University of Idaho
College of Agriculture

Cooperative Extension Service
Agricultural Experiment Station

Current Information Series No. 725

Construction Suggestions For Farm Buildings

Roy E. Taylor and John E. Dixon

This publication gives rules-of-thumb and generalities that can help the farm builder make initial decisions about his planned construction. For more specific information on the planning and construction on farm buildings, contact Extension Agricultural Engineering at the University of Idaho or refer to the publications listed below:

Available through Extension county offices:

PNW 211, Pole-type Farm Building Construction (50 cents)

Available from the publisher or through local bookstores:

Farm Builder's Handbook, R. J. Lytle, Structures Publ. Co., Box 423, Farmington, MI 48024 ($24.95)

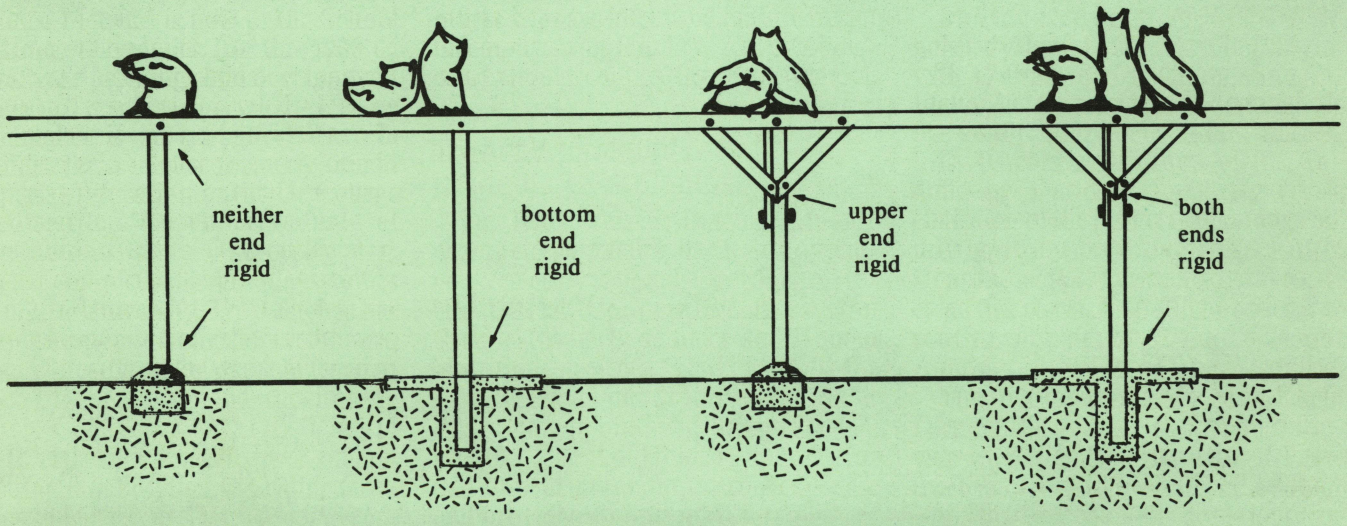
Farm Buildings from Planning to Completion, Richard E. Phillips, Doane-Western, Inc., 8900 Manchester Rd., St. Louis, MO 63144 ($19.95)

Vertical Supporting Capacity

Column length affects vertical supporting capacity. Within the range of typical pole lengths and loadings used in farm buildings, the following approximations occur as pole length increases.

Increase in pole length	Total vertical load carrying capacity
0%	100%
20%	67%
40%	50%
60%	38%
80%	29%
100% (length doubles)	24%

A pole or post with a well constructed, fixed, rigid* end can carry about 50 percent more load than one that is "hinged" at both ends. Another approximate 20 percent increase in load carrying capacity occurs if both ends are made rigid.



*An end is considered "rigid" only if it is absolutely inflexible. Poles or posts set in earth or gravel often allow some movement.

Pole and Post Equivalents As Columns

Pole diameter*	Square-cut post (nominal dimensions)	Pole diameter*	Square-cut post (actual dimensions)
4 inches	4 × 4 inches	4⅝ inches	4 × 4 inches
5¼ inches	5 × 5 inches	5¾ inches	5 × 5 inches
6¼ inches	6 × 6 inches	6⅞ inches	6 × 6 inches
8½ inches	8 × 8 inches	8 inches	7 × 7 inches
10½ inches	10 × 10 inches	9⅛ inches	8 × 8 inches
		11½ inches	10 × 10 inches

Pole and Post Equivalents As Beams

Pole diameter*	Sawed beam (nominal dimensions)	Pole diameter*	Sawed beam (nominal dimensions)
3⅛ inches	2 × 4 inches	6¾ inches	4 × 8 inches
4¼ inches	2 × 6 inches	6⅞ inches	2 × 12 inches
5⅛ inches	2 × 8 inches	7⅛ inches	3 × 10 inches
5⅝ inches	4 × 6 inches	8 inches	6 × 8 inches
6 inches	2 × 10 inches	8 inches	4 × 10 inches
6 inches	3 × 8 inches	9 inches	4 × 12 inches
		9⅜ inches	6 × 10 inches

*Diameter at ⅓ of pole length from the small end (diameter = $\frac{\text{circumference}}{3.14}$).

NOTE: For bolted connections, drill holes $\frac{1}{32}$ to $\frac{1}{16}$ inch larger than the diameter of the bolt.

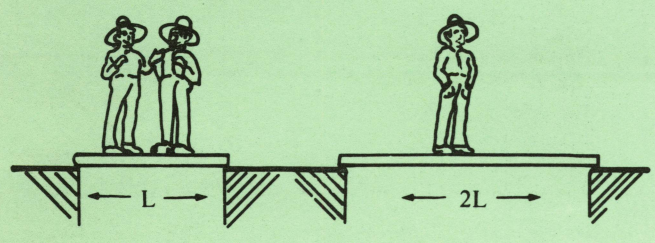
Load Bearing Capacities of Soils

Class of soil	Tons per square foot
Soft clay	½ to 1
Ordinary clay and sand	1½ to 2
Moderately dry clay	2 to 3
Hardy dry sand and clay	4
Well packed gravel	5
Hard rock	15

Effect of Beam Span On Supporting Capacity

Within the workable range that a beam can span, the following approximations occur as span increases:

Increase in span	Load carrying capacity per foot of length	Total load carrying capacity
0%	100%	100%
20%	68%	82%
40%	50%	70%
60%	39%	62%
80%	30%	54%
100% (span doubles)	24%	48%



Lumber Sizes

Nominal (inches)	Actual (inches)
1	¾
2	1½
3	2½
4	3½
6	5½
8	7¼ or 7½*
10	9¼ or 9½*
12	11¼ or 11½*

*¾ inch reductions are made if lumber **thickness** is less than 6 inches; ½ inch reductions are made if lumber **thickness** is 6 inches or more.

Example: a 2 × 8 is actually 1½ × 7¼ inches;
an 8 × 8 is actually 7½ × 7½ inches.

Western Wood Species

Group A: Douglas-fir and larch (tamarack)
Group B: Lodgepole pine, ponderosa pine, white pine, spruce, western red cedar.

Group A species are used almost exclusively as structural softwoods. Group B species produce lumber with about 60 percent of the strength of Group A. Nail holding power in Group B species is about 80 percent of that in Group A.

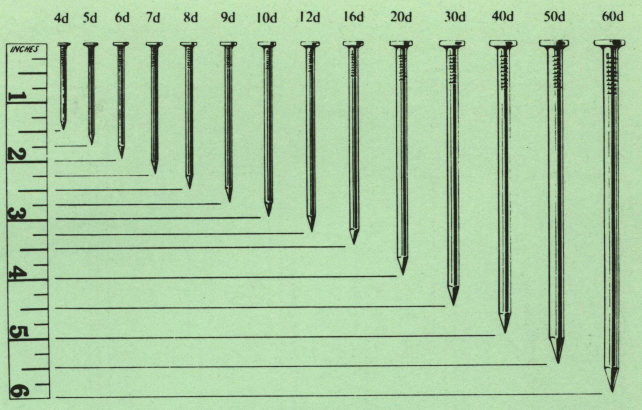
Roof Slope and Snow Load

Snow load:* 1 foot of ice exerts a force of about 60 psf.
1 foot of snow under the range of normal conditions exerts a force between 5 and 28 psf.

Roof slope: 20° slope (4:12 slope) or less, consider 100 percent snow load.
40° slope (10:12 slope), consider 50 percent snow load.
60° slope (20:12), consider 0% percent snow load.

Wind load:* An 88 mph wind produces 20 psf pressure.
A 108 mph wind produces 30 psf pressure.

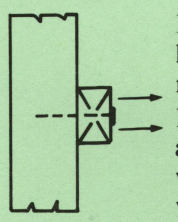
*Wind loads exert a force perpendicular to the surface. Snow loads exert a force straight down.



Common Wire Nails

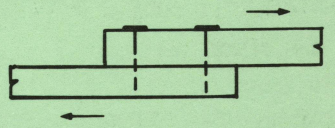
Threaded and Wire Nails

Types of threaded nails are screw shank, ring shank or pole-barn nails. Resistance to pulling means withdrawal resistance.



In dry, untreated lumber, threaded nails have about a 10 percent greater withdrawal resistance than do common wire nails.

In lumber subject to wetting and drying and in pressure treated lumber, common wire nails may lose up to 75 percent of their withdrawal resistance.



Lateral holding power (lateral loading)

In dry, untreated lumber, threaded nails for sizes up through 20d have the same strength as common wire nails. For sizes 30d through 60d, threaded nails are up to 60 percent **weaker** than common wire nails (threaded nails are normally smaller in diameter).

In lumber subject to wetting and drying and in pressure treated lumber, common wire nails may lose up to 25 percent of their strength against lateral loadings.

NOTE: Threaded nails, regardless of length, are recommended for timber exposed to weather or moisture and for timbers that are pressure treated. Under those conditions, common wire nails lose holding power; threaded nails do not.

NOTE: Toe-nailed joints have ⅚ of the lateral strength of a straight-through nailed joint.

Insulation and Glue

Typical wood frame insulation:

Wood sheathing both sides	- R-4
wood sheathing one side	- R-2
sheet metal one side	- R-1
(with 2 inch batt insulation, add R-7)	

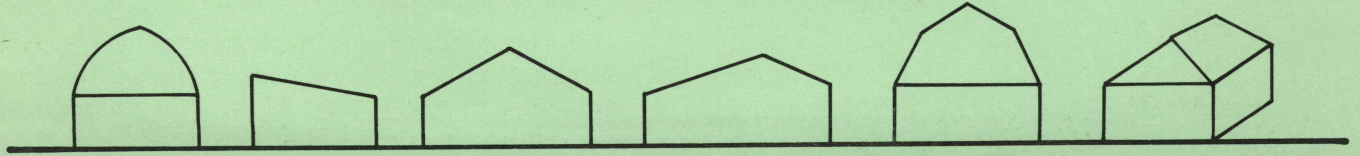
Masonry insulation:

8-inch concrete block	- R-2
with cores insulated	- R-5
6-inch concrete	- R-2

Use of glue:

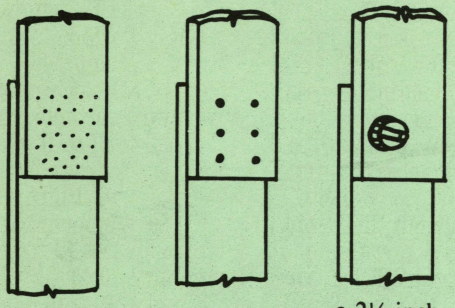
Use Resorcinol Resin glue for jobs exposed to weather or moisture. Casein glue can be used in dry locations. Use only dry wood (less than 15% moisture). Be sure joint matches and is free of oil and dirt. Apply pressure (nailing or stapling can be adequate). Allow curing time (one week before full load).

Roof Styles for Farm Buildings



Types of Fasteners

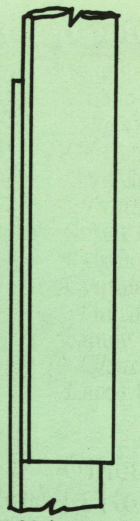
Fasteners of equal strength for connecting 2 × 6 lumber joints



30 16d nails

6 ½-inch bolts

a 2½-inch split ring



30-inch glue area

Quantities of Concrete For Slab Floors and Paving

Thickness	cu. yd. needed for 100 sq. ft.	sq. ft. of floor from 1 cu. yd.
4	1.23	81
5	1.54	65
6	1.85	54
8	2.47	40

The Authors

Roy E. Taylor is an Extension agricultural engineer, and John E. Dixon is a professor of agricultural engineering, both in the Department of Agricultural Engineering, University of Idaho, Moscow.

Issued in furtherance of cooperative extension work in agriculture and home economics, Acts of May 8 and June 30, 1914, in cooperation with the U.S. Department of Agriculture, H.R. Guenthner, Director of Cooperative Extension Service, University of Idaho, Moscow, Idaho 83843. We offer our programs and facilities to all people without regard to race, creed, color, sex or national origin.

1500 12-83

35 cents per copy