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College of Agriculture

Pole Frame Construction for Idaho Farm Buildings

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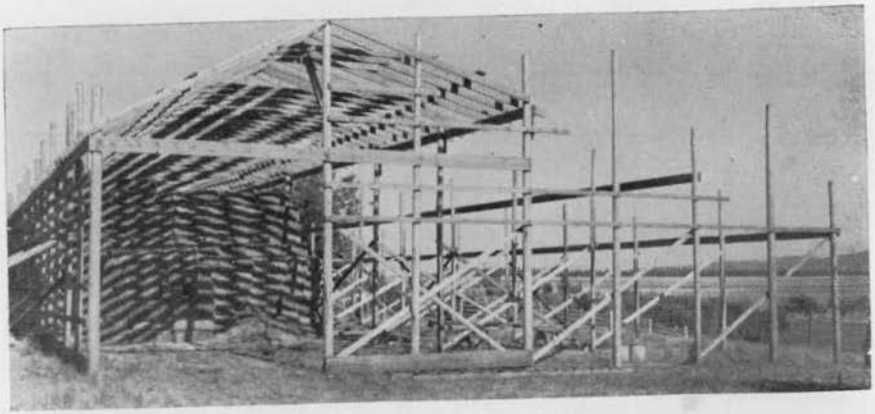
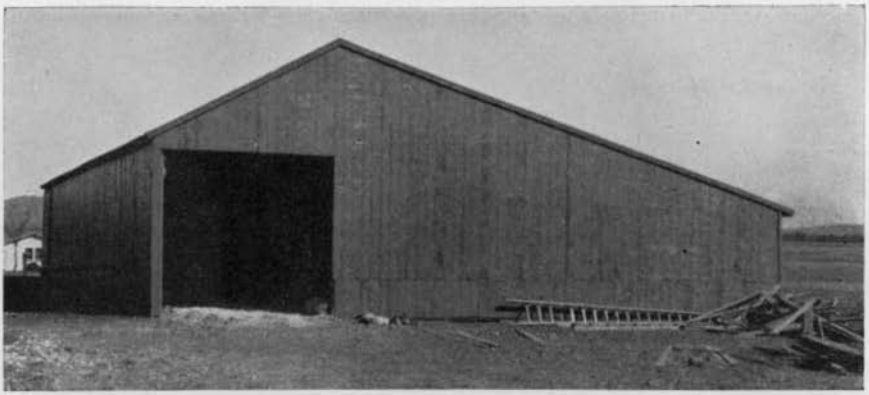


"Before and after" photos of a pole-frame barn. The owner did his own work, used local material. The structure is 52 by 104 feet and is used as a combination hay shelter and loafing shed. Note that the door and walls are high enough to allow use of a tractor inside for piling hay and removing manure. Site of the barn is a rise of ground which provides good drainage. The south side of this building can be left open for a loafing or feeding shed with room for hay or bedding storage in the taller section. Such storage is a necessity for efficient handling of feeds and bedding.

Today's farmer is often looking for the building he can build with his own tools at a cost he can afford. He is demanding that such a building save him time, travel, and energy in his chores. Pole structures are often the answer to his needs. They require approximately one-half the labor and materials of the conventional structure. The building cost is usually about $1 per square foot depending on the size and location. **Treated** poles solve the foundation problem.



Pole Frame Construction for Idaho Farm Buildings

J. E. Dixon and J. W. Martin*

A pole-frame building for half the cost of a similar one of conventional construction is entirely possible. This bulletin gives construction procedures, recommendations, and plans for such a building.

Location of Buildings

Locate the building on a nearly level, well-drained site. Make it fit conveniently with other buildings in the farmstead plan. A ground slope of about 1 percent is good.

If the structure is to be used as a loafing shed or machine shed, locate it so the open side faces south and is protected from the prevailing wind.

Layout

Once the site is decided upon, set up batter boards and string lines to represent the outline of the building as shown in Figure 1. Square the corners by laying out any right triangle whose sides are in the proportion of 3, 4, 5. This can be 3 feet on one side, 4 feet on the other, and 5 feet on the hypotenuse or long side of the triangle. Any multiple of these figures will do so long as the triangle is laid out the same way. It may be 6, 8, 10 as in Figure 1, corner A. It could be 9, 12, 15; 12, 16, 20, etc.

Most builders space their poles 12 to 15 feet apart. Measurements are made from the outside of each corner pole to the center of the next pole as indicated in Figure 1. Spacings are then determined from the center of each pole to the center of the next. The proposed pole locations are marked by measuring in from the outside wall a distance equal to half the diameter of the large end of the pole and driving a stake as indicated by "b" and "d" in Figure 1. (See Appendix I on page 10 of this bulletin for a typical plan layout using 15-foot pole spacings.)

*Assistant Agricultural Engineer and Agricultural Engineer, respectively, Idaho Agricultural Experiment Station.

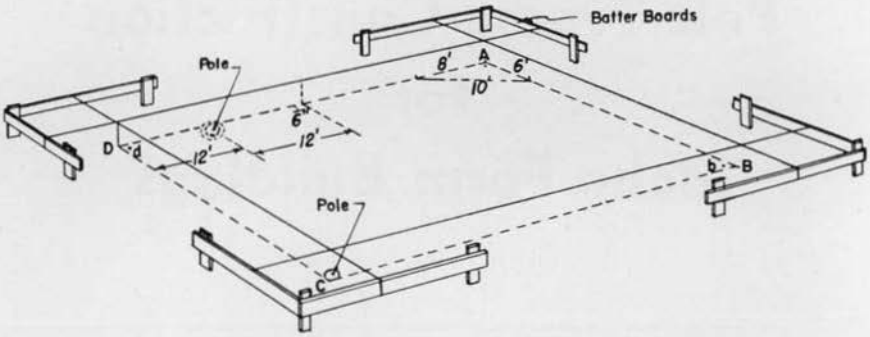


Figure 1.—How to lay out the site for a pole frame building.

Holes

The depth the poles are set into the ground depends upon the wind forces and rigidity needed in the building. For most pole-frame buildings the needed depth of the pole hole is shown in Table 1. This table is limited to buildings with pole spacings of 15 feet or less.

Table 1. Depth of pole hole

Total pole length	Ordinary and gravelly soils*
15 feet or less	4 feet
16-20 feet	4½ feet
21-25 feet	5 feet
26-30 feet	5½ feet

*For soft soils make the hole ½ foot deeper.

Make the holes 6 or 8 inches greater in diameter than the butt of the pole. The extra space around the pole is necessary to allow tamping of the fill **after the plates and rafters are fastened in place.**

Firm packing or tamping at final setting is essential for longtime stability of the building. For extra stability some engineers recommend a gravel or concrete backfill.

The pole footing is most easily prepared by placing gravel at the bottom of the hole. For a stable footing the bottom of the hole should be about 20 inches in diameter. If this is larger than needed to set the pole, the hole can be widened at the bottom. Gravel 10 inches deep provides a good footing. Concrete may be substituted for the gravel if desired. For either case, the footing thickness must be added to the hole depth specified in Table 1. Where the soil is soft, such as in wet clay, it is advisable to make the gravel or concrete footing about 30 inches in diameter and 15 inches thick.

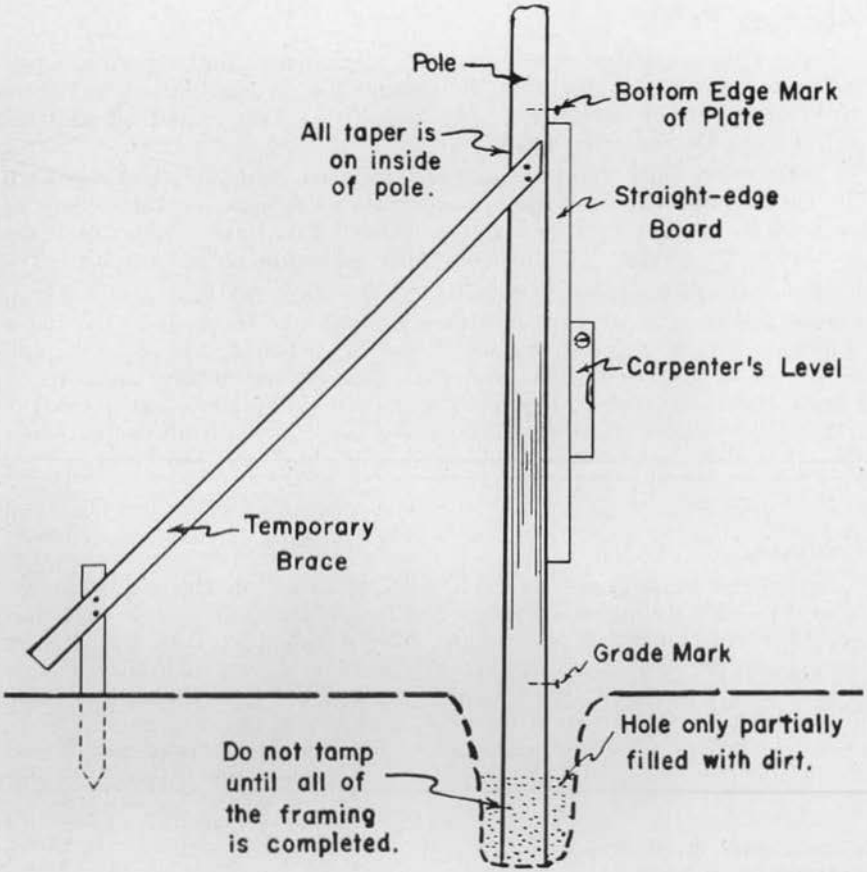


Figure 2.—A method of aligning the poles.

Poles

Pressure or hot and cold bath treated poles are best and should be used for building construction. The poles are obtained directly from pole treating yards* or through a local lumber dealer or construction firm. Untreated poles that come in contact with moist soil will last 5 years or less while treated poles can be expected to last 20 years or more. Although commercially treated poles are recommended, on-the-site, cold-soak treatment of most woods will give good results if done right. The Idaho bulletin "Cold-Soak Wood Preservatives," Extension Bulletin No. 187, gives full details of pole treatments.

Use poles that are 1 or 2 feet longer than the distance from the bottom of the pole to the roof. This allows for final trimming at the plate line. For most structures, poles with a 5- or 6-inch top diameter are suitable.

*Write Western Wood Preserving Operators Association, 1410 SW Morrison Street, Portland 5, Oregon, for the location of the plant nearest you.

Aligning Poles

Select the four straightest poles for the corners and carefully align them on the outward side with the ground line as established in Figure 1. Put just enough dirt in the hole to hold the butt ends from shifting out of line. **Do not tamp at this time.**

Set the sidewall and endwall poles in place and line them up with the corner poles. Irregularities in sidewall poles must be taken care of as much as possible by rotating these poles so that any crookedness lies parallel to the siding. This will minimize distortion in the sidewall.

Poles are next aligned vertically on the outward side as shown in Figure 2. Braces from near the top of the poles to stakes hold the poles in place. Locate a grade-level mark on the outward side of each pole as shown in Figure 2. See that these marks are at the same level. Locate them by using a farm level or a carpenter's level and a straight edge. Check these grade marks to make sure they are all at the same elevation, then make them permanent with a nail or a level saw-cut.

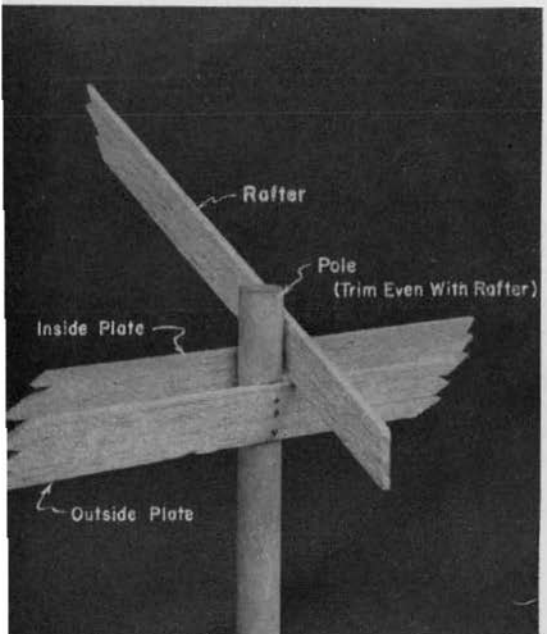
Framing

From the grade mark on each pole, measure up the required distance to locate the plate. Measure this height on each outside pole and drive a nail in each pole as a mark. The outside plate can then be set directly on the nails and spiked to the poles as shown in Figure 3. For best results, use ring or spiral shanked nails of the type shown in Figure 4. For stronger construction in windy and heavy snow areas, use bolts or notch the poles for the plates before nailing. To support the rafters, the inside plate is placed higher than the outside one (Figure 3). Put the inside plate in place after the rafters are up. To increase the load-carrying ability of the plates, 2" x 4" x 3' blocks are often nailed under the plates and purlins as shown in Figure 5.

Purlin plates are fastened to the poles supporting the center of the roof. These inside poles are spaced the same as the outside poles. Figures 5 and 6 show two methods of construction. Notice that the rafters are lapped and spiked to the poles.

Figure 7 shows construction at the roof peak. Rafters and girts are lapped and spiked together to save sawing and fitting. The pairs of rafters on each end of the building are cut and butted together. Rafters can be spaced from 2 feet to 6 feet apart depending on the size of the rafter material and the type of roofing to be used. When poles are spaced 12 to 15 feet apart, 2" x 10" rafters spaced 4 feet apart are satisfactory. For further information about the right size of rafter, see Idaho Extension Bulletin No. 324, "Wood Beams for Farm Structures."

Figure 3.—Framing detail for the outside row of poles.



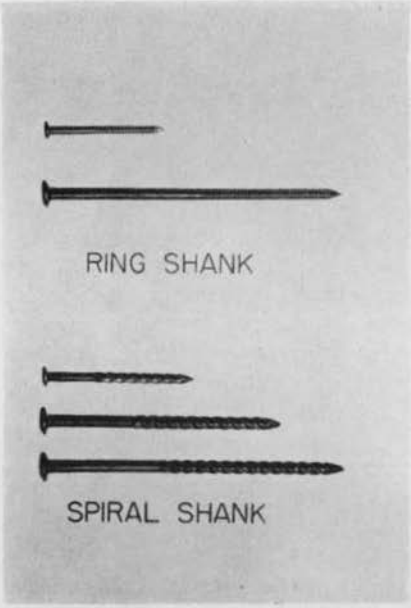


Figure 4.—Ring or spiral shanked nails of the type shown here increase the strength of pole-type buildings. This type of nail is also recommended for attaching metal roofing and siding.

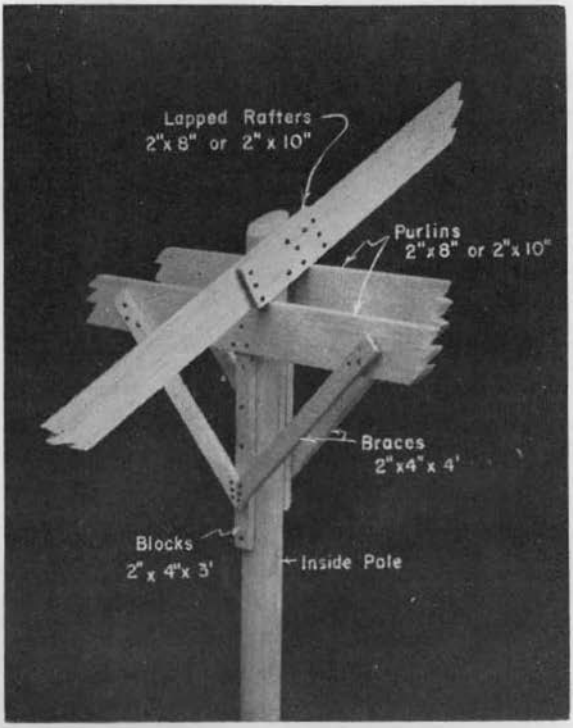


Figure 5.—A method of framing for the interior poles using braces.

After the rafters are in place, the tops of the poles may be sawed off. The 2" x 4" girts are nailed on edge and spaced 2 feet apart when corrugated roofing is used. Fasten the 2" x 4' girts to the rafter with a tie block as shown in Figure 9. If the rafters are spaced 3 feet or less apart, the 2' x 4" girts shown in Figure 7 may be nailed flat or 1-inch solid sheathing may be used.

Siding

To hold the siding, 2" x 6" girts usually are nailed on the outside of the poles as shown in Figure 8. To stiffen the girts a 2" x 4" can be nailed along the top edge of the girt to form an L-shaped member. Vertical wood siding or corrugated metal sheet is then nailed over the girts.

SUMMARY

When the pole-frame buildings fail, the failure is usually caused by inadequate fastening and bracing, settling of the poles, and rotting of the poles at the ground line.

To prevent damage from wind, it is very important to tie each building part together with adequate fasteners and braces. The ring-shank or spiral-shank type nails shown in Figure 4 make joints of about the same strength as a screw joint. The use of this nail type, along with the bracing and ties illustrated in Figures 5, 7, and 9, will provide sufficient strength for wind resistance.

The lack of ample bearing area under the poles may cause uneven settling. Gravel or concrete footings beneath the pole butts are insurance against this trouble. Poles set in well drained sand and gravel usually do not need this extra precaution. Use poles not less than 8 inches in diameter at the butt for load-carrying poles. Larger poles give more bearing area and are less likely to allow uneven settling.

Pressure treating makes it possible to extend the life of a pole to 30 or 40 years. Using untreated poles is inviting disaster at a saving of only a few cents per pole. Use only well-treated poles.

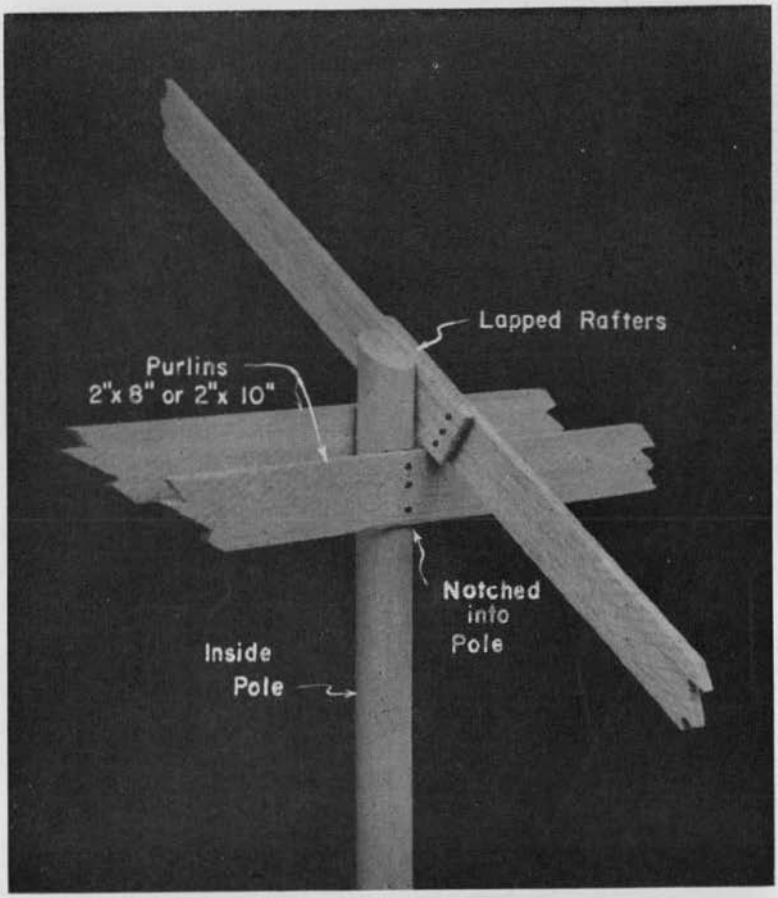


Figure 6.—An alternate method of framing the interior poles. Support for the purlins is provided by notching the pole.

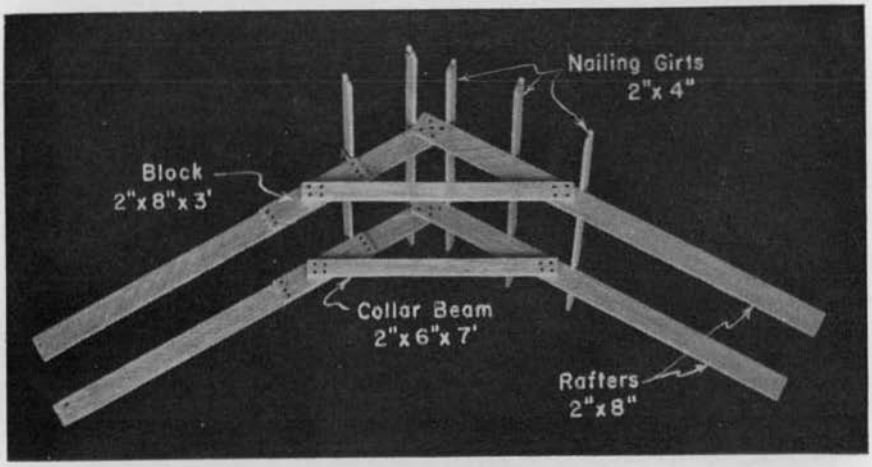


Figure 7.—Ridge framing details.

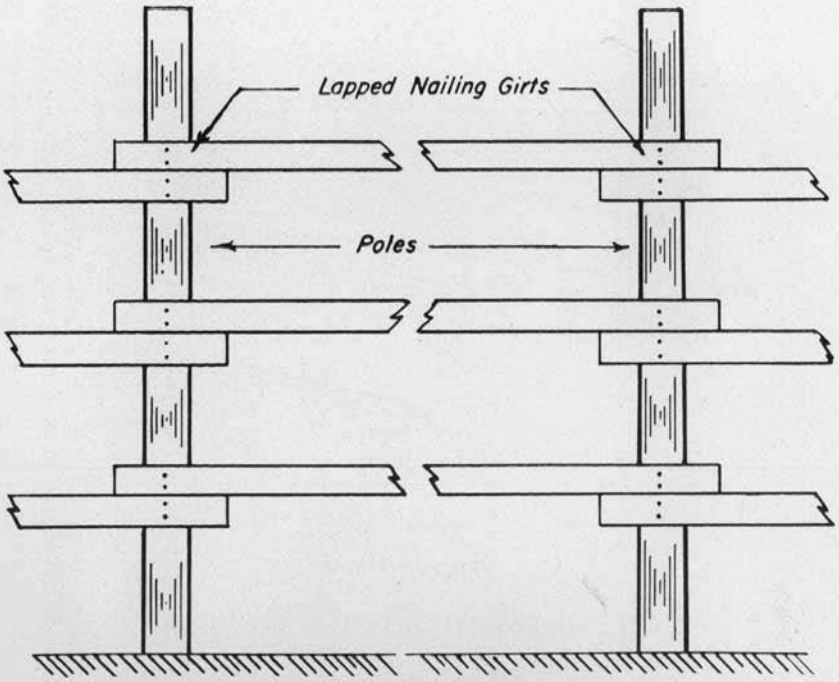


Figure 8.—Side framing details showing how girts are lapped to eliminate sawing.

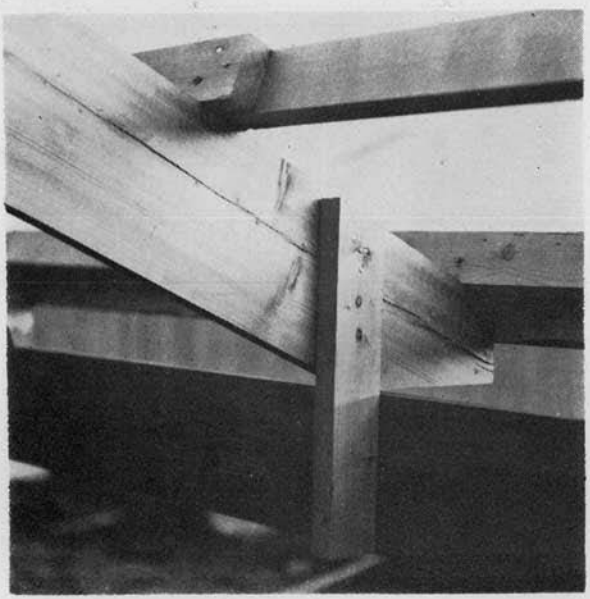
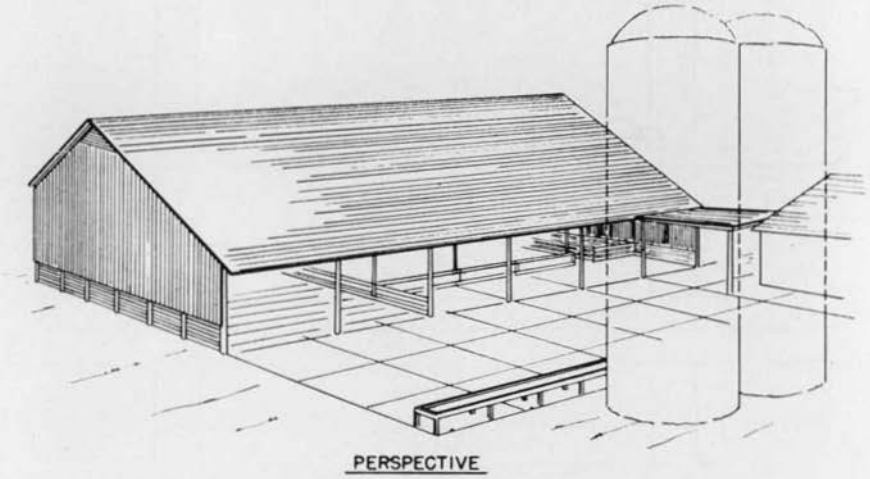


Figure 9.—A tie-block has been used here to fasten the between - the - poles rafter to the plate. The same type block can also be used to tie the roof nailing girts to the rafter.

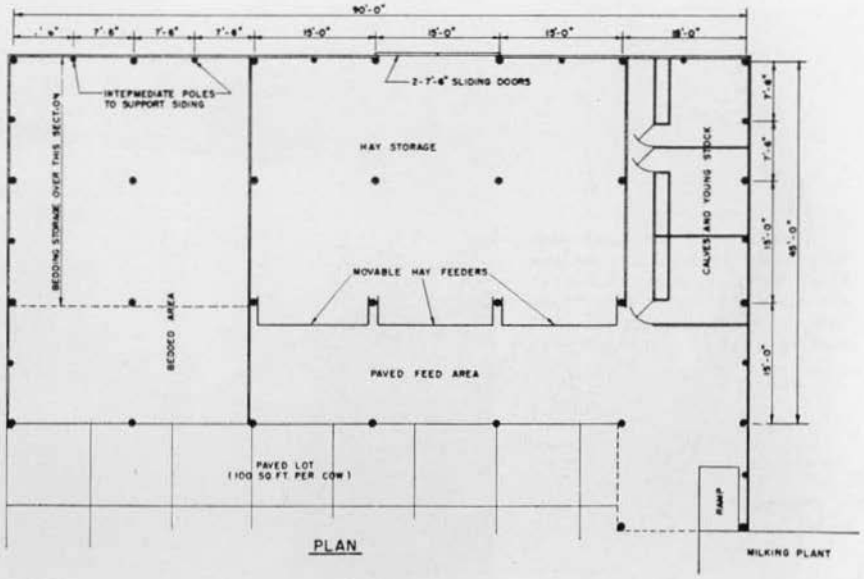


PERSPECTIVE

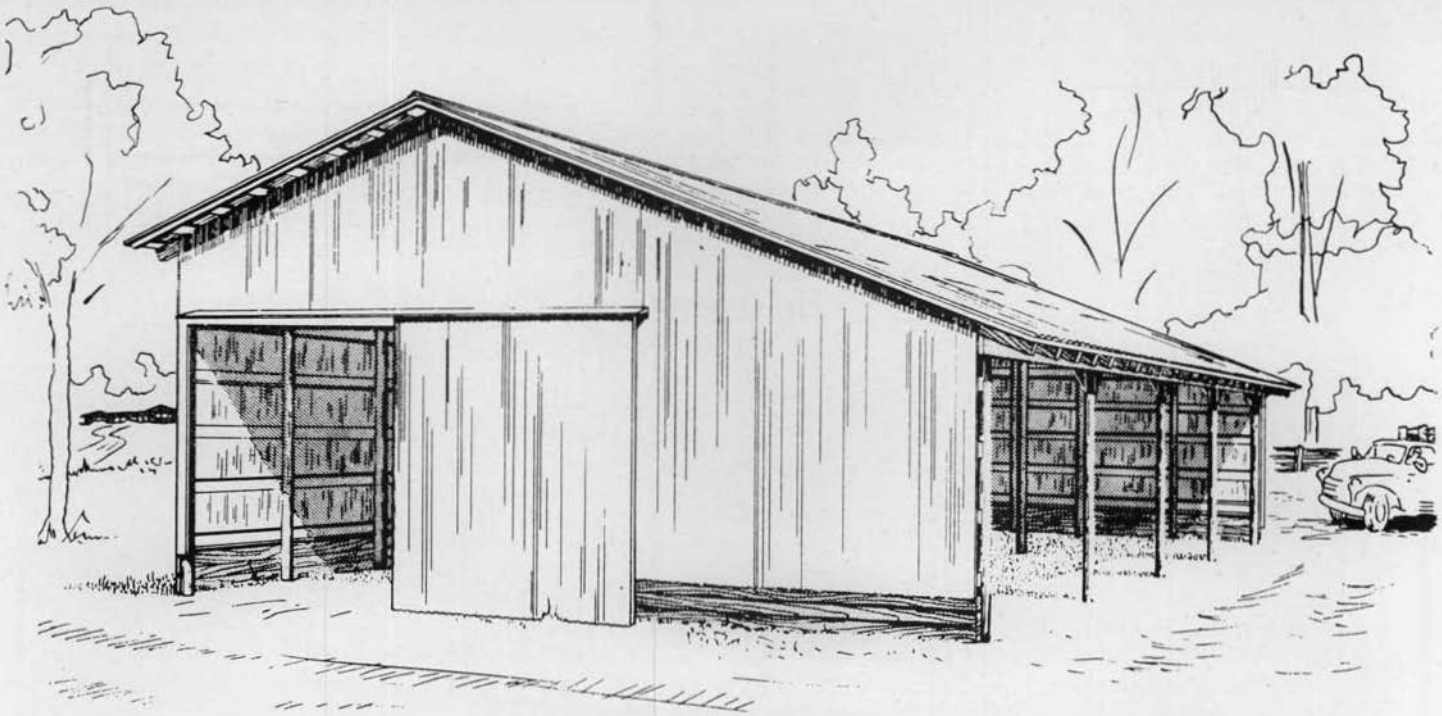
Appendix I

45-Foot, Loose-Housing, Pole Type Barn

This is an open front combination storage and loafing shed using pole-frame construction. If more detail plans are needed, order Plan No. 724-15 from the Extension Agricultural Engineer, University of Idaho, Price $0.60 (3 sheets).



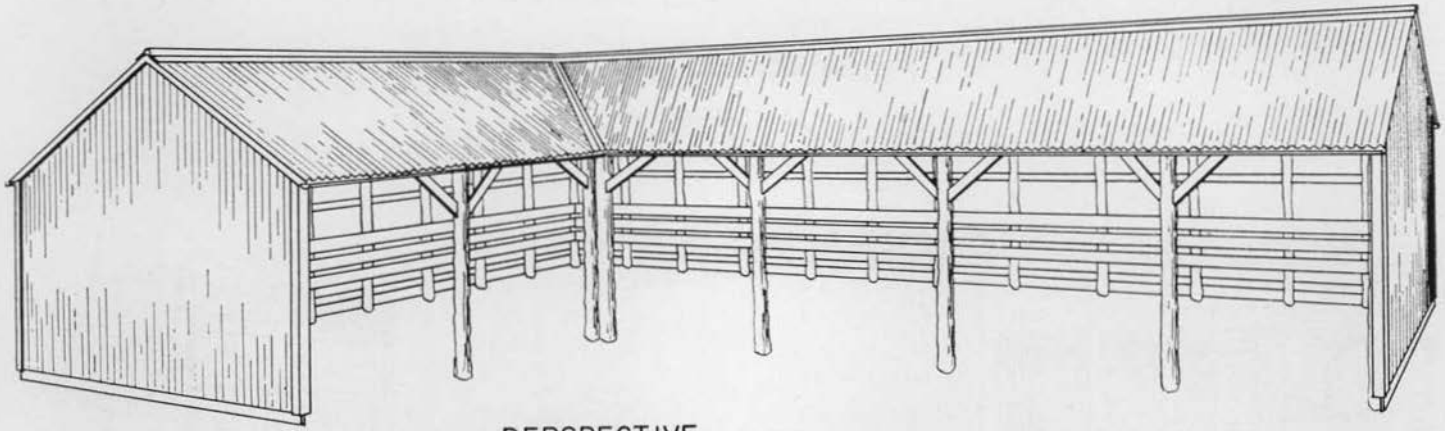
PLAN



Appendix II

39-foot, Pole-type Loose Housing and Storage Barn

This pole-type barn is shown as a 39-foot wide building. The same type of construction can also be used for other building widths. Details for constructing this width, a 26-foot width and a 52-foot width building are given in Plan No. .7034-4. Price $0.60 (2 sheets). Plans for building a barn of the same general shape but with slightly different construction details can be obtained by ordering Plan No. .7034-3; price $0.30 (1 sheet) or Plan No. .7034-5; price $0.30 (1 sheet). All of these plans may be ordered from the Extension Agricultural Engineer, University of Idaho.

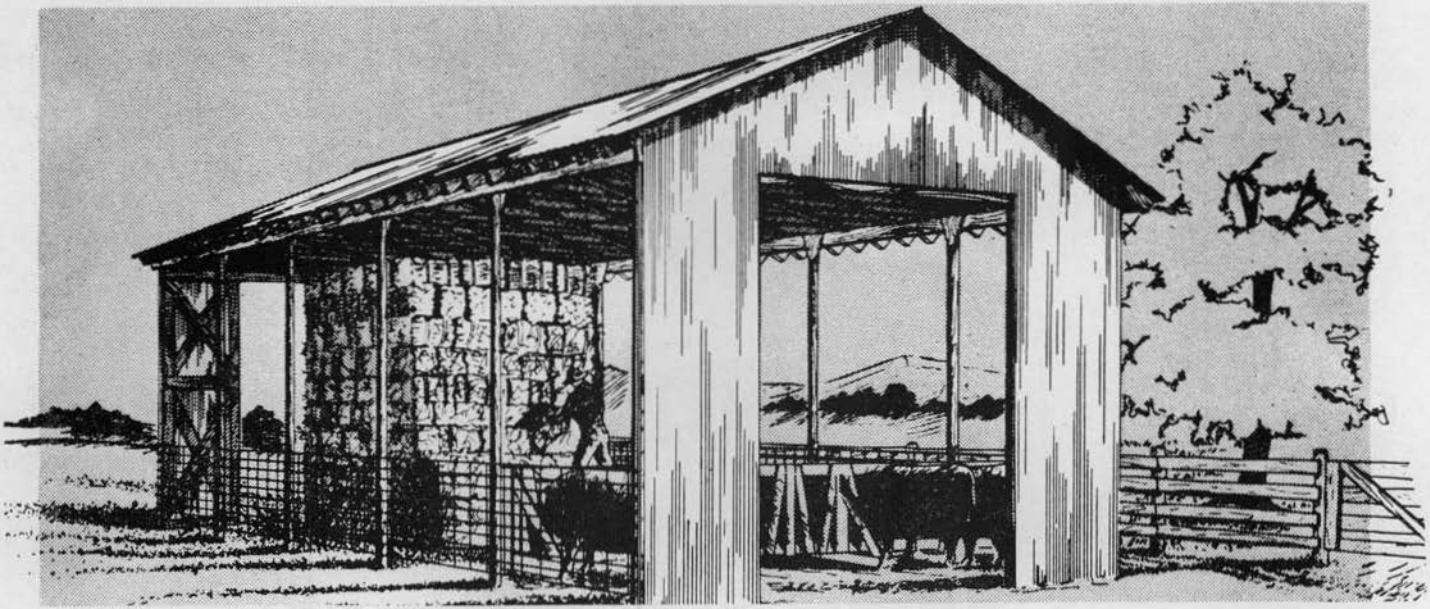


PERSPECTIVE
NOT TO SCALE

Appendix III

Pole-Type Cattle Shed

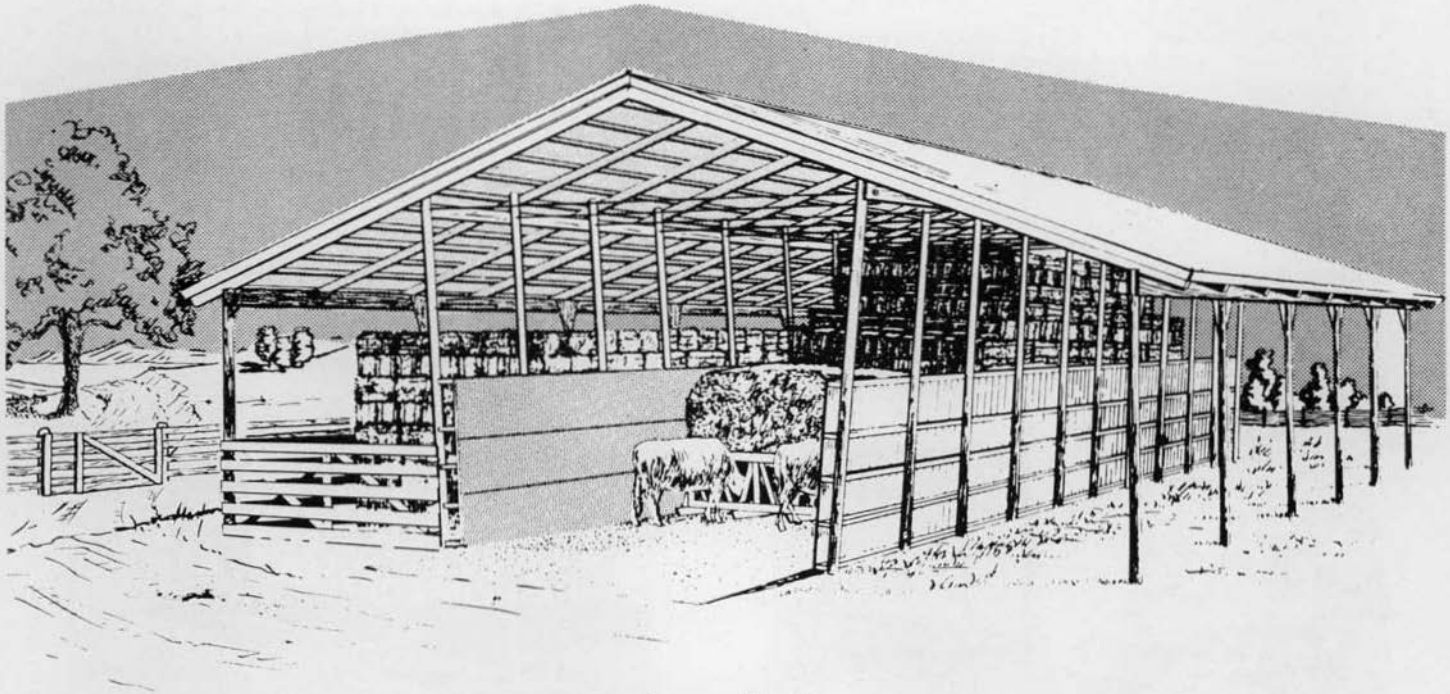
This pole-frame, L-type loafing shed will provide good shelter for animals. It is flexible in regard to size and construction materials. You can easily change the design size and shape to fit your location and needs. Remember to build the front high enough to allow easy operation of the tractor manure-loader. If more detailed plans are needed, order Plan No. .724-17 from the Extension Agricultural Engineer, University of Idaho. Price: $0.80 (4 sheets).



Appendix IV

24-Foot, Pole-Type Hay Shed

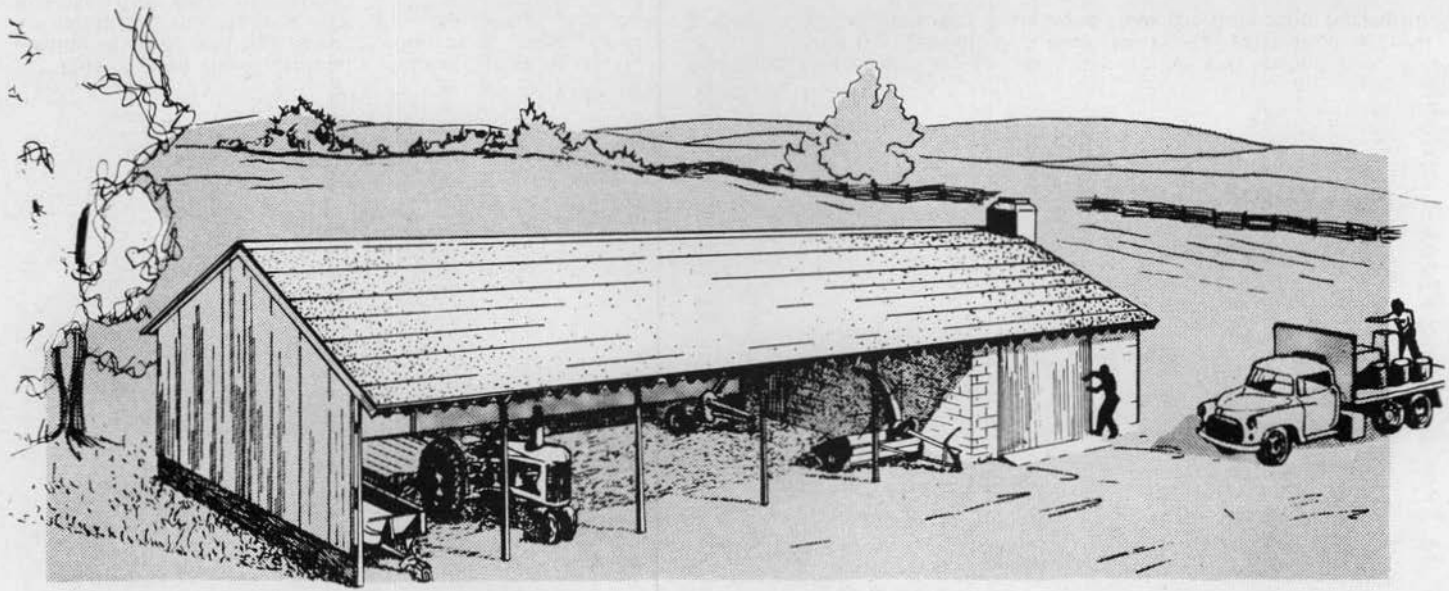
This 24-foot wide hay shed may be constructed in length units of 12 feet. The eave height is 16 feet which allows for up to 30 tons of baled hay storage per section. To make the shed self-feeding, self-feeding fences similar to those used in bunker-type silos may be used. Plan No. .772-15 shows details of construction for self-feeding fences; price $0.30 (1 sheet). To obtain the hay shed plans, order Plan No. .731-3; Price $0.30 (1 sheet). Either plan may be ordered from the Extension Agricultural Engineer, University of Idaho.



Appendix V

A Pole-Type, Roofed, Bunker Silo

This covered silo is especially suitable for rainy areas. The optional side sheds allow for extra hay storage and feeding area. Self-feeding of silage and hay is easily obtained by using self-feeding fences of the type presented in Plan No. .772-15; price $0.30 (1 sheet). To obtain the silo drawing order Plan No. .733-8; price $0.60 (2 sheets). Either plan may be ordered from the Extension Agricultural Engineer, University of Idaho.



Appendix VI

Pole-Type Machinery Storage

This combination machinery storage and shop building is designed for pole-type construction in the storage section and masonry construction in the shop section. The shop is 24 by 30 feet while the machinery storage is 30 feet wide and may be made any desired length in multiples of 12 feet. For complete working drawings of this building order Plan No. .741-28 from the Extension Agricultural Engineer, University of Idaho. Price $0.60 (2 sheets).

Additional Pole-Type Building Plans Available From the University of Idaho Plan Service

Order these plans and the one described in the appendix from the Extension Agricultural Engineer, University of Idaho, Moscow, Idaho.

Plan No.	Description	Price
.7034-6	SHED ROOF CONSTRUCTION—Type A. Span 30′ 0″ Truss spacing 7′ 6″. Live load up to 30 lbs. snow or 88 mph wind	0.30
.7034-7	SHED ROOF CONSTRUCTION—Type B. Span 30′ 0″ Truss spacing 15′ 0″. Live load up to 15 lbs. snow or 60 mph wind	0.30
.7034-8	SHED ROOF CONSTRUCTION—Type C. Span 26′ 0″. Truss spacing 7′ 6″. Live load up to 20 lbs. snow or 76 mph wind	0.30
.7034-9	SHED ROOF CONSTRUCTION—Type D. Span 28′ 0″. Truss spacing 7′ 6″. Live load up to 20 lbs. snow or 76 mph wind. Plywood gussets are used for this truss	0.30
.7035-1	WALLS, DOORS, AND WINDOWS FOR POLE-TYPE BUILDINGS	0.30

University of Idaho
Farm Building and Construction Bulletins of Interest

Woodfibre Diatomite Concrete	Extension Bulletin No. 179
Your Farmhouse—Plan it to Fit your Needs	Extension Bulletin No. 180
Plan Your Farm for Good Farm Living	Extension Bulletin No. 186
Cold-Soak Wood Preservation	Extension Bulletin No. 187
Your Electric Farm Shop	Extension Bulletin No. 202
Plans for Idaho Farm Builders	Extension Bulletin No. 236
The Idaho Farm-Flock Laying House	Extension Bulletin No. 244
Building Layouts for Dairy Units	Extension Bulletin No. 271
Farm Sheep Equipment Layouts	Extension Bulletin No. 273
Wood Beams for Farm Structures	Extension Bulletin No. 324

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