

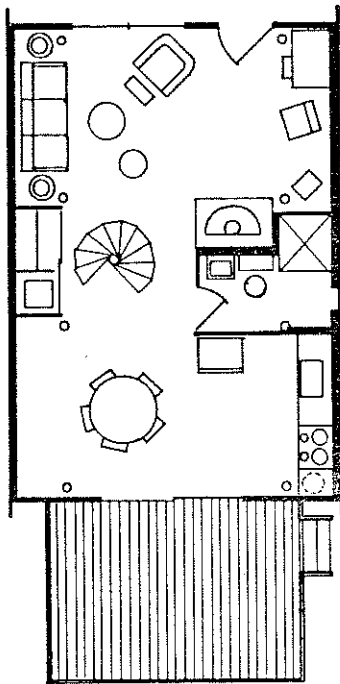
HOUSE PLAN NO. FS-SE-9 5-20-70

UNITED STATES DEPARTMENT OF AGRICULTURE-FOREST SERVICE

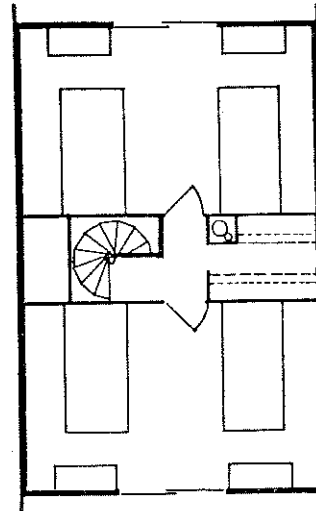
A HILLSIDE HOME

With two bedrooms, one bath, and a large living-dining-kitchen area, this unique 2-story home appears much larger than 900 sq. ft. because of its open floor plan. Easily built on rough and sloping sites, it could be used as a second home or recreation cottage in addition to serving the needs of rural families. Designed with the small

builder or do-it-yourselfer in mind, the house can be built with ordinary carpenter tools and with low cost materials that are usually available locally. This design is a modification of the earlier designed hillside duplex (No. FS-SE-6), and could easily be modified for the construction of a similar duplex.



FIRST FLOOR



SECOND FLOOR

Ninth in a series, this design was produced by a research program currently underway at the Forestry Sciences Laboratory, Southeastern Forest Experiment Station, Forest Service, U.S. Department of Agriculture. The objective of this program is to develop house designs and construction techniques leading to more efficient use of wood and wood products in housing. There are numerous variations on details of the design that can be made by competent builders. The target figure for construction cost has been about half the cost of equivalent homes of conventional construction. The original duplex design (FS-SE-6) was built in 1969 by the designer in Athens, Georgia, for about \$6 per sq. ft. He estimates that a house built of design FS-SE-9 would cost \$7 to \$8 per sq. ft. in 1971. This cost is exclusive of land, site development, and financing costs.

FOUNDATION SYSTEM

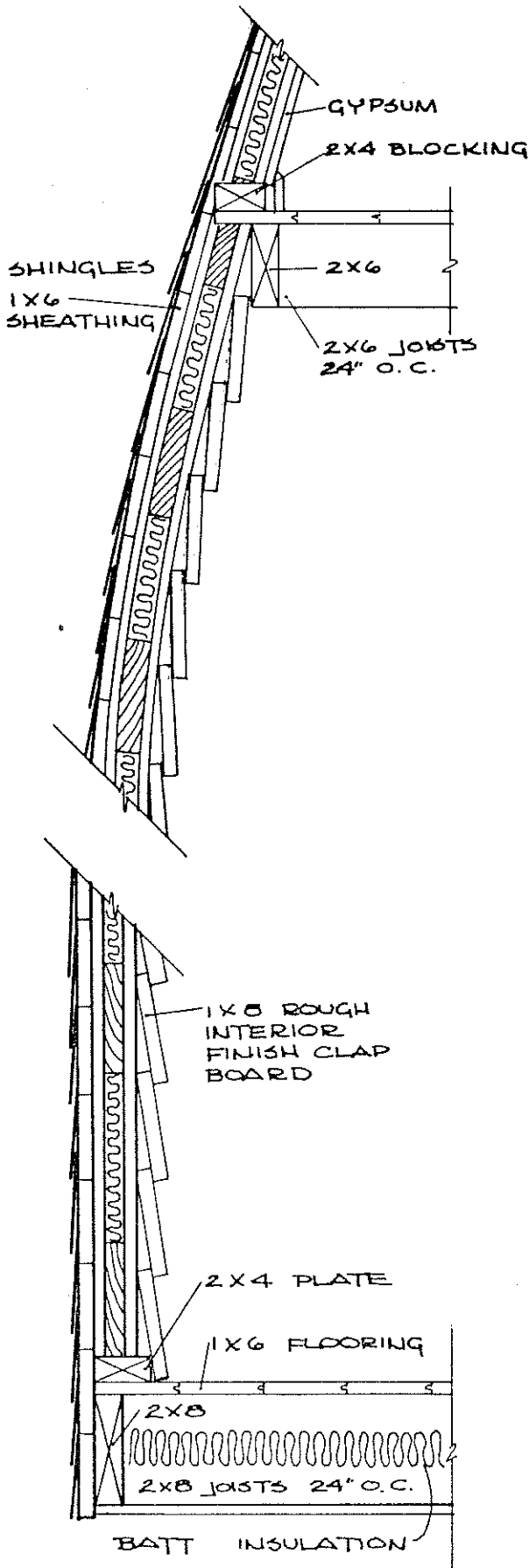
Durable pressure-treated wood poles support the structural framework of this home. The pole embedment depth and back-fill requirements vary according to soil conditions. If the home is placed on a steeply sloping site so that the house is more than three feet above the ground, a rigid pole foundation can be obtained by cross-bracing between the exposed poles or by enclosing the space between the poles for additional storage space. This enclosure would also conceal water supply and waste piping.

FLOOR FRAMING

The floor framing is quite simple with floor joists supported by the 2x8 longitudinal beams that are bolted to the poles at the first and second floors.

WALL FRAMING

The curved walls are built with unique



RIB-DETAIL

nail-glued laminated curved ribs that are supported at the ends of the floor joists which are cantilevered over the 2x8 beams. These ribs, a modification of those used in FS-SE-6, are simple to build by a carpenter in a small shop. Complete details on construction of the ribs are provided with the construction plans.

The end walls and most of the interior partitions can be built conventionally with 2x4 stud framing, or even more economically as detailed on the plans by using single layer board or panel material, and by nailing together sandwich end walls of 1x6 sheathing, insulation board, and cedar shingles.

EXTERIOR FINISH

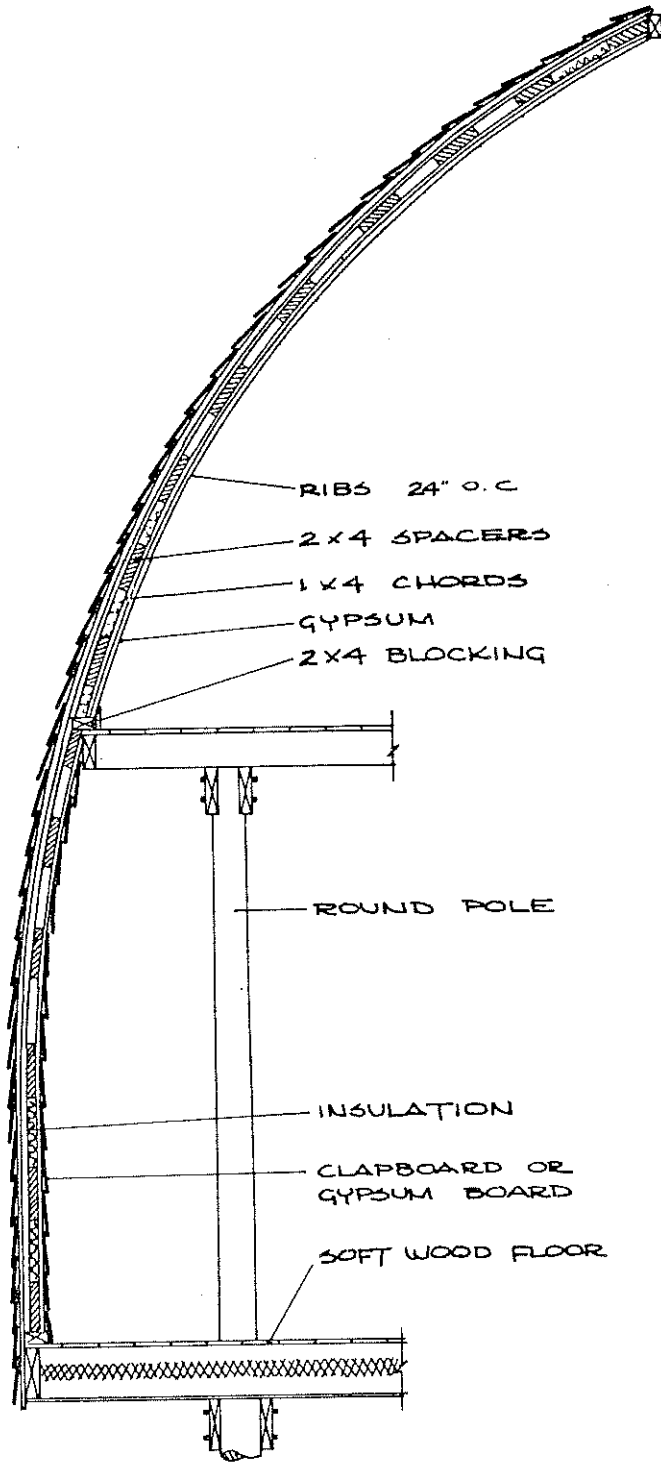
Cedar shingles are specified over one inch board sheathing for the curved roof surface. Hexagonal, staple-lock asphalt shingles, or any of the rigid composition shingles on the market could also be used. All of the shingles and exposed rough wood on the end walls and dormer are stained with one or two coats of a water repellent exterior stain.

DOORS AND WINDOWS

Conventional door and window units are installed without trim. The jambs are extended out from the wall surface to frame the doors and windows.

INTERIOR FINISH

Clap-board is used for the first floor interior finish of the curved walls. Three-eighth-inch gypsum board is used for the second floor interior finish of the curved walls. The floor joists supporting the upper floor are left exposed, as is the underside of the single-layer plank flooring. This forms an interesting ceiling that can be left natural or stained. Single-layer plank flooring is also specified for the first floor. Conventional sheathing with other types of finish flooring could be



STRUCTURAL SECTION

substituted for the single-layer flooring. The floors are sanded and given two coats of floor sealer. Unique all-wood spiral stairs, as described in FS-SE-6, are used.

MECHANICAL SYSTEMS

The gas or electric forced-air furnace is located in the central closet, and only short metal ducts are needed to distribute air to each room. Electrical wiring can easily be placed in the walls and through the open ribs. Plumbing service below the house should be boxed in and insulated. This might be done by enclosing the center four poles under the house for additional storage.

CODE ACCEPTANCE AND TECHNICAL ASSISTANCE

Certain experimental features of this design may not meet the requirements of all building codes. Builders should confer with local code officials to determine the requirements in the particular area the house is to be built.

Detailed plans and specifications for this home are available without charge from: Housing Research, Forestry Sciences Laboratory, Carlton Street, Athens, Georgia, 30601.

DESIGNED BY HAROLD F. ZORNIG

A HILLSIDE HOME (PLAN FS-SE-9)

This is one in a series of designs for low-cost wood homes developed by the Housing Research Unit at the Forestry Sciences Laboratory, Forest Service, U.S. Department of Agriculture, Athens, Georgia, which is a unit of the Southeastern Forest Experiment Station, Asheville, North Carolina. The principal mission of the Athens Unit is research and development in better utilization of forest products in housing.

A modification of an earlier plan, Hillside Duplex (FS-SE-6), this design incorporates a pole-frame foundation and structural system appropriate for sloping terrain and minimum site disturbance. Nail-laminated arches made of two sections joined at the ridge form a curved exterior shell for this two-story home. This unusual feature distinguishes the design from conventional two-story homes. Completely insulated, this home has a living room, dining-kitchen area and two bedrooms in 900 square feet of heated floor area. Sliding glass doors open onto a large balcony off the dining area. Space under the house can be used for a carport or enclosed for extra storage.

Construction cost in 1971, in Georgia, is estimated to be \$8,100, exclusive of land, external utilities, and site development. To meet this low cost, many economies were considered. Some of the economical features used are the pole-frame structural system, a reduction in hallway space, no unnecessary trim, and simplification of conventional framing construction. Exposed joists, single-layer flooring, economical cabinet construction, and single-coat stain finishes to highlight attractive wood grain also help reduce the cost of the home.

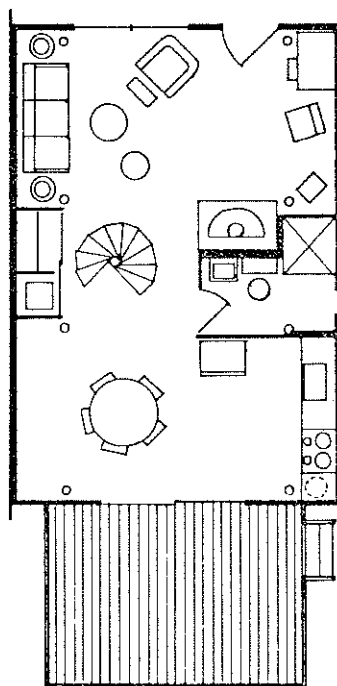
UNUSUAL EXPERIMENTAL FEATURES

1. A spiral stairway of low-cost wood materials.
2. Curved nail-laminated arches to replace conventional wall framing and roof construction.
3. Nail-glued wood strip flooring without subfloor.

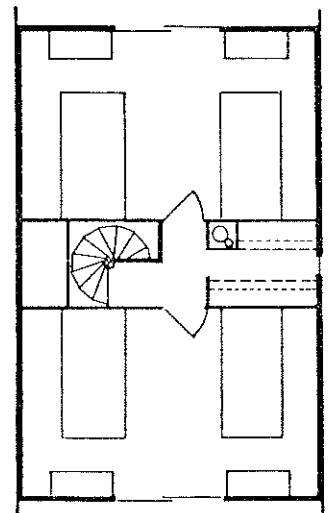
4. Light wood-sandwich end-wall construction.

All of the experimental features have not been completely evaluated. However, as of April, 1971, several houses have been built with house plan no. FS-SE-6 which has similar experimental features. Laboratory load tests have also been completed on the experimental arches used in both designs. This experience indicates that both designs are practical and economical. Some of the experimental design features may be applicable to other buildings to help reduce cost and increase design flexibility.

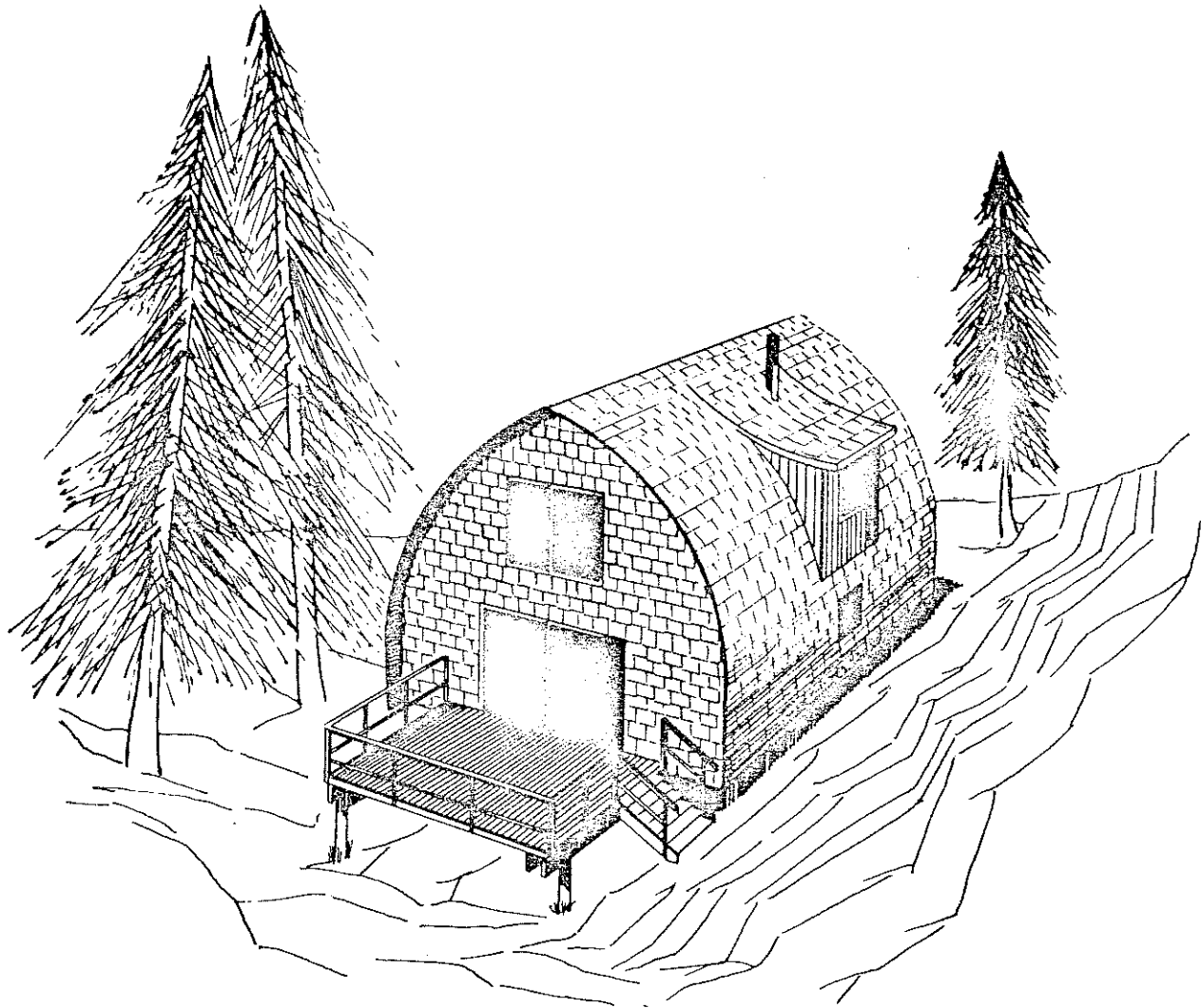
The Housing Research Unit in Athens is not an architectural design agency. It has developed a series of complete low-cost house designs as a means to illustrate how new wood materials and methods of construction can reduce building costs and improve performance. These design ideas are based on previous research and development in wood utilization by various Forest Service, university, and industrial laboratories.



FIRST FLOOR



SECOND FLOOR

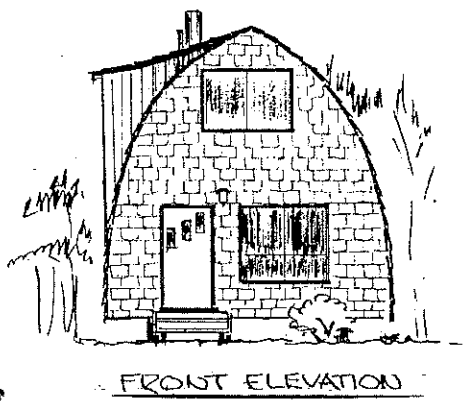
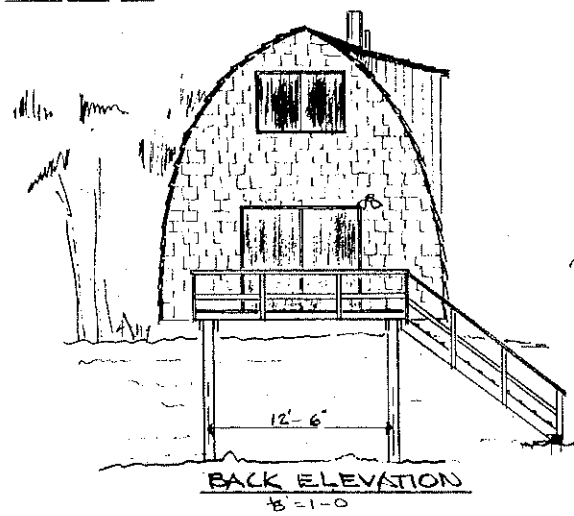
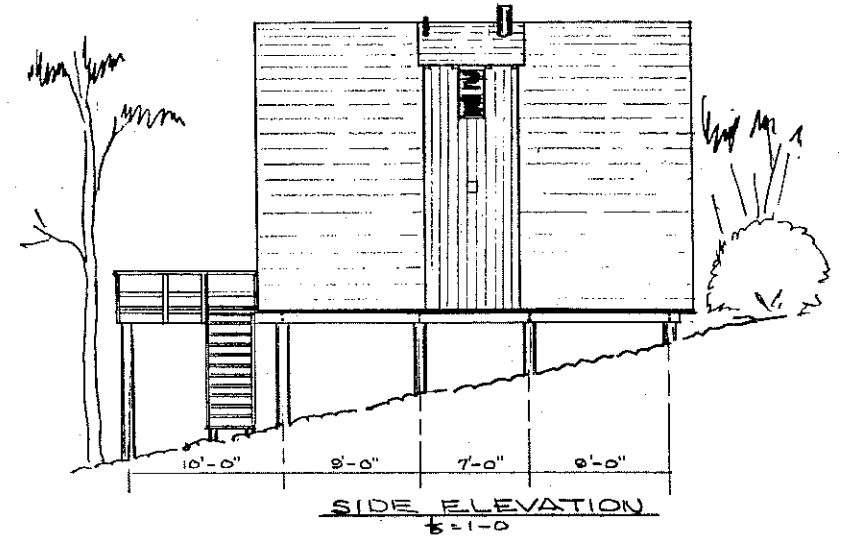
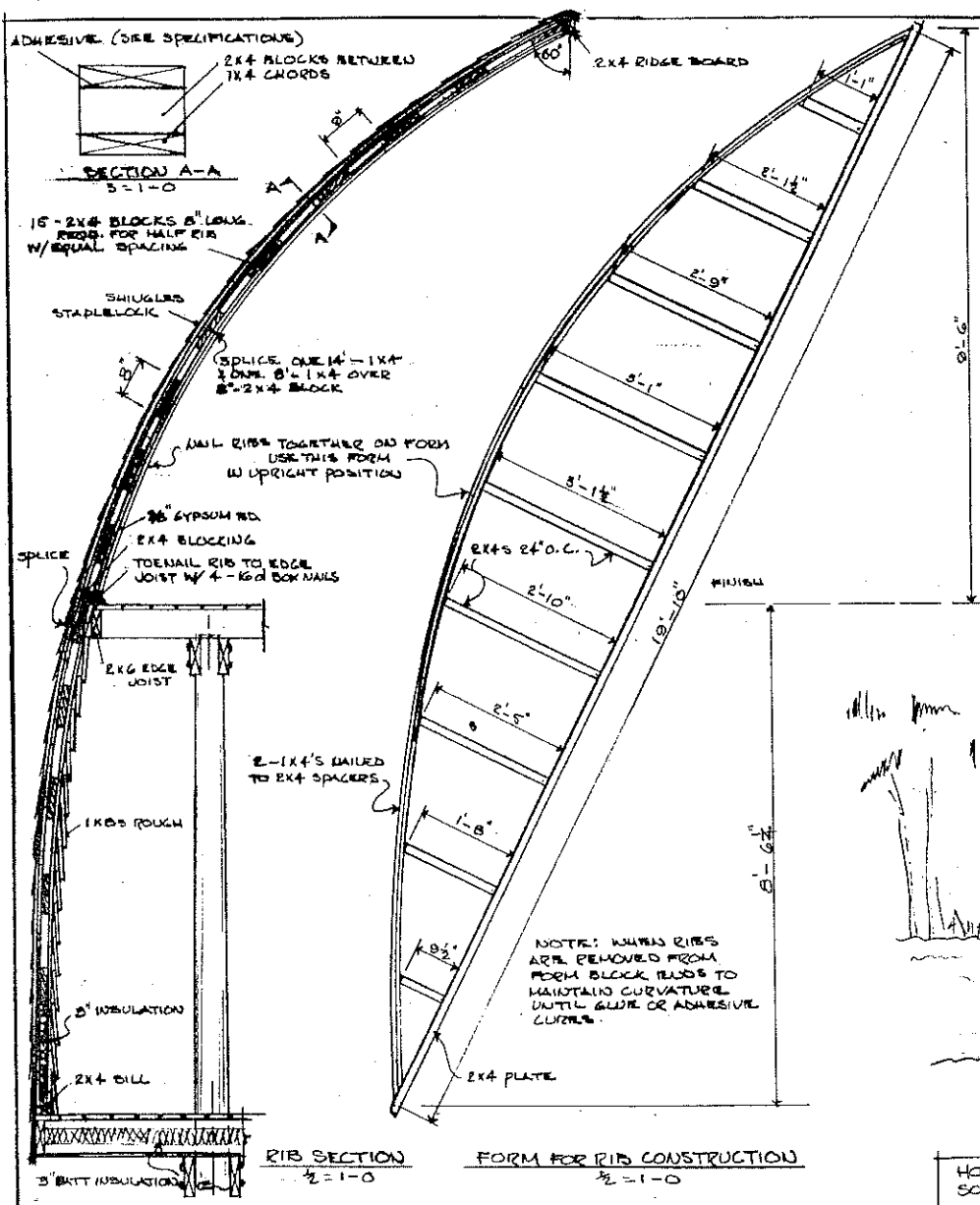


It is hoped that future changes in aesthetic design, room arrangements, and similar features will be made by architects and builders. The Athens Unit is not able to provide such service, nor is it involved in actual building, financing, approving, or other non-research activities.

Although the unique and experimental features may not be approved under some existing building codes, it is believed that the designs are safe and adequate.

Prospective builders should consult their local building officials for approval and local lending agencies for financial arrangements. No efforts by the Athens Unit have been made to seek approval by code authorities, or to determine acceptability for financing under various housing programs.

Technical questions on this design may be directed to the Housing Research Unit, Forestry Sciences Laboratory, Carlton Street, Athens, Georgia, 30601, phone: (404) 546-2445.

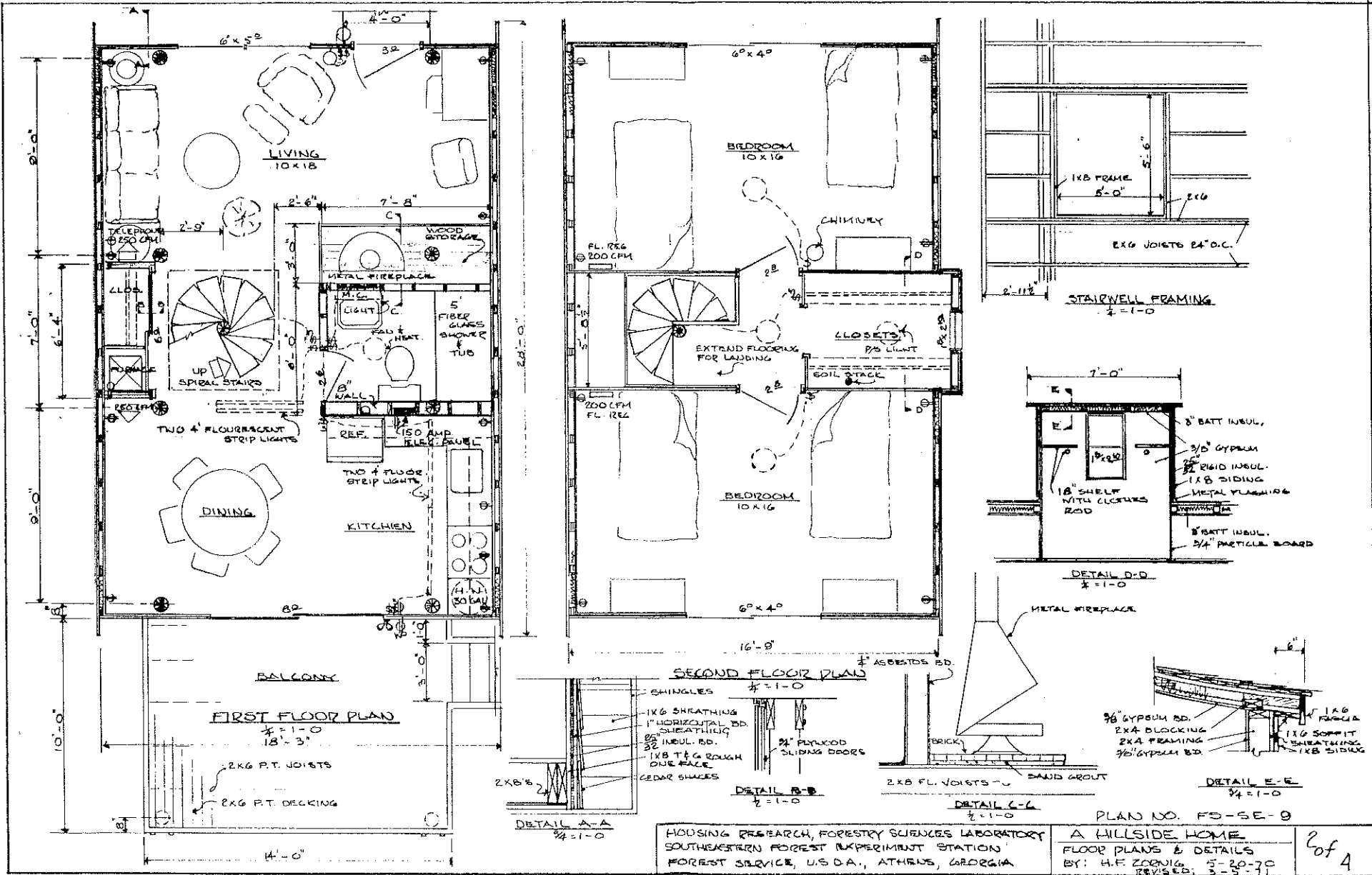


PLAN NO. FS-EE-9

HOUSING RESEARCH, FORESTRY SCIENCES LABORATORY
SOUTHEASTERN FOREST EXPERIMENT STATION
FOREST SERVICE, U.S.D.A., ATHENS, GEORGIA

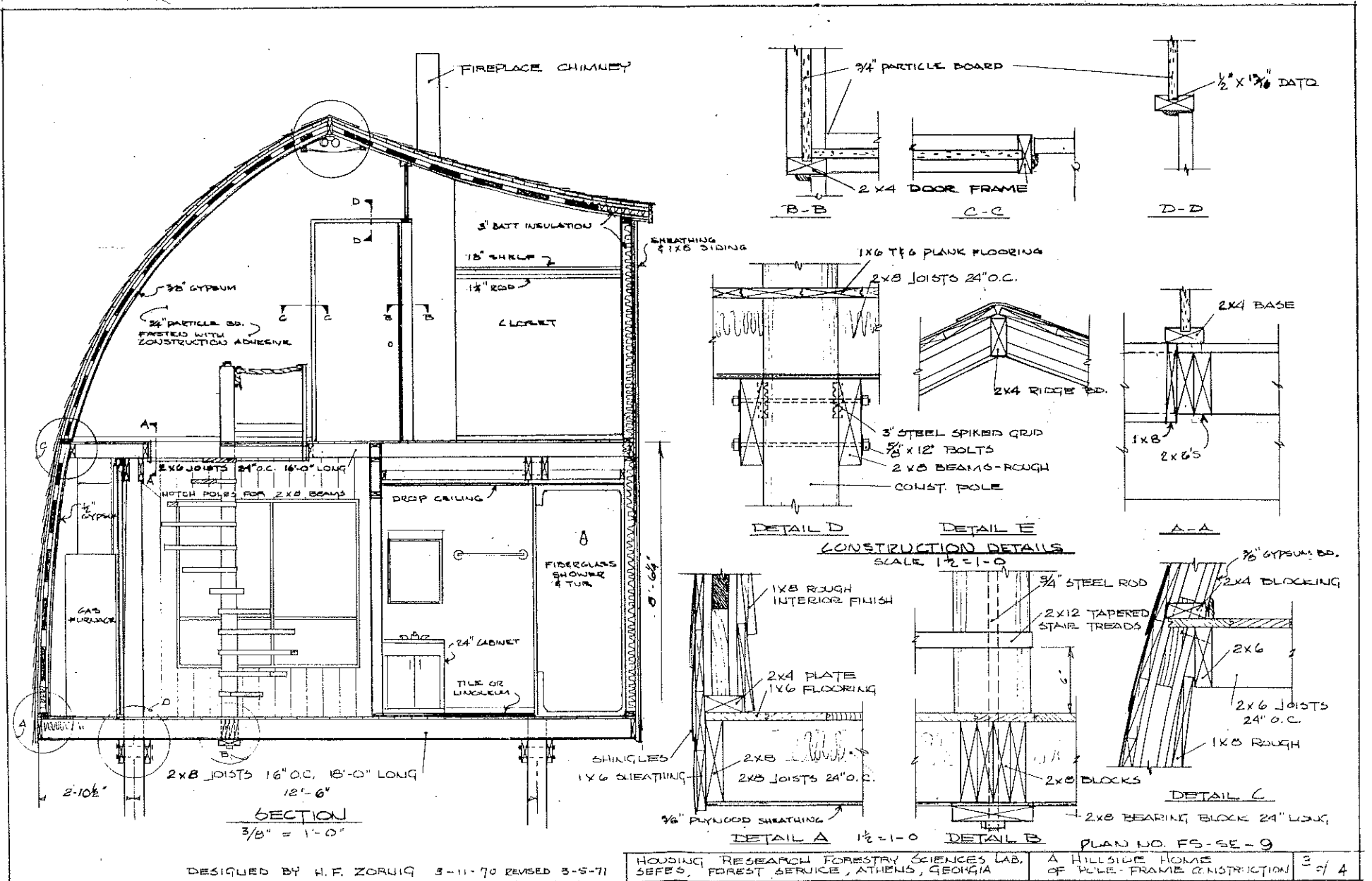
A HILLSIDE HOME
ELEVATIONS & CROSS SECTION
BY: H.F. ZORNIG 3-19-70

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HOUSING RESEARCH, FORESTRY SCIENCES LABORATORY
 SOUTHEASTERN FOREST EXPERIMENT STATION
 FOREST SERVICE, U.S. D.A., ATHENS, GEORGIA

PLAN NO. FD-SE-9
A HILLSIDE HOME
 FLOOR PLANS & DETAILS
 BY: H.F. ZOENIG 5-20-70
 REVISED: 3-5-71



FIREPLACE CHIMNEY

$\frac{3}{8}''$ GYPSUM
 $2\frac{1}{2}''$ PARTICLE BO. FINISHED WITH CONSTRUCTION ADHESIVE

3" BATT INSULATION

18" SHELF

14" ROD

2x8 JOIST

WEATHERING 1x6 SIDING

$\frac{3}{4}''$ PARTICLE BOARD

2x4 DOOR FRAME

$\frac{1}{2}'' \times \frac{3}{8}''$ DADO

B-B

C-C

D-D

1x6 T&G PLANK FLOORING

2x8 JOISTS 24" O.C.

2x4 RIDGE BO.

2x4 BASE

3" STEEL SPIKED GRID

$\frac{5}{8}'' \times 12''$ BOLTS

2x8 BEAMS-ROUGH

CONST. POLE

1x8

2x6's

DETAIL D

DETAIL E

A-A

CONSTRUCTION DETAILS

SCALE $1\frac{1}{2}'' = 1'-0''$

GAS HEURFACE

2x8 JOISTS 24" O.C. 16'-0" LONG

NOTCH POLES FOR 2x8 BEAMS

DROOP CEILING

FIBERGLASS SHOWER & TUB

2x4

24" CABINET

TILE OR LINOLEUM

SHINGLES

1x6 WEATHRING

$\frac{3}{8}''$ PLYWOOD SHEATHING

1x8 ROUGH INTERIOR FINISH

2x4 PLATE

1x6 FLOORING

2x8 JOISTS 24" O.C.

$\frac{3}{4}''$ STEEL ROD

2x12 TAPERED STAIR TREADS

$\frac{3}{8}''$ GYPSUM BO.

2x4 BLOCKING

2x6

2x6 JOISTS 24" O.C.

1x8 ROUGH

DETAIL C

2x8 BEARING BLOCK 24" LONG

DETAIL A $1\frac{1}{2}'' = 1'-0''$

DETAIL B

PLAN NO. FS-SE-9

DESIGNED BY H.F. ZORUIG 3-11-70 REVISED 3-5-71

HOUSING RESEARCH FORESTRY SCIENCES LAB. SEFES, FOREST SERVICE, ATHENS, GEORGIA

A HILLSIDE HOME OF PILE-FRAME CONSTRUCTION

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CONSTRUCTION NOTES^{1/}

A HILLSIDE HOME (FS-SE-9)

1. Pole foundation requirements will vary with soil conditions. A good source of information is a booklet on "Pole House Construction," available from the American Wood Preservers Institute, 2600 Virginia Avenue, N.W., Washington, D. C., 20037, at 50-cents a copy. The poles must be pressure treated with a suitable preservative for in-ground use, and should be stamped with the quality mark of the American Wood Preservers Institute. The stamp should be AWPI-CP-22. This will insure that the poles were adequately treated with a clean treatment. Trim only the pole ends that will be above ground.
2. Nail each floor joist to each 2 x 8 beam with at least two 16d nails, 8 per joist. This will anchor the house to the pole framing.
3. If the unsupported height of the poles under the house is over three feet, cross bracing to resist side sway will probably be needed. Two 3/8" galvanized steel cables crossed under the balcony end of the house, with turnbuckles for tightening, might be used, or the center four poles might be boxed in with walls to provide the necessary stiffening and additional storage as well.
4. Build a form out of 2 x 4's and 1 x 4's to use in nailing the ribs together (see sheet 1 of plans). The form should be braced and used in a vertical position to make nailing easier. Be sure to place some construction adhesive between the 1 x 4's and 2 x 4 blocks when nailing the ribs together. It will also be necessary to block the ends of the ribs when they are taken from the form until the adhesive cures. The blocks would be spaced in two rows, and the distance between the rows would equal the chord distance. Each rib should be trimmed to length before placing it between the blocks. It would also be wise to mark the location of the second floor on the rib while it is on the form. Use at least two 7d ring-shank nails to fasten each block to each 1 x 4.
5. A bead of construction adhesive is placed on each joist immediately before the flooring is nailed. The adhesive will make the floor stiffer and eliminate most squeaks; however, this is optional. Since the flooring is placed before the side and end walls, it is important that it be protected from rain. It should be covered with polyethene or canvas if rain or condensation is likely.

^{1/}These notes are provided as a guide for construction, in lieu of separate building specifications. Requirements for special materials are cited. Lumber grades are indicated in the Bill of Materials. In other cases, conventional materials as commonly used and accepted in good building construction may be used.

6. Install the end walls before the roof sheathing, and nail the first layer of interior vertical T&G boards to the floor joists and rib. Place the boards continuously across window and door locations and allow the boards to overlap the rib. Trim to the rib curvature after placing the planks. To complete the sandwich-type end walls, install the fiberboard insulation and horizontal board sheathing on the outer surface of the vertical planks, but don't cover the window and door openings. Saw out the window and door openings in the vertical interior planks when the windows and doors are ready to be installed.

7. When placing the roof sheathing, use a $\frac{1}{4}$ " bead of adhesive between the sheathing and the two end ribs. This adhesive will serve as caulking and should help to hold the sheathing along the rake in high winds.

8. If the board sheathing is placed in 36" high horizontal lifts on both sides of the house, the building paper and the shingles could be placed on each lift while working from the inside so that little scaffolding would be needed.

9. Sand the floors just enough to clean and level the surface. Sanding softwood floors should be done with the grain of the wood, and one sanding is adequate.

10. Interior finishing with stain and paint is optional. If the wood is kept clean during construction, very little finish would be needed. Be particularly careful with the round poles because they are difficult to clean, and the light green color of the treated wood would not need to be stained.

11. The exterior stain finish is a water-repellent preservative that will prevent mildew. A good exterior stain can be mixed in five gallon batches by mixing three gallons of mineral spirits, one gallon of boiled linseed oil, one gallon of pentachlorophenol (1:10 concentrate), $\frac{1}{2}$ -pound of household paraffin wax (melted), and about one pint of tinting colors. Stir the melted wax into the mineral spirits and then add the penta, linseed oil, and the tinting colors. A hand pump garden sprayer can be used to apply the stain.

12. To build the spiral stairway of wood, saw the column sections (stair risers) from the pieces that were trimmed from the extra long house poles. Use a band saw or a large circular saw. Number and match the risers according to size, and drill a $\frac{13}{16}$ " diameter hole through the center of each riser with a drillpress. Saw the tapered steps (treads) out of 2 x 12's. One tapered and rounded end of each tread should be about $\frac{1}{2}$ " wider than the column diameter. Drill a hole through the rounded end of each tread to match the hole in each riser.

Assemble the stairway risers and treads over a 3/4" steel rod. Bolt the entire assembly together with a nut on each end of the rod. Place construction adhesive between each riser and tread to increase column stiffness. Position each tread so that adjacent tread corners at the outer end are 1 1/2" apart when measured horizontally. If a handrail is desired, fasten a baluster between every two steps and place a screw eye in the end of each baluster to hold a rope handrail. The stairway landing is the top step. The landing can be made by sawing out the flooring if the flooring is laid across the stairwell. The edges of this landing should be reinforced with 1 x 8 boards and the tapered end placed between two column sections.

13. In most climates where damp conditions are likely to exist, and where non-durable species are to be used, preservative-treated lumber should be used for decks, stairs, and other uses, and shall be in conformance with the requirements of the American Wood Preservers Institute LP-2 Standard for Above-Ground Applications (AWPI Standard C-2). Each piece shall bear the appropriate AWPI quality mark.
14. There are no construction details in the plans on the exterior steps and railing. They might be constructed in several different ways. However, if the rough 2 x 8 stair stringers are used, the steps should be placed in 1/2" x 1 1/2" dado grooves that are cut into the stringers. The steps, stringers, railing, and posts are nailed together and to the balcony with 16 d aluminum nails. Support the bottom step and the stringers with two short treated-wood pole sections that are embedded 18" in the ground. These short pole sections are trimmed from the extra long house poles. Use a moisture-resistant adhesive in the joint between the steps and stringers.
15. Where a construction adhesive is indicated, use a good quality mastic-type adhesive, commonly available in cartridges for gun application. Neoprene-base adhesives are particularly suitable for such applications.
16. Materials and installation of wiring, plumbing, and heating, as well as for hardware, cabinets, and similar standard items are not prescribed here, but are included in the Bill of Materials. These should be selected on the basis of applicable local requirements and availability of suitable materials. Since such items are not matters of better utilization of wood, they are not detailed in this plan.

BILL OF MATERIALS AND COST ESTIMATES FOR THE HILLSIDE HOME (FS-SE-9)

The following bill of materials and material cost estimate are provided as guides. Local building codes and availability of materials may require some changes.

<u>ITEM</u>	<u>SIZE</u>	<u>NUMBER</u>	<u>UNIT COST</u> ^{1/}	<u>TOTAL COST</u>
Pressure Trd. Const. Poles Treated	25'	4	\$ 12	\$ 48
for in-ground use (See construction notes)	20'	4	10	40
	16'	2	9	18

Note: Poles are extra long to provide spiral stair risers and deck supports.

Concrete, 1/2 CY per hole		5cy	16/cy	80
1/2x6 Lag bolts for pole anchorage		30	15¢	5
2x8 Beams, rough, pressure treated, No. 2	20'	4	150/M	16
untreated	18'	8	100/M	24
untreated	10'	8	100/M	5
2x8 Stair stringers, rough, treated, No. 2	12'	3	150/M	8
2x6 Decking, pressure treated, No. 2	10'	32	180/M	58
2x6 Joists, pressure treated, No. 2	14'	8	180/M	20
2x12 Treads, pressure treated, No. 2	12'	5	180/M	22
2x4 Railing, window and door jambs, pressure treated, construction s.p.	14'	16	180/M	26

Note: 2x3 Posts for railing are sawn out of extra 2x6 joists.

2x8 Floor joists, No. 2	18'	18	150/M	65
2x6 Floor joists, No. 2	16'	20	150/M	48
2x6 Door jamb, No. 1	18'	1	180/M	3
2x4 Ridge, sills & blocking, const.	14'	9	150/M	12
	12'	4	150/M	5
2x4 Studs	8'	36	120/M	24
2x4 Door jamb, No. 1	14'	4	180/M	6
2x4 Rib blocking, utility or stud grade 6-10"		500	FREE	
1x4 Rib chords, No. 1 Southern pine	16'	28	180/M	27
1x4 Rib chords, No. 1 Southern pine	14'	56	180/M	85
1x6 or 1x8 Roof sheathing, T&G, No. 3 random		1420BF	130/M	185
15# Building paper		13SQ	1/SQ	13
Sawn Cedar shingles, No. 2, roof & end walls		19SQ	30/SQ	570
1x6 T&G softwood flooring No. 1		1000BF	200/M	200
1x8 End wall planks & interior part. T&G, rough one face, No. 2		1000BF	130/M	130
1x8 or 1x10 Rough planks, unsawn edges, interior paneling, No. 2		640BF	150/M	96
1x8 Shelving boards, No. 2	10'	3	150/M	10
2x12 Stair treads, No. 2	16'	2	180/M	12
3" batt insulation, foil one side, 24" width	2'	1612BF	50/M	81
25/32" fiber board insulation, end walls	4'x8'	560SF	50/M	28

^{1/}These costs are only for an initial estimate, and may vary considerably in various areas, and over a period of time.

<u>ITEM</u>	<u>SIZE</u>	<u>NUMBER</u>	<u>UNIT COST</u> ^{1/}	<u>TOTAL COST</u>
Plumbing fixtures: Lavatory w/faucet		1	\$ 25	\$ 25
Water closet		1	30	30
Floor drain w/trap		1	10	10
Shower head w/control		1	15	15
Kitchen sink w/fau- cets & drain basket		1	55	55
30-gal. base cabinet water heater		1	60	60
Rough plumbing: waste supply				100 75
Light fixtures & outlets:				
Lights & wiring		7	15	105
Exterior lights w/switches & wiring		2	20	40
115 volt wall outlets w/wiring		16	4	64
230 volt special outlets w/wiring		2	10	20
150 service entrance & panel w/150 amp. main breaker, two 230 V circuits & 4 115 V circuits				110
Finishes:				
Wood floors & stair treads: 2 coats of floor sealer-finish		5 gal.	6	30
Ceiling & closet: 1 coat floor sealer		4 gal.	6	24
Rough interior wood, paneling & exposed joists: 1 coat stain		8 gal.	6	48
Rough exterior wood & shingles: 1 coat preservative water repellent stain		16 gal.	4	64
Preservative treated exterior wood: unfinished		-	-	-
Exterior door & interior doors, 2 coats latex		1 gal.	6	6
Kitchen cabinets: stain, varnish or paint		1 gal.	5	5
Prefabricated shower and tub		1	250	250
1x2 Baseboard		75 ft.	10¢	8
Cove molding, 3/4"		208 ft.	10¢	21
Gas furnace, 2 wall registers, 2 floor registers & metal supply ducts		1	400	400
Miscellaneous				289
Total Estimated Cost of Material				\$4,600
Total Estimated Cost of Labor				3,500
TOTAL ESTIMATED COST				\$8,100

HOUSING RESEARCH
FORESTRY SCIENCES LABORATORY
SOUTHEASTERN FOREST EXPERIMENT STATION
CARLTON STREET, ATHENS, GEORGIA 30601

BY: H. F. ZORNIG

MAY 20, 1971

<u>ITEM</u>	<u>SIZE</u>	<u>NUMBER</u>	<u>UNIT COST</u> ^{1/}	<u>TOTAL COST</u>
5/8" plywood sheathing, CD, ext. glue, or 1/2" fiber board under joists	4'x8'	15	\$ 120/M	58
Metal closet rods	5'	3	20¢/ft.	3
3/4"x12'6" steel rod, threaded both ends, w/two nuts & washers		1	15	15
1/2"x9 bolts w/nuts & washers		20	25¢	5
5/8"x12 bolts w/nuts & washers		24	30¢	7
3"x3" steel toothed pole-beam connector		20	1	20
Nails: 25 lb/16d box, 10 lb/16d common				
5 lb/16d casing, 15 lb/10d box				
20 lb/10d casing, 15 lb/8d common				
15 lb/8d casing, 5 lb/8d finish		100 lbs.	15¢	17
16d aluminum, common		10 lbs.	1.50	15
10d galv. siding nails		15 lbs.	30¢	5
7d ring shank (ribs)		25 lbs.	30¢	8
6d ring shank (sheathing)		25 lbs.	30¢	8
1-1/4" galv. shingle nails or staples		25 lbs.	20¢	5
3/4" disk type nails for paper		5 lbs.	50¢	3
Flooring nails for flooring nailer		15 lbs.	1	15
36" Aluminum threshold, high rug type		1	4	4
3x4 Aluminum windows, double hung w/screen to be joined in pairs, provide connector		4	24	96
3x5 Aluminum windows, single hung w/screen joined in pairs, provide connector		2	28	56
1'8"x3' Aluminum window, double hung w/screen		1	25	25
2'4"x6'8" Interior door w/hardware		1	20	20
8'x6'8" Aluminum sliding door w/screen		1	120	120
3'x6'8" Exterior door w/glass inserts and hardware		1	35	35
2'8"x6'8" Interior door w/hardware		2	20	40
6'x8' Sliding closet door w/hardware		1	50	50
3/8" Gypsum board w/nails, cement and tape	4'x12'	864SF	50/M	44
Brick for fireplace base, 18SF		100	15¢	15
Cement grout, fireplace base		6-1/2cf	2/cf	13
Grout reinforcing wire mesh		20SF	10¢	2
1/4" Asbestos board, 4'x8" panel w/1x2 trim		32SF	30¢	10
Metal prefabricated fireplace(optional)		1	200	200
Construction adhesive, 1 qt. tubes, use for ribs, flooring, spiral stairs, and gluing sheathing to end ribs		24	2	48
3/4"x25" particle board, high density counter top material for partitions	16'	9	25¢/SF	36
Kitchen cabinets, 7' of base, 9'4" of wall		1		175