

Introduction

Create a realistic layout for your model railroad with the revolutionary SubTerrain System. This System includes high-density foam and all of the tools and accessories you will need. SubTerrain is extremely adaptable and expandable to your plans.

Building a layout with The SubTerrain System is extremely simple. It is also completely different from older methods of building model railroads. We recommend that you familiarize yourself with the entire process before beginning to use the SubTerrain System. Read through the entire book; then go back and follow the instructions step-by-step while you build your own model railroad.



TECH TIP

Woodland Scenics has created a full-length video as a helpful companion to this book. Ask your retailer for a copy of *SubTerrain: A How-To-Video*.

Before You Begin

Before creating a model railroad, there are a few preparations to make. First you need a plan. A wide variety of track plans are available. Many magazines, books and other publications feature track plans. See our track plan in the Appendix or you can create your own plan. The photography throughout this book and in the SubTerrain video refer to the track plan found in the Appendix.

SubTerrain is adaptable to any track plan, most scales and any type of track. The examples in this book use rigid sectional track, but SubTerrain works equally well with flexible track.

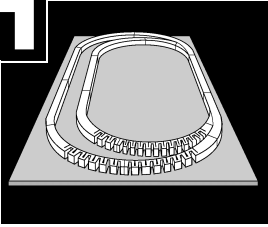
Once you have selected a suitable plan, transfer it to your base. In most circumstances, a sheet of plywood makes an adequate base. Simply lay out track on base and trace around it or draw on base.

Now you are ready for SubTerrain's five easy steps:

Overview

Install Risers

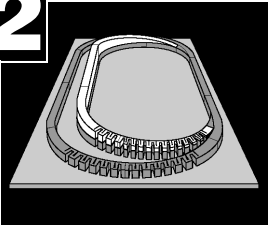
Step 1



Install Risers wherever track will be laid. This raises the track level to the height of the Risers, causing surrounding areas to be lower. You can quickly and easily make creeks and other low-lying areas without cutting into the layout base. (See page 10)

Add Inclines

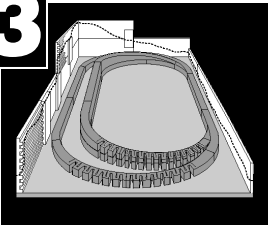
Step 2



Use flexible Inclines to easily change track elevations on curves or straights. The SubTerrain System's precut Inclines (with 2% or 4% grade) remove the guesswork and complicated calculations. (See page 17)

Install Profile Boards

Step 3

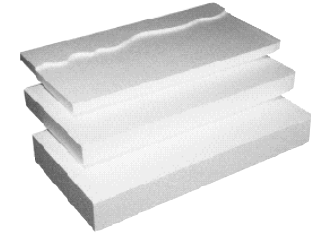
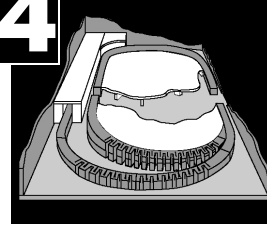


Install interlocking Profile Boards with matching Connectors to make a sturdy layout perimeter that can easily be cut with the Hot Wire Foam Cutter or a hobby knife to conform to any profile desired. (See page 22)

Overview

Install Foam Sheets

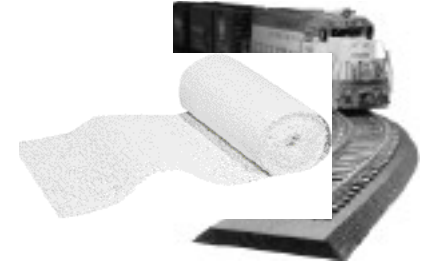
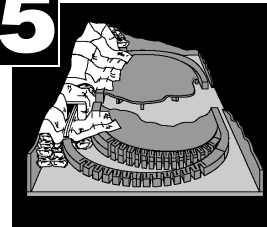
Step 4



Cut Foam Sheets to enclose tunnels, create interior terrain profiles and form level, elevated areas for buildings and towns. (See page 26)

Add Plaster Cloth and Track-Bed

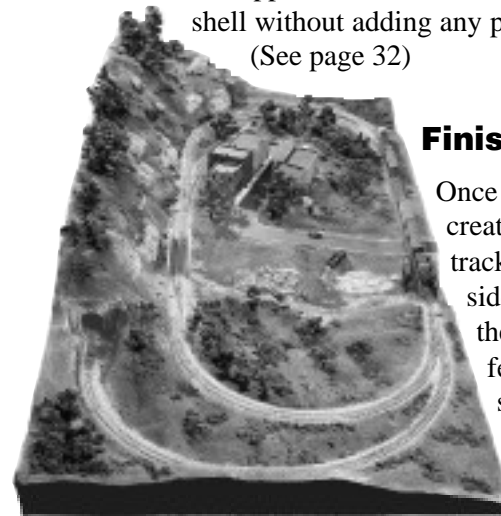
Step 5



Form terrain with newspaper wads and cover with Plaster Cloth that has been dipped in water. The Plaster Cloth will dry to a hard shell without adding any plaster. Install the Track-Bed. (See page 32)

Finish Your Layout

Once the SubTerrain base has been created, finish your layout. Lay track. Add streets, roads, curbs, sidewalks and parking lots using the Road System. Add terrain features, landscaping, buildings, structures, people and vehicles. Make the layout realistic and uniquely your own creation. (See page 40)



Before You Begin

A. Select a Plan

SubTerrain allows you to create any layout desired. You can select a plan from a plan book or create one of your own. You can start with a basic track diagram and add features later, or start with a detailed plan which indicates the track position, mountains, rivers, buildings, tunnels, trees and other *terrain* and *landscape* features. The plan featured in this book is located in the Appendix.

B. Select a Base

It is important to have a flat surface for building your layout. SubTerrain is a very versatile system and can be constructed on almost any size or type of base. The 4'x8' plan in this book starts with a sheet of 5/8", grade A/C plywood.

Because SubTerrain is lightweight, the layout can be supported by a table, sawhorses or you can build a stand for it. The important thing is to keep the layout flat during construction. Being lightweight makes SubTerrain ideal for situations where the layout will have to be moved, such as where space is limited or for *modular layouts*.

C. Transfer the Plan to the Base

Once you have a plan and a base, it's time to bring the two together.

The examples in this book use HO *scale* rigid sectional track. You can also use flexible track. The methods for using the SubTerrain System are similar regardless of the type of track or scale you have chosen. See the section Using SubTerrain With Other Scales on page 50.

Assemble and lay track on the base according to your plan. Temporarily pin the track in place with *Foam Nails*. Usually two Foam Nails, one at each

end of a track section, are sufficient. Track sections should be butted tightly together; check joints for a tight fit. Trace a line around both sides of your track directly on the plywood base.

If your detailed plan includes other terrain and landscape features, sketch those in now. This will help clarify the *track plan*, and will ensure all of the details of the plan will work together. If you have not decided where all of your terrain features will go, or they don't appear as part of your plan, you can work them in to fit later.

Foam Pencils come in two colors. Use one color to draw your track outline and another color to sketch in other features of your plan. This will help keep the layout clear.

TECH TIP

In order to accommodate Profile Boards, track should be kept at least 2 1/2" from the edge of your plywood base.

Foam Nails are designed to temporarily pin track, foam and other products to the base and to each other. They are ideal for testing and refining different parts of your layout.



TECH TIP

A simple plywood base is appropriate for most circumstances. Use at least 1/2" to 3/4" grade A/C plywood. Face the best side of the plywood up for a clean, flat surface to support your SubTerrain.

For an unusually large layout, or if you want additional strength, bracing can be added to the bottom of the plywood for additional support.



Trace a line around both sides of your track directly on the plywood base.

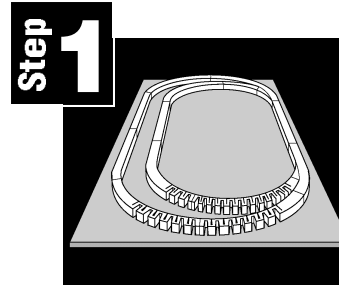
Woodland Scenics' Foam Pencils are ideally suited for drawing on a variety of surfaces, including wood and SubTerrain foam products. Some pencils will damage foam; Foam Pencils are soft and will not damage foam. Many markers and other writing products will bleed through paint or other porous coverings,

leaving unsightly marks on your landscape. Foam Pencils use a special compound that will not bleed through your layout. Foam Pencils are packaged in two colors so you can mark and distinguish different aspects of your layout.



Look over your layout to be sure there are no obvious problems with the plan. If you spot any problem areas now is the time to correct them. Once you are satisfied with your plan and have it clearly marked on the plywood base, remove the track. Now you are ready to use the SubTerrain System to build your layout.

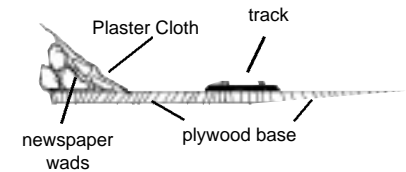
Install Risers



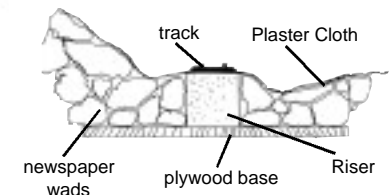
Risers serve as an elevated base for track and roads and are available in 1/2", 1", 2" and 4" heights.

Elevating the track above the base with Risers allows for dramatic scenery possibilities, such as ravines and creeks without the need for cutting into the base.

Without Risers



With Risers



A. What Size Do I Need

Use at least 2" Risers to elevate track. This will provide moderate *elevation* for gradual *relief*, hills and creekbeds. For a more dramatic landscape, use 4" Risers to give maximum elevation for steep relief, rivers and valleys. 1/2" and 1" Risers are generally used in conjunction with *Incline Starters*. (See page 19)

B. How Many Risers Do I Need

Risers are two feet long and are sold in packs of two or four, depending upon the height. Risers will be placed under the entire track. Determine the total length of your track in feet. You will need the same number of feet in Risers.

C. Install Risers

Center Risers over the track outline previously drawn on your base. Butt the Riser sections tightly together. Temporarily pin the Risers to the base with Foam Nails. If your plan calls for bridges, leave the correct space between Risers for each bridge. Check the manufacturer's instructions for each bridge or review "Install Bridges" on page 36.

Use Foam Nails to firmly hold Risers in place. Space Foam Nails 8-10" apart on straight sections and outside curves. For tighter inside curves, space Foam Nails 4-6" apart.

Our track plan (see page 67) calls for inner and outer loops that come together along the front of the layout. Your plan may have several such loops and may include crossovers, intersections, *turnouts*, overpasses and other features.

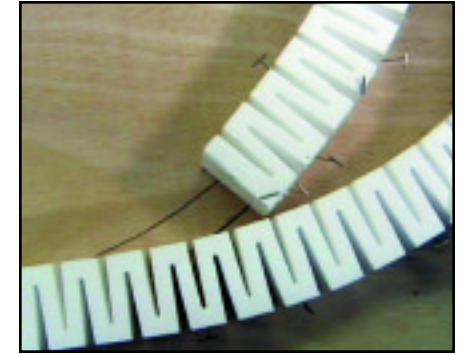
A SubTerrain Foam Knife can be used for cutting foam. The Foam Knife's 2" blade is ideal for making straight cuts in thick pieces of foam. Replacement Blades are also available.



Temporarily pin the Risers to base with Foam Nails.

TECH TIP

We find it easier to install the outer loops first and work toward the inside. In general however, cutting and laying SubTerrain foam is so simple you can start anywhere and work your way around the layout.



Where the Risers come together at a turnout, there will be a gap that will be filled in later.

On turnouts, install the straight section of Riser first. Then butt the turnout portion tightly against that section. This will leave a triangular gap between the Risers which will be filled in later (See Diverging Risers on page 20).

When cutting Risers, an exact fit is not necessary. Small gaps between Risers will be covered later with *Plaster Cloth* and *Track-Bed* (see page 32). Risers installed around a curve may tend to lift up on the inside edge. Pin these firmly in place with Foam Nails.



Hot Wire Foam Cutter



Bow & Guide Attachment



When installing SubTerrain, you may have to cut the foam. We recommend the Hot Wire Foam Cutter. This tool was designed to cut SubTerrain's high-density foam quickly and easily. SubTerrain foam is made of expanded polystyrene which emits no toxic fumes when cut with the Hot Wire Foam Cutter. Some other foam products do emit toxic fumes when cut with a Hot Wire Foam Cutter. We recommend using a Hot Wire Foam Cutter only on SubTerrain's white foam products.

The optional Bow and Guide make the Hot Wire Foam Cutter even more versatile. The Guide can be used to cut precise angles.

The Hot Wire Foam Cutter is designed to use special *nichrome wire*. Use only Woodland Scenics Replacement Wire with your Hot Wire Foam Cutter.

Gluing and Securing SubTerrain

The SubTerrain System includes two types of glue, each has its own properties and techniques. For best results with SubTerrain we recommend using both types of glue, as each is suited for different applications.

However, it is possible to select only one type of glue and use it throughout the entire assembly process. We recommend you read this chapter, and refer back to it as often as necessary while you are gluing SubTerrain products in place.

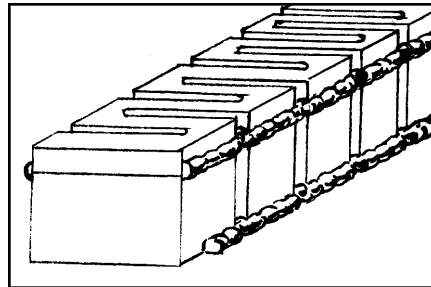
Woodland Scenics Low Temp Foam Glue Gun is intended for use with SubTerrain foam. The gun's operating temperature will not melt SubTerrain foam, and the special Low Temp Glue Sticks are ideal for fast bonding to foam and wood. Woodland Scenics Low Temp Foam Glue Gun should only be used with our specially formulated Low Temp Glue Sticks. Gun should be preheated for about 5 minutes before using.



A. Low Temp Foam Glue Gun

Woodland Scenics *Low Temp Foam Glue Gun* is specially designed to work with SubTerrain and other Foam products. The special gun, and the specially formulated *Low Temp Foam Glue Sticks* operate at a lower temperature than ordinary glue guns, so they will not melt SubTerrain foam. The Glue Sticks will bond quickly to wood, foam, cork, Homasote, cloth, and a variety of other products common in modeling and handicrafts.

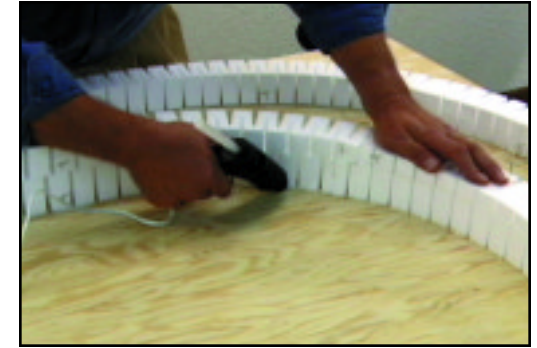
Use the Low Temp Foam Glue Gun to run a bead of glue along the seam between the two pieces of material, much like you would apply caulk. The glue will set quickly, and it is usually not necessary to move or disassemble your



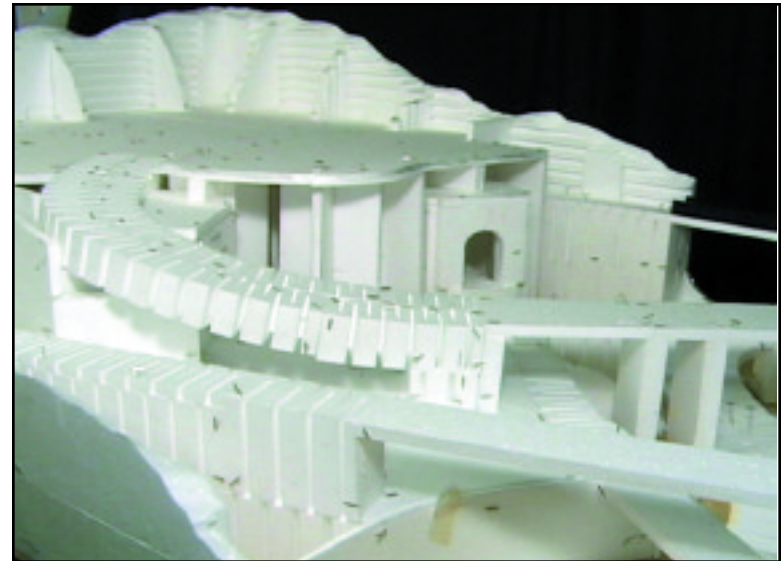
Run a bead of glue in the seam between two pieces of material.

work in order to apply glue.

Using this 'caulking' technique you could hold off on gluing any products together until the entire layout has been assembled and tested. This allows you to make changes as you work, and enables you to put a layout together, test it, refine it, add or remove sections, all before permanently gluing anything in place.



It is usually not necessary to move or disassemble your work in order to apply glue.



Pin the entire layout together with Foam Nails, then secure everything with the Low Temp Foam Glue Gun when you are satisfied with it.

You can also use the Low Temp Foam Glue between sheets of foam, and between foam and other products. Apply spots of glue to one piece of material, then press the work together. Hold the work in place for a few seconds while the glue sets. The glue will set quickly so work in small areas and apply only a little glue at a time.

Low Temp Foam Glue may cause lumps if it is used underneath thin material such as Track-Bed or the leading edge of an Incline Starter. Use a small piece of cardboard to spread the glue out if necessary prior to pressing your work together. Don't use your fingers to spread this glue. Even though the Low Temp Foam Glue Gun is not as hot as most glue guns, it is still hot enough to burn your skin.

B. Foam Tack Glue

Foam Tack Glue is high-tack and effective on wood, cork, Homasote, rough or smooth hardboard and foam, as well as many other materials commonly used in modeling and handicrafts.

We prefer to use Foam Tack Glue to adhere Risers and Inclines. Foam Tack Glue is high-tack and effective on most materials including foam, wood, cork, Homasote, Upsom board and rough or smooth hardboard. Foam Tack Glue is specially formulated to dry thoroughly. Many white glues will not dry properly between two large foam sheets or on other large surfaces. Foam Tack Glue solves this problem and is ideal for use any time you have two large surfaces to bond.

Foam Tack Glue can also be used as a contact cement, as explained in the Tech-Tip on the following page.



Foam Tack Glue is different from other white glues. It is specially formulated to dry thoroughly. If you've ever used white glue to glue two sheets of foam together, you know that the glue will seldom dry all the way through, and will leave wet spots in the middle of your work. Foam Tack Glue will dry thoroughly.

Foam Tack Glue is especially useful when gluing thin or narrow pieces together. Apply a bead of glue and press work together. Foam Tack Glue sets more slowly than Low Temp Foam Glue. Work will have to be pinned together with Foam Nails, clamped together or weighed down while the glue sets. Drying time will depend upon heat and humidity. When Foam Tack Glue is used as a *contact cement* it will bond instantly. No additional clamping or drying time is needed.

Because Foam Tack Glue must be spread on the surface of the materials to be adhered together you will have to take your work apart in order to apply the glue.

If you are using Foam Tack Glue for the entire layout we recommend testing your layout and gluing foam in place after each step. For example, after installing all of your Risers, lay your track on top of the Risers. Be sure the joints between track sections are tight. Be sure your track is centered over the Risers. If necessary unpin and adjust the position of your Risers. Once you are satisfied with the position of your Risers glue them in place. Remove one Riser at a time. Apply a bead of glue to the plywood base beneath the Riser. Press the Riser back in place, and pin it down with Foam Nails until the glue sets. Once you have glued down the Risers proceed to Step Two - Add *Inclines*. Repeat this testing and gluing process after each step.



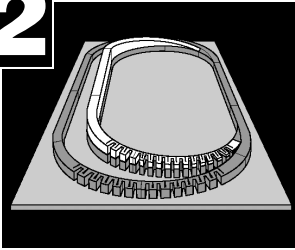
Use Foam Tack Glue underneath the leading edge of an Incline, or other thin material.

TECH TIP

Foam Tack Glue can also be used as a contact cement. Apply a thin coat of Foam Tack Glue to both surfaces to be bonded. Set the pieces aside for a few minutes until the glue is dry to the touch. Place the two glued surfaces together. The Foam Tack Glue will bond instantly. This is the ideal method for installing Track-Bed. If the Foam Tack Glue is still wet when surfaces are mated, some pinning or clamping may be needed.

Add Inclines

Step 2



Inclines support your track as it maneuvers through changes in elevation. Hills, mountains, ravines, creeks and river beds are all a part of the natural terrain that you can model. These terrain features make your layout more interesting and realistic. Inclines allow your train to climb and descend hills as it moves through the landscape.

The SubTerrain System includes *Incline Sets* and Incline Starters in 2% and 4% *grades*. Use them to realistically take your track from one elevation to another, without complicated calculations, guesswork or wood construction. Simply stack the precut, premeasured Inclines on top of the Risers for quick and easy elevation changes.

A. Before Installing Inclines

You need to decide what grade of Incline to use. To determine this, you need to know the elevation from the lowest point on the track to the highest point, and the total track length available between these two points. Now you can determine the grade needed.

CHART TO DETERMINE PERCENT INCLINE						
Desired Elevation from Roadbed:	1"	2"	3"	4"	5"	6"
# feet to reach elevation using:						
2% incline	4'	8'	12'	16'	20'	24'
4% incline	2'	4'	6'	8'	10'	12'

SubTerrain Inclines are available in 2% or 4% grades. They can be used independently or combined to make grades of 6% or more. Using this chart, determine the right grade for your situation. First determine the desired elevation from the lowest to the highest point of your track. Look down that column on the chart and find the minimum track length needed to reach that elevation. Move to the left of that row to determine the grade needed.

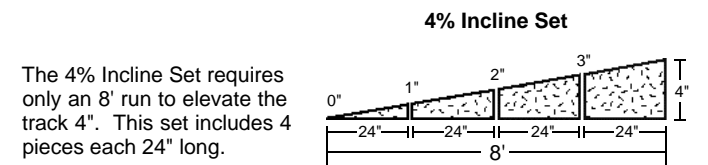
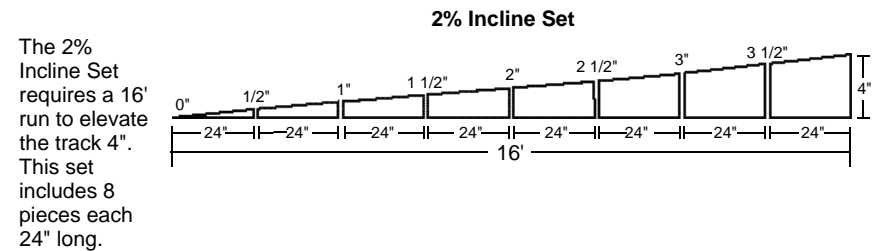
In most cases a 4% grade works best in limited space. Some engines will have trouble pulling cars up grades steeper than 4%. Test run your engine with a number of cars to be sure it will pull the grade you select.

When considering total track length available to create an incline, remember that your train must go up the incline and come back down. Since it is possible to climb and descend at two different grades, the chart only considers the distance available for one side of the incline. You should also refer to your layout plan and consider features such as turnouts, bridges and other elements when determining the total track length. Often these features are level, and your track must level out on either side of these features.

We find that a 4% grade is ideal for most situations. Although this is steeper than many real railroads would use, it allows for interesting changes in elevation over a short distance. Although you can use SubTerrain to create grades steeper than 4%, you should check your engine to be certain it will pull a long train up a steep grade.

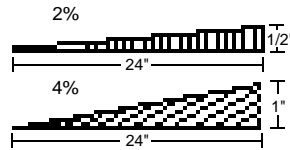
● Incline Sets

SubTerrain Incline Sets include everything necessary to raise the elevation of your track from 0" to 4". This is the ideal elevation for overpasses (in HO scale). Incline Sets come in either 2% or 4% grades. For most track plans and layouts Incline Sets are the ideal way to add elevation to your layout quickly and easily.



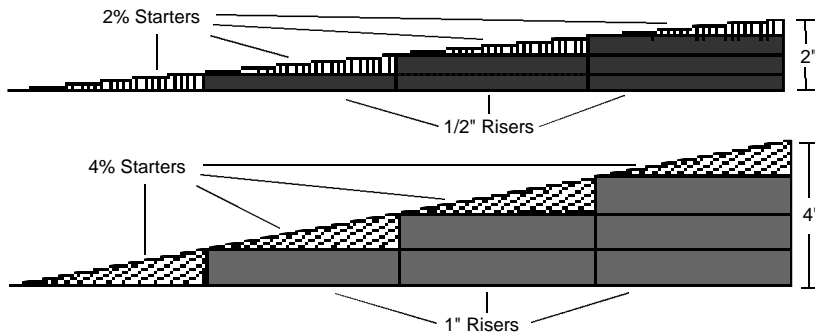
● **Incline Starters**

The SubTerrain System also includes Incline Starters. An Incline Starter is a wedge of high-density foam used to start your track on an Incline. A 2% Incline Starter raises the elevation from 0" to 1/2" over a length of 2 feet. A 4% Incline Starter raises the elevation from 0" to 1" over a length of 2 feet. Incline Starters can be used in stair-step fashion with 1/2" and 1" Risers to raise an incline to any height.



● **Stair-step Risers and Inclines**

A 2% Incline Starter will elevate the track 1/2". A 4% Incline Starter will elevate the track 1". Incline Starters can be stacked on 1/2" and 1" Risers to continue the incline to a higher elevation. Using a combination of Risers and Inclines in stair-step fashion, you can obtain any elevation.



B. Install Inclines

Once you have determined the right SubTerrain Inclines to use, it is time to install them on your layout. Center the Inclines on top of the Risers and pin them in place with Foam Nails.



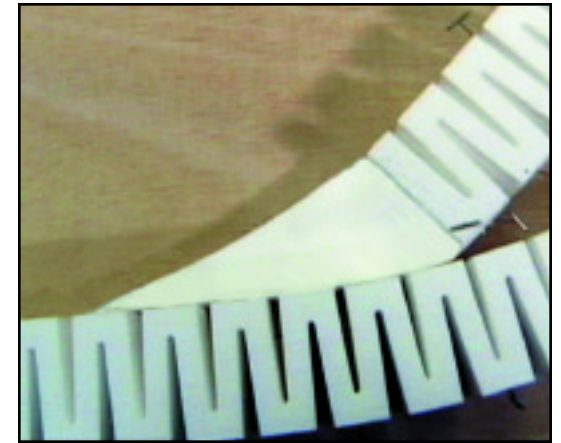
Center the Inclines on top of the Risers and pin them in place with Foam Nails.

As with Risers, you may need to cut Inclines to fit. Use your Hot Wire Foam Cutter or Foam Knife.

● **Diverging Risers**

If your layout calls for turnouts or intersections, you may have some small gaps to fill. A transition piece can be made with *Foam Sheets*.

This can be accomplished one of two ways. You can cut a solid block of foam to fill the entire gap. This solid piece of foam should be the same height as the Risers. You may also wish to cut a thinner piece of foam and support it underneath with small scraps of foam. Use at least 1" foam for proper support.



A transition piece can be made with a portion of a Riser or scrap foam.

To cut this piece to the proper size slip a piece of paper underneath your Risers at the gap. Trace the outline of the missing wedge on this paper. Transfer this outline to a Foam Sheet. Cut the foam and pin it in place with Foam Nails.

● **Test Your Layout**

Once all of the Risers and Inclines are in place, you may want to test your track. Lay the track sections directly on top of the SubTerrain foam. Pin track in place using Foam Nails. Put Foam Nails in at an angle or push them all the way in to avoid interfering with your train.

Use *rail joiners* to join the track sections together. Be sure to use insulated rail joiners, where appropriate, to ensure proper wiring and current flow. If you are unsure how to wire the track, follow your track plan or review one of the many books on wiring available from your retailer.

Run wiring neatly down the sides of Risers and Inclines and along the

base to the power supply. Connect all necessary wiring to the track, turnouts and the power supply. Follow the wiring instructions for your track plan, power supply and turnouts.

Now you can test run your train. Check for derailing. If you need to make adjustments, Risers and Inclines can be removed and repositioned. Gaps and rough spots may seem to be a problem now but will be smoothed over later with Plaster Cloth (See page 32). This is also a good time to be sure your engine will pull your train up steeper grades. At this point, check Risers and Inclines to be certain they are centered under the track and the track joints all fit together tightly.

TECH TIP

Where an Incline Starter, or the first piece of an Incline Set meets a Riser there may be a small ridge or bump. This is usually not a problem, as it will be smoothed over later with Plaster Cloth (see Step 5). If you are concerned about this you can fill this gap with Foam Putty.

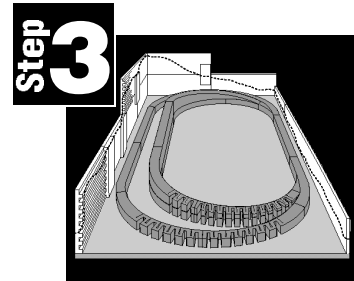
Apply Foam Putty after the Risers and Inclines have been glued in place. Foam Putty can be sculpted when applied, or sanded when dry. Use 220 grit sandpaper for rough sanding. Finish with 320 grit.

The best way to achieve a smooth edge when sanding is to make a sanding block slightly wider than the width of your Risers. Sand lengthwise along the top of the Risers and Inclines. Use long smooth strokes, and apply very little pressure.



Foam Putty is a non-shrinking, very lightweight filling material with the same characteristics as foam. Foam Putty requires no mixing and dries a bright white color. It may be used to fill cracks between foam pieces, gaps and holes in the layout. It can be sculpted when wet and sanded or carved when dry.

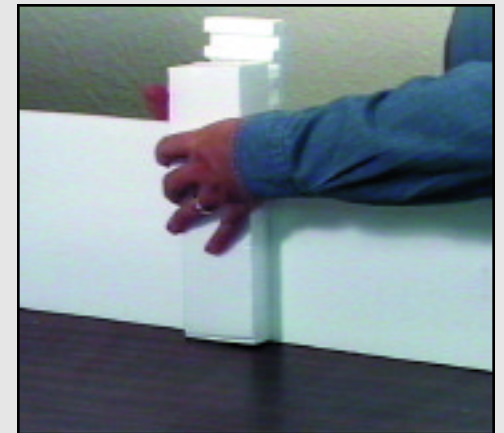
Cut & Install Profile Boards



Profile Boards are used around the perimeter of the layout. They support the terrain surface that you will create later. *Connectors* come with Profile Boards and are used to lock the Profile Boards together for a secure assembly. The special design of Profile Boards and Connectors allow them to interlock, making a strong assembly both horizontally and vertically, even before gluing. Profile Boards can be stacked and locked together with Connectors to reach almost any height. Profile Boards are 24" long and 8" tall. Each package contains 2 Profile Boards and 2 Connectors.

TECH TIP

Profile Boards and Connectors are molded to fit together very tightly for extra stability. Avoid indenting foam with your fingers while connecting Profile Boards by placing a scrap piece of foam between your hand and the Profile Board. If no scrap foam is available use any flat object, such as a book.



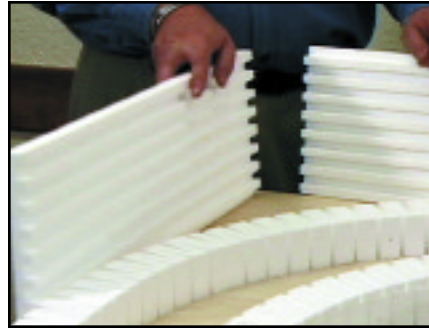
A. Place the First Row of Profile Boards Around the Perimeter of the Layout.

Join sections together with Connectors. Profile Boards are designed to interlock at corners by turning one board upside down. Pin the Profile Boards to the base with Foam Nails.

For a seamless joint, the Profile Boards can be cut at a 45° angle (*mitered*) at the corner using the Hot Wire Foam Cutter with Guide attachment.

Profile Boards may extend past the end of the base. If this happens trim the end of the profile board with the Hot Wire Foam Cutter or Foam Knife. Use a straight edge to ensure a straight, square cut.

Where higher elevations are required, additional Profile Boards can be added. Stack these above the first row of Profile Boards and join with Connectors.



Profile Boards are designed to interlock at corners.

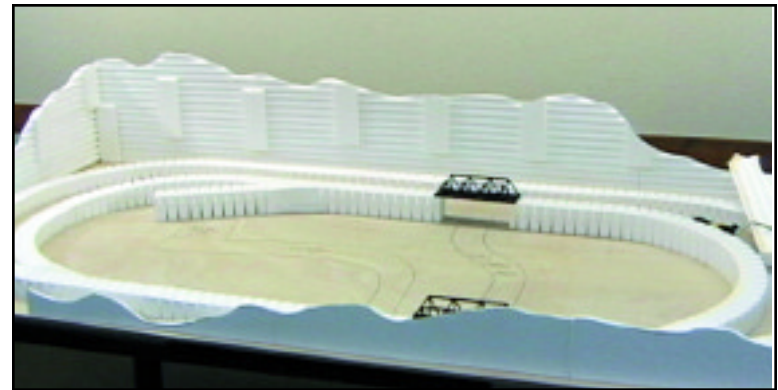
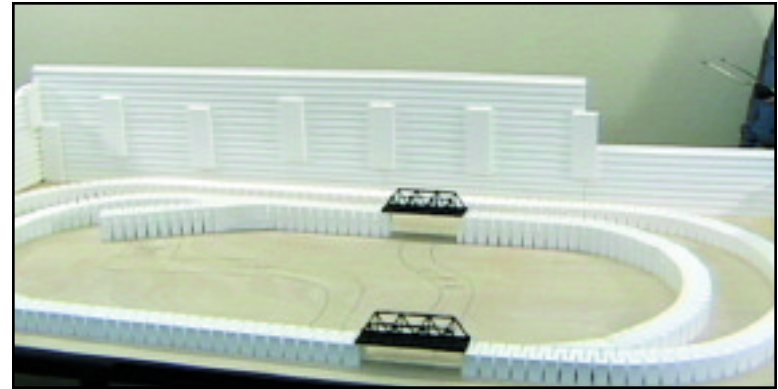


TECH TIP

If you run out of Connectors you can create your own. Simply cut 3" from the end of a Profile Board. Use this 3" section as a Connector.



For higher elevations, additional Profile Boards may be added by stacking above first row and joining with Connectors.



Profile Boards can be cut with the Hot Wire Foam Cutter or hobby knife to create contours around the perimeter of your layout.

B. Cut Contours

Profile Boards can now be cut to create the contours around the perimeter of your layout. If your track plan provides a pattern for the exterior profile, or you know approximately what you want this profile to look like, you can cut it now. If you are not sure what contours you want, wait until after you have created your interior terrain features with paper wads. (See page 32.)

To cut the profile's contour, first draw the contour on the outside of the Profile



TECH TIP

Profile Boards can be easily cut with the Hot Wire Foam Cutter. The optional Bow attachment can be used for a more ergonomic cutting angle.

Use a sawing motion with the wire for a faster cut.

Boards with a Foam Pencil. Then use the Hot Wire Foam Cutter to cut along the drawn line. If you make a mistake or don't like the contours you have created, simply re-attach the pieces of Profile Boards with the Low Temp Foam Glue Gun. Wipe off excess glue.

Later you will cover the perimeter of your layout with Plaster Cloth, covering any seams or gaps in the Profile Boards. This will create a hard surface to protect your perimeter walls and hide seams, gaps and imperfections in the exterior.

The exterior or flat side of Profile Boards has raised marks from the molding process. If you wish, sand these out with a 320 grit sandpaper. Use a sanding block for a smooth finish.

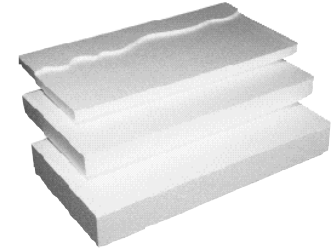
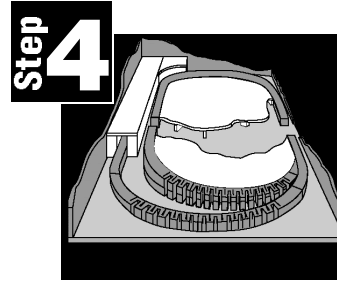
Permanently glue the Profile Boards and Connectors to each other and to the base. The Hot Wire Foam Cutter will cut through Low Temp Foam Glue.



TECH TIP

To save material, you may wish to turn the cut-off pieces upside down for use in the front of your layout or in areas where the profile is lower. These cut-off pieces can also be stacked on the top edge of other Profile Boards.

Install Foam Sheets



Sheet goods are made from the same nontoxic, high-density foam that is used for the entire SubTerrain System. Foam Sheets are available in 1/4", 1/2", 1", 2", 3" and 4" thicknesses.

These sheets are ideal for creating elevated, flat areas for towns, tunnel walls and ceilings and contour supports. The 1/4" and 1/2" sheets can be bent to almost any radius.

Woodland Scenics SubTerrain white foam does not emit hazardous fumes when cut with a hot wire cutter. Our foam is high density, expanded polystyrene which is nontoxic and does not damage the ozone layer.

Foam insulation boards (sold in most lumberyards) are usually made with extruded polystyrene foam and emit low levels of toxic fumes when cut with a hot wire cutter. This should only be done with good ventilation. Many extruded polystyrene products also use ozone depleting chemicals.

Polyurethane foam; rigid and flexible (foam rubber) emits extremely toxic fumes if cut with a hot wire cutter. Polyurethane foam should never be cut with a hot wire cutter.

Our white foam is perfectly safe to cut with a hot wire cutter; obviously some foam is not safe. We recommend our Hot Wire Foam Cutter be used only on expanded polystyrene -- like SubTerrain's white foam products. Anyone allergic to any kind of smoke should use good ventilation, even when cutting our white foam.

A. Create Level Elevated Areas

When creating towns, parking areas or placing buildings you might want an elevated flat area. Don't worry about actually elevating the area yet; simply decide where the area will be located and what shape it should be. Free span level areas should use at least 1" thick foam. If the elevated area must fit the contours of a Riser or other feature, trace the contour on a sheet of paper; then transfer the shape to a sheet of foam. Cut the contour with a Hot Wire Foam Cutter or Foam Knife.



Use at least a 1" Foam Sheet for elevated areas.

To support the elevated areas, cut several small pieces of foam to the proper height. These pieces can be cut from scraps of foam left over from previous operations. Pin the foam in place to test the height of your supports. When you are satisfied with the fit and support, glue the foam down with the Low Temp Foam Glue Gun or Foam Tack Glue.

B. Create Tunnels

You can also cut Foam Sheets to form tunnel sides and ceilings. These will support terrain contours and keep the track area clear. Pin the foam in place with Foam Nails and check for clearance.

To ensure adequate clearance between tunnel sides and track, space the walls at least 1/2" from the Risers. You can use scrap pieces of 1/2" foam as spacers. For curved tunnel walls, use 1/4" foam and bend to fit.



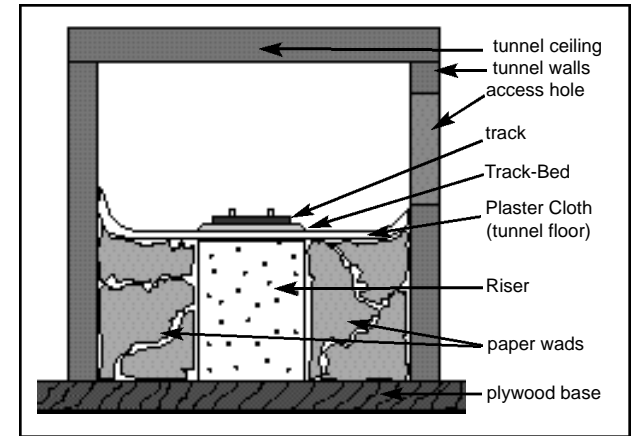
Foam Sheets may be used to form tunnel walls and ceilings.

(See Create Vertical Curved Areas on page 29.)

Before permanently attaching the tunnel sides and ceiling, you will need to install the track in areas covered by the tunnel. In these areas, create a Plaster Cloth *hardshell*; then install the Track-Bed and finally the track. These steps are covered in more detail later.

The easiest way to create a realistic tunnel floor is to glue the walls in place, then lay Plaster Cloth between the walls and on top of the Risers. Put wads of newspaper between Riser and tunnel walls to support Plaster Cloth, if necessary. Now lay the Track-Bed and track. Refer to Step 5 on page 32 for help on using Plaster Cloth and laying Track-Bed. Refer to Finishing Your Layout on page 40 for help on laying track.

Once the track has been installed, glue the ceiling in place with the Low Temp



Put newspaper wads between Risers and tunnel walls to support Plaster Cloth.



TECH TIP

Remember you will have Plaster Cloth and Track-Bed between the foam and the track, so you will need to allow for that when checking the clearance for the tunnel ceiling.



TECH TIP

If your layout calls for tunnels or other hard to reach areas, cut *access holes* in the Profile Boards with a Foam Knife. If the train derails in this area, you can now reach it easily.



Foam Glue Gun.

C. Create Vertical Curved Areas

If your tunnel curves, you will need to bend the tunnel wall, creating a vertical curved area.

Vertical curved areas can also be used to support flat areas and create bluff faces or *retaining walls*.

Cut a sheet of 1/4" or 1/2" foam to the desired height. Gently flex the foam back and forth. You will hear it "give" as you flex it. Pin the foam in place with Foam Nails. Once the foam is positioned correctly, you can glue it in place with the Low Temp Foam Glue Gun (or other glue).



After flexing, 1/4" Foam Sheets work great for curves. Pin in place with Foam Nails and glue in place with the Low Temp Foam Glue Gun.

D. Build Streets and Roads

Roads may rise and fall faster and turn and bank more sharply than tracks; therefore they can be fit in almost anywhere. You will need streets and roads to the industries, towns and other buildings on your layout. Since the roads on your layout bear no significant weight, they may be suspended (as shown) and supported periodically with pieces of scrap foam. Later, streets and roads will be covered with Plaster Cloth and paved with the Woodland Scenics Road System.

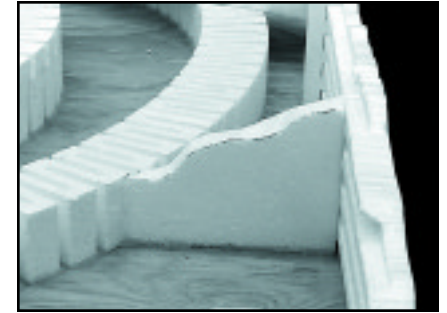
To build roads, use any combination of Risers and Incline Sets and Starters in the same manner as they were used to support your track. Roads are generally wider than railroad track so you may need to place two Risers side-by-side to



Roads are generally wider than railroad track so two Risers may be placed side-by-side to create a road. Notice in the foreground that the road is the same level as the track, and rises to the elevated areas.

support the road.

Pin Risers and Inclines in place with Foam Nails. Once you are satisfied with the position of your roads, glue the foam in place with the Low Temp Foam Glue Gun.



Cut contour supports out of scrap foam with the Hot Wire Foam Cutter or Foam

E. Make Contour Supports

For extra support and to help you visualize how the terrain will flow, use Foam Sheets as contour supports. You can use scrap pieces left over from previous steps. Use the Hot Wire Foam Cutter or Foam Knife to cut foam pieces to the shape you desire. Glue supports in place with the Low Temp Foam Glue Gun.

F. Install Wiring

Before creating a Plaster Cloth hardshell you should install wiring. Installing wiring is simple and fast with SubTerrain. Run wire along, and if necessary through, Risers and Inclines to connect the track to the power supply and switch control boxes to electric switches.

Locate wiring positions on turnouts and track. Leave about 3" of wire unattached and temporarily tape over the exposed ends.

Make a hole in the foam just large enough for the wire, or run wire down the sides and along Risers and Inclines. Tack wire in place with the Low Temp Foam Glue Gun. Make one exit for a neater appearance.

If you prefer, drill a hole through the Inclines, Risers and the plywood base. This hole should be just large enough for your wire to pass through. On the underside of the layout, route the wiring to your power supply or electric switches. If you plan on building a table for your layout, be certain it will not interfere with the wiring.



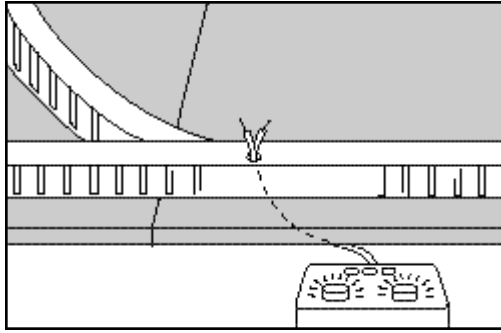
TECH TIP

Toggle switches can be mounted in your Profile Boards. Cut a hole in your Profile Board with the Foam Knife, or use a drill. Install the toggle switch just as you would in hardboard. Use a fender washer for extra support. Wire appropriately.

Use *Cable ties (zip ties)* to bundle wires together to keep them neat. Cable ties are available in most electronic stores.

Try not to place wiring joints in areas that will be covered by the Plaster Cloth hardshell, as these will be difficult to service later. Use continuous wiring runs wherever possible. If it is necessary to join wires, be sure to solder them carefully to provide a good mechanical and electrical joint. Be sure to follow the safety instructions for your soldering iron or gun, and be careful not to melt SubTerrain foam while soldering.

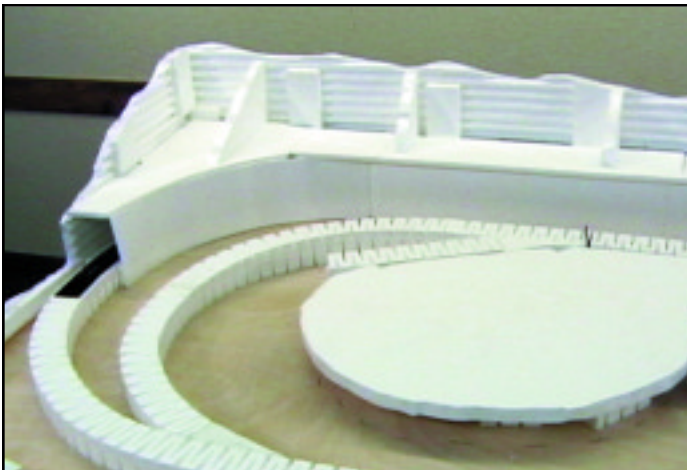
For a cleaner appearance to your layout we recommend you run all of your wiring underneath the Plaster Cloth hardshell to a single exit point, where you can make all of your final connections.



Drill hole through Incline, Risers and plywood base for your wiring.

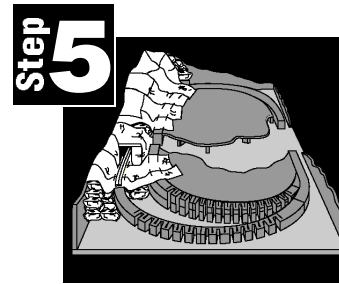
 **TECH TIP**

We recommend hiding all of your wiring underneath the Plaster Cloth hardshell. Run your wiring along the top of the layout to a single exit point along the perimeter. Make your final connections to power supplies or other devices here. All of your wiring will be covered over with Plaster Cloth in Step 5.



Once all SubTerrain foam is in place you are ready to add terrain contours with Plaster Cloth.

Add Plaster Cloth & Track-Bed




Woodland Scenics Plaster Cloth is a plaster-coated cloth for terrain modeling. Plaster Cloth, when dipped in water, is used to form a hard terrain shell (hardshell), without adding plaster. It easily accepts coloring, rock castings and landscape materials.

A. Create Terrain Contours

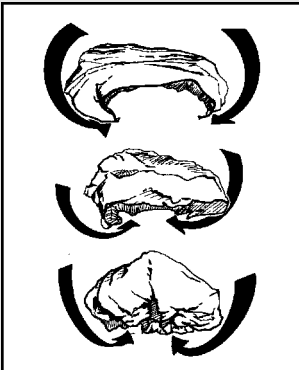
Before creating the hardshell, fill in terrain contours with paper wads.



When you are satisfied with your layout contours, use masking tape to hold paper wads in place.

 **TECH TIP**

When making newspaper wads for terrain building, the best shape for the wads is a pillow shape. Start with a sheet of newspaper and roll the edges underneath from each side until a small pillow with a gently curved top, slightly concave bottom and rounded edges is achieved. These pillow shaped newspaper wads will be easier to stack up than wads of miscellaneous shapes to form the terrain contours.




Wad up sheets of newspaper and stack them on the layout between and around contour supports to form the shape of mountains, hills and land contours. Make your wads in a pillow shape by rolling the edges underneath from each side. The pillow should have a gently curved top, slightly concave bottom, and rounded edges. This will allow the pillows to fit together neatly and provide a smooth upper surface for laying Plaster Cloth.

Move the newspaper wads around to experiment with contours in different areas. Use masking tape to hold the paper wads in place when you achieve a satisfactory appearance.

B. Make a Hardshell

If you have not done so already, now is the time to cut the terrain contours in your Profile Boards. Refer to "Cut Contours" on page 24 for this step.

 **TECH TIP**

If you have trouble seeing these mounds as terrain features, place a sheet of newspaper over the paper wads and mist with water. The newspaper will conform to the created shape and provide a better idea of how the contours will look.

Be sure to consider the clearance needs of your trains when you lay out your contours.

Covering the layout with Plaster Cloth will provide a smooth, self-supporting hardshell. On this surface you will mount Track-Bed and track. Then add *rock outcroppings, tunnel portals*, retaining walls, landscaping materials, buildings and other features.

Cut the Plaster Cloth in strips of manageable size, usually 8-18 inches

is easiest to work with. One side of the Plaster Cloth is bumpy because it has a heavier coat of plaster. Apply Plaster Cloth with the bumpy side up to more easily smooth the plaster and optimize strength.

Dip a strip of Plaster Cloth in water and lay it on the paper wads. Plaster Cloth will conform to the shape of the underlying material. While it is still wet, rub the Plaster Cloth with your hands to fill holes in the cloth and smooth it out.

Where Plaster Cloth meets the tops of the Profile Boards or the edge of the plywood base, fold the Plaster Cloth over itself to form a smooth edge. Rub the Plaster Cloth with your hands, pressing firmly. If the Plaster Cloth pulls away from the edge, pin it in place with Foam Nails until it dries. Lay a second sheet of Plaster Cloth in the same manner as the first. Overlap the Plaster Cloth so that 50% of the new piece covers the previous piece and 50% covers new territory. Cut strips of Plaster Cloth in half lengthwise and place on both ends of the layout. When applied in this manner you will have two layers of Plaster Cloth over the entire layout, with no overlapping seams. This will produce a very strong covering for your layout, without requiring additional plaster or other bonding materials.

Plaster Cloth should be smooth underneath the track and Track-Bed. Use your hands to smooth these areas while the Plaster Cloth is still wet. The Plaster Cloth will dry hard and firm. After drying it can be sanded to



Overlap the Plaster Cloth so that 50% of the new piece covers the previous piece and 50% covers new territory.



While the Plaster Cloth is still wet, use your hands to fill in holes and smooth.



Plaster Cloth forms a hardshell over your entire layout.

remove any rough spots that remain. Drying time will depend upon heat and humidity.

C. Cover Perimeter

You can also use Plaster Cloth to create a hardshell on the exterior surface of the Profile Boards. This will increase the strength of your layout, and also provide a clean, smooth surface for painting. In order to prevent seams from showing, the Plaster Cloth on the exterior should be butted together rather than overlapped. Plaster Cloth has scalloped edges. Be sure to cut these off with scissors or Foam Knife when butting Plaster Cloth edge-to-edge.

Beginning at the bottom edge of the Profile Board, use Foam Nails to pin a row of dry Plaster Cloth around the outside perimeter of the layout. Do not overlap this Plaster Cloth; butt the ends together. Where elevation around the outside edge is higher, add additional rows of Plaster Cloth.

When the Plaster Cloth is pinned in place, use a spray bottle to spray water on the Plaster Cloth. Wet one area at a time, smooth it with your hands and move on. When smoothing the Plaster Cloth, rub the plaster into the holes in the cloth, and blend the seams together for a seamless appearance.

At the top of your layout trim the Plaster Cloth to about an inch above the perimeter and fold this over the top of your layout. Blend this into



TECH TIP

When the Plaster Cloth is dry you might want to sand the Riser/Incline area smooth. If you are using Woodland Scenics Track-Bed this will not be necessary. Track-Bed is resilient and will compensate for these rough spots, and your train will run smoothly. If you wish to smooth this area out you may fill gaps or rough spots with Smooth-It. When Plaster Cloth and filling products are dry, sand with 120 grit sandpaper then finish with 220 grit. Lightly wipe the sanded area with clean damp cloth after each sanding .



Plaster Cloth can be used to create a hardshell on the exterior surface of the Profile Boards.

the hardshell covering your layout. This will provide a smooth upper edge, and strengthen your layout.

If desired for additional strength, add a second layer of Plaster Cloth around the perimeter of your layout. Avoid overlapping the seams where possible. Spray and smooth as before. If seams appear where Plaster Cloth was butted together, they can be filled and smoothed with *Smooth-It*.

Joints may be sanded for smoother finish. Make one light pass with 220 grit sandpaper, then another with 320 grit sandpaper. Use a damp, clean cloth to remove dust between sandings.

The Plaster Cloth perimeter can be painted with latex paint. Flat paint in dark colors gives the best appearance. We recommend painting the perimeter after all scenery and landscaping is in place.

D. Install Bridges

Timing the installation of a bridge depends upon its construction. If your bridge includes a track section as part of the bridge, follow the general guidelines below for adhering the bridge but install it when you install the track. If your bridge has a flat deck on which track will be laid, it should be installed along with Track-Bed.

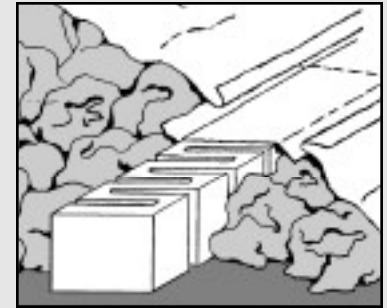
Bridges differ from manufacturer to manufacturer and between models



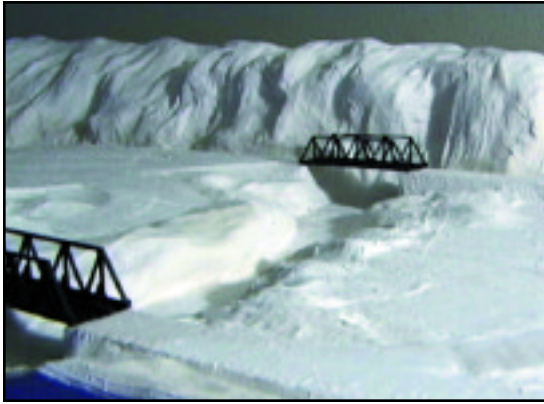
TECH TIP

If you are concerned with getting an extremely smooth surface below your Track-Bed, Plaster Cloth can be laid on Risers and Inclines separately. Cover all Risers and Inclines with a single layer of dry Plaster Cloth. Where edges meet over a Riser butt them together rather than overlapping. Once all of this Plaster Cloth is in place spray it with water or brush it with a clean wet paint brush. Work in small sections and smooth this Plaster Cloth with your hands. Blend the plaster together at the seams for a seamless finish.

Once this is done create the rest of the hardshell. Cut strips of Plaster Cloth, dip it in water, and cover the rest of the layout. Where Plaster Cloth comes near Risers fold it over or under itself to avoid getting additional Plaster Cloth on the Risers.



from the same manufacturer. Review the manufacturer's instructions for your particular bridge. The following instructions may vary slightly for your bridge and layout. The bridge should be painted prior to installation.



Bridges differ between manufacturer and models. Review the manufacturer's instructions for installing your bridge.

Some bridges have a thinner or narrower area where the bridge is to be attached to the layout. Examine the underside of your bridge. Use a Foam Pencil to mark your layout where the bridge will rest. Match elevation of bridge to track on layout.

Double check the bridges position and alignment. Check to be sure it is at the right elevation to meet your track, and also is positioned correctly side to side. Use *shims* or trim away foam wherever necessary to make sure the bridge is placed correctly. When you are satisfied with the position, glue the bridge in place.

E. Lay Track-Bed

Roadbed is used in model railroading for a number of reasons. In real railroads a roadbed, usually made of rocks, would be built up below the tracks. This would provide support for the tracks and train and also would be graded for smooth operation.

In model railroading roadbed is usually installed under the track to take the place of the roadbed used in real railroads. Roadbed should provide support for the track, smooth out any imperfections in the underlying surface, absorb engine and wheel noise and absorb vibrations for more stable and realistic operation. Cork, homasote and foam are the most common products to use for roadbed on model railroads. We think Woodland Scenics Track-Bed is the best choice for roadbed, because it surpasses both cork and homasote in meeting all of the requirements listed above. Track-Bed meets all applicable *NMRA* standards for

roadbed.

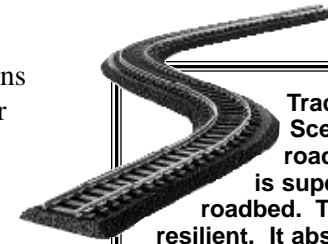
Track-Bed deadens the sound of your train for quieter operation. It provides for smoother operation and cushions vibrations. Track-Bed is easier to use than other roadbed products. It can be glued or tacked in place, it does not require pre-soaking, and will not dry out or crumble. Track-Bed is so flexible it can be directly installed in most turns without splitting.

Track-Bed can be secured with Foam Tack Glue, Low Temp Foam Glue or it can be tacked.

Track-Bed should not be cut with any hot wire cutter. Use a Foam Knife for easy cutting.

Before laying Track-Bed, it is necessary to determine where to put it. Lay track on top of the Plaster Cloth, temporarily pinning it in place with Foam Nails. Temporarily attach wiring and test the track. Check for clearances and derailing.

For clearance, run your longest car all the way around the track in both directions, and check the outside rear corner of the car around curves. When checking for derailing problems you should run the train both directions around the track. If track joints are uneven, derailing may



Track-Bed is Woodland Scenics revolutionary roadbed product. Track-Bed is superior to all other forms of roadbed. Track-Bed is highly resilient. It absorbs noise, vibration and irregularities in the underlying base.

Track-Bed has been certified by the NMRA as meeting all applicable standards for roadbed. Track-Bed is easy to cut and install. It is highly flexible and does not require pre-soaking. It will not break, crumble or dry out.

Track-Bed is available in individual strips or in packages of 12 and 36.



Temporarily attach wiring and test the track for clearance and derailing.

occur only in one direction. If rough spots seem to be causing a problem you can sand your hardshell, however the Track-Bed will probably correct most of these problems. Other roadbed products are not as resilient, and may actually make these rough areas worse.

If you want to sand the hardshell smooth make one pass with 120 grit sandpaper then follow with 220 grit. Wipe the area with a damp cloth after each sanding to remove dust.

When you are satisfied with the position and operation of the track, trace its outline onto the Plaster Cloth hardshell. Now remove the track.

Use the outline you've just drawn as a guide for laying Track-Bed. Lay it with the narrow or *beveled* side up. Track-Bed is extremely resilient and will conform to very tight curves. Track-Bed is slit down the middle, and can be split apart and laid in two sections for extremely tight curves.

The best way to apply Track-Bed is to glue it in place with Foam Tack Glue. Spread a thin layer of Foam Tack Glue on the Track-Bed and on the hardshell. Pin the Track-Bed in place while the glue dries. You can also use Foam Tack Glue as a contact cement. Spread a thin layer of Foam Tack Glue on both surfaces. Allow to dry. Press the Track-Bed in place.



TECH TIP

Plaster Cloth is a porous material. If excessive moisture gets underneath your Track-Bed the plaster may loosen and the track may lift up. This can be avoided by sealing the Plaster Cloth with Flex Paste. This will create a non-porous surface. Use this technique any place where you feel the Plaster Cloth hardshell will be directly exposed to water.



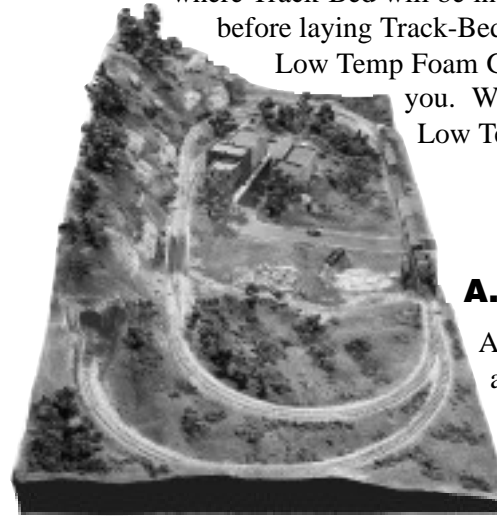
When satisfied with position of track, trace outline onto the Plaster Cloth hardshell.



Run a bead of Woodland Scenics Foam Tack Glue on the hardshell and on back of Track-Bed. Allow to dry. Press Track-Bed in place.

Glue will bond instantly.

You can also run a bead of Low Temp Foam Glue on the hardshell where Track-Bed will be installed. Spread the glue out before laying Track-Bed; do not use your hands, as Low Temp Foam Glue is still hot enough to burn you. Work in small sections because Low Temp Foam Glue sets quickly.



Finishing your Layout

A. Installing Track

Assemble and wire your track according to the track plan. Be sure to review the manufacturer's instructions for installing your track and rail joiners. Test track

before gluing it in place.

It might be necessary to remove a small sliver of Track-Bed underneath the *throwbars* of turnouts. This will vary for different track manufacturers. Check the operation of your track. If necessary cut away a small piece of Track-Bed with a hobby knife.

Run a small bead of Foam Tack Glue along the top of Track-Bed and spread it out. For turnouts, be sure not to apply glue to moving parts. Place the track on the Track-Bed and pin it in place until the glue sets. You may wish to weight the track down until the glue dries. Excess Foam Tack Glue can be cleaned with a clean, damp cloth before the glue sets.

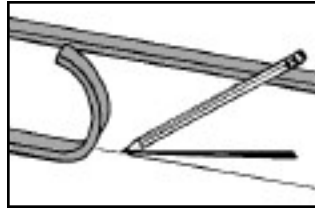
B. Using the Road System

Woodland Scenics *Paving Tape*, *Smooth-it*, *Asphalt Top Coat* and



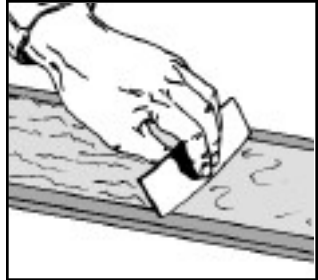
Use Woodland Scenics Paving Tape and Smooth-It with an Asphalt or Concrete Top Coat for any paved area.

Concrete Top Coat are the ideal products for creating highly realistic roads, streets, highways, parking lots, sidewalks and other paved areas. These products are designed to be used directly on top of a Plaster Cloth hardshell but will also work on almost any clean, hard surface.



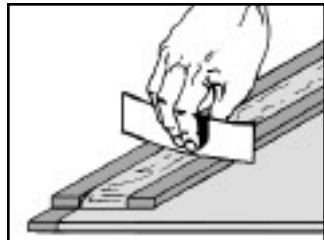
Use our Foam Pencils to draw outlines of roads before laying Paving Tape.

Draw road outlines with a Foam Pencil. Keep in mind the scale you are using. A 22' wide road would be 3" wide on an HO scale layout or approximately 1 3/4" wide on an N scale layout. When planning and drawing your roads, include the width of sidewalks and curbs in the overall road width.



Evenly spread and level Foam Smooth-It between the strips of Paving Tape.

After drawing roads, lay Paving Tape along road edges and press it down firmly. Mix a batch of Smooth-It according to package directions. Use the spreader included with the Paving Tape to evenly spread and level Smooth-It between the strips of Paving Tape. Drying time for Smooth-It will vary depending upon temperature and humidity. Smooth-It should be dry to the touch within 20-30 minutes, longer in more



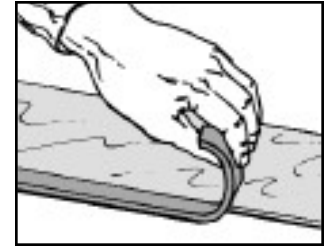
For sidewalks and curbs, lay strips of Paving Tape on existing tape and paved area. Spread Smooth-It between these strips.

humid areas.

If you are building sidewalks and curbs, add those before removing Paving Tape.

For sidewalks and curbs, lay a strip of Paving Tape over the existing strip or strips beside the road you've just created.

Allow Smooth-It to dry one hour before laying paving tape on top. Lay another piece of paving tape on top of the paved area, leaving a gap wide enough for the sidewalk or curb. Spread Smooth-It in the area(s) between these strips of Paving Tape. Allow Smooth-It to dry 20-30 minutes.



Carefully pull Paving Tape away from Foam Smooth It.

Carefully pull Paving Tape away from Smooth-It. Do not leave Paving Tape in place any longer than necessary. When Smooth-It is thoroughly dried, it can be sanded with 220 grit sandpaper.

Once the Smooth-It has dried and been sanded it can be painted with Asphalt or Concrete Top Coat. Then the road can be weathered (see section on page 43).

C. Making Shoulders on a Road

Road shoulders can be created using Fine Ballast. Spread a layer of Ballast along the road side. Mist the Ballast with water using a spray bottle. Drip Scenic Cement onto the Ballast

with an eye-dropper. Misting the Ballast with water will help the Scenic Cement soak in and blend better with the Ballast. Be sure to spray on enough water to allow the Scenic Cement to flow evenly throughout the Ballast. Once Scenic Cement has dried apply a second

TECH TIP

If Paving Tape can not be removed easily dampen it lightly with water. Allow water to soak in for a few minutes. Now Paving Tape should come up easily.

TECH TIP

Cut a scrap of foam to the width desired for your roads and tape a Foam Pencil to each side. Use this tool to trace the outline for all of your roads. This will keep your roads a uniform width.



TECH TIP

For a smoother finish on your roads mist Smooth-It lightly with water before it dries.

coat to ensure thorough coverage.

You can also affix the Ballast in place by misting it with Scenic Cement from a spray bottle. When doing this avoid getting Scenic Cement on the road's surface by masking it off prior to spraying.

For more information on using Ballast and Scenic Cement see Ballast the Track on page 64.

D. Weathering Pavement

Several techniques can be used for weathering pavement. Try one or more of these for a realistic effect.

1. Lightly sand Top Coat with 220 grit sandpaper. This will alter the color and leave streaks and scratches, simulating road wear.

Fold the sandpaper to the width of a single lane and sand the road one lane at a time.

2. Blend a small amount of Asphalt and Concrete Top Coats to make different colors.

Use a *dry brush* technique to dab spots or streaks of blended Top Coat onto a road already painted (and dry) with normal Top Coat. Use a blend of 10% Concrete Top Coat with 90% Asphalt Top

Smooth-It can be painted with Asphalt or Concrete Top Coat. These Top Coats are specially formulated for use on any material. They can be used full strength or thinned. Brush Top Coat directly on any smooth, clean surface. Use Top Coats to touch up roads on existing layouts. Thin or clean with water.



For streaks and scratches, use 220 grit sandpaper.

Coat for the best color. You may also experiment with mixing Top Coats in other blends for different color effects. This should give the appearance of skid marks or oil puddles. You don't need to be an artist; the more random and blotchy these areas look, the more realistic they will be.

3. Thin Top Coat with water. Use thinned Top Coat to paint road surface. This will give a mottled appearance. Blot this on with a wadded rag or sponge.

4. Draw cracks in the pavement with a sharp pencil. Again, don't try to be a perfectionist, just draw in a jagged line for a natural look.

5. There are several ways to add lane markers and stripes to roads and parking lots. We prefer to use a ruling pen, available from most art or office supply stores, with thinned white or yellow paint.

You can use striping tape, also available from art or office supply stores. This tape works very well when applied in straight, or relatively straight areas, but may not work well around curves.

You can also mask off the road around the stripes, then apply white or yellow water based paint. Finish the road first with Asphalt or Concrete Top Coat and allow this to dry thoroughly before applying masking tape. Remove masking tape carefully after the striping paint has dried.

6. Make expansion joints in sidewalks or roads by scoring the dry Smooth-It with a sharp knife.

7. Rub a graphite pencil on coarse (80 grit) sandpaper to produce powdered graphite. With your finger rub this graphite on your sidewalks for natural looking wear.

There is more information on using the Woodland Scenics Road System on page 48. The Road System products can be used on a new layout, or to improve the appearance of roads on an existing layout.

Special Situations

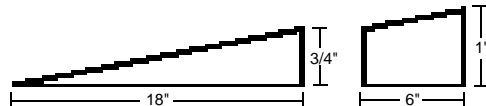
A. More Ideas for Inclines

SubTerrain is extremely versatile and allows you to easily create a base for track in almost any situation. This section contains examples of many special situations you can model using a combination of Risers and Inclines. You will find many more uses for SubTerrain foam as you work and experiment with it.

Incline Sets are specifically designed to raise the elevation of your track 4". On an HO scale layout this is the ideal elevation for overpasses. If you wish to raise to an elevation other than 4" you can use a combination of Incline Sets, Incline Starters and Risers to reach any elevation you desire.

Incline Starters are 2' long and raise the track in set increments. If you need an elevation between these increments, simply cut off the highest end of a Starter to create the correct height.

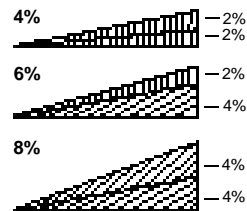
For example, a 4% Incline Starter raises the track 1" over a length of 24". If you only want to elevate the track 3/4" use only 3/4 of the 24" length or 18" of the Starter, simply cut off the last 6" from the end of the Incline Starter.



The same is true for Incline Sets. The 4% Incline Set uses 4 pieces of foam, each 24" long to raise the track 4". If you only want to raise the track 3 1/2" simply find where the Incline Set has increased to 3 1/2" and cut it off at that point.

● Create Steeper Grades

Stack 2% Incline Sets or Starters on top of 4% Incline Sets or Starters to create a 6% grade. Place 4% Starters on top of 4% Starters for an 8% grade. Remember, the steeper the grade, the more trouble the engine will have climbing. Make sure your engine will pull a train up the grade you design.

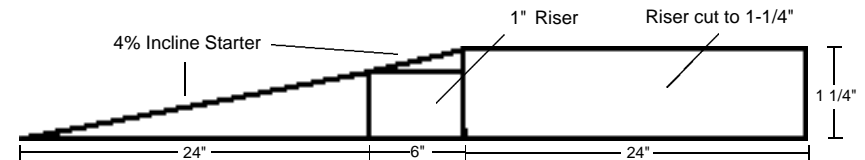


● Change Grades

Use 2% and 4% Incline Starters in combination to change grades in the middle of an Incline. Start your inclines on a 2% grade; increase to 4% in the middle of the incline; drop back down to 2% before leveling off. This will create more dramatic grades and a more realistic look.

● Rise to Any Elevation

Incline Starters and Risers are designed for elevations in even increments of 1/2" (at 2%) or 1" (at 4%). Inclines and Risers can be cut for other elevations. Suppose, for example, your track plan calls for the track to climb 1-1/4" at a 4% grade, run level for some distance, and then either rise or fall to a different elevation. Combining the appropriate Risers and Inclines is quite simple.



First, use a 4% Incline Starter to raise the elevation 1". Then using another 4% Incline Starter, cut off all but the first 6". This 6" portion of the Incline raises the track 1/4". Cut a 1" Riser to 6" long to place under this Starter.

Now you need Risers cut to 1-1/4" for the level, elevated area. This can be done with the Hot Wire Foam Cutter. Adjust the collars so the wire is held 1-1/4" away from the ends of the rods.



Adjust height of wire and push foam through the cutter for exact thicknesses.

Hold the Hot Wire Foam Cutter upside-down against a clean, level surface. Be sure the surface is non-metallic and will not conduct electricity. Push a 2" Riser through the Foam Cutter. This will cut the Riser to 1-1/4". You may wish to make a test cut first on a scrap piece of foam. Check the height against your Incline.

● **Banking Risers and Inclines**

Real roads and railroads are often banked slightly on curves. Some modelers choose to bank their layout's roads and track to enhance realism. Insert shims under Risers or Inclines around the outside of curves. Then glue your track down normally.



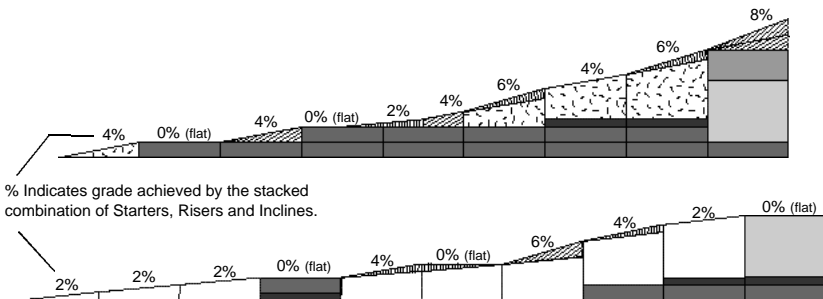
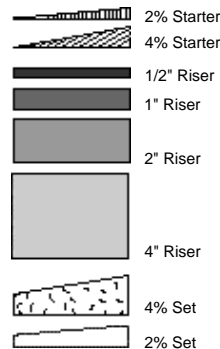
For banking the shims need to be inserted under the outside of curves before gluing in place.

● **Pre-Assemble Risers and Inclines**

You may also wish to simplify installation of Incline Starters and Risers by pre-assembling sections. Start with the lowest section and work toward the highest. Stack Risers and Incline Starters to desired height. Glue these together with the Low Temp Foam Glue Gun, or Foam Tack Glue. Install these preassembled sections just as you would Incline Sets.

● **Model any Situation**

Incline Starters and Risers can be used together to accommodate any circumstances your track plan may call for. You can stack 2% Inclines on top of 4% Inclines to form 6% Inclines. You can use 2% Inclines on a part of a 4% Incline Set to change the grade in the middle of a slope. You can stack Risers on top of Risers to form an elevated level area.



There is no limit to the situations you can create. The illustrations show many ways Risers and Inclines can be used together. It is unlikely that you will use all of these methods in a single layout. Use the Risers and Inclines in combination to make the grade you need.

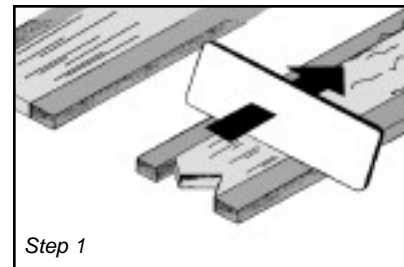
B. More Ideas for the Road System

Woodland Scenics Road System is a line of products specially designed and formulated to create realistic streets, roads, sidewalks, parking lots and curbs. The Road System can be used on a new layout you are creating or to resurface roads on an existing layout.

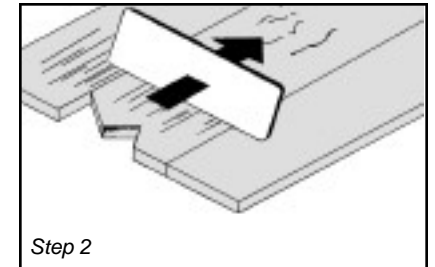
● **Building a Large Parking Area**

Build a large parking area one section at a time. Lay Paving Tape around the perimeter of the parking area to be created. Break the interior into smaller sections with Paving Tape.

Fill alternate sections with Smooth-It and allow to dry. Remove Paving Tape. Use Smooth-It to fill remaining sections. Use the existing dry Smooth-It to support the Spreader Tool.



Step 1



Step 2

Create a parking area by breaking the interior into small sections.

● **Building Road Crossings**

Road crossings are necessary wherever a street or road crosses railroad tracks.

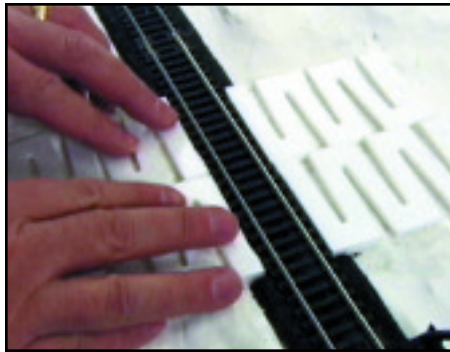
Determine the width and position of the road, and draw it onto your hardshell as discussed in the section Using the Road System on page 40.

Where the road will cross the track the Track-Bed will need to be removed from both sides of the track. Use the Foam Knife or a hobby knife to cut out and remove this material.

The finished road should be the same height as the top of the rails on your track. Cut an Incline Starter to raise the height of the road. If you are using the Woodland Scenics Road System, allow 1/16" for the thickness of the road.

Once this Starter is covered with Plaster Cloth, Smooth-It and Top Coat it will be the right height. If you are using another system to finish your roads, the incline height might need to be slightly different.

Use one or more Incline Starters to accommodate the entire width of the road. Place Starters on each side of the road in the area where Track-Bed was removed. Push these Inclines tightly up against the track's



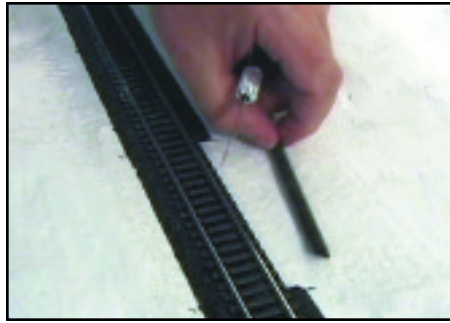
Use one or more Incline Starters to accommodate the entire road width.

ties. This will leave a small gap between the Incline and the rail. This gap will be filled later with Plaster Cloth and Smooth-It.

Lay Plaster Cloth over the Incline Starters. Blend this Plaster Cloth into the existing hardshell. Keep this Plaster Cloth off of the rails. If plaster gets on the rails it should be cleaned off with a damp rag.

Now, fill in the area between the rails. Cut two small strips of Paving Tape to fit between the rails, and place them at either side of the road crossing. Mix a small batch of Smooth-It and use it to fill in the road between the rails.

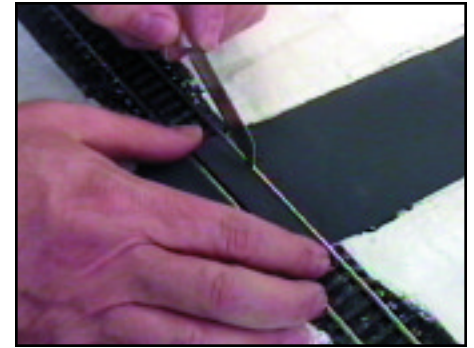
Use a Foam Knife or hobby knife to cut a thin groove in the road on the inside of the rails. This will allow the trains' wheels to pass over the road crossing. This can be done while the Smooth-It is still slightly wet, or after it has dried.



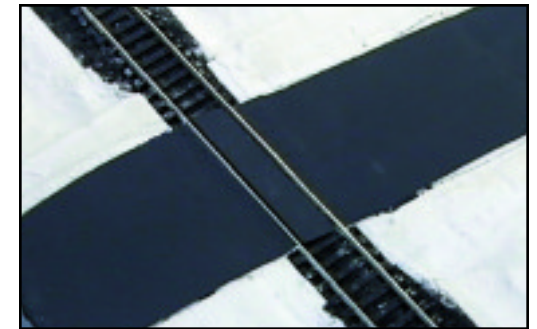
Where the road will cross the track, the Track-Bed will need to be removed from along the sides of the track.

Finish the road with Asphalt or Concrete Top Coat as described in Using the Road System on page 40.

If you prefer, you may also fill the road between the rails with a thin styrene strip or a piece of Foam Sheet cut and sanded to fit. Check the height of the rails for your track type, and also the width between the rails and the road's width. Be sure the styrene or foam stays back far enough from the rails to allow the train's wheels to pass without interference. This styrene or foam strip can be painted with Asphalt or Concrete Top Coat just like the rest of your roads.



Use a hobby knife and cut a thin groove along the inside of each rail.



Finish the road with Top Coat.

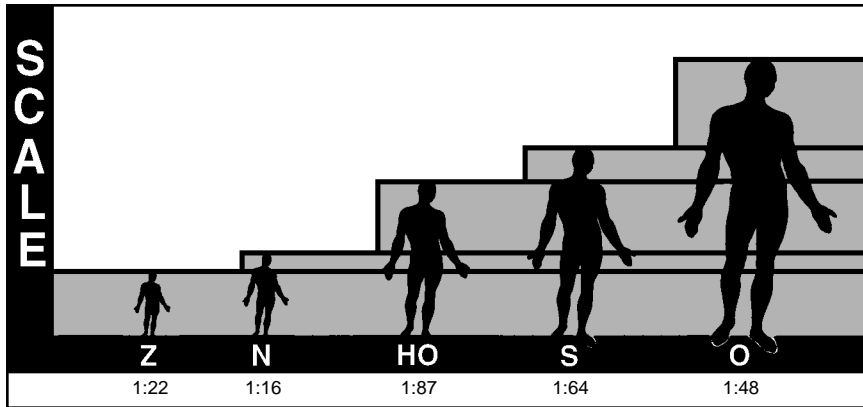
C. Mixing Smooth-It and Top Coats

Concrete and Asphalt Top Coats can be mixed with Smooth-It before applying for variations in color. Each batch will be a slightly different color, so be sure to mix enough at one time to complete the whole job.

D. Using SubTerrain With Other Scales

Model railroads are generally built as scale railroads; that is: Everything on the layout is built to a specific percentage of its size in the real world. In model railroading there are a number of common scales, with engines ranging from those small enough to hold in the palm of your hand to those large enough to ride.

The selection of scale to model is entirely up to you. There are a number of items that can be considered before selecting a scale. These include the available space, how much railroad you want to work with,

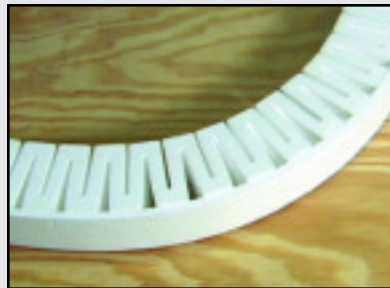


money available to put into the hobby and where the railroad is to be located. SubTerrain foam is designed to work well in most scales. Ask your dealer for more help determining which scale is right for you.

This book has focused on using SubTerrain to build an HO scale model railroad. Although HO is a very popular scale, many modelers prefer to use other common scales. SubTerrain was designed with this in mind. The SubTerrain system can be used for most scales. The most important thing to remember about using SubTerrain with other scales is that the foam components will be covered with Plaster Cloth, so modifications to the foam will not affect the appearance of your layout.

 **TECH TIP**

Many N scale track plans feature large sections of double track. SubTerrain Risers are slightly too narrow to accommodate this. After installing Risers and Inclines cut a 1/4" or 1/2" wide piece of Foam Sheet to glue to the sides of Risers. This will give you adequate width to support two sections of track side by side.

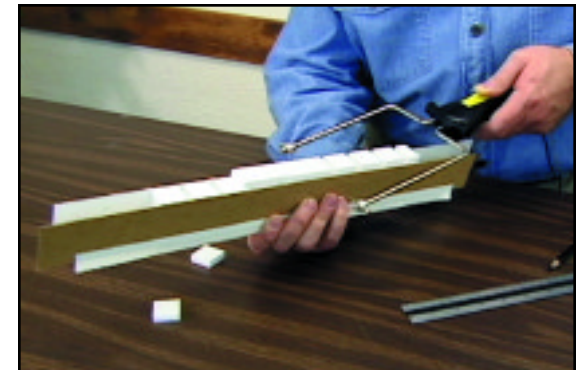


Risers or Inclines can be laid side-by-side to form a wider track base for 'larger' layouts such as O scale. Foam components can also be cut narrower or beveled for 'smaller' layouts such as N or Z scale, although this is only necessary where foam will interfere with other features of your layout such as ravines, creekbeds or the layout perimeter.

Many scenery items have no specific scale. Because trees, bushes, grass, mountains and streams all occur in a variety of sizes, Woodland Scenics scenery products can be used with most scales. Any Woodland Scenics product that is designed for a particular scale has that information listed on the product label.

● **Cutting Risers/Inclines Lengthwise**

Due to the unique shape of SubTerrain foam products, if you cut the Riser or Incline lengthwise prior to installation, it will fall apart. You can cut 1/4" off each side of a Riser or Incline without it falling apart. Cut two identical cardboard templates, as long as possible, up to 2' long. Make a "sandwich" with the templates taped to the top and bottom of the Riser or Incline, and no more than 1/4" from the edge. Use the edges of the cardboard templates as guides and cut the Riser/Incline with your Hot Wire Foam Cutter.



Cut two identical cardboard templates to use as a guide for cutting your Riser or Incline lengthwise.

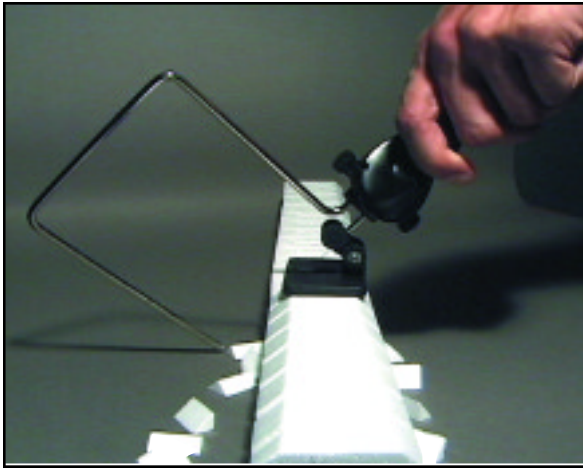
Remember, cutting Risers and Inclines should not be necessary unless their position interferes with other landscape features such as gullies or mountains. Normally you can simply install the SubTerrain and cover with Plaster Cloth.

● **Beveling Risers and Inclines**

Risers and Inclines can also be beveled at the top to provide a narrower surface for laying track. This can be especially useful for creating gullies and ditches along the track side. Bevels should be cut prior to installing foam.

Cut two identical cardboard templates, as long as possible, up to 2' long. Tape one cardboard template on top and one on the side of your Riser or Incline. These

will serve as a guide for cutting your bevel, so space them back from the edge the distance to be cut out. Use the edges of the templates as guides to cut the Riser or Incline with the Hot Wire Foam Cutter.



Attach the Bow and Guide to your Hot Wire Foam Cutter to cut a proper angle.

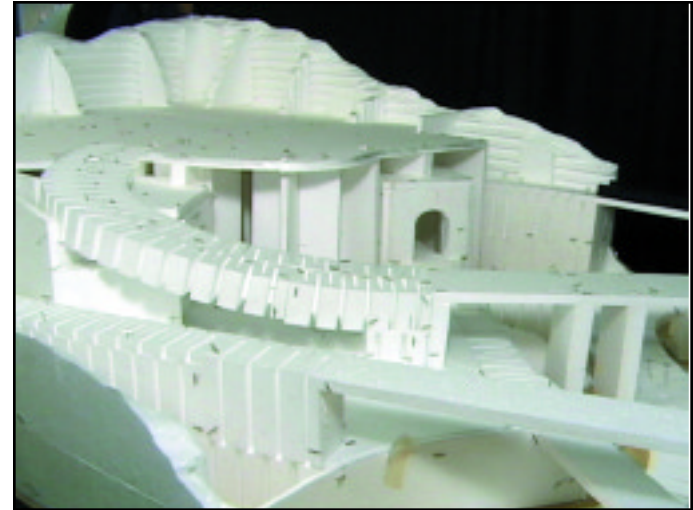
You can also use the Bow Guide to bevel foam products. Attach the *Bow and Guide* to your Hot Wire Foam Cutter. Set the angle of the guide to the angle of the bevel.

E. Split-Level Layouts

Several techniques are available for layouts that require multiple levels. Suppose your layout calls for a large town area elevated 10" above the main layout. You could easily elevate this area with Foam Sheets, bring the track to it with Inclines and use large pieces of Foam Sheets to support buildings. This is identical to the methods already presented in this book, the only difference is the total height.

It would also be possible to build a separate elevated area. Construct a 'box' out of Foam Sheets to support this area. Place this box on your layout. Use Inclines to reach this elevated area. Install Risers and

Inclines on top of this box just as you would on your plywood base. Depending on the size of this area, you may want to add additional support, use thicker Foam Sheets or create a separate plywood base.



The SubTerrain Foam System makes it easy to develop multiple levels for your layout.

F. Overpasses

A layout may call for track or roads to pass over or under each other. If your layout calls for this kind of overpass, keep in mind that you will need adequate clearance both horizontally and vertically. The amount of clearance will depend upon the scale of your layout. Check trains or vehicles that will pass through.

When creating an overpass it is important to adequately support the upper track or road. Use at least 1/2" Foam Sheets for the upper support. If gap is large you may wish to use thicker foam or hardboard for proper



When installing overpasses the amount of clearance may vary depending upon the scale of your layout.

support. Cut a piece of hardboard or Foam Sheet 2 1/2" wide (the width of a Riser) and 3" longer than the length of the opening.

Now cut notches in the tops of the Riser at either end of the overpass. These notches should be 1 1/2" long. Glue the piece of Foam Sheet into the opening you have created.

G. Creating Mountains

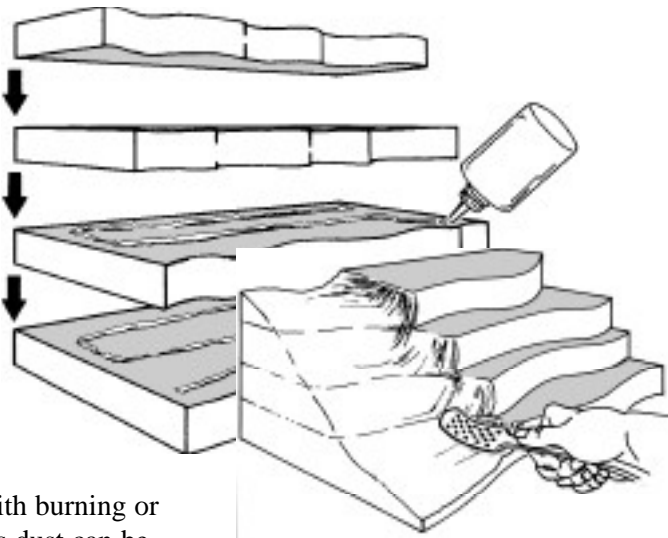
The easiest, cleanest way to create realistic mountains and hills in your layout is with newspaper wads and Plaster Cloth, as described in step 5 (see page 32). It is also possible to create mountains using Foam Sheets.

Cut rough contours in several pieces of Foam Sheet and stack these sheets on your layout base. Glue these sheets together with Foam Tack Glue. Some glues and solvents will melt foam products, so be sure to use a product designed to work with foam.

Allow this glue to dry thoroughly before proceeding. Use the Foam Knife, sandpaper, a file or rasp to refine your terrain contours.

Sanding away this much foam will produce a lot of dust. As with burning or melting foam, this dust can be hazardous with some types of foam. SubTerrain white foam dust is nontoxic, but a dust mask or ventilator should be used to avoid inhaling dust.

Once you have created the profile you desire you can seal the foam with *Flex Paste* or Plaster Cloth. Be sure to wipe up all loose foam dust with a damp cloth before sealing or finishing your mountain. Seams and gaps between sheets of foam can be filled with *Foam Putty*.



If you want a hollow mountain you can create a mountain with newspaper wads and Plaster Cloth as described earlier. Once the Plaster Cloth has hardened the newspaper wads can be removed. Once dry, the Plaster Cloth hardshell will support itself.

Flex Paste bonds to foam, plaster, wood and other materials and forms a durable, flexible, waterproof surface when dry. Flex Paste is specially formulated for modeling; it does not shrink as it dries. Paint Flex Paste on surfaces with a clean brush.

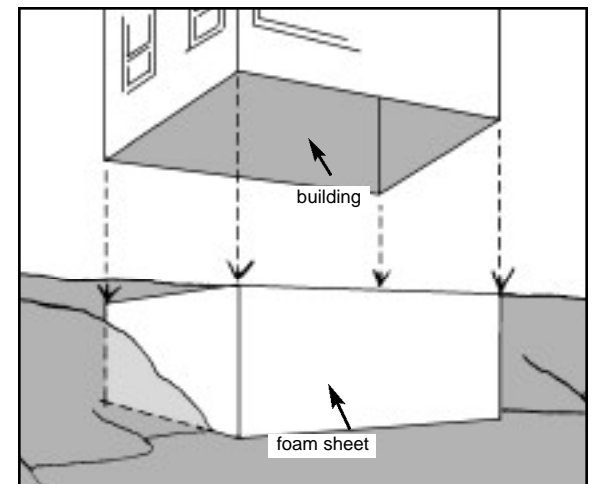


H. Placing a Building on a Hillside

Buildings and other structures added to your layout should rest on a level surface. Often terrain has contours making it unsuitable for supporting buildings.

To place a building, cut a foam block to act as the building's foundation. This should be cut to the size and shape of the building. Draw or trace the foam block's outline onto your hardshell. Cut away the hardshell with a sharp knife. Size the hole to fit your block. Remove the hardshell and newspaper wads underneath it. Insert your foam 'foundation' and glue it in place with Low Temp Foam Glue or Foam Tack Glue.

Fine sand and coat the foundation with *Flex Paste* and *Concrete Top Coat* to give it the appearance of a concrete foundation. Mount the building on top of the foundation and glue it in place.



Cut into the Plaster Cloth hardshell and install foam sheet for foundation where building will be placed.

I. Adding to an Existing Layout

Many model railroad layouts change over time. You may wish to change your layout by adding buildings and roads. Buildings can be added as described above in Placing a Building on a Hillside. This method of cutting into the hardshell and adding a building can be used anywhere on a layout. You can also add roads in a similar manner. All of this can be done even after landscaping has been installed.

First determine where the road will be located. Now cut through the Plaster Cloth hardshell using a hobby knife, and remove the Plaster Cloth and any newspaper wads where the road will be located.

Install Risers in place underneath the road. If necessary use newspaper wads or scrap foam to support these Risers. Glue Risers to the remaining hardshell or pin them in place with Foam Nails. Foam Nails can be left in place



Buildings and roads can be added to an existing layout.



Use a hobby knife to remove Plaster Cloth hardshell where buildings and roads will be located.



Remove newspaper wads and install risers where roads will be located.

permanently, so long as they do not protrude above the new hardshell.

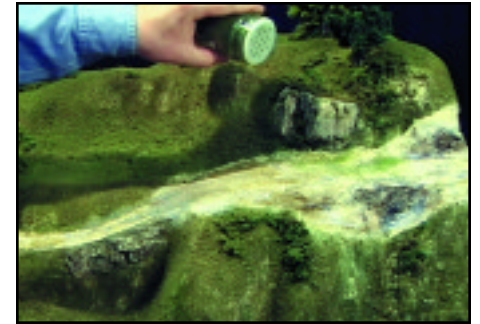
Cover Risers with a new layer of Plaster Cloth and blend this into the existing hardshell. If landscaping has already been installed, it might be necessary to clear some of this material away in order to properly blend the Plaster Cloth. A thin putty knife usually works well for removing landscaping material.

When the Plaster Cloth has dried, finish the road as described in the section Using the Road System on page 40. Replace any landscaping material that might have been removed during this process.

These techniques can be used to add buildings, roads, even additional track to any layout.



Cover Risers with a new layer of Plaster Cloth and blend this into the existing hardshell.



Replace any landscaping material that might have been removed during this process.



SubTerrain is great for new layouts or modifying existing layouts to form a realistic model.

J. Using Under the Track Switch Machines

Most *switch machines* allow a maximum of 1" of material between the switch machine and the switch or turnout. Switch machines may be installed inside the Risers. Review the manufacturer's instructions to determine the location and to ensure proper operation of the switch machine's linkage after installation.

To install an under the track switch machine simply cut a notch in the Risers and install a piece of hardboard to support the switch machine. Cut a hole in the plywood base for installation and servicing of the switch machine.

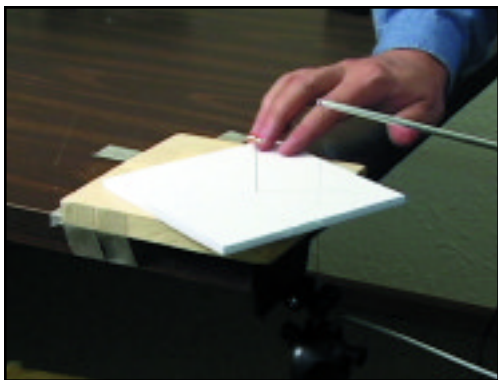


Use a piece of hardboard to support your switch machine as shown in module above.

Now you should be ready to finish the installation of the switch machine following the manufacturer's instructions.

K. Cutting Foam Circles

It is easy to cut perfect circles from Foam Sheets with the Hot Wire Foam Cutter. Use a Foam Nail to pin a piece of foam to your work table. The Foam Nail should be the same distance from the edge of the table as the radius of your circle. Hold your Hot Wire Foam Cutter against the edge of the table and rotate the piece of foam around the Foam Nail. As the foam rotates, the Hot Wire Foam Cutter will cut a perfect circle.



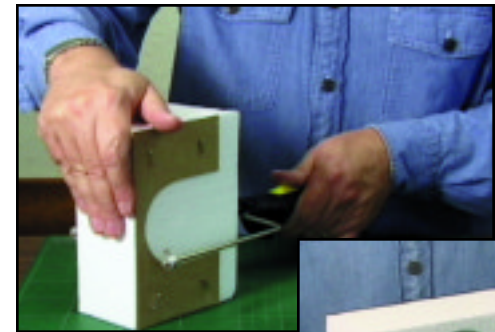
Rotate the Foam Sheet to form a perfect circle.

L. Elevated Buildings

Often it is important to install certain buildings, such as a depot, precisely at track height. If you have a level area prepared for this building you can use Foam Sheets under the building to bring it up to track level. 1/4" Foam Sheet is the ideal thickness for this. Cut the outline of your building in Foam Sheets of the appropriate thickness. Glue this foam directly to your hardshell. Cover this with Flex Paste. This should create a 'foundation' for your building that is elevated above your level area.

M. Cut Your Own Bridges From Foam Sheets

You can make bridges and other structures from Foam Sheets. Cut templates from piece of cardboard. Tape these templates to the sides of a piece of 3" Foam Sheet. Use your Hot Wire Foam Cutter to cut along the outlines formed by the template.



Bridges and other structures can be made from Foam Sheets.



You can also assemble a bridge from Foam Sheet pieces. Cut two sides of a bridge as described above, only use 1/2" Foam Sheets. Glue these together to form a bridge.



With either of the bridges above you can create bridge railings from 1/4" Foam



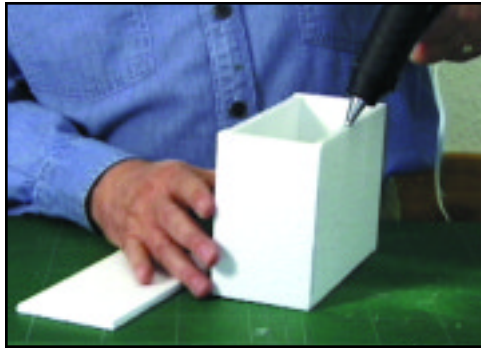
Sheets or cut thin strips with the Hot Wire Foam Cutter. You can also use styrene strips available from your hobby retailer. Paint your bridge deck with Asphalt or Concrete Top Coat. Use Concrete Top Coat to paint the sides of the bridge.

N. Mock-Up Stand-In Buildings

Often it is difficult to judge whether or not you have enough space to place a building on your layout. Nothing is more frustrating than putting together a building kit, only to discover it is too large for your layout.

Most building kits have the building's dimensions printed on the package. Simply write down these dimensions for all of the buildings on your layout before purchasing or assembling them. Use 1/4" or 1/2" Foam Sheets to cut out and assemble replicas of the buildings you wish to purchase. Arrange these on your layout. Adjust the position of any buildings that do not fit. If the buildings are not the right size, go back to your hobby store and find buildings that will fit. Now you can purchase and assemble buildings with the confidence they will fit perfectly.

If you cannot find a building that's just right for your layout, you might consider Design Preservation Model's Modular Building System. With this system you can custom design and create exactly the buildings you want for your layout.



Create "mock ups" to test fit your buildings.



Plan entire cities with "mock up" buildings.

Add More Terrain Features

SubTerrain is a complete layout construction system. It was designed to integrate with Woodland Scenics' complete line of terrain and landscaping accessories. Woodland Scenics Terrain and Landscaping Systems are the perfect way to bring your layout to life. Using these products together, anyone can create a realistic model railroad. For a complete description of the entire Woodland Scenics Terrain and Landscaping Systems refer to The Scenery Manual and The Clinic video, both available from your retailer.

Here are just a few of the simple ideas you can use to add realistic scenery to your layout.

● **Install Tunnel Portals and Retaining Walls**

Tunnel Portals provide a realistic facing for tunnel entrances. Retaining Walls are used to stop rock and dirt from falling on the track.

Woodland Scenics Tunnel Portals and Retaining Walls are made of high-density plaster which can easily be stained or further detailed. Place Tunnel Portals at tunnel openings. Use Retaining Walls to hold back rock along steep terrain.

Stain pieces with Woodland Scenics *Earth Color Liquid Pigment* as desired and test fit in place. Plaster castings can be shaped to fit with sandpaper, a sharp knife or rasp. Attach Tunnel Portals and Retaining Walls with *Lightweight Hydrocal* or Foam Tack Glue. When using *Lightweight Hydrocal*, mist the plaster with water before applying for better adhesion. Gaps can be filled with *Lightweight Hydrocal*.●

Create Rock Outcroppings

Rock outcroppings are naturally occurring terrain features that range in size from small field rocks to large cliff faces. Rock outcroppings form differently in different areas of the country, so be sure to consider the



Stain then test fit your Plaster castings.

area your layout represents before adding rock outcroppings.

Test fit the rock outcroppings in place. Stain them with Earth Color Liquid Pigment washes. Adhere them in place with Lightweight Hydrocal. If you prefer, you can stain or paint them after they have been



Test fit rock outcroppings before adhering them in place with Lightweight Hydrocal.

affixed. Use Woodland Scenics *Talus* (rock debris) under the rock outcroppings for additional realism.

When fitting Tunnel Portals, Retaining Walls and rock outcroppings in place, it may be necessary to cut into the Plaster Cloth hardshell. If there is not a tight fit, these are easily filled with small strips of Plaster Cloth or Lightweight Hydrocal.

Lightweight Hydrocal is specially formulated for terrain modeling. It can be used as an extra durable coating on top of Plaster Cloth, to fill open spaces around plaster castings, cast rocks and other

terrain features, and as an adhesive for joining plaster castings together. When dry, Lightweight Hydrocal can be formed with a hobby knife or sanded to an extremely smooth durable finish.



Create rock outcroppings with Woodland Scenics Rock Molds and Lightweight Hydrocal. You can purchase Rock Molds, or create your own using Woodland Scenics Latex Rubber. Either way, the finished rock outcroppings can be shaped and carved with sandpaper or a hobby knife.



● **Stain the Hardshell with Earth Pigment Washes**

Stain the Hardshell with Woodland Scenics Earth or Green Undercoat Liquid Pigment washes. Pigments are specifically designed for model use and include earth tones that are often difficult to find elsewhere. Use the pigments to color hardshell. Don't overdo this. A light transparent covering of pigment, with some white still showing through is sufficient. This will be covered later with Turf.

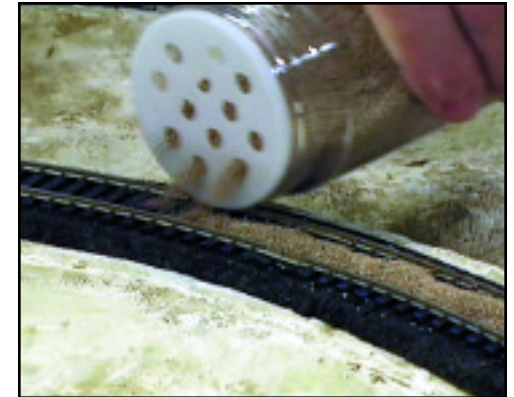
● **Ballast the Track**

All railroads use rock between the ties for stability. This rock is called Ballast. Woodland Scenics Ballast is made in several different sizes and colors. When selecting a size, be sure to consider the scale of your layout.

Pour a small quantity of Ballast down the center of the track using a Scenic Sifter. Use a dry, clean paintbrush to sweep the Ballast off the tops of ties and rails. Spray the Ballast with Scenic Cement to affix to Track-Bed. After Ballast has dried, remember to clean off the track with an eraser-type track cleaner to remove any traces of Ballast or Scenic Cement. If the track is not carefully cleaned, power may not get to the engines or derailments could occur when the wheels come in contact with material on the rails.

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Refer to the Scenery Manual for a full explanation of Woodland Scenics complete line of landscaping products.

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● **Plant Vegetation and Trees**

Use the complete line of Woodland Scenics products to add realistic vegetation to your layout. Start with a ground cover using Green or Earth Blended Turf. Hold Blended Turf in place with a misting of Scenic Cement. Add variegated coloring with Fine Turf. Spray with Scenic



Woodland Scenics Scenic Detail "Gazebo" D236.



Design Preservation Models has a variety of building kits to choose from to complete your scene.

Cement. Add more texture and realism with Coarse and Extra Coarse Turf, representing larger plants and shrubs; affix them with Scenic Cement or Hob-e-Tac. Finally, add Field Grass and Trees to complete the landscape.

● **Add Buildings, Vehicles and People**

Woodland Scenics complete Scene Kits, Trackside Scenes and Scenic Details are designed for the modeler who wants fine quality craftsmanship, intricate detail and authenticity. A full line of scenes is available from your retailer.

Some of the best quality building kits available at a reasonable price are those made by Design Preservation Models (DPM). They have an extensive line of highly detailed injection molded styrene building kits. You can also design and build your own buildings with DPM's modular building kits.

Woodland Scenics Terrain and Landscaping Systems are the best way to add realism and authenticity to any model railroad. The Woodland Scenics product line is so easy to use that anyone can turn a train set into a realistic model railroad.