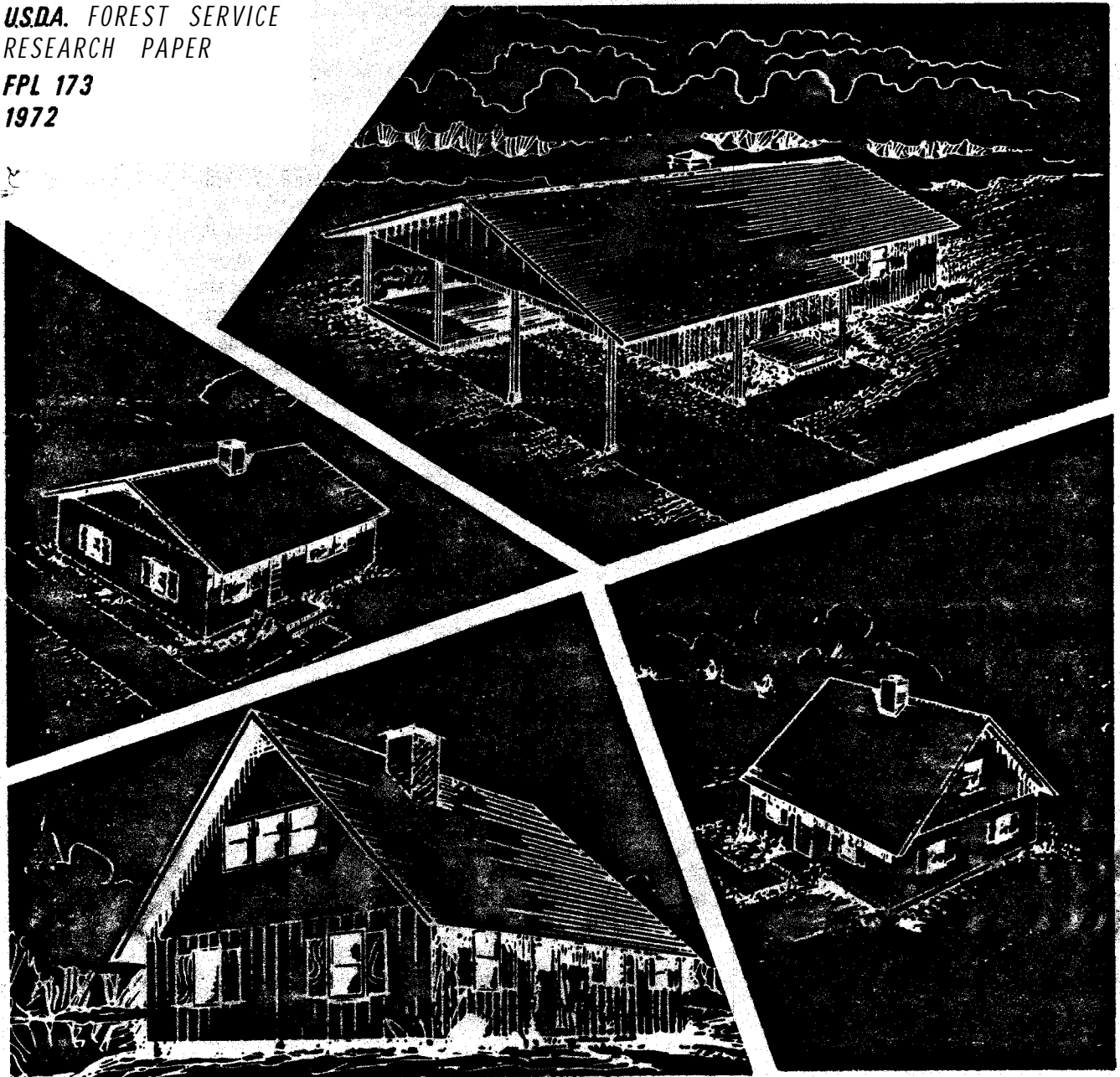


FPL DESIGNS MEET

FAMILY HOUSING NEEDS

USDA. FOREST SERVICE
RESEARCH PAPER

FPL 173
1972



U.S. Department of Agriculture, Forest Service, Forest Products Laboratory, Madison, Wis.

Abstract

The Forest Products Laboratory (FPL) has developed five house plans for low-cost rural houses to demonstrate cost-saving principles of construction. The plans feature simplicity of design, but provide structurally sound houses that fulfill the needs of many families.

To determine to what extent the plans were used, how they met the needs and the acceptance standards of low-income families, and how they could be improved, a questionnaire was mailed to 1,620 individuals who requested and were sent the FPL plans during 1969. A total of 1,129 responded. The replies indicated that 225 houses had been built and that 318 houses were planned for future construction. Ninety-three percent of the reported costs were less than \$12,000; 92 percent indicated incomes of less than \$7,000. In general, the survey results show that structurally sound houses can be built to meet the needs of low-income families at prices they can afford to pay.

This report should be useful to individuals and organizations concerned with low-cost houses. Builders who consider using the FPL plans should find the information particularly useful.

Acknowledgment

The author is indebted to Richard J. Klade of the Laboratory staff for assistance in formulating the questionnaire, in analyzing the responses, and for his helpful suggestions throughout the work.

FPL DESIGNS MEET

FAMILY HOUSING NEEDS

By

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**Forest Products Laboratory,¹ Forest Service
U.S. Department of Agriculture**

Introduction

Adequate low-cost housing is needed in both² urban and rural areas throughout the Nation. Most new housing is priced beyond the low-income family's purchasing ability. Rising costs of labor and materials are partly responsible, but much of the cost is due to large size, numerous amenities, ill-advised selection of materials, and adherence to traditional construction techniques.

Because a large percentage of substandard housing is in rural areas, the U.S. Department of Agriculture called on the Forest Service for help in improving rural housing. In response, the Forest Products Laboratory (**FPL**) designed five low-cost houses. The houses range from a **576-square-foot**, two-bedroom house for a small family, to a **1,404-square-foot**, story and a half, five-bedroom house for a large family with as many as 12 children. Floor plans for each of the five houses plus descriptive material are given in Appendix I.

Although detailed plans were developed for the houses, the primary objective was to demonstrate principles of construction that would reduce total

cost and be applicable in constructing almost any wood-frame house. The houses were to be **structurally** sound, well insulated, easy to maintain, yet simple in design and attractive. The designs include plans for installing plumbing, electrical wiring, and forced-air heating, and call for materials that are generally available in any rural area lumberyard.

Techniques to save costs, yet maintain strength and usefulness, were simplicity of design, optimum use of all living space, single-layer exterior wall and floor coverings, treated wood-post foundations, elimination of some interior doors between rooms and on closets and cabinets, and elimination of some nonstructural members. The houses meet all requirements for Federal Housing Administration and Farmer's Home Administration financing; they are not substandard. A manual³ was published to detail construction methods applicable to the five FPL houses and other wood-frame house design.

Although the designs and the manual provided the direction and technology for building wood-

¹The Laboratory is maintained at Madison, Wis., in cooperation with the University of Wisconsin.

²President's National Advisory Commission on Rural Poverty. The people left behind. U.S. Government Printing Office, Washington, D.C. 20402. 1967.

Anderson, L. O. Low-cost wood homes for rural America--Construction manual. Agr. Handb. 364. U.S. Dep. of Agr., Forest Serv. 1969.

frame houses, construction costs and how the houses met the needs of families who occupied them were not known. During the first year (1969) the plans were available, 1,620 persons requested and received sets of working drawings and specifications. To determine how plans were used,

how they met the needs and acceptance standards of low-income families, and how they could be improved, a survey questionnaire was sent to all who received the plans. This report presents results of the survey.

Response to Survey

The survey questionnaire and the cover letter are reproduced in Appendix II. The number of answers received to each question is shown on the questionnaire. The questionnaire was answered and returned by 663; 30 questionnaires were returned by the post office as undeliverable.

Six weeks after the first mailing, a followup questionnaire was sent to those who had not replied. An additional 466 questionnaires were then answered and returned; thus of the 1,620 questionnaires, a total of 1,129 replies was received.

Analysis of Survey Response

Replies to the questionnaire showed that 225 houses were built from the FPL plans. Fifty-eight replied that the plans were being used for instructional purposes in high school and college classes and in university extension programs. The survey response is summarized in table 1.

Of those who indicated they had not built, 318 stated they still intend to build and will use the plans. A leading reason for not building was difficulty in finding a contractor who would build according to the FPL plans. Some contractors were reported reluctant to be associated with low-cost houses. About one-half of those who did not build replied they ordered the plans for information only.

Replies from those who built houses are discussed under several categories. Not all questions were answered; thus, percentages quoted from the survey are based on the number of replies received to a particular question.

Location of Houses

In the survey, locations were classified as (1) rural area or city under 5,500 population and (2) city larger than 5,500 population. The results show that of the houses built, 47 percent were rural and 53 percent, city. Two builders were

largely responsible for the high percentage of houses in cities, a Wisconsin builder with 43 houses and a Texas builder with 60 houses,

Builder and Owner

The FPL houses were designed for simplicity of construction to reduce cost; this provided an additional benefit, the possible use of "selfhelp." Ten percent were reported built by the owner who participated in some phases of construction. Eighty-seven percent were reported built by contractors for speculative purposes; 3 percent, by contract for an individual.

The houses were designed to improve living conditions for low-income families; thus knowing the income level of the owners was important. Thirty-four percent reported an income of less than \$3,500 per year (considered poverty level at time of the survey). Fifty-eight percent were in the \$3,500 to \$7,000 per year income group. Thus, 92 percent had incomes of less than \$7,000, the upper limits of low-income classification.

The suitability of the FPL designs for vacation homes has been recognized since they were developed. To determine whether the house plans were used to improve housing for low-income families or to provide second homes for the more

affluent, a question: on use of the house was included in the survey. Only 5 percent of the houses were reported used for second homes. Four percent were built for rental purposes, and these were probably the one home of a family.

Characteristics of Houses Built

In cold climates, many of the houses were constructed on full basements. Of the foundations reported, 32 percent were basement; 56 percent, wood post; and the remaining equally divided between concrete slab and masonry with crawl space.

The Texas builder of 60 houses left floors unfinished because buyers preferred to install floor tile themselves. Thirty-three percent of those reporting had finished wood floors: 13 percent, carpeted floors; and 19 percent, tile.

Replies indicated most houses had finished, kitchen cabinets and doors on bedrooms. Front porches were added to 50 percent of the houses; rear porches, to 20 percent. Shutters were added to 31 percent of the houses, indicating that decorative trim was considered of some importance. Skirtboards were added in 54 percent of the houses with post foundations (Examples of houses built from FPL plans are shown in figures 1-7).

Valuation of Houses

Although space for various living functions was generally reported as adequate, about half replied that storage space was inadequate. A number commented on the living space in Plan FS-FPL-2. Although bedrooms in this plan will accommodate 12 children plus parents, the kitchen,

dining, and living room were considered too small for such a large family. A need for doors on bedrooms and on kitchen cupboards was indicated by the number who responded that they had added the doors.

The appearance of the houses was generally acceptable; only 6 percent who built rated appearance below average. Six respondents who did not build objected to appearance.

All who replied considered ease of maintenance average or better. Few suggested changes if the houses were again built. Some suggestions applied only to a particular locality. Some builders in warm climates suggested wider overhangs and larger porches. Others suggested using metal roofing. A large-scale builder felt that partial prefabrication would be beneficial to reduce cost. Some builders of the story and a half houses suggested that the stairs be moved from the kitchen. A builder who made a number of changes stated if he were building again, he would follow FPL specifications exactly,

Cost of Houses

Costs varied widely with geographical location and with type of foundation and other options. Cost ranged from \$2,000 for materials only for the smallest house (FPL-3) to \$18,000 for an FPL-4 house with many extras. Ninety-three percent reported costs were less than \$12,000. Table 2 includes representative costs reported for houses from each of the plans. The type of foundation is listed for each house, because it has a major influence on cost. Other variance from the basic plan is also listed, except that bedroom doors and finished kitchen cabinets are assumed used unless otherwise noted.

Summary

Response to the survey questionnaire showed that houses have been built from the FPL plans at various locations. Reported costs were generally far below those for conventionally built houses. This indicates that functional, structurally sound houses can be built at prices low-income families can afford. Thus, FPL houses basically simple in design and easy to construct meet the needs of low-income families.

Plan Source

Working drawings and specifications for the Forest Products Laboratory low-cost houses are available at nominal cost from the U.S. Government Printing Office. A brochure, 'Designs for Low-Cost Wood Homes,' can be purchased for 25 cents per copy from the Superintendent of Documents, Government Printing Office, Washington, D.C. 20402. The brochure contains an order blank for complete sets of plans,

Table 1.--Response to questionnaire

Questionnaires sent	Replies	Not delivered	Houses built from plan	Used for Instruction	Intend to build later
INITIAL MAILING					
1,620	663	30	145	42	210
FOLLOWUP MAILING					
905	466	--	80	16	108
TOTAL					
--	1,129	30	225	58	318

Table 2.--Cost of houses constructed from FPL plans

Number built	Location		Type of foundation	Cost per house	Variance from basic house plan
	State or province	Rural or urban			
PLAN FS-FPL- 1 (24 feet by 32 feet, 1 story, 3 bedrooms)					
20	Texas	Urban	Wood posts	\$ 4,500	Some unfinished floors, aluminum windows, and metal cabinets
	Wisconsin	Rural	Wood posts	6,400	Porch, carport, tiled bath and kitchen counters, and fireplace
16	Alberta	Rural	Basement	8,644	Double-layer floor, cedar siding, shutters, bifold closet doors, 90,000 6.t.u. furnace, and humidifier
	Wisconsin	Rural	Concrete block foundation	9,600	Two picture windows and fireplace
	Wisconsin	Rural	Concrete block basement	10,030	Masonry chimney, wood-coal burning furnace, and switched lights in bedrooms
	Iowa	Rural	Basement	12,200	
	Wisconsin	Rural	Concrete slab	12,500	Includes city lot, 6- by 8-foot utility room, water softener, vented range hood, thermopane window, and hookup for city water and sewer
PLAN FS-FPL-2 (24 feet by 36 feet, 1-1/2 story, 5 bedrooms)					
	Massachusetts	Rural	Basement	9,000	Two baths
	Wisconsin	Rural	Poured concrete crawl space	11,400	Two-layer floor system, boxed eaves, driven well, and septic system
	Wisconsin	Rural	Basement	13,700	Water and sewer hookup
	Indiana	Rural	Basement	15,000	Double garage, fireplace, and two baths
7	New York	Rural	Concrete slab	15,000	Carpeting and shutters
	Wisconsin	Rural	Poured concrete basement	15,200	Well and septic system

Table 2.--cost of houses constructed from FPL plans.--Cont.

Number built	Location		Type of foundation	Cost per house	Variance from basic house plan
	State or province	Rural or urban			

PLAN FS-FPL-3
(24 feet by 24 feet, 1 story, 2 bedrooms)

1	Pennsylvania	Rural	Concrete slab	2,000	Materials only. Some used lumber. Unfinished floors
1	Texas	Rural	Wood posts	2,690	Skirtboard. Partly self help
1	Wisconsin	Rural	Poured concrete	5,300	Cost for materials plus well and septic tank. Fiberglass tub-shower unit. Paneling on most walls
7	Arizona	Rural	Masonry with crawl: space	6,000	
1	Wisconsin	Rural	Masonry with crawl: space	7,074	Drilled well and septic system. \$300 for grading. No carport
1	Wisconsin	Rural	Basement	8,000	
1	Wisconsin	Rural	Wood posts	8,500	Carpeting in two rooms
1	Wisconsin	Rural	Concrete block basement	8,500	Horizontal, lap siding, boxed cornice. No carport
1	Wisconsin	Rural	Wood posts	8,560	Carpeting in three rooms

PLAN FS-FPL-4
(24 feet by 32 feet, 1-1/2 story, 4 bedrooms)

1	New York	Rural	Basement	6,000	Materials only. Volunteer labor
1	Rhode Island	Rural	Masonry with crawl: space	9,674	1-1/2 baths, carpeting in 6 rooms and in baths, electric heat
1	New Hampshire	Rural	Basement	18,000	Finished wood floors, fireplace, electric heat

P L A N FS-FPL-5
(24 feet by 28 feet, 1 story, 2 bedrooms)

1	Alaska	Rural	Wood posts	2,300	Materials only. No plumbing, heating, or electrical. Increased pitch of roof to provide sleeping loft. All floors unfinished.
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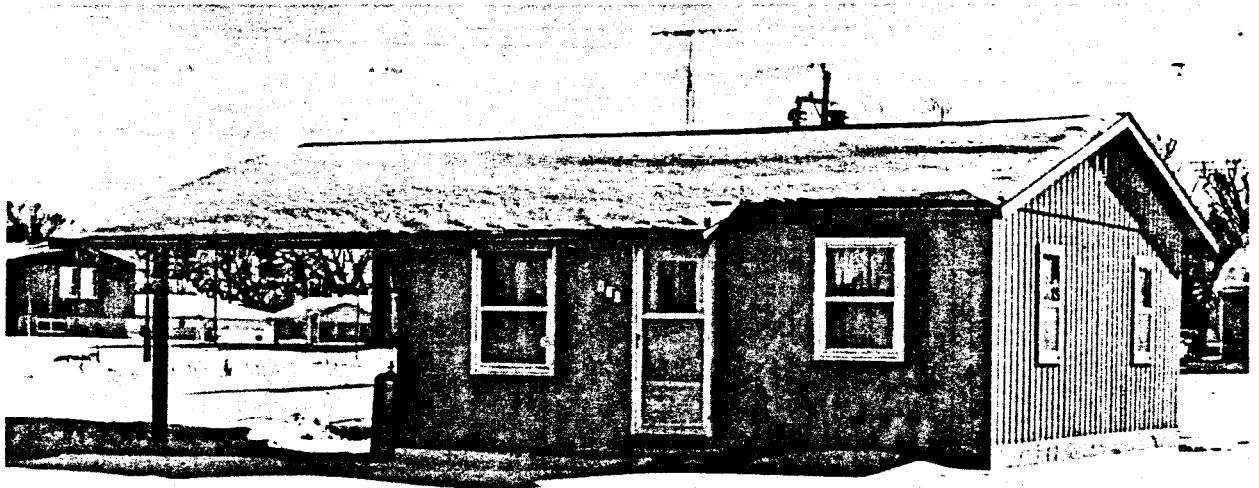


Figure 1.--Two-bedroom house on preservative-treated wood-post foundation from plan FS-FPL-3. Contract price, excluding lot, \$8,500, included finished kitchen cabinets and 1 linen closet, carpeting in two rooms, and vinyl-asbestos tile in remainder of house. M 137 424-4



Figure 2.--Two-bedroom house on concrete block foundation from plan FS-FPL-3 without carport. Built by an area contractor with financing guaranteed by Farmers Home Administration. Cost, excluding lot, \$7,074.20, included septic tank, drilled well, and \$300 for grading. M 137 179

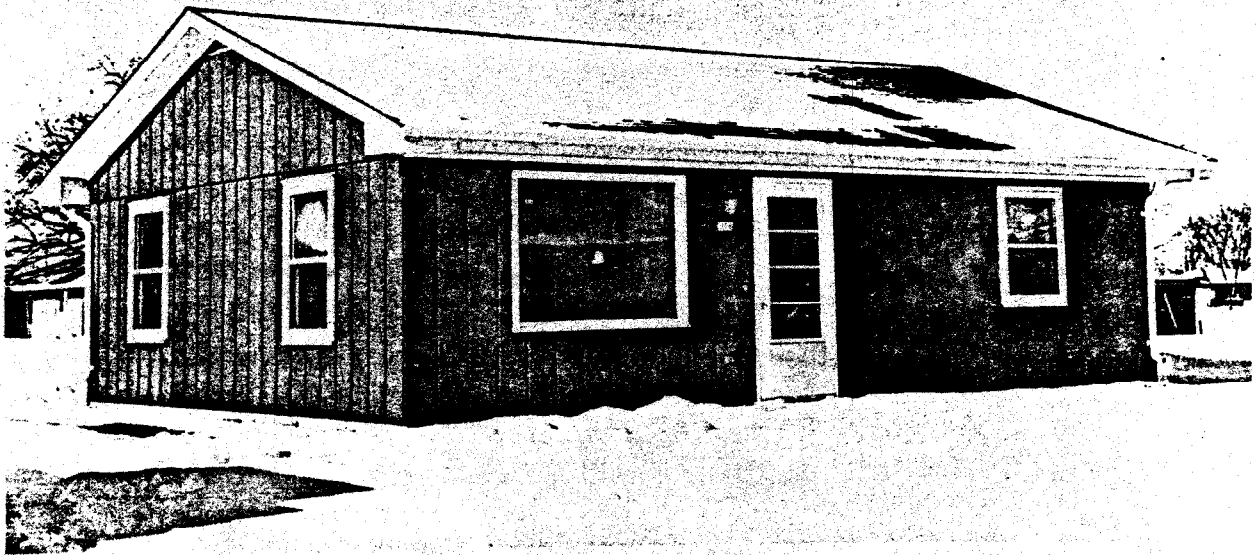


Figure 3.--Two-bedroom house from greatly modified plan FS-FPL-1 built in small city for sale. Sale price, including lot and Improvements, was about \$12,500. House has 6- by 8-foot utility room, 200-ampere electric service, automatic water softener, disappearing stairway to attic storage, vented range hood, thermopane window, and boxed cornices. Some of work by builder-seller. M 137 353-1

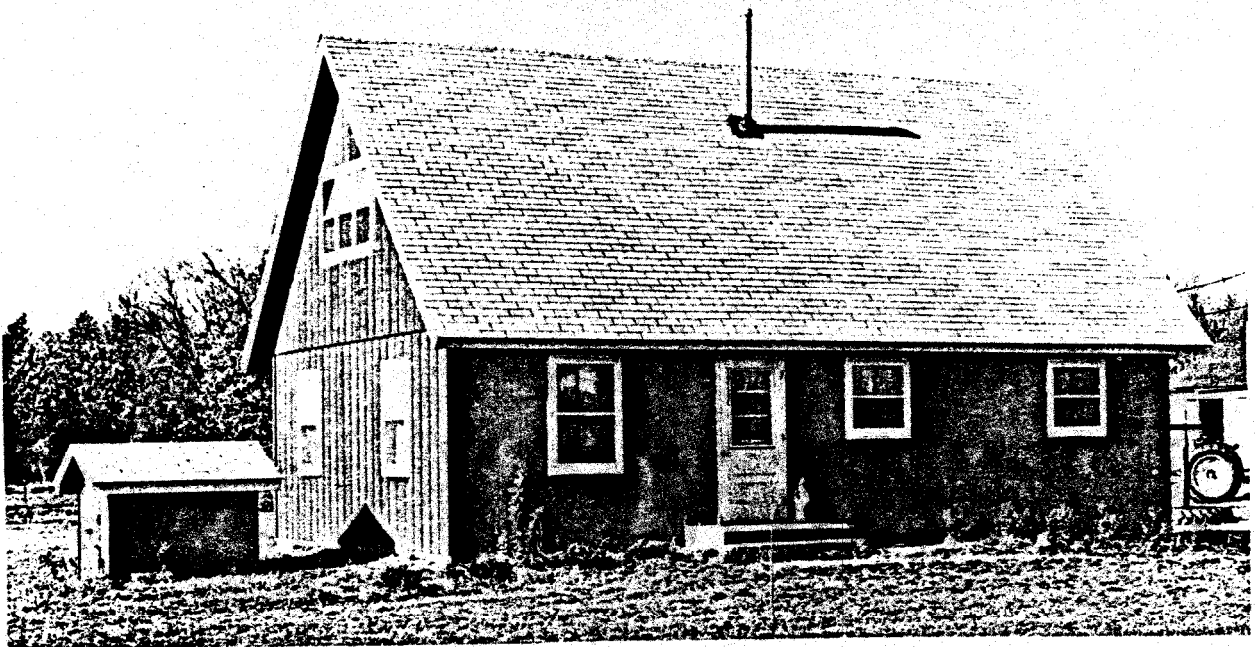


Figure 4.--Five-bedroom house on poured concrete foundation from plan FS-FPL-2 built by area contractor for rural family with nine children at home. Financing guaranteed by Farmers Home Administration. Contract price, approximately \$11,400, included finished kitchen cabinets, two-layer floor, and boxed eaves, (Small structure on left is a pumphouse.) M 139 775-2A

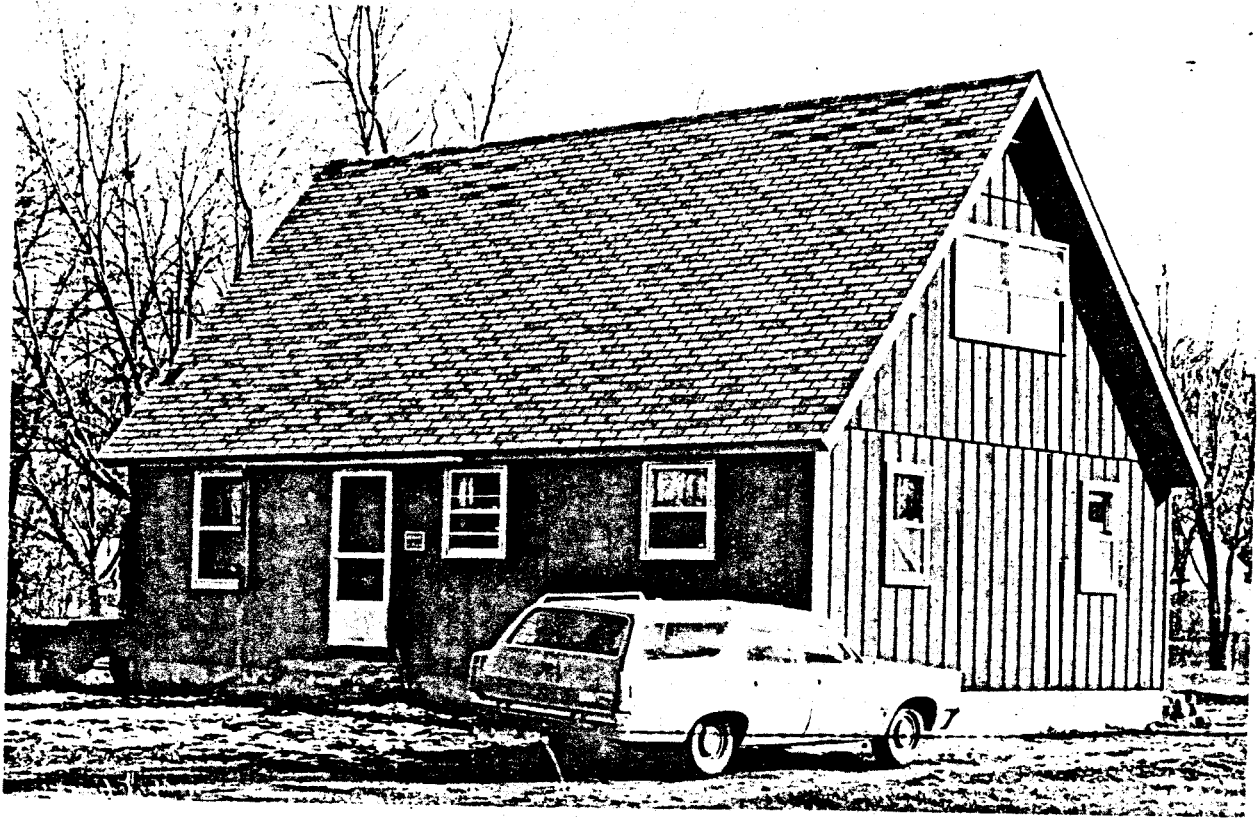


Figure 5.--Five-bedroom house on poured concrete basement from plan FS-FPL-2. Contract price inclusive of septic tank and city water hookup was \$13,700.

M 139 775-12A

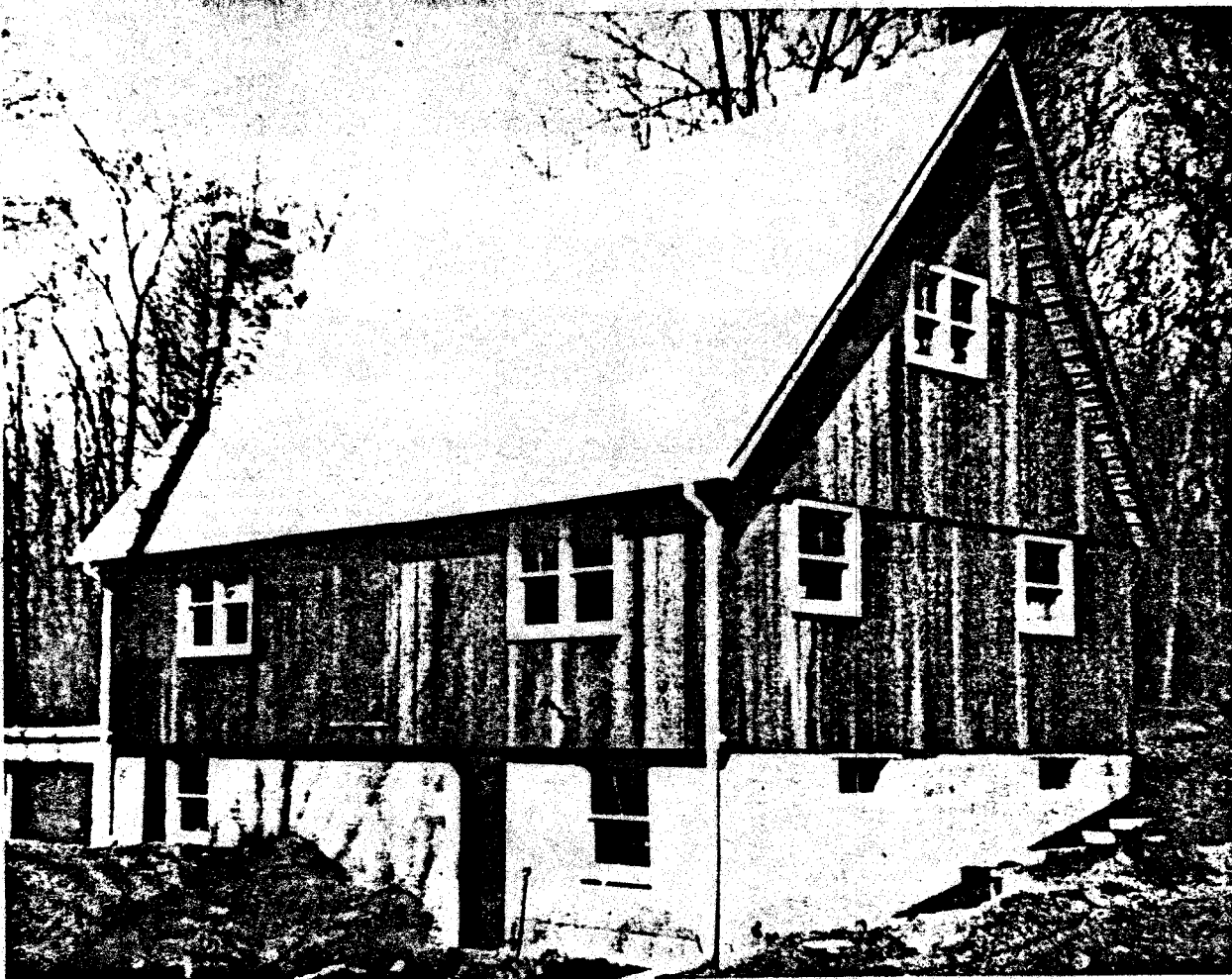


Figure 6.--Five-bedroom house on full basement from plan FS-FF'L-2. Total cost of the house, inclusive of double garage, fireplace, and two baths, was 815,000.

M 139 803



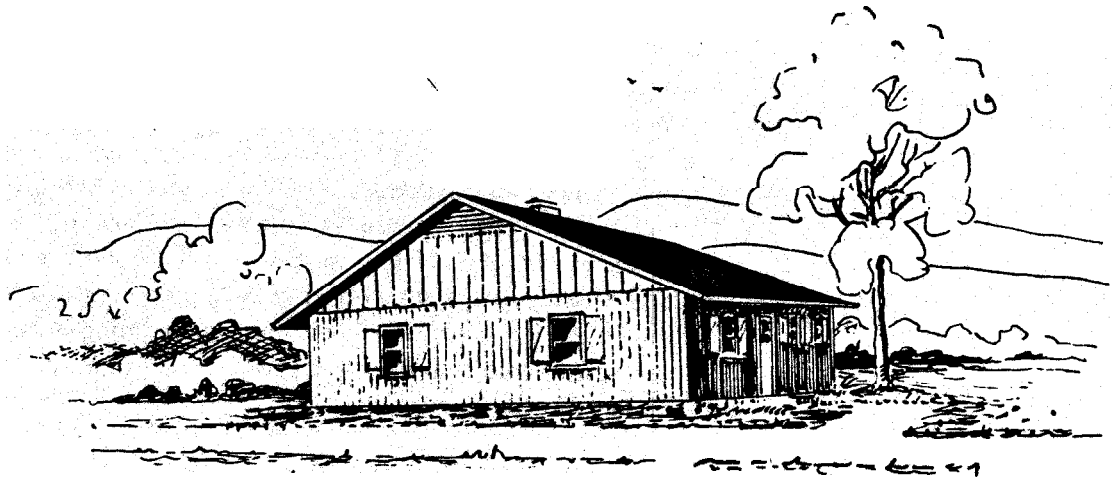
Figure 7.--Two-bedroom house on wood-post foundation from plan FS-FPL-5 modified for a vacation house. Built by owner with a materials cost of \$2,300, exclusive of heating, plumbing, or electrical systems.

M 139 802

APPENDIX I

Fact Sheets for Five FPL Low-Cost Houses

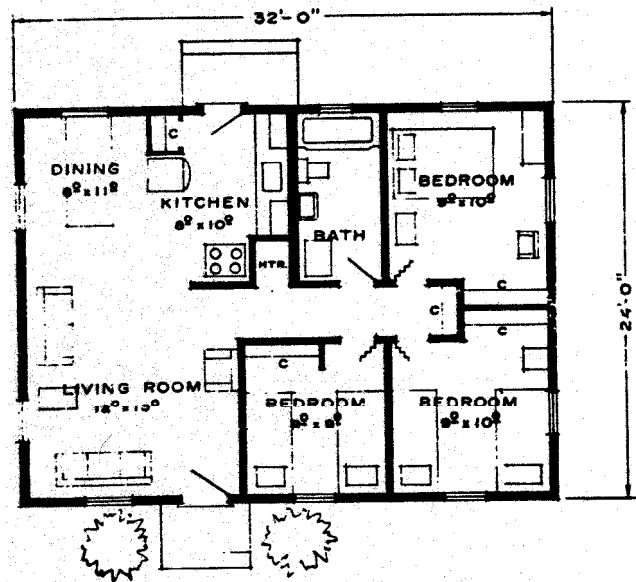
U. S. Department of Agriculture • Forest Service • Research



house plan no. FS-FPL-1

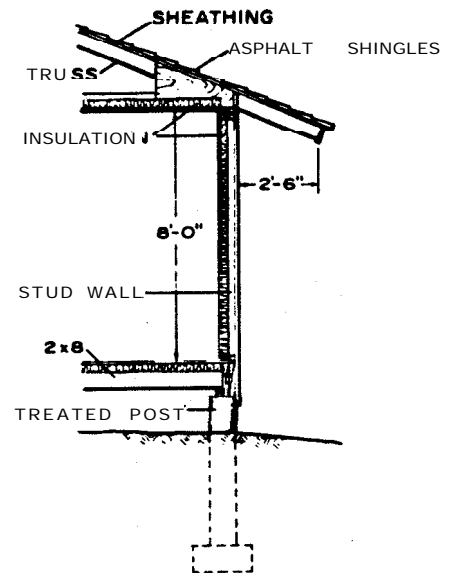
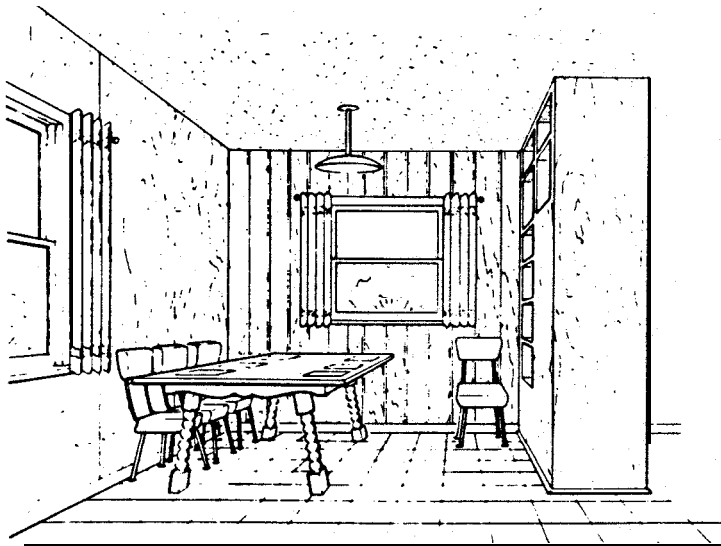
This house (FS-FPL-1) was developed to provide a good livable home for a cost much lower than most houses now being constructed. It is 24 by 32 feet in size and contains 768 square feet of living area. In spite of its relatively small size, this home has three bedrooms, affording desirable privacy for a family with 3 to 5 children. There is little waste space and the bath and kitchen, as well as the living room and dining area, are conveniently arranged. The plan was developed by the Forest Products Laboratory of Madison, Wis., and is one of a series for low-cost houses of wood being designed by the Forest Service, U.S.D.A.

AREA • 768 sq. ft.



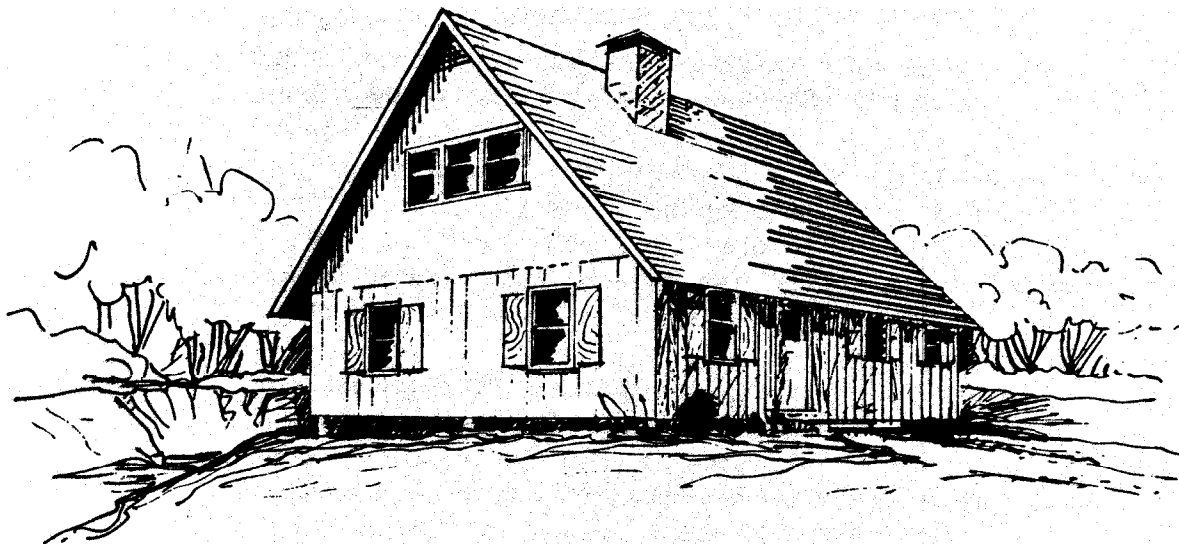
This crawl-space house has a treated wood post foundation which reduces the cost without reducing its performance. It can be constructed on sloping sites without costly grading and masonry work. Most of the materials used can be obtained at local lumber yards or small local mills.

The panel siding exterior and trim are finished with long-lasting stains which can be obtained in many contrasting colors. The wide overhangs at the cornice and gable ends provide a good appearance as well as excellent protection for the side walls. Insulation in the walls, floors, and ceiling reduce heating costs as well as providing a cool house during the hot summer months. The open living-dining-kitchen area, gives a feeling of spaciousness not possible when walls separate these rooms.



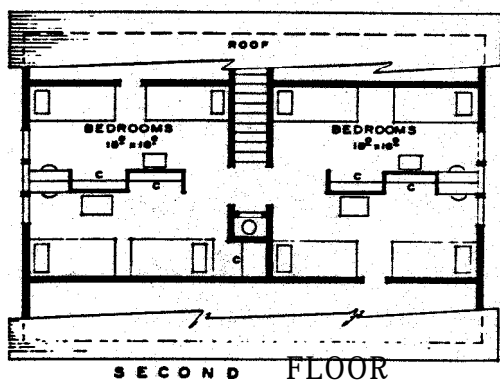
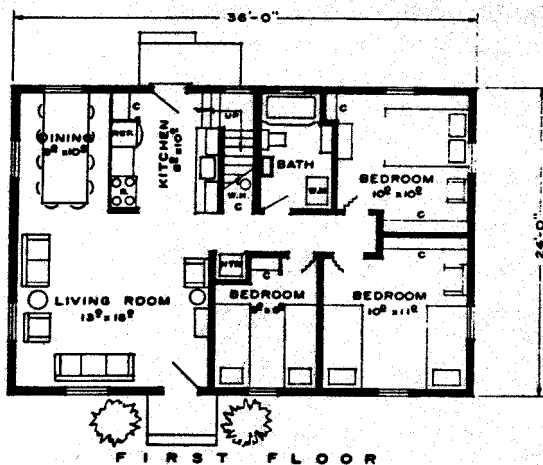
DINING ROOM

Forest Products Laboratory/P.O. Box 5130/Madison, Wisconsin 53705



HOUSE PLAN NO. FS-FPC-2

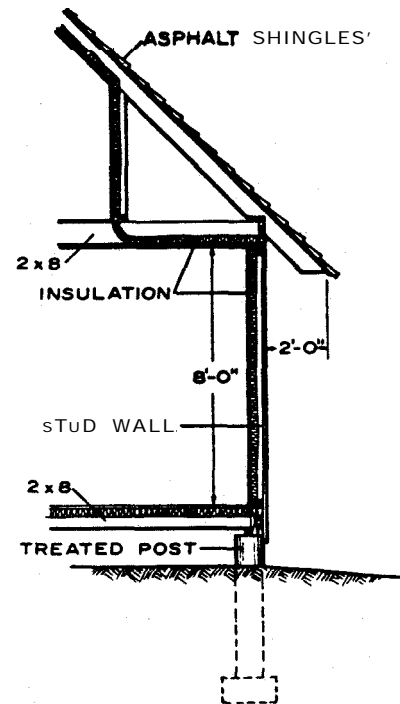
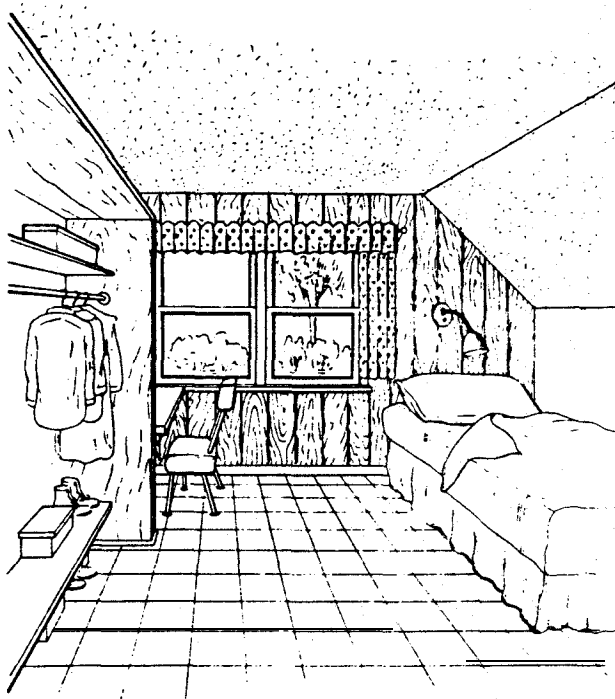
This home (Plan FS-FPL-2) was developed for a large family of up to 12 children at a reasonable cost. It is 24 by 36 feet in size and is one and one-half stories. The first floor has 864 square feet, consisting of three bedrooms, a bath, and a living-dining-kitchen area. The second floor contains about 540 square feet and consists of two large dormitory-type bedrooms. Each is divided by a wardrobe-type closet which, in effect, contains space for two single beds on each side. The plan was developed by the Forest Products Laboratory of Madison, Wis., and is one of a series of low-cost houses of wood being designed by the Forest Service, U.S.D.A.



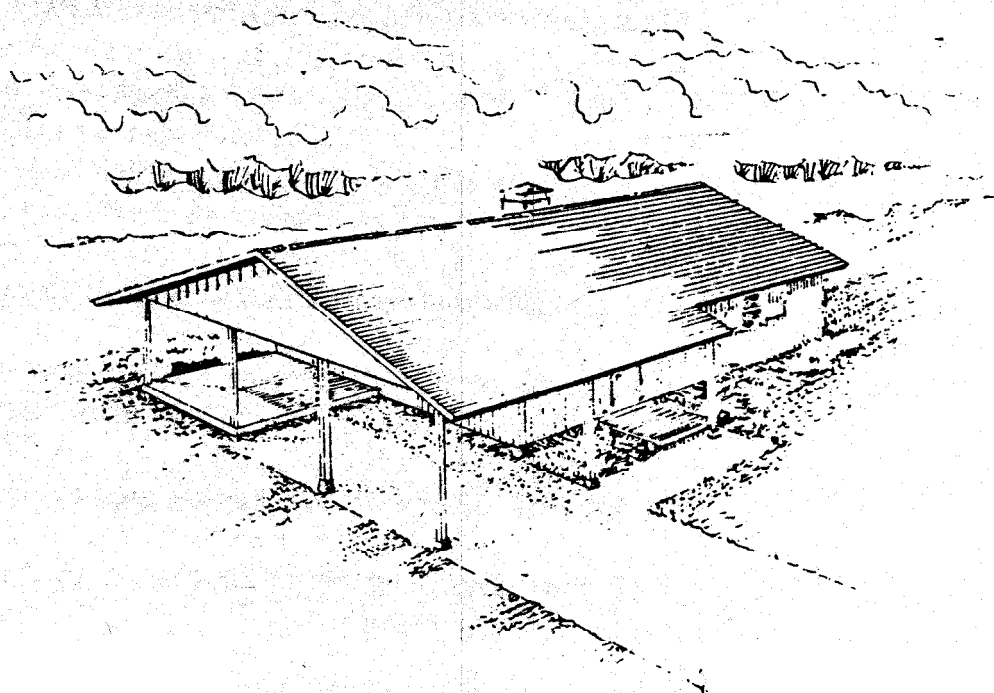
The design features which aid in reducing the cost and in providing maximum space for the overall size are (a) the treated post foundation with a crawl space and (b) the steeply sloped roof. The long-lived treated foundation posts can be installed with little or no costly grading and leveling. They serve as a rugged base for the beams and joists of the floor system. The one-half pitch (12 in 12 slope) roof with a 4-foot-high knee wall encloses two large 15- by 16-foot dormitory bedrooms. Windows are installed at the gable ends of the second floor.

The panel siding on exterior walls and the trim and shutters are finished with a pigmented stain which can be obtained in a variety of colors for contrast. The wide overhangs at both the gable ends and the cornice provide desirable protection to the side and end walls. Floors, walls, and ceiling are insulated to reduce heat loss. The thickness of this insulation can be varied, and the amount usually depends on whether the house is located in the northern part of the United States or in a milder climate.

SECOND FLOOR BEDROOM

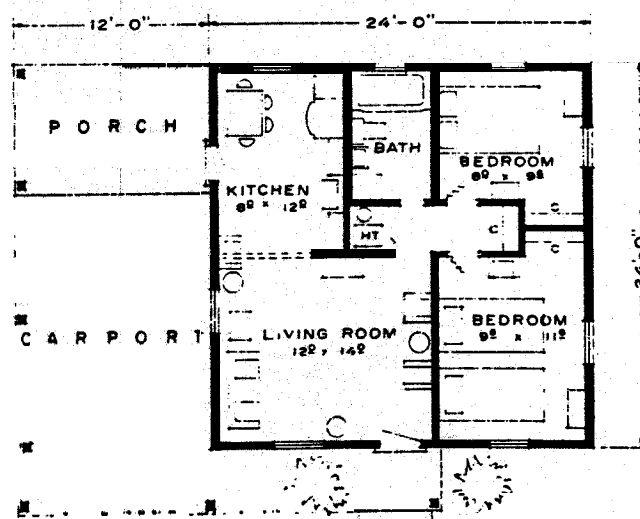


Forest Products Laboratory/P.O. Box 5130/Madison, Wisconsin 53705



houseplan no. FS-FPL-3

This house plan (FS-FPL-3) was developed to serve a small family or senior citizens who require only one main bedroom and a spare room which can serve as a sewing room, workroom, or also as a second bedroom. The kitchen and living room are open with a drop beam between them. The main house is 24 by 24 feet in size and has 576 square feet of living area. As shown in the plan, an 8- by 12-foot porch is included as well as a carport. When a minimum house is desired, the porch and the carport can be eliminated. The plan was developed by the Forest Products Laboratory of Madison, Wis., and is one of a series for low-cost houses of wood being designed by the Forest Service, U.S. Department of Agriculture.



AREA - 576 sq. ft.



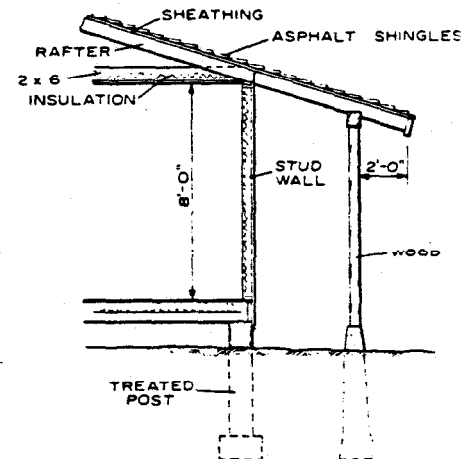
foundation which reduces the cost of the house without reducing its performance. This type of house can be constructed on a sloping lot, eliminating costly grading which is normally necessary for houses with other designs,

The floors, walls, and ceilings are well insulated, insuring comfort both winter and summer. The small forced-air heating unit can be either the oil or the gas-fired type. The bathroom contains space for a small washing machine. Closet space is sufficient for a small family. More storage area can be provided by the installation of small plywood wardrobes in the bedrooms.

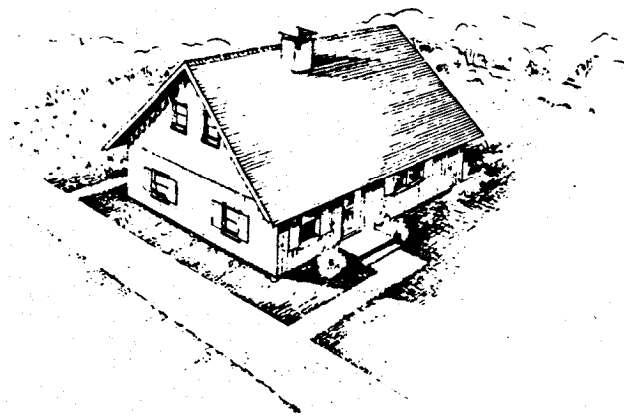
The panel siding and other exterior wood can be finished with a pigmented stain. These materials are not only easily applied, but they are long lasting. Many colors are available. The interior has a gypsum board wall and ceiling finish which are painted. In addition, the bath and part of the living room walls have prefinished plywood for a desirable contrast.



KITCHEN



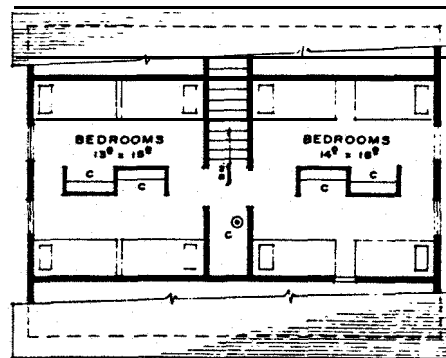
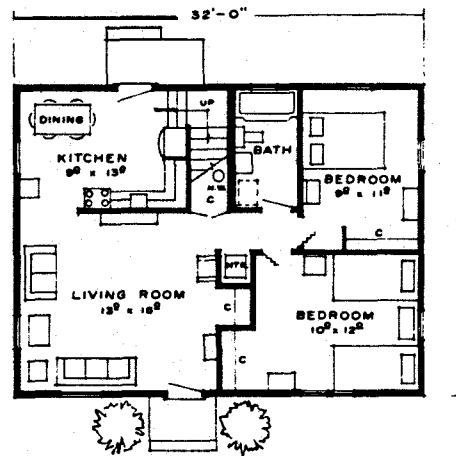
SECTION



house plan no. FS-FPL-4

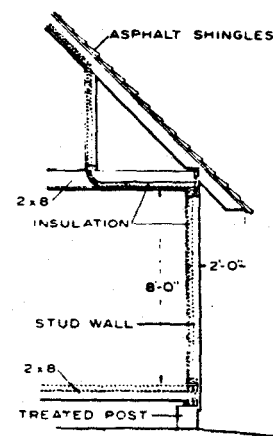
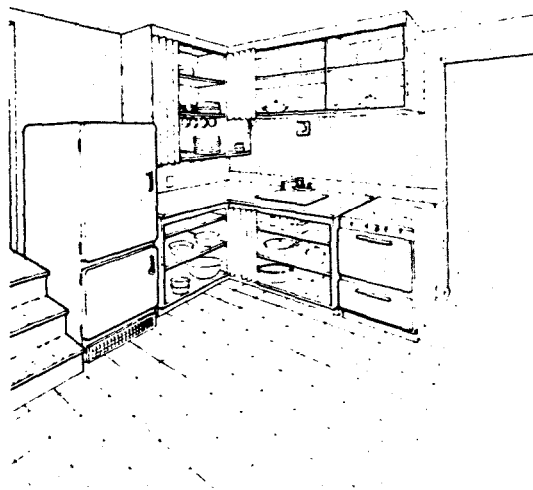
This home (Plan FS-FPS-4) is an expandable type. With its steeply pitched roof, there is more than adequate space on the second floor for two dormitory-type bedrooms, which can accommodate up to eight children. The working drawings also provide for an additional bath on the second floor if it is desired. The house is 24 by 32 feet in size with an area of 768 square feet on the first floor and about 460 square feet of usable space on the second. The first floor contains a moderate-size living room, a compact kitchen with a large adjoining dining area, two bedrooms, and a bath. Storage space is adequate with four closets on the first floor and five on the second. The first-floor bath is arranged to accommodate a washing machine,

This home was developed by the Forest Products Laboratory of Madison, Wis., and is one of a series of low-cost houses of wood being designed by the Forest Service, U.S.D.A.

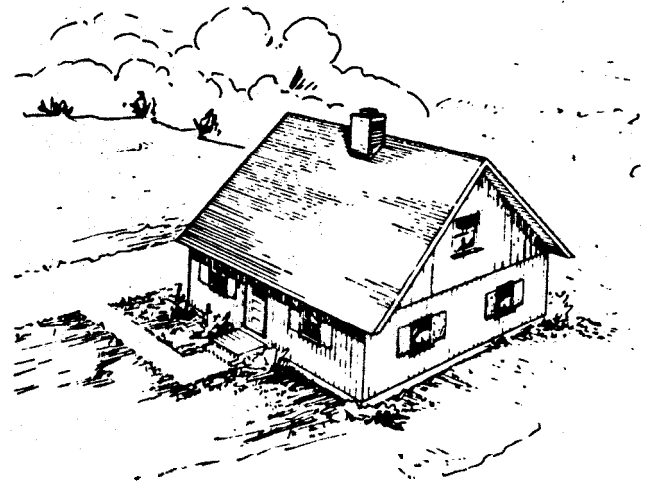
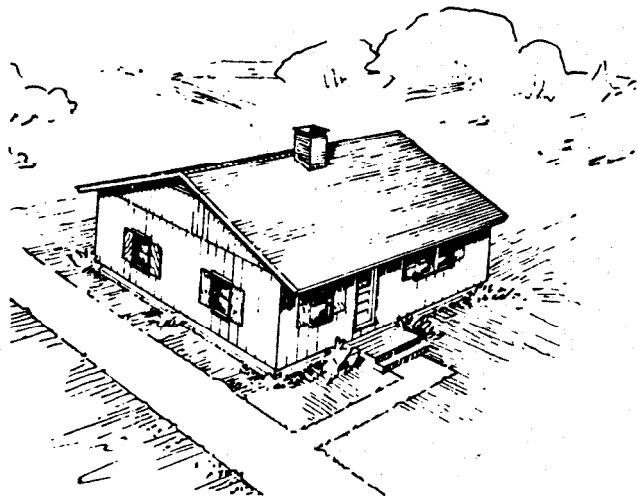


There are several important factors which aid in reducing the cost of this home. One is the fact that it is a crawl-space house, which eliminates the need for extensive excavation and grading. In addition, the floor framing is supported by long-lived treated wood foundation posts resting on concrete footings. A more costly masonry foundation is included in the working drawings as an alternate. The use of a single covering material for the subfloor and the exterior walls also leads to reduced costs. The subfloor consists of tongued-and-grooved plywood or square-edge plywood with edge blocking and serves as a base for a resilient floor covering. The panel siding, with perimeter nailing, eliminates the need for corner bracing as well as the need for sheathing. Such coverings are usually rough-textured exterior-grade plywood, which can be finished with a pigmented stain. Suitable stains are available in many colors, and contrasts can be obtained by treating the trim and shutters with a different color or shade;

Further cost reductions are obtained by eliminating much of the exterior trim as well as some of the less important interior millwork. However, these refinements can be added in the future. An adequate forced-air heating unit with relatively short heat runs is also a part of the design. Insulation is included in the floor, wall, and ceiling areas; the thickness selected depending on the location of the home. In the colder climates, the ceiling and floor insulation might be 4 inches or thicker with 2-inch-thick blanket insulation in the walls.



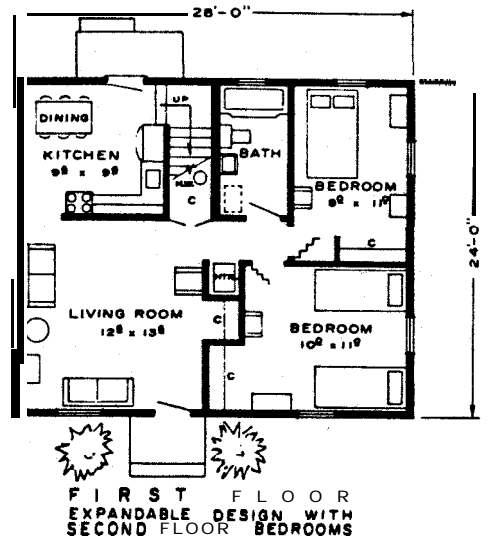
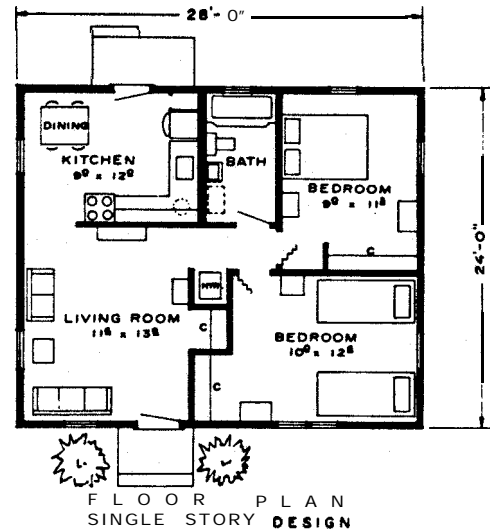
Forest Products Laboratory/P.O. Box 5130/Madison, Wisconsin 53705



House Plan no. FS-FPL-5

Plan FS-FPL-5 provides for the construction of either a single-story two-bedroom home or an expandable type with two additional bedrooms on the second floor. The basic house is 24 by 28 feet in size with an area of 672 square feet. The expandable plan provides an additional area of about 370 square feet on the second floor. The second-floor bedrooms can be completed with the rest of the house or left unfinished until later. Both plans include a kitchen, bath, living room, and two bedrooms on the first floor.

To accommodate the stairway to the second-floor bedrooms in the expandable plan, the first-floor bedrooms and the kitchen are slightly smaller than those in the one-story plan. One second-floor bedroom is 9-1/2 by 14 feet and the other is 13 by 14 feet. The larger bedroom may be divided by the addition of a wardrobe wall, which provides two closets and also serves as a room divider.

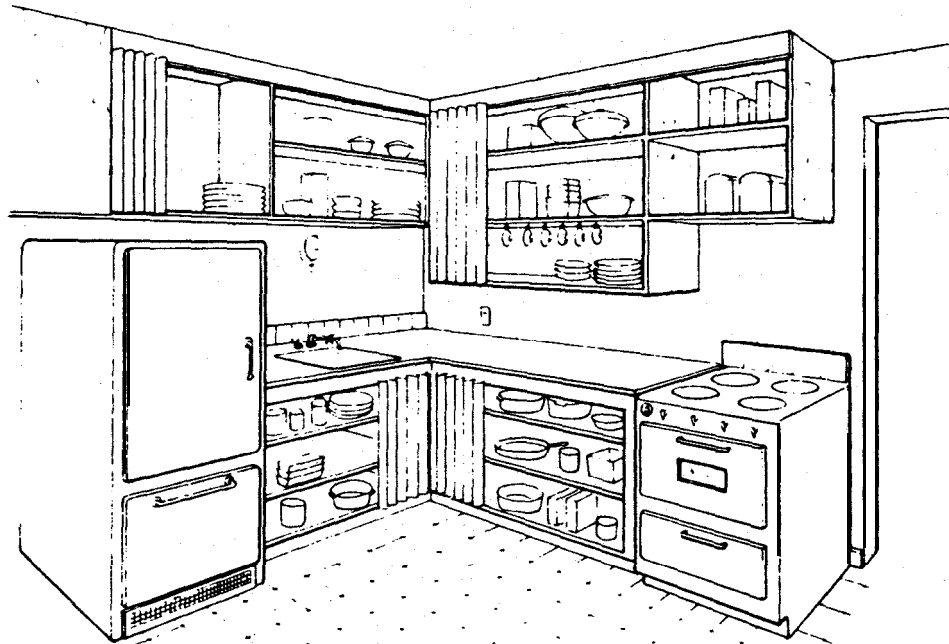


Both plans have a front entrance closet and a closet for each bedroom. The expandable house also has a storage area under the stairway in which the hot water heater is located. The heating unit is located in a small closet adjacent to the bath-bedroom hallway. Walls, floors, and ceiling areas are insulated. Dining space is provided for in each kitchen.

This plan was developed by the Forest Products Laboratory of Madison, Wis., and is one of a series of plans for low-cost houses of wood being designed by the Forest Service, U.S.D.A.

There are a number of factors which aid in reducing the cost of these homes. They are designed as crawl-space houses with post or pier foundations, which eliminate the need for extensive grading on sloping building sites. The single floor covering serves as a base for resilient tile or a low-cost linoleum rug. It can be painted if further cost reductions are required. Panel siding is used for exterior wall finish which eliminates sheathing and the need for a braced wall. Exteriors are finished with long-lasting pigmented stains. Many contrasting colors are available in this type of finish. Exterior and interior trim and millwork have been reduced to a minimum. However, many of these refinements can be made at anytime after the house has been completed.

Details of a second-floor bathroom, a porch addition, a full foundation wall, and an enclosing skirtboard are also included in the working drawings.



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