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A New Method of Building Scale-Model Houses

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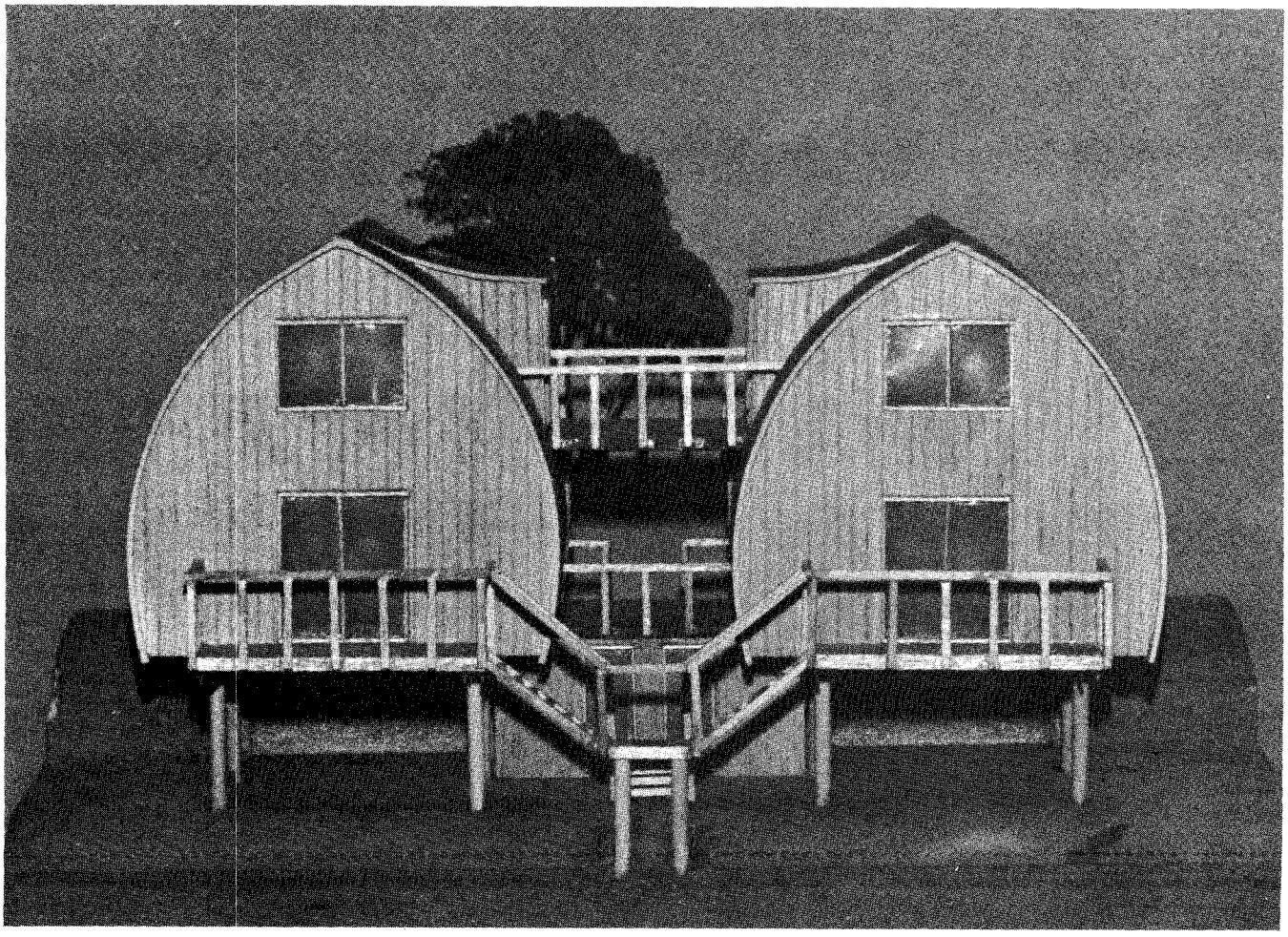

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A New Method of Building Scale-Model Houses

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Abstract. --Scale-model houses are used to display new architectural and construction designs. Some scale-model houses will not withstand the abuse of shipping and handling. This report describes how to build a solid-core model house which is rigid, lightweight, and sturdy.

Keywords: Solid-core model.

Scale models are an excellent way to present and convey new housing construction ideas to the general public. If properly constructed, scale models are well worth the time and money spent by architects to display their designs. A three-dimensional model generates more visual interest and enthusiasm than a sketch or line drawing.

The Housing Research Unit of the Forestry Sciences Laboratory in Athens, Georgia, designed several low-cost wood homes to demonstrate efficient utilization of wood in housing construction. The Unit needed to build sturdy scale-model houses to present their designs to the public. Often scale-model houses are weakly constructed and easily damaged in handling. To solve these problems, I built three-dimensional model houses constructed around a solid core of wood, applying simulated siding and trim to the outside (fig. 1).

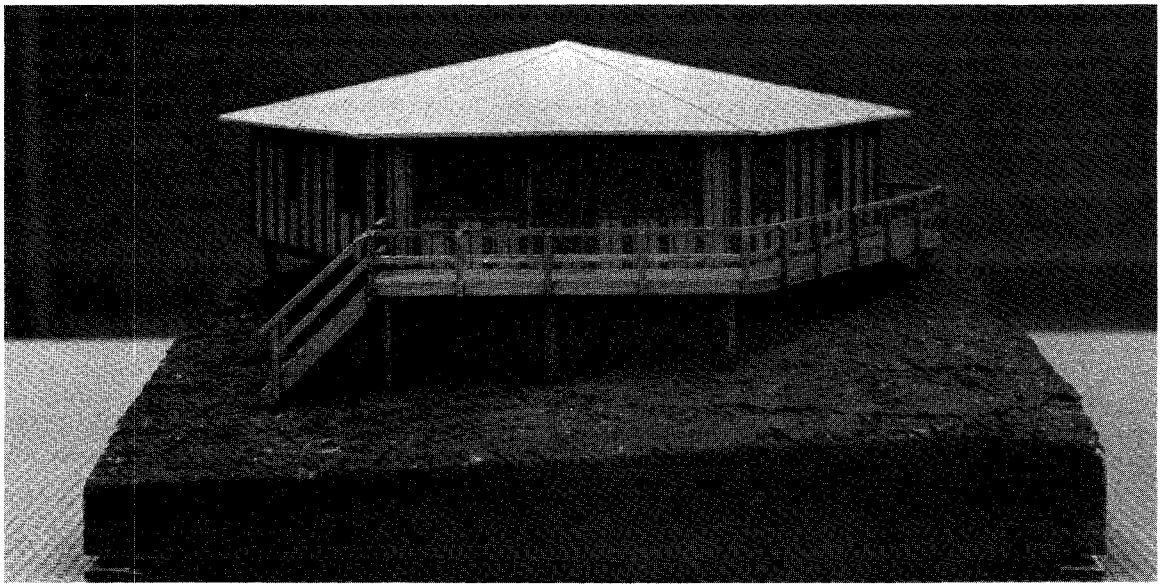

Figure 1. --Finished scale-model house constructed from a solid core.

The present report shows the steps used to construct solid-core model houses. These instructions can be easily applied to any housing design. The models were built to scale according to the plans found in "Designs for Low-cost Wood Homes," published by the Forest Service.[1]

STEP 1: PLANNING AND MATERIALS

Study the construction plans carefully until you are completely familiar with the design. Decide on the amount of materials needed for construction. I suggest gathering the following materials: scaled balsa wood, water-based stain, latex paint, wood dowel rods, drywall paste, colored paper, contact cement, plywood, poster board, white pine boards, sharp knives, drawing pencils, a T-square, ruler, small compass, C-clamps, polyvinyl acetate (P.V.A.) glue, and a quick-setting model cement. These materials can be purchased at a building supply company or a hobby shop. A plywood cutting board with a 90° angle on the cutting edges is helpful when aligning and cutting straight edges. Be sure to gather a liberal amount of patience before starting construction.

STEP 2: CONSTRUCTING THE SOLID CORE

A solid core is the foundation for a rigid, stable model house. The solid core is formed by laminating white pine boards into a block (fig. 2). Plane the white pine boards to provide a smooth gluing surface. Cut the boards to the approximate block dimensions, leaving an excess for later trimming. Apply P. V. A. glue to the surfaces to be bonded and then stack the boards on top of each other. Place the core block in a cold press or use C-clamps to apply enough pressure to set the glue evenly. Remove any excess glue with a damp cloth. After 2 to 4 hours the block is ready for trimming and squaring.

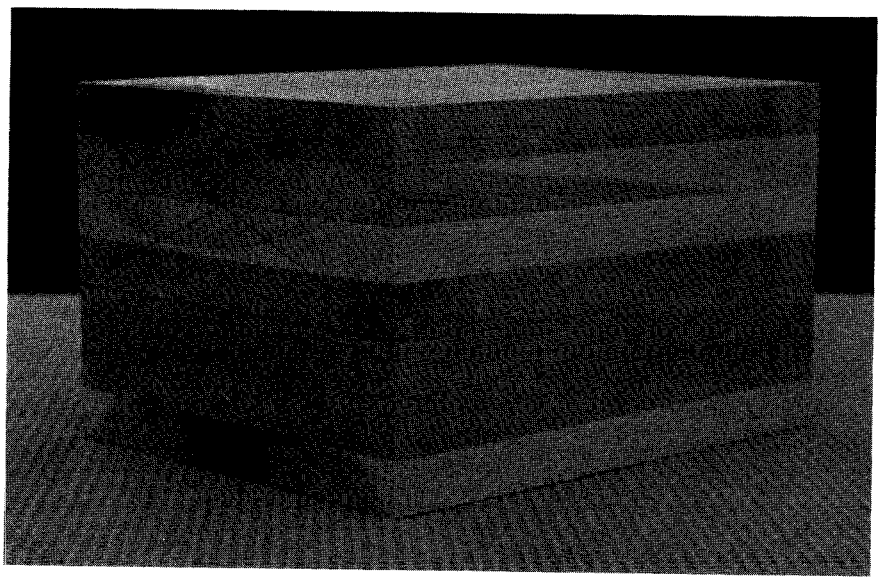

Figure 2.--Laminated block core.

[1] Anderson, L. O., and Harold F. Zornig. 1969. Designs for low-cost wood homes. p. 1-28. U.S. Gov. Print. Off., Washington, D. C.

Cut the block down to scale size, but leave an excess for later shaping of the roof. Mark the foundation on the bottom of the model core. If your design calls for a raised house on foundation poles, drill holes for the support poles now. When drilling holes in the block, do not penetrate the roof slope. You can reduce the weight of the solid core by drilling additional holes in the bottom (fig. 3). Above all, don't damage any foundation holes when drilling to remove excess weight. For safe operation, use high-speed drill bits in a drill press at medium setting. Mark the angle of the roof and set the bandsaw for desired cuts (fig. 4). After cutting the roof angle the solid core is complete.

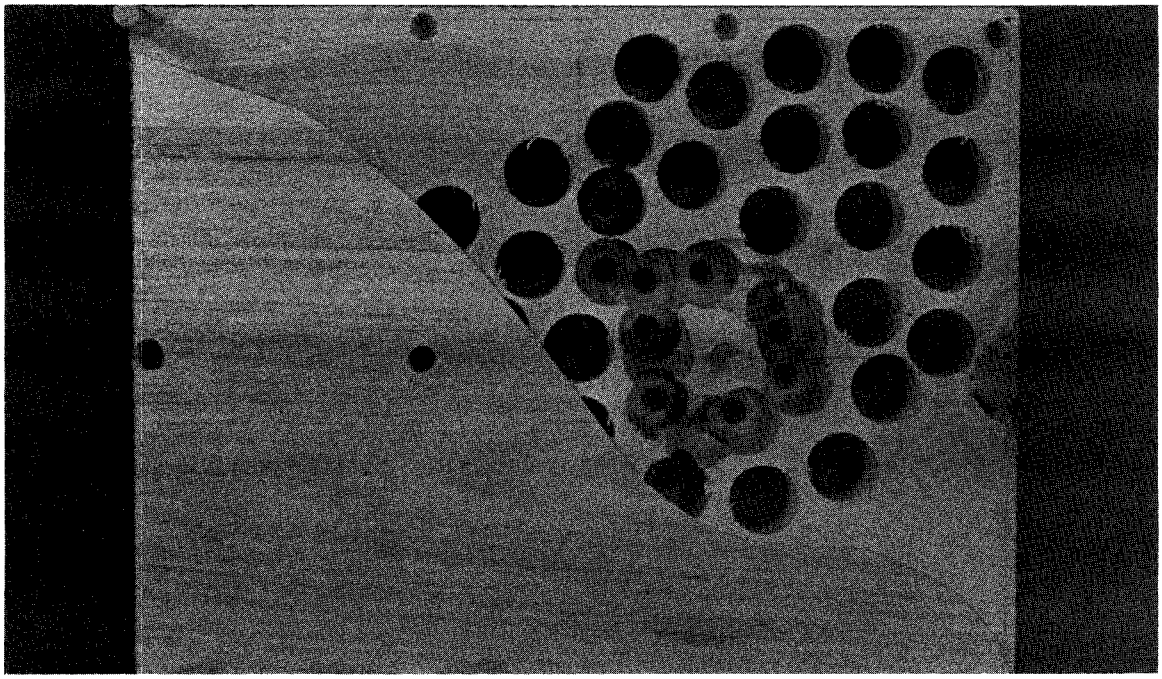

Figure 3.--Holes drilled to reduce excess weight.

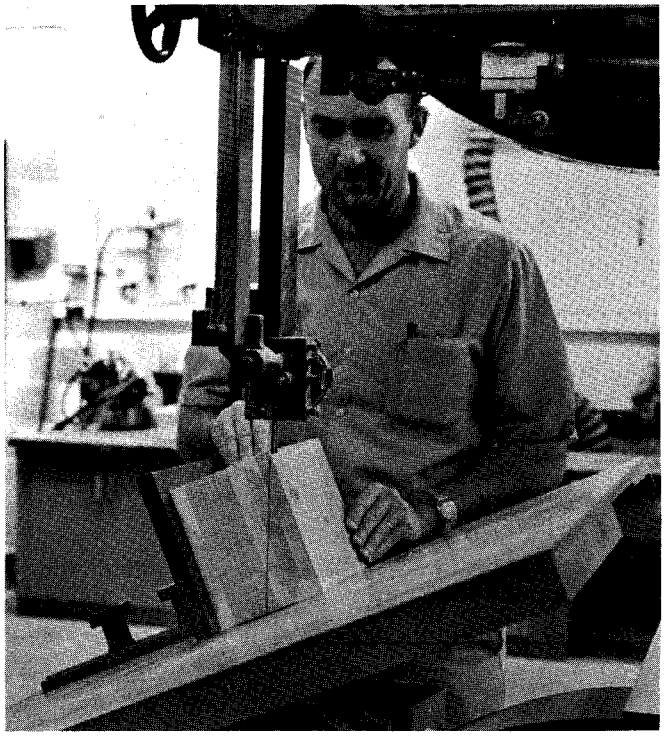

Figure 4.--Bandsawing roof slope.

STEP 3: PREPARING EXTERIOR MATERIALS

Window and door casings, window sashes, doors, steps, step stringers, deck flooring and railing, and all siding should be cut to scale from thin balsa wood strips and stained or painted with a water-based stain or latex paint. You must stain before gluing to assure an even surface overall. If you wait until after gluing, the stain will not cover any area that has glue on it. Also, glue does not bond well to oil-based finishes, so water-based finishes are recommended.

After the finish has been properly applied and completely dried, the exterior siding can be cut. First, mark all exterior siding material with soft lead, using dividers to indicate individual lines, creating a design like grooves on 1-11 plywood siding (fig. 5). Then use the plywood cutting board, 30° to 60° or 45° triangles, and a sharp knife. Measure the siding to scale, place it against the fixed 90° angle on the cutting board, and hold the material firmly to score. If more than one piece of the same size is needed, use the first piece you cut as a pattern for all the others. This practice eliminates repeated measurements.

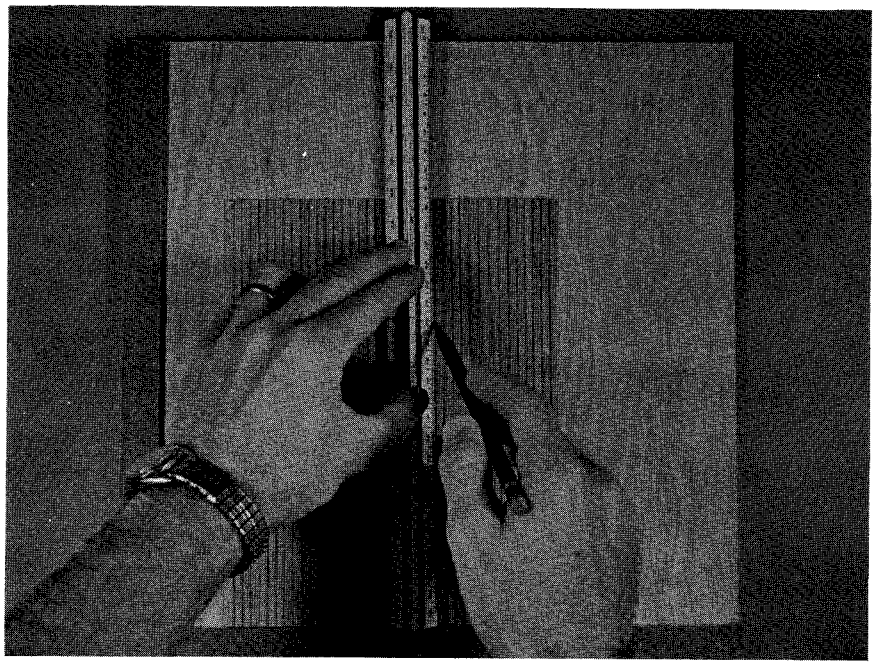

Figure 5.--Marking of exterior material.

STEP 4: BONDING THE SIDING

Arrange all siding on scrap paper with no sides touching and the outside face down. Use an inexpensive paintbrush to apply contact cement to the inside face of the siding and to the outside face of the model core; let the cement dry until tacky. Use contact cement to speed the bonding process. To test when the siding and model core are ready for bonding, press a small scrap of paper to the set surface. If the paper can be removed without sticking, the contact cement is dry and the siding and core are ready to bond. If the paper sticks, the contact cement needs to dry longer.

Bonding is the most crucial point in construction, so be careful and precise. Align the objects accurately before pressing into final position because once together, the objects are bonded! There can be no shifting or separating to straighten or move the siding. One trick is to cut all the outside surface materials oversize and then, after bonding, trim the excess using the model core as a guide. To position the siding, place paper between the surfaces being bonded until they are aligned. Bond one end, remove the paper, and, in a rolling motion, work to the other end pressing the siding to the core (fig. 6).

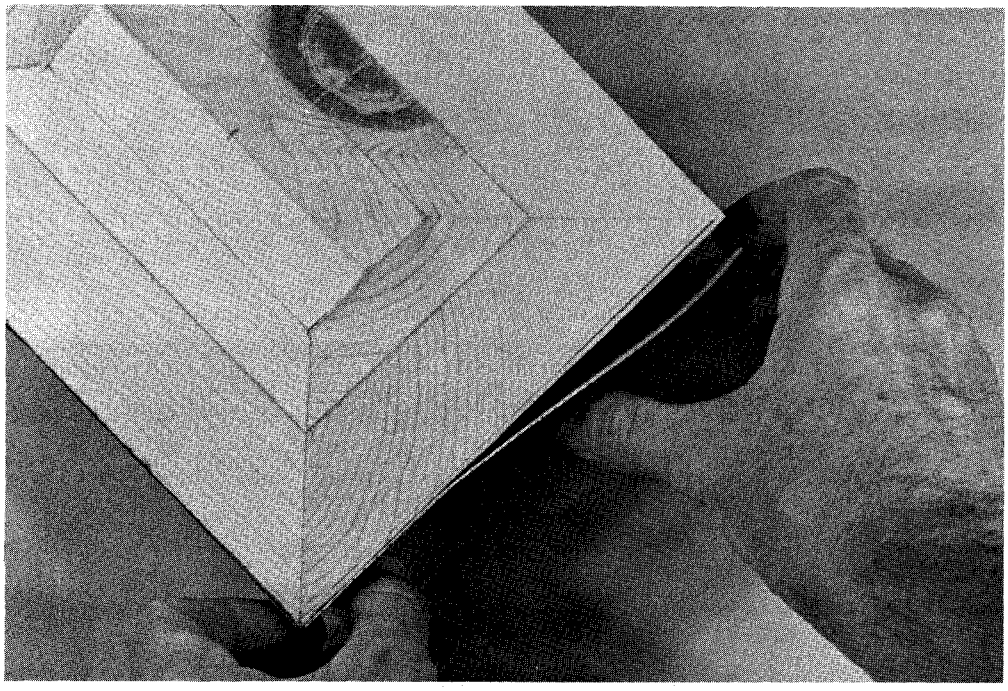

Figure 6.--Bonding siding to core.

STEP 5: FINISHING THE EXTERIOR WALLS

After all the siding has been bonded to the core, you are ready to make the window and door openings. Follow the working drawings and locate the openings. Place a scale or divider in a vertical position at each end of the wall and mark the desired height lightly. Draw very light horizontal lines between the height marks. Then mark width openings on the horizontal lines. Be extremely careful in cutting the openings in the siding (fig. 7). A sharp knife and careful following of the penciled lines are essential.

Use colored paper to represent glass and wood panels. After the paper has been glued in the openings, the jambs, headers, and thresholds should be sized and positioned over the paper. Strips of prestained balsa should be scaled and cut to size for window and door frames, thresholds, and casings. These strips should be thick enough to protrude from the model core so that they are not flush with the siding. For proper bonding, spread contact cement on the bottom and one side of thresholds, jambs, and headers (fig. 8). Remove all excess glue before it dries, to eliminate reflection spots.

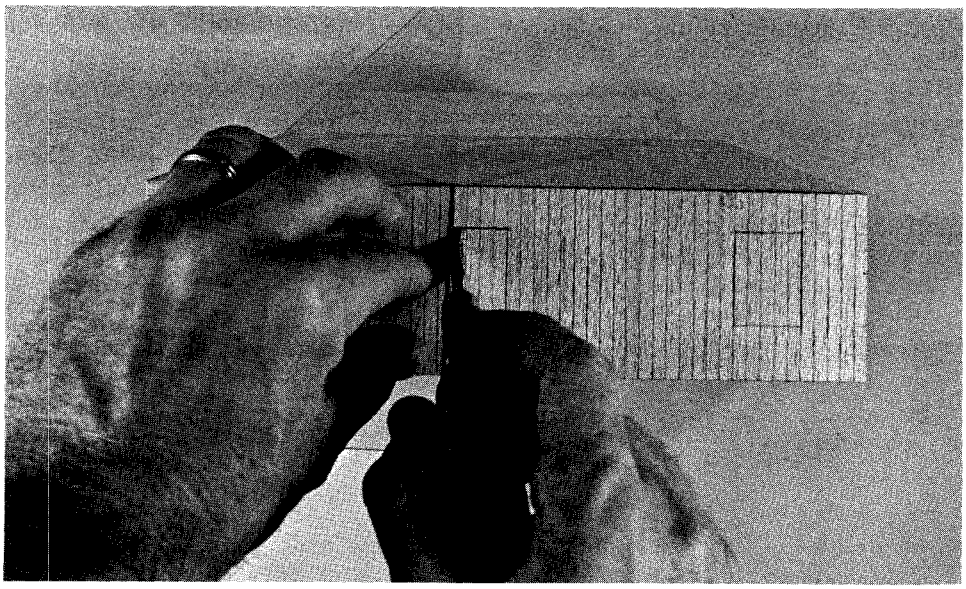

Figure 7.--Cutting door and window openings.

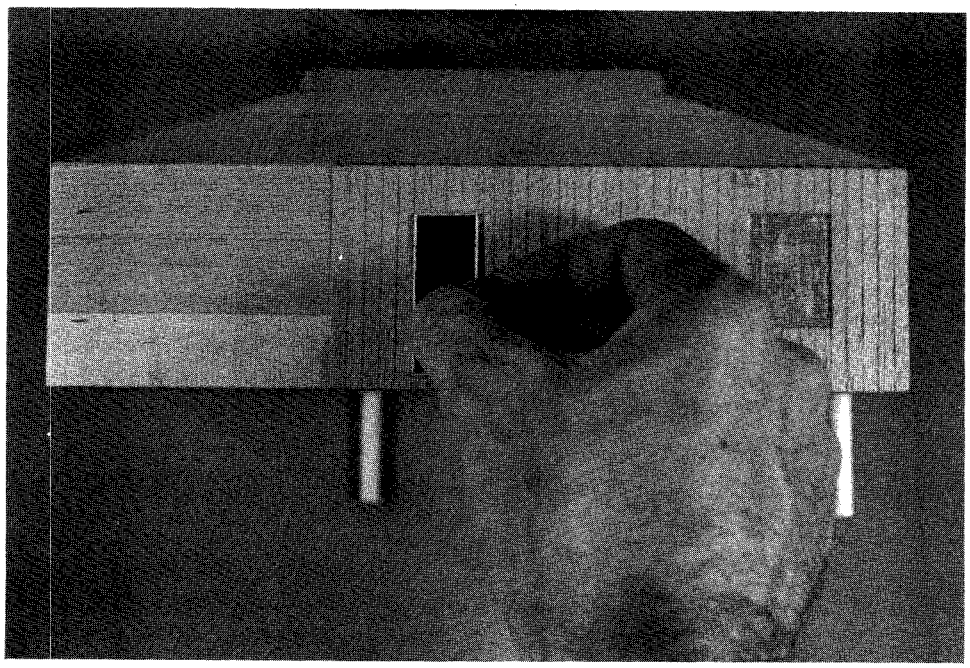

Figure 8.--Placing doorjamb in position.

STEP 6: FINISHING THE ROOF

The roof may be covered in several ways. Explained here are two methods: colored poster board and drywall paste. The poster-board construction method requires dividers, a T-square, and a knife. You also need a plywood cutting board with a raised metal 90° angle fixed in one corner to mark and cut the shingle patterns. Cut the poster board to scale, following the blueprint for the shape of the roof and the overhang. Each plane surface of the roof requires a separate piece of poster board. To represent horizontal edges of shingles, draw lines, scaled to the actual shingle size, parallel to the edge of the roof.

Then place the poster board on the plywood cutting board, the outside overhang edge against the horizontal edge of the 90° angle and T-square. Using firm but light pressure, score the poster board, being careful not to cut too deeply. Then position and score the vertical lines representing the shingle width. Bond the poster-board shingle patterns to the core roof with model cement (fig. 9). The overhang will not be bonded to the core; a line should be lightly drawn on the underside of the poster board to indicate the areas to glue. Again, be extremely careful when aligning the roof in its proper position for bonding. When the roofing is bonded correctly, there will be thin spaces between the roof sections, at the hip, valleys, and ridge. These spaces should be covered with thin strips of scored poster board.

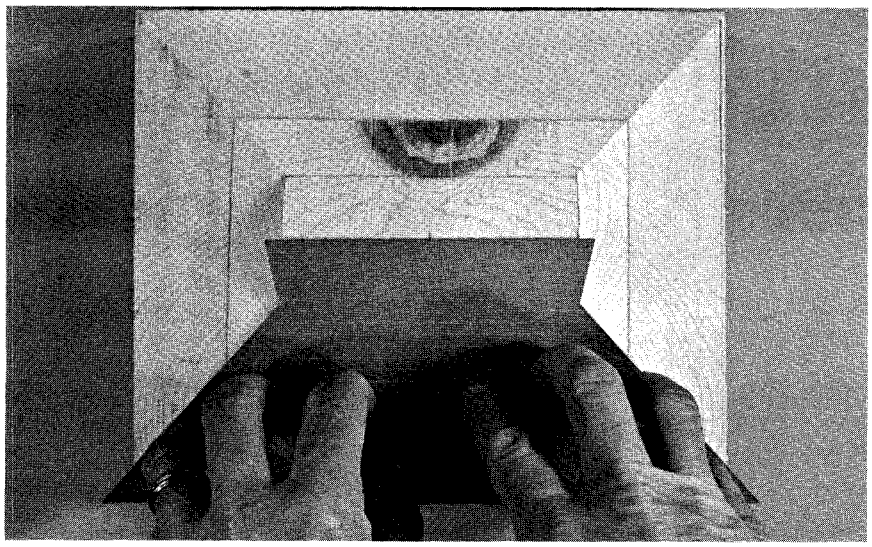

Figure 9. --Bonding shingles to roof.

Drywall paste compound can be used to simulate a built-up composition roof or sprayed-on foam roof. First bond the poster board, using contact cement, to all areas to be covered with the roofing compound. This poster board absorbs excess liquid from the drywall compound, preventing any distortion of the model structure. Following directions on the container, mix and spread the joint compound with a spatula. After obtaining the desired buildup, but before the joint compound is dry, use a spatula in a patting motion to give a stippled texture (fig. 10).

STEP 7: CONSTRUCTING THE BASE

To complete and enhance a finished model, build an attractive base from 3/8-inch or 1/2-inch plywood covered with polystyrene foam. The size of the base may vary, but keep the model and base in proper proportion. Bond the plywood and foam together with contact cement. Mark the exact location of the house on the foam base. If the house design requires visible pole foundations, then drill the place for the support poles in the base before finishing the base. The length of the wooden dowels to be used as support poles must be measured carefully, taking into consideration the depths of the holes in the solid core and the base. Follow the blueprint carefully!

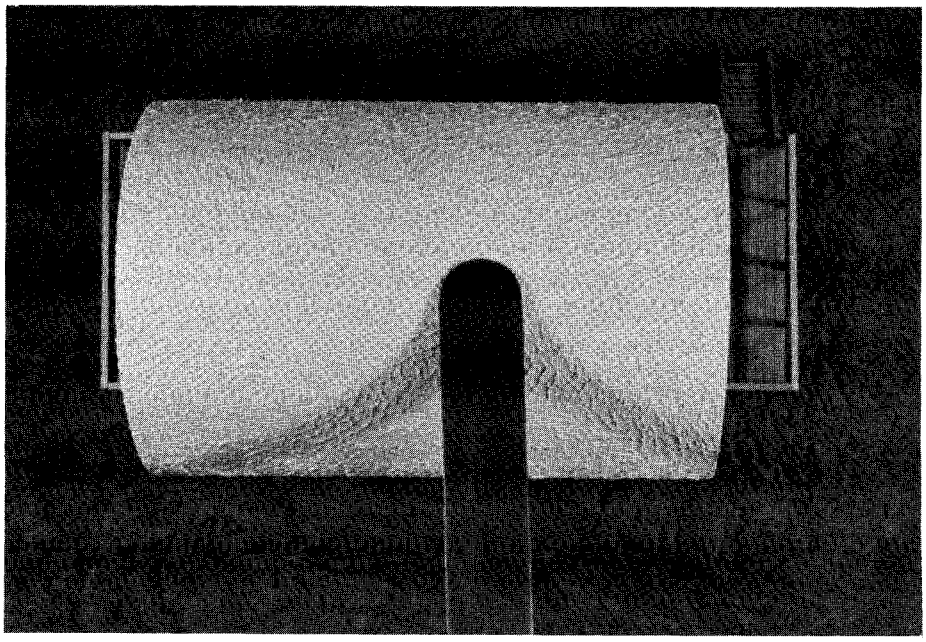

Figure 10. --Spatula used to stipple roof.

Mark the pole foundation positions on the bottom of the base. Drill these positions with a drill press. If a drill press is not available and a hand press is used, drill oversized foundation holes completely through the base. Plumb the precut wooden dowels with a triangle, forming 90° angles between the base and the poles.

The foam is ready to be cut to its desired surface shape. A bandsaw, butcher knife, or other appropriate cutting tool can be used to trim the base. Final shape of the base can be the personal preference of the model builder.

To add texture to the base, cut lines up and down the surface of the foam, 1/8 inch apart and 1/16 inch deep with a sharp knife. Then make similar cuts across the foam, perpendicular to the lines you have just drawn. When you finish, the surface of the foam should resemble graph paper. Scrape the knife over the base to chip away excess foam. When done correctly, this procedure will leave the base with a slightly rough surface (fig. 11). Paint over the rough surface with water-based paints that do not deteriorate plastic foam. Different colored paints can represent earth or grass.

STEP 8: MOUNTING AND FINISHING THE MODEL

After the paint has dried, mount the model onto the proper position on the base or support poles. Securely bond the house and base together with either P.V.A. glue or contact cement. When the glue has set, you may construct outside sundecks, porches, or steps out of balsa wood. Follow the blueprints for the proper scale and position of these exterior options. Use a quick-setting model cement to attach the finished structures to the house. These exterior structures will be the most fragile part of your scale-model house.

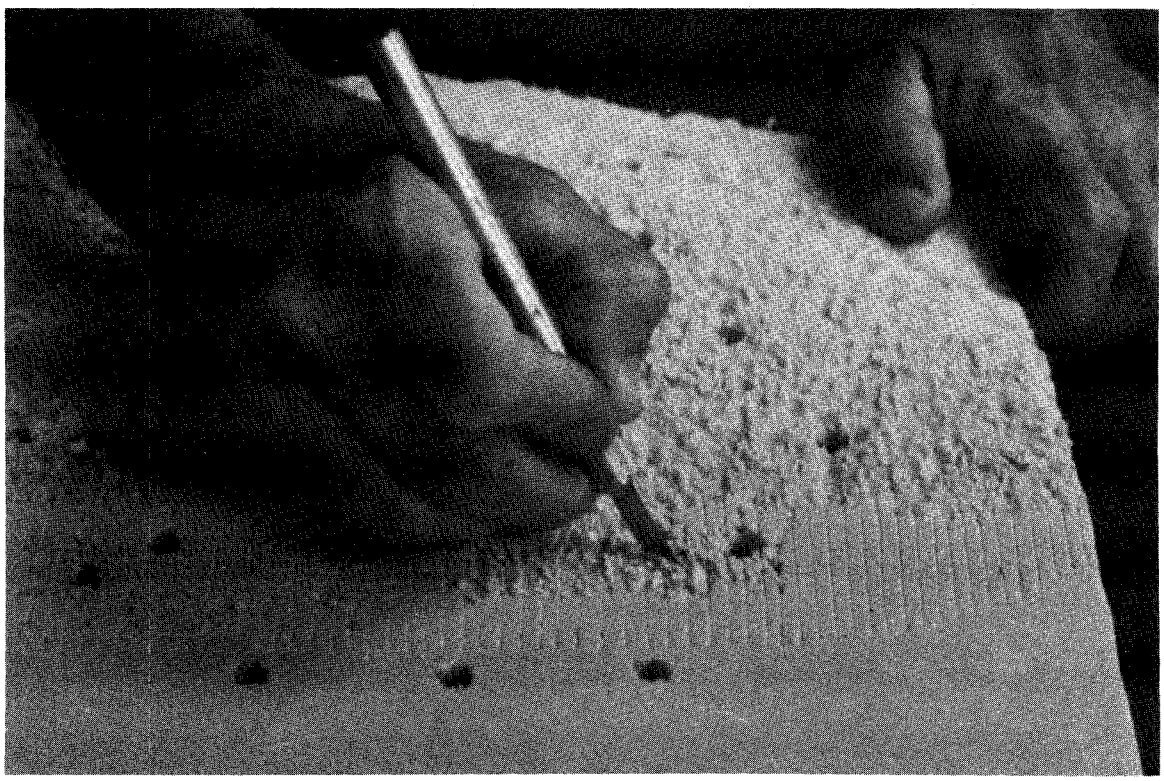

Figure 11. --Preparing the base.

Now you have successfully completed a scale-model house (fig. 12). The solid core has added stability and strength to the basic design of model houses. By using your imagination and patience, this method could be applied to a variety of house plans and scale models.

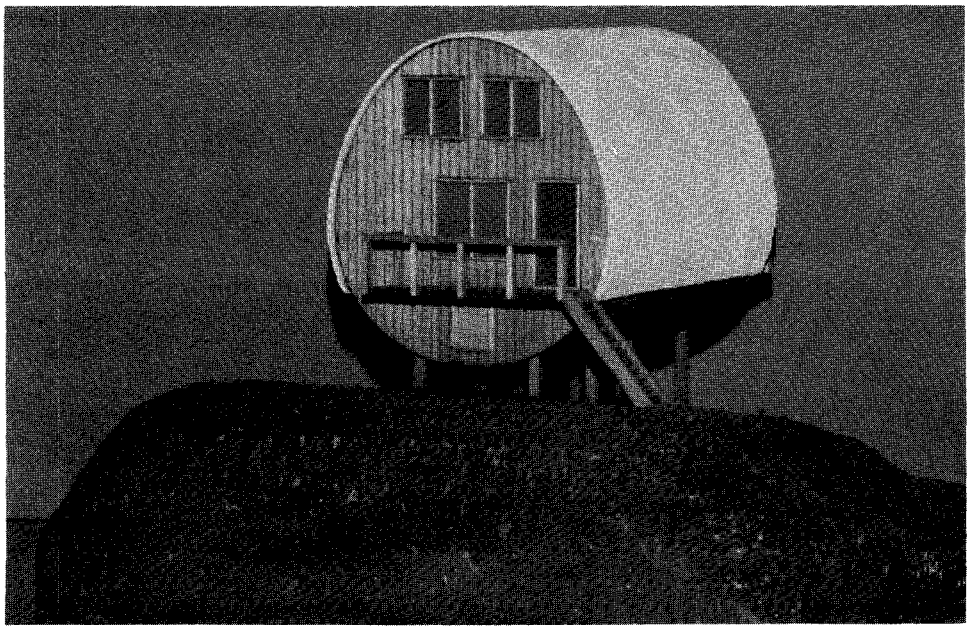

Figure 12. --Completed scale-model house.

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1978. A new method of building scale-model houses. U. S. Dep. Agric., For. Serv. Gen. Tech. Rep. SE-12, 9 p. Southeast. For. Exp. Stn., Asheville, N. C.

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