# Contents

# How to plan your rigid frame building

You can get 529 possible designs out of this manual. All are based on safety and economy and provide the most workable shapes and sizes. Other spans are possible, but will require a complete structural analysis.

At this beginning stage – plan carefully. It will pay off in the long run, eliminating problems before they even come up.

## Area planning

Area planning is the basic step toward a useful, adequate building. Plan enough space for work areas, equipment, furnishings and room partitioning. Try to make the area adaptable for any future change-over to another purpose. Keep in mind that in clear span construction, long narrow types are more economical than the more nearly square versions.

As with any building, the site should be selected carefully. Consideration must be given to the slope of the land, relation to other buildings and ease of access.

## Planning the frame shape

After the area has been determined, a frame shape and leg height are selected. These play an important part in the overall function of the rigid frame building. Here the enclosed room volume and storage capacity is determined. With the option of either a vertical or slant shape, the resulting design can differ in both usability and economy.

Of the two, the vertical shape is more conventional in appearance but requires the use of heavier frames than those used for a slant shape with the same load and span conditions. The slant leg is more efficient structurally; however, the slant leg shape reduces storage volume when compared to an equal span vertical leg structure.

In many instances, the function of a building may call for vertical inside walls. In these cases, keep the leg height to a minimum to take advantage of the resulting smaller frame material sizes. Extending the leg height of a vertical walled rigid frame unit will increase the stress in the members and may require that they be of a larger size.

On the other hand, as the slant leg height increases, the rigid frame approaches a more efficient structural shape. Thus, in some cases, smaller, less costly member sizes may be used. This may not apply in some cases where the member size is dictated primarily by the wind load rather than the vertical load.

## Spacing and loading

Clearly, the greater the spacing between the frames, the fewer the number of frames required. However, plan several spacings – the decreased cost in framing may be offset by the thicker roof sheathing required by the increased spacing.

The loading values used in the tables throughout this manual are the sum of the roofing materials plus the snow load. Be certain to select loads that are realistic.

The use of light loads to justify a marginal design is risky and should never be done. Likewise, it is just as foolish to use excessive design loads. Unnecessary loads result in overbuilding and higher costs.

In any case, comparison of your design with the local building code is a must. Be certain to get the actual local snow load value. Also make sure the requirement for wind pressure design does not exceed the maximum allowable for these rigid frame designs (20 psf).

## Doorways

Doorways and other openings should be planned to work with the area, shape and framing. End wall openings offer the easiest approach. Because the end walls bear no load, imaginative treatments not allowable in conventional framing may be applied to the rigid frame structure.

Side doors can be included as a part of the design, although they present engineering and construction problems that are sometimes difficult to work out. Any openings in the side of the rigid frame building involve moving or cutting of the frame units and extreme care must be taken to preserve adequate anchorage, foundation and reinforcement to the adjacent frames.

One of the easiest methods to use in constructing a side entrance, without redesigning the frame unit, is to group the frames at the door sides and span the opening with purlins.

## Design conditions

To aid in the design of your rigid frame building, a design example and work sheet follow, illustrating the use of the tables on member sizes, framing details, roofing, wall sheathing and anchorage.

In developing the tables and designs, these conditions were used:

1. Recommended grades for plywood gussets are STRUCTURAL I (A-C, C-C, C-D) or C-C Exterior, depending on moisture conditions and desired appearance.
2. Lumber is stress-graded, with an allowable bending stress of at least 1200 psi throughout its length. Grades meeting this stress level include No. 2 Douglas fir or larch, No. 2 KD southern pine and No. 1 'hem-fir.'
3. Duration of load stress increases have been applied in computations. A 15% increase for snow load and a 33-1/3% increase for wind load were used.
4. The rigid frame building is designed to withstand a 20 psf wind load. This is equivalent to an 80 mph wind and as such, is an adequate value in all areas except those where hurricanes or tornados may be expected.
5. The rigid frame building will carry the total roof load shown in the tables. This includes dead load (structure and roofing) plus any live load (snow, etc.).

## Foundation design

This publication contains all the information required to design a rigid frame building from the sills upward, as long as it is within the span and load limitations covered. Also included are the forces which must be resisted by the foundation. Design of the foundation requires knowledge of the local soil conditions.

## Plywood sheathing required

The frame designs are predicated on the use of plywood as structural elements in the roof decking, wall sheathing and gusset plates. An absolute requirement for a rigid frame building is the use of plywood sheathing. Only plywood will develop the added stiffness essential to the frame members. *Substitution of other materials could result in an unsafe structure.* Complete technical information and design data can be obtained by writing to the American Plywood Association, P.O. Box 11700, Tacoma, Washington 98411, Attention: Technical Services Division.

**Note: Current APA nomenclature for C-D and C-C panels is Rated Sheathing. C-D panels are classified Exposure 1 or Exposure 2 and C-C panels are classified Exterior. Structural I panels are so marked. For gussets use only plywood panels which include the notation PS 1-74 in their trademarks.**

# Design example

## 1. Required:

A 36′ span machine shed with an
8′ side wall height.
Vertical side walls are preferred.
Location: Near Atlanta, Georgia.

## 2. Loads:

Local inquiry to building officials reveals that the 20 psf wind load design for the rigid frames in this manual is satisfactory for the region.

Using a dead load of 5 psf added to the 10 psf snow load totals 15 psf. This value will be used in the selection of the member sizes and roof decking.

## 3. Selection of member sizes:

Select the member size and spacing from tables on page 6. In the 36′ span column, and opposite the 15 psi roof load entries, locate the options for an 8′ side wall height. A 24″ frame spacing is satisfactory for a farm building.

Frame spacing is often governed by the most economical thickness of plywood for roof sheathing and wall siding.

When no increase is required in sheathing thickness, it is usually more economical to specify heavier frames at a wider spacing.

Also check the member selection table. It's quite possible that the same member size will enclose a higher or wider building.

Final choice:

36′ span

8′ side wall height (vertical side wall)

24″ o.c. frame spacing

2x10 frame members

## 4. Layout and fabrication details:

The details for cutting and fabricating the frame members and gussets are shown on page 14. They apply to all vertical leg frames made from 2x10 members.

The 8′ frame leg — which is called for in this design — is cut at a 5:12 slope on the upper end, and the rafter length (for a 36′ span) is 21′-2″. However, assume 22′ long 2x10's are not available, so the optional splice must be employed to obtain the desired length. An 8′ and a 14′ member will do.

## 5. Determining the base anchorage:

In rigid frame structures, certain thrusts must be resisted. The tables on page 9 give the values to be used. In this design example, the values are:

An outward thrust of 330 lbs.,

An inward thrust of 318 lbs., and

An uplift of 75 lbs. at each frame leg.

The anchorage details, page 10, show that one framing anchor, well nailed to the leg and sill, will serve as sufficient anchorage to resist these forces. The sill should then be fastened to the foundation with 1/2″ anchor bolts spaced 2′ o.c. as shown.

## 6. Foundation design:

Several suitable foundations are discussed on page 8. Each case varies, of course, with such details as the building's use, the soil, and the climate. Thus, it is difficult to design a correct foundation without complete knowledge of local conditions.

For these reasons, American Plywood Association cannot assume any responsibility for the foundation design. It is suggested that a local engineer or other authority be consulted on its design. The thrust values on page 9 will aid him in developing a satisfactory foundation.

## 7. Finishing details:

Selecting and detailing the windows, the plywood siding and doors and other finish items will complete the design.

# Worksheet

**1. General information**

| | | | |
|---|---|---|---|
| Shape | (circled) ☑ / ☐ | Bldg. Use | *Farm Machine Shed* |
| Span | *36′-0″* | Roof load D.L. | *5* PSF |
| Frame spacing | *24″* o.c. | Snow load | *10* PSF |
| Leg Length | *8′-0″* | TOTAL | *15* PSF |
| | | (Wind load *20* PSF) | |

**2. Member size:** *2″ x 10″* **(Leg & rafters)** Rafter length: *21′-2″* Leg length: *8′-0″*

Grade: (Must have allowable bending stress of 1200 psi throughout) *No. 2 KD Southern Pine*

| **3. Plywood (APA)** | | THICKNESS | IDENTIFICATION INDEX* | APA GRADE |
|---|---|---|---|---|
| Gussets: | Haunch | *1/2″* | | C-C EXT ☑ STRUCT 1: AC ☐ C-C ☐ C-D ☐ |
| | Crown | *1/2″* | | C-C EXT ☑ STRUCT 1: AC ☐ C-C ☐ C-D ☐ |
| Combination Wall Siding-Sheathing | | *3/8″* | | C-C EXT ☑ B-C EXT ☐ A-C EXT ☐ Texture 1-11 ☐ 303 Siding ☐ Medium Density Overlaid Plywood ☐ |
| Inside Finish | | *NONE* | | C-D INT ☐ C-D INT exterior glue ☐ C-C EXT ☐ B-C EXT ☐ A-C EXT ☐ |
| Roof Decking | | *3/8″* | *24/0* | C-D INT ☐ C-D INT exterior glue ☐ C-C EXT ☑ B-C EXT ☐ A-C EXT ☐ |

*Required for roof deck only

**4. Reactions for use in anchorage and foundation design** **(see page 9)**

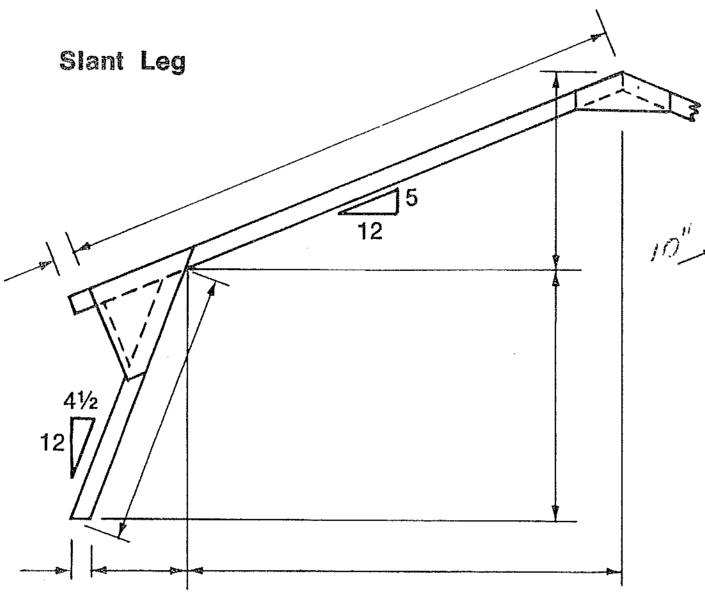
| | | |
|---|---|---|
| Outward | *330* | lb. |
| Inward | *318* | lb. |
| Upward | *75* | lb. |

$$\text{Down} = \frac{\text{span x spacing x loading}}{2} = 540 \text{ lb.}^\dagger$$

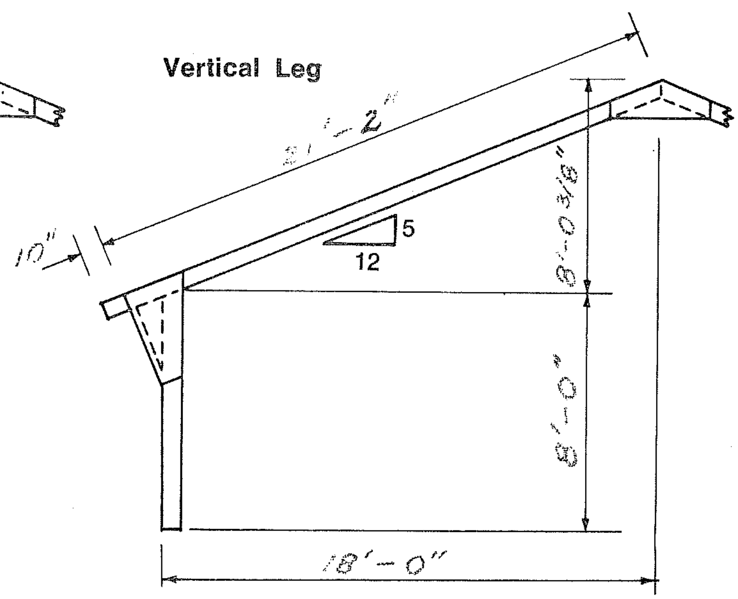
†Required for foundation design only

**5. Construction details for this building were taken from page 14**

**Slant Leg**




**Vertical Leg**



# Member selection table
# vertical leg

## 24′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 20 PSF | 6′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 25 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 35 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 50 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |

## 32′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x10 | 2x12 | 2x12 | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 20 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x10 | 2x12 | 2x12 | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 25 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 35 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 50 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |

## 36′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 20 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 25 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 35 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 50 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |

## 40′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x10 | 2x10 | 2x12 | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 20 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 25 PSF | 6′ | 2x10 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 35 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |
| 50 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |

## 44′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x12 | — | — | — |
| 20 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 25 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 35 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |
| 50 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |

## 48′ SPAN

| Total Roof Load | Leg Height | Frame Spacing, o.c. 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x12 | — | — | — |
| 20 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 25 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |
| 35 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |
| 50 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |

# Member selection table
# ◣ slant leg

## 24′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x6 | 2x6 | 2x6 | 2x8 |
| | 8′ | 2x6 | 2x6 | 2x8 | 2x8 |
| | 10′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 12′ | 2x6 | 2x8 | 2x8 | 2x10 |
| 20 PSF | 6′ | 2x6 | 2x6 | 2x6 | 2x8 |
| | 8′ | 2x6 | 2x6 | 2x8 | 2x8 |
| | 10′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 12′ | 2x6 | 2x8 | 2x8 | 2x10 |
| 25 PSF | 6′ | 2x6 | 2x6 | 2x8 | 2x10 |
| | 8′ | 2x6 | 2x6 | 2x8 | 2x8 |
| | 10′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 12′ | 2x6 | 2x8 | 2x8 | 2x10 |
| 35 PSF | 6′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 8′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 10′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 12′ | 2x6 | 2x8 | 2x8 | 2x10 |
| 50 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x6 | 2x8 | 2x8 | 2x10 |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

## 32′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 8′ | 2x6 | 2x8 | 2x8 | 2x10 |
| | 10′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x8 | 2x10 | 2x12 |
| 20 PSF | 6′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x6 | 2x8 | 2x10 | 2x10 |
| | 10′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x8 | 2x10 | 2x12 |
| 25 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x8 | 2x10 | 2x12 |
| 35 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x8 | 2x10 | 2x12 |
| 50 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

## 36′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x6 | 2x8 | 2x10 | 2x10 |
| | 8′ | 2x6 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x10 | 2x10 | 2x12 |
| 20 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x10 | 2x10 | 2x12 |
| 25 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x10 | 2x10 | 2x12 |
| 35 PSF | 6′ | 2x10 | 2x10 | 2x12 | — |
| | 8′ | 2x10 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 50 PSF | 6′ | 2x10 | | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | | — |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

## 40′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x8 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x10 | 2x10 | 2x12 |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 20 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x10 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 25 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 35 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 50 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

## 44′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x10 | 2x10 | 2x12 |
| | 8′ | 2x8 | 2x10 | 2x10 | 2x12 |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 20 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x8 | 2x10 | 2x12 | — |
| 25 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 35 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x10 | — | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 50 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

## 48′ SPAN

| Total Roof Load | Leg Height | 16″ | 24″ | 32″ | 48″ |
|---|---|---|---|---|---|
| 15 PSF | 6′ | 2x8 | 2x10 | 2x12 | — |
| | 8′ | 2x8 | 2x10 | 2x12 | — |
| | 10′ | 2x8 | 2x10 | 2x12 | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 20 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x10 | 2x12 | — |
| 25 PSF | 6′ | 2x10 | 2x12 | — | — |
| | 8′ | 2x10 | 2x12 | — | — |
| | 10′ | 2x10 | 2x12 | — | — |
| | 12′ | 2x10 | 2x12 | — | — |
| 35 PSF | 6′ | 2x12 | — | — | — |
| | 8′ | 2x12 | — | — | — |
| | 10′ | 2x12 | — | — | — |
| | 12′ | 2x12 | — | — | — |
| 50 PSF | 6′ | — | — | — | — |
| | 8′ | — | — | — | — |
| | 10′ | — | — | — | — |
| | 12′ | — | — | — | — |

Frame Spacing, o.c.: 16″, 24″, 32″, 48″

# Thrust, foundation and anchorage

A characteristic of the rigid frame, not found in many framing systems, is the thrust type of force.

The rigid frame develops an outward thrust similar to an arch, a moderate inward force plus a small uplift. The outward thrust is caused by the weight of the building and any snow load on the roof. The inward and uplift forces are due to the action of the wind on the sides of the building.

The designers of the rigid frames have provided the building strength and rigidity required through the use of plywood. But sound rigid frame buildings also depend upon good foundations and special leg anchorage.

## Foundation type

Foundation types and sizes vary with the building use, soil type, climate and building code requirements. Because of this, you will need to obtain the services of a qualified builder or engineer to prepare the foundation design. The thrust tables will aid the designer in developing a satisfactory design.

Some of the popular methods used as foundations for the rigid frame employ the use of a "cross-tie" system. The slab-foundation acts as a tie rod to join the walls so the thrust of one counteracts the other. For rigid frames with wood floors, floor joists can be designed to act in the same way. When no floor is planned, a buttress or gravity type wall foundation will serve well when properly designed.

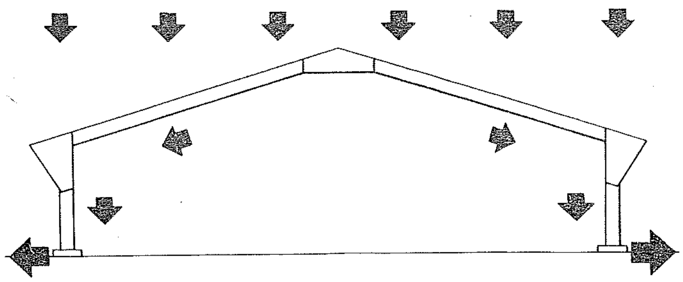
## Anchorage

Anchoring the studs to the foundation is critical. Toe-nailing them to the sill plate is not adequate and could result in a failure of the frame support. Framing anchors shown in the illustrations on page 10 have known load bearing capacities. Wrap-around or bent plate fasteners are suitable, but care must be taken to use an adequate number of nails.

The anchorage details on page 10 are suitable for either the slant or vertical leg versions.

# Thrust Tables

## Vertical Leg



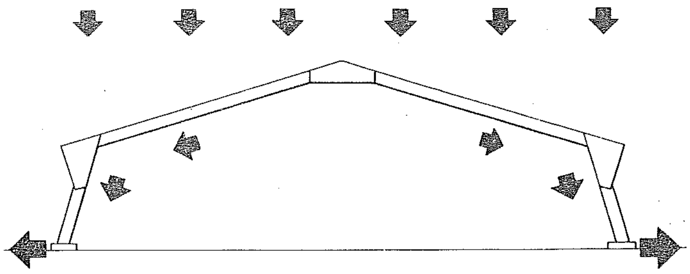
### Maximum Base Reaction Horizontal Thrust—Outward (lbs./Frame Leg)

| Leg Height | Member Size | | | |
|---|---|---|---|---|
| | 2 x 6 | 2 x 8 | 2 x 10 | 2 x 12 |
| 6′ | 150 | 275 | 440 | 640 |
| 8′ | — | 210 | 330 | 480 |
| 10′ | — | 170 | 270 | 390 |
| 12′ | — | 140 | 220 | 330 |

### Maximum Base Reaction Horizontal Thrust—Inward (lbs./Frame Leg)

| Leg Height | Frame Spacing | | | |
|---|---|---|---|---|
| | 16″ | 24″ | 32″ | 48″ |
| 6′ | 161 | 241 | 322 | 483 |
| 8′ | 212 | 318 | 424 | 637 |
| 10′ | 262 | 392 | 523 | 785 |
| 12′ | 308 | 462 | 616 | 924 |

## Slant Leg



### Maximum Base Reaction Horizontal Thrust—Outward (lbs./Frame Leg)

| Leg Height | Member Size | | | |
|---|---|---|---|---|
| | 2 x 6 | 2 x 8 | 2 x 10 | 2 x 12 |
| 6′ | 310 | 630 | 880 | 1290 |
| 8′ | 320 | 560 | 840 | 1260 |
| 10′ | 320 | 650 | 970 | 1100 |
| 12′ | 290 | 580 | 870 | 980 |

### Maximum Base Reaction Horizontal Thrust—Inward (lbs./Frame Leg)

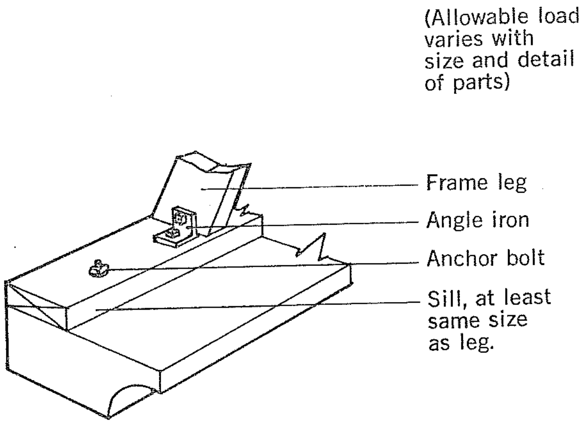
| Leg Height | Frame Spacing | | | |
|---|---|---|---|---|
| | 16″ | 24″ | 32″ | 48″ |
| 6′ | 117 | 175 | 234 | 351 |
| 8′ | 156 | 234 | 312 | 468 |
| 10′ | 195 | 293 | 391 | 587 |
| 12′ | 236 | 354 | 472 | 709 |

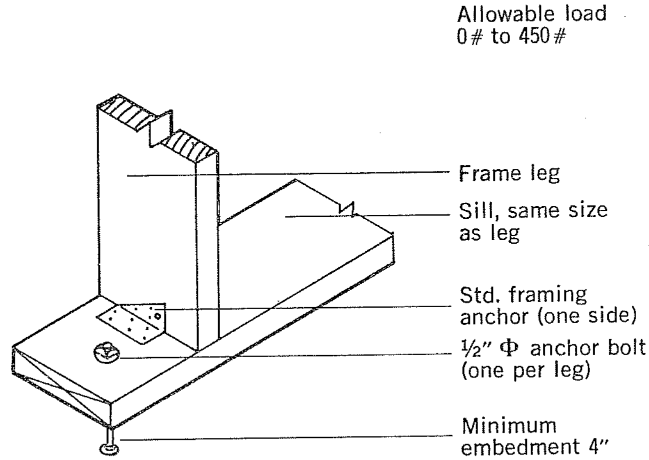
### Maximum Uplift (lbs./Frame Leg) Vertical and Slant Leg Values

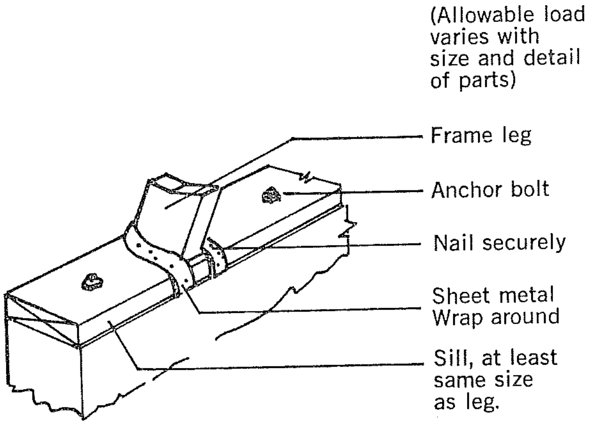
| Frame Spacing | Uplift |
|---|---|
| 16″ o.c. | 50 |
| 24″ o.c. | 75 |
| 32″ o.c. | 100 |
| 48″ o.c. | 150 |

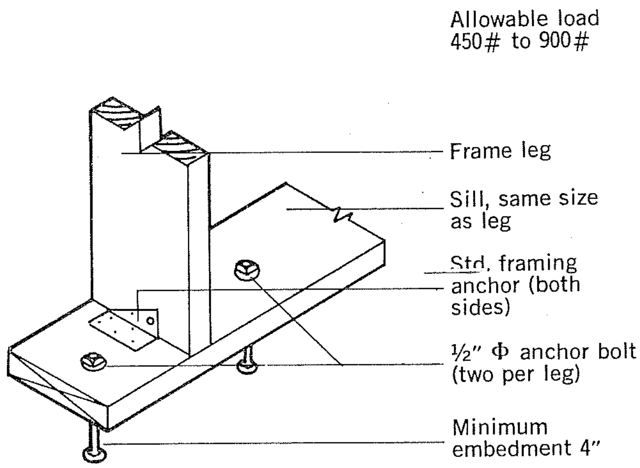
NOTE: In order to keep the thrust table simple, like values have been grouped. The most critical case is shown and as a result construction based on these values will always be safe.

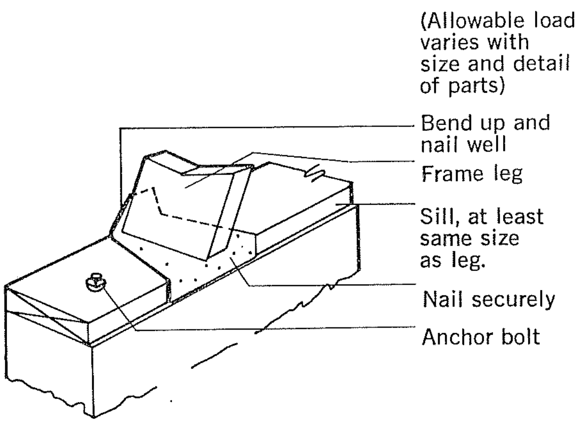
# Anchorage details

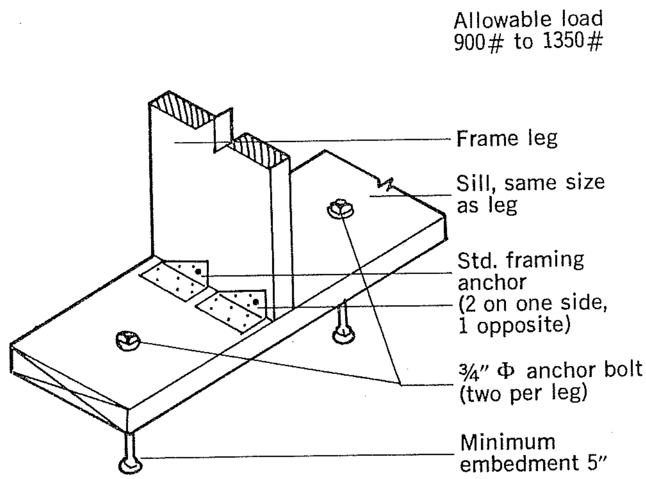


# Frame fabrication details

Note that dimensions correspond to pre-PS 20 net lumber sizes. However, dimensions remain accurate within 1/4".

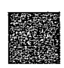
## How to use the fabrication details

The following pages contain plans and information for fabricating and erecting the rigid frame. Frame dimensions and layout may be found by turning to the page that corresponds to the member size and shape selected.

Details for each member size apply to the entire range of spans and leg lengths. Because these details are varied, be sure to take the correct information from the tables and drawings.

The first section of fabrication details pertains to member sizes for vertical leg shapes. The slant leg section follows.

To prevent selecting a member size with the wrong shape, symbols are placed in the page heading.

The vertical leg symbol: 

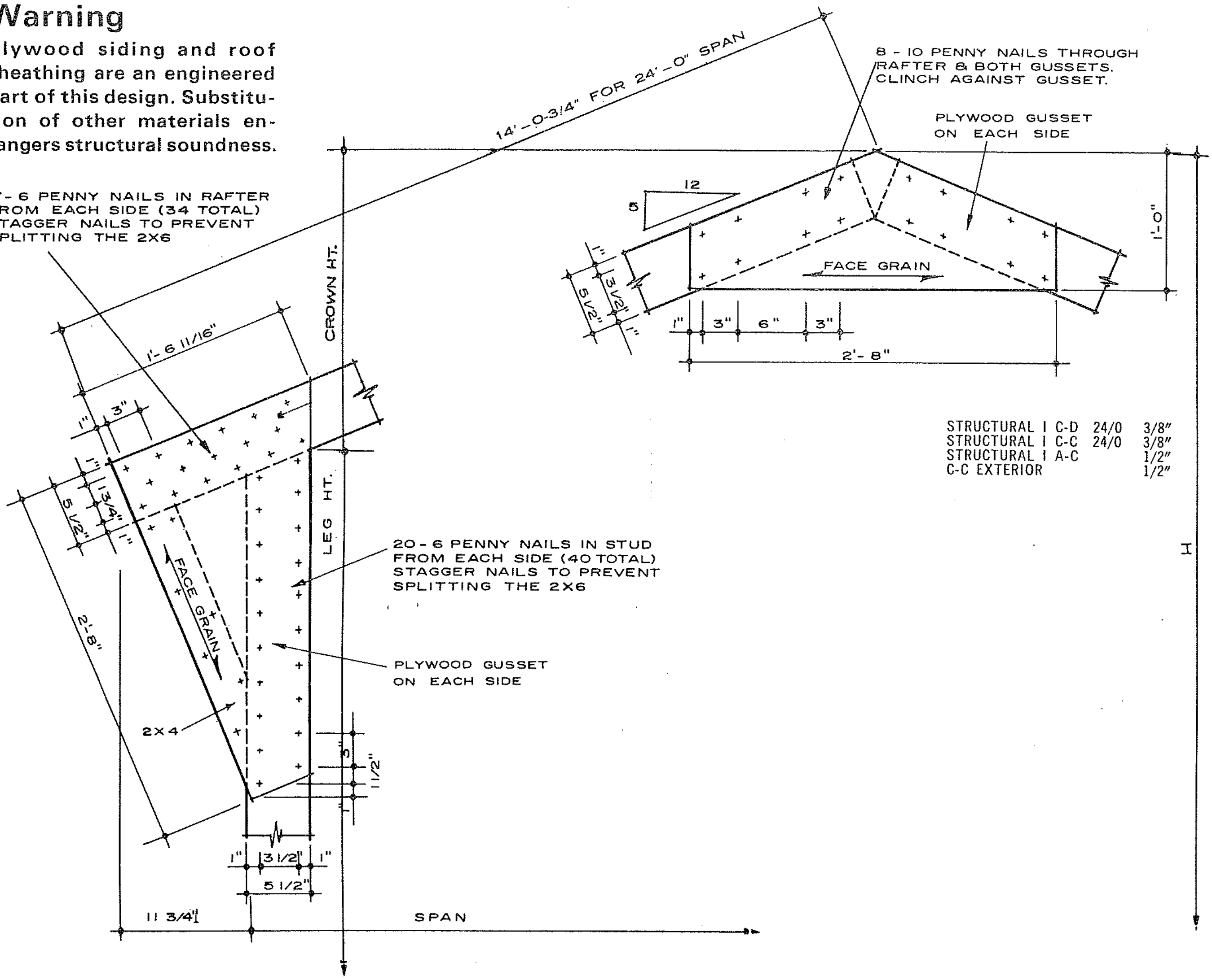
The slant leg symbol: 

Be sure you have the right page by checking the symbol on the page heading.

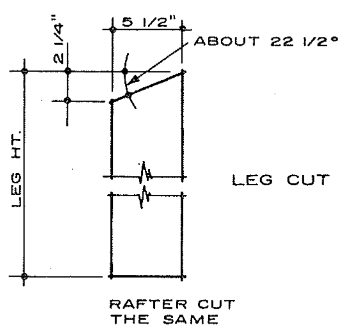
# Fabrication details
# 2x6 vertical leg

## Warning

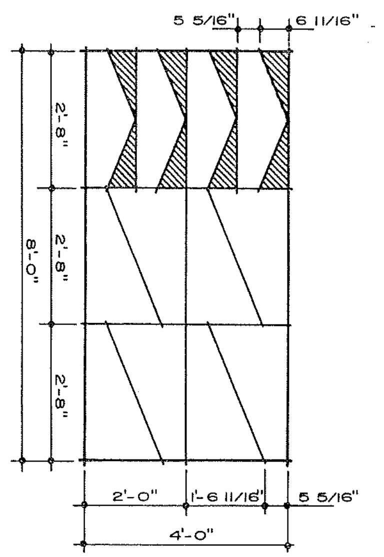
**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**




STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"




## Plywood cutting diagram



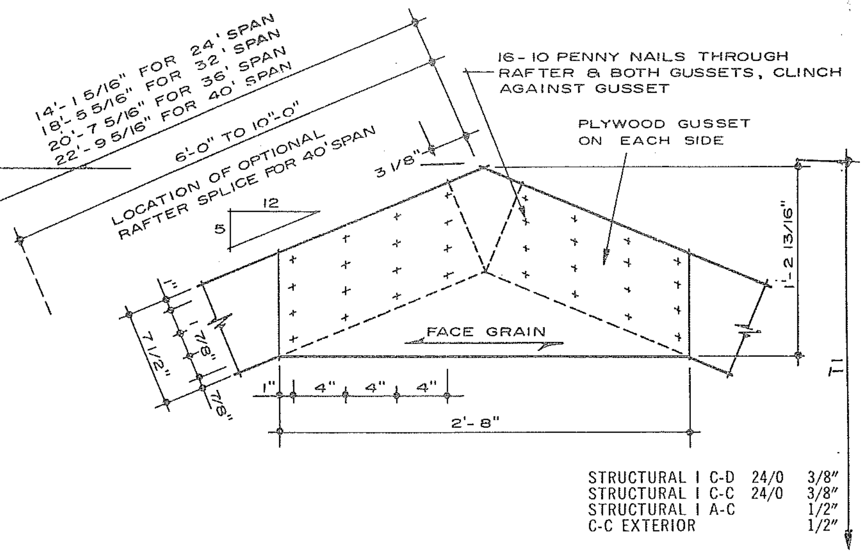

## Frame layout

| Span | Crown Height | Leg Height 6' | 8' | 10' | 12' |
|---|---|---|---|---|---|
| | | Overall Dimension (H) | | | |
| 24' | 5'- 3⅝" | 11'- 3⅝" | 13'- 3⅝" | 15'- 3⅝" | 17'- 3⅝" |

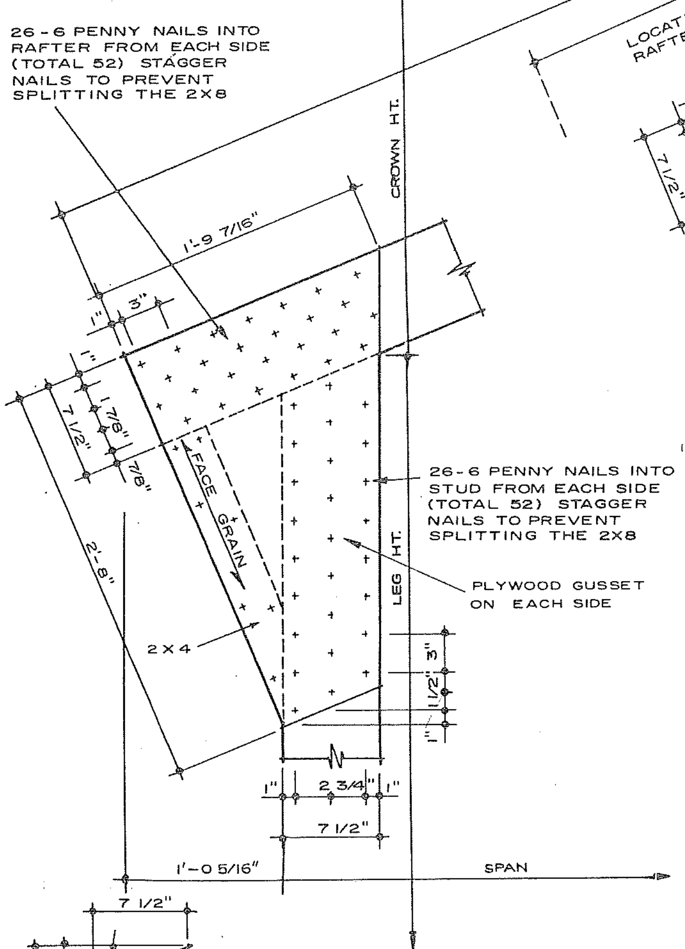
# Fabrication details
# 2x8 vertical leg

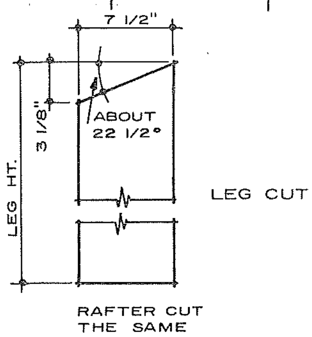
## Warning

**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**

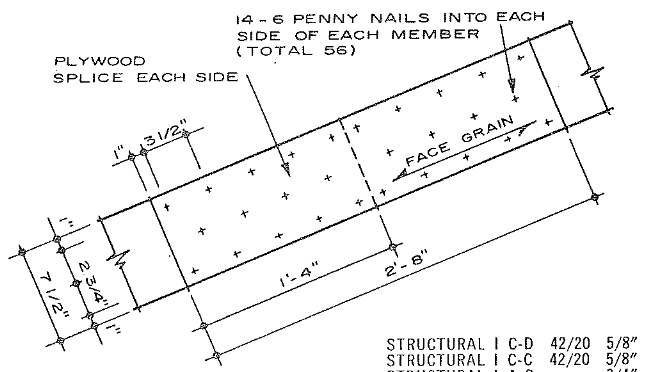



STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"



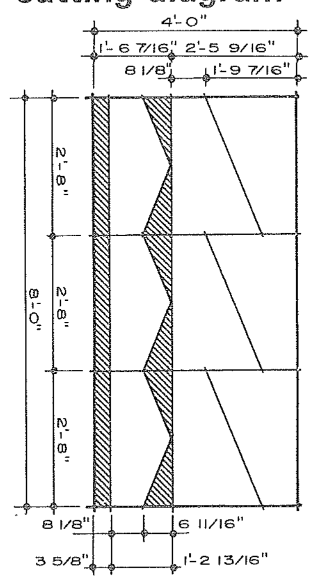




## Optional rafter splice




STRUCTURAL I C-D 42/20 5/8"
STRUCTURAL I C-C 42/20 5/8"
STRUCTURAL I A-C 3/4"
C-C EXTERIOR 7/8"*
*Substitute 8d common nails for adequate penetration.*

## Plywood cutting diagram



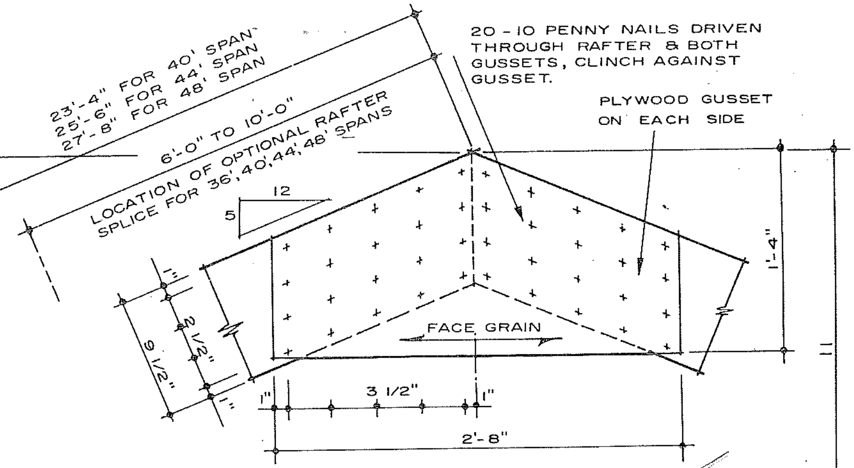

## Frame layout

| Span | Crown Height | Leg Height 6′ | 8′ | 10′ | 12′ |
|---|---|---|---|---|---|
| | | Overall Dimension (H) | | | |
| 24′ | 5′- 5″ | 11′- 5″ | 13′- 5″ | 15′- 5″ | 17′- 5″ |
| 32′ | 7′- 1″ | 13′- 1″ | 15′- 1″ | 17′- 1″ | 19′- 1″ |
| 36′ | 7′-11″ | 13′-11″ | 15′-11″ | 17′-11″ | 19′-11″ |
| 40′ | 8′- 9″ | 14′- 9″ | 16′- 9″ | 18′- 9″ | 20′- 9″ |

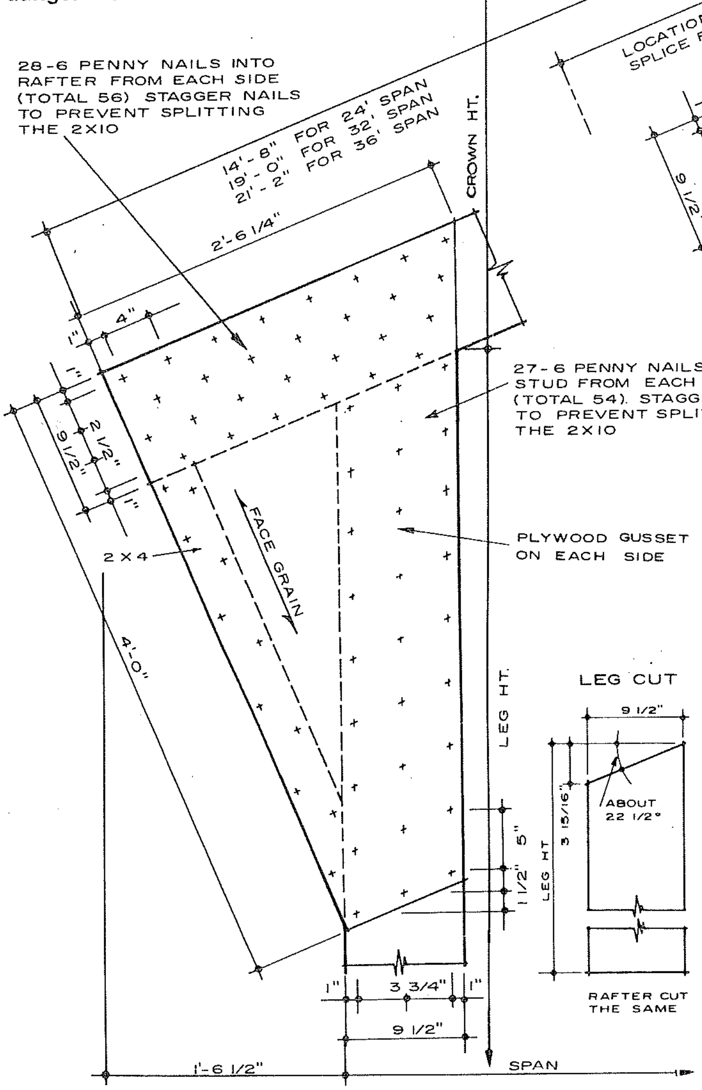
# Fabrication details
# 2x10 vertical leg

## Warning

**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**

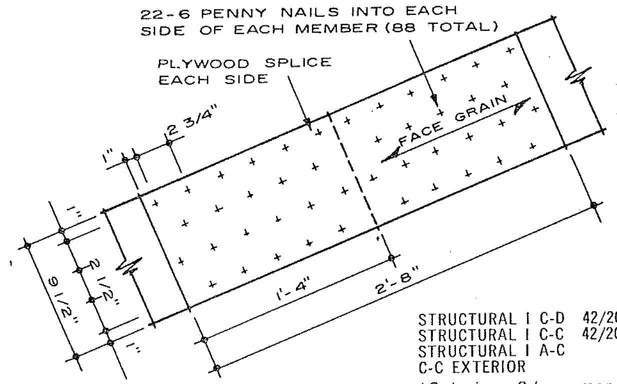



STRUCTURAL I C-D 42/20 5/8"
STRUCTURAL I C-C 42/20 5/8"
STRUCTURAL I A-C 3/4"
C-C EXTERIOR 7/8"*
*Substitute 8d common nails for adequate penetration.*



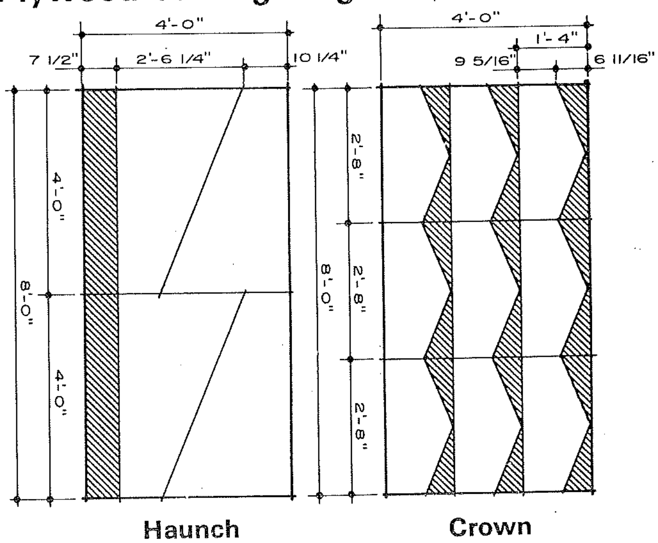

STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"

## Optional rafter splice




STRUCTURAL I C-D 42/20 5/8"
STRUCTURAL I C-C 42/20 5/8"
STRUCTURAL I A-C 3/4"
C-C EXTERIOR 7/8"*
*Substitute 8d common nails for adequate penetration.*

## Plywood cutting diagram




**Haunch** **Crown**

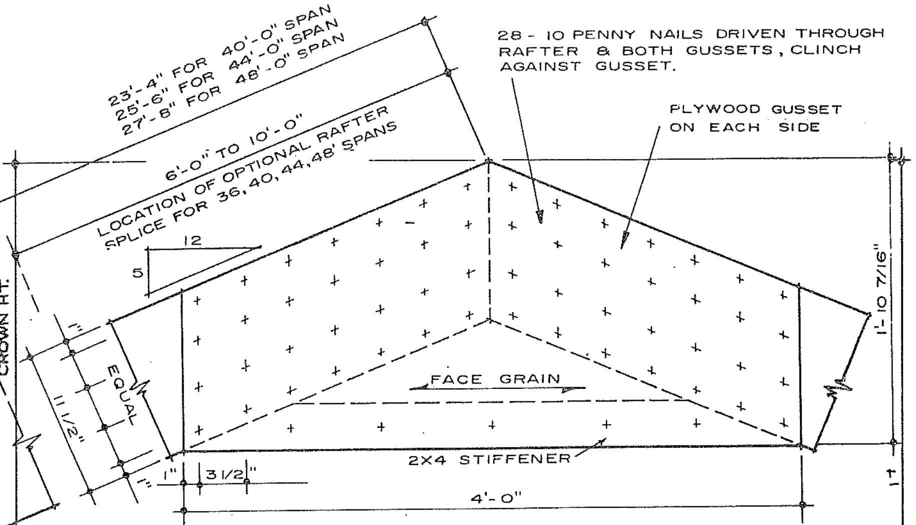
## Frame layout

| Span | Crown Height | Leg Height 6' | 8' | 10' | 12' |
|---|---|---|---|---|---|
| | | Overall Dimension (H) | | | |
| 24' | 5'- 6⅜" | 11'- 6⅜" | 13'- 6⅜" | 15'- 6⅜" | 17'- 6⅜" |
| 32' | 7'- 2⅜" | 13'- 2⅜" | 15'- 2⅜" | 17'- 2⅜" | 19'- 2⅜" |
| 36' | 8'- 0⅜" | 14'- 0⅜" | 16'- 0⅜" | 18'- 0⅜" | 20'- 0⅜" |
| 40' | 8'-10⅜" | 14'-10⅜" | 16'-10⅜" | 18'-10⅜" | 20'-10⅜" |
| 44' | 9'- 8⅜" | 15'- 8⅜" | 17'- 8⅜" | 19'- 8⅜" | 21'- 8⅜" |
| 48' | 10'- 6⅜" | 16'- 6⅜" | 18'- 6⅜" | 20'- 6⅜" | 22'- 6⅜" |

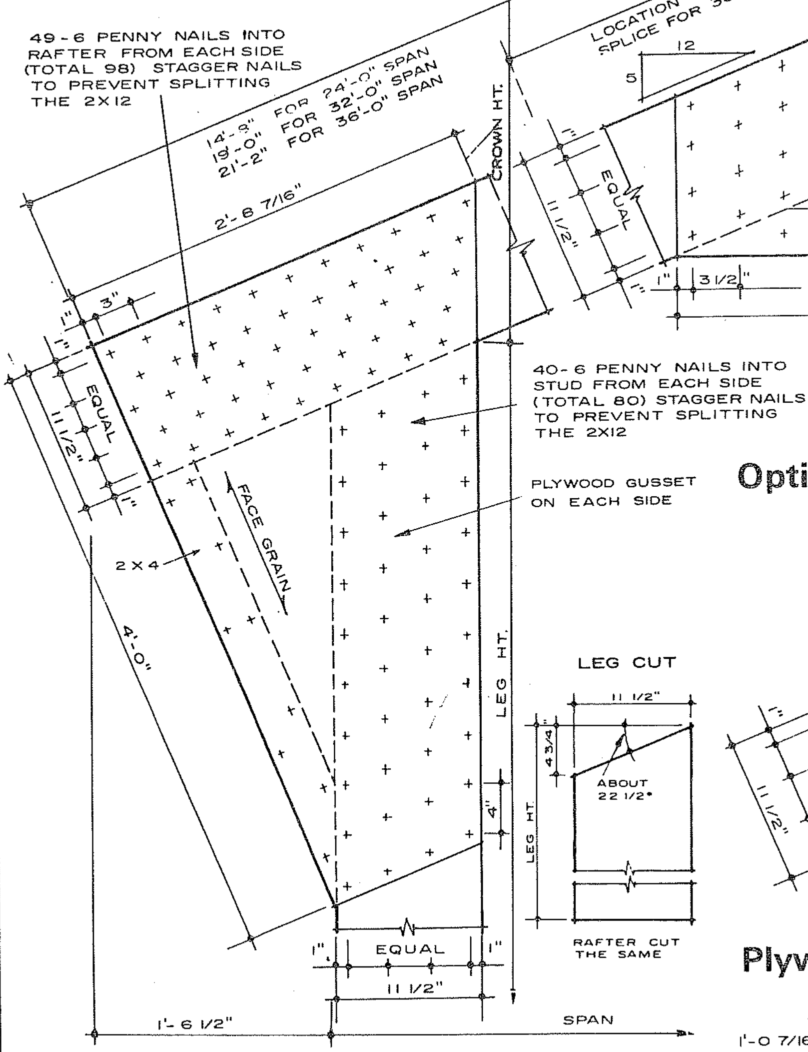
# Fabrication details
# 2x12 vertical leg

## Warning

**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**

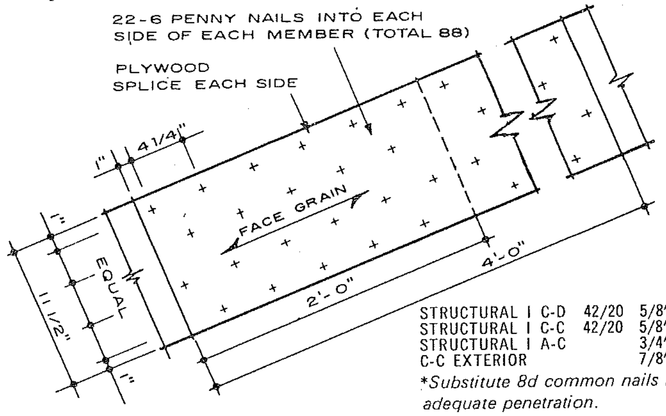



STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"




STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"

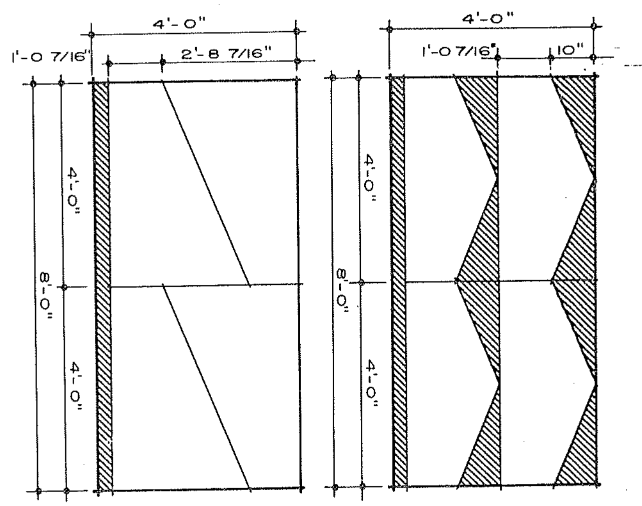
## Optional rafter splice




STRUCTURAL I C-D 42/20 5/8"
STRUCTURAL I C-C 42/20 5/8"
STRUCTURAL I A-C 3/4"
C-C EXTERIOR 7/8"*

**Substitute 8d common nails for adequate penetration.*

## Plywood cutting diagram



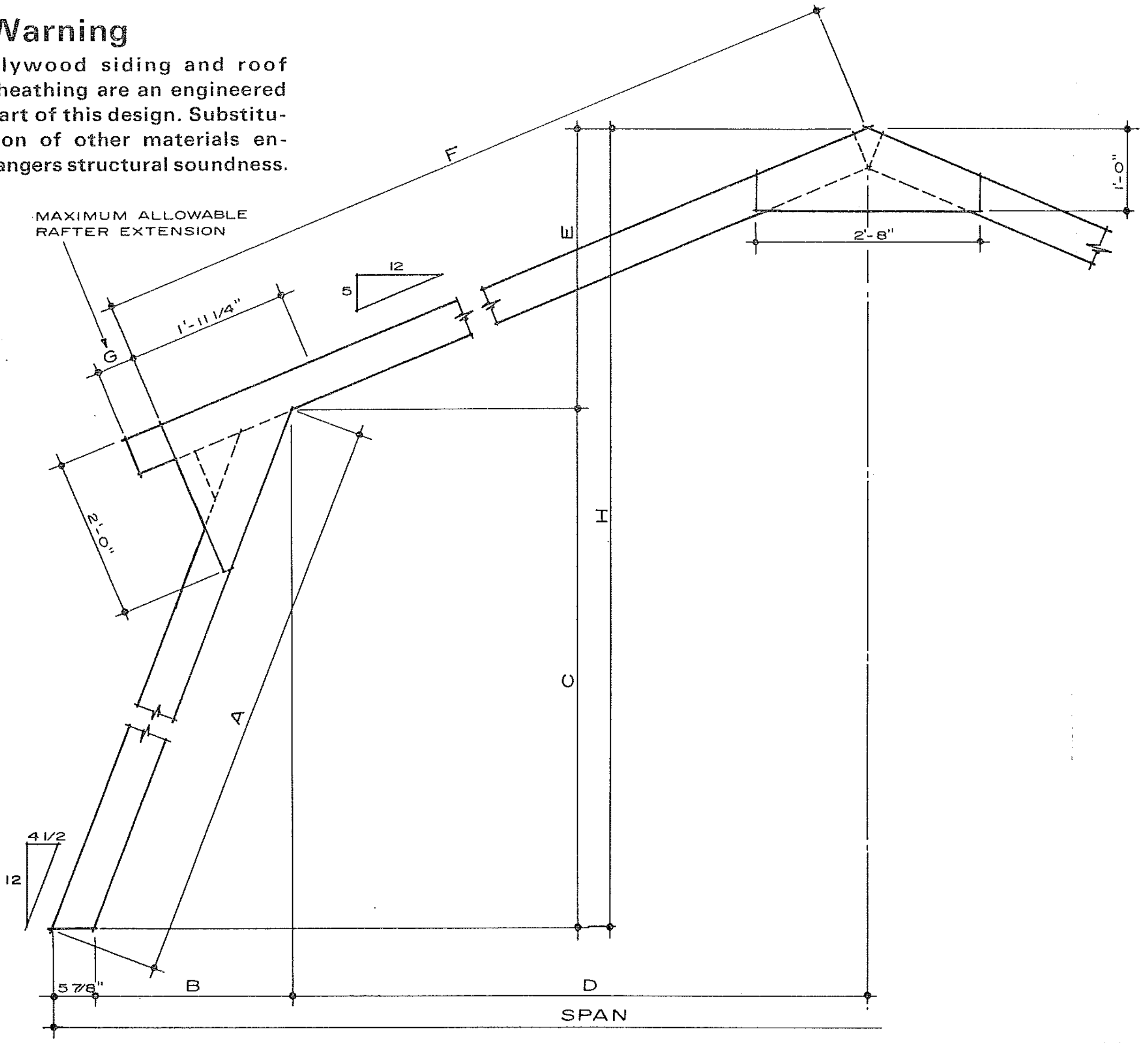

## Frame layout

| Span | Crown Height | Leg Height 6′ | 8′ | 10′ | 12′ |
|---|---|---|---|---|---|
| | | Overall Dimension (H) | | | |
| 24′ | 5′- 7⅝″ | 11′- 7⅝″ | 13′- 7⅝″ | 15′- 7⅝″ | 17′- 7⅝″ |
| 32′ | 7′- 3⅝″ | 13′- 3⅝″ | 15′- 3⅝″ | 17′- 3⅝″ | 19′- 3⅝″ |
| 36′ | 8′- 1⅝″ | 14′- 1⅝″ | 16′- 1⅝″ | 18′- 1⅝″ | 20′- 1⅝″ |
| 40′ | 8′-11⅝″ | 14′-11⅝″ | 16′-11⅝″ | 18′-11⅝″ | 20′-11⅝″ |
| 44′ | 9′- 9⅝″ | 15′- 9⅝″ | 17′- 9⅝″ | 19′- 9⅝″ | 21′- 9⅝″ |
| 48′ | 10′- 7⅝″ | 16′- 7⅝″ | 18′- 7⅝″ | 20′- 7⅝″ | 22′- 7⅝″ |

# Fabrication details
# ◣ 2x6 slant leg

## Warning

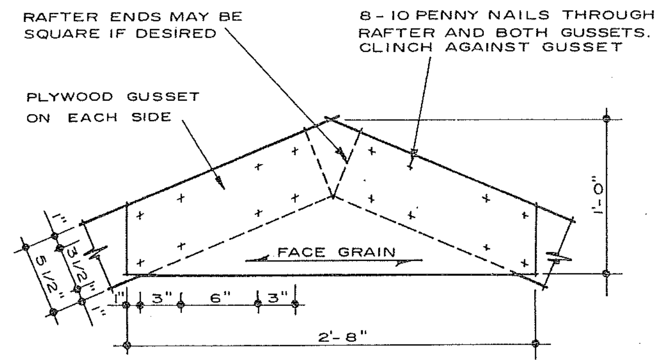
Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.




## Frame layout

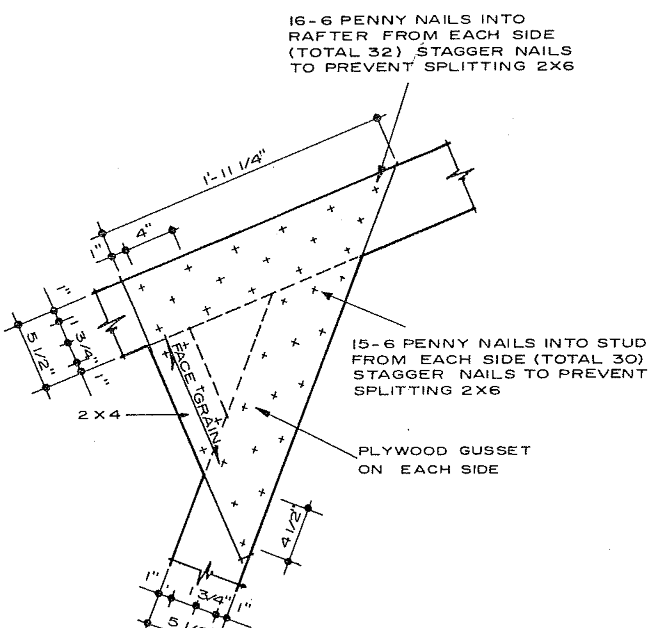
| | A | 6'- 0" | 8'- 0" | 10'- 0" | 12'- 0" |
|---|---|---|---|---|---|
| All | B | 2'- 0 9/16" | 2'- 9" | 3'- 5 3/8" | 4'- 1 13/16" |
| | C | 5'- 5 1/2" | 7'- 4" | 9'- 2 7/16" | 11'- 0 7/8" |
| | G | 1'- 0 9/16" | 1'- 9 11/16" | 2'- 6 3/4" | 3'- 3 7/8" |
| 24' span | D | 9'- 5 9/16" | 8'- 9 1/8" | 8'- 0 3/4" | 7'- 4 5/16" |
| | E | 4'- 5 1/4" | 4'- 1 3/4" | 3'-10 1/4" | 3'- 6 3/4" |
| | F | 11'-11 7/16" | 11'- 2 5/16" | 10'- 5 1/4" | 9'- 8 1/2" |
| | H | 9'-10 3/4" | 11'- 5 3/4" | 13'- 0 11/16" | 14'- 7 5/8" |
| 32' span | D | 13'- 5 9/16" | 12'- 9 1/8" | 12'- 0 3/4" | |
| | E | 6'- 1 1/4" | 5'- 9 3/4" | 5'- 6 1/4" | |
| | F | 16'- 3 7/16" | 15'- 6 5/16" | 14'- 9 1/4" | |
| | H | 11'- 6 3/4" | 13'- 1 3/4" | 14'- 8 11/16" | |
| 36' span | D | 15'- 5 9/16" | 14'- 9 1/8" | | |
| | E | 6'-11 1/4" | 6'- 7 3/4" | | |
| | F | 18'- 5 7/16" | 17'- 8 5/16" | | |
| | H | 12'- 4 3/4" | 13'-11 3/4" | | |

## Crown gusset detail



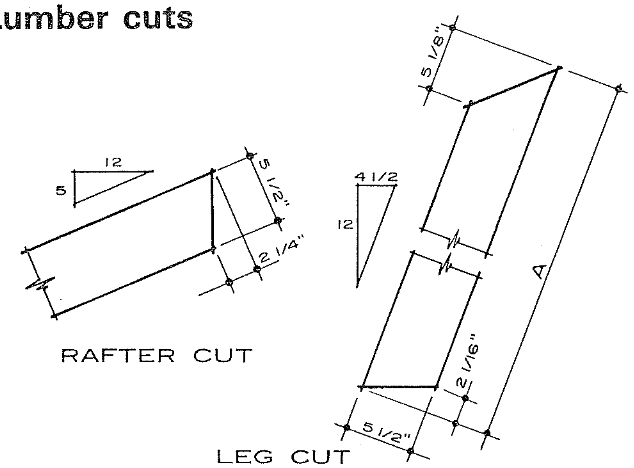

STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"

## Haunch gusset detail

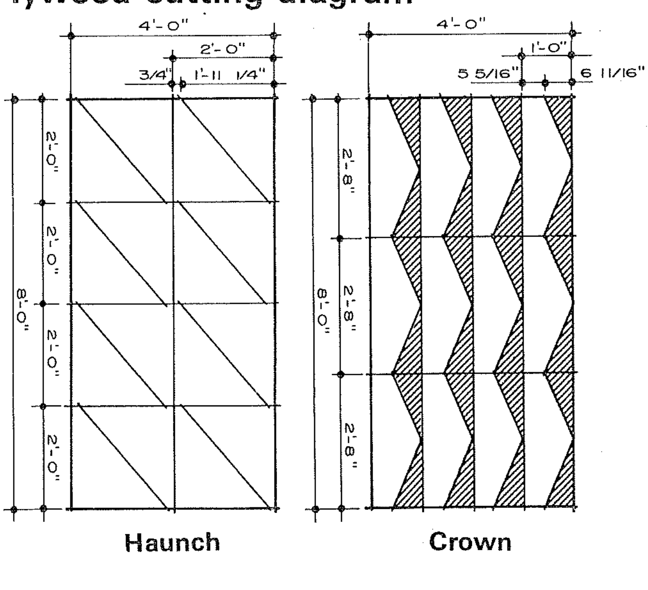



STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"

## Lumber cuts




## Plywood cutting diagram



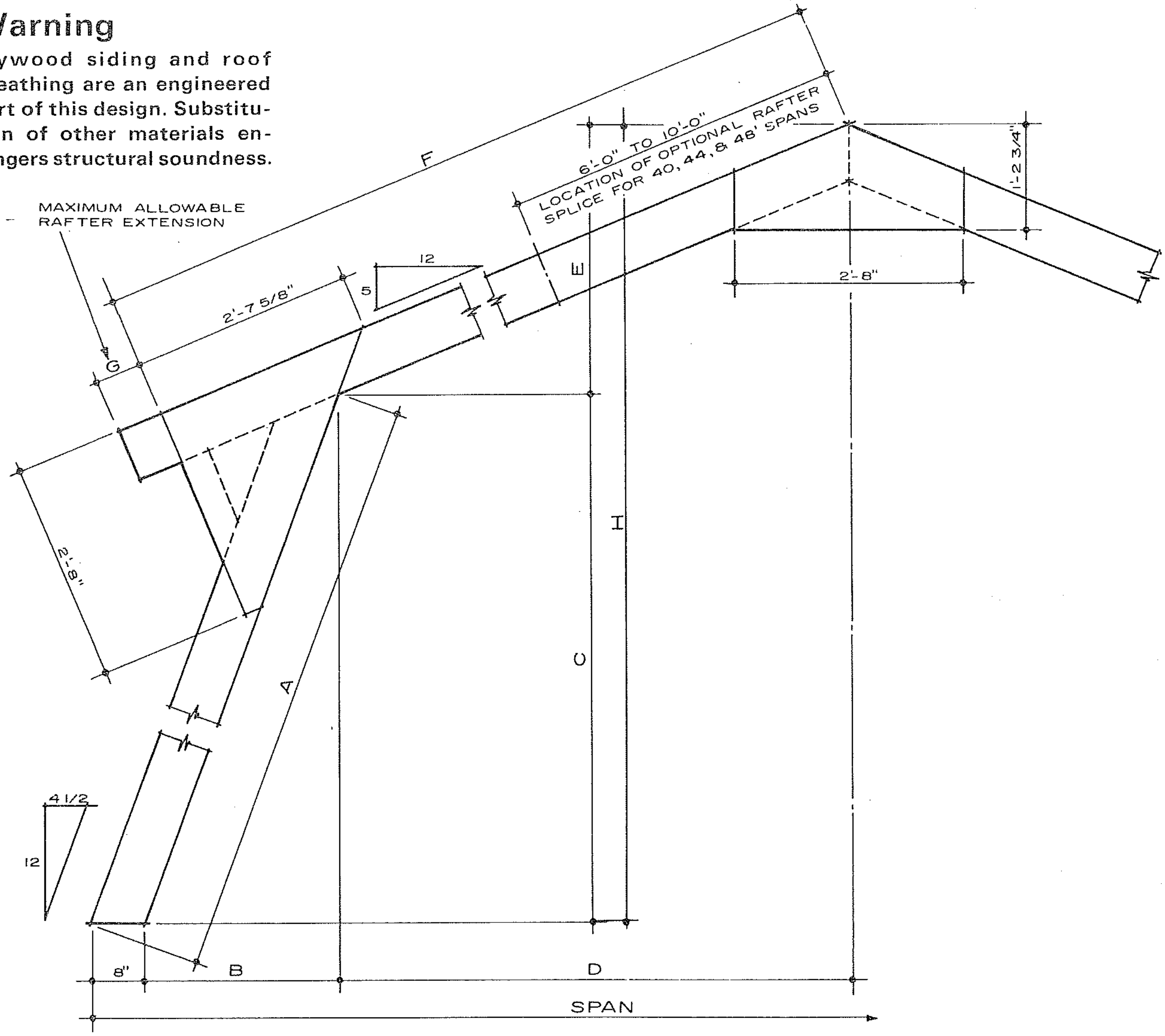

Haunch

Crown

# Fabrication details
# ◣ 2x8 slant leg

## Warning

**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**

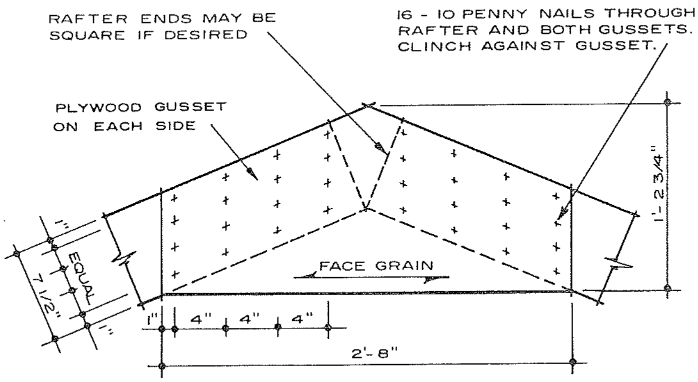



## Frame layout

| | A | 6′- 0″ | 8′- 0″ | 10′- 0″ | 12′- 0″ |
|---|---|---|---|---|---|
| All spans | B | 2′- 0¼″ | 2′- 8¾″ | 3′- 5⅛″ | 4′- 1⅝″ |
| | C | 5′- 4¾″ | 7′- 3¼″ | 9′- 1¾″ | 11′- 0¼″ |
| | G | 7¼″ | 1′- 4⅜″ | 2′- 1½″ | 2′-10⅝″ |
| 24′ span | D | 9′- 3¾″ | 8′- 7¼″ | 7′-10⅞″ | 7′- 2⅜″ |
| | E | 4′- 6⅝″ | 4′- 3⅛″ | 3′-11⅝″ | 3′- 8⅛″ |
| | F | 12′- 4¾″ | 11′- 7⅝″ | 10′-10½″ | 10′- 1⅜″ |
| | H | 9′-11⅜″ | 11′- 6⅜″ | 13′- 1⅜″ | 14′- 8⅜″ |
| 32′ span | D | 13′- 3¾″ | 12′- 7¼″ | 11′-10⅞″ | 11′- 2⅜″ |
| | E | 6′- 2⅝″ | 5′-11⅛″ | 5′- 7⅝″ | 5′- 4⅛″ |
| | F | 16′- 8¾″ | 15′-11⅝″ | 15′- 2½″ | 14′- 5⅜″ |
| | H | 11′- 7⅜″ | 13′- 2⅜″ | 14′- 9⅜″ | 16′- 4⅜″ |
| 36′ span | D | 15′- 3¾″ | 14′- 7¼″ | 13′-10⅞″ | 14′- 2⅜″ |
| | E | 7′- 0⅝″ | 6′- 9⅛″ | 6′- 5⅝″ | 6′- 2⅛″ |
| | F | 18′-10¾″ | 18′- 1⅜″ | 17′- 4½″ | 16′- 7⅜″ |
| | H | 12′- 5⅜″ | 14′- 0⅜″ | 15′- 7⅜″ | 17′- 2⅜″ |

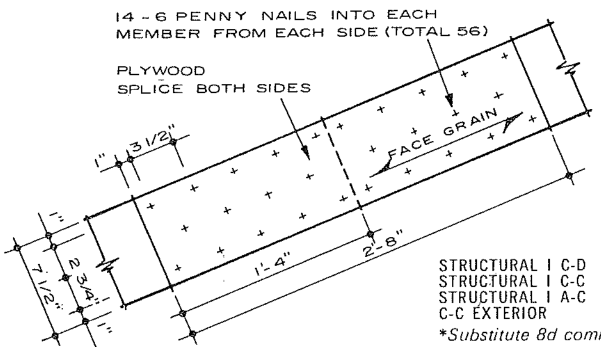
| | A | 6′- 0″ | 8′- 0″ | 10′- 0″ | 12′- 0″ |
|---|---|---|---|---|---|
| All spans | B | 2′- 0¼″ | 2′- 8¾″ | 3′- 5⅛″ | 4′- 1⅝″ |
| | C | 5′- 4¾″ | 7′- 3¼″ | 9′- 1¾″ | 11′- 0¼″ |
| | G | 7¼″ | 1′- 4⅜″ | 2′- 1½″ | 2′-10⅝″ |
| 40′ span | D | 17′- 3¾″ | 16′- 7¼″ | 15′-10⅞″ | 15′- 2⅜″ |
| | E | 7′-10⅝″ | 7′- 7⅛″ | 7′- 3⅝″ | 7′- 0⅛″ |
| | F | 21′- 0¾″ | 20′- 3⅝″ | 19′- 6½″ | 18′- 9⅜″ |
| | H | 13′- 3⅜″ | 14′-10⅜″ | 16′- 5⅜″ | 18′- 0⅜″ |
| 44′ span | D | 19′- 3¾″ | 18′- 7¼″ | 17′-10⅞″ | 17′- 2⅜″ |
| | E | 8′- 8⅝″ | 8′- 5⅛″ | 8′- 1⅝″ | 7′-10⅛″ |
| | F | 23′- 2¾″ | 22′- 5⅝″ | 21′- 8½″ | 20′-11¾″ |
| | H | 14′- 1⅜″ | 15′- 8⅜″ | 17′- 3⅜″ | 18′-10⅜″ |
| 48′ span | D | 21′- 3¾″ | 20′- 7¼″ | 19′-10⅞″ | 19′- 2⅜″ |
| | E | 9′- 6⅝″ | 9′- 3⅛″ | 8′-11⅝″ | 8′- 8⅛″ |
| | F | 25′- 4¾″ | 24′- 7⅝″ | 23′-10½″ | 23′- 1⅜″ |
| | H | 14′-11⅜″ | 16′- 6⅜″ | 18′- 1⅜″ | 19′- 8⅜″ |

## Crown gusset detail




| | | | |
|---|---|---|---|
| STRUCTURAL I | C-D | 24/0 | 3/8" |
| STRUCTURAL I | C-C | 24/0 | 3/8" |
| STRUCTURAL I | A-C | | 1/2" |
| C-C EXTERIOR | | | 1/2" |

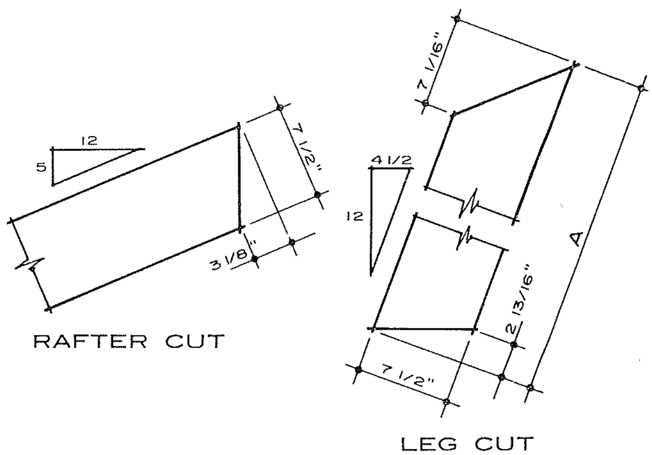
## Optional rafter splice



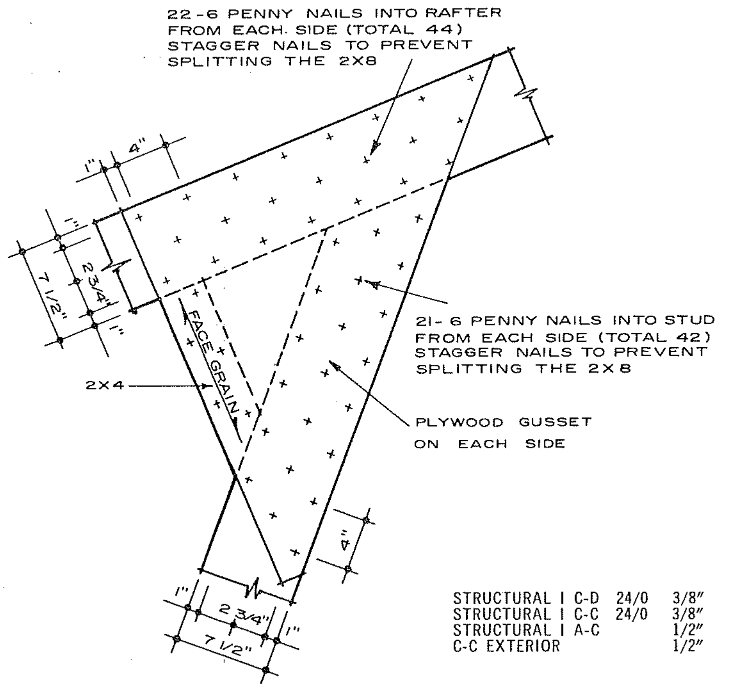

| | | | |
|---|---|---|---|
| STRUCTURAL I | C-D | 42/20 | 5/8" |
| STRUCTURAL I | C-C | 42/20 | 5/8" |
| STRUCTURAL I | A-C | | 3/4" |
| C-C EXTERIOR | | | 7/8"* |

**Substitute 8d common nails for adequate penetration.*

## Lumber cuts

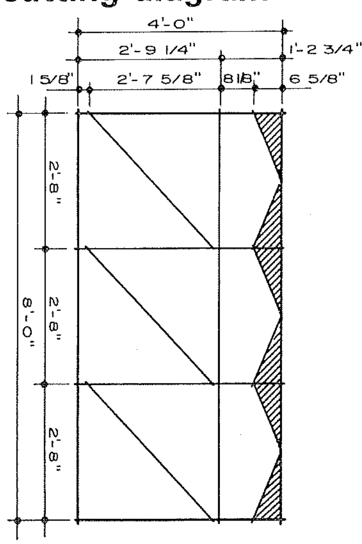



## Haunch gusset detail




| | | | |
|---|---|---|---|
| STRUCTURAL I | C-D | 24/0 | 3/8" |
| STRUCTURAL I | C-C | 24/0 | 3/8" |
| STRUCTURAL I | A-C | | 1/2" |
| C-C EXTERIOR | | | 1/2" |

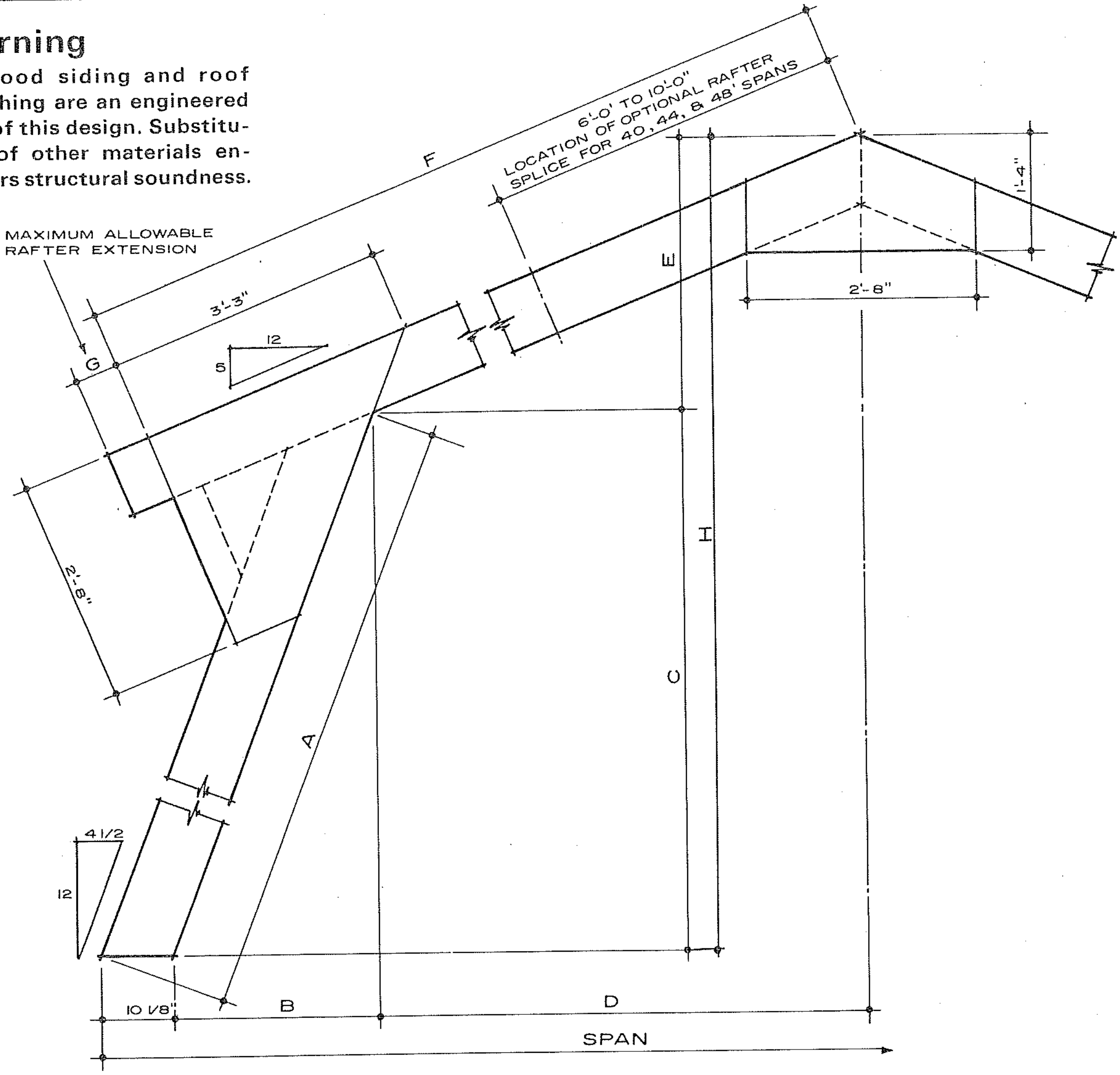
## Plywood cutting diagram



# Fabrication details
# 2x10 slant leg

## Warning

**Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.**

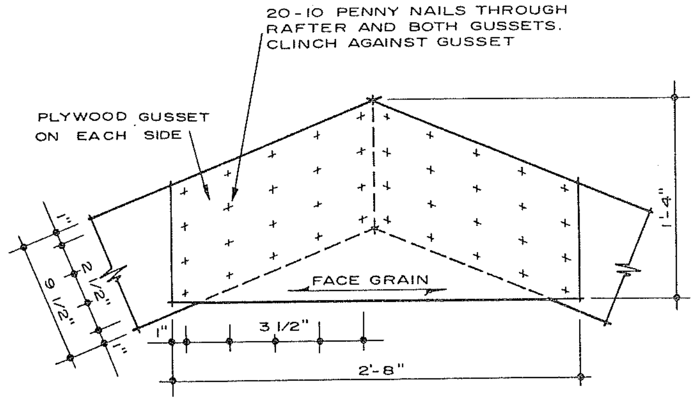



## Frame layout

| | A | 6'- 0" | 8'- 0" | 10'- 0" | 12'- 0" |
|---|---|---|---|---|---|
| All spans | B | 2'- 0" | 2'- 8½" | 3'- 4⅞" | 4'- 1⅜" |
| | C | 5'- 4" | 7'- 2½" | 9'- 1" | 10'-11½" |
| | G | 3" | 1'- 0½" | 1'- 9¼" | 2'- 6⅜" |
| 24' span | D | 9'- 1⅞" | 8'- 5⅜" | 7'- 9" | 7'- 0½" |
| | E | 4'- 8" | 4'- 4½" | 4'- 1" | 3'- 9½" |
| | F | 12'- 9" | 11'-11⅞" | 11'- 2¾" | 10'- 5⅝" |
| | H | 10'- 0" | 11'- 7" | 13'- 2" | 14'- 9" |
| 32' span | D | 13'- 1⅞" | 12'- 5⅜" | 11'- 9" | 11'- 0½" |
| | E | 6'- 4" | 6'- 0½" | 5'- 9" | 5'- 5½" |
| | F | 17'- 1" | 16'- 3⅞" | 15'- 6¾" | 14'- 9⅝" |
| | H | 11'- 8" | 13'- 3" | 14'-10" | 16'- 5" |
| 36' span | D | 15'- 1⅞" | 14'- 5⅜" | 13'- 9" | 13'- 0½" |
| | E | 7'- 2" | 6'-10½" | 6'- 7" | 6'- 3½" |
| | F | 19'- 3" | 18'- 5⅞" | 17'- 8¾" | 16'-11⅝" |
| | H | 12'- 6" | 14'- 1" | 15'- 8" | 17'- 3" |

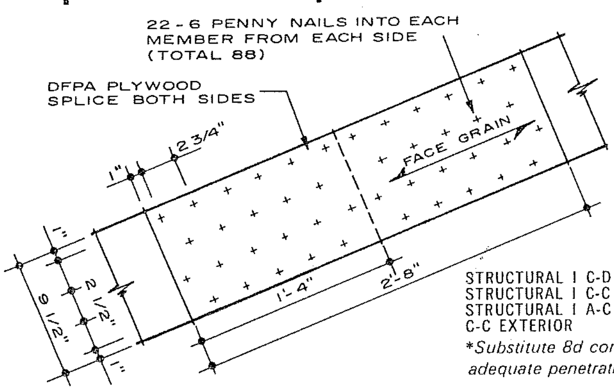
| | A | 6'- 0" | 8'- 0" | 10'- 0" | 12'- 0" |
|---|---|---|---|---|---|
| All spans | B | 2'- 0" | 2'- 8½" | 3'- 4⅞" | 4'- 1⅜" |
| | C | 5'- 4" | 7'- 2½" | 9'- 1" | 10'-11½" |
| | G | 3" | 1'- 0⅛" | 1'- 9¼" | 2'- 6⅜" |
| 40' span | D | 17'- 1⅞" | 16'- 5⅜" | 15'- 9" | 15'- 0½" |
| | E | 8'- 0" | 7'- 8½" | 7'- 5" | 7'- 1½" |
| | F | 21'- 5" | 20'- 7⅞" | 19'-10¾" | 19'- 1⅝" |
| | H | 13'- 4" | 14'-11" | 16'- 6" | 18'- 1" |
| 44' span | D | 19'- 1⅞" | 18'- 5⅜" | 17'- 9" | 17'- 0½" |
| | E | 8'-10" | 8'- 6½" | 8'- 3" | 7'-11½" |
| | F | 23'- 7" | 22'- 9⅞" | 22'- 0¾" | 21'- 3⅝" |
| | H | 14'- 2" | 15'- 9" | 17'- 4" | 18'-11" |
| 48' span | D | 21'- 1⅞" | 20'- 5⅜" | 19'- 9" | 19'- 0½" |
| | E | 9'- 8" | 9'- 4½" | 9'- 1" | 8'- 9½" |
| | F | 25'- 9" | 24'-11⅞" | 24'- 2¾" | 23'- 5⅝" |
| | H | 15'- 0" | 16'- 7" | 18'- 2" | 19'- 9" |

## Crown gusset detail



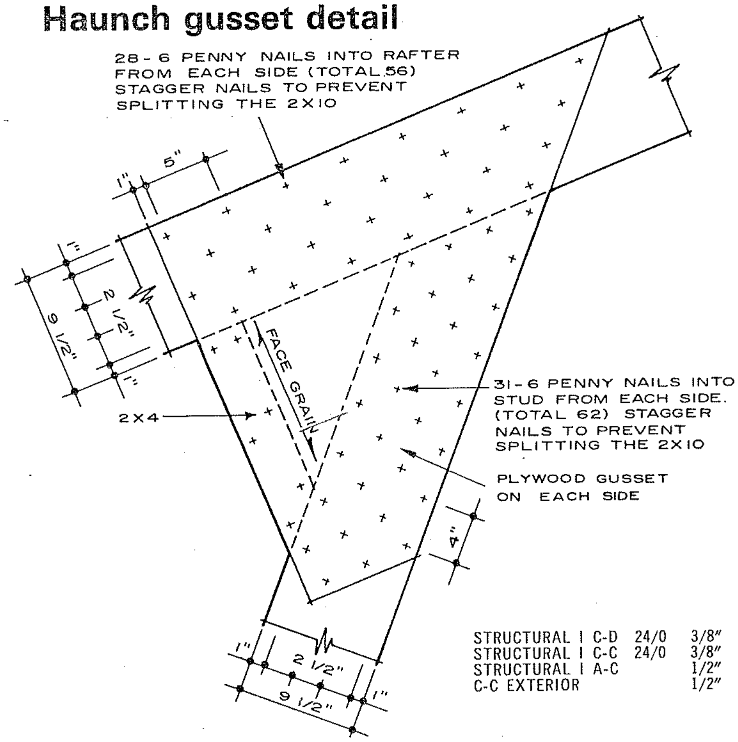

STRUCTURAL I C-D 32/16 1/2"
STRUCTURAL I C-C 32/16 1/2"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 5/8"*
*Substitute 12d common nails for adequate penetration.*

## Optional rafter splice



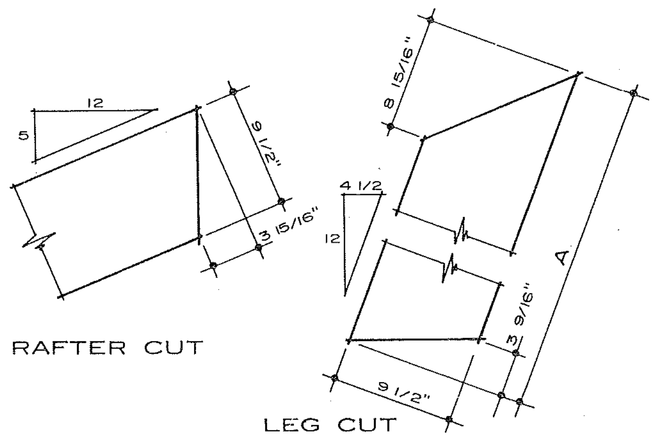

STRUCTURAL I C-D 42/20 5/8"
STRUCTURAL I C-C 42/20 5/8"
STRUCTURAL I A-C 3/4"
C-C EXTERIOR 7/8"*
*Substitute 8d common nails for adequate penetration.*

## Haunch gusset detail

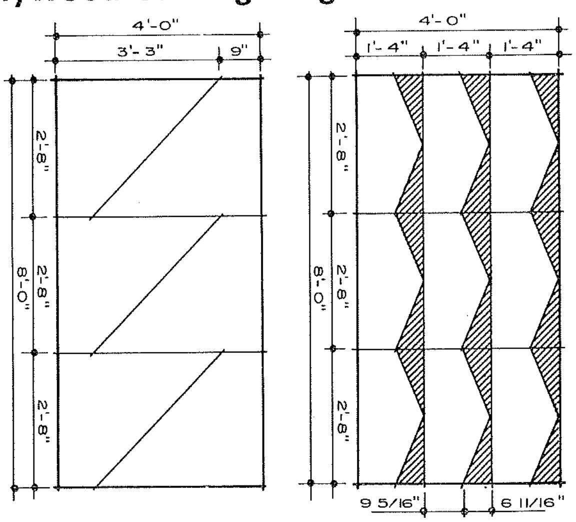



STRUCTURAL I C-D 24/0 3/8"
STRUCTURAL I C-C 24/0 3/8"
STRUCTURAL I A-C 1/2"
C-C EXTERIOR 1/2"

## Lumber cuts



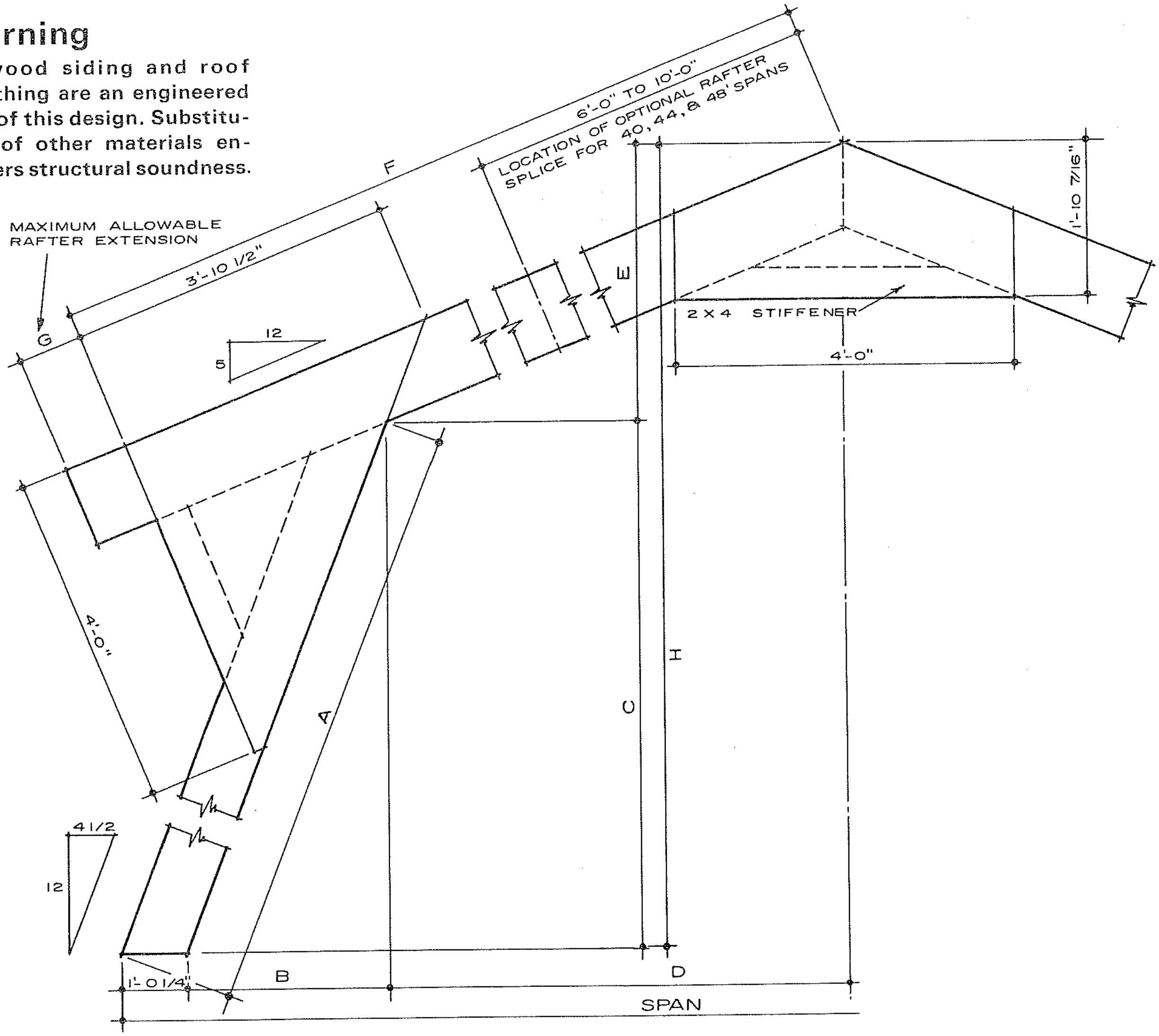

## Plywood cutting diagram



# Fabrication details
# ◣ 2x12 slant leg

## Warning

Plywood siding and roof sheathing are an engineered part of this design. Substitution of other materials endangers structural soundness.

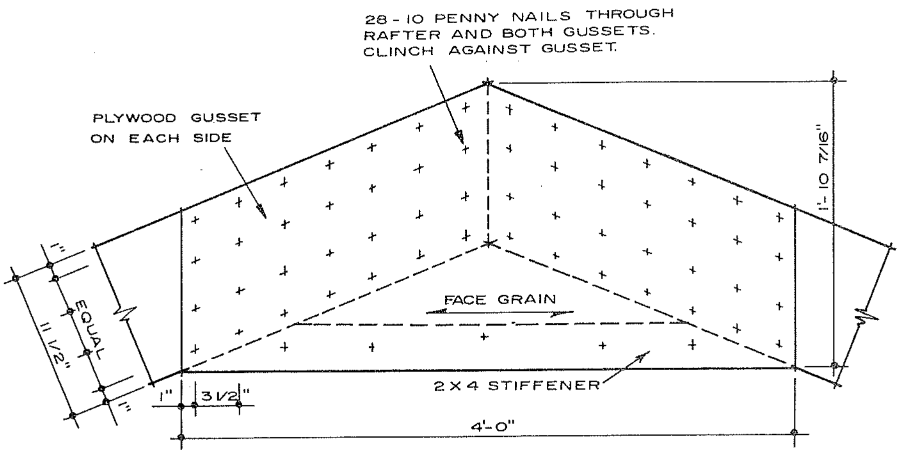


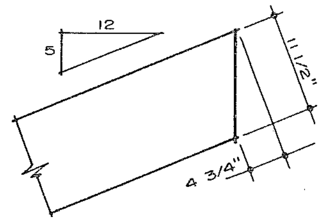

## Frame layout

| | A | 6'- 0" | 8'- 0" | 10'- 0" | 12'- 0" |
|---|---|---|---|---|---|
| All spans | B | 1'-11¾" | 2'- 8⅛" | 3'- 4⅝" | 4'- 1" |
| | C | 5'- 3⅜" | 7'- 1⅞" | 9'- 0¼" | 10'-10¾" |
| | G | 0" | 7⅝" | 1'- 4¾" | 2'- 2" |
| 24' span | D | 9'- 0" | 8'- 3½" | 7'- 7½" | 6'-10⅝" |
| | E | 4'- 9½" | 4'- 6" | 4'- 2⅜" | 3'-10⅞" |
| | F | 13'- 1½" | 12'- 4⅜" | 11'- 7¼" | 10'-10" |
| | H | 10'- 0⅞" | 11'- 7⅞" | 13'- 2⅝" | 14'- 9⅝" |
| 32' span | D | 13'- 0" | 12'- 3½" | 11'- 7⅛" | 10'-10⅝" |
| | E | 6'- 5½" | 6'- 2" | 5'-10⅜" | 5'- 6⅞" |
| | F | 17'- 5½" | 16'- 8⅜" | 15'-11¼" | 15'- 2" |
| | H | 11'- 8⅞" | 13'- 3⅞" | 14'-10⅝" | 16'- 5⅝" |
| 36' span | D | 15'- 0" | 14'- 3½" | 13'- 7⅛" | 12'-10⅝" |
| | E | 7'- 3⅛" | 7'- 0" | 6'- 8⅜" | 6'- 4⅞" |
| | F | 19'- 7½" | 18'-10⅜" | 18'- 1¼" | 17'- 4" |
| | H | 12'- 6⅞" | 14'- 1⅞" | 15'- 8⅝" | 17'- 3⅝" |

| | A | 6'- 0" | 8'- 0" | 10'- 0" | 12'- 0" |
|---|---|---|---|---|---|
| All spans | B | 1'-11¾" | 2'- 8⅛" | 3'- 4⅝" | 4'- 1" |
| | C | 5'- 3⅜" | 7'- 1⅞" | 9'- 0¼" | 10'-10¾" |
| | G | 0" | 7⅝" | 1'- 4¾" | 2'- 2" |
| 40' span | D | 17'- 0" | 16'- 3½" | 15'- 7⅛" | 14'-10⅝" |
| | E | 8'- 1½" | 7'-10" | 7'- 6⅜" | 7'- 2⅞" |
| | F | 21'- 9½" | 21'- 0⅜" | 20'- 3¼" | 19'- 6" |
| | H | 13'- 4⅞" | 14'-11⅞" | 16'- 6⅝" | 18'- 1⅝" |
| 44' span | D | 19'- 0" | 18'- 3½" | 17'- 7⅛" | 16'-10⅝" |
| | E | 8'-11½" | 8'- 8" | 8'- 4⅜" | 8'- 0⅞" |
| | F | 23'-11½" | 23'- 2⅜" | 22'- 5¼" | 21'- 8" |
| | H | 14'- 2⅞" | 15'- 9⅞" | 17'- 4⅝" | 18'-11⅝" |
| 48' span | D | 21'- 0" | 20'- 3½" | 19'- 7⅛" | 18'-10⅝" |
| | E | 9'- 9½" | 9'- 6" | 9'- 2⅜" | 8'-10⅞" |
| | F | 26'- 1½" | 25'- 4⅜" | 24'- 7¼" | 23'-10" |
| | H | 15'- 0⅞" | 16'- 7⅞" | 18'- 2⅝" | 19'- 9⅝" |

## Crown gusset detail

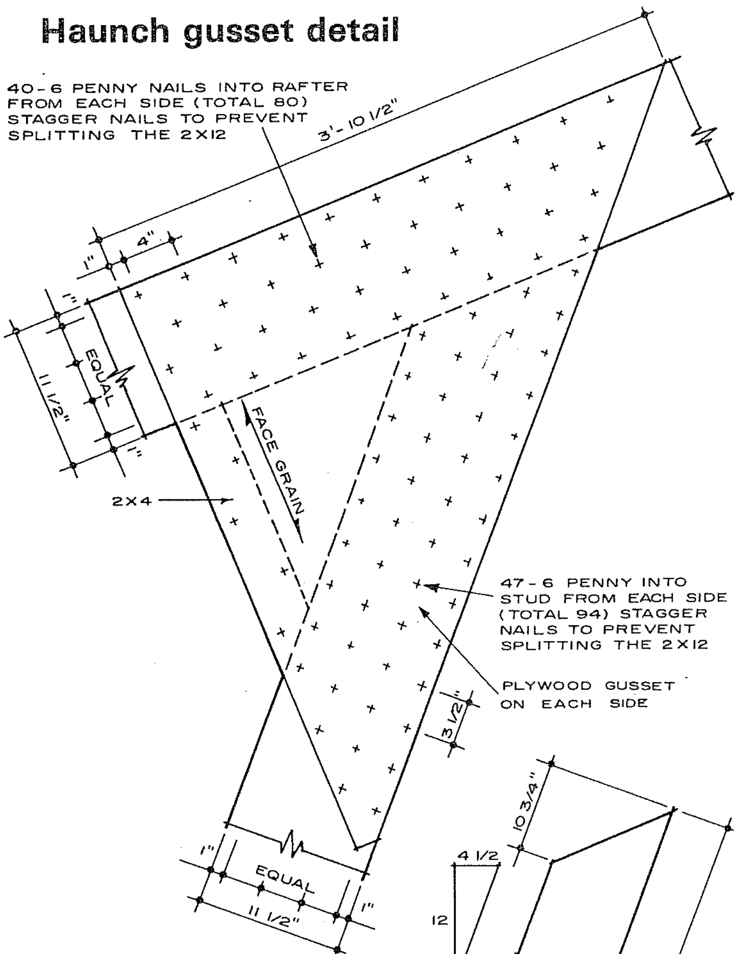


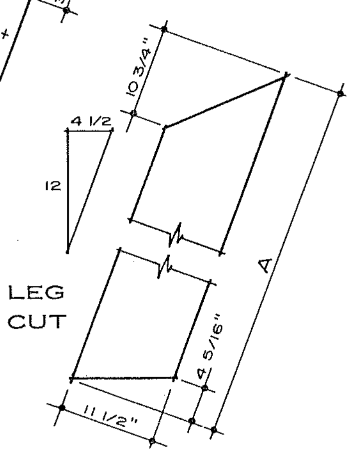




RAFTER CUT

| | | |
|---|---|---|
| STRUCTURAL I C-D | 24/0 | 3/8" |
| STRUCTURAL I C-C | 24/0 | 3/8" |
| STRUCTURAL I A-C | | 1/2" |
| C-C EXTERIOR | | 1/2" |

## Haunch gusset detail

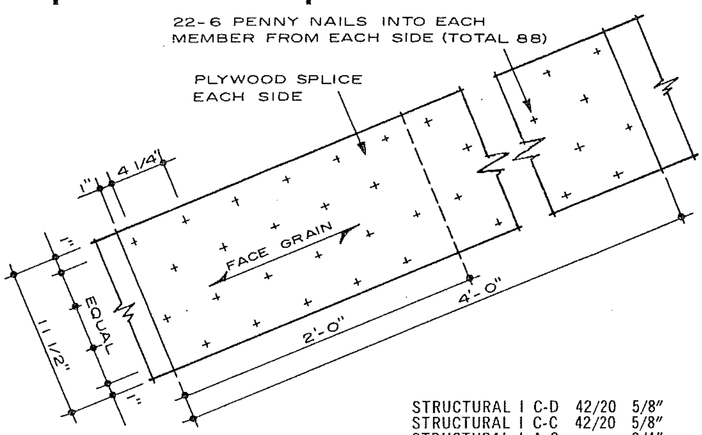



LEG CUT

| | | |
|---|---|---|
| STRUCTURAL I C-D | 24/0 | 3/8" |
| STRUCTURAL I C-C | 24/0 | 3/8" |
| STRUCTURAL I A-C | | 1/2" |
| C-C EXTERIOR | | 1/2" |

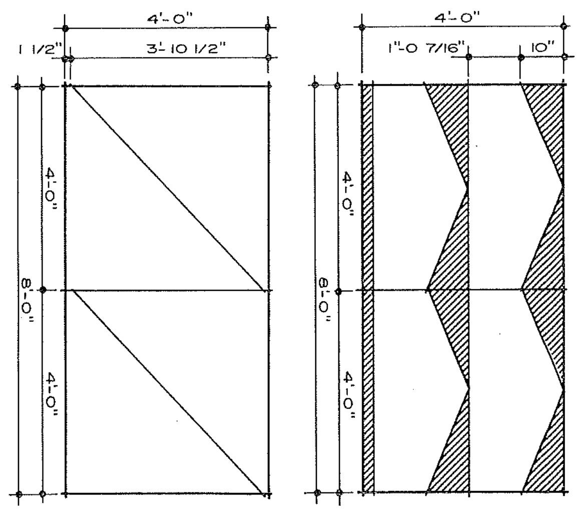
## Optional rafter splice




| | | |
|---|---|---|
| STRUCTURAL I C-D | 42/20 | 5/8" |
| STRUCTURAL I C-C | 42/20 | 5/8" |
| STRUCTURAL I A-C | | 3/4" |
| C-C EXTERIOR | | 7/8"* |

**Substitute 8d common nails for adequate penetration.*

## Plywood cutting diagram

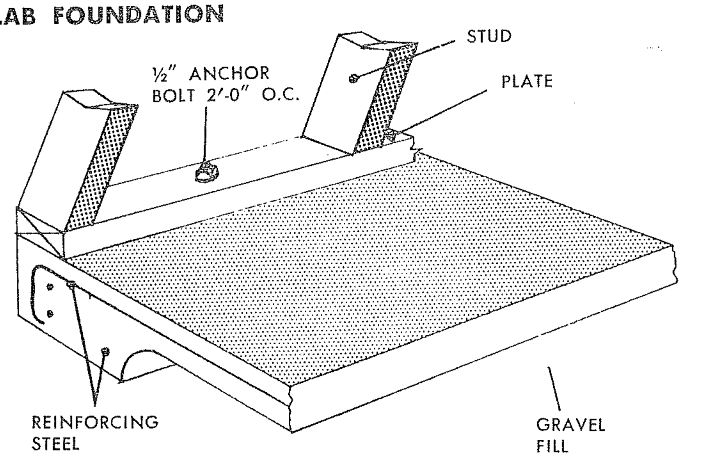



**Haunch** **Crown**

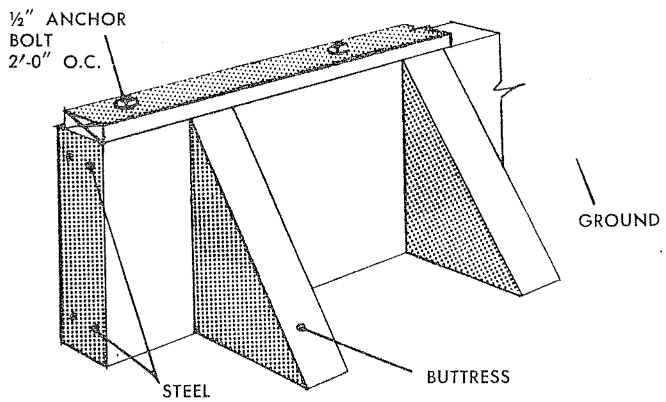
## STEP-BY-STEP ERECTION OF A RIGID FRAME STRUCTURE

### STEP 1: FOUNDATIONS (3 ALTERNATE METHODS)

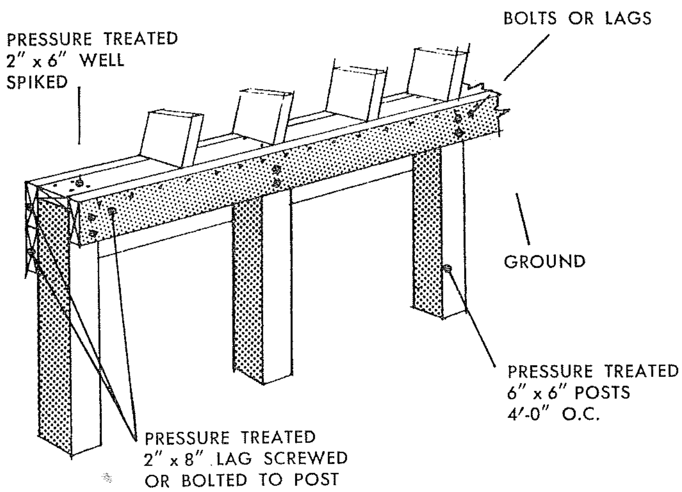
#### SLAB FOUNDATION




#### WALL FOUNDATION




#### POST AND BEAM




As with any building the site should be selected carefully, considering the slope of the land, relation to other buildings and possible uses of the building.

Since conditions and functions vary greatly the foundation must be designed to meet the varying purposes of each building. It must be capable of supporting the vertical load plus resisting about 700 pounds of outward thrust at each rigid frame.

The slab foundation, as illustrated, is a method of letting the slab reinforcing steel act as a tie rod. This "tie rod" joins the walls so that the thrust of one counteracts the other.

If the building is to be heated, the edge of the slab should be insulated. Note that ½" anchor bolts are spaced 2' to fasten plate down. The slab type foundation will give a simple economical foundation and permanent slab floor in one unit.

The buttresses of the wall foundation carry the outward thrust of the rigid frames directly to the soil. This type of foundation will serve when no concrete floor is desired or when soil conditions forbid use of a slab. Again ½" anchor bolts at a spacing of 2' are required.

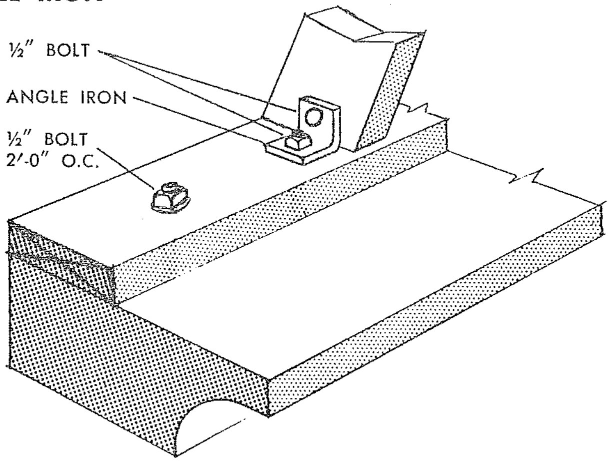
Note: *Footings and wall foundations require form work that can easily be made with plywood. With a little advance planning the plywood used in the form work can be used later in some portion of the building.*

The post and beam system makes a very economical foundation. It utilizes pressure treated posts and planks. This foundation is recommended when concrete is not readily available. The length of posts required will depend upon soil conditions. Pressure treated planks are lag screwed or bolted to the sides of the post so that they extend into the soil to resist the thrust of the rigid frames. Placing the planks partially in the ground helps to eliminate drafts in the finished building.

While only three basic foundation ideas are illustrated, there are other suitable types to meet special conditions. Whatever type of foundation is used it must be designed carefully to carry the loads. Before building, local building authorities should be consulted.

**STEP 2: FOUNDATION FASTENING (3 METHODS) (SEE ALSO PAGE 10)**

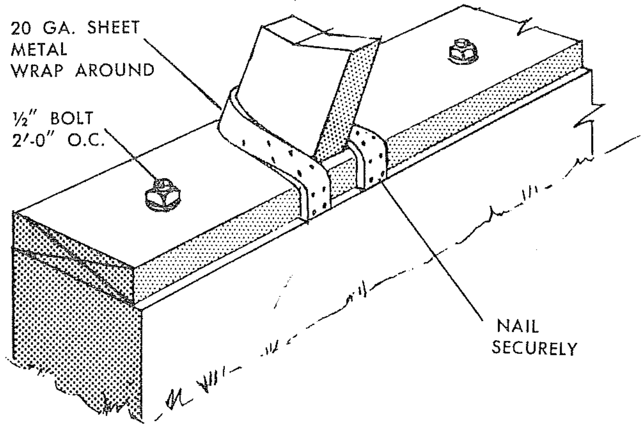
**ANGLE IRON**




Rigid frames must be anchored securely to the plate to resist the outward thrust at the base. Merely toe-nailing the stud to the plate is *not* sufficient.

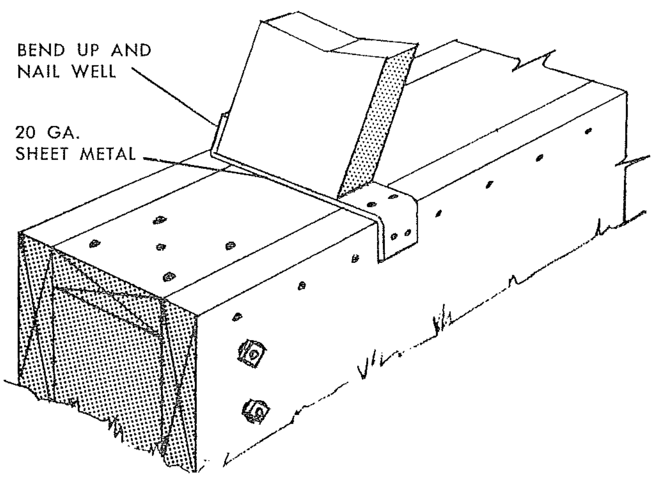
A short section of angle iron fastened to the plate and the stud will work well. Half inch bolts are recommended for fastening. If the bolts used to anchor the plate are positioned accurately they may also serve to fasten the angle iron.

**WRAP FASTENER**




The sheet metal connectors illustrated can be purchased or easily made by the builder. Twenty gauge metal is desirable since it can be nailed without drilling. The use of galvanized sheet metal prevents rusting. Connectors should be nailed securely with ample nails. Care should be taken not to split the stud or the plate.

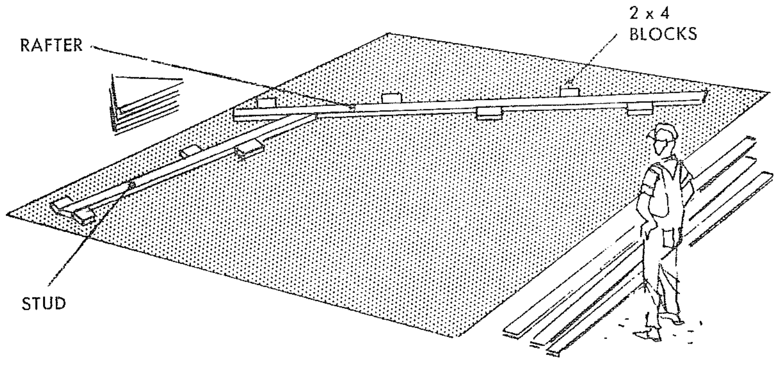
**PLATE FASTENER**




Various commercially available stud sockets, and framing anchors may be used, providing they are capable of withstanding about 700 pounds of thrust.

# STEP-BY-STEP ERECTION OF A RIGID FRAME STRUCTURE

## STEP 3: LAYOUT OF RIGID FRAMES

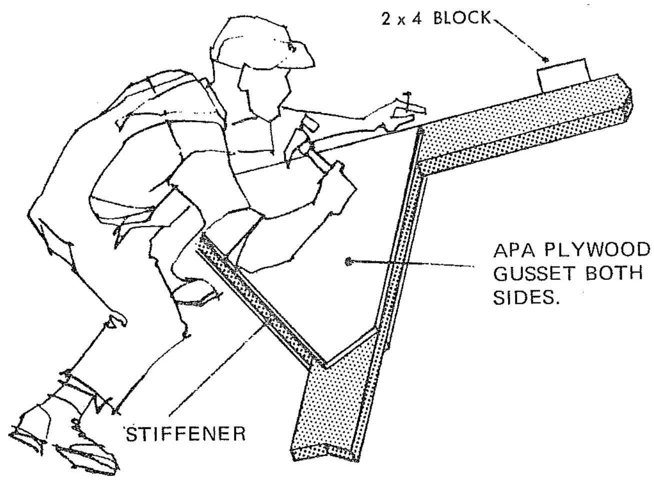



First cut plywood and lumber for one-half of a rigid frame and before cutting the balance of the material check it in an assembly jig.

Lay out the jig as shown. A level floor or large platform should be used. A temporary working surface can be made by laying several sheets of plywood on a level piece of ground. A raised platform on posts will make the job much easier.

Nail 2" x 4" blocks as illustrated to hold framing members in the correct position. Place members in position, and check all dimensions given on the plan. Make sure that the plywood gusset fits accurately. Do not nail these members together. They should be marked and used as a pattern for cutting the other members. All members may now be pre-cut.

## STEP 4: NAILING OF GUSSETS

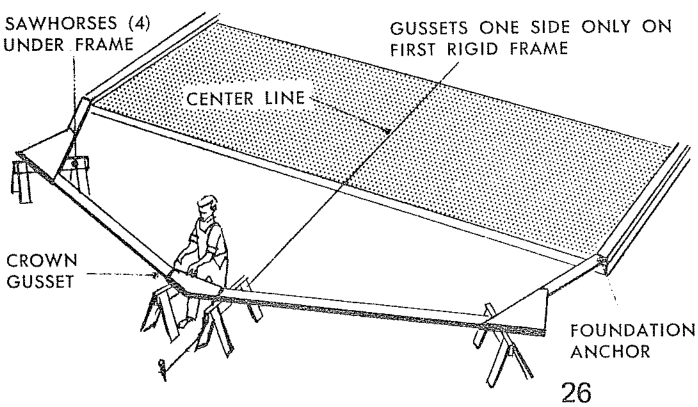



Arch halves are fabricated by nailing a plywood gusset to each side of the haunch. For easy nail spacing, a paper or cardboard stencil can be made with a 1/4" hole at each nail location. With this stencil and stencil paint, or a similar marking device, marks can be made where required. This saves time and eliminates nailing errors.

**Even though it's nearly impossible to split plywood by nailing, gusset nails should be staggered slightly to prevent splitting the lumber members. At this point be certain you plan ahead for doorways. See page 31 for doorway details.**

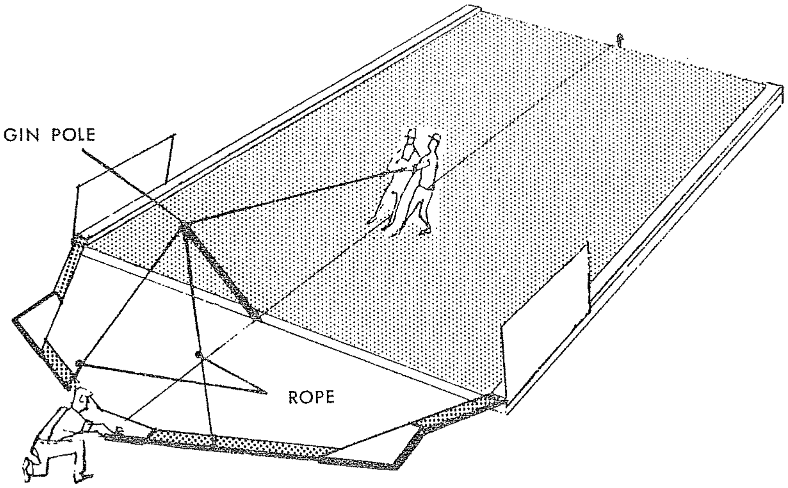
It is easier to assemble rigid frame *halves* only at this time. The crown gusset will be applied just before raising the frames. The first frame has gussets only on the inside face since the plywood end wall will serve as the outside gusset.

## STEP 5: LAYOUT OF RAFTER HALVES AND ATTACHING OF CROWN GUSSET




Two halves may now be placed on sawhorses as illustrated. The base of the stud should be at the edge of the plate. The use of a center line will help to properly position the halves. Use 10d nails to nail the crown gusset since it is impractical to nail the gusset from both sides and 10d nails will go through the rafter and both gussets. The nails can then be clinched on the lower side. A pair of clamps will help hold the lower gusset while the first nails are driven.

## STEP 6: GIN POLE ERECTION OF FIRST FRAME

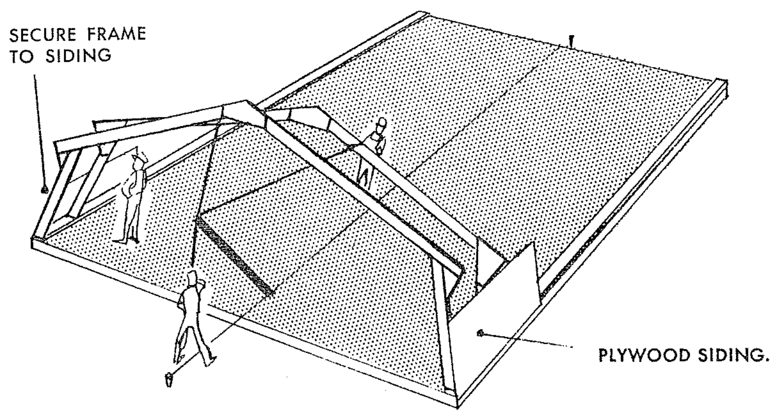



The frame is now ready for raising. Stud anchors should be located and fastened to the plate. Two sheets of plywood can be nailed to the plate as illustrated. These will serve as braces when the rigid frames are raised. They also are part of the finished building. Nail with 6d nails 3" o.c.

Three men working with a simple gin pole arranged as illustrated can easily raise and secure rigid frame units in place. The pole should be slightly shorter than the distance from the ground to the crown gusset. Fasten a rope bridle to the frame about 8 to 10 feet from the crown and pass over the gin pole at about 20 degrees off the perpendicular.

When the frame is vertical two men carefully plumb the legs and fasten to the plywood wall panels. Nail with 6d nails 6" o.c.

## STEP 7: ERECTION OF SUCCEEDING FRAMES

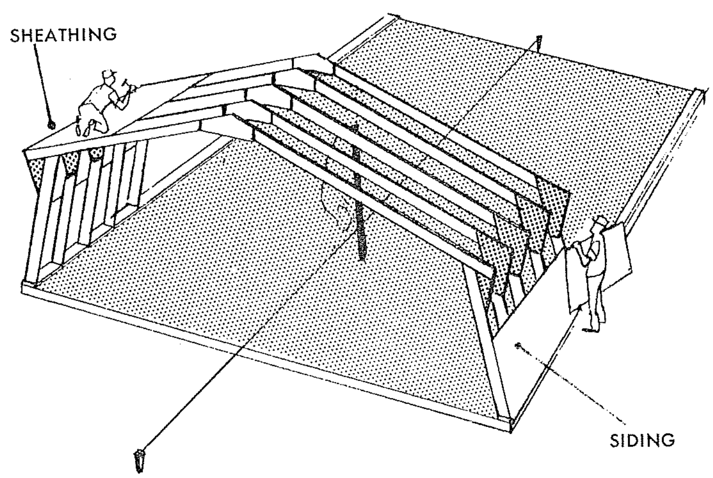



The second frame is laid out and raised from inside the building. Follow the same procedure as for the first rigid frame.

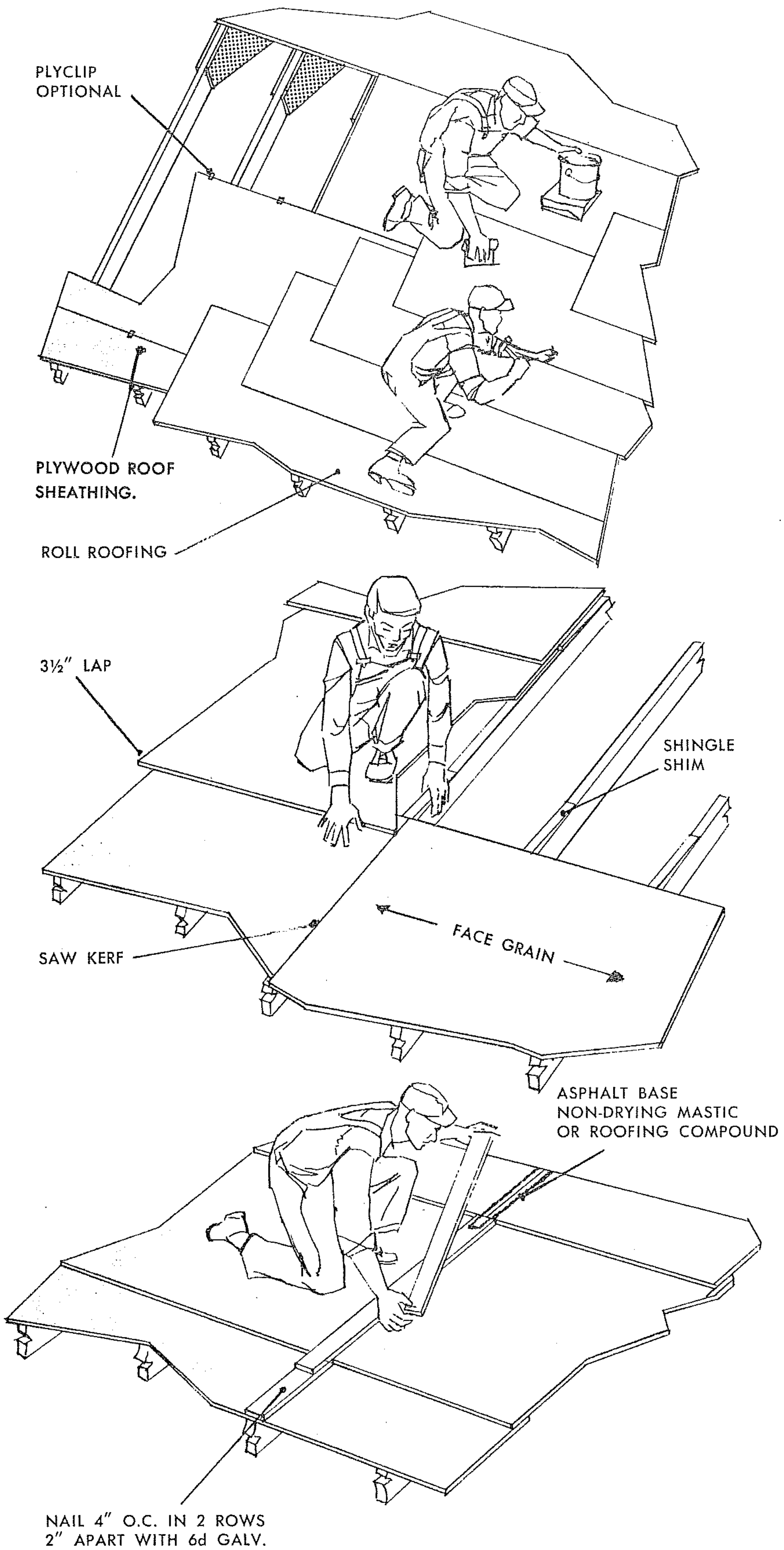
Each frame is plumbed as it is raised and fastened to the plywood siding. Plywoods large panel size serves both as a temporary and permanent bracing. This eliminates any need for additional braces in the building. Once several frames are up, apply a panel of plywood roof sheathing at the eave line.

This will prevent the possibility of the frames being blown down by wind before the roof is fastened securely in place.

Mechanical equipment such as a farm tractor with loader can also be helpful in speeding the erection job.



## STEP 8: ROOFING DETAILS




Big 4 x 8 plywood panels easily provide the diaphragm strength and rigidity a building of this type requires.

An economical watertight roof can be obtained by sheathing the roof with plywood roof sheathing and covering with roll roofing, asphalt shingles or wood shingles. Plyclips may be used to join panel edges for additional stiffness. Face grain of the panels must be across the rafters as the plywood is stiffer when applied in this manner. Stagger panel joints. Nail panels with 6d nails 6" on centers on all supported panel edges and 12" on centers on intermediate rafters.

Plywood's excellent nail holding properties and high dimensional stability insure a solid, flat and nonbuckling roof that stays down.

### ALTERNATE ROOFING METHOD

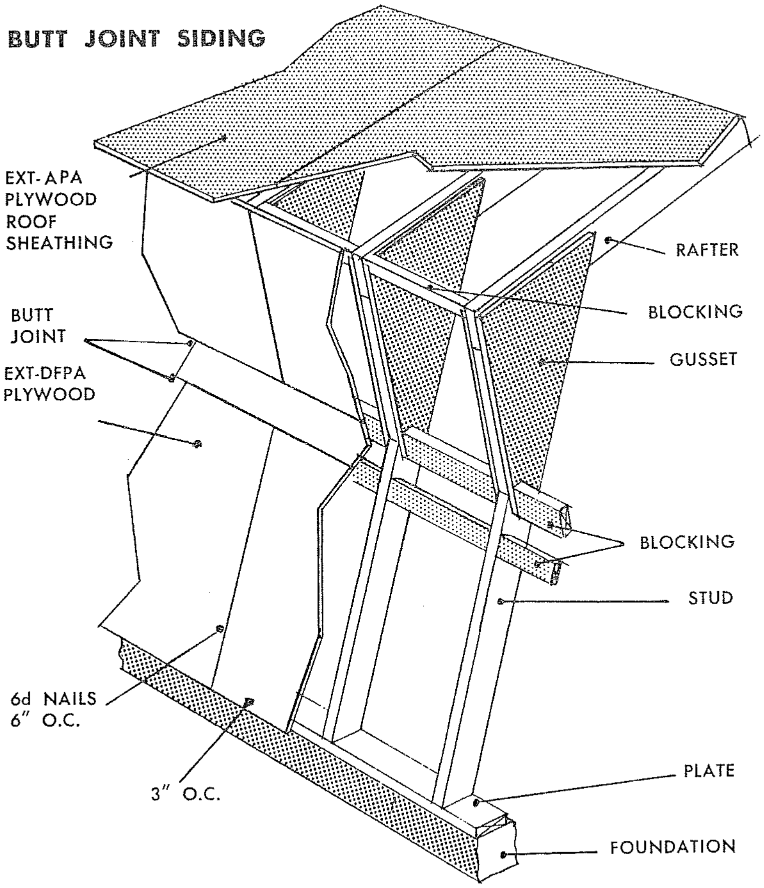
Exterior plywood can be applied as giant shingles on buildings when a weather resistant roof is satisfactory and minor leaks occurring are not objectionable. The degree of water-tightness obtained depends on the quality of application, workmanship and the joint sealer used.

To apply an exposed plywood roof, nail a course of panels along the eave line with 6d galvanized nails with a nailing schedule the same as used on applying roof sheathing. Place a shingle shim on each rafter above top panel edge. Run a power saw kerf between vertical panel joints to allow for expansion. Lap the second course of panels 3½" over the first course with a generous bead of asphalt base, non-drying mastic under the lap. Repeat until roof is covered.

Rip 3" wide batten strips 4′ long from a ⅜" C-C Exterior panel with the face grain running lengthwise of the batten. Fill the saw kerf with a generous application of non-drying asphalt base roofing compound as well as thoroughly coating the area to be covered by the batten. Apply the battens as illustrated, nailing 4" on centers with 6d galvanized nails in two rows, 2" apart, slanted to catch rafter. Fill any open panel defects with roofing compound to avoid panel leaks.

## STEP 9: SIDING DETAILS

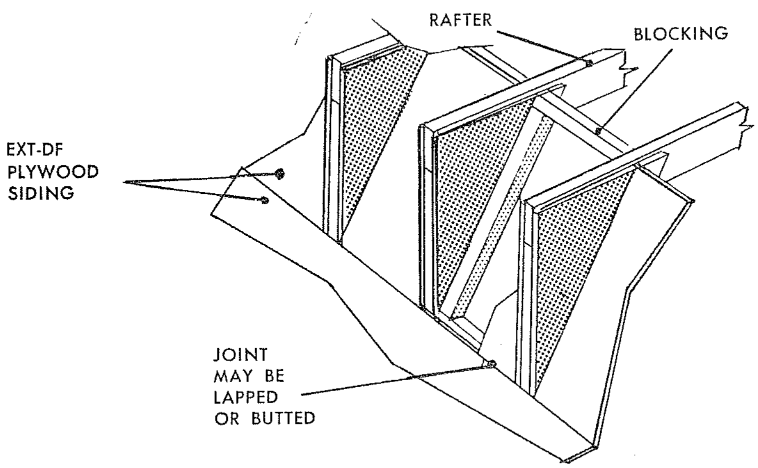
### BUTT JOINT SIDING




Plywood is the only material that easily and fully develops the strength of a rigid frame building. And the best method for applying plywood siding depends largely upon the intended use of the building. The methods illustrated on this page are adequate for most utility buildings. The butt joint system requires a minimum of cutting. Plywood panels should be nailed with 6d nails 6" o.c. around the outside of the panel and 12" o.c. on intermediate studs.

If a more weatherproof wall is needed, a system similar to the giant shingle roof can be used. This lap and batten system is illustrated on page 28.

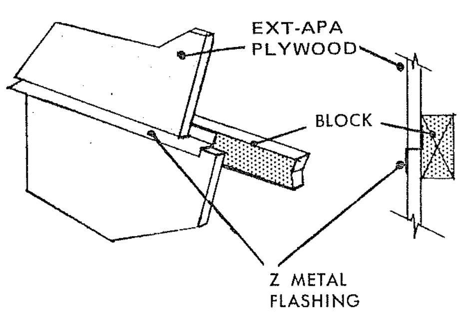
### ALTERNATE SIDING METHODS




By nailing blocking to the sides of the gusset the siding can extend straight up between the frames to give a continuous slanted wall. This siding method as illustrated makes it possible to use up small plywood cuttings. Glass may be substituted to give a low cost window.

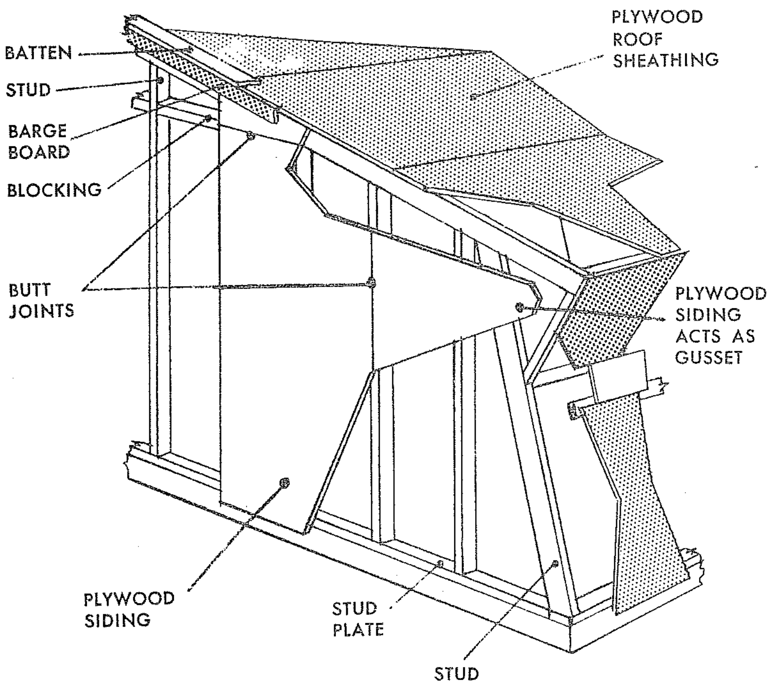
Construction with plywood provides a draft free building because the large panel size means a minimum number of joints.

### ALTERNATE PLYWOOD JOINT TREATMENT




A bent metal Z flashing will give a very weather resistant horizontal joint. Light gauge galvanized steel or aluminum should be used.

## STEP 10: END WALLS




End walls are conventional stud wall construction, with plywood as a "must" for end wall siding because it acts as a gusset for the end rigid frame.

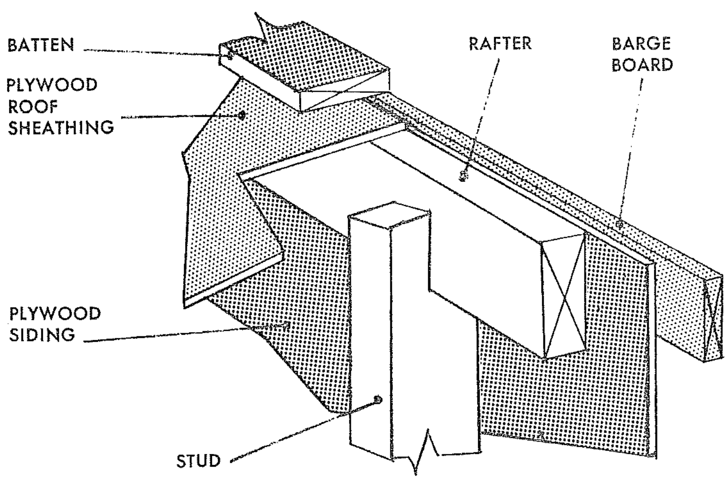
Nailing of the frame gusset should be duplicated in this area. Space the studs 24" o.c. and block as required at the horizontal joints. Fasten your plywood siding in place with 6d galvanized nails. Space them 6" apart around the panel edges and 12" apart on intermediate supports. Butt joints, like those shown here, will be satisfactory for most utility buildings.

**A Z flashing as shown on page 29 may be used at the horizontal joint for more weather resistance.**

**If an extremely weatherproof end wall is desired the giant shingle system as illustrated on page 28 should be used.**

If desired the entire end wall may be omitted without weakening the structure. But the gussets must be applied to the outside face of the rigid frame.

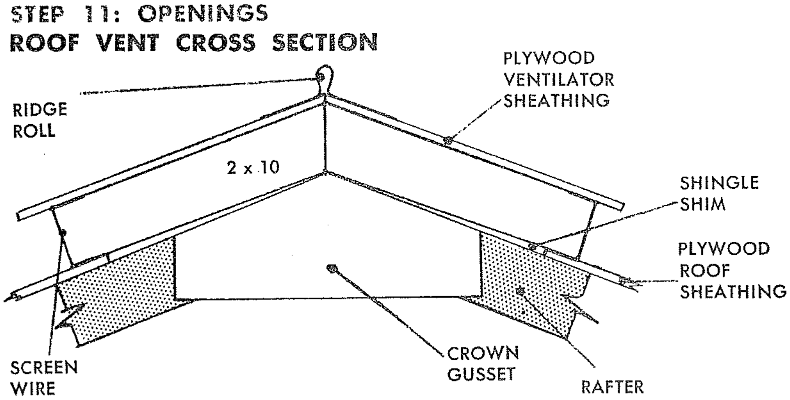
## DETAIL AT TOP OF STUDS (INSIDE)




End wall studs are notched to fasten to the rafter as illustrated. The batten and barge board as illustrated give a neat inexpensive joint.

## STEP 11: OPENINGS

### ROOF VENT CROSS SECTION



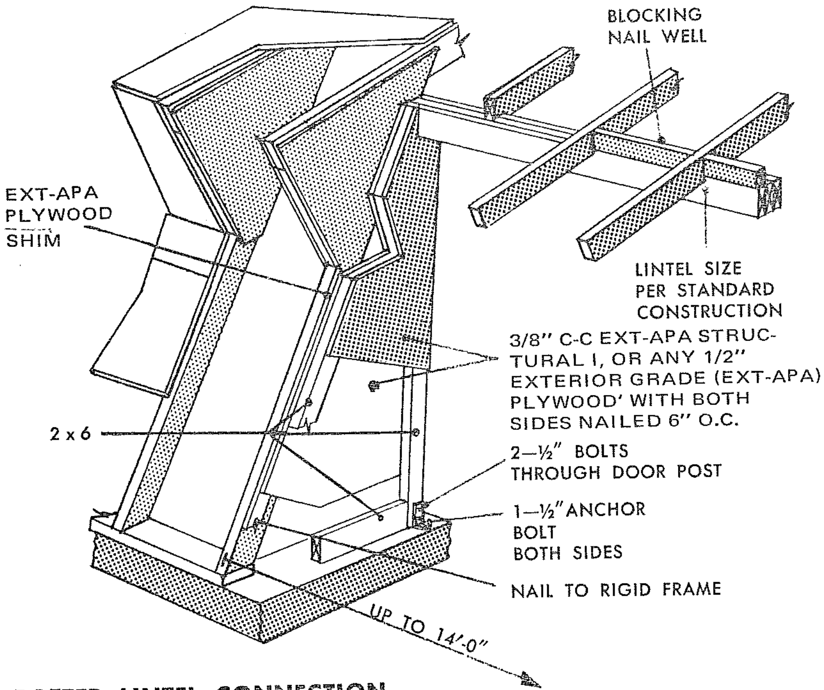

A simple plywood ridge ventilator (shown here and on the cover) is best when ventilation is desired. Simple plywood doors, when added to the ventilator prevent excessive drafts. Screening will prevent birds nesting.

The side wall door openings affect a critical portion of the rigid frame structure, and they have been carefully engineered. It is essential that you follow the exact details as shown. **Do not alter.**

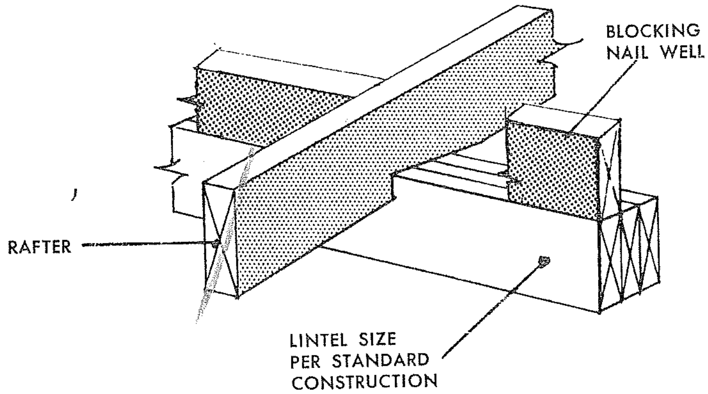
It is important that you plan side wall door openings well in advance, and to achieve the lateral stability of the building plywood siding is a "must." It's important that at least 8' of siding exist between adjacent door openings.

The triangular shaped door post is designed to receive the outward thrust of the rafters over the opening.

## (TRIANGULAR DOOR POST)

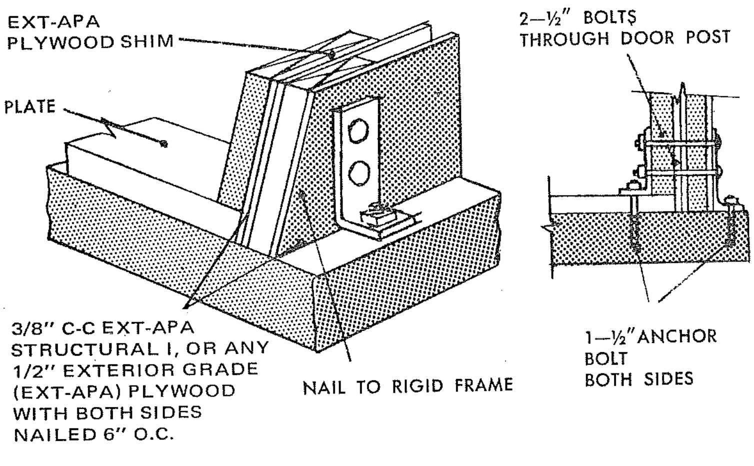



## RAFTER LINTEL CONNECTION




The blocking between the lintel and the roof sheathing must be securely nailed to both. The notch at the top of the triangular door post serves as a seat for the lintel. Small plywood shims are nailed to the rigid frame stud below the gusset.

## ANCHORAGE DETAIL

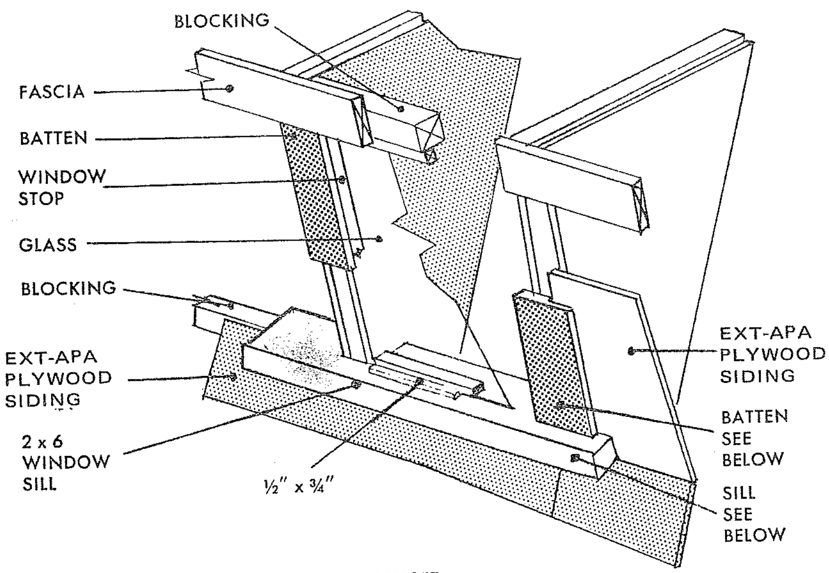


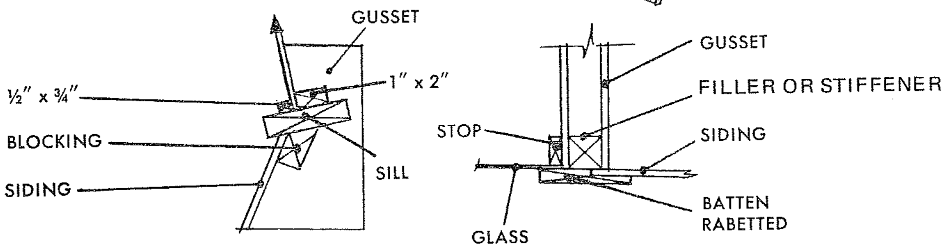

The door posts must be anchored securely with the four small angles as shown. The plywood on both sides of the triangular door post also serves the function of enclosing the door recess.

All types of doors may now be used to close the opening. If doors are hinged, it will be necessary to add a vertical 2" x 6" to give good hinge mountings.

STEP 11: OPENINGS (continued)

## WINDOW INSTALLATION DETAILS

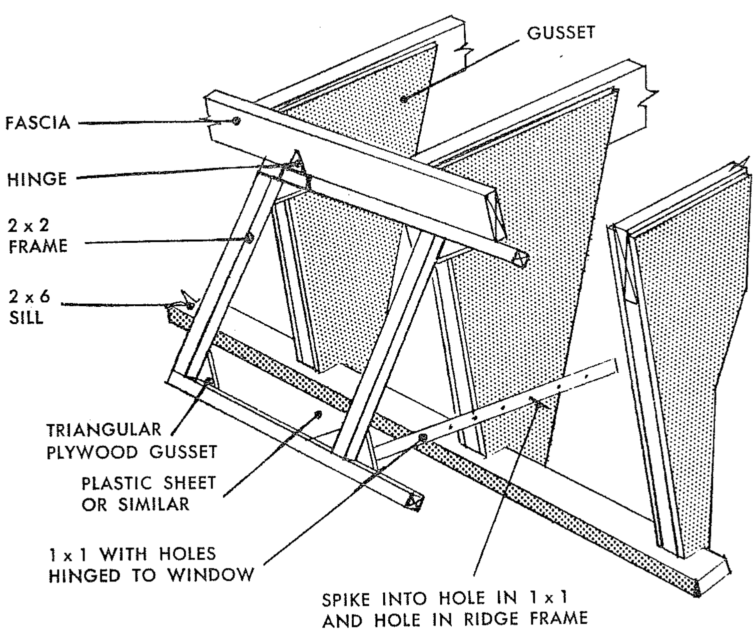



Endwall windows, if desired, are installed as in conventional stud construction. For side windows large panes of glass may be set with glazing compound and wood stops as illustrated. The 2" x 6" sill is notched to fit around the rigid frames. Tipping the sill as shown insures drainage. It is placed perpendicular to the outside edge of the gusset. The 1" x 4" batten at the edge of the windows must be rabbeted as shown to catch both the siding and the glass. The windows as shown could run the entire length of the building.

If desired, a standard sash unit may be installed in a similar manner.

## ALTERNATE WINDOW DETAIL




For some buildings it will be necessary to have windows that may be opened for ventilation. A simple window frame may be built of 2" x 2" as shown. Small triangular gussets at each corner make the window frame very solid. The frame may then be covered with plastic or similar inexpensive sheet material.

The 1" x 1" with holes and a spike serves as a prop to hold the window open or latch it when closed. The 1" x 1" is hinged to the frame.