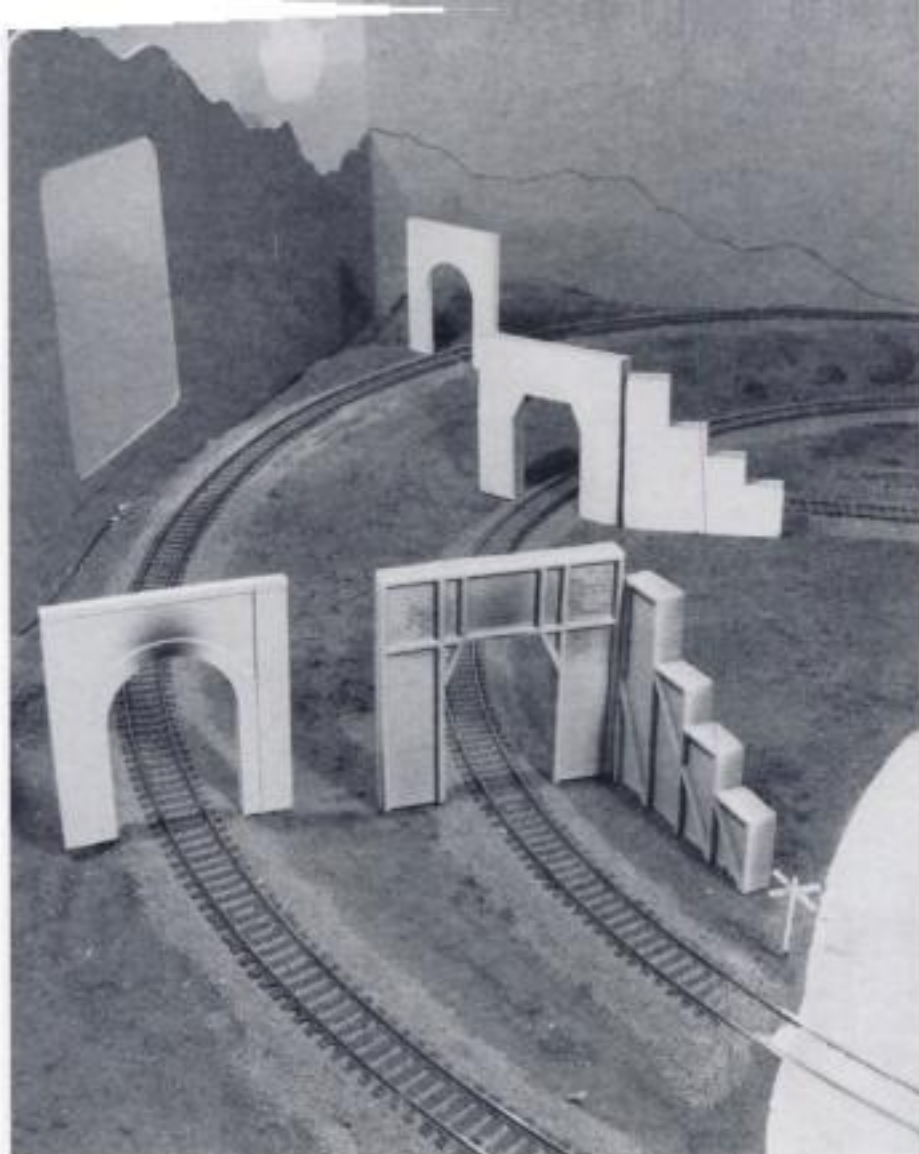


Figure 2: Fascia Panel Dimensions



Place the tunnel portals on the layout to help you visualize the finished form of the mountain while you mark the fascia boards. Note the cutout for the access door.



ABOVE: Use a countersink drill bit to set the screws for the fascia below the surface. Use C-clamps to hold the panel in place while you drill the holes. After the screw holes are filled, sanded, and painted, they will be invisible. RIGHT: Pieces of 1 x 1 molding work well for fastening the fascia corners together. These pieces can be used both above and below the table surface as needed. Be sure to drill pilot holes for the screws, as these small pieces of wood will split easily.



be easily trimmed or sanded away after the fascia board is installed.

When you've marked all the pieces, use a saber saw to cut the panels. The cuts along the mountain sections do not have to follow the lines exactly, since you'll construct the scenery to whatever shape you cut. However, try to make the cuts along the level portion of the table as straight as possible. Any uneven cuts here will show along the edge of the layout after the fascia is completed.

After cutting all the fascia pieces, install them on the frame assembly, using C-clamps to attach them to the frame. Test-fit everything to ensure that the panels fit properly. Trim or sand the pieces to fit and remove any roughness. A quick pass along these edges with 100 grit sandpaper leaves them nice and smooth. Now use a countersink drill bit to drill holes for the mounting screws. Make the countersink holes deep enough that the screwheads rest below the surface of the fascia board. After you drill the holes, attach the board with 1" drywall screws.

Complete the same steps for each of the sides, making certain that all four corners line up. To hold the corners in proper alignment, cut small lengths of 1 x 1 molding and attach them on the inside of the corners as needed.

Install a small door in the fascia board to provide access to the track underneath the mountain. This door will be especially handy for cleaning the track or removing a derailed or uncoupled freight car from inside the tunnel. Figure 3 shows how to build the door. Also, install some 1 x 1 molding braces inside the fascia board to give the large end panel some rigidity when you open and close the door.

When all four fascia boards are installed, turn your attention to the corners of the table. You need to apply some exterior spackling paste to fill the seam where the panels come together. This paste is available at most well-stocked hardware stores. You can also fill the screwheads if you choose. Let the paste dry thoroughly, then sand the material smooth. A power sander comes in handy here, but if one's not available, sandpaper and a little elbow grease work just as well.



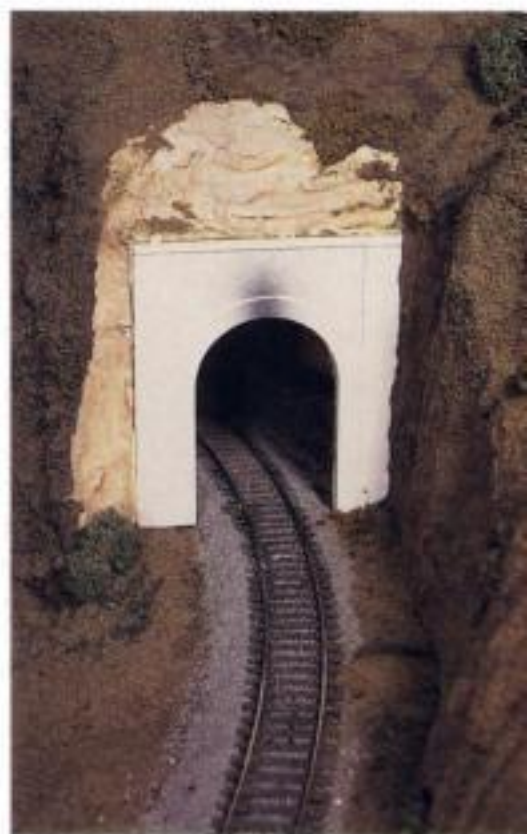
After the glue dries thoroughly, use a rasp bit in a power drill and grind the foam to the final shape. As you can see, this process makes quite a mess, so be sure to stop every few minutes and vacuum up the shavings.



Once you finish shaping the foam, apply a thin coat of plaster over the hill to hide the cracks between the foam pieces. Apply the plaster with a putty knife, then go over it with wet fingers to provide a smooth surface.



ABOVE: Apply the ground foam to both the mountain and hill as you did in the previous stages. A thick coat of latex paint hides the plaster and provides an adhesive for the ground cover. **RIGHT:** The rocks near one of the portals were added as an afterthought. A better approach would be to use rock molds and plaster to create the rock castings right after the main plaster was applied, then color them with acrylics. Washes of brown and gray artists' acrylics make realistic colors.



paper strips around the tunnel portals. Excess plaster here will be difficult to remove from the portal castings. You may find it easier to use some thicker-mixed plaster to touch up any hard-to-reach spots around the portal and retaining wall castings.

When the mountain is complete, start building the hill. As I mentioned previously, I constructed the hill using a different scenery technique. Here, I

stacked Styrofoam pieces on top of each other to form the rough shape of the hill. Then I ground away the foam to form the final shape. A thin coat of plaster finishes the surface and prepares it for the application of paint and ground covering.

To start, cut the Styrofoam pieces to fit as shown. The dense, bright pink insulation Styrofoam sold at building supply stores is the right type of foam

for this project. This material is available in 4 x 8-foot sheets; one sheet will provide more than enough material to finish the hill. This material is easy to cut with a utility knife. Simply score it in the shape you want, then snap it from the sheet.

Cutting the Styrofoam pieces is a trial-and-error procedure. Measure the size of the corner where the hill will go, then cut a piece of Styrofoam slightly



Making homemade trees is easy. First, collect some twigs that are the right size and shape for HO scale trees. Pick twigs that branch realistically into several limbs.



ABOVE AND BELOW: Next, stretch some Woodland Scenics Polyfiber material into small pieces and attach them to the twig with contact cement.



When all the Polyfiber is in place, spray the tree with hair spray and apply some ground foam. Use a variety of colors to give the tree some depth.



TOP AND ABOVE: Plant the trees in the layout by twisting a spade drill bit with your hand to make a small hole in the plaster. Be careful not to make the hole too big. Then simply insert the tree into the hole and fix it in place using white glue.

larger than this size. Test-fit this piece, then cut it to its final shape. Next, cut a slightly smaller piece and stack it on top of the first. Continue to cut and stack the Styrofoam pieces until you have filled the area between the fascia and tabletop and completed the rough shape of the hill.

When you've cut all the foam pieces, glue them in place on the corner of the layout. White glue works well, or you can use Liquid Nails latex adhesive. Start by gluing the bottom piece. Position it so there is little or no gap between the fascia board and the foam. With the bottom piece in place, glue the remaining pieces on top of it, also positioning them against the fascia board.

Before going any further, let the foam pieces dry thoroughly. When they are permanently fixed in place,

you can form them to the final shape. There are a couple of ways to accomplish this. You can use a hot-wire tool to cut the foam to the finished shape. If you don't have one of these tools, a rasp in a power drill works as well, although a bit more slowly. If you use the rasp, the glue holding the foam pieces must be completely dry before starting, or the pieces will pop loose when you start shaping them.

Start shaping the foam at one end of the hill. Slowly work and shape the finished form by carving off the corners of the foam pieces. The rasp will scatter foam shavings all over the layout, so stop and vacuum them up every few minutes.

When you have formed the hill to the final shape, mix some plaster and apply a thin coat over the foam. This coating helps hide the seams between



ABOVE: Before painting the fascia, go back and give the entire board a sanding with 320 grit sandpaper. This will provide a smooth surface for the paint. A power sander makes the process much quicker. Be sure to wear a particle mask to avoid breathing the sanding dust. **RIGHT:** Apply the paint to the fascia using a roller. Use a brush to apply the paint where the fascia meets the scenery. You can paint the fascia to match the decor of a particular room or setting. The color is up to you.



the foam pieces and provides a nice surface for applying ground cover. Mix the plaster to the consistency of cake frosting and apply it to the hill with a putty knife. Use some of the plaster to fill any holes between the foam and fascia board. Let the plaster dry thoroughly before applying the ground cover.

Finishing Touches—Ground Cover and Foliage

After the mountain and hill are in place and the plaster is set, you can apply the ground covering. As in Stage 1, the first step is to apply a coat of paint. Without this step, the stark white color of the plaster would inevitably show through the ground cover no matter how thickly you applied it. Any earth-color latex paint will work, just as long as it dries flat. No glossy dirt allowed!

Apply a thick coat of paint, then sprinkle the ground foam into it. Use a variety of colors and textures, as nature is rarely uniform. If you carefully apply the ground foam, the new scenery will blend perfectly with the existing scenery.

With the ground cover in place, the mountain and hill are beginning to look realistic. However, there's something still missing—the trees! Even on a 4 x 8-foot layout, the number of trees required to make things look natural can number in the dozens, or even hundreds. Unless you are modeling the desert or flat farmland, it's not likely that your layout can have too many trees.

The dozen or so trees added in the earlier stages now look rather inadequate with the new scenery additions, so some additional trees are in order. You will need plenty of foliage to cover the new hill, so you might consider building homemade trees to help keep the costs down. While it may sound complicated, making trees isn't difficult. The key is to let nature provide you with some of the raw materials, namely the trunks. Investigate your yard or surrounding neighborhood, and you will most likely turn up twigs that make ideal HO scale deciduous tree trunks.

Look for twigs that are naturally brown in color and branch realistically into several limbs. Also, collect

many different shapes and sizes to represent a variety of trees. There are literally dozens of species of trees and shrubs that can provide you with ideal twigs.

Next, sort the tree trunks by size and shape. Stretch some Woodland Scenics Polyfiber material into realistically shaped clumps, then glue these clumps onto the tree trunks with contact cement. Again, try not to make your trees look too uniform. In nature, one tree is rarely identical to another.

After you glue the clumps to the trunks, spray the trees liberally with inexpensive hair spray. It's best to do this outside to avoid breathing in the spray residue. Next, while the spray is still wet, sprinkle ground foam onto



The control panel looks much better after a coat of paint. Be sure to remove the power packs and control switches, then paint the panel with a roller and brush. Be careful not to apply the paint too heavily or you will plug the holes for the wires.



Here's a view of the finished access door. As you can see, the trains are readily accessible with the door open.

the fiber clumps. Apply the foam over a container to catch the extra material that doesn't stick to the tree. Use a variety of green shades to give the tree some depth. Start with darker greens, then add lighter greens on top. Finish the tree by applying another light coat of hair spray to seal everything in place.

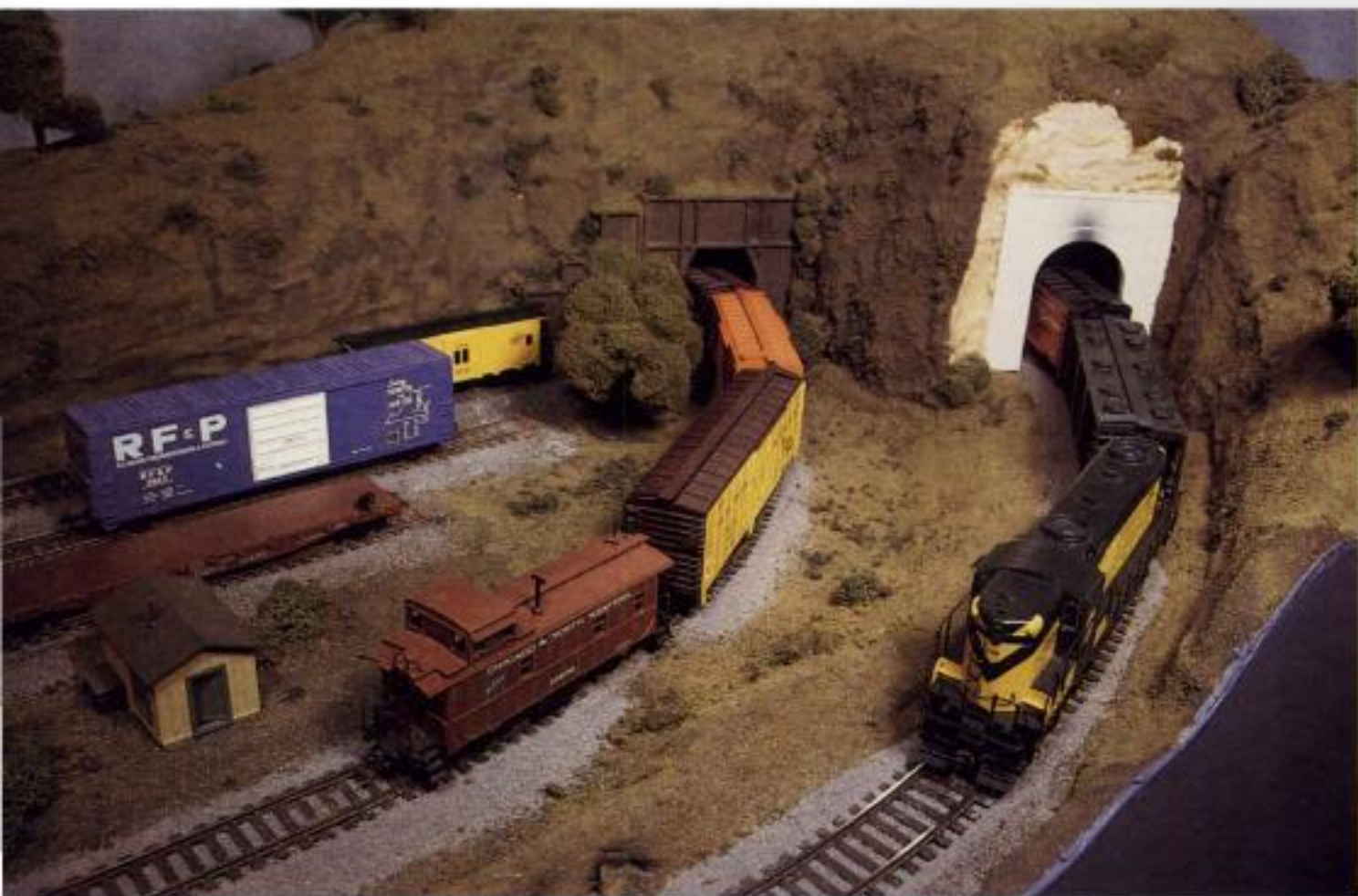
With this technique, you can transform a twig and fiber into a realistic HO scale tree in only a matter of seconds. You'll probably find that you can build several dozen trees an hour once you get the hang of it. Build as many as you like—most model railroads always have room for another tree.

Of course, where you find trees, you'll often find shrubs. You can construct shrubs for the CC by omitting the tree trunk from the Polyfiber method just described. Or you can use lichen. For greater realism, use both methods to add variety to the vegetation on the layout. Attach the finished

shrubs to the layout with white glue.

The last step in this stage is to paint the fascia board. The color and finish are up to you. You can use spray cans, an airless sprayer, or a brush and roller to apply the paint of your choice. I finished the fascia board on the CC using semigloss exterior latex paint applied with a roller. Be careful not to get paint on the layout when covering the area around the top edge of the fascia. You can apply a coat of paint to the control panel too. If you desire, add accent color stripes or designs to the board by applying the accent color, covering the design or stripe with masking tape, then applying the finishing color. Simply peel off the tape to reveal the design.

All that's left now is the cleanup. Vacuum the entire layout and clean the track with a track-cleaning block. When you're done, place the trains and structures back on the layout and run some trains!



As one train comes roaring out of a tunnel, the caboose of another disappears into darkness. Besides adding variety to the scenery, the mountain makes the layout look much larger. It also serves as a view block, dividing the layout into two sections.



Looks like another quiet, sleepy day in the town of Callahan. In this chapter the town comes to life with new structures, new streets, cars, and other details. You can assemble a town with a unique character by selecting from the hundreds of structures and accessories available.

STAGE 5 Building the Town of Callahan

You may have noticed that the town of Callahan has been growing as new structures and town accessories were added. In this chapter we'll take a closer look at some of the methods and products used to bring the town of Callahan to life.

Structures are the main focus of any town, so choosing them determines what you'll have in the end. I selected several different structures to provide a variety of buildings for the town of Callahan. You don't have to select the same structures, of course. With the techniques described below, you can

use virtually any building kit that will fit the available space.

Choosing the Right Structures

Three basic types of structure kits are available—plastic, preassembled, and craftsman. The most common type is the plastic kit. These kits contain the wall assemblies, roofs, bases, and details molded in colored plastic. They are usually ready to assemble using some basic tools and a little modeling time.

There are literally dozens of companies that produce plastic structure kits.

You can find buildings of just about any size, shape, or style. What's more, most of these kits are reasonably priced, which allows most modelers to purchase an entire town's worth without breaking the bank.

Plastic kits are generally easy to construct, and most include assembly instructions. Since the parts are usually cast in colors, painting is not required. However, a quick paint job with aerosol cans or a paintbrush can greatly improve the appearance of the finished model.

Some of the more elaborate plastic kits have numerous parts. It's best to

RIGHT: This model of a modern prefabricated building was built from a Micro-Engineering kit. The structure represents a small industry that can be served by rail. The concrete base of this structure was painted using an aerosol spray can. **LOWER RIGHT:** Neat structures don't always have to be large. This little shanty was built from an Atlas kit and brush-painted to dress it up. The color scheme matches the colors applied to the train station buildings to give the railroad buildings a "family" look.



removing all the pieces from the box and checking for damaged or missing parts. Review the kit instructions and collect the tools you'll need to complete the structure. Then clean up any molding flash with a hobby knife in preparation for painting.

It's easiest to paint the buildings before you assemble the pieces. An aerosol can works well for painting structures, but you can use a paintbrush or even an airbrush. Floquil's numerous colors come in spray cans that work well for structures and other projects around the layout. You can paint multiple colors by masking the first color with masking tape and then spraying the details with the second color. Details on structures can be painted the same way or with a brush.

When the pieces are dry, cut them from the molding sprue and clean up any sprue remnants with a flat mill file. It's best to cut apart the pieces only when you're ready to use them. A pair of flush-cut wire cutters works well for cutting large pieces from the sprue, while a hobby knife is adequate for cutting the smaller parts free.

BILL OF MATERIALS: STAGE 5

Structures

Atlas
702 trackside shanty
706 passenger shanty

Bachmann
35103 Lyric Theater

International Hobby Corp.
3508 general store and billiards parlor
3509 service station

Micro Engineering Company
55004 Murphy Manufacturing

Pikestuff
17 loading dock

Walthers
3001 Gemini Building
3004 Wallschlag Motors
3006 Interstate Fuel and Oil
3018 Golden Valley Canning Company
3033 Neighborhood Food Mart
3037 Western Avenue Fire Dept.

Miscellaneous

Evergreen Styrene:
134 .030" x .080" styrene strip 1 package
144 .040" x .080" styrene strip 2 packages
9030 .030" thick sheet 4 packages
4514 .040" sidewalk material 1 package

Oregon Rail Supply:
123 dwarf signal, pair 2 pairs

Model Power
494 streetlights 2 packages

Odds and Ends
vehicles, various
plastic cement 1 bottle
white glue 1 bottle
paint, aerosol paint can, various
paint, Polly S bottles, various
masking tape 1 roll



A quick paint job can do wonders for the appearance of a plastic kit. Here, the Walthers Automobile Dealership receives a coat of light brown before assembly. Floquil offers a large variety of aerosol paints that work well for model railroad structures.

After cutting the walls from the sprue, the next step is to install the windows and doors. Cut the window and door castings from the sprue and glue them in place using plastic cement. Apply the cement sparingly to the inside surface with a small fine-tipped

paintbrush. Don't install the "glass" pieces just now—you may choose to spray the structure with a matte lacquer spray after the building is assembled.

When all the windows and doors are installed, assemble the walls on the structure base. When gluing the walls together, first remove any paint from the surfaces to be joined. Next, check that the pieces fit together properly. Make sure the walls fit together squarely without any gaps or large seams.

If everything fits properly, apply the liquid glue to the top inside portion of the joint as shown in Figure 2. Gravity will carry the cement down the entire joint. Use the glue sparingly, so it doesn't damage the visible surfaces of the parts. Also, be sure to work in an area with adequate ventilation, as most modeling glues can be hazardous to your health.

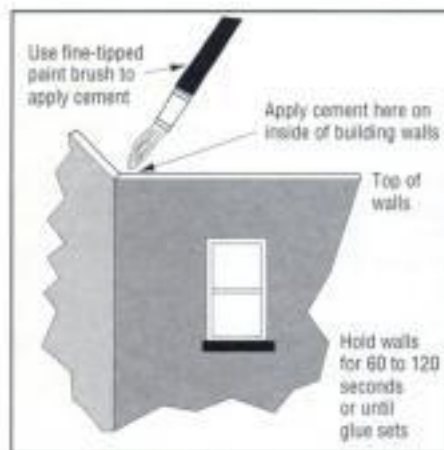
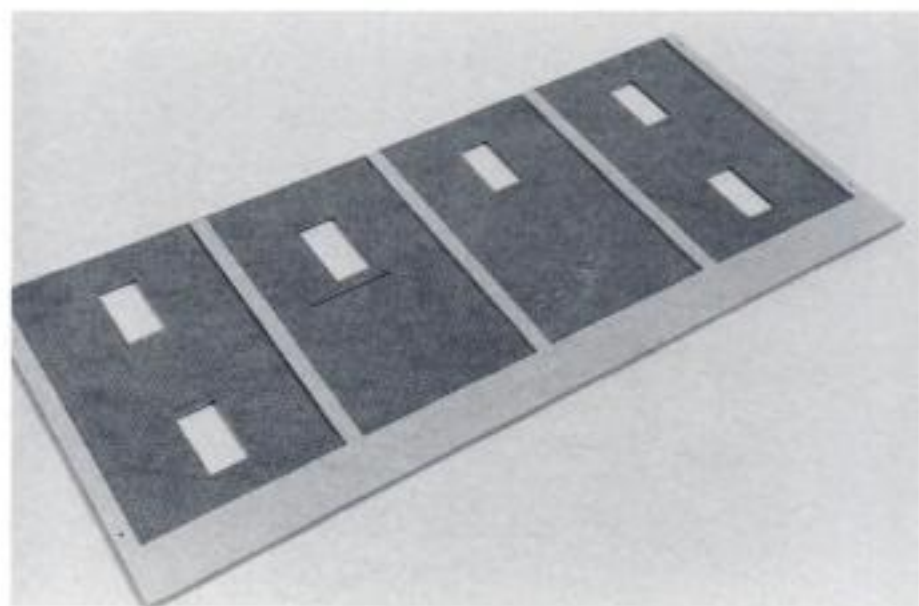
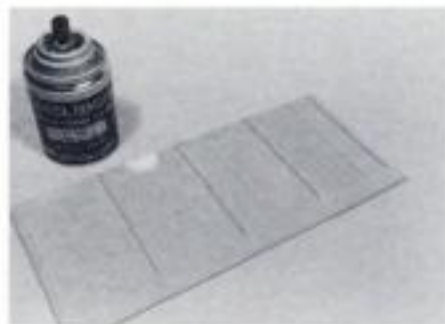


Figure 2: Gluing Structure Walls

Hold the wall assemblies in place for a minute or two until the glue sets. After the glue takes hold, move on to the next wall. When all the walls are complete, install the roof and any remaining exterior details. Then when all the parts are assembled, let the structure dry for several hours. You can use rubber bands to hold everything tightly together, if necessary. Before installing the "glass," spray the building with a coat of Testor's Dullcote. It blends the different colors of the building and eliminates the plastic sheen of unpainted plastic parts.



Painting details is easy with the aid of a little masking tape. UPPER LEFT: Place the tape over the portions of the kit you don't want to paint. Make sure the edges of the tape are sealed to the structure. UPPER RIGHT: Then spray the structure using an aerosol paint can. ABOVE: Remove the tape from the structure after the paint has set for a few minutes.

Painting Existing Buildings

I painted the newer structures shown in this chapter at the same time as I built them; but I had never painted some of the earlier buildings.

Unfortunately, since the earlier buildings were already assembled, they couldn't easily be painted using an aerosol can. Instead, I used a brush to apply the paint. It's important to choose the right type of paint for brush-painting models. Since so much of it comes in contact with the surface of the model, it must be plastic-compatible. Polly S paints are ideal for brush-painting structures, as they are plastic-safe acrylics that clean up easily with water. What's more, Polly S offers numerous colors that look appropriate on structures.

For the best results from brush-painting, apply the paint, then leave it alone. If you continually re-brush the paint, you will work in brush strokes

Even assembled structures can benefit from a fresh coat of paint. **RIGHT:** The Atlas train station kit as it appears out of the box. **BELOW:** The kit after a new coat of paint and a new parking lot. Painting assembled structures is time-consuming, but the results are worthwhile.



that set in the finished surface of the model. It's best to start with the base color, such as that used for the walls, and then paint the details in the appropriate colors. Depending on the color, you may have to apply several coats to get adequate coverage. Allow the paint to dry thoroughly between coats.

When the paint is completely dry, spray the entire structure with Testor's Dullcote in an aerosol can. This helps seal the paint and blends the colors. While brush-painting takes longer than spray-painting, the results can be just as good.

Building New Streets

The roadways receive a thorough upgrade during this stage as well. The original posterboard roadways still look okay, but they lack sidewalks and a detailed street surface. As a result of the new roadways, the town will be changed too.

To start the rebuilding, first remove the existing roadways. Use a putty knife to scrape the road pieces loose from the tabletop. Also remove the ground cover

from the entire town area. Remove as much of the ground foam and old adhesive as possible so that the structures and roadways will lie flat. As before, vacuum the loose debris before it scatters all over the layout.

Next, plan the design of the town. The street arrangement is much as it was before, but most of the structures will be relocated. Move the structures around and try different arrangements until you find one you like. Use a felt-tip marking pen to identify the location of the roadways and buildings on the tabletop once you decide where everything will go.

Now start building the new streets. Instead of posterboard, the new street is made of styrene plastic. Evergreen styrene, available at most well-stocked hobby shops, comes in a variety of plastic strips and sheets, including pieces scribed with sidewalk patterns. This material is easy to work with and can be painted to represent a variety of different surfaces.

Before you start cutting the styrene pieces, decide how you want to model your streets.

Prototype streets and sidewalks are almost always made from one of two materials—poured concrete or asphalt. Real poured concrete streets are made by pouring concrete into forms, one section at a time. The sections give the finished roadway a segmented look. Asphalt roads are formed by pouring a hot asphalt mixture into a paving machine, which forms the roadway. Rollers then smooth the mixture into one continuous road surface.

Styrene works well for modeling either type of roadway. On the CC, I modeled poured concrete roads for the downtown area; I used asphalt for roads outside of town and a couple of parking lots.

The streets themselves are made of .030" plain sheet styrene. The curbs are made of .040" x .080" styrene strip, and the sidewalks are cut from .040" thick styrene sidewalk material. You will also need some .030" x .080" strip to support the sidewalk section. See the parts list for the correct Evergreen part numbers.

Construction is fairly straightforward. First, cut the roadways from the .030" styrene sheet. The concrete streets were made 30 scale feet in width. This works well for a two-lane road with parking on one side. To measure the pieces in scale measurements, you will need a scale rule. This tool shows the measurements in HO scale feet and is handy for all sorts of modeling projects. Again, a well-stocked hobby shop should have what you need.

When you have marked and measured the pieces, cut them from the sheet using scissors. For the concrete streets, you must scribe the form lines. I made the pour sections a scale 10 x 15 feet. Use the scale rule to measure these dimensions, mark them with a fine-tip marker pen, then carefully scribe lines in the styrene with a hobby knife. Make the lines just deep enough that they will be visible in the finished roadway. Use a scrap piece of plastic to practice scribing a few lines. While scribing the lines, be careful not to cut yourself—the hobby knife blades are sharp.

Now glue a curb section along the edge of each street piece. Glue the curbs with an .080" side facing the street section. It only takes a little

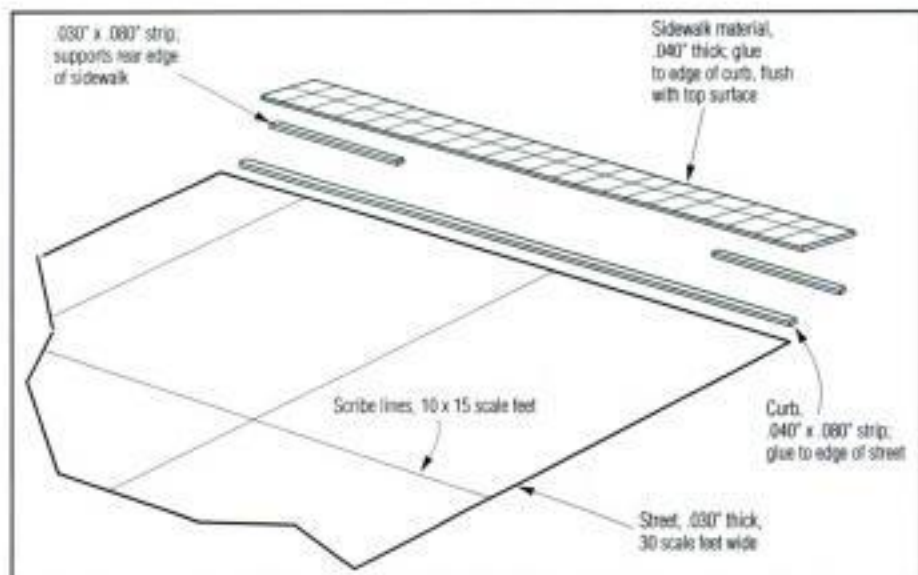
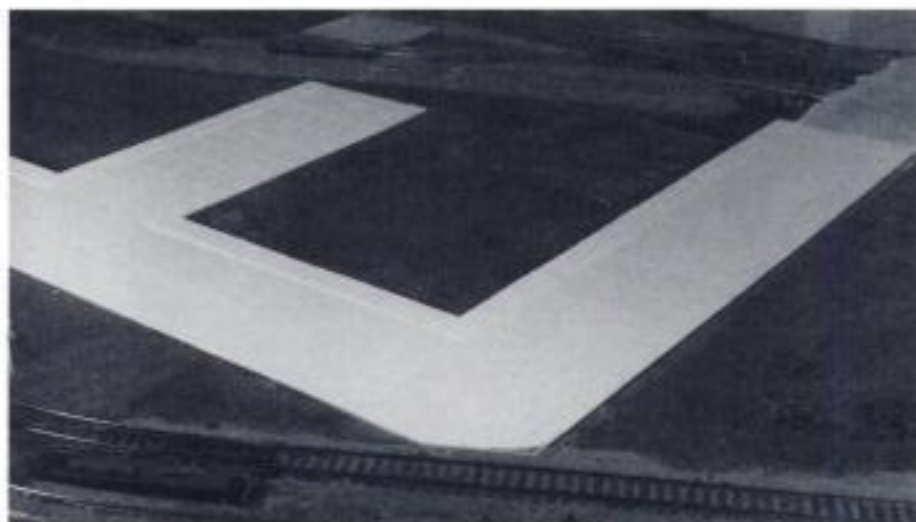


Figure 3: Concrete Street and Sidewalk Construction



ABOVE LEFT: You'll need a scale rule to measure the score lines on the concrete road sections. This tool shows actual HO scale dimensions, allowing you to cut and scribe parts in scale sizes. This tool also comes in handy for other modeling projects. **ABOVE RIGHT:** Score the scribe lines in the street pieces with a sharp hobby knife. Be extremely careful that you don't slice your fingers.



Once you build the roadways, test-fit them on the layout to see that they fit properly. Make any adjustments before painting the roadway.

plastic cement to make a tight bond between raw styrene pieces; be careful not to use too much—any excess might deform the surface of the plastic.

Sidewalks on the CC are a scale 6 feet wide. Measure the pieces and cut them with a hobby knife. There's an easy way to make straight cuts on styrene. First, score the piece a few times with your hobby knife, then snap it along the score line. A few passes with a flat mill file will quickly clean up any burrs.

Cut some lengths of .030" x .080" strip to support the sidewalk, then glue them to the bottom of the sidewalk pieces. When they are dry, glue the sidewalk assemblies to the roadway-curb pieces. It works best to stagger the joints between the sidewalk pieces and the roadway pieces, as this helps strengthen the assemblies. If you want, you can assemble the entire road section at your work table, or you can assemble several smaller pieces and make the final assembly on the layout.

Before you place the pieces on the layout, paint them an appropriate color. Krylon Dove Gray in an aerosol can works well to simulate concrete road sections. Whichever paint you use, make sure it's plastic-compatible. Paints that aren't plastic-compatible will distort, or craze, the surface of the plastic, ruining hours of work. Again, when in doubt, test the paint on a scrap piece of plastic before spraying it on the roadway assembly.



Glue the road pieces in place using white glue. Then if you decide to rearrange the town section later on, you'll be able to pop the roadways loose without damaging them.



Two trains meet as they pass over the drainage culvert leading to Callahan Creek. Model water is always an attention-getter on a layout. In this stage you will see how to add the creek and drainage ditch shown here.

STAGE 6 Get Your Feet Wet: Build a Creek!

Since I added a mountain and hill during Stage 4 construction, the next logical addition to the Callahan Central would be a creek or lake. While the CC doesn't have room for a lake, there is space in a corner of the layout to add a creek.

Figure 1 shows the exact location of the creek. In addition, there's room for a drainage ditch on the inside of the two track loops, and for drainpipes running under the track and into the creek. Since all the track is already in place and ballasted, these additions can be completed without removing the track. With some careful planning and

cutting, it's easy to do. Moreover, these items will work nicely to fill the only unoccupied corner of the layout.

Before building the creek and drainage ditch, you must cut into the tabletop to recess these areas. Using the track plan as a guide, trace the location of the creek and drainage ditch on the tabletop with a felt-tip pen. The exact location of these waterways is not important, but use care when marking their location to ensure that they don't pass right over a joist. See Figure 1. While it's possible to cut away a joist for the table recess, it would require a lot of work.

After you've marked the creek and drainage ditch on the table, remove all the loose items from the layout. Use the saber saw to cut the holes in the tabletop. Be careful not to damage the track sections as you cut alongside them. Don't worry about disturbing the track ballast, as it can be touched up later. When you've cut the plywood pieces, set them somewhere safe where they won't be accidentally thrown out.

To build the creek, cut into the fascia board at the edge of the layout, making the openings correspond to the openings in the table. On the short end of the layout, you'll also have to cut

into the end joist located right behind the fascia. Be careful not to cut too deep, as any mistakes here will be visible when the creek is complete.

Now add cross braces between the joists to support the plywood cutouts. See Figure 2. Cut lengths of 1 x 2 to fit between the joists. Insert these 1 x 2 pieces so they are flush with the bottom of the joists; this will set the depth of the creek at a consistent level. Since the fascia board is already installed on

the end of the layout, you must insert screws through the fascia to hold the 1 x 2s in place. Use a countersink bit to drill pilot holes so that the screwheads will rest below the surface of the fascia board. The screw holes can be filled later with spackling paste.

After the 1 x 2 cross braces are installed, place the cutouts from the table on top of the braces, centered under the table openings. These pieces will support the creek and drainage

ditch scenery. Position them in the correct location, then attach them to the cross braces using drywall screws as shown.

To blend the openings with the existing scenery, fill the holes with Styrofoam and shape the creek and drainage ditch using a rasp in an electric drill. This is the same method you used to build the hill in Stage 4. To fill the holes, you'll need to cut out pieces in the exact shape of the holes. The easiest way to do this is to place a piece of foam on top of the layout and trace the opening from below. Then use a utility knife to trim the foam piece to the proper shape.

It took two layers of foam to fill the holes even with the tabletop. Cut the required foam pieces and test-fit them into the holes. When you have cut the foam pieces to the proper shape, glue them in place using white glue or Liquid Nails latex adhesive. Allow the glue to dry at least 24 hours so the foam can permanently bond to the layout.

After the foam is firmly glued in place, use a rasp bit in an electric drill to carve out the creek and drainage ditch. This is a time-consuming process, so

BILL OF MATERIALS: STAGE 6

Raw Materials

1" Styrofoam insulation	1 sheet
EnviroTex	1 package

NOTE: some of these materials may be available as leftovers from earlier stages.

Scenery

Woodland Scenics	
1262 culvert set	1
ground foam, various	

Miscellaneous

artists' acrylic paints, various	
white glue	1 bottle

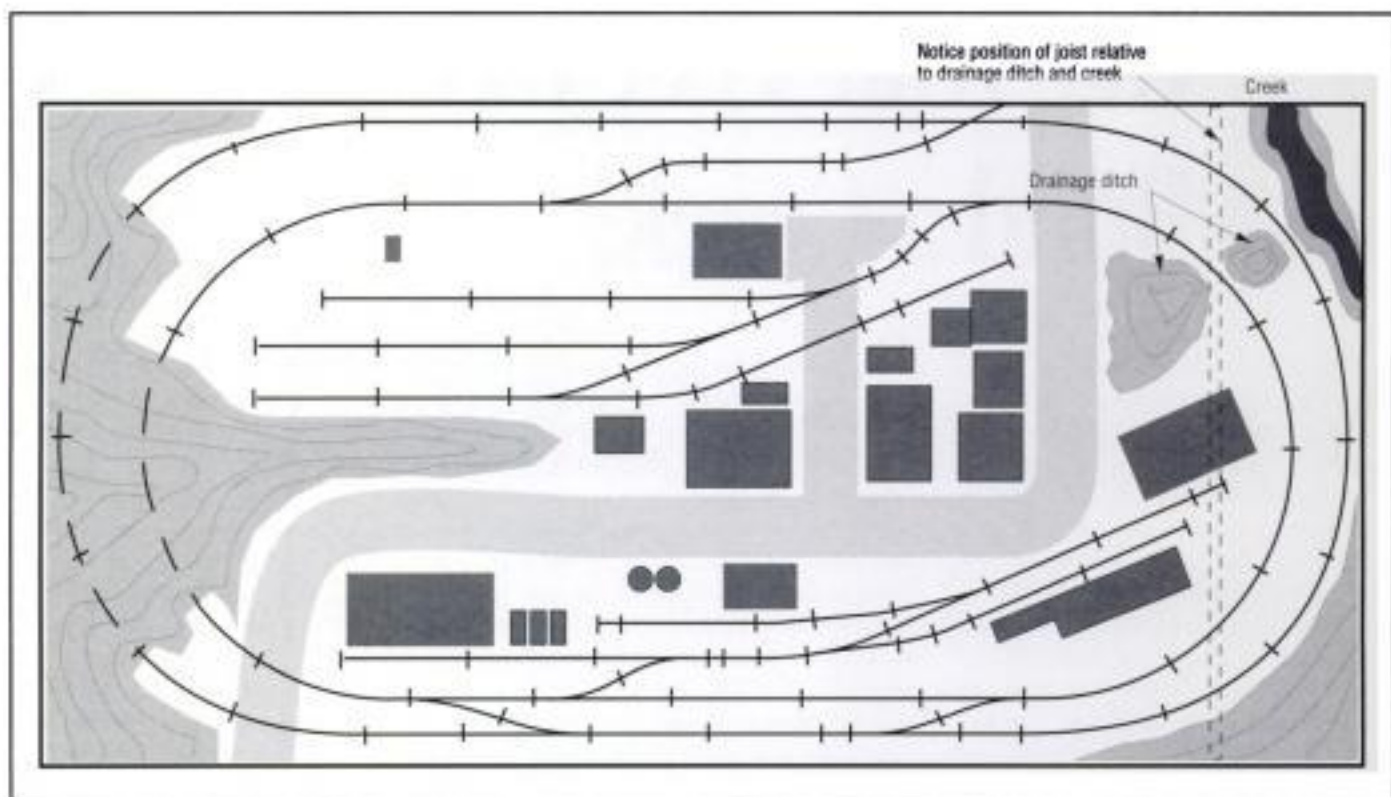
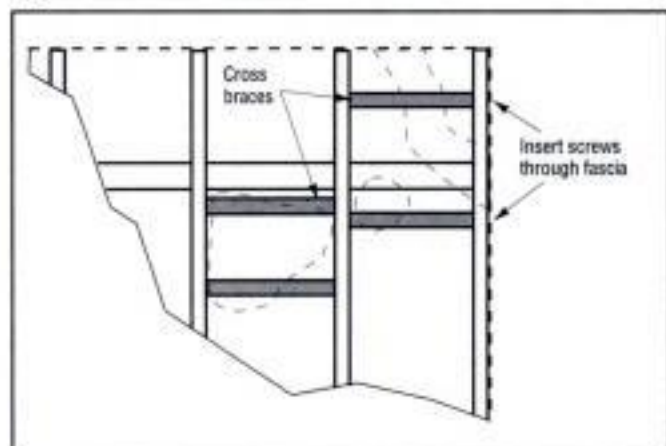
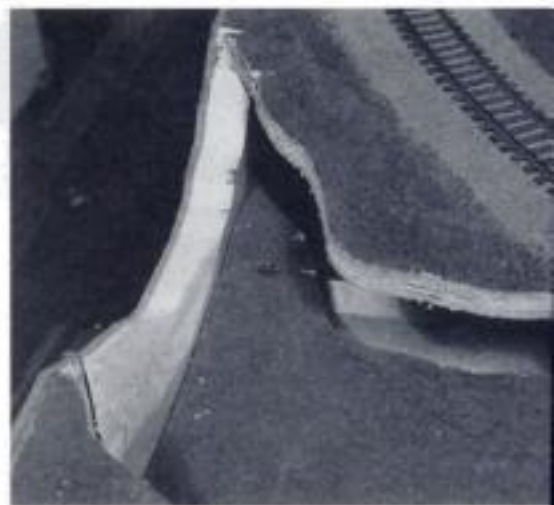


Figure 1: Adding the Creek and Drainage Ditch

Figure 2: Cross Brace Placement



ABOVE: After you draw the shape of the creek on the tabletop, cut the openings with the saber saw. Note the cut in the fascia board on the end of the layout. Also note the position of the drainage ditch in relation to the joist where it passes under the inner loop of track. **LEFT:** After installing the cross braces, attach the cutouts using drywall screws. Make sure the creek cutout is level before you install it on the cross braces. **BELOW:** The end joist on the layout must be cut to accept the recessed creek. Use a saber saw to cut this piece as shown. Plaster will fill any seams or holes in this area.



work slowly until you achieve the desired shape. The foam will scatter all over the layout, as it did when you built the hill. Keep the vacuum handy and stop every few minutes to clean up shavings. If these pieces settle into the ground cover, they will be difficult to remove from the existing scenery.

As you shape the foam, try to make the contours blend with the existing tabletop. Where the gully passes under the outer loop of track, install a culvert casting from Woodland Scenics. Assemble this culvert according to the instructions, then carve the foam away so this casting fits along the tracks as shown. You'll need one casting for each side of the track; these items come two to a package from Woodland Scenics.

Once the foam is shaped, you can insert the culvert castings permanently.

Glue them in place on each side of the outer track.

For the inner track and the top of the drainage ditch, you can make drain culverts from a drinking straw. Cut several sections of the straw to an appropriate length, then drill holes for them in the foam. Insert the straw pieces in the holes and glue them in place with white glue. Let everything dry for several hours before applying the plaster.

After you place the drainage pipes and culvert, mix some plaster to cover the foam. The plaster should be about the consistency of cake frosting. It's important to cover the bottom of the creek with a thick coat of plaster. Any holes or exposed pieces of foam may cause air bubbles to form in the "water." More about this later. Cover

the rest of the foam with plaster to finish blending the creek and drainage ditch with the existing scenery. Where the creek meets the fascia board, you'll also need to fill any holes with plaster, then smooth the surfaces until they have a finished appearance.

Coloring the Creek Bed

Instead of applying a coat of latex paint over new plaster, use a different



ABOVE: Regular drinking straws make nice HO scale drainpipes. Cut the straws to the proper length, drill holes in the foam, and insert the straws, using white glue to fasten them. Simple household items like these have all sorts of applications in model railroading. **RIGHT:** Apply the plaster over the foam. Mix the plaster to the consistency of cake frosting. Be sure to cover all the foam at the bottom of the creek with a thick coat of plaster. Any exposed areas of foam will introduce bubbles into the "water" when it is poured in the creek.



Pouring the Water

People often think the best material to use to model water is water itself. While it is hard to dispute that real water looks authentic, using it on a model railroad presents a whole host of problems, not the least of which is the thriving environment it provides for mold and mildew. Besides, with the design of the creek, it would be quite difficult to keep the water from running off the edge of the layout and onto the floor!

Fortunately, alternatives do exist. One of the most common and effective methods for modeling water uses EnviroTex. This product, an epoxy mixture designed for coating furniture, just so happens to simulate water quite well when it's cured. EnviroTex is available from most well-stocked hardware stores.

Before you mix the "water" and fill the creek, you must dam the ends where it leaves the layout. A couple of scraps of hardboard work well here. To keep the EnviroTex from gluing these scraps to the fascia board, however, place a piece of waxed paper between the hardboard scrap and the fascia board. Since the EnviroTex won't stick to waxed paper, you'll be able to remove the dam easily after the water has hardened. Use drywall screws to attach the dams to the fascia board. It's

important to have a nice tight seal between the dam and the edge of the layout or the EnviroTex may leak out, drip down the side of the layout, and puddle on the floor. Once cured, this material is virtually impossible to remove from a surface, so you don't want a puddle of it on the floor of your garage or spare bedroom. Make sure everything is sealed properly!

After the dams are placed, mix some EnviroTex according to the instructions. It's important to mix this material exactly as recommended by the manufacturer or it may not cure properly. After you pour the two parts together, stir them for several minutes. Be sure to mix this material in a disposable container, as the container will be impossible to clean out once the EnviroTex hardens. The same thing goes for your stir stick. Don't use anything that's not disposable. As always, when working with chemicals, use extreme caution, wear eye protection, and work in a well-ventilated area.

After you've mixed the EnviroTex thoroughly, pour it slowly into the creek bed. Allow it to flow into all the cracks and holes in the creek bed and around the dams. You may notice many small air bubbles in the mixture as you pour it. This is normal. As the EnviroTex instructions explain, you can easily remove the bubbles while the



Use artists' acrylics to color the creek bottom and other new plaster. Paint the creek bed an earth color first, then use a black-green paint on the creek bed where the water "runs." This color should be blended into the earth color at the banks of the creek. Remember, the darker the color, the deeper the water will appear when the creek is complete.



LEFT: Using pieces of hardboard, dam the ends of the creek where it leaves the edge of the layout. Place a piece of waxed paper between the hardwood and fascia to prevent the EnviroTex from permanently bonding the board to the layout. Also make sure there is a tight seal between the hardboard dams and the plaster scenery to prevent leakage. **BELOW:** Mix the EnviroTex thoroughly in a disposable container, then slowly pour it into the creek bed. Let the material flow into all the nooks and crannies of the creek, especially around the dams. Follow the EnviroTex instructions to remove all the air bubbles from the mixture, then cover the creek and let the material cure overnight.



Here's what the EnviroTex looks like after it has cured. Note how the dark green-black sections look deeper than the water along the shoreline. As you can see, all the bubbles have disappeared.

material cures. Try exhaling on the bubbles, and watch them react and then dissipate when exposed to the carbon dioxide in your breath. **Note:** If you use this technique, do not inhale the fumes. The best approach is to pour the material and leave it alone. This will allow virtually all the air bubbles to rise to the surface, where they can be eliminated.

EnviroTex remains liquid for about 20 to 30 minutes, and it cures fully within 24 hours. During this time, it's a good idea to keep the creek covered to prevent dust from landing on its surface. Also, be sure to provide adequate ventilation, since the product does give off fumes as it cures. Most important of all, resist the temptation to poke and prod the material after you have poured it. Leave it alone as it cures and it will look good.

Finishing Touches

Now that the water is fully cured, the creek looks realistic. Notice the way the paint below the EnviroTex simulates deep, murky water. At this point, you can add the ground cover around the banks and in the drainage ditch. First, remove the dams from the ends of the creek. Remove the drywall screws and pop the hardboard dams loose. The waxed paper may still be stuck to the water; if so, peel it away from the edge of the layout. The screws you used to hold the dams in place will leave holes in the fascia. Apply some spackling paste to these holes and let it dry.

Since the plaster was already colored before you poured the water, you can use white glue to attach the ground cover to the banks of the creek and the drainage ditch. Spread the glue around the plaster with your finger. Don't apply it too heavily, as the glue may run down the bank and puddle on the EnviroTex. Now sprinkle on the ground cover. As you did before, use a variety of colors to blend the scenery into the existing ground cover.

Apply ground cover to the drainage ditch as well. Start by painting the drain culverts silver. Place rocks of various sizes around the pipes. Woodland Scenics offers rock debris (talus) that will work well. Or you can collect

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Complete the scenery in the drainage ditch with ground cover. Talus from Woodland Scenics simulates the rock debris around the drainage pipes. Paint the pipes silver before you apply ground cover.



The drainage ditch between the tracks was constructed in the same way as the larger part of the ditch. With the ground cover in place, the new scenery looks natural.

rocks from nature. Also, add some weeds and gravel to the rest of the drainage ditch to give it a realistic appearance. For added detail, place an HO scale fisherman or two by the banks of the creek.

Now you can go back and touch up the track ballast and any other places that may have been damaged when you

cut the tabletop. Sprinkle on the ballast, spray it with water, and then apply diluted white glue with an eyedropper to bond everything in place. Let the scenery and ballast dry overnight, then clean the track. You should also vacuum any loose ground cover from the creek and gully. For the last step, sand the spackling paste and touch up the paint

on the fascia board, without getting any paint on the EnviroTex material.

Now you have some waterfront property on your model railroad. The EnviroTex is quite durable, but you will have to dust it once in a while. Other than that, no maintenance is required. Sit back and enjoy the trains running past your "running" creek.



Looks like one of these guys is having some luck! Three fishermen are trying to hook the big one as a CC freight passes over the culvert above. There are literally hundreds of different HO scale figures

available from several manufacturers. These figures are made by Preiser. Small details like this bring the layout to life.

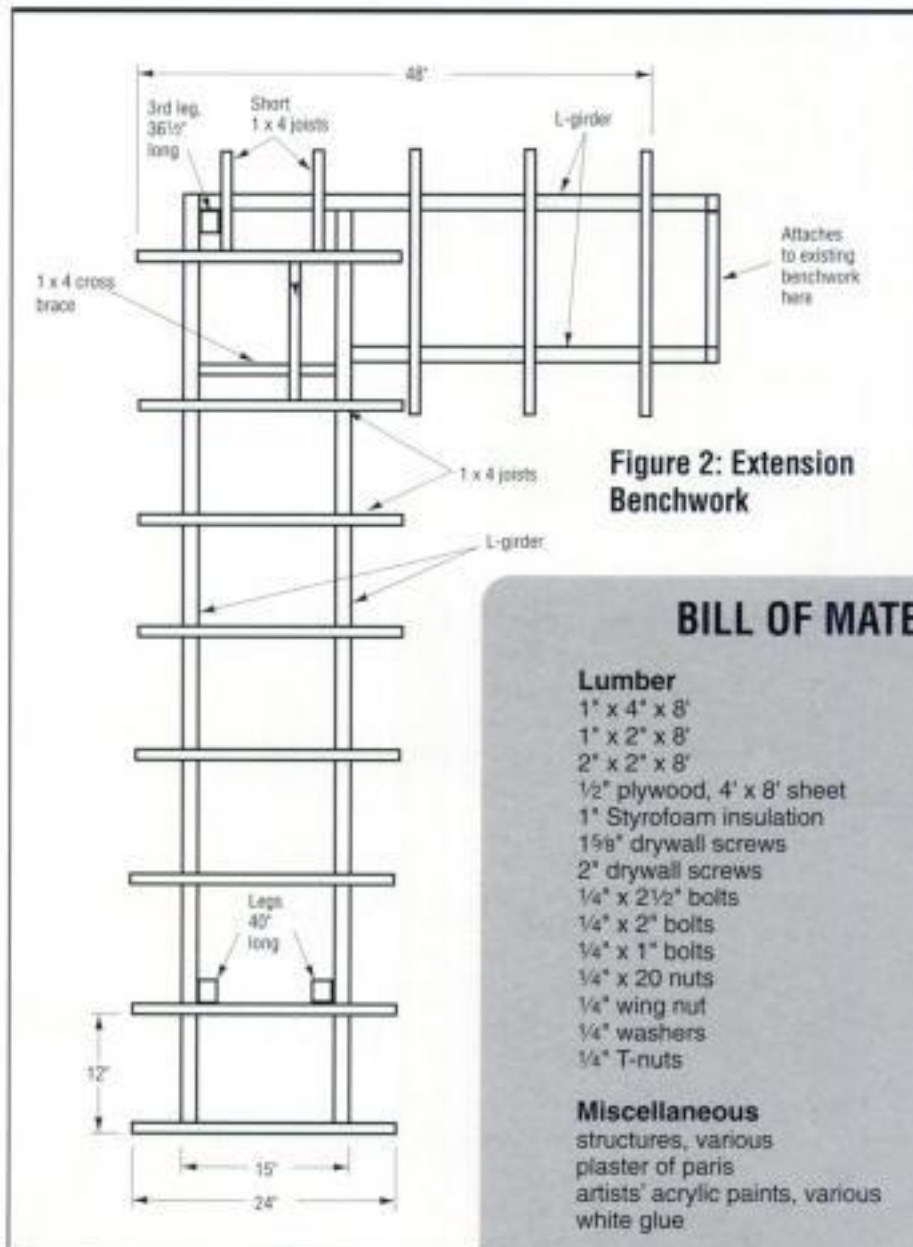


Figure 2: Extension Benchwork

Now on to the leg assemblies. Cut two 2 x 2 legs 40" long and one leg 36 1/2" long. Drill holes in one end of each leg and mount T-nuts and bolts as before. These bolts will allow you to level the new section on uneven floors. Next, mount two of the legs to a 1 x 4 joist as shown in Figure 3. Position the legs 4 1/2" in from the edge of the joist. Using a carpenter's square and tape measure, mark the correct location of the legs on the joist and attach them using drywall screws. Make sure that the joint between the legs and joist is square. Add 1 x 2 cross braces to complete the leg assembly. Set the last leg aside for now.

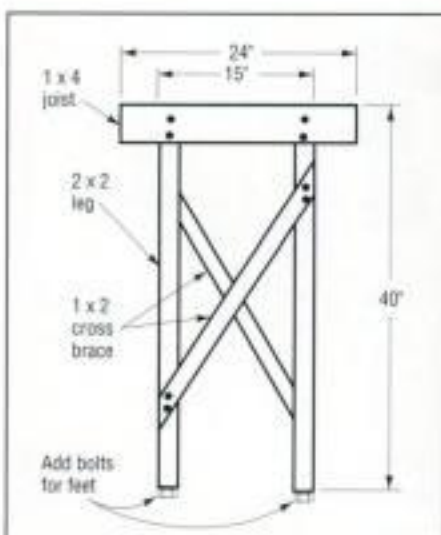


Figure 3: Leg Assembly

BILL OF MATERIALS: STAGE 7

Lumber

1" x 4" x 8'	8
1" x 2" x 8'	10
2" x 2" x 8'	2
1/2" plywood, 4' x 8' sheet	1
1" Styrofoam insulation	1 sheet
1 5/8" drywall screws	1 box
2" drywall screws	1 box
1/4" x 2 1/2" bolts	14
1/4" x 2" bolts	3
1/4" x 1" bolts	3
1/4" x 20 nuts	14
1/4" wing nut	3
1/4" washers	34
1/4" T-nuts	3

Miscellaneous

structures, various	
plaster of paris	1 box
artists' acrylic paints, various	
white glue	1 bottle

Track and Materials

Atlas	
900 Code 83 flex track	10
920 Code 83 rail joiners	2 pk.
922 Code 83-Code 100 transition joiners	1 pk.

Walthers

826 #6.5 code 83 left curve turnout	1
890 #2.5 code 83 wye turnout	1
891 #5 code 83 left-hand turnout	1
892 #5 code 83 right-hand turnout	2

Caboose Industries

202 ground throws	5
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Midwest

3013 cork roadbed	10
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Scenery Materials

Woodland Scenics ground foam, various	
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Now assemble all the L-girders. Lay the pieces out on the floor and check that they fit together as shown. Next, fasten them together using 2" drywall screws. To help keep the new assembly rigid, attach a 1 x 4 joist to the end of the long section. This will keep the L-girders positioned properly while you assemble the rest of the table. Note the location of the 1 x 4 brace between the L-girders at the L section of the table. Finally, attach the 1 x 4 brace between the L-girders at the short end of the extension. This is where the new benchwork joins the existing table.

Next, with some help from a friend, raise the L-girder assembly into place and use C-clamps to attach the leg assembly to the long end. Now attach the third leg to the inside of the outer L-girder joint using C-clamps. Don't worry about the exact position of the legs—they will be adjusted later. You may want to cut a temporary leg and clamp it in place under the short section so the extension benchwork will stand by itself.

Cut away 2 feet of the fascia board and frame where the new extension joins the old layout. Be sure to cut the lines in the fascia straight. Again, with a friend's help, attach the new benchwork to the original table L-girder with bolts and wing nuts. Note that you will need to drill two clearance holes in the 1 x 4 end piece so it will fit over the bolts that hold the leg to the original table. Make sure that the joint

between the two table assemblies is tight and square.

Now that the new L-girder assembly is fastened to the layout, it's time to permanently attach the legs and joists. Start by measuring the location of the table joists. As on the original table, joist spacing of 1 foot works well. Measure and cut the required number of pieces from 1 x 4. Note how the joists in the L section of the table are arranged. Carefully measure these pieces and install them as shown in Figure 2.

The leg assembly joist should be the second one in from the end of the extension. Position it and attach it to the layout with C-clamps. Have your friend hold the benchwork as you position the new leg assembly. Now secure the legs to the L-girder as before, using bolts and nuts. When they are in place, remove the drywall screws that fasten the legs to the joist and attach the joist to the L-girder with drywall screws. This way you can remove the legs from the benchwork if you ever have to move the layout.

Finish the benchwork by installing the third leg and its braces. Attach it and the braces to the assembly with nuts and bolts. Note that this leg is not adjacent to any joists. To give this and the other legs some stability, add 1 x 2 braces, using gussets cut from

scrap plywood. Like the legs, the braces should be attached to the L-girders with nuts and bolts to allow easy removal.

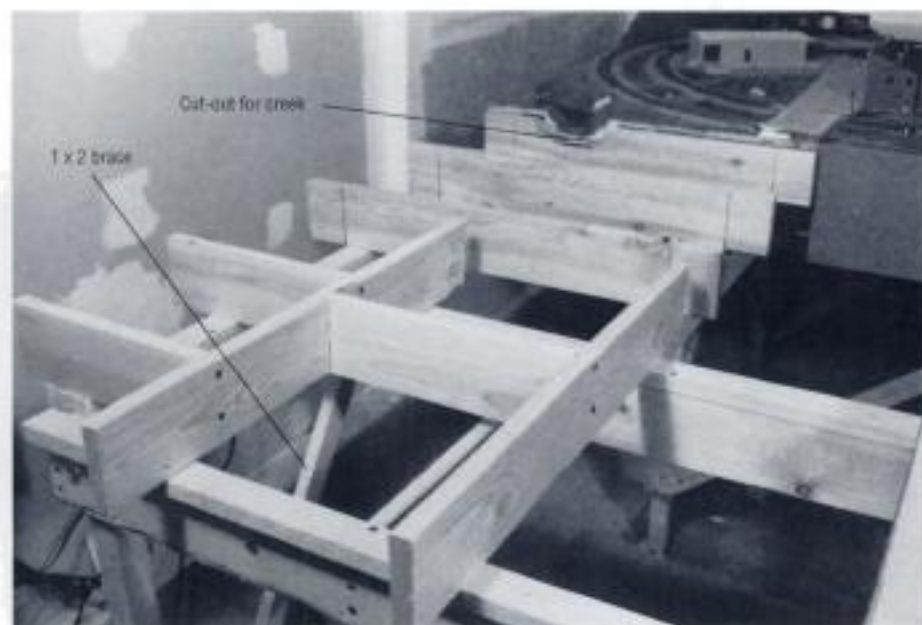
Build the Subroadbed

By now you have an L-shaped extension of empty benchwork extending from the side of your model railroad. Now it's time to start work on the subroadbed. On the original layout, a 4 x 8 piece of plywood covers the entire table. For the extension, however, the "cookie cutter" subroadbed method works quite well. Since the plan is to build hills over a sizable portion of the new section, you don't have to install plywood over the entire area. Instead, cut plywood subroadbed pieces to support the track and leave a portion of the table open. Figure 4 shows the shape and size of the plywood sections needed. You can use the track radius tool constructed back in Stage 1 to mark the section of curved roadbed.

Using a saber saw, cut the pieces from 1/2" plywood as shown, then test-fit them on top of the benchwork. Keep in mind that the exact size of these pieces is not critical. The important thing is that the track fits according to the track plan. Remember, the



The new benchwork is connected to the existing table by nuts and bolts. This allows you to disassemble the extension in case the layout needs to be moved. You'll need to drill clearance holes in the 1 x 4 piece to clear the bolt heads that hold the leg on the original layout.



RIGHT: Here's the new benchwork, assembled and bolted to the original table. Note the arrangement of the joists in the L section, and also the cut in the fascia panel and the far joist for the creek.

areas not covered by plywood will be hidden by scenery later on.

Assemble the cut pieces and attach them to the table joists with cleats. Use plywood splice plates to connect the subroadbed pieces as necessary. Start with the piece of subroadbed adjacent to the interchange track diamond. Attach this using cleats to the first new joist. Drill pilot holes to prevent the wood from splitting. When you attach

the plywood to the cleats, be sure to use screws that won't protrude through the top of the layout.

Now proceed around the extension, connecting the subroadbed pieces with splice plates as needed. First install the cleats using drywall screws; then adjust the position of the roadbed. Finally, fix it in place using drywall screws. Finish by installing the 2 x 5-foot plywood section for the new industrial spurs.

Cork Roadbed and Track

With the subroadbed in place you're set to start on the track. The extension for the CC uses flextrack instead of sectional track. As the name implies, this track is flexible and bends to almost any shape to provide a more free-flowing track design. However, its downside is that it requires a little more effort to install.

The Atlas line of track components includes flextrack, and this is the brand I used on the CC. Atlas offers two styles of flextrack, code 100 and code 83. Track "code" refers to the height of the rail in thousands of an inch. So rail in code 100 track is .100" high and rail in code 83 track is .083" high. The original Atlas Snap-Track line of track components uses code 100 rail throughout.

However, code 83 track is closer to scale size. Since the extension is an attempt at more accurate modeling, I used code 83 track throughout. It's easy enough to mix the two codes using transition rail joiners, available from Atlas. Of course, code 83 turnouts should be used with code 83 flextrack. You have a few choices in turnouts. The CC uses Walthers code 83 turnouts. While they cost more than the Snap Switches used on the original layout, they are nicer in both appearance and operation.

Of course, if you're happy with the appearance of code 100 track, feel free to use it for this extension. The track

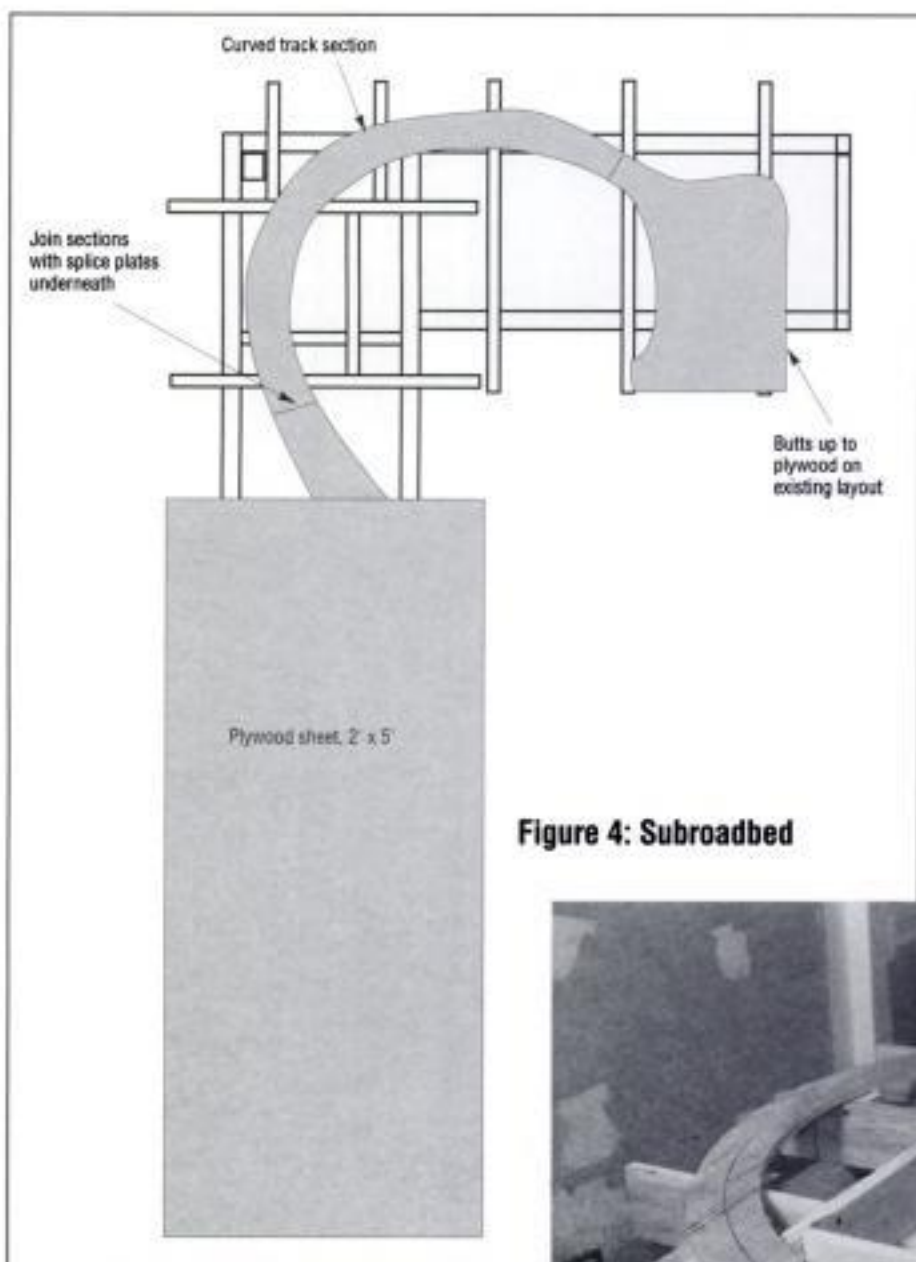


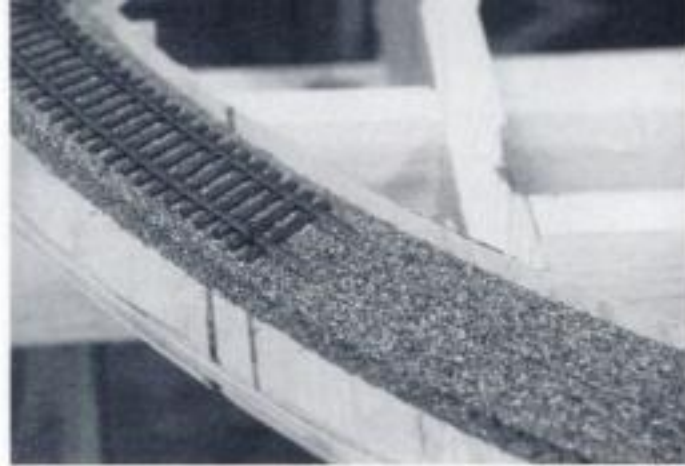
Figure 4: Subroadbed

Cut the subroadbed pieces from plywood sheet and test-fit them on the layout. Use splice plates to fasten the subroadbed together. If everything fits as it should, attach them to the joists with cleats. Attach the subroadbed from underneath as before, making sure to use screws that won't stick up through the surface after they are installed.





Rail nippers are the quickest way to cut the rails on flextrack. When you bend the flextrack, you'll have to trim the rails at the end of each section in order to join them with the next section. A useful tip—don't use rail nippers for cutting anything other than track. Other use may pit the blades, shortening the life of the tool.



After you cut the rails and remove the ties, use a spike to hold the track in alignment. Check the rail ends for burrs and make sure that the joiners slide on easily. Clean up any burrs with a small file.



The best way to achieve smooth transitions from one track section to the next is to solder them together. Apply some flux (non-acid, so it won't corrode) on the joiner, then touch the iron to the outside of the rail. After a second or two, touch the solder to the joiner. The solder should flow into the joint, creating a solid bond between the two rails.



After the solder joints cool, bend the track around the curve and continue on to the next section. You can replace the ties that you removed to allow the joiners to fit on the track. Put them under the joint to make the track section look continuous.

plan will work, regardless of which type of track you choose.

Again, the first step in track-laying is to install the cork roadbed. Using the plan as a guide, measure and draw the track center line along the subroadbed. Then install the cork roadbed as you did in Stage 1. On the new switching section, the track plan and some trial-and-error fitting will show you where to position the turnouts. Use a hobby knife to trim the cork pieces around the turnout locations. When everything is cut, glue the cork roadbed in place and let it dry overnight.

Now you're ready to start laying track. Start by installing two transition rail joiners to the end of the interchange track crossing, and then attach a length of flextrack. Note that you

must remove a tie or two from the end of the flextrack in order to install the rail joiners. A sharp hobby knife works well for this. Of course, remove only enough ties to allow the joiner to fit on the rails. Be sure the transition rail joiners form a tight connection between the code 100 crossing and the code 83 flextrack. Also check to make sure that the rail head heights are even and line up properly on the inside edges.

After connecting the track, bend it to fit on top of the cork roadbed, then fasten it in place as you go. Place track nails in every hole of the flextrack to hold it in alignment. Atlas flextrack is designed to straighten out after being bent, so you'll have to fasten it down securely to prevent it from straightening itself out.

There's another characteristic of flex-track to consider. As you nail the first track section in place, look at the rails. When you bend the track around a curve, the inside rail will be longer at the end of the section than the outside rail. One of the rails is designed to slide through the tie assemblies as the track bends. This is what makes the track flexible. When you attach a new section, you must trim the rails to the same length. To do this, simply cut the longer rail to the proper length with a pair of flush-cut rail nippers as shown. Remove the last few ties to allow the joiners to fit.

When you attach the next track section, align the joint so it is straight. The best way to get smooth joints from section to section is to solder the track

sections together. If you haven't soldered before, now's a good time to learn. It isn't difficult to do, and the results are improved operation and appearance. When you solder track sections together, you end up with one continuous length of track. A soldering iron in the range of 25 to 40 watts is adequate to solder rail. You'll also need

flux and small-diameter solder. All of these materials are available at Radio Shack or other electronics supply store. Use caution when soldering, of course, as a soldering iron gets hot enough to cause serious burns.

When the joint is properly aligned, apply some flux to each of the joiners. Now touch the tip of the hot iron to

the outside edge of one of the joiners. In only a second or two, the flux melts and the joint is ready for the solder. Apply the solder to the outside of the rail joint. Do not apply the solder to the inside of the rail joint—it may interfere with passing train wheels. As you apply the solder, it should instantly flow into the joiner. Keep the iron on the joiner and apply solder until it has flowed through the entire joiner. This process should take no longer than 10 seconds. If it does, stop. If you continue, you'll run the risk of melting the ties on the flextrack.

When the joint is soldered, move on to the other joiner and repeat the process. Before you bend the track, let the solder cool for a few seconds. Then bend the track around the curve and continue. You'll have to replace the ties that you removed to make room for the joiners. Cut off the spike detail molded into the top of these ties. When this detail is removed, the ties slip under the joiners. Fix them in place using cyanoacrylate cement.

Work around the extension, arranging the track as shown in the track plan. Use the flush-cut rail nippers to trim the flextrack to fit the track switches. You will have to shorten the Walthers turnouts for everything to fit properly. Cutting track on the turnouts is no different from cutting flextrack. Just be sure to double-check your measurements before grabbing the rail nippers.

Walthers code 83 turnouts differ from Atlas turnouts in another way.

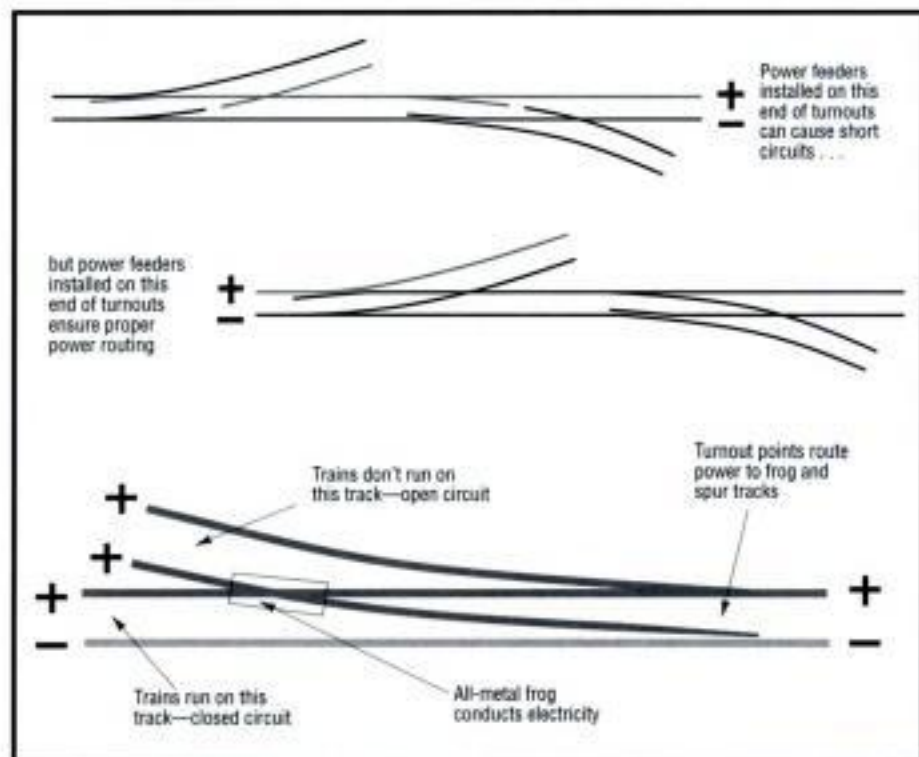


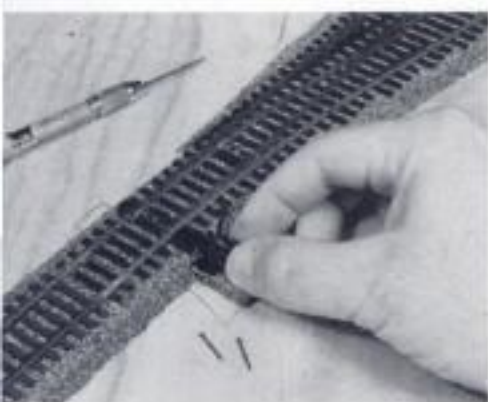
Figure 5: Wiring Selective Turnouts



Trim the track switches in the same way as the flextrack. Some trimming and cutting is required to make all the track pieces fit as shown. Solder all rail joints for solid connections from section to section. Soldering also provides a more reliable electrical path through the track.



To promote the illusion that the world extends beyond the edge of the layout, the main line continues off the end of the benchwork. Install the track section over the edge of the layout, then trim the piece even with the edge of the benchwork as shown. Aside from the visual enhancement this track provides, it also serves as the ideal spot to connect future expansion projects.



TOP: You'll need to drill a hole in the throw bar for the ground throw. A pin vise allows you to use drill bits that are too small and delicate to fit in a regular power drill. A well-stocked hobby shop should have several models to choose from, as well as a selection of small drill bits. **ABOVE:** To install the ground throw, set the points of the turnout to the middle position and the handle of the ground throw straight up. This will ensure that the turnout throws completely in each direction after the ground throw is nailed down.

Electrically speaking, they are what's called selective turnouts. These turnouts have an all-metal frog (the place where the rails cross), and the turnout points (the pieces that move) determine the polarity of the electricity going to this frog. See Figure 5. Essentially, these points act as a simple form of block control that permits locomotives to run on the track that turnout is set for. These turnouts do call for some additional steps in wiring, though.

Since these turnouts have a metal frog, short circuits can occur depending on how the turnouts are set. To prevent this, power must be fed to these turnouts from the point end. Insert insulated joiners in *both* rails as shown in the track plan in Figure 1.

Even the common rail must be insulated to prevent short circuits. In this stage, don't install the feeder joiners you used earlier. Instead, solder feeder wires directly to the rails. While all this may seem like additional work, the superior operation provided by the powered frog arrangement makes it worthwhile.

Finish installing the remaining turnouts and flextrack as shown in the plan. Solder every pair of rail joints except where insulated joiners are required. When you have finished laying the track, go back and install ties under each joint. Give all the track a careful inspection to make sure that everything lines up properly and that there are no kinks where the sections join. Roll a freight car around the new track to see if it runs without hanging up or derailing. If you find any trouble spots, check the alignment of the track joints. If necessary, use additional track nails to hold things in alignment.

Walthers turnouts don't come with throws or locking mechanisms for the points. Caboose Industries offers manual ground throws that are reliable and handy to use. These ground throws are simple in design and easy to install. You can place them on either side of the turnout depending on the space available. Determine where you want to install the throw, then place a small piece of cork roadbed next to the throw bar of the turnout. Trim the throw bar to the proper length as shown, then drill a hole in the throw bar for the small plastic nub on the ground throw. Use a drill bit in a pin vise to make this hole. (A pin vise is a handy precision drill tool that should be available at your hobby shop.) Next, center the points of the turnout. Place the handle of the ground throw in an upward position and insert the plastic nub into the hole in the throw bar. You may need to trim the length of this nub so it does not interfere with the cork roadbed. With the nub inserted, nail the ground throw in place on the cork piece. Check to see that the turnout operates properly. The points should move freely from side to side, and they should close completely against the outer rails. Make adjustments to the position of the ground throw if necessary, then move on to the next turnout.

Wiring the Extension

Now you'll hook up the electrical connections. Start by soldering track feeders to each rail in the isolated sections. Drill a hole next to the outside edge of each rail and feed wire up from underneath the table. Strip about $\frac{3}{16}$ " of insulation from each wire and bend it to fit along the outside edge of the rail. Apply a small amount of flux, then solder the feeder in place. Again, work quickly to avoid melting any of the plastic ties. If the solder does not melt after a few seconds, pull the iron away, apply some additional flux, and try again. When you've soldered the wires in place, run them to terminal strips underneath the layout, one for the common rail, another for the outside rail. The terminal strip will be wired to the control panel later.

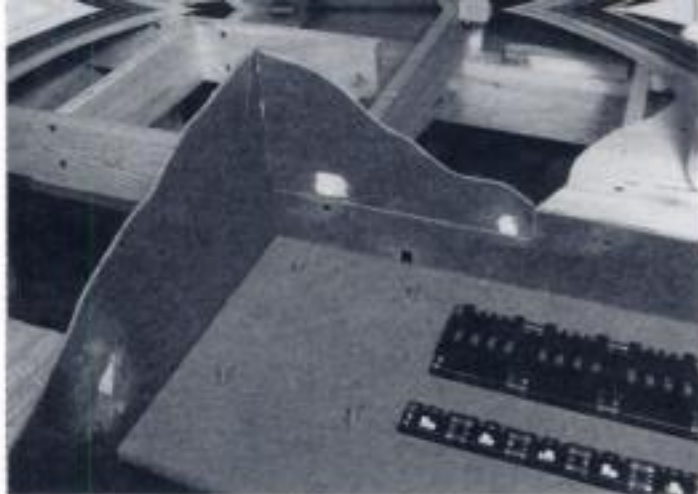
With the new extension in place, the control panel is in the way, so you'll have to relocate it to the end of the aisleway. This repositioning allows the operator more room to move around in the opening, but it also means that you must reroute the wires for the entire layout. Start by disconnecting all the wires from the control switches on the panel. To make reconnecting them easier, label each wire with masking tape so you know where it goes. Unhook and remove the power packs, then remove the screws from the panel assembly. This should allow you to move the control panel away from the layout.



Instead of feeder joiners, the extension uses wires soldered to the outside edge of the rails. Drill a $\frac{3}{16}$ " hole right along the outside edge of the track, feed the wire through, then bend the wire to fit along the rail. A little flux should allow you to solder it to the rail before the heat from the iron melts the plastic ties.



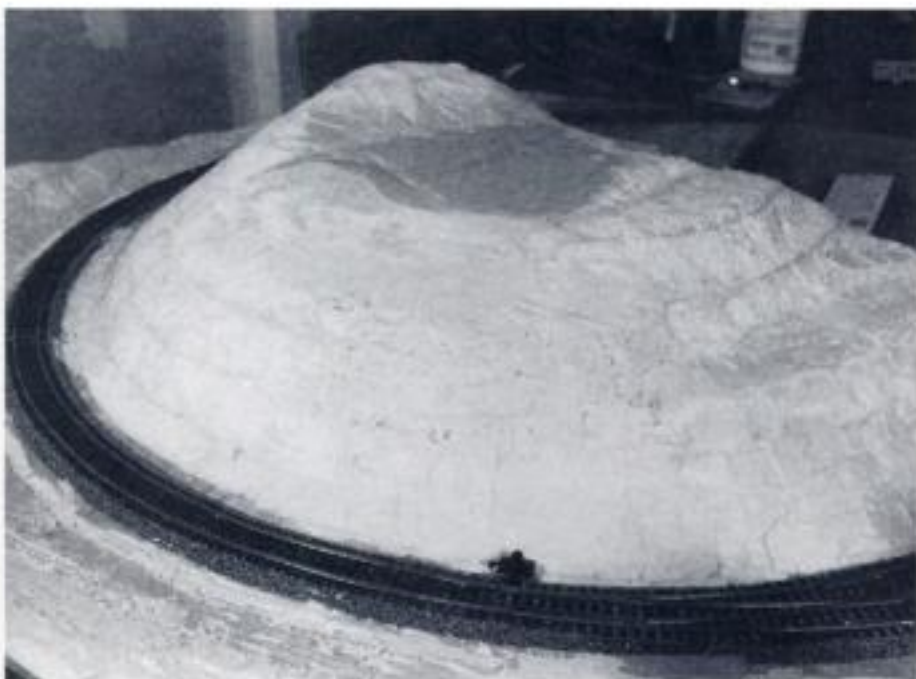
Before starting the scenery, build the fascia frame from 1 x 2, as on the original layout. Fasten everything in place with C-clamps, check the fit, then attach them to the layout using drywall screws.



Here's the fascia panel above the control panel. Again, you'll have to cut a removable section with holes for the power pack cords so that the power packs can be removed from the panel.



ABOVE: Stacked Styrofoam pieces form the scenery on the extension. Cut the pieces to the appropriate shape and size, test the fit, then glue them in place using white glue or Liquid Nails latex adhesive. Let everything dry thoroughly before shaping the foam. **RIGHT:** Once the foam has the proper contours, apply a thin coat of plaster to cover the seams between the layers and fill any holes. You don't have to cover the entire hill with plaster, as the paint and ground cover will spread right over the foam pieces. **BELOW RIGHT:** Apply the ground cover just as you did in the earlier stages. Use a variety of textures and colors to achieve a realistic effect. Grandma's house appears atop the hill overlooking the railroad tracks.



opening, then attach it with drywall screws. Apply spackling compound over the screws and seams, sand smooth, then apply a coat of paint.

Now you can start rewiring the panel. Run the wires from the old panel location to the new location and reconnect them to their proper places. If the original wires don't reach, either splice extra wire to the existing pieces or attach a new piece from the source. The entire extension is wired as a single track block, so run one wire from the outside rail feeder terminal strip to the block switch on the selector that controlled



the interchange track. Feeders from the common rail should run through a terminal strip to the common connection on the main layout.

With this connection, trains should run over your new extension. Set the block control switch on the selector, throw the switch from the inner main line and run the first train up the branch line. This is a good time to double-check your track work for any kinks or trouble spots that might cause problems with operation.

Scenery and Details

Now that the trains are running, it's time to cover the bare benchwork. Use

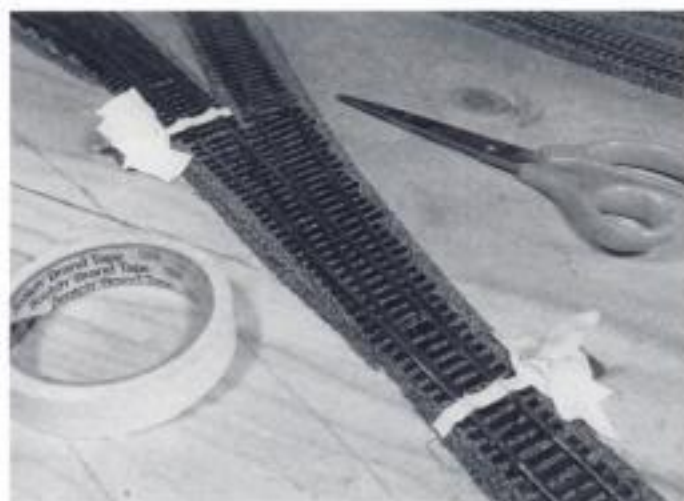
the Styrofoam scenery technique to make the hills. After you shape the Styrofoam pieces, a thin coat of plaster readies the scenery for paint and ground cover.

First, assemble the fascia board for the new extension. Start by building the frame from 1 x 2s, clamp it in place to make the necessary adjustments, then fasten everything together with drywall screws. Cut the rectangular hardboard pieces to the appropriate size, then clamp them in place on the layout. The type of scenery you want to build will dictate the size of the hardboard pieces.

Next, mark the panels for the scenery contours. Cut the pieces using

a saber saw, test-fit them, then install them on the layout with drywall screws. Patch the holes and corner seams with spackling paste. Sand these areas smooth after the paste is dry.

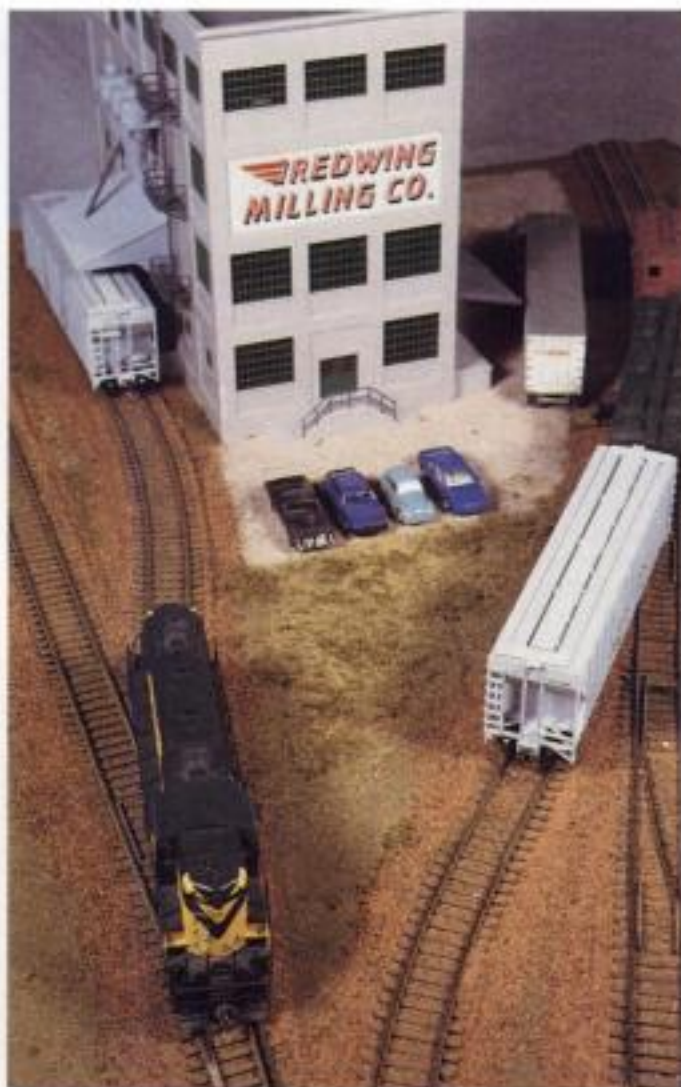
When the fascia is in place, cut the Styrofoam pieces for the scenery. Remember that the final contours for these pieces have to match the fascia board you installed earlier. Stack the Styrofoam pieces right on top of the joists. You can use white glue or Liquid Nails latex adhesive to attach the pieces to the benchwork and to each other. It will take some cutting and fitting to build up the foam to the right height for the hills. Cut and trim the pieces as needed, then glue them in place. Work



Before you paint the track, mask the throw bars on the switches. The points on Walthers turnouts have small contacts for selective power routing, and they will not function if painted.



The road on the extension provides highway access to the new structures. To pour this road, spread a very thin layer of plaster over the tabletop with a putty knife. After it dries, color it with dark gray artists' acrylics. The yellow center line is made with Chartpak 1/32" graphic tape.



The Walthers Redwing Milling Company is one of the structures used on the new extension. This is a neat kit, as its large size makes it tower over the trains. This structure would most likely have been too large to include on the original layout, but it looks right at home here on the extension.

one layer at a time until you have built the pieces to the correct height.

After the glue has dried, the foam is ready to shape. As you did previously, use a rasp bit in a power drill and start grinding the foam to form the mountain. Again, the foam shavings will make a real mess, so stop every few minutes and vacuum up the pieces. Work slowly until you have the shape you're after. If you accidentally remove too much foam from one area, don't panic. You can fill it with plaster later on.

When you have shaped the foam pieces as you want them, mix some plaster and go to work. Spread the plaster over the foam with a putty knife. You don't have to cover the entire hill with plaster, since the paint and ground cover will spread right over the foam pieces. As you did with the tunnel, cover the track pieces with tape to prevent any accidental spills on the track work.

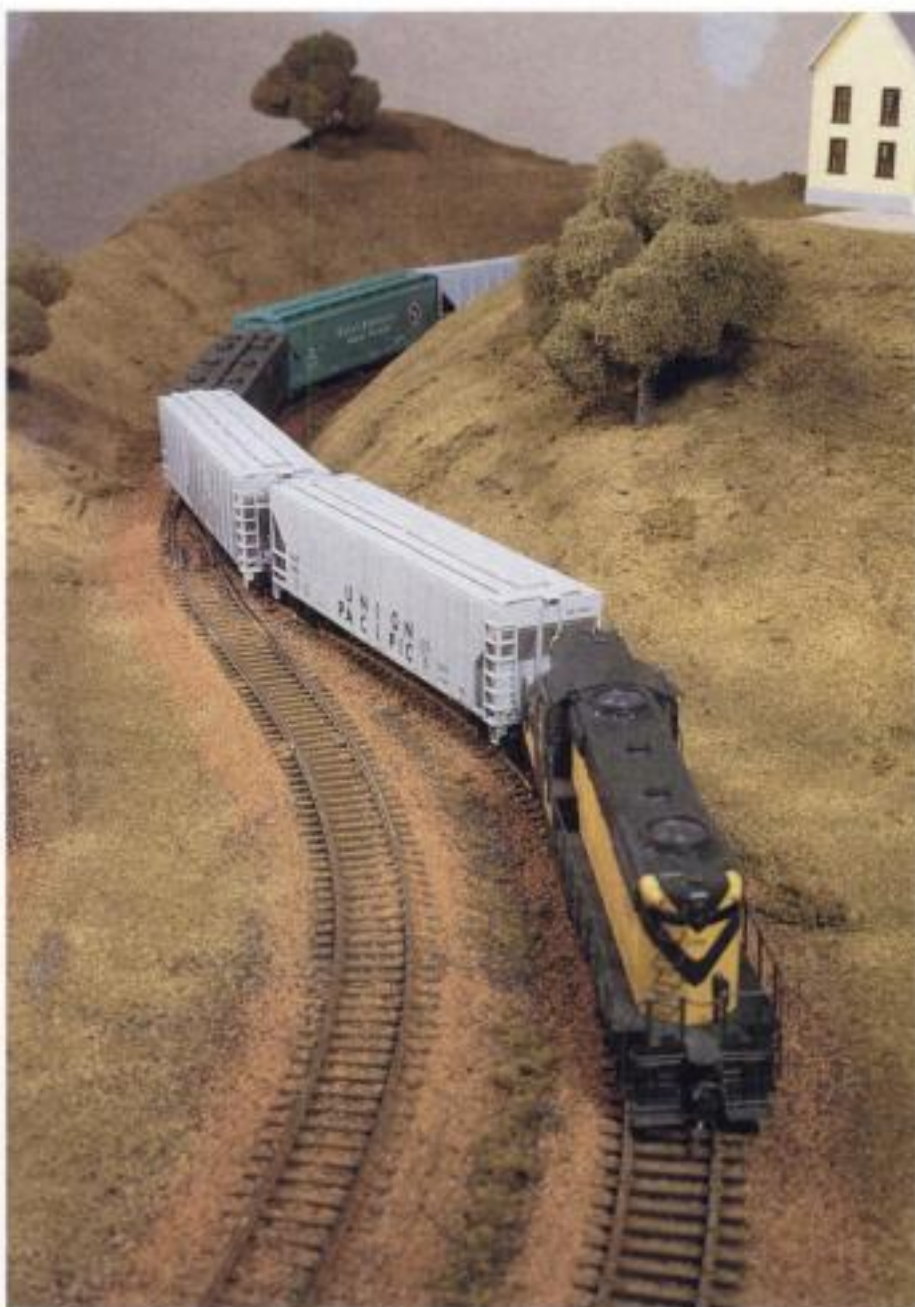
After forming the hills, apply the paint and ground cover. Blend the new scenery with the existing scenery using various shades of ground foam. Use the same coloring and "water" techniques as before to extend the creek on the corner of the extension. Of course, the new extension will need trees, which you can make as shown in Stage 4 or purchase from your local hobby shop. Whatever your preference, plant them as appropriate on the finished scenery.

At the end of the branch line, you may want to add some structures. Walthers kits provide industries that require freight car traffic. Again, there is a wide variety of structures to choose from. Pick structures that appeal to you and complement the theme you have chosen for the layout extension. Last, add a road and railroad crossing made of plaster of paris. The shape and size of the road will depend upon the type and location of the buildings you choose.

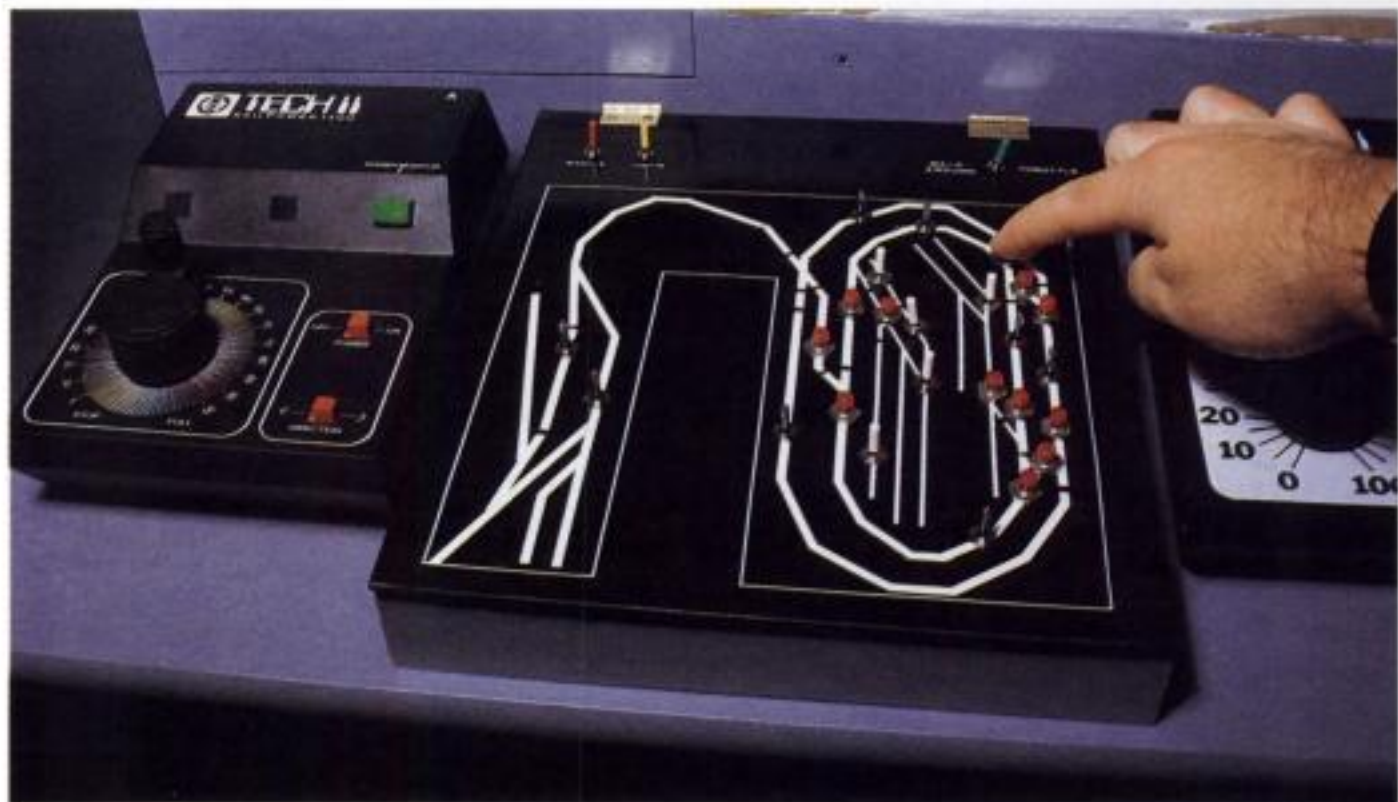
Of course, the extension can be detailed and finished to the same level as the main layout. Again, this can be one of the most time-consuming parts of the process. It's up to you to determine the amount of detail you want to add. The trains are running, and you now have some additional destinations for the freight cars on your pike.



The finished control panel looks right at home at the end of the center aisleway. Positioning the panel here puts the operator right in the middle of all the action.



The local traverses the S-curve as it enters Scott Valley to service the large flour mill. The string of covered hoppers following the locomotive will leave the mill full of cargo. The new extension adds even more operational variety to the Callahan Central!



A new control panel with a track schematic shows the operator just which switch to push to keep the trains running smoothly. This chapter covers the construction of this panel. When you get the hang of operating trains with it, you'll like it much better than the original.

STAGE 8 Build a Better Control Panel

The control panel on the Callahan Central is both simple and functional. The Atlas electrical components make layout wiring easy to understand and install. But there is one down side to these components—you must memorize the different block and turnout numbers to know which buttons to push. There is no way for the operator to quickly determine which block a train is in and which block control will keep things running.

Now that the new extension is in place, an all-new schematic-style control panel will make operations easier. This type of control panel has a schematic diagram of the layout that

includes toggle switches and push buttons placed at the locations corresponding to the functions they perform. This makes it much simpler to locate the controls that operate the different blocks and turnouts.

While the switch components used to control the blocks, lights, and turnouts may look a lot different from the Atlas components, they function exactly the same. The switches and buttons are available through a number of electronic parts suppliers. On the CC, a combination of components from Radio Shack and Miniaturics fill the control panel (see the parts list). Installing these components does require soldering skills; if you had no

difficulty soldering track in Stage 7, hooking up these switches will be no problem. You don't necessarily have to understand the exact function of each wire for this panel. As long as you connect everything as shown in the schematic, your layout will be operating from the new control panel in no time.

In addition to the new control panel, the CC includes a walkaround throttle. With the panel on the other side of the layout, switching trains in the industrial area can be difficult. The walkaround throttle allows the operator to be right next to the action. When not in use, it can be switched off and the operator can run the train from the regular power pack controls.

Building the Control Panel

The first step is to remove the old Atlas electrical components. Start by disconnecting the wires and pulling them down through the control panel. Labeling the wires with a pen and masking tape makes reconnecting them to the new panel much easier. Next, remove the screws and pull the Atlas components from the table.

The new control panel is made from a piece of hardboard cut $9\frac{1}{2}'' \times 10\frac{1}{2}''$. This panel is designed to rest upon a frame made of lengths of 1×2 and hardboard. See Figure 1. Cut the pieces of wood as shown, then assemble the side 1×2 pieces and the front hardboard panel. Cut the rear 1×2 piece to the proper length, but don't screw it in place just yet.

Next, drill the holes in the hardboard panel. Figure 2 shows a full-sized mockup of the track schematic and the location of the holes for the components. Copy this template and temporarily place it on the panel as a drilling guide. Be sure to keep a clean copy to help you create the panel schematic later on.

Drill the holes for the panel components. The double-pole, double-throw (DPDT) switches for the blocks require a $\frac{1}{4}''$ hole, while the push buttons for the switch machines require a $\frac{3}{32}''$ hole. The smaller switches for the



The new control panel occupies the space previously used for the Atlas electrical components. Cut the frame from 1×2 s in the dimensions shown. Also drill several $\frac{1}{2}''$ holes in the panel shelf to allow the wires to pass through. To provide a nicely finished surface on the front of the control panel, cut a piece of hardboard and attach it to the front as shown. Because this piece isn't load-bearing, you can attach the front panel with contact cement or white glue and avoid the necessity of patching screw holes.

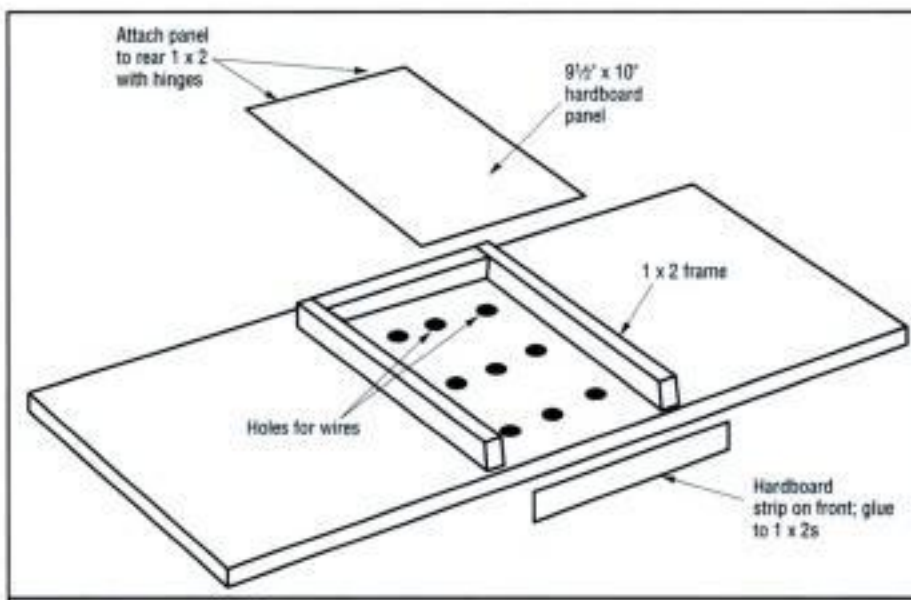


Figure 1: Control Panel Assembly

BILL OF MATERIALS: STAGE 8

Electrical Components

Radio Shack	
275-620 DPDT center-off toggle	13
275-625 SPDT toggle	2
275-626 DPDT toggle	1
275-1547 mini SPST momentary switch	12
278-1341 solid bus wire	1 roll
274-688 five-lug tie point	1 pkg.
274-678 8-position terminal strip	4
274-650 8-position jumper	4
274-204 4-prong plug set, male	2 sets
274-205 4-prong plug set, female	2 sets

Miniatronics

36-260-04 DPDT toggle switch (alternative to Radio Shack 275-620)	13
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Model Rectifier Corp.

Tech II cab control walkaround throttle	1
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Lumber

$1'' \times 2'' \times 8'$	1
hardboard, $1' \times 2'$	1

Miscellaneous

wire, 20 gauge	100 feet
phone cable, 4-conductor	100 feet
solder	1 roll
flux	1 tube
brass hinge set, small	1
Chartpark tape, white, $\frac{1}{32}''$	1
Chartpark tape, white, $\frac{1}{16}''$	1
Chartpark tape, white, $\frac{1}{8}''$	1

NOTE: Some materials may be available from previous stages.

lights, signals, and walkaround control require a $\frac{7}{32}$ " hole. After removing any burrs from the holes with a hobby knife, sand the front of the panel with 400 grit, then 600 grit sandpaper. Check for burrs on the back of the panel as well. They must be removed in order for the switches to fit properly.

Now prepare the panel for painting. Be sure to wipe all traces of sanding dust from the front of the panel. Paint the panel black to match the power packs, or use some other color if you prefer. Krylon ColorWorks Epoxy Enamel in aerosol paint cans works well for control panels, as it

dries hard and provides a glossy, durable finish. Spray the panel with several light coats of paint until the surface is evenly colored and smooth. Be sure to let the panel dry for at least 24 hours before handling it, or you may leave fingerprints in the not-quite-dry paint.

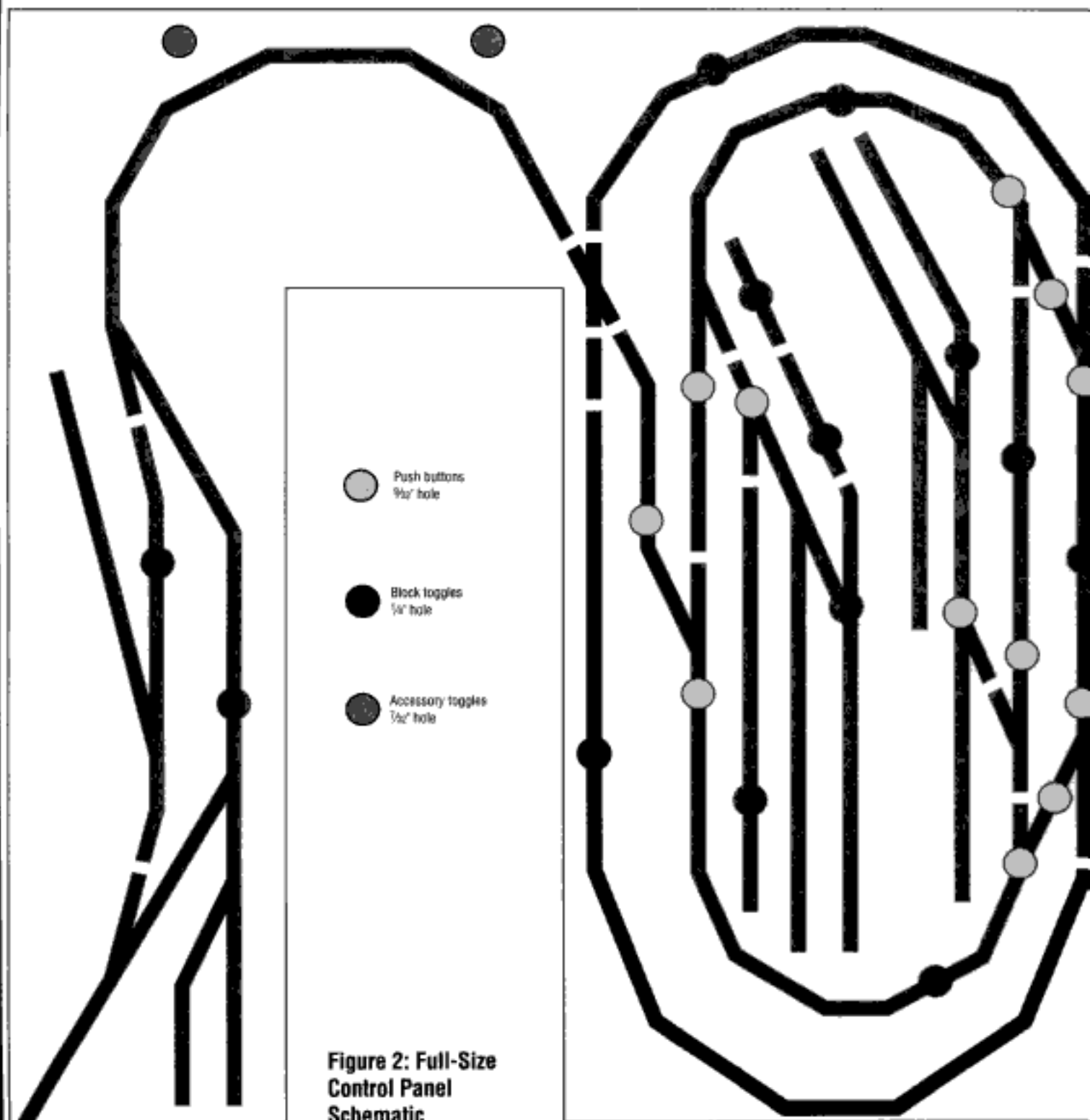
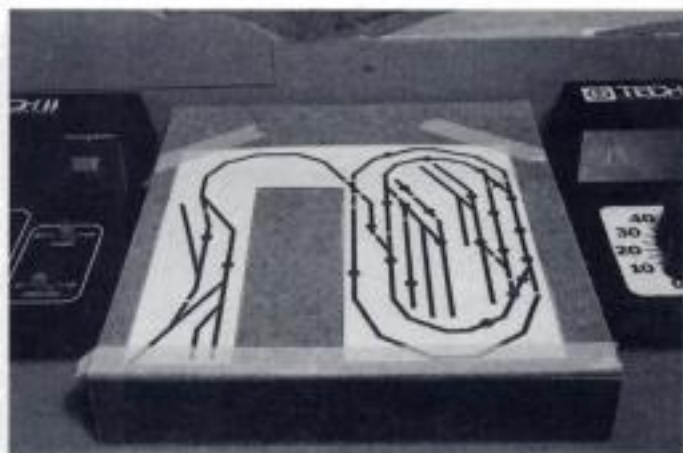


Figure 2: Full-Size Control Panel Schematic



ABOVE LEFT: Copy the schematic in Figure 2 and tape it in place over the panel to serve as a drilling guide. To help keep the drill bit from wandering across the hardboard, punch each mark with a drywall screw to start the hole. **ABOVE RIGHT:** Chartpak Graphic Tape and dry



transfer lettering from Woodland Scenics provide all the materials you need to decorate the control panel. Cut the Chartpak tape with a sharp hobby knife. Be sure the panel is completely dry before applying the tape and lettering, or you may leave fingerprints in the surface.

Once the panel is completely dry, create the schematic using Chartpak graphic tape. I used white tape in $\frac{1}{32}$ ", $\frac{1}{16}$ ", and $\frac{1}{8}$ " widths. Again, the color choice is up to you. Use a sharp hobby blade to cut the tape accurately. Start by making the layout outline with the $\frac{1}{32}$ " tape, using the schematic in Figure 2 as a guide. When it is complete, start building the main tracks on the layout with the $\frac{1}{8}$ " tape.

The tape should run right through the middle of the holes in the panel. Cut the tape to fit right against the adjacent pieces, then firmly press it in place with your finger. Next, you'll need to trim the tape from the switch holes. Finish by making the yard and industrial tracks from the $\frac{1}{16}$ " tape. Cut small gaps in the tape to indicate the corresponding location of the track blocks. Also, install labels for the accessory switches using dry transfer lettering. Be sure to apply this lettering directly adjacent to each switch.

When you finish applying the tape and lettering, clear the panel of dust and extra tape pieces, then spray it with a clear coating. Krylon makes a clear coating in their Epoxy Paint line. This will seal the tape and lettering in place. Again, let the panel dry thoroughly for at least 24 hours before handling it.

Now install the switches and push buttons. These components should slide right into the holes; if they don't, clean up the hole using a hobby knife. When you install the toggle switches, make sure that the toggle levers move

properly before tightening them in place. The block toggles and walk-around toggle should move from left to right, while the signal and lights toggles should move up and down. When all the switches are positioned properly, tighten the nuts to hold the components in place.

Last, mount the control panel to the 1 x 2 frame. Start by mounting hinges on the panel as shown. Next, set the panel in place on top of the 1 x 2 frame. Remove the fascia panel behind the control panel. Working from underneath, mark the position of the holes in the hinges on the rear 1 x 2. Remove the rear 1 x 2, drill the holes, then attach it to the panel hinges. Note that you'll also have to drill clearance holes on the top of the 1 x 2 to clear the hinge screws on the panel. After you've attached the panel to the 1 x 2, set it in place on the 1 x 2 frame. Carefully position the rear 1 x 2, then screw it in place from underneath. Be sure to drill pilot holes to keep the wood from splitting.

Now test the operation of the hinged panel. It should open and close freely to provide easy access to the underside wiring. If the panel catches, adjust the hinge screws until the panel functions properly.

Installing the Walkaround Throttle

As I mentioned earlier, the CC uses a walkaround throttle to make it easier to

operate when the operator is away from the main control panel. Model Rectifier Corporation's Tech II Cab Control Unit is ideal for the CC, as it's easy to hook up and can operate on the power output from one of the existing power packs.

In order to use this unit at different locations, you must install plugs at the different places around the layout. Any four-prong plug can be used; Radio Shack offers a four-position plug that works perfectly (see the parts list).

Attach the female version of this plug into the fascia board. To do this, you'll need to disassemble the plug and use a water-soluble marker pen to apply a heavy coat of ink to the edge of the plug housing. Then press the housing against the fascia board at the desired location. The ink will transfer to the fascia board to show the shape of the cutout you need to accept the plug assembly. Remove the material inside the mark by drilling holes around the perimeter of the ring, then finish by cutting the opening with a hobby knife. Test-fit the female plug piece, trim any excess material from the opening, touch up the fascia paint, then glue the plug in place with five-minute epoxy. Repeat this process with the other plugs.

Next, install the cable and male plug on the walkaround throttle. A coiled 5-foot cable from Radio Shack connects the walkaround unit. If you want, you can also use a length of telephone cable. Strip the insulation from the wires and attach them to the terminals



ABOVE LEFT: To mount the Radio Shack four-conductor plug in the fascia board, trace the plug housing with water-soluble ink. Press this housing against the fascia and the resulting ink ring will show you the material that must be removed. Drill several holes around the perimeter of this mark, then carve the piece out with your hobby knife. **ABOVE RIGHT:** The finished plug looks nice sitting in the fascia. The male counterpart press-fits into the socket for easy hook-up and disconnection.



of the walkaround. Install a plastic wire fastener to the end of the unit to prevent the wires from accidentally being yanked loose from their terminals. Last, solder the male plug on the other end of the cable. Be sure to note which wires are hooked to which terminals and the plug pins they correspond to.

Now run wires from the female plugs to the control panel. Phone cable or equivalent four-conductor wire works for this. Strip the wire insulation from the ends and solder the wire to the connectors on the plugs. Again, apply wire fasteners to the underside of the layout to hold the cable in place and prevent it from being yanked loose. Run wires from each plug to a terminal strip under the layout. Consolidate these wires at the terminal strips. You'll connect them to toggles on the new panel later on.

Wiring the Panel

Now it's time to start wiring all those toggle switches and push buttons on the new control panel. Prop the panel in the open position with a pen or similar item. Next, install four eight-position terminal strips underneath the hinged control panel. Two of them are for cab A, the other two for cab B. Insert bus clips on one side of these terminal strips as shown. These allow you to connect each block toggle to a position on the terminal strip for both cab A and cab B. The wires from these terminals then go to each side of the block toggle switches. See Figure 3 for wiring instructions.

There's an easy way to connect wires to the toggle switches. First, strip the insulation from the end of the wire, twist the strands together, and bend it 180 degrees to form a small hook. Insert this hook through the hole on the connector of the toggle switch. Place a hot soldering iron on the connector, then apply some solder. In just a few seconds, the solder will melt and attach the wire securely to the toggle switch.

Now hook up the switch machines. Figure 4 shows the schematic for wiring the push buttons. For the push-button switches, you'll have to run a



While working on the underside of the control panel, prop it in the upright position to free both hands to work on the wiring. A ball-point pen or similar object makes a perfect prop.



The MRC Tech II Cab Control unit works well for this installation, as it is small, easy to use, and reasonably priced. When attaching the wires to the terminals, install a plastic wire fastener loop to secure the cable and keep it from accidentally being yanked loose.

wire from one of the AC terminals of the power pack to one connector on each push button. The easiest way to do this is to connect one terminal on each of the push buttons with bus wire. Solder a length of bus wire to each push-button terminal, then connect a wire from one of the AC terminals on the power pack to the bus wire.

Next, install a place to connect all the common wires from the switch machines. A five-position solder terminal strip from Radio Shack will work.



Install four terminal strips inside the control panel housing to wire the track blocks. Use bus strips to connect two terminals to the same power pack output. This gives a total of 16 block connection points for each power pack, more than you need to wire the panel as shown.

Connect all five terminals together using bus wire. This gives you several terminals where you can solder the common wires. Next, solder a wire to the bus wire and run it to the other AC terminal on the power pack. Again, see Figure 4. Connecting this wire provides power for your switch machines to the underside of the control panel.

Now connect the switch machine wires. The black wire in the cable goes to the five-position terminal strip. Solder it in place on one of the terminals. Next, connect the green wire to the proper push button. The green wire should energize the turnout to the straight, or mainline, position, so connect it to the correct push button

according to the schematic. The red wire goes to the push button for the diverging route. There is a button in each straight track for the two crossovers. Connect the green wire for both of these turnouts to both push buttons. See Figure 4.

Now wire the walkaround toggle as shown in Figure 5. This toggle switch allows either power pack B or the walkaround throttle to serve as the second cab. This toggle switch has no center-off position, so either the power pack or the walkaround will control the cab B blocks at all times. Connect the wires from the walkaround plugs as

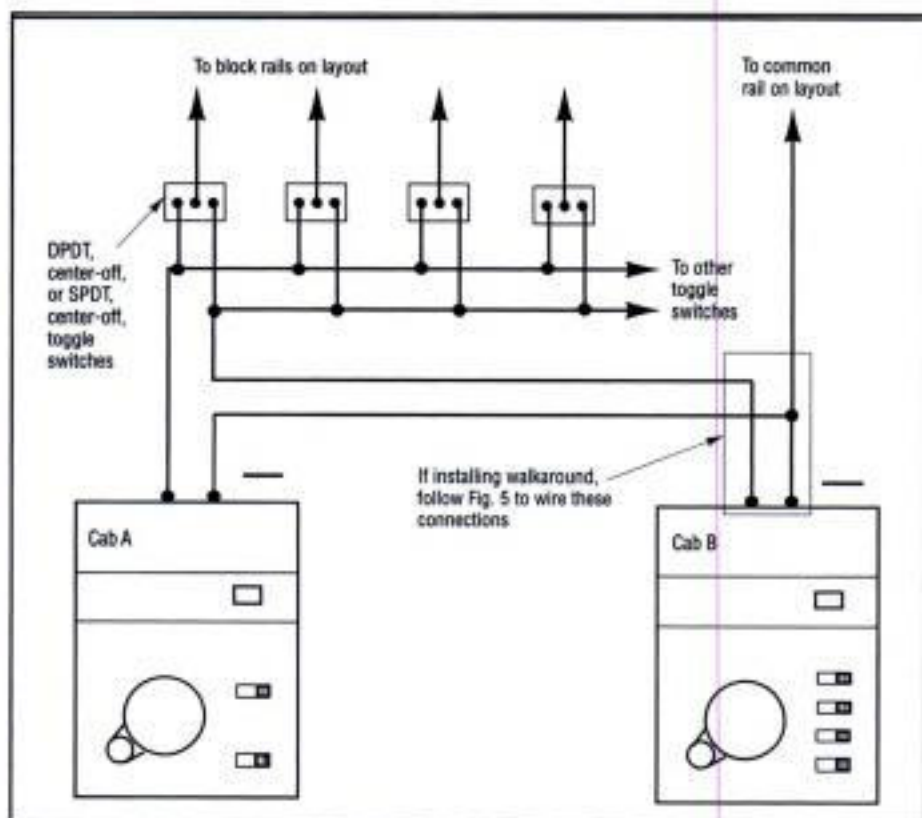


Figure 3: Wiring the Block Toggle Switches

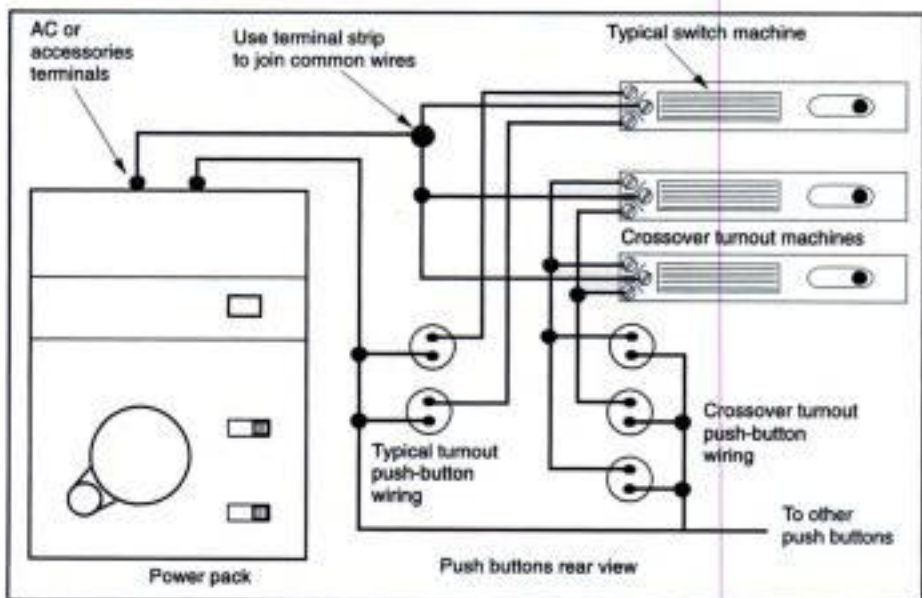
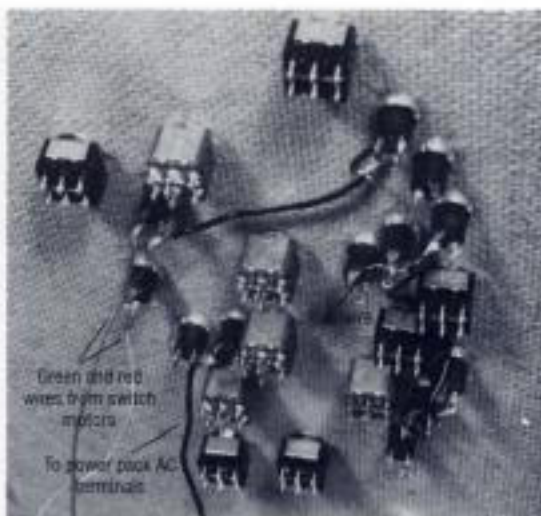


Figure 4: Wiring the Turnout Push-Button Controls



Connect a length of bus wire to one of the terminals on each of the push-button turnout switches. Then connect this bus wire to one of the AC terminals on the power pack. This provides power to all the push buttons, which send the power to the turnout motor when they're pushed.



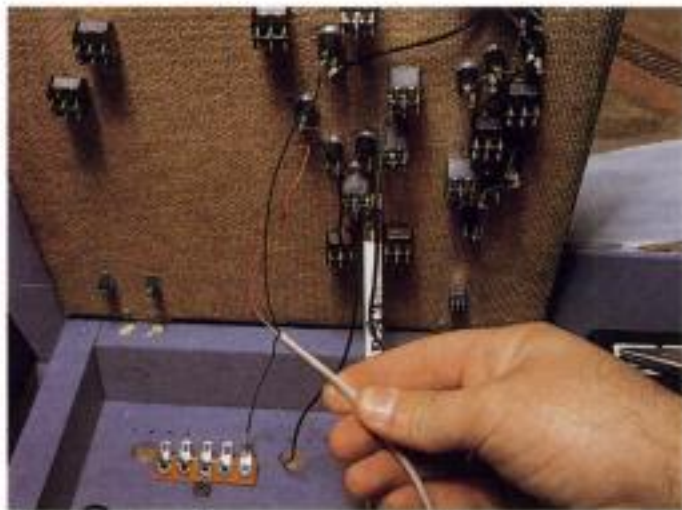
A five-position solder terminal provides a terminal point for all the switch machine common wires. Solder the terminals together using bus wire, then run a wire to the other AC connection on the power pack. This supplies power to all five terminals.

shown, then connect the center pair of connectors on the toggle to the block toggle cab B terminal strip and the common-rail connection, respectively. The power pack track outputs for cab B connect to the other pair of connectors on the toggle switch. Finish by hooking up the lights and signals as in

Figure 6. As before, one wire from these accessories hooks directly to the accessories terminal on either power pack (preferably the one not being used to power the switch machines). The other wire for these accessories runs through the respective toggle switches. Connect these wires and solder them in place.

Operating the Panel

Your new control panel should now be ready for service. Operating the panel is straightforward. When the block control toggles are placed to the left, trains run in these blocks using cab A. Those placed to the right use cab B or the



Wiring the turnouts and block controls is not difficult, but it will take some time to connect all the wires to the proper locations. Work slowly, follow the schematics, and everything should work.

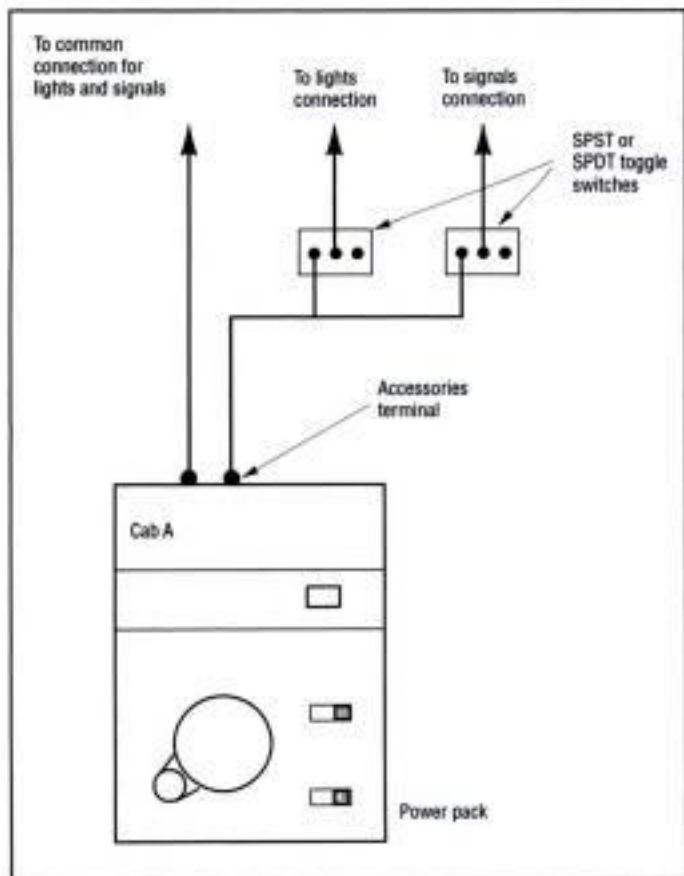


Figure 6: Wiring the Lights and Signals

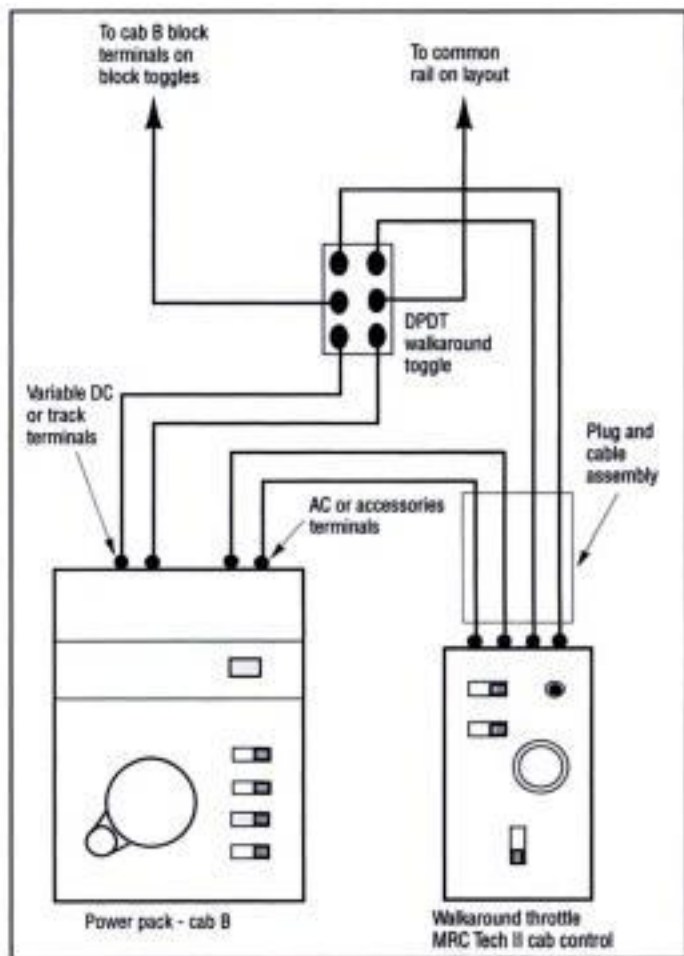


Figure 5: Wiring the Walkaround Throttle



This switch determines which throttle controls the blocks set to the B (or right) position. This toggle has no center-off position, so either the power pack or the walkaround will control cab B blocks at all times.

Index

Subject	Chapters	Subject	Chapters	Subject	Chapters
Access door, tunnel	5	Kadee couplers	3	Terminal joiners	2, 3, 4, 8
Atlas electrical control components		Leveling table	2	Terminal strips	3, 9
Connector	3	Lichen	2, 5	Toggle switches	9
Selector	4	Locomotives	1	Tools required	1
Ballast	4	Lumber, selection	2	Track	
Benchwork		Mountain, modeling	5	brass	1
gussets	2	Paint, use as adhesive	2	cleaning	2
joists	2, 8	Plaster, scenery	4, 5	code of rail	8
height	2	Power pack		fastening	2
L-girders	2, 8	selecting	1, 1'	flex	8
plywood tabletop	2	connecting	2	nickel-silver	1
table legs	2, 8	wiring for two-train operation	4	positioning	2
Blocks, electrical	3, 4, 8	Rail joiners	2	sectional	2, 3, 4
Control panel	4	Risers	2, 4, 8	Traction tires	1
Culverts	7	Road crossings	3, 6	Train sets	
Details	6	Roadbed, cork	2, 3, 4, 8	components	1
Drywall screws, use for benchwork	2	Roadway construction		pre-packaged	1
Enviro-Tex	7	cardboard	2	Trees	
Extension, layout	8	plaster	3	pre-made	2
Fascia board	5, 7, 8	styrene plastic	6	scratchbuilt	5
Ground cover	2, 3, 4, 5, 6, 7, 8	Rolling stock	1	Tunnel, modeling	5
removing	3, 4, 5, 6, 7	Schematic, control panel	9	Turnouts, use	3, 4, 8
Ground throw turnout control	8	Signals	6	wiring for automatic control	3, 9
Hill, modeling	5	Soldering track	8	Two-train operation	4
Insulation foam, scenery	5, 7, 8	wires	9	Walkaround control	9
Insulated rail joiners, use	3, 4, 8	Spur tracks	3	Water, modeling	7
Interchange track	4	Streets	3, 6, 8	Wheel stops	3
		Streetlights	6	Wiring	
		Structures	6	track	2, 3, 4, 8
		painting	6	switch machines	3, 4
		Subroadbed	4, 8	lights	6, 8
				Yard tracks	3

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