BUILDING OUTDOOR STRUCTURES
FOR GARDEN RAILROADS

BY: DON WATSON
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Core Materials:

- **Wood:**
  - Not the best material for outdoor structures.
  - Requires good quality, exterior grade sealants applied inside and out.
  - Recommend Marine grade plywood, cedar, redwood, or treated lumber.
Core Materials:

- **Foam:**
  - Excellent weatherproof material.
  - Must be sealed.
  - Not insect proof.
  - Choice of glues important.
  - Some inside bracing required with thin foams.
Core Materials:

- **Plexiglas/Acrylic:**
  - Waterproof and easy to work with.
  - Prone to warping.
  - Needs interior bracing.
  - Expensive and needs to be covered to prevent sun damage.
  - Special Adhesives required.
Core Materials:

- **Plastic Sign Material:**
  - Most commonly known as Coroplast.
  - We used it for our PGRS signs.
  - Inexpensive and weatherproof.
  - Requires interior bracing.
  - Easy to work with (razor blades or scissors).
  - Has a slight ripple to it but can look like wood siding.
Core Materials:

**Sintra® PVC Foam board:**
- Is a very durable PVC sheet.
- Is generally used for photo mounting, display construction and a variety of other uses.
- Excellent for outdoor use.
- Sintra® PVC is also available with a self-adhesive peel and stick film for mounting. Comes in assorted colors, sizes and thicknesses.
Core Materials:

- **Concrete:**
  - Lasts a lifetime if correct concretes are used.
  - Difficult to work with, requires a learning curve. Molds can be used to fabricate parts.
    - Great source on “How To” for making concrete molds:
    - Source for “Jigstones” molds:
  - Concrete can be used with foam for somewhat easier applications.
Core Materials:

Resin:

- Waterproof but not sun proof.
- Requires casting knowledge and exterior coverings.
- Also needs interior bracing, subject to warping.
Core Materials:

- **Pre-Made Plastic Components:**
  - **Complete Commercial Kits:**
    - There are a few companies who sell plastic kits for structures that include all parts necessary to build a complete structure.
    - Most notable are PIKO and POLA.
    - If assembled correctly, these structures, left outdoors year-round, will last many years.
    - They are weatherproof but colors will fade over time.
    - Aristocraft also made complete buildings.
Core Materials:

Pre-Made Plastic Components:

- **Component Commercial Kits:**
  - Colorado Model Structures sell an assortment of plastic components that may be used to build custom structures.
  - They also provide instructions on how to build certain structures from their parts.
  - They also sell sets of their components to build a custom structure.
  - Many PGRS members have used these components.
Core Materials:

**Gatorfoam:**
- Commercial name for a foam core material.
- It is foam laminated between plasticized wood fiber layers.
- Weatherproof, ridged, and machines just like wood.
- Can be painted or laminated with various plastic sheathing materials.
- Generally requires a foam-compatible glue.
Core Materials:

- **Steel:**
  - There are several companies/individuals that fabricate steel structure including buildings and bridges.
  - There are also several people who have made custom steel structures.
  - Building in steel requires considerable skill.
  - Once completed steel structures must be powder coated or painted.
  - Can last a lifetime if taken care off.
Wood Structures:

Wood structures vary from elaborate custom structures to simple birdhouses.
The next pages show a few examples of my wooden structures:

Scratch built from cedar
Cedar Kit
Wood Structures: (Continued)

Cedar Wood Kit

Scratch built from wood and styrene textured sheets
Foam Structures:

- Foam structures must be covered with paint, plastic siding or concrete.
- Structures from foam can be scribed to look like stone, brick, or other effects like boards.
- Scribing can be done using a soldering gun, wood burner, foam cutter or any sharp-edged tool. Once foam is scribed it can then be painted with exterior latex or acrylic paints.
Foam Structures:

- More examples of carved foam:
Foam Structures:

Another popular technique is to apply a thin coat of cement to the foam and carve it to resemble practically any kind of siding.

The next 4 slides show the steps used to create a culvert using the **concrete-on-foam** technique.
Foam Structures:

First step: Cut foam and surround with dam.
Next step: Mark edges for guides to scribe stones in concrete.
Next step: Insert drainage pipe guides.
Foam Structures:

Apply cement and level using edge dams as guides. I used a long piece of wood as a scree.

Next use marks on edges and a straight edge to scribe concrete before it sets up. About 30 minutes working time.
Foam Structures:

After initial application has hardened, use the same technique to create stone pattern on edges. If you use a very thick mix you can apply freehand.

You can also apply additional layers to create more details.
Foam Structures:
Culvert assembly:
Notice use of angle aluminum to add additional strength.

Culvert in place since 2009:
Foam Structures:

Here’s one of the first things I built using the concrete-on-foam technique. It was outside for 8 years before I moved.
Foam Structures:

- There are some people who have taken the **concrete-on-foam** technique to an extreme level.
- For your information, I am providing you with a description of how to create really nice structures with this technique. This article was written by Jim Strong (father of Kevin Strong of Garden RR fame).
- The quality of his structures indicate the level of artistic skill required to achieve this kind of detail using concrete and is not recommended for the faint-of-heart.
- His structures are well over 20 years old and the only maintenance that has been required is some paint touch.
Foam Structures:

On the Woodland Railway, a train approaches the Author's new concrete station.

Sculpting Concrete Structures

A readily available patching cement is the key

by Jim Strong
Upper Marlboro, Maryland
Photos by Kevin Strong unless noted

Structures can be the backdrop or set for your garden railway's "stage." They can provide focal points or, when they represent the source or destination of people and goods, they can provide the railway's reason for being. In this article, I'll describe a building technique that is more like sculpting than constructing a building piece by piece.

In the woods behind our house we have a small Japanese lantern made of concrete. It looks a little like a papier mâché and is just the right scale for our railway. I have often wished that I could construct buildings out of concrete similar to that lantern. They would be the ultimate in durability and it would be difficult for vandals to carry off. However, I never could figure out a reasonable way to construct the necessary molds to cast the buildings.

A few years ago, Dave McNenny, a friend and fellow garden railroader in Rockville, Maryland, showed me some bridges he had made of concrete. When I asked him how he cast the bridges, he said they were actually made of styrofoam and were just coated with about 1/4" of concrete. They looked so realistic that I thought maybe this was a way I might use concrete to make my buildings. Several months later, my Woodland Railway decided to replace an old covered bridge that required a lot of maintenance. This was an opportunity to try Dave's technique. The new concrete bridge has been in place now for over two years; it has no cracks and has required no maintenance.

The Material

Before I go any further, let me tell you about the "concrete" that Dave used. It is actually a vinyl patching material for repairing concrete walls and driveways. It is sold under the trademark Quikrete at building-supply stores. When cured, Vinyl Concrete Patch is extremely tough and resists cracking even when it is only 1/4" thick. It contains a fine sand, although I sometimes wish it were even finer for detailing purposes.

One of this material's most useful properties is that it is easily modified or sculpted. After a few minutes of setting, it becomes stiff enough that it doesn't sag, even on vertical surfaces. At this point it can be formed into almost any shape with modeling tools. It's similar in texture and workability to wet sand used for making sand castles, but has strong adhesion characteristics. If you wet the tip of your modeling tool, the product sort of melts under it and becomes easier to shape. Wetting the tool also helps to produce a smooth surface. In a few minutes, the concrete becomes stiff again. Also, this setting process doesn't seem to affect the product's toughness when it cures.

However, you only have about an hour to sculpt before the material gets serious about setting and becomes difficult to mold. I've found that I have been able to sculpt the concrete patch to look like most common construction materials, including brick, stone, cinder block, wood siding, and roofing and siding shingles. When used to simulate concrete, it really looks like concrete. For example, if the surface gets wet, it darkens just like the real stuff. It can be stained in appropriate colors with thin paint, to simulate brick or stone. Staining instead of painting causes this material to look more natural when wet.

This past winter, I constructed a small village in a vacant spot on the railway. I wanted the buildings to have some

Cement can be used to replicate a variety of surfaces. In this key store it is made to resemble maconico, and on the base (sidewalk) it is undulating concrete.
character, with raggng roofs and sides that weren’t necessarily vertical. So it seemed as if a good time to try out the concrete technique.

**STYROFOAM CONSTRUCTION**

The first step is to build a styrofoam substructure upon which to lay the concrete. Basically, you construct a building out of styrofoam with all dimensions 1/8” smaller than the finished size to allow for the 1/6” coating of concrete all the way around. For added strength, I make the corners on the roofs 1/6” thick, since they often hang over the edges of the buildings.

Jack Verdany’s article in the February 1995 issue of Garden Railways covers the building of styrofoam structures, so here I’ll only add a few comments based on my own experience.

I use the blue styrofoam insulation board that Jack suggests in his article. This material is 1/8” thick. I mention this because when you plan the locations of windows and doors in your buildings, you must take into account the thickness of adjacent walls that might get in the way of the opening. I’ve also found that dry-wall screws are excellent for holding pieces of styrofoam together while the glas is drying. The screws can be inserted almost all the way in by hand and they will not split the foam.

In designing a building, I draw front and side views on paper. To transfer the shapes to the foam, I lay the drawing on the styrofoam and use sawing or paper to punch holes in the styrofoam at corners on the drawing. Then I lift up the drawing and draw straight lines on the styrofoam between the corner holes. (When cutting out openings for windows and doors, I save the cut-out piece as a plug. You’ll see why later in the article.) Photo 1 shows the substructure for a small gabled building, the passenger station for my village.

This building has a great deal of roof overhang over the front and rear platforms and on the sides. Making a roof with overhang requires the construction of “forms.” It is much easier to attach the forms to the styrofoam substructure on the sides than to attach them to finished concrete sides, so the roof is built first. Photo 2 shows the forms made of styrofoam attached to the side of one quadrant of the building and held in place with 1/6” and 2” dry-wall screws. The forms are re-used on the other quadrants. I’ve found that coating them with Vaseline keeps the concrete from sticking. Any cracks or openings in the forms that you don’t want concrete seeping into can be sealed with modeling clay and smoothed over before applying the Vaseline. In Photo 2 you can see that pieces of the form shaping the edges of the roof are textured in the shape of the profile of the shingles. These notches act as guides for locating and shaping horizontal edges of the shingles in the concrete. The concrete is spread and the shingles modeled on one surface at a time. It helps if the surface is kept horizontal as you spread the concrete, but the surface can be tilted.

**TOOLS**

For modeling cement, you can use all of the tools that are available in hobby stores for modeling clay. I have several, but the one I find the most useful is a piece of brass, 2” x 3” x 0.005” thick, that is about the thickness of the 1/6”. This tool is perfect for cutting grooves for bricks or shingles and for smoothing surfaces. The tool helps get the jointed edges correct.

Another helpful tool is a piece of brass, 1” x 10” x 1/32”, which is great for making long horizontal grooves in bricks or locating the bottom edges of shingles. It is useful, too, for spreading the cement smoothly over the surface. I also have a resistos tool about 1” in size that is good for smoothing sharp corners.

**SHINGLES**

To shape the shingles, the piece of brass stock is used to mold the concrete to form the bottom edges, using the guides on the forms for location. Then the vertical grooves are cut. (You can add “character” to each shingle by filing it, or changing its length with respect to the others. That’s not detailed, but it is time consuming.) It’s a good idea to work on small areas (about 6” square), if you are doing detailed modeling such as shingles. This gives you time to consider your work before the cement becomes difficult to work. Photo 3 shows a close-up of the shingles.

The ridge of the roof is made after both sides of the roof are finished (or after all four quadrants are completed, if you prefer). I used duct tape on both sides of the ridge, to cover the finished shingles while spoothing wet cement onto the ridge. I used my fingers to form it into a rough cylinder shape. Then I sculpted the ridge with the tools and removed the tape.

I found that when new cement is poured next to finished concrete, the finished concrete tends to absorb the water, causing the new concrete to become stiffer faster. This makes modeling a little more difficult, so the tools have to be dipped in water many times to get a smooth surface. Adding some detergent to the water makes it easier to sculpt smoothly. On the ridge of the station’s roof, I molded terra cotta tiles similar to those found on many of the Pulla stations. Photo 4 shows the finished roof with the tiles removed.

All of the buildings in my railway’s village are built in the Tudor style, which uses heavy beams to form the supports and angle braces of the walls, with plaster or stucco filling in between to form the actual wall. This is called half-timber construction. The passenger station also reflects this style. Photo 5 shows the “beams” of the styrofoam substructure on the walls. These beams are made of the same styrofoam as the substructure. To protect from abrasion, the beams are coated with a water-based carpet adhesive that forms a tough coat when dry. Quicklime is then spread between the beams. After initial spreading, the mixture trowel is used to smooth the concrete into the narrow areas and corners under the gables. Below the windows, the station is constructed of “stone.” Cement is spread to about 1/6” thick under the windows and, after letting it sit a short while, grooves are cut to shape the stones.

These can be seen in photo 6, which also shows the small stone ledge, or sill, under the windows.

A form for this sill can be made from two pieces of styrofoam, each about 1/6” thick and set parallel to each other to form a trough. Because the forms have to be placed on top of the finished concrete stone, a sticky putty product called “Ticky-Tack” by 3M is helpful for holding them in place. This putty makes a temporary bond between two surfaces.
Foam Structures:

STUDIES OF FOAM

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Foam Structures:

- Here is another example of simply taking some thick foam, roughly carving it and applying paints and/or dyes to create variations in color:

- Curtesy of Terry Ketcham
Plexiglas/Acrylic Structures:
This structure was built entirely from Plexiglas and covered with styrene siding.
Plastic Sign Material:

The core of this structure was made using Coroplast. It was later covered with styrene siding sheets.
Plastic Sign Material:

- SINTRA PVC Foam Board: Sintra has become a popular material for building outdoor structures since it’s weatherproof and easy to work with.

This building uses a combination of Sintra, acrylic, and styrene. Completed model.
Plastic Sign Material:

- Using Sintra PVC Foam Board, continued:

Sintra can be carved to resemble bricks. Levels of detail can be added using overlays of Sintra carved pieces.
Plastic Sign Material:

- Sintra PVC Foam Board Continued:

  Carving Sintra to resemble stonework.

Completed building made from Sintra
Plastic Sign Material:

Using Sintra PVC Foam Board, continued:
Concrete Structures:

This is an all concrete tunnel portal on my layout. It is made using small concrete castings formed in latex molds.

This scratch built water tank has a foundation also made from concrete castings.
Concrete Structures:

Best for spreading on foam, etc.
The 2 center cements best used for castings.

I use this liquid for filling gaps in castings and painting backs of foam.
Concrete Structures:

Two examples of structures built using Jigstones molds. The buildings on the left are actually facades line up against the wall of a garage.
Resin Structures:

- There are few resin kits out there any more and for good reason. Although they can be quite detailed, the parts especially the roofs tend to soften in the sun.

- There have been some people who have made molds and cast roofs and building sides, but the skill level required is high.

- I will cover using resin for building details later.
Resin Structures:

Below is a great example of a resin kit I built many years ago. Since I do not leave my custom structures outside, it has held up well. The company that produced these fine kits are no longer in business.
Plastic Structures:
Can’t say enough about Piko/Pola plastic structures. Their kits are easy to build and last for many years if left outside. The 2 structures on the left are mine and have been left outside, year round for over 15 years and show no signs of deterioration. The one on the right is new and painted to show the brickwork better.
Plastic Structures:

Here are a few examples of structures that you can create from Colorado Models components.
Structures From Foam Core Materials:

Here is a church that I scratch built using Gatorfoam as the core. It is covered with various styles of styrene sheets from Precision Products and then painted with acrylics.
Steel Structures:
Glues for Building Structures:

- For Plastic Sign Materials:
  - Silicone Adhesive
  - Welder
  - E-6000

- For Concrete:
  - More concrete
  - Concrete adhesive – PL Polyurethane

- For Resins:
  - Welder
  - Epoxies
  - Silicone adhesive
Favorite Glues:
Accessories for Building Structures:

- Exterior Coverings:
  - Styrene Siding:
    - Precision Products: [http://www.ozarkminiatures.com](http://www.ozarkminiatures.com)
  - Show samples
Accessories for Building Structures:

Exterior Coverings:

- Magic Sculpt:
  - Magic Sculpt is a durable two-component epoxy that lets you create extra-fine, highly-detailed sculpture projects.
  - Magic Sculpt is also an excellent repair putty with tremendous strength and adhesive properties.
  - Mixed components (add pigment if desired) have a clay consistency with about 1-2 hours of working time. Magic Sculpt cures at room temperature to a strong rock-hard finish that can be sanded, painted and drilled.

Accessories for Building Structures:

- Windows, Doors, etc.:
  - There are a few suppliers of windows, doors, chimneys, etc.
  - Grandt Line: http://www.grandtline.com
  - Stoneworks: http://www.rrstoneworks.com
  - Houseworks: https://www.houseworksltd.com/
  - Ozark Miniatures: https://www.ozarkminiatures.com/Scripts/default.asp
I used multiple resin castings to create these cornices for my lighthouse station.
Resources:

- **Plastic Kits:**
  - Colorado Models: [http://www.coloradomodel.com](http://www.coloradomodel.com)
    - Also available at numerous G scale suppliers.
  - Pola: Numerous G Scale hobby suppliers.

- **Metal Bridges and Buildings:**
  - Bridge Masters: [http://www.bridge-masters.com](http://www.bridge-masters.com)
  - Eagle Wings Iron Craft: [http://www.eaglewingsironcraft.com](http://www.eaglewingsironcraft.com)
  - Daniel Peck: peckdaniel73@yahoo.com
Resources:

- **Large Plastic Sheets and Glues:**
  - TAP Plastics: [http://www.tapplastics.com](http://www.tapplastics.com)
  - Foam Board Source: [http://www.foamboardsource.com](http://www.foamboardsource.com)
    - Sintra PVC Foam Board
    - Gatorfoam
  - Coroplast: [http://www.coroplast.com](http://www.coroplast.com)

- **Resin Casting Materials:**
  - Micro Mark: [http://www.micromark.com](http://www.micromark.com)
Resources:

- Web Sites:
  - http://www.mylargescale.com
  - http://www.largescalecentral.com

- Garden Railways Magazine:
- Fellow PGRS Members:
A Thing About Scale:

- Does it matter?
  - Not really.
  - Depends somewhat on scale of trains you run.
  - Many modelers pick 1:24. (In the middle) My choice for scratch building

- What’s the most common available?
  - 1:24
  - 1:22.5
  - 1:20.3 Not so common
  - 1:29 or 1:32 Almost nothing

- When I’m scratch building something I generally start with a figure to decide on the height of the doors and go from there.