Design for Code Acceptance

5

Post Frame Buildings

Introduction

Post-frame buildings are efficient structures whose primary framing system is comprised of wood roof trusses or rafters connected to vertical timber columns or sidewall posts. Secondary members such as roof purlins and wall girts support the exterior cladding and transfer vertical and horizontal forces to and from the post-frame. Figure 1 illustrates the common components of a post-frame building.

The purpose of this document is to provide guidance to post-frame building designers for meeting the requirements of the *International Building Code (IBC)* and to confirm that a properly designed post-frame building is in fact code compliant.

The following chapters and headings correspond to those of the *IBC*:

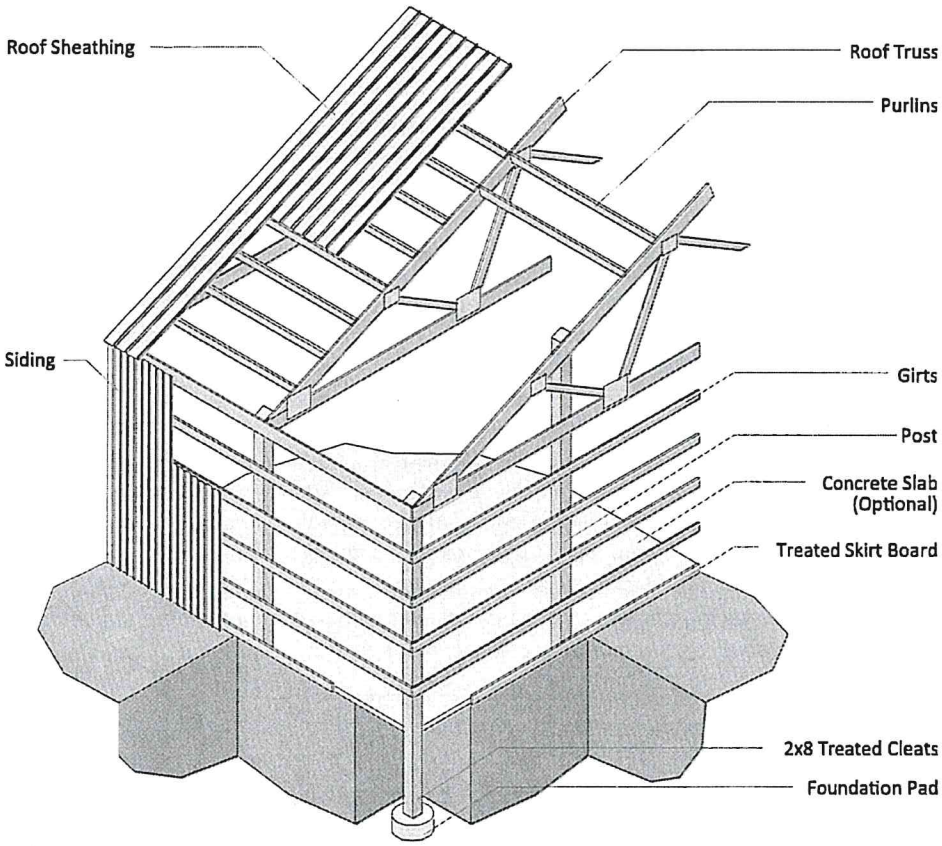

Figure 1 Components of a Post Frame Building

with R-40 or higher materials. Because of their unique construction, post-frame walls may be easily insulated with R-30 batts. See Figure 2.

Chapter 14 Exterior Walls

Table 1405.2 Minimum Thickness of Weather Coverings

The most common exterior wall covering for post-frame buildings is pre-painted corrugated steel siding. But other materials such as exterior plywood, wood sidings, brick veneers, etc. are also common. This table provides the code prescribed minimum thickness for weather coverings.

Section 1405.11Metal Veneers

This section provides the requirements for metal sidings.

Section 1406 Combustible Materials on the Exterior Side of Exterior Walls

This section provides requirements for combustible sidings and Section 1406.2.3 provides fire blocking requirements.

Chapter 15 Roof Assemblies and Rooftop Structures

Section 1507.2 Asphalt shingles

Shingle and wood sheathed roofs are also common on post-frame buildings. Section 1507.2 provides the minimum code requirements for asphalt shingle roofs.

Section 1507.4 Metal roof panels

As with siding, the most common roof cladding for post-frame buildings is pre-painted corrugated steel. Section 1507.4 provides the minimum code requirements for metal roof panels. These steel roof systems are commonly used as horizontal diaphragms to transfer lateral loads from the post-frame to end and interior shear walls. When using a "floating" metal roof such as standing seam, it is essential to recognize that the "floating" roof does not provide a diaphragm, and to accommodate this during structural design.

Chapter 16 Structural Design

Post-frame buildings must be designed for structural requirements of this chapter, just as any other building.

Table 1604.3 Deflection Limits

One notable exception to the deflection limits in Table 1604.3 is Note "a". Because of its inherent flexibility, corrugated metal can sustain relatively high deflections without failure. If purlins or girts are used to support interior finishes in addition to metal siding, then they must meet the deflection limits of Table 1604.3.

Section 1604.8 Anchorage

Embedded posts must maintain a load path for uplift loads per the provisions of Section 1604.8.1. Note that dead load can be used to offset uplift as permitted in Section 1605.3.

Chapter 18 Soils and Foundations

The foundation system of a post-frame building is unique. The posts can be embedded in the ground or anchored to a concrete foundation (Figure 4).

In all cases, vertical loads from the roof are transferred to columns and from columns to concrete footings or foundations, and finally to the soil. Buried or embedded posts also can resist lateral loads by developing partial fixity. See Figure 3.

Section 1806 Presumptive Load Bearing Values of Soils

The foundation system must be evaluated with respect to load bearing values of the soil. Section 1806 outlines those requirements.

Section 1807 Foundation Walls, Retaining Walls and Embedded Posts and Poles

Standard practice for embedded posts is that a round hole is drilled for each post approximately four feet in the ground (or greater if required for frost protection per 1809.5). Either a pre-cast or cast in place round concrete pad is placed in the bottom of this hole. Pads are usually unreinforced. The diameter of this pad is determined so that the calculated vertical load in the post divided by the area of the pad is less than the allowable soil bearing pressure (per Sections 1806 and 1807). The foundation under an anchored post is designed conventionally. The minimum 28 day concrete strength is 2,500 psi or 3,000 psi per Items 1 and 2 in Table 1808.8.1.

Section 1807.3 Embedded Posts and Poles

Embedded posts can resist lateral loads through the development of partial fixity of the base. However, there are limitations as shown in Section 1807.3.1. Research has shown that where the roof and side walls can act as diaphragms or shear walls, that the majority of the lateral loads will be resisted by them. The *Post-Frame Design Manual*, published by the National Frame Builders Association, as well as ANSI/ASAE EP 484.2, referenced in Section 2306.1, provide techniques for dividing the lateral loads among frames and diaphragms. After the design moments at the base of the posts have been determined, the embedment depth can be checked in accordance with Section 1807.3. More extensive design and analysis procedures for embedded post and pier foundations are contained in ANSI/ASAE EP 486.1.

Chapter 23 Wood

Section 2303.1.8 Preservative-treated wood

Preservative treated wood has been used successfully in contact with the ground for many years. The use of properly treated wood may provide assurance that a post-frame building may last for 50 years or more. This section and Section 1807.3 specify that wood posts shall be treated in accordance with American Wood Protection Association (AWPA) standard U1 (Commodity Specification A, Use Category 4B for sawn timber posts and Commodity Specification B, Use Category 4B for round timber posts). Waterborne preservatives are often the preferred method of treatment for wood in contact with the ground. Posts or wood columns embedded in soil must be treated to a minimum use category level of AWPA UC4B, and other wood at or above soil level up to one foot above grade must be treated to at least UC4A. Southern Pine has long been a preferred species for treatment because its cellular structure permits relatively deep and uniform penetration of the preservative.

Section 2303.4 Trusses

Metal plate connected wood trusses shall be designed and manufactured in accordance with ANSI/TPI 1. Chapter 2 in ANSI/TPI 1 is titled *Standard Responsibilities in the Design and Application of Metal-Plate-Connected Wood Trusses*. Every post-frame building designer should be familiar with this document, since 1) trusses are based on the building designer's specifications and 2) long-span trusses require special attention to bracing and erection. It is important that building designers understand their role in the design process relating to wood trusses. Additional information pertaining to design and installation of metal plate connected wood trusses is available from SBCA.

Section 2304.9 Connectors and Fasteners

Structural lumber in a post-frame building is usually in a highly stressed state at design loads. Therefore, it is important that all connections between structural members be carefully designed by the post-frame building designer, not left to the discretion of the erector. When preservative-treated or fire-retardant-treated wood is used, care should be taken in the selection of fasteners and connectors. Section 2304.9.5 covers the different applications.

Section 2304.11 Protection against decay and termites

This section specifies the locations where wood is required to be preservative treated.

Section 2306.1 Allowable stress design

Post-frame design is normally based on allowable stress. The ANSI/ASAE standards cited in this section as well as the *Post-Frame Design Manual* published by the National Frame Builders Association, give guidance to the post-frame building designer.

For additional information contact:

The information contained in this document is intended to assist the designer of post framed structures. Special effort has been made to assure that the information reflects the state of the art. However, the American Wood Council does not assume responsibility for particular designs or calculations prepared from this publication.

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WICHITA

POST AND FRAME (POLE BARN) CONSTRUCTION

MINIMUM STANDARDS

SPACING OF POSTS OR COLUMNS
Douglas fir or Southern Pine (Treated for Ground Contact)
All Poles 5" Rough Cut or Larger

Poles Spaced 8' on Center
- 2X4 Purlins
- 2X4 Girts – Side
- 2X12 Double Header
- Engineered Trusses 4'on Center

Poles Spaced 10' on Center
- 2X4 Purlins
- 2X6 Girts – Side
- 2X12 Double Header
- Engineered Trusses 5'on Center

DIAMETER OF BORED HOLES	
Width of Building	Diameter and Depth
24 ft	12 in / 4ft
30 ft	14 in / 4 ft
36 ft	16 in / 4 ft
40 ft	17 in / 4 ft

One Bag of Quikrete in Bottom of Hole or Concrete Cookie
Pole Holes to be Back Filled with Sand, Road Gravel or Dirt

Sidewall and Headers
Wood to Carry Grade Stamp of #2 and Better
Girts to be Spaced 30" on Center with Bottom Rail to be Treated for Below Ground Contact
Purlins to be 2X4s at 24" on Center up the Slope of the Roof; Wood to Carry a Grade Stamp of Standard and Better.
All Metal Sheeting to be 29 Gauge Steel or Better

14' MAXIMUM Side Wall Height*
42' MAXIMUM Width* 60' MAXIMUM Length*
**If building exceeds any one of these dimensions, plans shall be sealed by a State of Kansas licensed engineer.*

Table 32.1 Headers MAXIMUM HEADER SPANS (FT. – IN.) – D.FIR-L, HEM-FIR AND S.Y.P., No.2 GRADE (Exterior Bearing Walls)

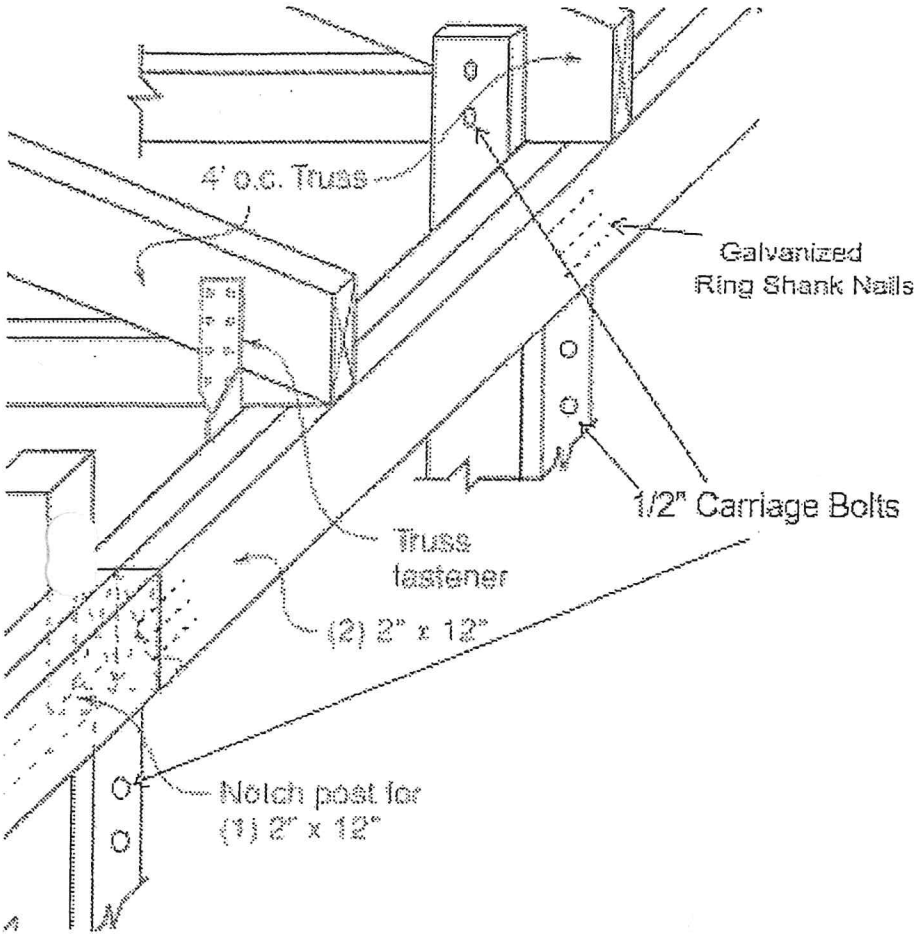
Headers Supporting Roof and Ceiling	Size	Roof Live Load (psf) 20 Building Width (ft) 20	20 28	20 36	30 Building Width (ft) 30 20	30 28	30 36	40 Building Width (ft) 40 20	40 28	40 36	50 Building Width (ft) 50 20	50 28	50 36
	2-2x4	3-6	3-2	2-10	3-3	2-10	2-7	3-0	2-7	2-4	2-10	2-5	2-2
	2-2x6	5-5	4-8	4-2	4-10	4-2	3-9	4-5	3-10	3-5	4-1	3-7	3-2
	2-2x8	6-10	5-11	5-4	6-2	5-4	4-9	5-7	4-10	4-4	5-2	4-6	4-0
	2-2x10	8-5	7-3	6-6	7-6	6-6	5-10	6-10	5-11	5-4	6-4	5-6	4-11
	2-2x12	9-9	8-5	7-6	8-8	7-6	6-9	7-11	6-10	6-2	7-4	6-4	5-8
	3-2x8	8-4	7-5	6-8	7-8	6-8	5-11	7-0	6-1	5-5	6-6	5-8	5-0
	3-2x10	10-6	9-1	8-2	9-5	8-2	7-3	8-7	7-5	6-8	7-11	6-10	6-2
	3-2x12	12-2	10-7	9-5	10-11	9-5	8-5	9-11	8-7	7-8	9-2	8-0	7-2
	4-2x8	9-2	8-4	7-8	8-6	7-8	6-11	8-0	7-0	6-3	7-6	6-6	5-10
	4-2x10	11-8	10-6	9-5	10-10	9-5	8-5	9-11	8-7	7-8	9-2	7-11	7-1
	4-2x12	14-1	12-2	10-11	12-7	10-11	9-9	11-6	9-11	8-11	10-8	9-2	8-3

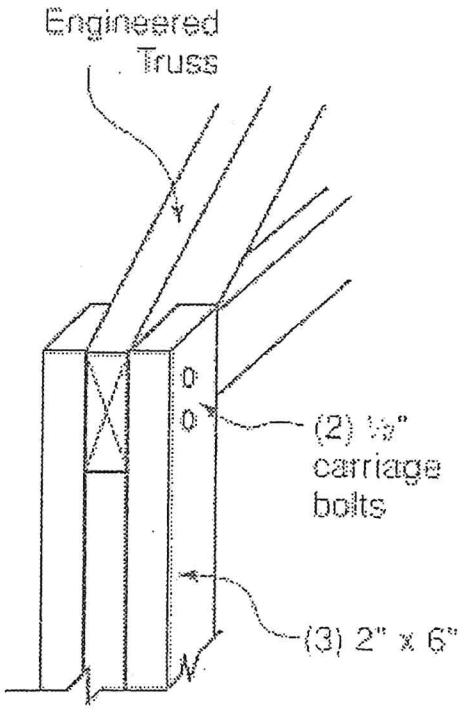
The U.S. Span Book for Major Lumber Species

Headers U.S. Spans for U.S. Species

These are guidelines only. Most [illegible] Building and Residential Requirements [illegible]

Truss Terminology





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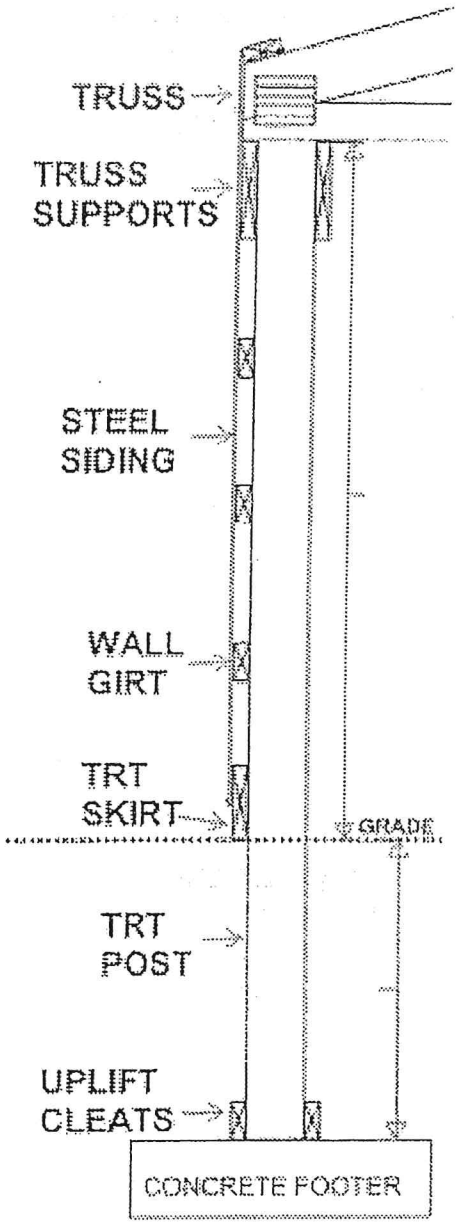
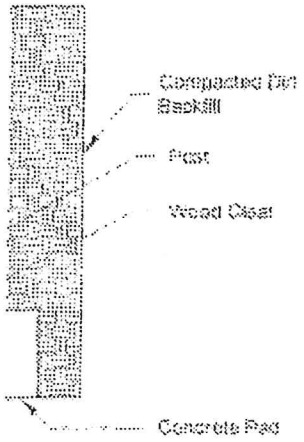
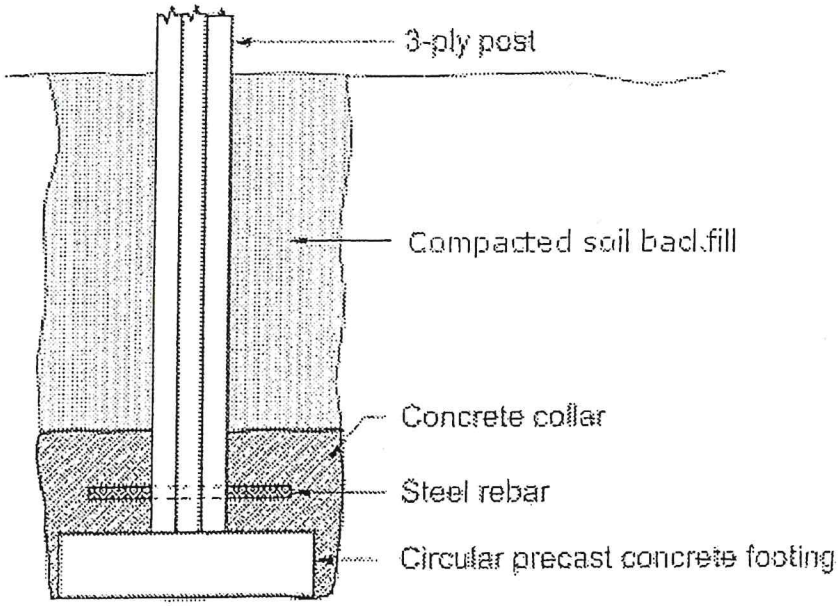


Pole Barn Wall Section



mbedment Method



High Wind Embedment