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# **A LOW-COST SHELTER AND FEED STORAGE UNIT FOR BEEF CATTLE**



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## ACKNOWLEDGMENTS

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# A Low-Cost Shelter and Feed Storage Unit For Beef Cattle

K. C. ELLIOTT, C. B. BOYLES, A. D. LONGHOUSE and G. C. ANDERSON

## Introduction

**N**EW livestock shelters can be built for satisfactory service without being expensive or elaborate. Readily available materials and a simple design make it possible for a beef cattle shelter to be built easily and inexpensively. The use of farm labor and home-grown lumber keeps the cost of this barn and feed storage unit to a minimum.

The unit (cover picture) described in this bulletin is made up of a 26 x 55-foot pole barn and a 65-ton capacity silo. These were designed to provide shelter and feed storage for a herd of about 25 to 35 yearling steers, or with extra hay storage, 25 to 35 beef cows. In developing this unit the following items were kept in mind:

1. Simplicity in design for low labor cost.
2. Use of low-cost building materials.
3. Long service with minimum upkeep.
4. Ease of expansion in keeping with herd increase.
5. Low labor need in feeding and caring for the cattle.

## Pole Barn

The 25 x 55-foot pole barn is shown in Figure 1, and details of construction are given in Figures 2, 3, 4, 5, and 6. A bill of materials for this barn, and the materials for one 11-foot bay are listed at the end of this bulletin. This barn can be easily enlarged by adding on to either end or by adding a wing to give an L-shape structure. Another way to meet the needs of a larger or increased herd would be to build a hay storage unit at one end of the barn, using longer poles to get the needed height. An additional pole barn could then be added so as to put the hay storage unit in the center for easy feeding of the hay.

The poles should have a 5-inch minimum top diameter. There are two poles 20 feet long, twelve 16-feet, and nine 10 feet long. The splash boards are 2 x 10 inches and pressure-treated for longer life.

Untreated lumber may be used, but it will have to be replaced every few years. The splash boards are lapped at the joints to eliminate sawing. All of the framing members are 2-inch rough lumber. No finished lumber is required in the barn. The plates and rafters are 2 x 10 inches, 12 and 16 feet long. The rafter ties are 2 x 6 inches x 22 feet and pieces 2 x 4 inches x 12 feet are used for the purlins and nailing girts. Bracing and blocks are cut from 2 x 4-inch lumber. The roof requires sheets 7 and 8 feet long, and the side sheets must be 10 feet long. The end sheathing is 12 feet with the waste used in the center to fill the gable. Listed in order below are estimates of the total cost of the complete barn when various sheathing materials are used:

Galvanized steel roof and vertical board siding .....	\$ 900.00
Paper roof on solid one-inch deck and vertical board siding .....	1,000.00
Aluminum roof and vertical board siding .....	1,100.00
Aluminum roof and siding .....	1,200.00

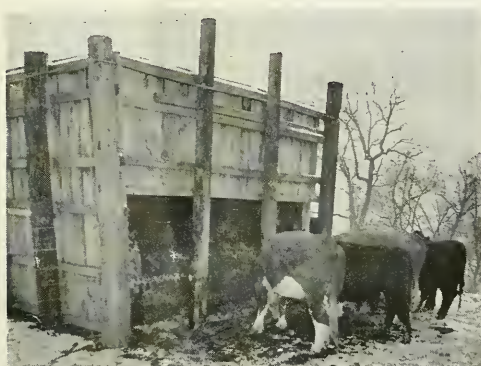
These figures, calculated in 1958, are for all purchased materials; creosote-pressure-treated poles and splash boards, and 2-inch rough oak lumber.

## Box Silo

The box silo (Figure 7) can be easily constructed from poles, rough lumber, and building paper. Because of its simple design, full use can be made of the lumber. The ends of the silo are vertical. The sides slope outward 1 foot at the top, which helps to pack the silage as it settles. Spoilage losses vary between 3 and 6 per cent with a good cover. The door (Picture 1) pulls out at opening time for self-feeding (Picture 2). Wedges between the door and the poles (Picture 3) are removed, before opening, to free the door and make it easier to pull out.



PICTURE 1. The door at the end of the box silo can be easily removed. The wedges between the door and the poles have been removed and the door is being pulled out.



PICTURE 2. The cattle are allowed to self-feed at the face of the newly-opened silo.



PICTURE 3. Note 1-inch block used as a wedge between the pole and silo door.

Several different types of poles can be used. These may be pressure-treated with creosote, new or discarded utility poles, or farm-grown poles of durable species. All poles should have a minimum top diameter of 5 inches and one fairly straight side turned toward the inside of the silo. There are 18 main poles 14 feet long, placed 4 feet in the ground to support the sides of the silo as the silage settles. The brace poles give added support to the silo walls.

The framing members are 2 x 4 inches x 14 feet rough lumber. Creosote pressure-treated lumber would last 20 to 30 years, whereas untreated lumber could be expected to last only 5 to 10 years, depending upon the kind used. The rough lumber wood sheathing is 1 inch thick, random width, 10 feet long, and the silo requires 800 board feet. Use two 40 d. nails at each 2 x 4-inch joint and 8 d. nails for the sheathing. The bill of materials is given at the end of this bulletin.

The 55-pound roofing paper is used to line the silo to make it air tight. This helps to prevent the crop from spoiling. The joints could be tarred to make an even better seal. The paper liner will last two years, and with care even longer. About two rolls may be necessary yearly to repair the liner before refilling the silo.

Plastic caps have been satisfactory when weighted at the edges with boards and covered with 6 to 10 inches of sawdust. Another method, which worked well for the 1957-58 season, was to cap the silo with long green hay, such as you would cap off a field hay stack.

## Filling the Silo

Only wilted grass silage has been used in the silo. There is no apparent reason why direct-cut grass or corn silage could not be stored.

Any method may be used to fill the silo. A blower was used the first three years. In 1958 a gasoline-engine-powered elevator was used. Each method worked well.

The silage should be kept level and tramped as the silo is filled. It should be well tramped around the edges and in the corners to remove air pockets.

Before capping the silo, it is best to let it settle at least one night. The silage is rounded up until no more can be added. Then the next day more silage is put on and the silo capped.

## Self-Feeding

The narrow width of the silo and the two supporting poles in the end make it dangerous to self-



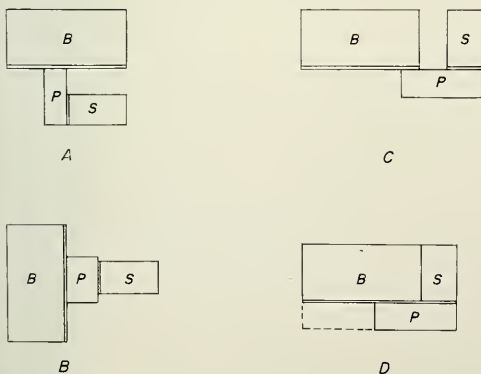
PICTURE 4. The cattle are being fed from the plank bunk.

feed silage to cows heavy with calf. Self-feeding can be practiced, however, if the cattle being fed are not horned or with calf.

If self-feeding is to be practiced, the silo floor should be paved. Experience in feeding the silage in a bunk (Pictures 4 and 5) showed that the area in front of the silo should be paved even when the area is well drained.

## Possible Arrangements

These are four possible arrangements of the silo and barn:



Key : B - Barn , S - Silo , P - Paved Strip

A. The barn and silo are parallel to each other with the 6-foot wide concrete strip providing a paved platform on which the cattle stand to feed at the silo. The concrete strip also extends to the barn to provide a walk which helps keep the cattle out of the mud.



PICTURE 5. Note the simple bunk used in the silo. It is put in after the cattle self-feed into the silo enough to permit putting it in.

B. The silo is perpendicular to the barn with the paved strip between the barn and silo. This is the arrangement being used at the West Virginia University Animal Husbandry Farm. An eves trough over the open side of the barn drains the roof water off to one end.

C and D. The two arrangements are very similar. In "C" the barn and silo are separated, whereas in "D" the silo is built next to the barn and some of the barn poles help support the side of the silo. This would call for a few changes in design.

The location of the silo and barn depends upon the water supply, roads, hay fields used for silage, and pasture. In any case the barn should be oriented to put the open side away from the wind and also to make double use of the concrete strip at the silo.

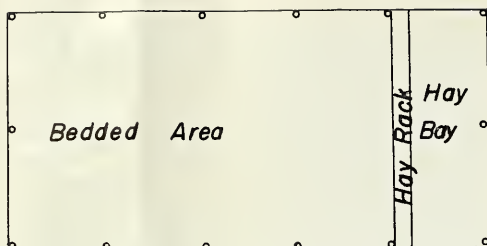
Any water trough should be outside the barn to prevent the bedded area from becoming wet and unnecessarily soiled.

One bay is used to store about 12 tons of baled hay. A desirable position for the hay rack is between the bedded area and the hay bay, as shown in the drawing at the top of page 6. It is recognized that the 12 tons of hay may not be enough to carry the cattle through the winter. It would be possible to use two bays instead of one or part of another to store the extra hay needed. The hay rack can be moved back as the hay is fed out to give more room in the barn as winter progresses. Another 11-foot bay could be added if needed.

## Changes for a Larger or Increased Herd Size

The box silo, like the barn, may be changed to meet the needs of a larger herd size.

By making the 12-foot wide silo 13 feet longer or a total of 39 feet in length, the capacity would be increased from 65 to 97.5 tons. If the silo was made



wider by 4 feet or a total of 16 feet wide and 26 feet long, the capacity would be 86 tons. These figures are based on a density of the settled silage of 40 lbs. per cubic foot and 10 feet of settled silage.

The estimated box silo capacity in tons is given for the 12 x 26 size and calculated for two densities of silage and for three heights of the settled silage in Table 1.

TABLE 1. ESTIMATED CAPACITY OF BOX SILO IN TONS

DENSITY OF SILAGE IN LBS. PER CU. FT.	HEIGHT OF SETTLED SILAGE		
	8 Ft.	9 Ft.	10 Ft.
35	Tons 47.3	Tons 53.3	Tons 59.1
40	54.0	60.8	67.6

## Hay and Silage Requirements

In Table 2 the number of tons of grass silage and hay is given for 100, 120, and 140 feeding days. These figures are based upon the two recommended rations given below.

**Brood Cows**—30 lbs. of grass-legume silage per cow per day; 7-8 lbs. of good legume hay per cow per day.

**Yearling Steers**—25-30 lbs. of grass-legume per steer per day; 4-5 lbs. of mixed hay per steer per day.

From Table 2 can be found the amount of hay and silage in tons required for a feeding period of 100, 120, and 140 days for brood cows or yearling steers. For example, if 25 brood cows were to be fed for 140 days, 53 tons of grass silage and 13.1 tons of hay would be needed. The underlined figures in the table indicate where the capacity of the barn and silo do not meet the required storage space for hay or silage.

## Summary

Satisfactory livestock shelters and feed storage units can be built easily and inexpensively with home-grown lumber and farm labor.

The barn and silo will house and feed 20 to 35 yearling steers or beef cows, depending upon the length of feeding period.

The least expensive construction for the barn is a galvanized steel roof and vertical board siding with home-grown locust poles and preservative treated splash boards. Aluminum roofing will last much longer, but the initial cost is slightly higher.

Discarded or used utility poles would be satisfactory for the barn or silo if the top does not exceed 10 inches; however, a top diameter of 6 inches would be more satisfactory to use in the construction process.

Spoilage losses of 3 to 6 per cent can be expected in the silo when a good cover is used.

TABLE 2. ESTIMATED TONS OF SILAGE AND HAY REQUIRED FOR VARIOUS NUMBERS OF BROOD COWS OR YEARLING STEERS

NUMBER OF ANIMALS	GRASS SILAGE NUMBER OF FEEDING DAYS			HAY NUMBER OF FEEDING DAYS		
	100	120	140	100	120	140
<b>BROOD COWS</b>						
20	20	36	42	7.5	8.4	10.5
25	38	45	53	9.4	10.5	13.1
30	45	54	63	11.3	12.6	15.8
30	53	63	74	13.1	14.7	18.4
<b>YEARLING STEERS</b>						
20	28	34	38	4.5	5.4	6.3
25	34	42	48	5.6	6.8	7.9
30	41	50	58	6.1	8.1	9.5
35	48	58	68	7.9	9.5	11.0

## BILL OF MATERIALS

### Pole Barn - 26 x 55, one side open

#### POLES

- 5 in. top and pressure-treated
- 2—20 feet
- 12—16 feet
- 9—12 feet

#### SPLASH BOARDS—pressure-treated

- 16—2" x 10" x 14'
- 20—2" x 10" x 12'

#### FRAMING MATERIAL

##### 2-inch rough oak, fir, or poplar

- 20—2" x 10" 12' Plates
- 15—2" x 6" x 12' Nailing girts—side walls
- 12—2" x 6" x 14' Nailing girts—end walls
- 22—2" x 10" x 16' Rafters
- 9—2" x 6" x 22' Rafters Ties
- 10—2" x 6" x 1½' Scab Boards
- 22—2" x 4" x 2' Blocks
- 90—2" x 4" x 12' Purlins
- 4—2" x 4" x 16' Fascia—can use shorter pieces
- 2—2" x 8" x 8' Door Framing
- 20—2" x 4" x 4½' Braces

#### NAILS

- 70 lbs.—40 d. common
- 40 lbs.—20 d. common
- 40 lbs.— 8 d. common

#### ROOFING MATERIAL—

##### 28-gauge galvanized steel or

##### 24-gauge aluminum

- Roof—58 sheets 26" x 8'—0"
- 58 sheets 26" x 7'—0"
- Rear—29 sheets 26" x 10'—0"
- Ends—28 sheets 26" x 12'—0"
- 56-foot ridge (coverage)

If desired, the ends and rear may be sheathed with wood either rough, random width, or finished.

## BILL OF MATERIALS

### One 11-foot bay of 26x55 pole barn

#### POLES

- 2—16 feet
- 2—12 feet

#### SPLASH BOARDS

- 4—2" x 10" x 12'

#### FRAMING LUMBER—

##### 2-inch rough oak, poplar, or fir

- 4—2" x 10" x 12' Plates
- 3—2" x 6" x 12' Nailing girts
- 4—2" x 10" x 16' Rafters
- 2—2" x 6" x 22' Rafter ties
- 2—2" x 6" x 1½' Scab boards
- 4—2" x 4" x 2' Blocks
- 18—2" x 4" x 12' Purlins
- 4—2" x 4" x 4½' Braces

#### NAILS

- 12 lbs.—40 d. common
- 7 lbs.—20 d. common
- 7 lbs.— 8 d. common

#### ROOFING MATERIAL—

##### 28-gauge galvanized steel or

##### 24-gauge aluminum

- Roof—12 sheets 26" x 8'—0"
- 12 sheets 26" x 7'—0"
- Rear— 6 sheets 26" x 10'—0" (if metal sheathed)
- 12-foot ridge (coverage)

## BILL OF MATERIALS

### Pole box Silo 12'x10'x26'

#### MAIN POLES

- 18—14' long —5"—top minimum pressure-treated or utility poles

#### BRACE POLES

- 16—10' long—5"—top minimum, pressure-treated or utility poles

#### FRAMING LUMBER

- 33—2" x 4" x 14'—rough oak or poplar

#### SHEATHING

- 800 bd. feet—1" rough, 10' long, random width oak or poplar

#### ROOFING PAPER

- 9 rolls—55 lb. roofing paper plus nails and cement

#### NAILS

- 25 lbs.—40 d. common
- 20 lbs.— 8 d. common

## Source for Plans for Building Pole Structures

Plans for building pole structures can be obtained from the following:

1. *How to Build Pole Type Frame Buildings—* Southern Pine Association, New Orleans, Louisiana.

2. *Pole Type Machinery Shed*—Koppers Company, Inc., Wood Preserving Division, Koppers Building, Pittsburgh 19, Pennsylvania.

3. *Build and Save*—United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

4. *Where to Get Plans for Ranch and Farm Structures for Use in Fourteen Southern States*—United States Steel Corporation.

5. *Plan Catalog*—Reynolds Metal Company, 2000 South Ninth Street, Louisville 1, Kentucky.

6. *Cattle Shelters and Equipment for Southern States*, United States Department of Agriculture, Agriculture Handbook No. 81.

7. Weyerhaeuser Sales Company, Saint Paul 1, Minnesota.

*Open Front Livestock Shed*—No. 1130

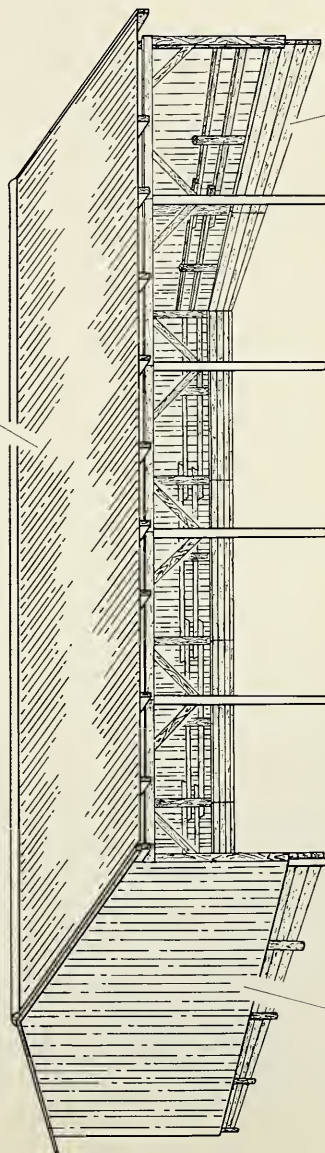
*Loft Storage Livestock Shed*—No. 1131

*T-Shape Livestock and Storage Shed*—No. 1132

*U.M.U. Feeder Barn*—No. 1102.

8. Agricultural Engineer, Agricultural Extension Service, College of Agriculture, Forestry, and Home Economics, West Virginia University, Morgantown, West Virginia.

Metal Roofing  
Sheets or Rolls  
Aluminum or Galvanized



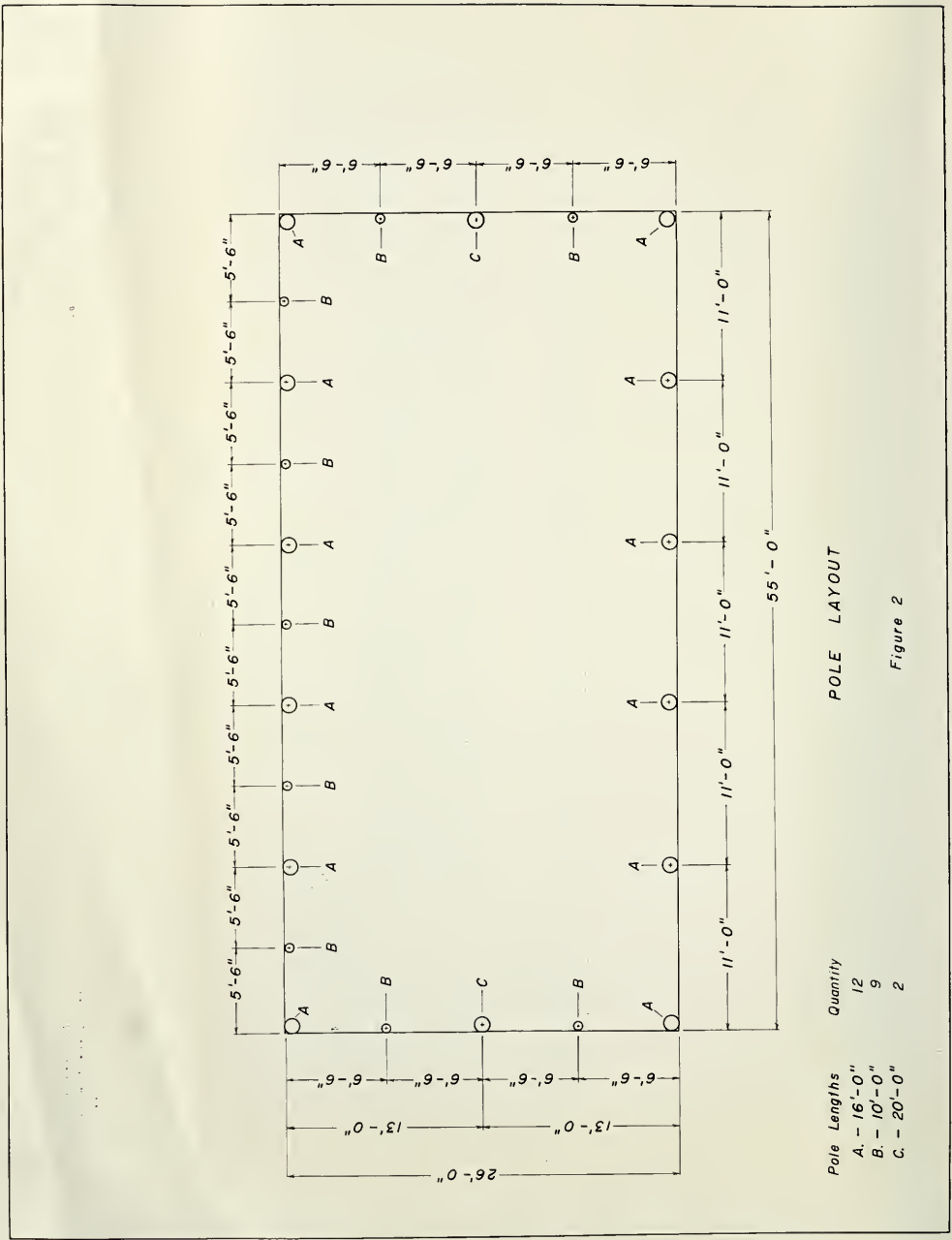
26 x 55 FOOT POLE BARN

Rough  
Random Width Siding  
Poplar and Oak  
or  
Metal Siding

Preservative Treated  
2 x 10 Splash Boards

Preservative Treated Pole

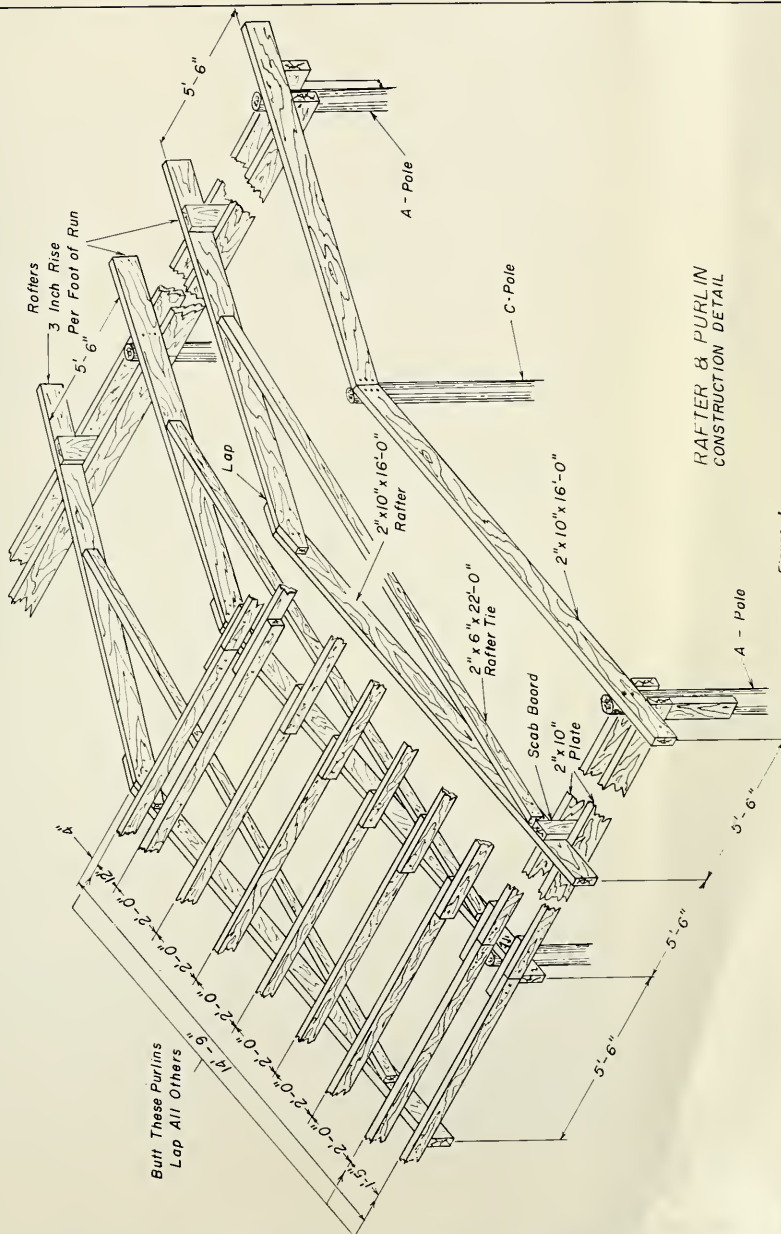
Figure 1

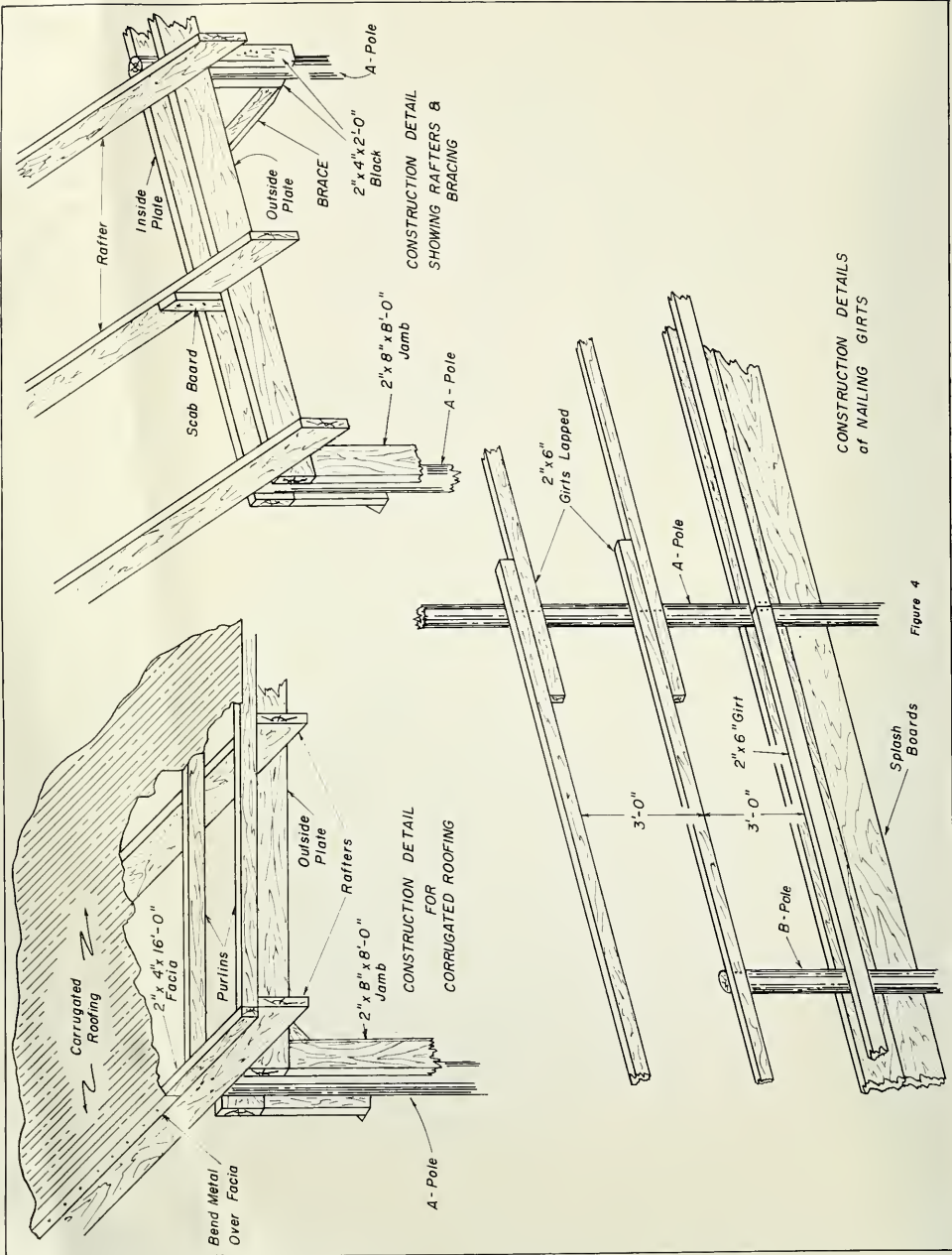


POLE LAYOUT

Figure 2

Pole Lengths	Quantity
A. - 16'-0"	12
B. - 10'-0"	9
C. - 20'-0"	2



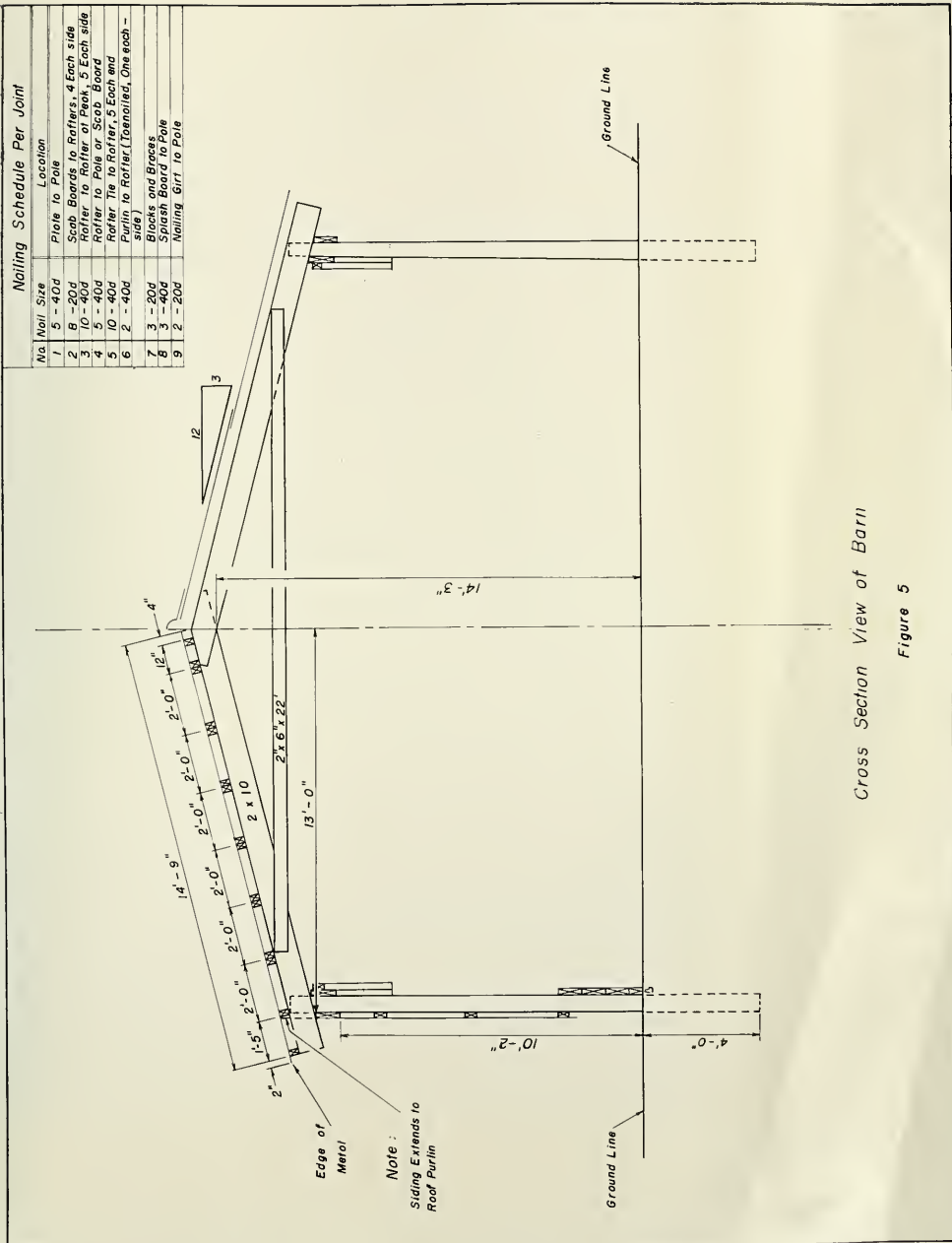


CONSTRUCTION DETAIL  
SHOWING RAFTERS &  
BRACING

CONSTRUCTION DETAIL  
FOR  
CORRUGATED ROOFING

CONSTRUCTION DETAILS  
of NAILING GIRTS

Figure 4



Cross Section View of Barn

Figure 5

Note:  
A. Nailing Block 4'-6" Long

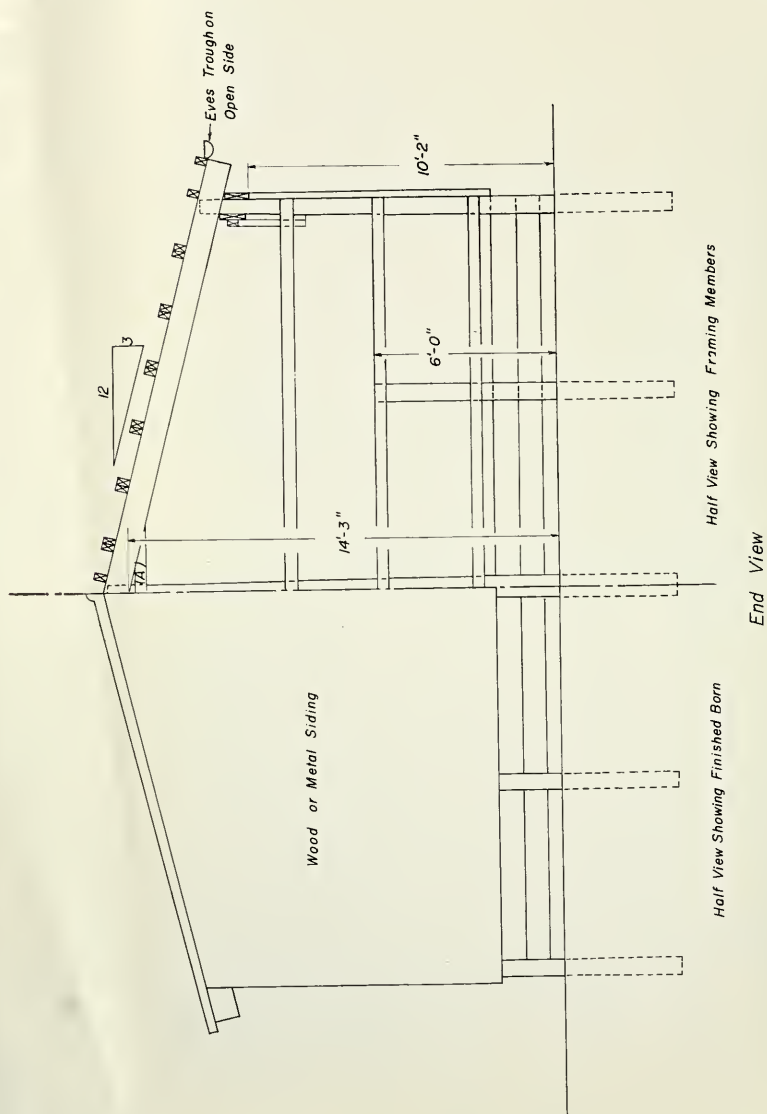


Figure 6

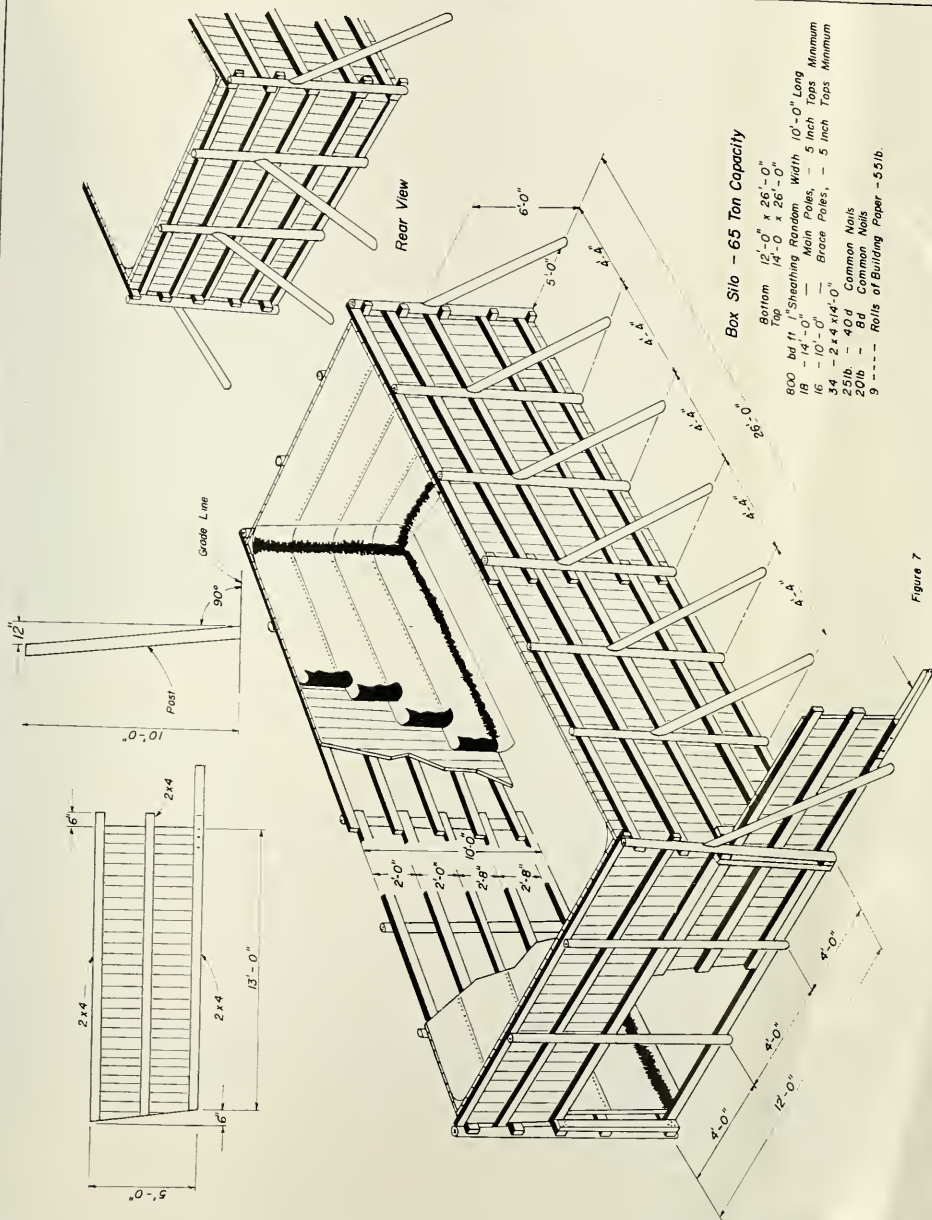


Figure 7

