Foamboard Layout Construction

A Model Railroad Technique Clinic
Conducted by John Burchnall, of The Eastern Loggers, Cincinnati, Ohio

See techniques engineered by The Eastern Loggers using horizontal laminations of foamboards in place of conventional roadbed and scenery bases. Slides and hands-on demonstrations reveal how and why to use the method, and how it applies to any size layout. Includes a discussion of the materials and tools, pitfalls to avoid, and tips and techniques through all phases of layout construction. An orientation to the Eastern Loggers 1920's era HO scale sectional layout is also shared.

OVERVIEW

- Introduction
- Materials & Tools
- Examples & References
- How-To Steps (Strategy, Steps, Tips, Pitfalls)
- Advantages & Disadvantages
- Introduction to the Eastern Loggers

INTRODUCTION

Use of foamboard in layout construction has become more popular in the last decade. Until then it has generally been a largely unpublicized, "closet" or "underground" technique. Multiple origins are probable, including Eastern Loggers (1979). Several adaptations seen for foamboard use in layouts - from use for just scenic forms, to use for the complete structure and form of the entire layout, including legs. This clinic involves using foamboard laminations for the **combined foundation and shape of the base for BOTH the scenery and track,** in place of conventional roadbed and scenery base construction methods. Roadbed is still used under the track, rather than laying track directly on foamboard.

Dispelling Myth #1 - Not just a modular, sectional, or portable layout construction technique!
Dispelling Myth #2 - Not just for flat layouts or flat layout areas (e.g. yards, cities, etc.) - actually, the advantages of the method really shine in the construction of both subtle and dramatic three dimensional layouts! Works well for tunnels, too.
Dispelling Myth #3 - Both white "beaded" foamboard or blue/pink "extruded" board work well (see tips later to avoid the mess with white beadboard).

EXAMPLE LAYOUTS

Cincinnati, Ohio: 10'x20' HO scale sectional Eastern Loggers layout; 2 portable 4'x6' door prize layouts (with tunnels); large home layout of Merle Bevis; Dave Keith's home layout, several others. See also several articles in the NMRA Bulletin (Scale Rails), Model Railroader, Railroad Model Craftsman and other model railroading magazines (see references).

SOME HOBBY MAGAZINE REFERENCES

"Clinchfield" layout construction series (1970's MR). Used foamboard only for scenery.

"ABCs of Benchwork", January 1987 MR. Shows example uses of foamboard in simple/small layouts, and for shelf layouts. Recommends larger layouts have a light supporting frame of 1 1"x2"s. Goes on to discuss the more traditional methods of subroadbed and roadbed construction. Interesting quote: "Incidentally, we've heard from readers who've built layouts 100 percent from foam, using it for the roadbed and all, and have been quite happy with the results."

"ABCs of Scenery", June 1987 MR. states "The material you use to establish scenic form doesn't matter much - when you're through it'll be hidden anyway." Mentions foamboard as an alternative scenic form technique particularly useful for small modules. Gives detailed description of traditional scenery base construction methods (plaster on screen wire, or hardshell on cardboard latticework).

"Editor's Notebook -Module Building", November 1988 RMC, on building "live" a 30"x48" On3 module at the 8th National Narrow Gauge Convention in Wilkes Barre, PA. "By the amount of ... blue insulation board stacked under one corner of Jim's new layout, I knew my co-conspirators were also fans of the material." "We came up with some ideas for using even less wood and more foam. The next time I would use an even lighter spline roadbed. I'm impressed with how the white craft foam can be worked and its rigidity. The final module weighed in at around twenty pounds at most, we think..."

"The D&H's Upper Second Subdivision", Tony Steele, series in RMC. Mufti-level shelf-style layout. Feb 1989 article states "The remaining underside surfaces are painted with a Fire Fighter fire retardant paint. This is an 'intumescent' compound: exposure to heat causes it to foam, thereby creating an additional barrier to flames. Since it is white, it also acts as a reflector

"Foam Base for Nice and Easy Paste Scenery", August 1989 NMRA Bulletin, Spike McGinty & Ron Hatch. Illustrations of some cutting, laminating, and shaping steps. Primarily module oriented, showing a somewhat different method using thin foamboard sheets, yellow glue, and toothpicks. A footnote mentions "... a good vacuum cleaner comes in handy."

"Tom Culora's Saratoga & Adirondack", June 1992 RMC (Don Mitchell). "Son of the S&A" switching layout used 8" thick foamboard covered by 1/2" thick sheet of Homasote, with thin wood fascia on sides. Cut thru Homasate and carved foamboard for creek. There are many advantages to using foam, such as being able to easily shape using only a rasp."

"Model Railroad Roadbed - NMRA Data Sheet", Sept 1993, Bulletin, Dennis Vaccaro. Mentions vertically laminated foamboard as "subroadbed", and horizontally layered extruded foamboard as "roadbed". Recommends adding a layer of

conventional roadbed material. "This method is becoming popular due to its weight and time saving properties. The popularity of modular railroading has also added to its growing use."

"Build a Featherweight Layout", Nov 1993 Railmodel Journal, Spike McGinty and Polyterrain. Total foamboard demonstration layout. See also Ron Hatch catalog and "Small Spaces" brochure.

"Hot-Wire Foam Layout Construction", June 1994 MR, Bill Darnaby. Mentions this clinic given at 1992 Columbus National NMRA Convention. Advocates expanded foamboard. Mentions looking into Upsom board for roadbed to deaden sound and hold spikes.

"Ron Hatch's Midwestern Narrow Gauge", Sept 1994 RMC.Total foamboard demonstration layout, including grid frame and risers, using Polyterrain Paste. "... probably best to glue Upsom board or Homasote roadbed over it to avoid poor track laying." "While foam is great for scenery I wouldn't recommend it as a framing material for all layouts." "suggest that some sort of veneer, such as paneling or countertop laminate, be used on the exposed sides."

"Better N Scale Tracklaying Techniques", 1994? MR, Scott Seekins (Gerald Gustafson). Uses 2" expanded foamboards for benchwork and subroadbead construction. Cork roadbed.

"The Pioneer Valley RR", Sept. 1994 MR, Michael Tylick. Lauan plywood "plate girder" table, with foamboard layers on top. "foam insulation board is the only practical material for forming land contours on portable layouts." "A serrated steak knife is my favorite tool for cutting foam." Uses Elmer's Saf-T Contact Cement. Uses 1/4" foamCORE for roadbed.

"Hot Wire Foam Cutter - Product Review", Oct. 1994 MR, Pete Wicklund. "Cut without the mess". " ... the tools work best with the white-beaded foam"

"Building a Small LGB Train Display", Nov. 1994 Gazzette, Ralph Ryan. Used 4" thick white foamboard base layer as trackboard, with stacked scraps for mountains. Covered with wallboard joint compound and spackling paste.

"The Soo's Red Wing Division", Dec. 1994 MR, Pete Wicklund (Keith Thompson). 4x8 sheet of 2" foamboard as layout "board", w/ Instant Roadbed. Laminated 1 " slabs for mountains, with SurForm or hot wire edge smoothing, then added Rigidwrap (plaster impregnated gauze) on top.

"My Colorado Midland", Feb. 1995 MR, Sam Posey (Dave Frary). Non-mountainous scenery built 2" sheets of Dow Styrofoarn insulation, and Mountains in Minutes foam.

"The Latest on Foam-Board Layout Construction", March 1995 MR, Bill Darnaby. Advocates only extruded, and not expanded (beaded), foamboard. Uses SurForm tool to transition between track levels carved with hot wire. Mentions some sound problems.

"Workshop - Hard to Find Materials", April 1995 MR, gives extruded foamboard sources.

ADVANTAGES OF THE METHOD

- **Simultaneous construction of both the roadbed and scenery contours and bases**.
- **Replaces conventional construction steps** of risers, subroadbeds, roadbeds, scenery shells, supports, tunnel liners, etc.
- **Fast to construct, and easy to modify**.
- **Easy to visualize and create realistic 3-D scenery and roadbed contours**. Works exceptionally well in establishing grades and in constructing smooth vertical and horizontal curves and transitions. Built-in vertical reference planes greatly aid obtaining vertical alignments. Promotes the use of below-the-track scenic features.
- **Results in a very rigid, durable**, and often lightweight layout or module.
- **Like constructing in the real world** (e.g. cuts, fills, tunneling, grades, etc.), with the added benefit of building and shaping each "earth" layer (foamboard) to desired form, prior to adding layers above.
- **Results in solid roadbed and scenery bases** (not hollow), just like nature. This has advantages in anchoring trees, rock castings, and structures, and in constructing tunnel interiors, among other things.

DISADVANTAGES OF THE METHOD

- **Possibly more costly raw materials** - foamboards (about $5 to $6 per 2"x2'x8' sheet, if purchase retail) and glue (about $2 per caulking gun sized tube).
- **Messy shavings!** - static electric cling; possible lung health hazard if inhaled. **Tip**: Spray the area with “wet” water before, and periodically while, carving - the water stops the static electricity charge, and also makes the beads heavier so they don’t float around. Then use a shop vacuum to clean up as well as remove residual shavings from skin and clothes. Also use simple dust filter mask while carving, and rinse hands in water to remove any remaining clinging shavings.
- **Possible initial delay in getting started** - due to having to wait for glue to set between slabs prior to starting to carve.
- **Wiring and "under the table" switch control linkages** - must be installed to pass through an often deep thickness of built-up foamboard. **Tip**: Construct and use a simple wire puller to "drag" the wire down through the foamboard, and use a tube-within-a-tube throwbar linkage, instead of the more traditional wire-in-tube linkage.

MATERIALS

Types of Foamboard (Source: Building Supply & Craft Stores) - "Beaded" (Styrene, usually white, less effort to carve, "beaded" shavings) & Extruded or "Craft" (Styrene or Urethane, blue or pink, stronger, harder to carve, chip/flake shavings).

Foamboard Thicknesses - Ranges from 3/4" to about 3.5"; 3/4" and 2" most common; Recommend use 2" thick board (actually about 1-3/4"), since it gives an optimal combination of glue savings, waste minimization, availability, and spacing of vertical "contour depth guidelines" (the glue layers).

Foamboard Glue - use only a non-flammable, thick-bodied, non-brittle, construction adhesive (especially on "beaded" foam), such as acrylic or latex based glues, e.g. non-flammable "panel & foam", "construction", or "drywall" adhesives in chalking gun tubes by Franklin and Weldwood (both in blue tubes), and Elmer's (Bordens) or Liquid Nails. Can also use similar brands of non-flammable "Flooring", "Ceiling Tile" or "Cove Base" adhesives sold in cans. Acrylic latex contact cements have too thin a consistency for this application. Normal inexpensive solvent-based construction adhesives will usually "eat" (dissolve) the foamboard, often even when very small beads are used. Normal "Craft White" and "Carpenter's Yellow" glues are useable for small, non-critical areas, but are too brittle and usually require too much air and drying time to be useful in large foamboard laminations.

Upsom Board - for track roadbed; use either 3/16" or 1/4"; sides can be easily beveled (with knife blade in tilting jig saw) to the contour of ballast; takes handlaid track spikes very well; the thinness is not only more prototypical, but also provides flexibility for smooth vertical curves.

Fire Retardant Paint - optional, for treatment of exposed underside of foamboard. One brand is "Fire Fighter".

Profile Boards (Masonite, paneling, etc.) - for exposed sides of layout; finished appearance, protects foamboard from wear.

Simple Wood "Benchwork" or Support Grid - 1"x2" or 1"x4" open grid or modified open grid benchwork to support the solid laminates of foamboard. The first layer of foamboard should be glued directly to the grid top.

Structolyte/Gypsolyte "Underlayment Plaster"- to provide a sturdy crust and better textured surface over the carved foam board for good scenery base, and to protect the foamboard from damage. Some people elect to skip this step. We recommend using the plaster coating.

Normal "Water-Soluble" Scenery Materials - rock castings, acrylic paint washes, trees, different colors and textures of ground foams, dirt and gravel, etc.

TOOLS

Cutters, Carvers and Shavers - Highly recommended: Stanley "SurForm" Shaver Tool No. 21 -115 (having a slightly curved, about 1.5"x3", blade); common hand saws (key hole, etc.) and toothed knives; Optional: rotary rasps or grind stones for electric drill.
Shop Vacuum Cleaner - after, and sometimes during, shaving operation
Dust Filter Masks and Safety Goggles - common inexpensive types.
Heavy Objects - as weights for holding foamboard laminations tightly together while the glue sets.

"HOW TO" STEPS (INCLUDING TIPS & PITFALLS)

BASIC STRATEGY - Fill the entire area between the wood supporting grid and layout top with solid horizontal laminations of foamboard. Carve in all scenery and roadbed profiles, using the layer surfaces as elevation reference lines. Then hide and protect the foamboard from damage by completely covering (encapsulating) it with roadbed, scenery materials and profile boards. See attached figure.

1) Construct Simple Wood Supporting Grid - 1"x2" or VW" open grid (or modified open grid) benchwork to support the first layer of foamboard. Also provides anchorage for profile boards and walkaround controls, and protected open space under layout for wiring, switch machines and linkages, etc. **Tip**: Add a "runner" board underneath front and back grid boards (in effect forming "inverted-L" girders) to provide an "assembly jig", stronger grid connections, additional control protection, and in the case of portable sections, to provide a carrying lip and runner to "slide" sections into/out of vehicles.

2) Cut Cookie-Cutter Style Roadbed - Lay out the desired track plan (mark centerlines first, and then outside ballast base edges - about 1.75" to 2" wide in HO) on large sheets of upsom board and cut out the resulting "cookie-cutter" style roadbed pieces. **Tip**: Use a knife blade "bit" in an electric saber or jig saw to easily and cleanly cut the upsom board (no saw dust). Tip: Form beveled mainline ballast during same cutting operation by using an adjustable angle jig saw.

3) Add Foamboards Laminations - Up to the desired "base" elevation (recommend a minimum of two 2" layers, both to form a sturdy structural base and to provide room for below-the-track scenery). The rest of the foamboard layers needed to reach the scenery peaks may be added either now, or later after the lower levels of roadbed or track are in place. Use the adhesives as listed in the materials section. **Watchout:** Some adhesives will dissolve some types of foamboards! See Materials Section.

4) Trace Roadbed Onto Foamboard - Trace outline using a bold permanent marking pen. Also write desired base-of-roadbed elevation markings at appropriate points along the outside of the roadbed outlines. **Tip**: Use the top of the slab as the "zero" elevation reference in your markings. That way it will be easy to measure your progress in the subsequent "subroadbed carving step".

5) Rough Cut the Scenery Contours - This optional step allows you to quickly visualize the final scenic contours, and makes the next steps more efficient.

6) Carve Down to Roadbed Elevations - Use the SurForm tool to shave down between the roadbed outlines until reaching the marked base-of-roadbed elevations. Its easier than you'd think to get a smooth roadbed base this way, since you'll soon notice as you scrap the shaver tool back and forth you can actually "feel" any bumps and other uneven spots in the "trenches" you're carving. **Tip**: Spray “wet” water before and periodically during carving to minimize the mess - also use inexpensive dust filter masks while carving (see Tools and Disadvantages Sections) and a shop vacuum to clean up afterwards. **Tip**: Measure your vertical progress frequently while carving. **Tip**: Use a rotary rasp or grinder for rough cutting deep cuts (as well as for roughing in deep scenery cuts later). **Tip**: If desired, you can also easily shave the foamboard at a slight angle to incorporate superelevation into the "subroadbed" you are creating.

7) Glue Down Roadbed - Use foamboard adhesive. **Tip**: Drill angled holes into the centerlines of the upsom board roadbed and temporarily insert large nails to pin the roadbed down while the glue sets. Weights are awkward for such a narrow width.

8) Add Remaining Foamboard Layers and Carve All Scenery Contours - Use the materials, adhesives, carving tools, and precautionary items as discussed in the Materials and Tools sections. If you shave off too much foamboard in a particular area, simply level off a section, apply new foamboards, and re-carve that area. Also, your landforms don't need to be totally finalized at this point, since with this method it is relatively simple to add additional landform areas even after all the finished scenery materials are applied.

Long tunnels will need some care in planning and construction. It's best to laminate the first series of foamboards only up to the lowest point of the tunnel roof, then carve the roadbed "trench" through these layers first (in effect forming the tunnel base and the bulk of the tunnel walls). After installing the tunnel roadbed, tracks, optional plaster wall lining, and tunnel interior paint (usually flat black), you can then add the remaining layers of foamboard above the tunnel. The first layer will probably complete the walls and roof portions of the tunnel, and will need an inverted "trench" carved into it to achieve the desired tunnel clearances. **Watchout**: Be sure to carve the tunnel walls wide enough apart for rolling stock clearance, and leave room for any plaster lining you may elect to apply.

9) Cut and Apply Profile Boards - The first step is to flush mount scrap blocks of 1"x2" wood boards into the sides of the foamboard laminates to act as anchor points for the profile boards. Space blocks about 6" to 9" apart, and be sure to install blocks as close to the top of the profile boards as possible. Use a small rotary rasp or the SurForm tool to cut snug recesses. Similarly, fit flush mounted vertical 1"x2" wood boards in any corner where two profile board sides will meet. Fasten all the blocks with foamboard glue, and allow them to completely cure.

Next, mark and cut the profile boards, and attach them to the wood support grid, and to the wood blocks, with countersunk flat head wood screws, along with liberal amounts of foamboard adhesive. **Tip**: Use a framing square to ensure all the wood blocks and profile boards are mounted "true" and square, especially vertically. This is particularly important when constructing layout modules or sections. Note, the edges of the foamboards themselves don't need to be as "true", just the anchorage points for the profile boards.

10) Lay Trackage - Handlaid, sectional or flex track all install well on the upsom board roadbeds. Use conventional methods.

11) Start Scenery Construction (optional at this point) - Described later.

12) Fabricate and Install Turnout Linkages and Mechanisms - If you elect to use "under-the-table" linkages you will need to use a mechanism that can adequately function properly through a significant depth of foamboard laminations. It is recommended you use telescoping brass tubes to provide the proper torsional rigidity through this type of depth (see figure). Glue the upper end of the outer tube to a hole in the upsom board roadbed. Glue the lower end of the outer tube to a hole through a scrap piece of masonite that is itself glued to the underside of the foamboard.

The inner tube is then free to turn inside the outer tube to transmit a rotary action to the turnout. Cut a slot into the slightly protruding upper end of the inner tube and fit a spring steel wire connection to the throw bar. Fabricate a "torque arm" out of slightly larger sized square brass tubing to fit the lower, generously protruding, end of the inner tube. Drill a snug hole clear through the square tubing on one end, and fasten it to the inner tube by soldering. Also, drill several small holes along the length of the square tube to serve as adjustable mounting points for your connecting actuating device (i.e. wire, rod, or choke cable to switch machine or manual throw knob on the front profile board). **Tip**: Adjust the centering of the linkage by re-heating and re-aligning the soldered connection of the square tube.

13) Complete the Electrical Installations - Solder track feeder wires to rails and drop through holes drilled into the upsom board roadbed to the underside of the layout. **Tip**: Fabricate and use a simple wire puller to drag the wires down through the layers of foamboard. Cut electrical gaps in rails. Install walk-around controls and electrical hardware in the front profile board and underneath the layout. Route all connecting wires through pre-drilled regular spaced holes in the supporting wood grid. **Tip**: Use "can shaped" hole saw "bits" in an electric drill to cut large (1.5" to 3") holes through both the front profile board and the front wood grid board to make convenient areas for recessed controls.

14) Complete Scenery - Use popular water soluble techniques. Apply rock castings first, either by "slapping" in place while still wet, or by gluing pre-cast castings directly to the carved foamboard landforms. Then apply a crust of inexpensive plaster over the remaining exposed foam surfaces. This step is optional, but often desired for texture, tree anchorage, rock blending or foamboard durability reasons. **Tip**: Underlayment plasters, such as Structolyte or Gypsolyte, are very economical for this, as well as providing a nice "gritty" surface.

Trees can be mounted firmly and quickly by using a round file or rod to stab holes through the crust and the top layer of foam. Then simply add a liberal amount of yellow carpenter's glue and insert the trunk of the tree. Touch up the base of the tree with a suitable blend of colored ground foam.

Watchout: When modeling water, make sure the water bed areas are completely sealed (with plaster, paint, etc.) prior to applying any type of casting resin or other volatile solutions to form “water”. These chemicals often dissolve foamboards.

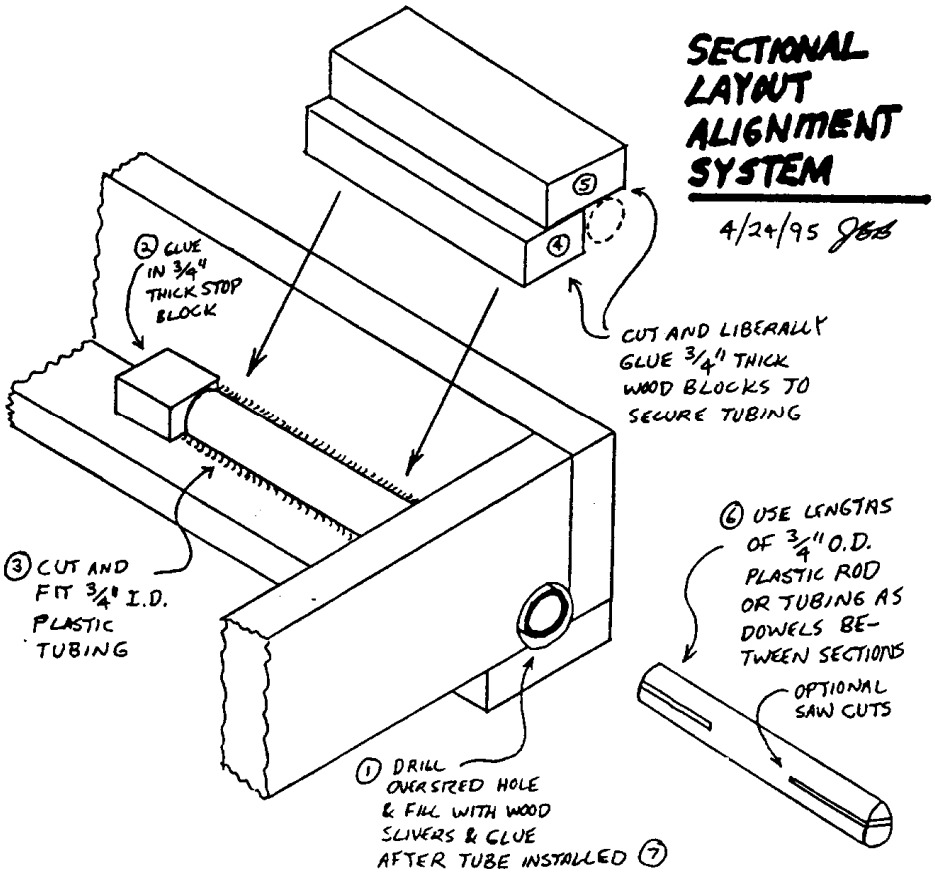
THE EASTERN LOGGERS

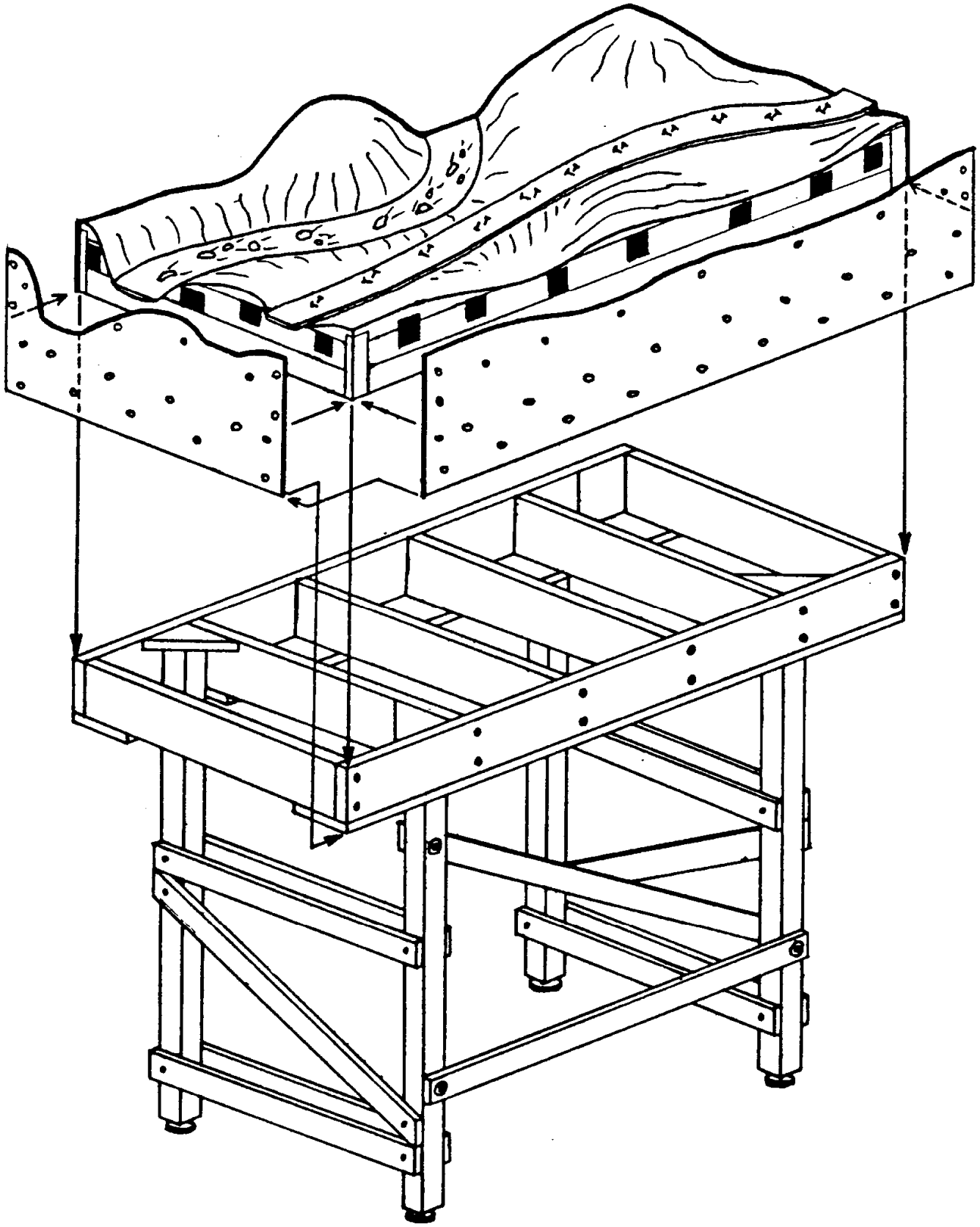
The Eastern Loggers - The Eastern Loggers are an informal group of about eight modelers with the primary purpose of promoting the hobby of scale model railroading through modeling and sharing the history of Pennsylvania logging railroads and related industry. Their major focus is the research, development, and exhibition of their "museum quality" portable layout. Other family members participate in social activities, as well as pitching in on layout set up, staffing, and take down activities. The Loggers first got together in January 1981, at the initiative of Jerry Strangarity. Two of the four original members are still actively involved. The Loggers periodically meet on Thursday evening. Operating sessions have been the focus in recent years.

The Eastern Loggers Layout - An HO scale 1920's era Pennsylvania logging layout, built by an informal group known as "The Eastern Loggers". Inspired by the series of books authored by Kline, Casler, and Taber. This is a "fine scale" sectional model railroad layout emphasizing realistic scenery, structures, rolling stock, and theme consistency. It is totally built using a pioneering foam board construction method. The basic scenery is 100% complete. The structures and final scenery are about 98% complete. In addition to the standard gauge track, the layout has some narrow and dual gauge track. The best features of the layout include scenery, trees, structures, rolling stock and cohesive theme and execution. The layout is currently rectangular, measuring 10 x 20 feet, with a double-ended horseshoe shaped staging yard hidden in the interior.

Layout Exhibition History - The portable HO scale layout has been exhibited in numerous model railroad shows and conventions in the Cincinnati, Ohio area over the years, including three showings in Columbus, Ohio, with one as part of the 1992 National Model Railroad Association Convention, and another during a National Narrow Gauge Convention. During the July 4th weekend in 1989, the layout was on display at the Annual Bark Peeler's Convention at the Pennsylvania Lumbering Museum in north-central Pennsylvania. This exhibition marked a very special highlight for the Eastern Logger's, as it was in essence a "Back-to-the- Roots" type experience. Another highlight was displaying at the “Cass Bash” logging modelers event at Cass Scenic Railway in August of 2003.

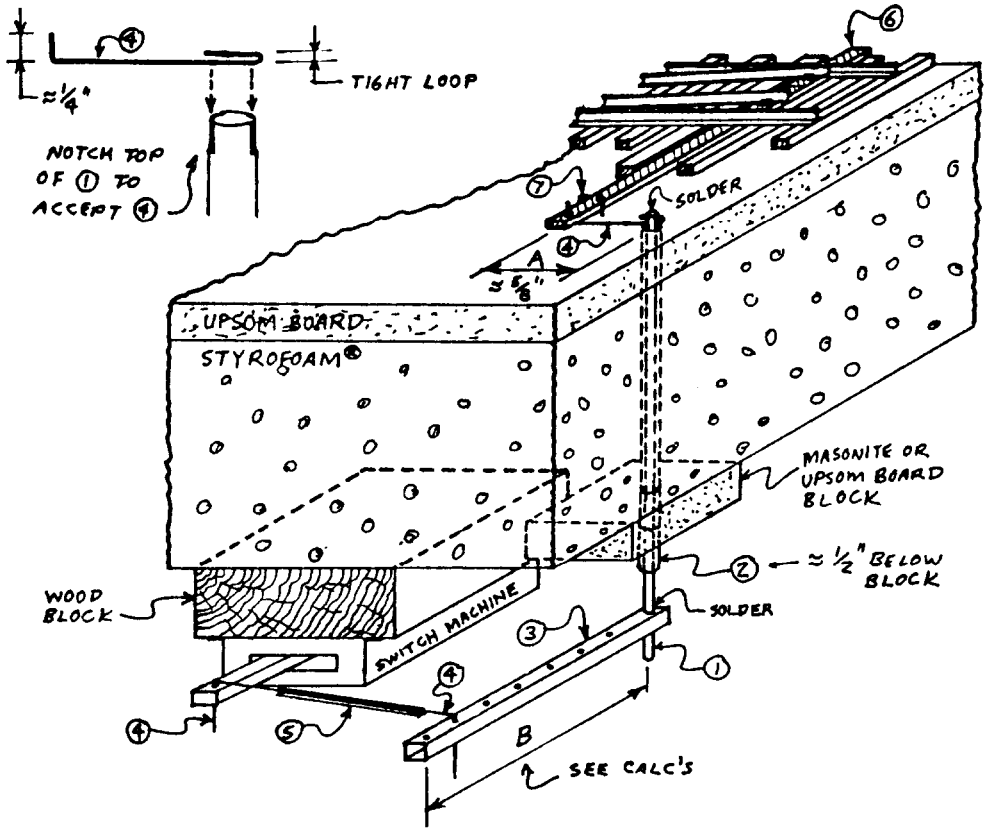
The layout has was awarded **Best of Show** at the 1992 NMRA National Convention in Columbus, Ohio. **Railroad Model Craftsman** magazine featured the layout in the September 1992 issue. A color photo of a scene on the layout was the cover of the July 1994 issue of NMRA **Bulletin** magazine. The layout also had feature articles in the 1997 issue of **Great Model Railroads** magazine (with photos taken by Lou Sassi), and in the September 2004 issue of NMRA **Scale Rails** (Bulletin).





SWITCH MACHINE / THROWBAR LINKAGE

(SPECIALIZED FOR EXTRA-THICK SUBROADBEDS)



BILL OF MATERIALS	
PART NO.	DESCRIPTION
1	1/8" DIA. ROUND BRASS TUBING
2	5/32" " " " "
3	3/16" SQUARE BRASS TUBING
4	1/32" (.032") MUSIC WIRE
5	SCRAP RAIL (N/S OR BRASS)
6	CIRCUIT BOARD TIE
7	LARGE SPIKES (KEEPERS)
TUBING & WIRE = K&S ENGINEERING	

B_{MAX} LENGTH CALCULATION

$$B_{MAX} = \frac{A_{MAX} \cdot T_{MAX}}{P_{MIN}}$$

WHERE:

P_{MIN} = MIN. POINT THROW DISTANCE (INCL'D X-TRA FOR SPRING ACTION) ≈ 3/16"

T_{MAX} = MAX. THROW OF SWITCH MACHINE

A_{MAX} = SPRING TOP WIRE LENGTH = 5/8" RECOMMENDED

EXAMPLES:

$$B_{MAX\ (MANN\text{-}MADE)} = \frac{(5/8)(1)}{(3/16)} = 3\tfrac{1}{3}" \approx 3\tfrac{1}{2}"$$

$$B_{MAX\ (NJ, KTM, PFM)} = \frac{(5/8)(1/2)}{(3/16)} = 1\tfrac{2}{3}" \approx 2"$$