DESIGN GUIDE 12

Prescriptive Design Specifications for Non-Diaphragm Post-Frame Buildings

Prepared in Accordance with the Non-Diaphragm Post-Frame Building Design Guide (NDPFBDG) by NFBA

timbertech ENGINEERING

United States Department of Agriculture

Natural Resources Conservation Service

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Acknowledgement

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Timber Tech Engineering, Inc., (TTE) developed the final document with design interpretations of the references used. Additional background information is provided in the Introduction section. NRCS retains a copy of the supporting calculations at the PA NRCS State Office. TTE and its personnel make no warranty regarding the prescriptive design tables, drawings, calculations, and recommendations provided in this document. In no event shall TTE be liable for any damages related to use of the materials in this document.

The use of this document is entirely voluntary. The user is responsible to ensure that the application is appropriate and fits within the codes and standards referenced. Engineering evaluation is required when deviating outside the listed parameters. Changes shall be supported with calculations by a Professional Engineer.

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1. INTRODUCTION

This document was prepared by Timber Tech Engineering, Inc., (TTE) in collaboration with the Pennsylvania Natural Resources Conservation Service (NRCS), United States Department of Agriculture (USDA). The purpose of this document is to provide prescriptive design specifications for non-diaphragm post-frame buildings using the design procedures outlined in the Non-Diaphragm Post-Frame Building Design Guide (NDPFDG) by the National Frame Building Association (NFBA). This document was developed for specific building scenarios. Users are responsible for following the design criteria and limitations listed within the document. Design scenarios outside of the listed parameters must be supported by additional design documentation by the user. The scope is limited to non-diaphragm post-frame buildings with 40', 50', and 60' truss spans, and 12', 16', and 20' eave (ceiling) heights with embedded columns and columns pinned or fixed on top of the 4' tall continuous concrete wall foundation. Buildings may be open, partially open, enclosed, or partially enclosed as defined in ASCE 7. In total, 54 separate design examples were considered. Six of the 54 examples, however, did not result in a working design under the common design criteria. The non-diaphragm designation in this document applies only to the lateral force resisting system (LFRS) resisting lateral loads in the direction perpendicular to the ridge. In this direction, each primary frame of the building is self-supporting and does not require help from the diaphragm action. Diaphragm action is required and was considered for resisting lateral loads parallel to the ridge line.

Buildings are separated by width, height, sidewall sheathing condition, and column base condition (Figure 1). Endwall sheathing condition is not a category: one or both endwalls in any building in this document may be sheathed or remain open. The terms “open sidewalls” and “sheathed sidewalls” should not be confused with the ASCE 7 envelope classifications. A more detailed discussion on this is provided in the Structural Design section. A detailed description of limitations, assumptions, and the design criteria are listed in the corresponding sections of this document.

The design specifications in this document are comprehensive. The dead, snow, wind, and storage load specifications are provided in the Design Criteria section. Structural properties of soils, foundation components, primary and secondary framing members, LFRS members, and fasteners are provided in the Materials section. Building dimensions, truss geometry, and placement of primary and secondary framing members are summarized in the Building Geometry section. The Generic Drawings section provides sketches of floor plans, building sections, primary frame details, sidewall frame details, girder details, foundation details, roof framing plan, permanent truss bracing details, etc. The explanation of the structural analysis, additional stipulations and assumptions are covered in the Structural Design section. The Design Tables section provides detailed specifications for all design-specific members and connections. All member sizes and connection specifications that vary by design or are unique to building size or category are specified generically in the Generic Drawings section and specified in detail in the design tables. For example, columns vary by design and are specified in the drawings as “glulam column per design tables”; the user is directed to the design tables for the additional specifications. All common member sizes and connection specifications (specifications that do not vary by design) are communicated directly in the Generic Drawings section. For example, wall girts, and roof purlins do not vary by design and are specified entirely in the drawings (member sizes, grades, spacing, fastener type, size, and quantity). Similarly, the connection between the knee brace and the bottom chord of truss does not vary by design and is specified entirely in the drawings. Common members and connections are not included in the design tables. A comprehensive design is achieved only when specifications from all sections in this document are considered and communicated in the project's structural drawings.

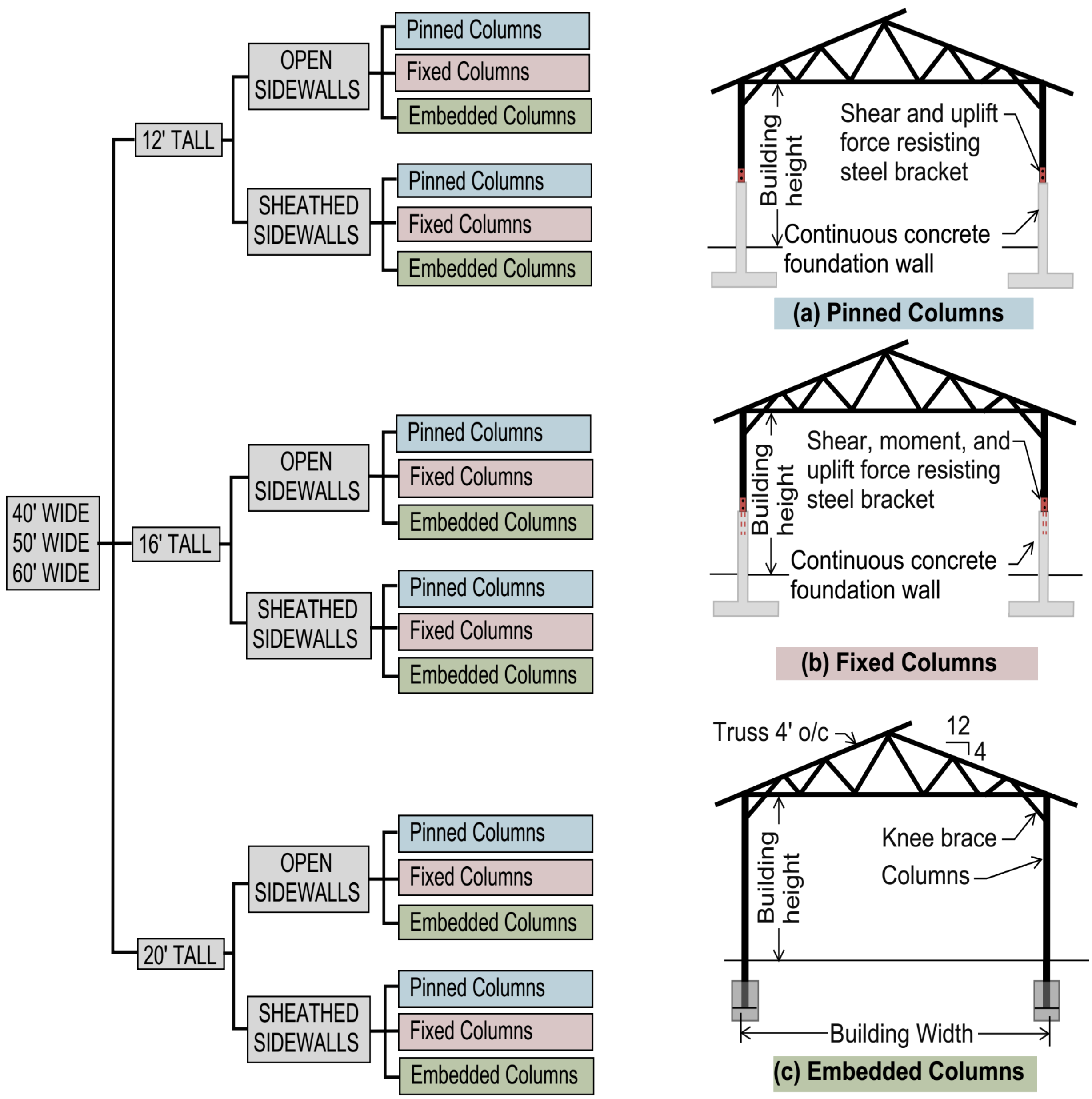


Figure 1: *Schematic diagram of building designs*

2. DESIGN CRITERIA

The sketches and design tables have been prepared using the design criteria listed in this section. The design criteria are suitable for agricultural buildings.

- **Structural Codes:** 2018 IBC, ASCE 7-16, NDS 2018, ACI 318-14
  ASAE EP486.3, ASAE EP484
- **Building Risk Category:** I (Agricultural Buildings)

- **Dead Loads**
  - Top Chord of Roof Truss 5 psf
  - Bottom Chord of Roof Truss 5 psf
  - Total Roof Load 10 psf

- **Snow Loads**
  - Ground Snow Load, p_g 35 psf
  - Snow Risk Factor 0.8
  - Thermal Factor, C_t 1.2
  - Exposure Factor, C_e 1.0
  - Sloped Roof Factor, C_s 1.0
  - Flat Roof Snow Load, p_f 24 psf
  - Sloped Roof Snow Load, P_s 24 psf
  - Unbalanced Windward Snow Load 7 psf
  - Unbalanced Leeward Snow Load
    - 40 ft Wide Buildings 41 psf 8 ft from the ridge, then 24 psf
    - 50 ft Wide Buildings 43 psf 9 ft from the ridge, then 24 psf
    - 60 ft Wide Buildings 45 psf 10 ft from the ridge, then 24 psf
  - Snow Drift Load not evaluated; requires additional design
  - Sliding Snow Load not evaluated; requires additional design

- **Roof Live (Construction) Loads** 20 psf

- **Wind Loads**
  - Basic (Ultimate) Wind Speed 105 mi/h
  - Exposure Category C
  - Building Mid-Height 25 (or less)
  - Wind Directionality Factor, K_d 0.85
  - Topographic Factor, K_{zt} 1.0
  - Velocity Pressure, q_h 22.7 psf
  - Building Enclosure Category
    - Sheathed Sidewalls Partially Enclosed (also Enclosed, Partially Open)
    - Open Sidewalls Open (also Partially Open)

- **Seismic Loads** not evaluated
- **Rain and Ice Loads** not evaluated

- **Storage Loads (Fill)**
  - Dry Bulk Density 70 pcf
  - Angle of Internal Friction 32°
  - Angle of Fill Line 32°
  - K_a 0.85 (Rankine)
  - EFD 60 psf/ft (applied at 32°)

3. MATERIALS

The sketches and design tables have been prepared using the following material properties:

- **Posts (Columns)**
  - Type Glulam (true glulam, no fasteners, no alternatives)
  - Governing Standard ANSI A190.1-2017
  - Compression Parallel to Grain, F_c 1,900 psi
  - Compression Perp. To Grain, F_{cp} 650 psi
  - Tension Parallel to Grain, F_t 1,100 psi
  - Bending About Strong Axis, F_{by} 1,900 psi
  - Bending About Weak Axis, F_{bx} 1,700 psi
  - Shear Parallel to Grain, F_v 260 psi
  - Modulus of Elasticity, E 1,700 ksi
  - Modulus of Elasticity, E_{min} 900 ksi

- **Roof Purlins, Wall Girts, Temporary and Permanent Roof Bracing**
  - Type Visually Graded
  - Species SPF
  - Structural Grade #2 or better
  - Specific Gravity, SG 0.42
  - Reference Design Values NDS 2018

- **Knee Braces, Wye Braces, and X braces (between columns)**
  - Type Visually Graded
  - Species SYP
  - Structural Grade #2 or better
  - Specific Gravity, SG 0.55
  - Reference Design Values NDS 2018

- **Roof Girders**
  - Type Visually Graded

○ Species	SYP
○ Structural Grade	Per design tables
○ Reference Design Values	NDS 2018

- **Column Base Brackets**

○ Pinned Bracket	Bracket anchored to concrete using wet-set or post-installed anchors; bracket design is excluded from this document; the selected bracket must have sufficient allowable shear and uplift capacities to resist the tabulated column base reactions in the design tables
○ Moment-Resisting Bracket	Bracket with welded rebar wet-set into concrete; bracket design is excluded from this document; the selected bracket must have sufficient allowable moment, shear, and uplift capacities to resist the tabulated column base reactions in the design tables; the effective rotational rigidity of the joint, M/θ, consisting of the bracket, bracket-to-concrete element, and bracket-to-wood element, must be within the following ranges: 3-ply 2x6 min. 30 in-k/deg, max. 50 in-k/deg 4-ply 2x6 min. 40 in-k/deg, max. 60 in-k/deg 3-ply 2x8 min. 70 in-k/deg, max. 100 in-k/deg 4-ply 2x8 min. 70 in-k/deg, max. 100 in-k/deg

- **Roof Trusses**

○ Top Chord	SYP (SG of 0.55), size and grade per truss designer
○ Bottom Chord	Size, species, and grade per truss designer
○ Webs	Size, species, and grade per truss designer
○ Loading	Per the design criteria
○ Other Requirements	Panel points (intersection of webs with truss chords) must be configured such that there is a panel point near the intersection of the top chord and the knee brace; truss must be designed to receive concentrated point loads from the knee braces (axial knee brace forces are provided in the design tables)

- **Fasteners**

○ Type	Per Design Tables and Sketches
○ Nails	0.135"x3.5" Ring Shank Nails (per design tables) 0.177"x4" Ring Shank nails (per design tables) Nails must conform with NDS specifications; nails in contact with treated wood must be hot-dipped galvanized

- Structural Screws — Nominal diameter and length per design tables; minimum bending yield strength, F_{yb}, should be 164,000 psi, minimum root diameter should be 0.172 inches (1/4" SDS screws by Simpson Strong Tie, TLOK and similar fasteners by Fasten Master, 5/16" RSS screws by GRK, 1/4" WS Pro Series and similar screws by MiTek, similar structural screws by other manufacturers)
- Structural Grade — Per design tables
- Reference Design Values — NDS 2018

- **Sheathing**
  - Metal Panels (Roof and Walls) — 29 Gauge (or thicker gauge) corrugated metal panels with major ribs spaced at 9" o/c; fastener schedule is provided in Section 5
  - OSB or Plywood — 7/16" APA rated sheathing on walls and 5/8" APA rated sheathing on roof; fastener schedule is provided in Section 5; wood panels and corrugated metal panels may be used interchangeably (for example walls may have wood panels and roof corrugated metal panels); wood and metal panels need not be used together in walls or roof (two layers)

- **Shallow Post Foundations***
  - Concrete Compressive Strength, f'_c — 3,000 psi
  - Soil Type (Unified Soil Class.) — SW, SP, GW, GP, GW-GC, GC, SC
  - Consistency — Medium to dense
  - Moist Unit Weights, γ — 120 lbf/ft^3
  - Drained Soil Friction Angle, φ — 35°
  - Increase in Young's Modulus — 220 $(lbf/in^2)/in$, water table is below the footer
  - Allowable Soil Bearing — 2,000 psf
  - Water table — Below the footing

  **Other soil types may be acceptable but were not considered in this document.*

- **Continuous Wall Foundation**
  - Concrete Compressive Strength, f'_c — 4,000 psi
  - Allowable Soil Bearing — 2,000 psf
  - Sliding Factor of Safety — 1.5
  - Overturning Factor of Safety — 1.5
  - Rebar Yield Strength, F_y — 60 ksi (Grade 60)
  - Coefficient of Friction — 0.35 (between soil and footer)

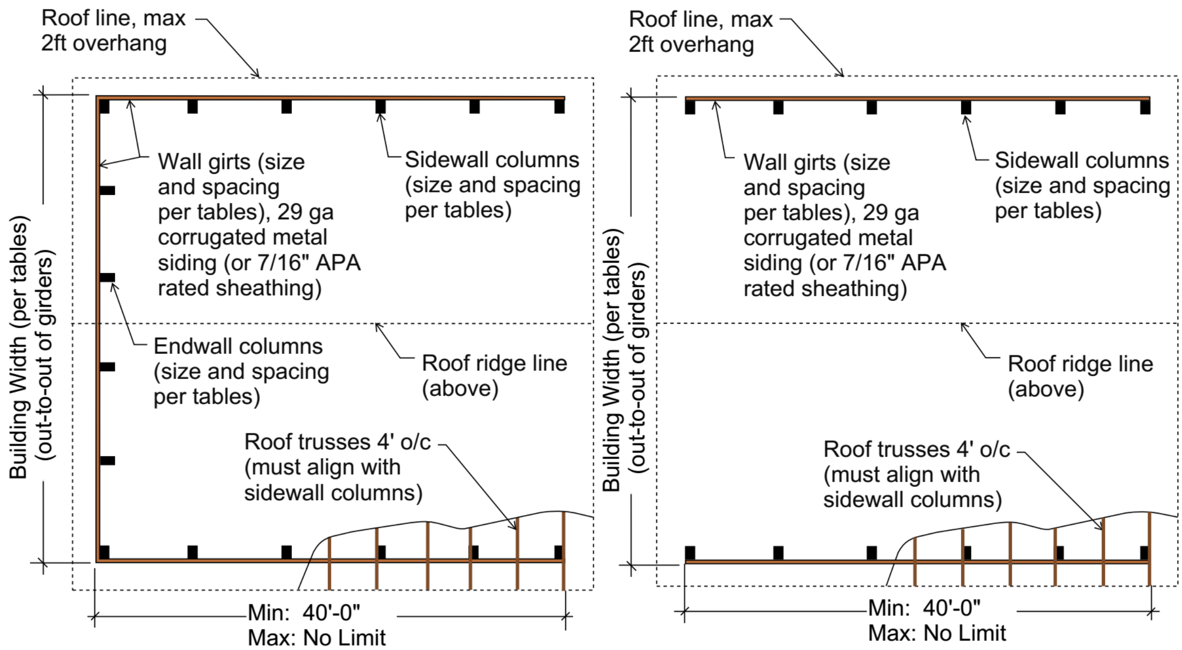
4. BUILDING GEOMETRY

The sketches and design tables have been prepared using the following geometry limitations:

- **Building Geometry**
  - Width (perpendicular to ridge) — 40 ft, 50 ft, 60 ft
  - Length (parallel to ridge) — Minimum 40 ft, no maximum (unlimited)
  - Ceiling (or eave) height) — 12 ft, 16 ft, 20 ft
  - Bottom chord pitch — 0:12
  - Top chord pitch — 4:12
- **Truss Spacing** — 4 ft
- **Roof Overhang** — 2 ft
- **Overshoot (at peak)** — 4 ft (horizontal dimension, per sketches)
- **Column Spacing**
  - Open and Sheathed Sidewalls — 8 ft (reduced to 4 ft where required by structural analysis)
  - Open Endwalls — No columns
  - Sheathed Endwalls — 8 ft (max)
- **Purlin Spacing** — 2 ft
- **Girt Spacing (Sheathed Walls)** — 20 in (sidewalls or endwalls)
- **Shallow Post Foundation** — Per design tables and sketches
- **Continuous Wall Foundation** — Per design tables and sketches

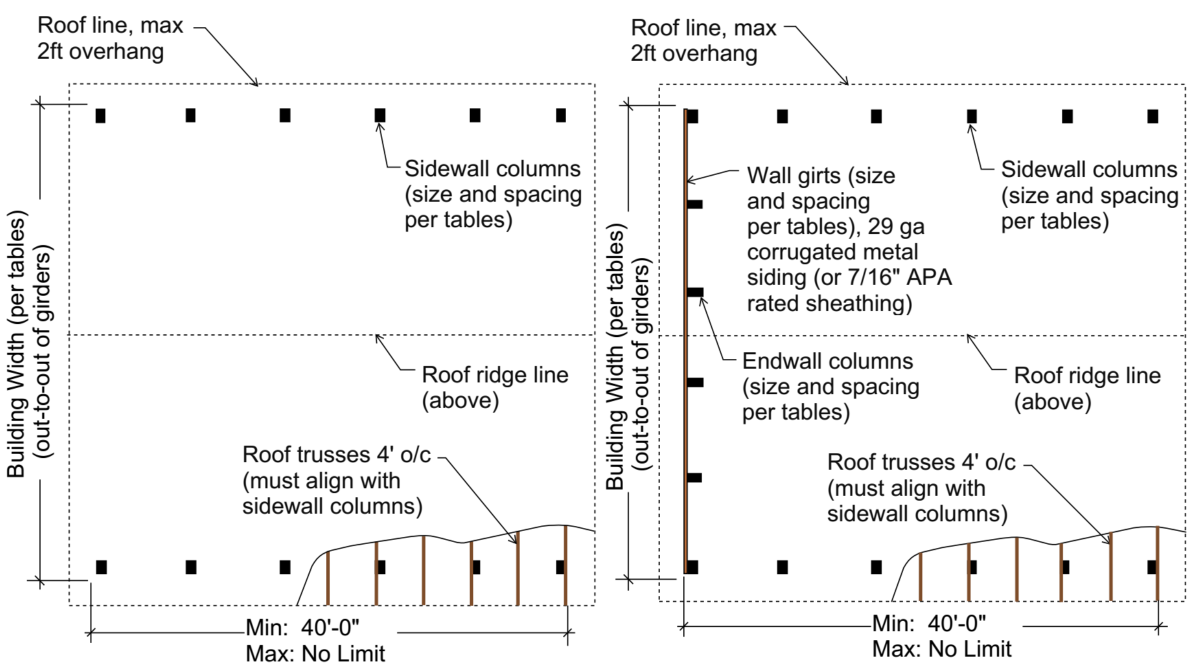
5. GENERIC DRAWINGS

Standard floor plans, cross sections, sidewall framing elevations, and details are provided in this section. All columns are glulam columns. Mechanically laminated columns, with or without an adhesive between laminations, are not an acceptable alternative. Truss spacing is 4' o/c in every design example. The sidewall columns that are spaced at 4' o/c, per design tables, must be aligned with every truss. The sidewall columns that are spaced at 8' o/c, must be aligned with every other truss. In all cases, all sidewall columns, including the corner columns, must be notched 1.5" to receive the roof truss. Trusses at columns must have direct bearing on column (girder connections are not designed to support loads from the primary truss). A knee brace between each sidewall column and truss is required in every design. Endwall columns, if used, must be continuous to the top of the top chord of truss (no splices). A diagonal brace is required at every endwall column (Figure 5.7). All common member sizes, wood species and grade as well as all common connections are specified directly in the drawings in this section. All members and connections that vary by design are shown generically in the drawings and specified in the design tables.



(a) Sidewalls and one or both endwall are sheathed *(b) Only sidewalls are sheathed*

Figure 5.1*: Standard floor plans for "SHEATHED SIDEWALLS" building designs; (a) building is enclosed/sheathed on three or four sides, (b) only sidewalls are enclosed/sheathed*



(a) Building is open on all sides *(b) One or both endwalls are sheathed*

Figure 5.2*: Standard floor plans for "OPEN SIDEWALLS" building design; (a) building is open on all sides, (b) one or both endwalls are enclosed/sheathed*

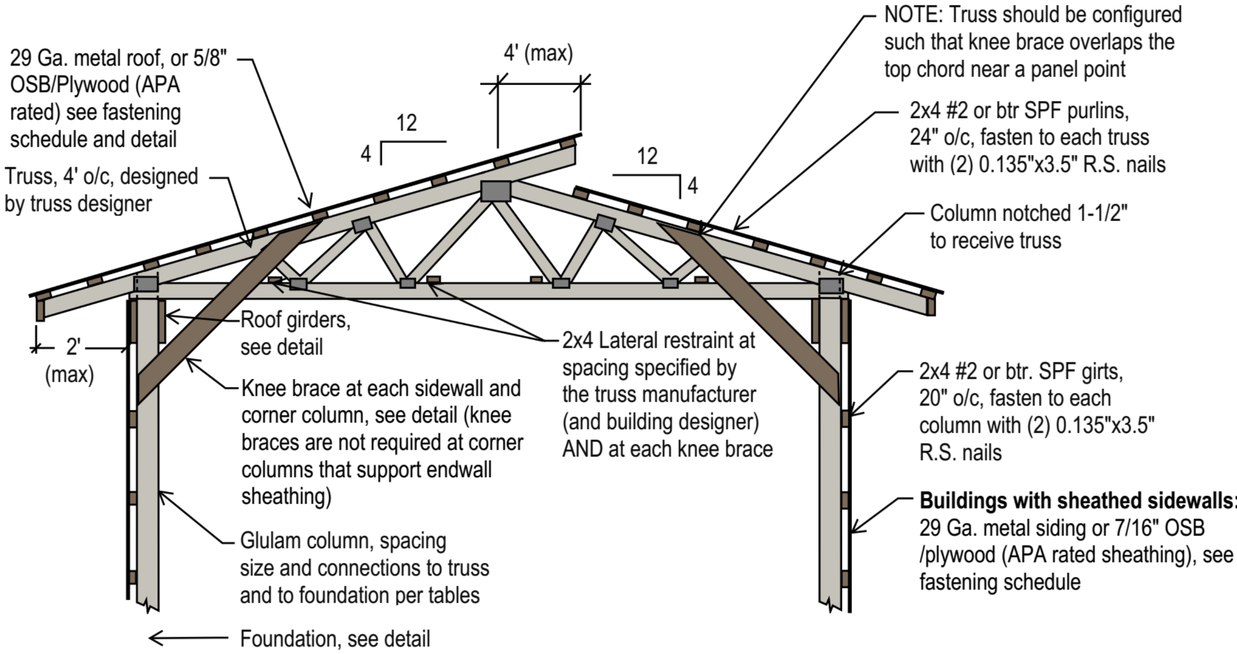


Figure 5.3*: Standard cross section (buildings with and without wall sheathing on sidewalls)*

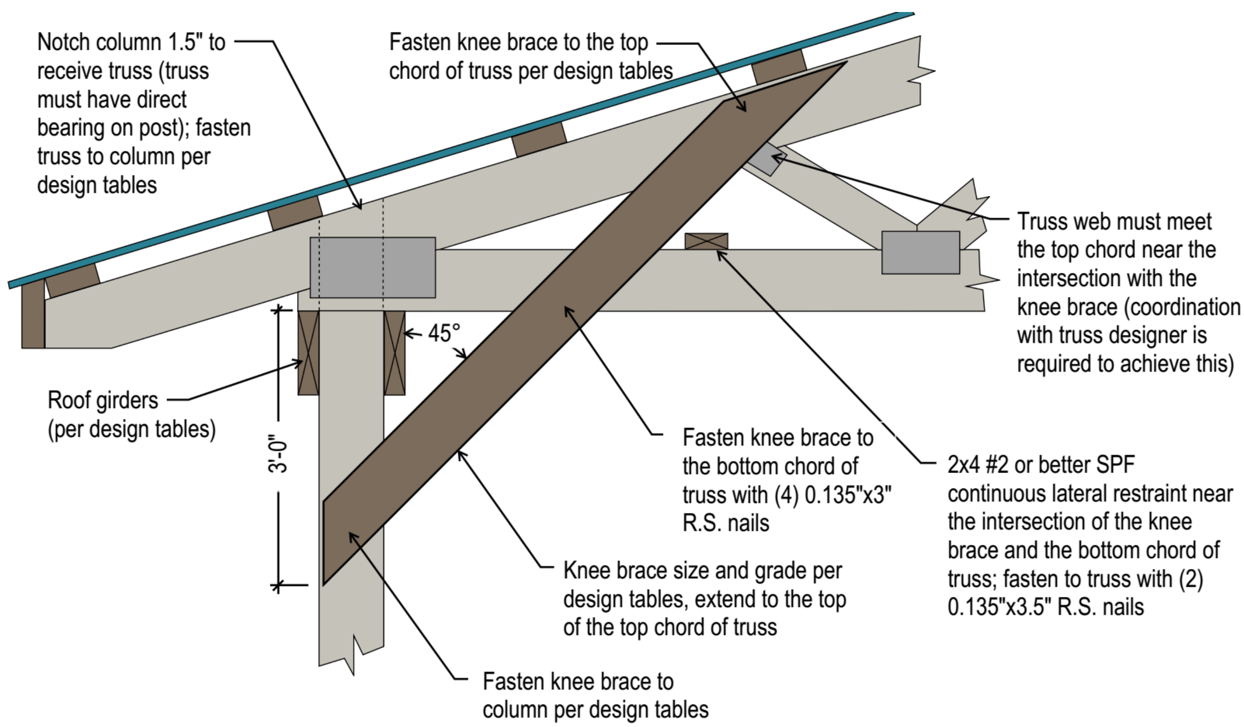
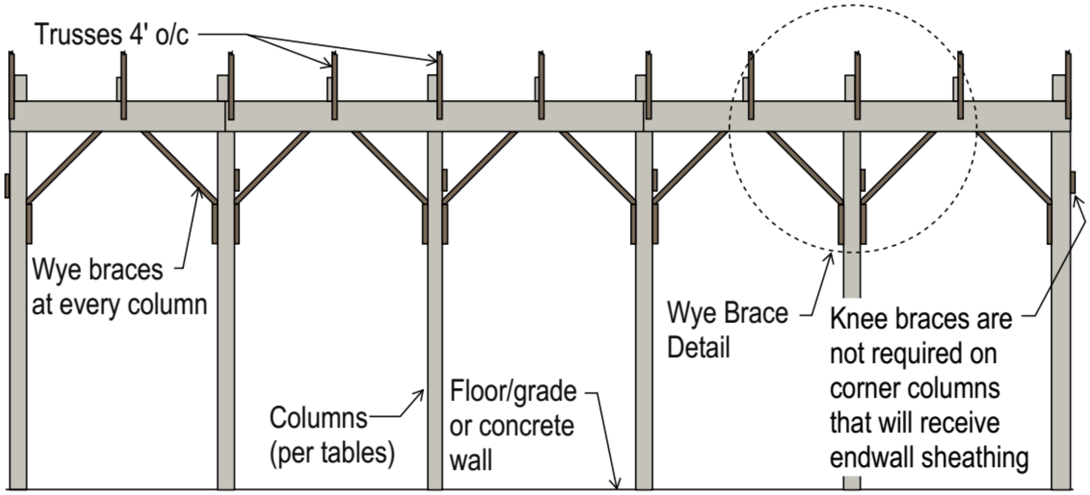
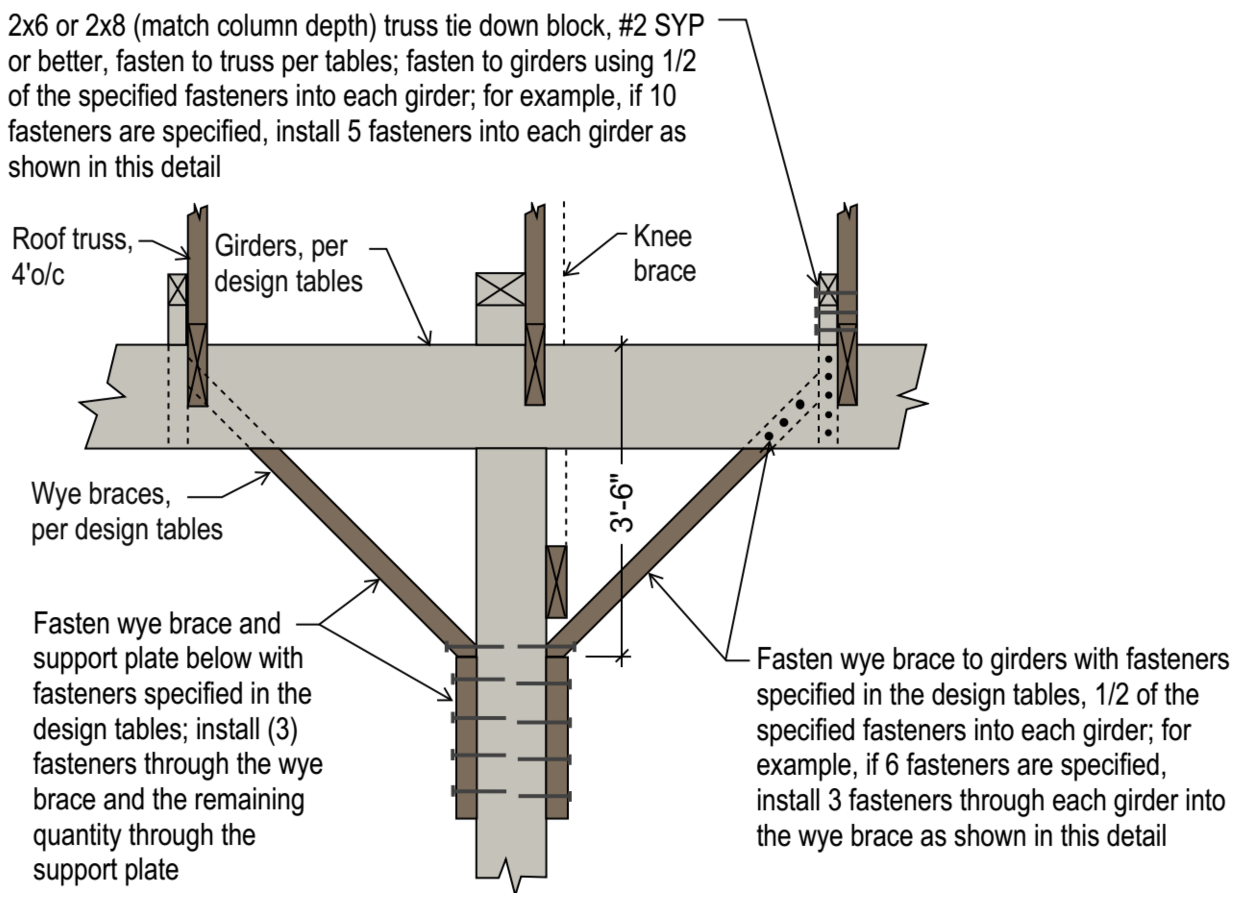


Figure 5.4*: Standard knee brace detail*

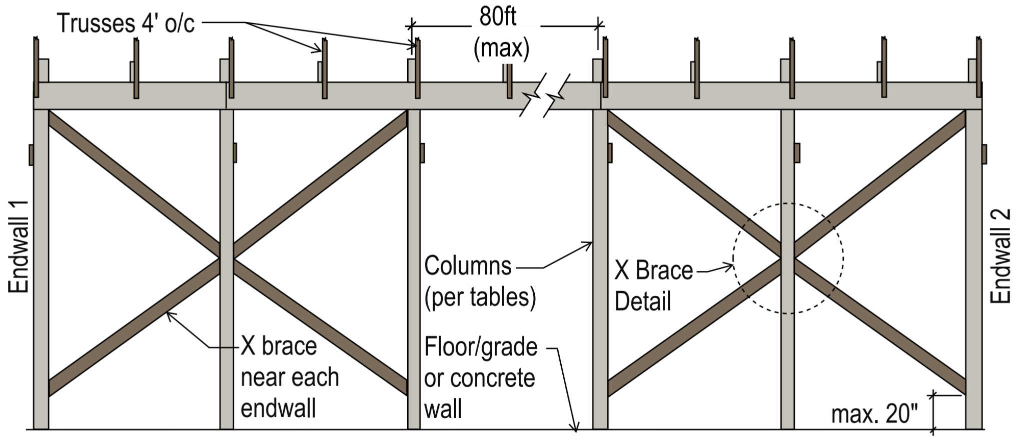


a. *Standard sidewall framing elevation for "OPEN SIDEWALLS" design with wye braces; wye braces are only allowed with specific buildings per the design tables; all other open-sided buildings require "X" bracing as shown in Figure 5.6.*

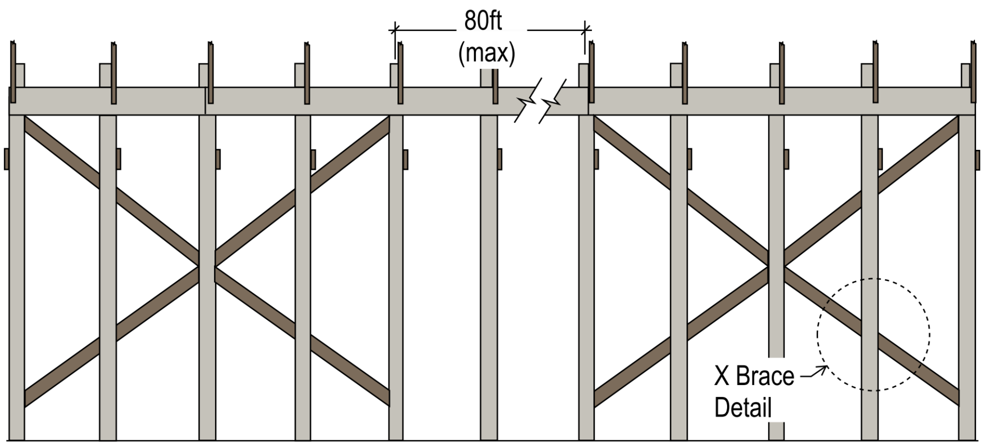


b. *Standard Wye brace detail for buildings with "OPEN SIDEWALLS"*

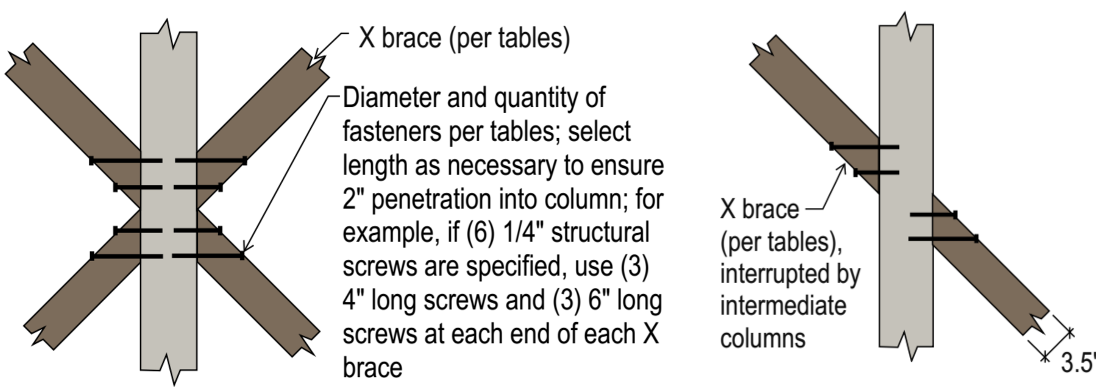
Figure 5.5*: Sidewall frames with wye braces – OPEN SIDEWALLS*



a. Sidewall framing elevation with X braces, columns 8ft o/c, X brace across 3 columns;



b. Sidewall framing elevation with X braces, columns 4ft o/c, X brace across 5 columns



c. X brace connection detail

Notes:

1. *X braces are required at each end of each sidewall; spacing between bracing may not exceed 80ft; longer walls may require additional/intermediate X bracing to comply with this requirement*
2. *Knee braces are not required at corner columns that will receive endwall sheathing*

Figure 5.6*: Sidewall frames with X braces – OPEN SIDEWALLS*

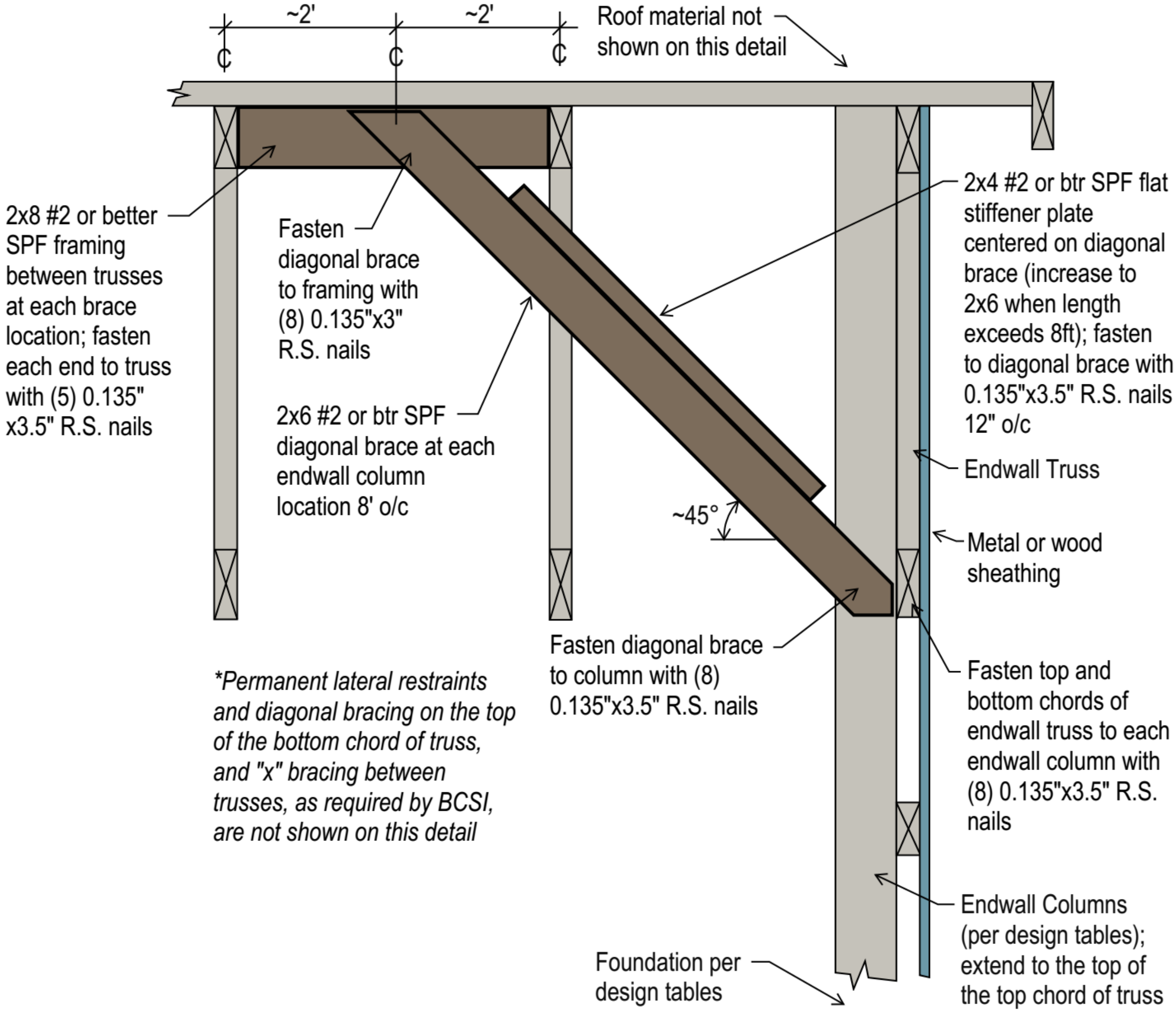


Figure 5.7*: Standard section through endwall with endwall columns and wall sheathing*

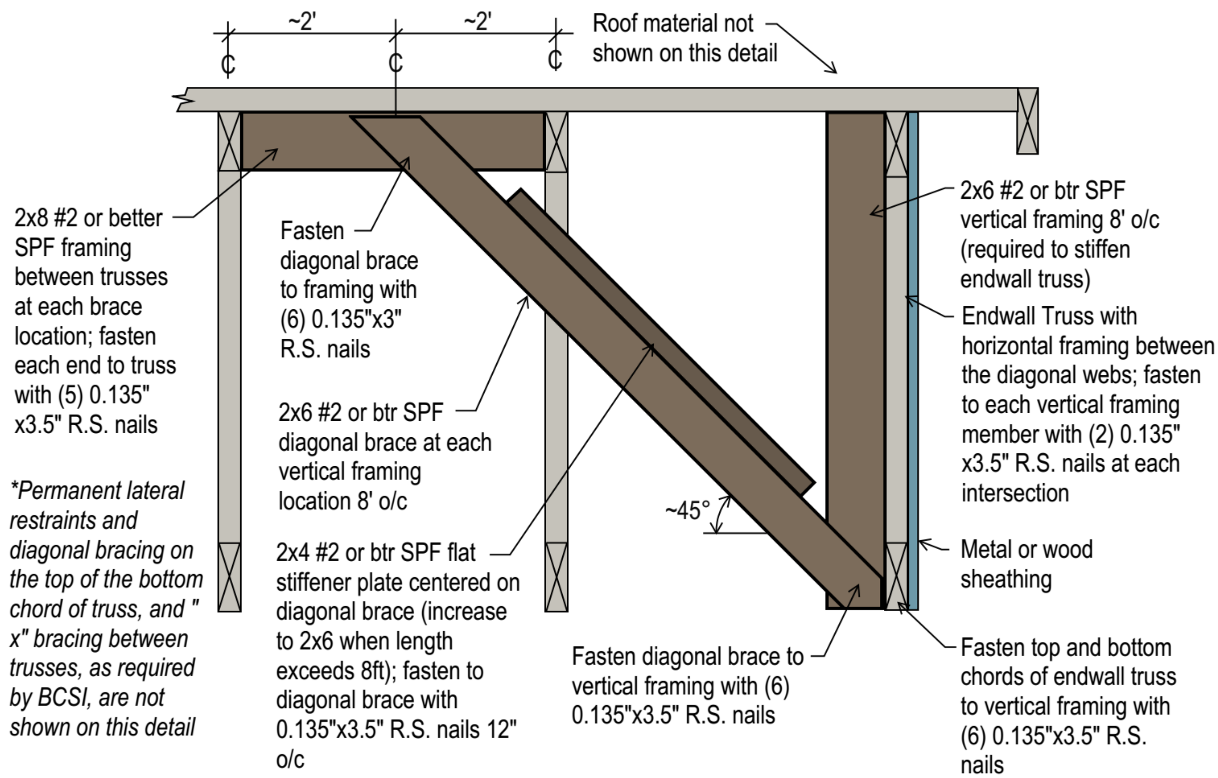


Figure 5.8*: Standard section through endwall with no endwall columns*

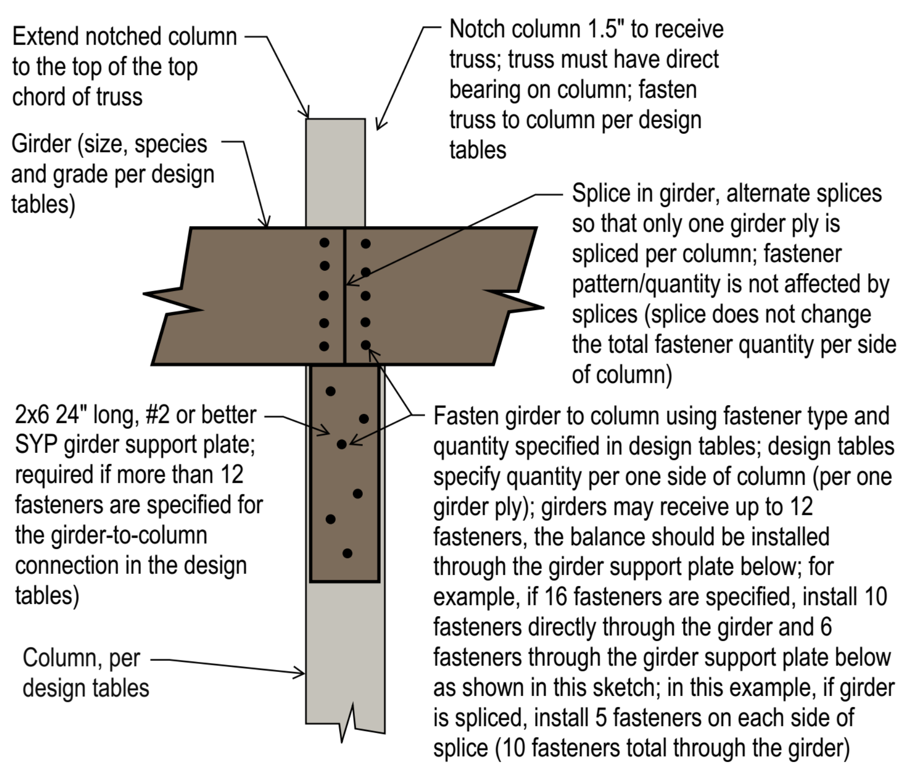


Figure 5.9*: Roof girder attachment detail*

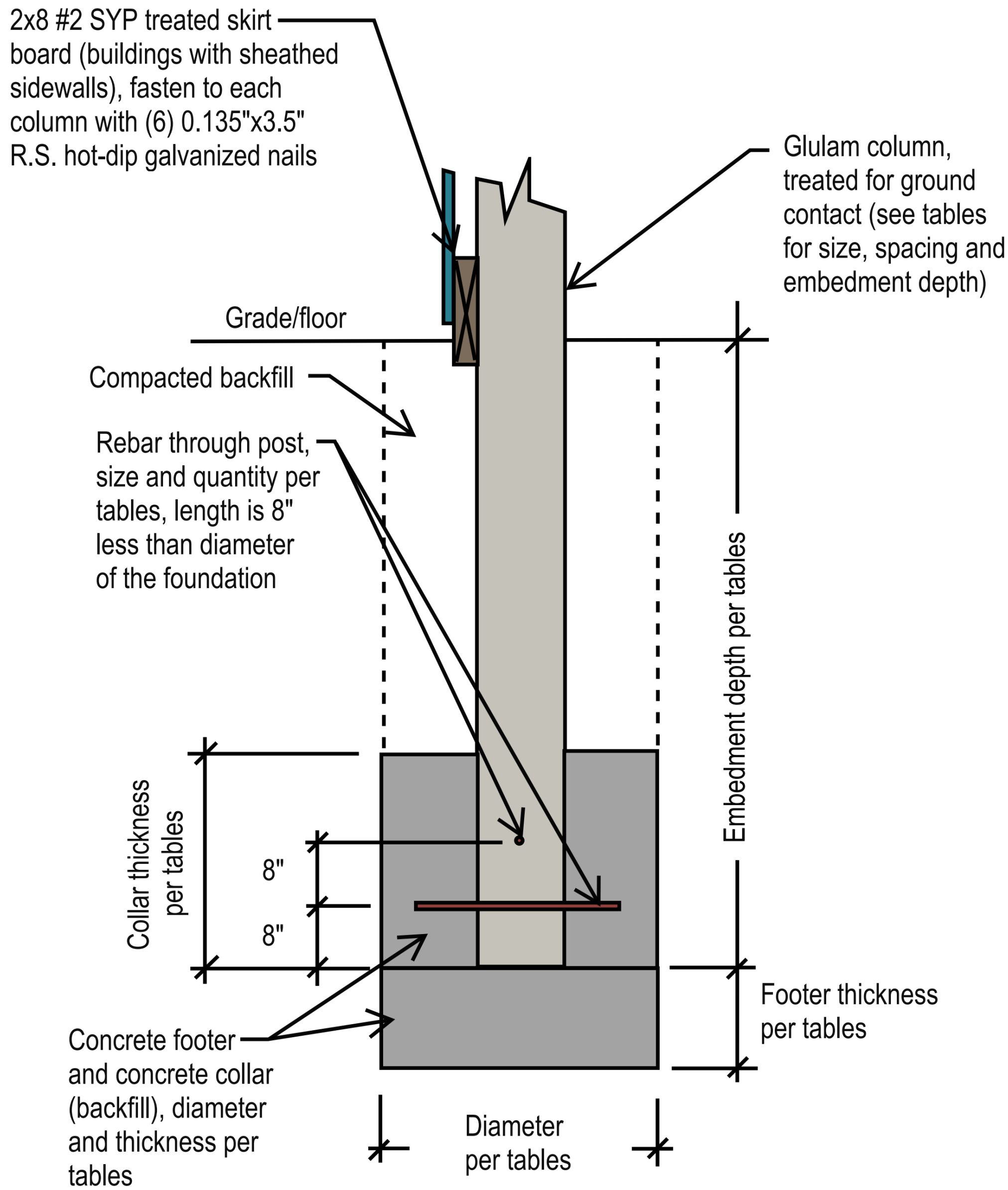


Figure 5.10*: Foundation detail for embedded columns*

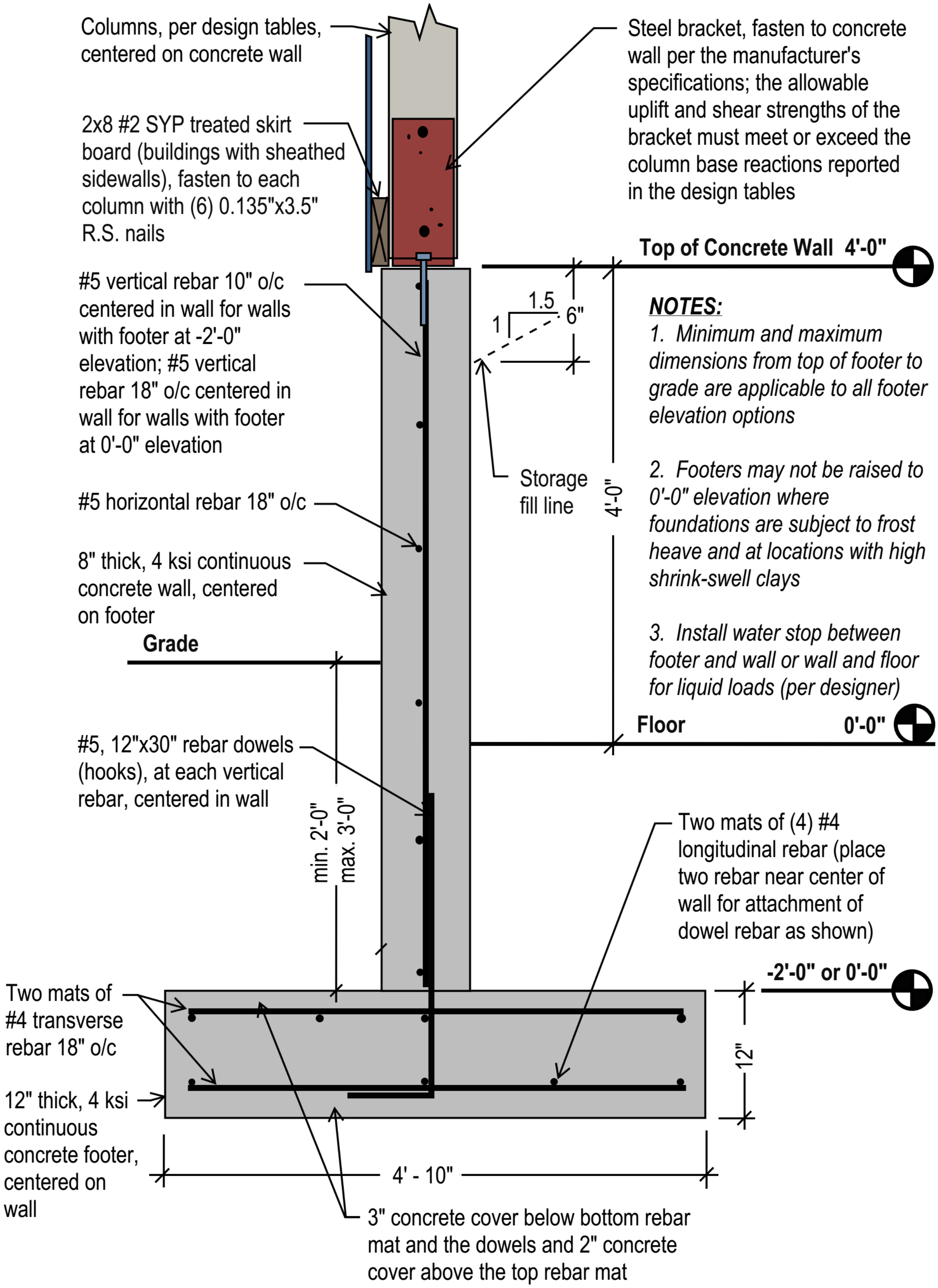


Figure 5.11*: Detail of continuous concrete wall foundation with "pin" post-base bracket (Concrete Wall A)*

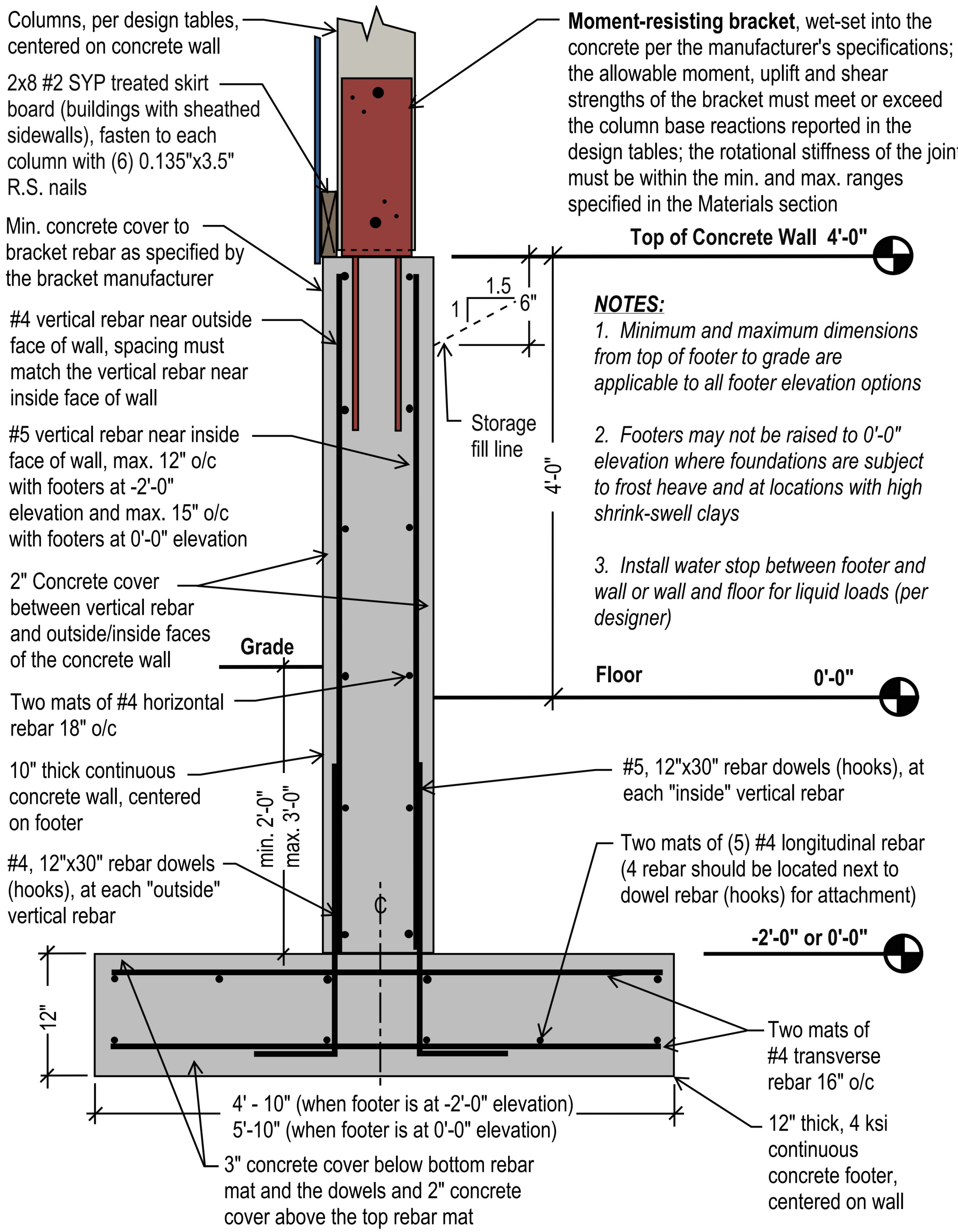


Figure 5.12*: Detail of continuous concrete wall foundation with moment-resisting post-base bracket (Concrete Wall B)*

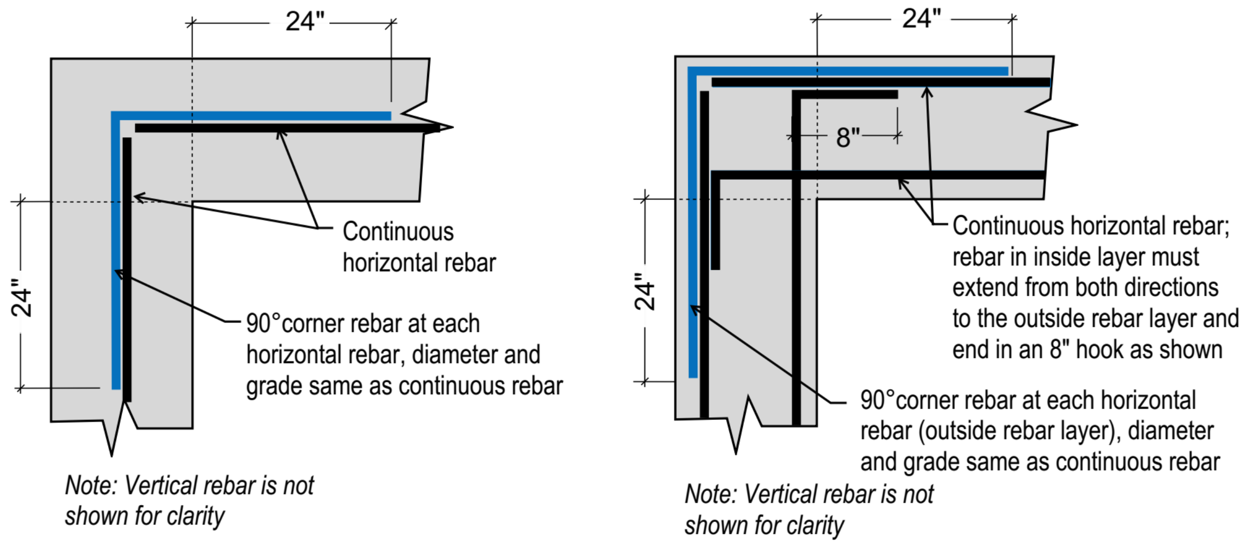


Figure 5.13*: Concrete wall corner detail*

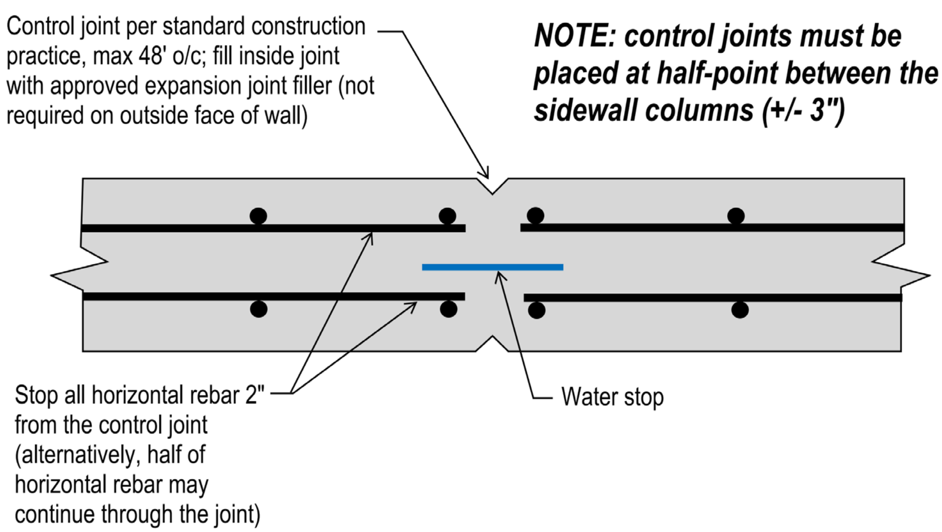


Figure 5.14*: Concrete wall control joint detail (the concept applies to double and single rebar layer)*

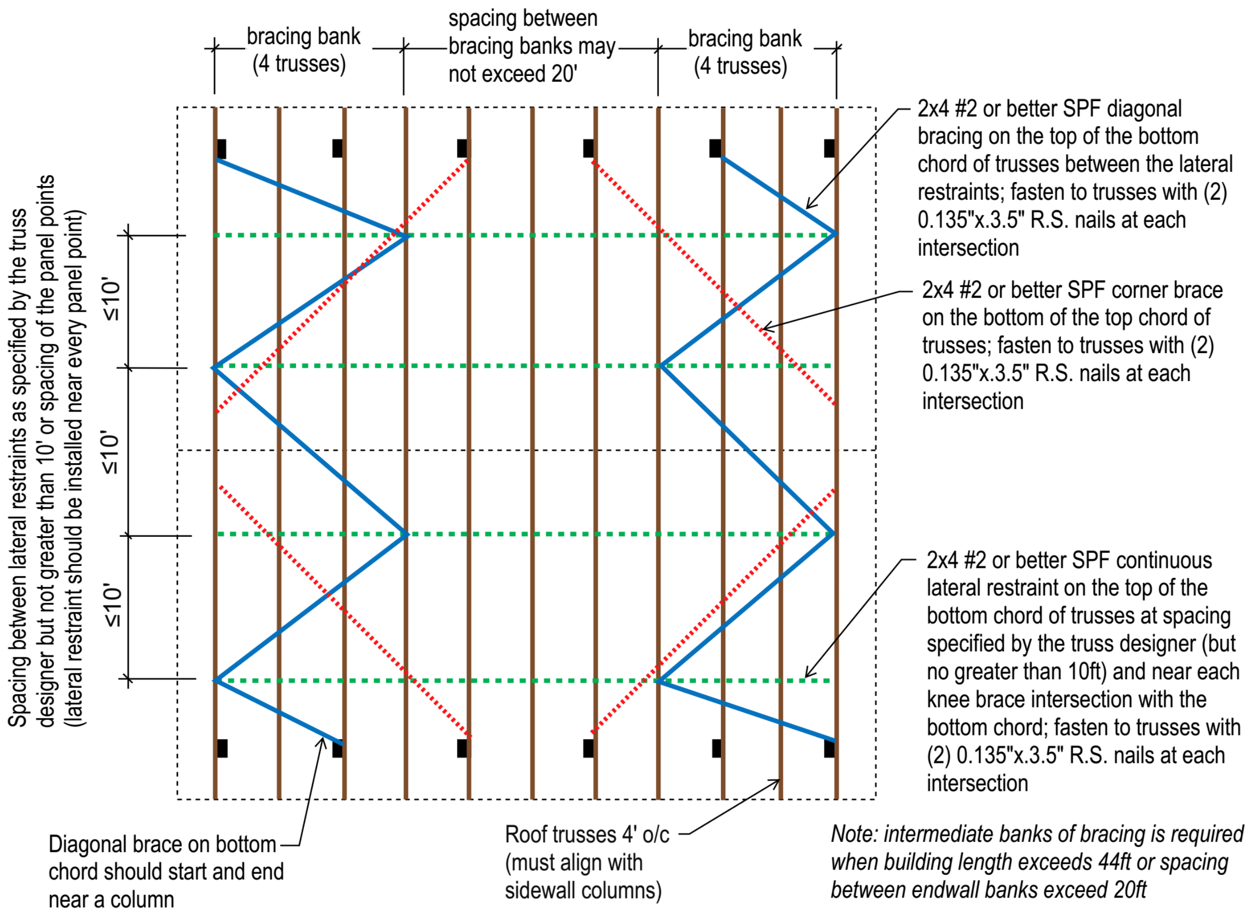


Figure 5.15*: Permanent truss bracing plan*

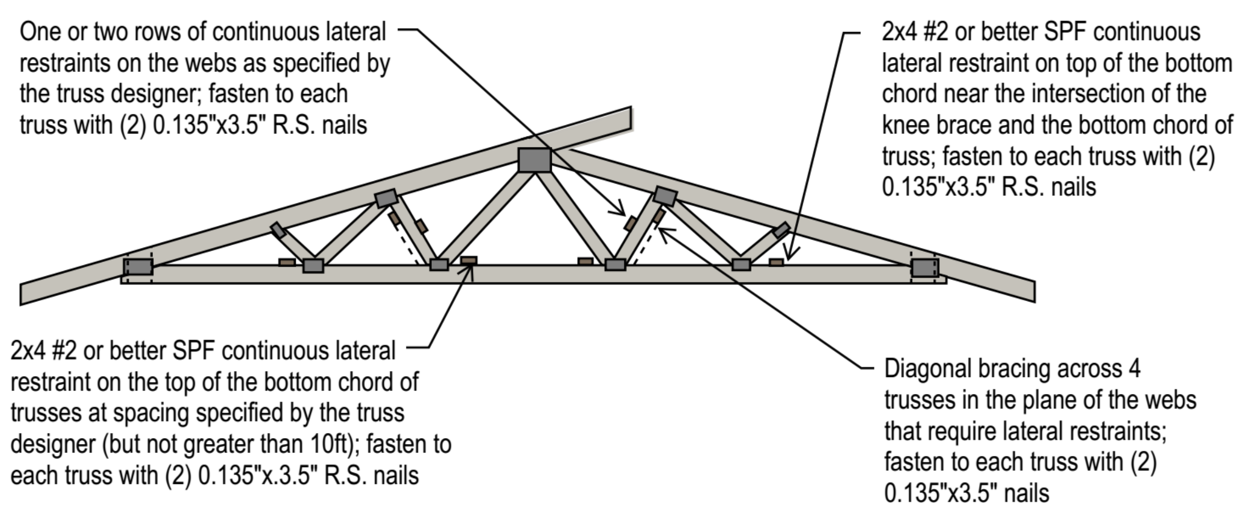


Figure 5.16*: Truss profile with permanent truss bracing*

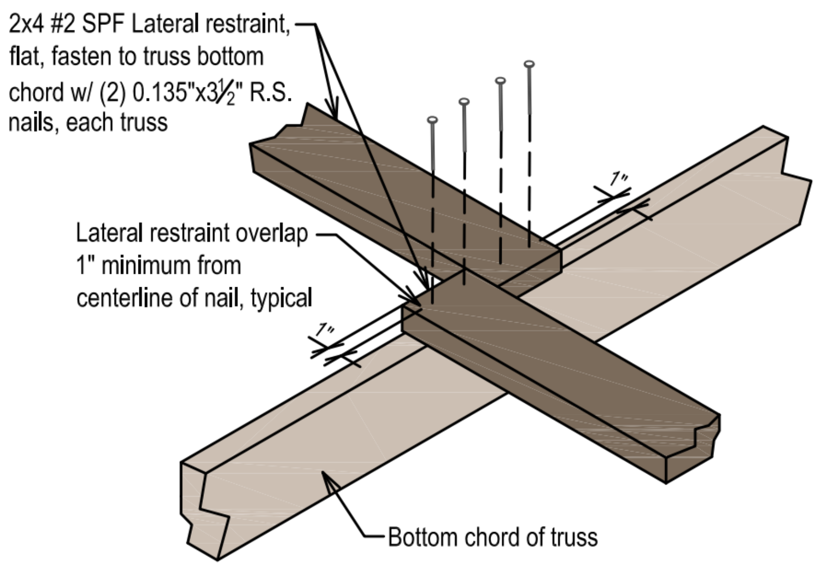


Figure 5.17***: Splice detail of lateral restraints at bottom chord (and lateral web restraints)***

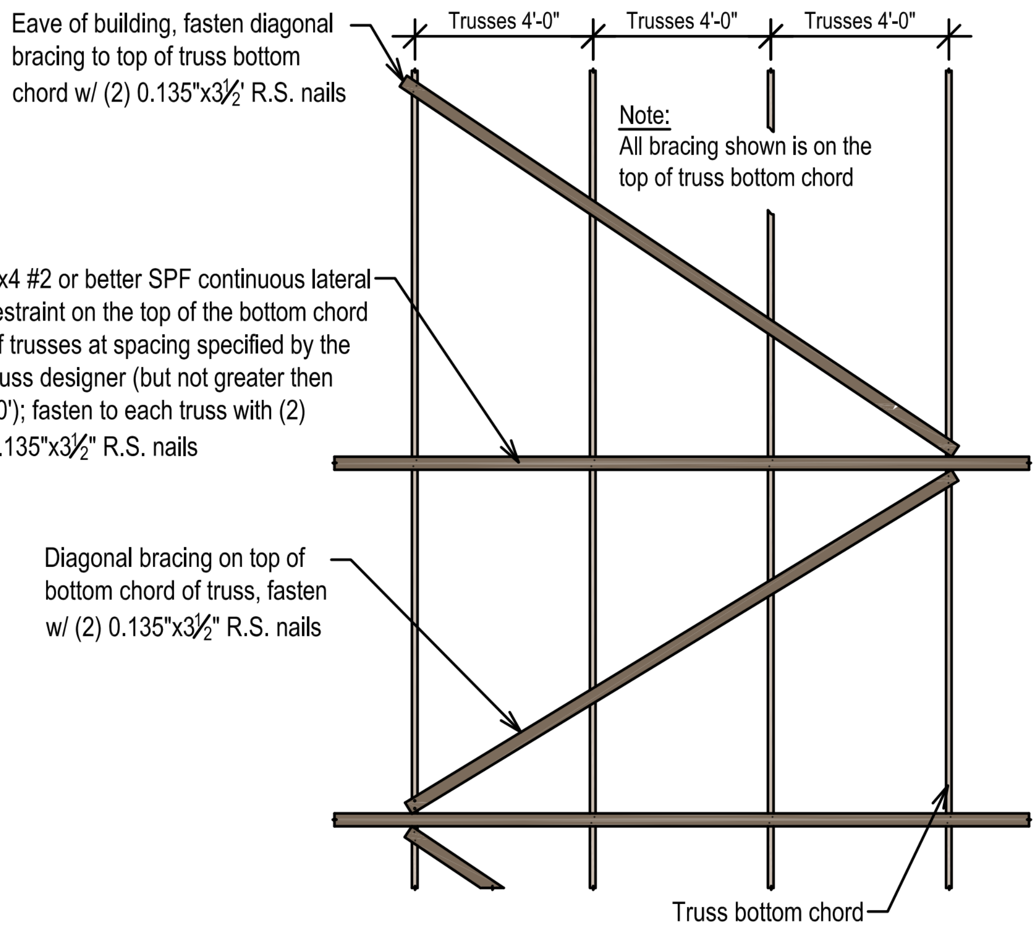


Figure 5.18***: Top view of lateral restraints and diagonal bracing on the top of the bottom chord of truss***

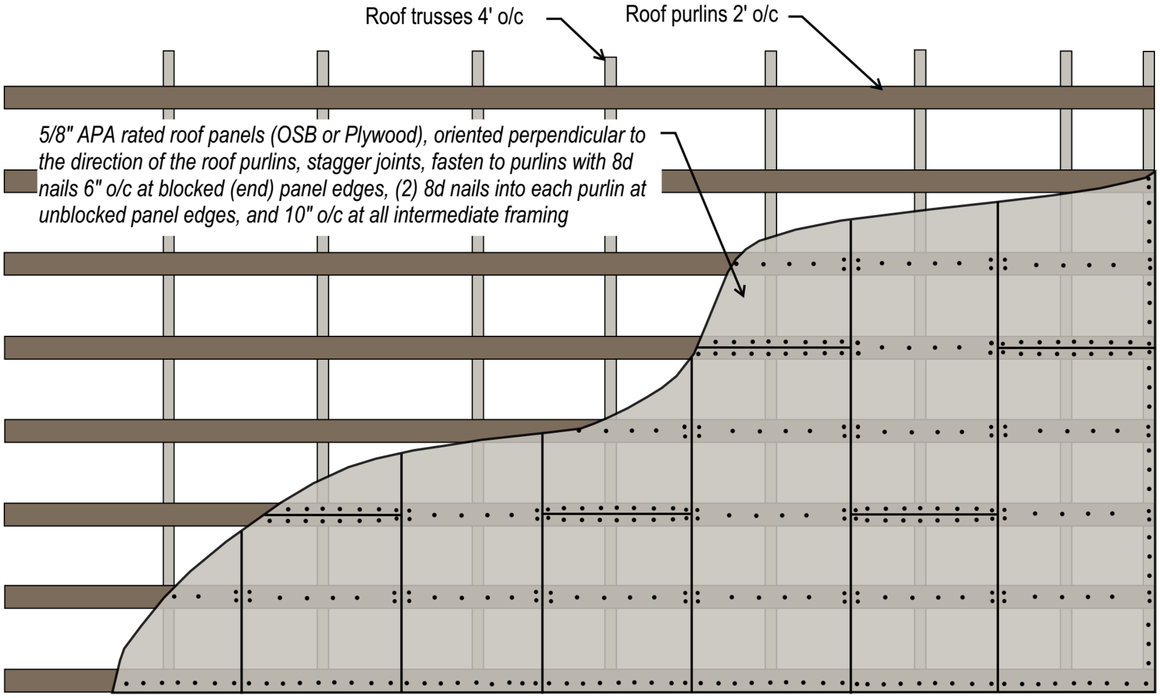


Figure 5.19*: OSB or plywood panels on roof – panel layout and fastening schedule*

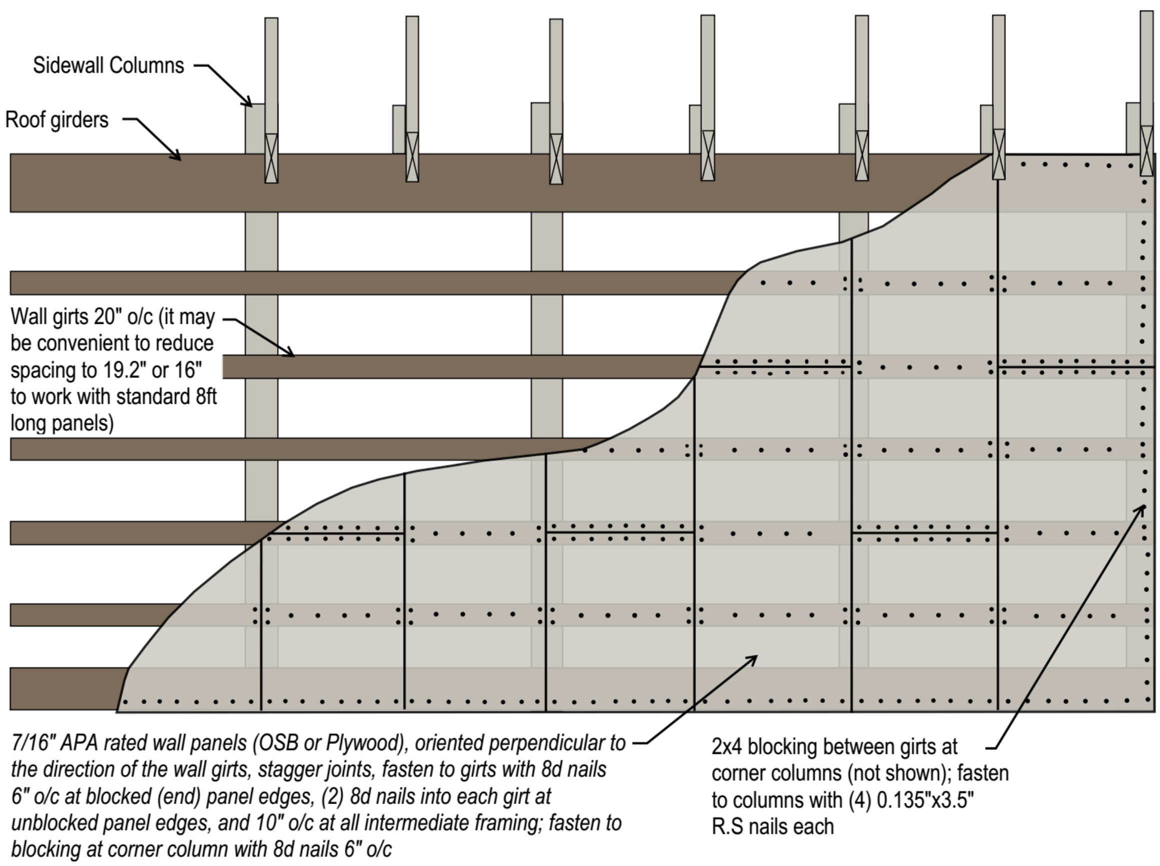


Figure 5.20*: OSB/Pywood panels on walls – panel layout and fastening schedule*

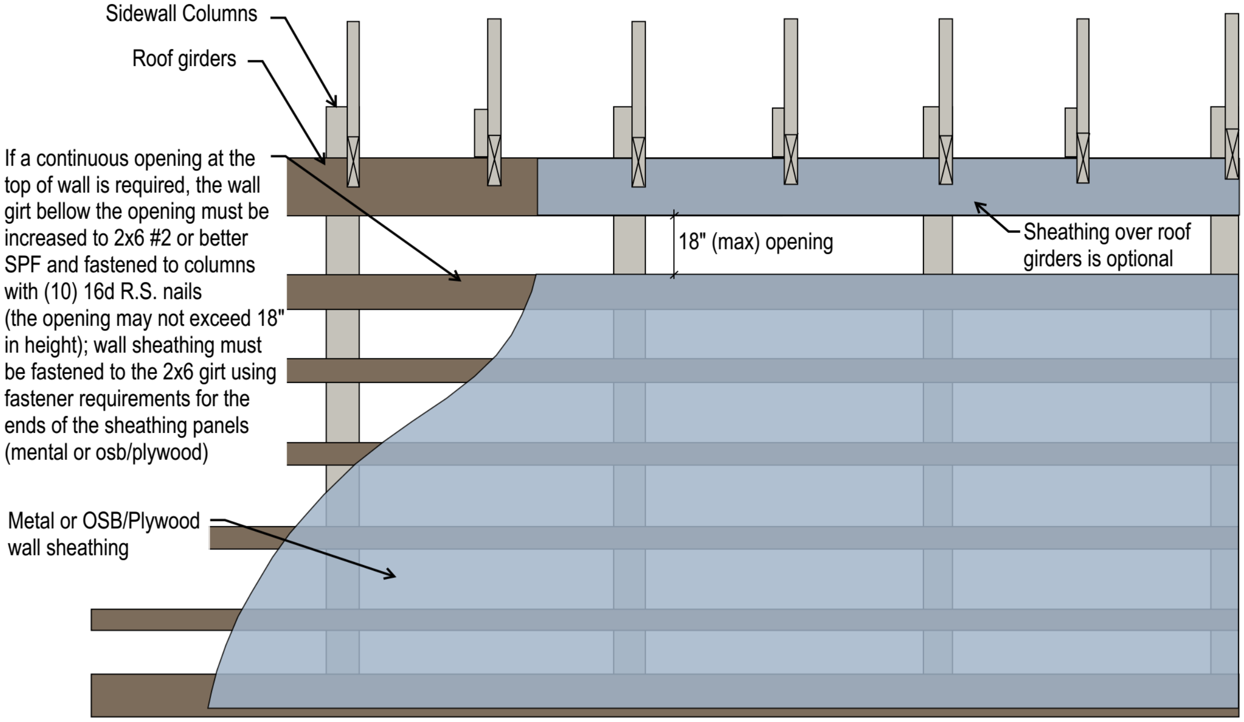


Figure 5.21*: Walls with continuous opening at the top*

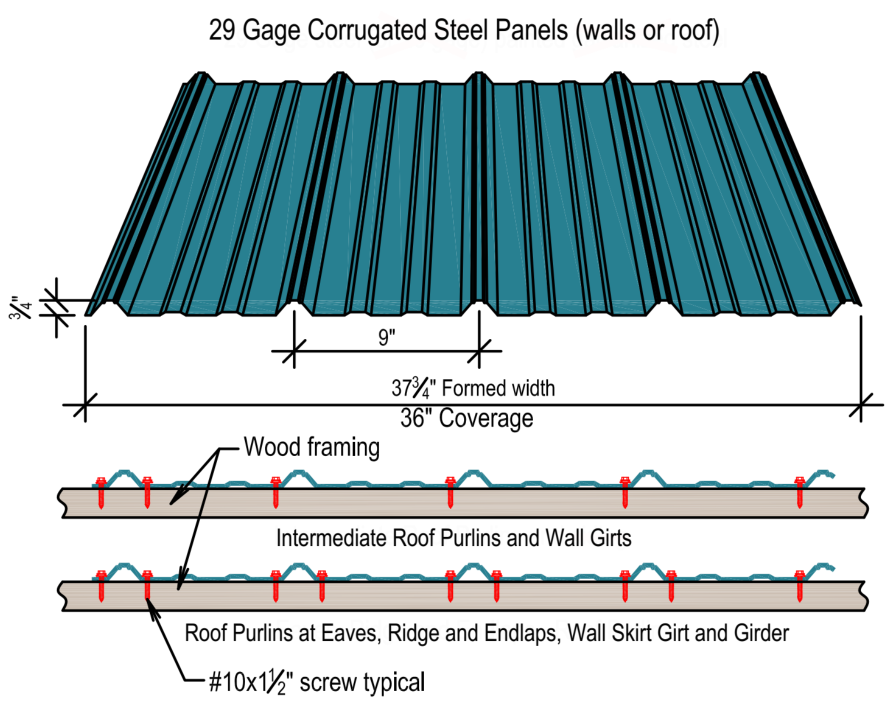


Figure 5.22*: 29 Gauge metal roof and wall panel fastening schedule*

6. STRUCTURAL DESIGN

The design of the primary frame, the sidewall frames, and the endwall columns was completed using Visual Analysis version 20 structural design software by Integrated Engineering Software (IES). The design procedures follow the recommendations of the NDPFBDG. All calculations are completed using the Allowable Stress (Strength) Design (ASD) methodology. The primary frame consists of two glulam columns with structural properties specified in the Materials section, one roof truss and two knee braces. To account for the loss of stiffness associated with fastener slippage between the truss-to-column connection, knee brace-to-truss connection, and knee brace-to-column connection, effectively reducing the rotational frigidity of knee brace connection (Figure 6.1), the analog for the knee brace was reduced to a profile with 1.1 in^2 cross-sectional area. The selection of the knee brace profile area assumes that the adjoining members will have 1/64" to 1/8" slippage at each of the connections when loaded. The fastener slippage analog in Figure 6.1 is represented by springs S1 through S3 arranged "in series". The springs were added together using the inverse summation rule to calculate an approximate equivalent spring constant: $1/k_{eq} = 1/k_1 + 1/k_2 + 1/k_3$. The axial stiffness of the knee brace is a function of the profile area, member length and the modulus of elasticity of the material: $P/\Delta = AE/L$. The length is constant and cannot be changed. The axial stiffness can be controlled by overriding the profile area or the modulus of elasticity. Overriding the modulus of elasticity is less convenient as the process requires creating custom material properties in the database of the structural program. Specifying custom profile dimensions in Visual Analysis is more direct and is the method used in this design. The axial stiffness of knee braces with 1.1 in^2 profile area is within the range of calculated equivalent spring constants. The design check of the knee braces (pass/fail) was completed separately in WoodWorks Sizer structural component design software using the resulting interior axial forces from the Visual Analysis report. The knee braces are fastened to one side of each sidewall column creating a torsional effect on the column. This phenomenon was addressed by reducing the acceptable "passing" unity for the columns (actual load divided by the corresponding allowable strength) to well below 1.0.

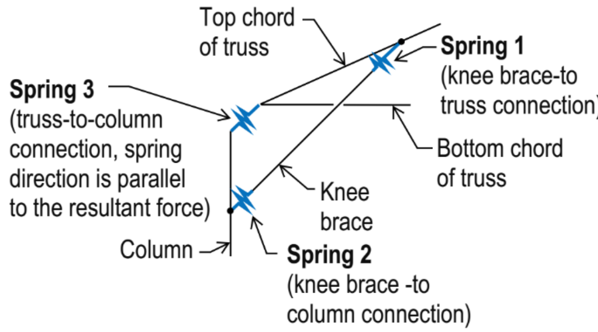


Figure 6.1: *Knee brace Fastener Slippage*

Loading on the primary frame consists of dead, snow, and wind loads applied as uniform loads to the truss and concentrated point loads applied to the columns (Figure 6.2). The concentrated point loads represent loads from the intermediate trusses located between the primary frames. Primary frame columns also resist uniform wind loads in buildings with sheathed sidewalls. Loads were calculated in accordance with ASCE/SEI 7-16 and applied as recommended in the NDPFBDG. Regardless of the endwall enclosure condition, buildings with open sidewalls were analyzed using "open building" provisions of ASCE/SEI 7-16 for wind direction perpendicular to the ridge line. For wind analysis in the direction parallel to the ridge line, buildings with open sidewalls were analyzed using "partially open" provisions of ASCE/SEI 7-16. Regardless of the endwall condition, buildings with sheathed sidewalls were analyzed using the "partially enclosed" provisions of ASCE/SEI 7-16. Both design categories, the open sidewall category and sheathed sidewall category, assume fully sheathed endwalls for the analysis and design of the sidewall frames. This approach is conservative for buildings with open endwalls where only the endwall truss area is sheathed. The minimum wind load requirements of ASCE/SEI 7-16 on a vertical projection have also been considered (16 psf walls, 8 psf roof).

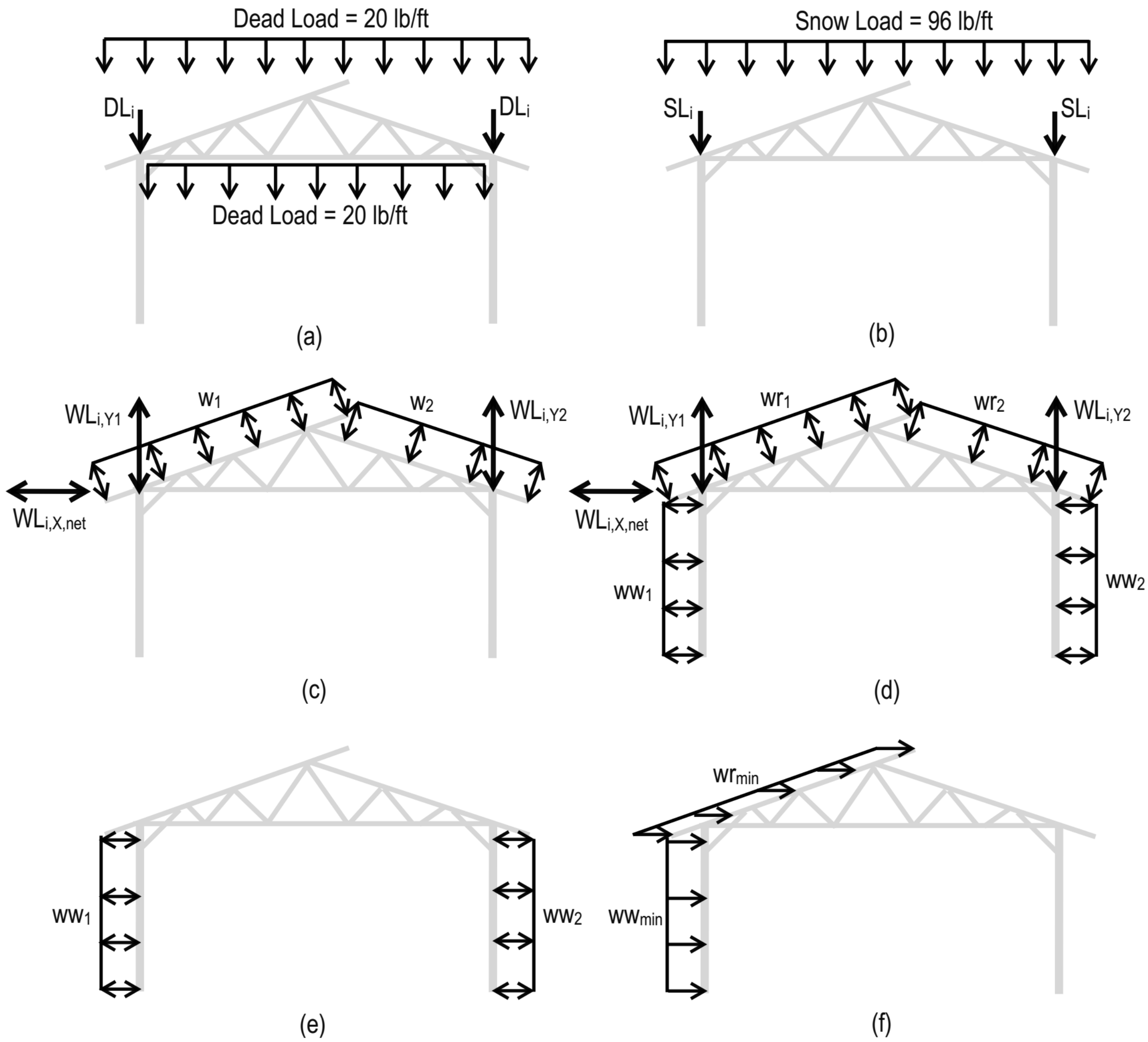


Figure 6.2*: Load diagram on the primary frame; (a) is a dead load diagram, (b) is a snow load diagram, (c) is a wind load diagram for buildings with open sidewalls, (d) is a wind load diagram for buildings with enclosed sidewalls, (e) is a wind load diagram similar to (d) except wind roof loads are ignored per ASCE 7, (f) is the minimum wall and roof wind load on vertical projection per ASCE 7; DL_i and SL_i represent dead and snow loads from the intermediate truss; $WL_{i,Y1}$ and $WL_{i,Y2}$ represent vertical wind loads from the intermediate truss; $WL_{i,X,net}$ is the net horizontal wind load from the intermediate truss; for buildings with columns spaced 4' o/c, DL_i, SL_i, $WL_{i,Y1}$, $WL_{i,Y2}$, and $WL_{i,X,net}$ equal zero*

The horizontal wind load on the sidewall frames was calculated using the approximated effective wind area method. For simply connected endwall columns, the effective wind area includes the truss triangle and 1/2 of the wood-framed endwall area below the truss (L_{eff} = 1/2 L_{column}, Figure 6.3). For fixed and embedded columns, the effective wind area includes the truss triangle area and 3/8 of the wood-framed wall area below the truss (L_{eff} = 3/8 L_{column}, Figure 6.3). The wind pressure applied to the effective wind area is the net wind pressure on windward and leeward walls even if the leeward wall (second endwall) is not enclosed. Structural models of sidewall frames with wye braces also receive out-of-plane horizontal point loads from the knee braces – as predicted by the primary frame models. Columns with wye braces, therefore, are subjected to biaxial loading. Sidewall frame models with X braces ignore the out-of-plane knee brace forces since X braces do not produce bending about the weak axis in columns (no biaxial bending is expected) and knee brace effects are addressed in the primary frame models.

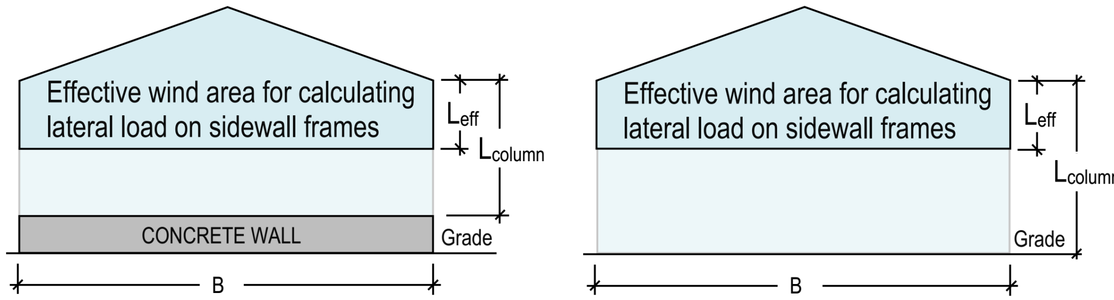


Figure 6.3: *Effective endwall wind area for columns on concrete wall and embedded columns*

In sidewall frames, the fasteners between wye braces and columns do not offer significant resistance to tension loads. The wye braces are therefore analyzed and designed as "compression-only" members. The primary purpose of wye braces is to resist lateral (longitudinal) loads on the building. However, the geometry and fastening methods are such that wye braces also receive a percentage of the vertical loads from the girders (loads from the intermediate trusses). This is not intended and not desired but is difficult to prevent. The design of wye braces and related connections reflect this load condition. The design of roof girders, completed separately in WoodWorks Sizer design software, ignores the contribution from the wye braces.

The combination of knee and wye braces create a biaxial bending load condition on sidewall columns and create "sway frames" in both directions. Such arrangement requires the use of larger buckling length coefficients, K_e, for columns, making it impossible to utilize wye braces on some taller structures. In such cases, wye braces were replaced with X braces. The X braces span from bottom to top of columns such that columns are no longer loaded in bending about the weak axis and the sidewall frames are no longer "sway frames". The X braces, where specified in the design tables, may not be replaced with wye braces. On the other hand, the building designer may choose to replace wye braces with the stiffer X braces and use connection specifications from the taller buildings that specify X braces in the design tables.

Walls sheathed with 29 gauge corrugated metal siding or 7/16 APA rated sheathing (OSB or plywood) in accordance with the specifications in this guide do not require the use of wye or X braces. The shear stiffness and strength is provided by the metal siding or the APA rated sheathing. The allowable shear strength of the sheathed wall assembly must be 110 lb/ft or greater. Sketches in Section 5 show the acceptable assemblies and the fastener schedules. If the desired sheathing is different than what is specified in this document, building designer may elect to use X brace specifications from the same-size building in the "open sidewall" design category.

The lateral force resisting system in the direction parallel to the ridge line relies on diaphragm action. The roof diaphragm collects and transfers lateral loads from the endwalls into the sidewall frames. Sketches in Section 5 show the acceptable roof panel assemblies and fastener schedules. The minimum building length limitation specified in the sketches is related to the diaphragm design. Using buildings with smaller lengths may compromise the diaphragm's ability to resist lateral (longitudinal) loads.

Three foundation options were considered: (1) embedded columns, (2) columns simply (pin) connected and (3) rigidly connected to the 4-foot tall continuous concrete wall foundation. The embedded column option was analyzed using lateral soil springs in accordance with the Universal Method of the ASAE EP486.3. Each spring stiffness was assigned a unique spring constant consistent with the non-cohesive soils described in the Materials section. Other soil types may be acceptable but were not considered in this document. The design check of soils and concrete backfill was completed using the "envelope" procedure of the EP486.3.

The continuous concrete foundation walls were analyzed and designed in the Quick Wall structural design program by Digital Canal. Concrete walls transfer concentrated point loads from the columns into the soil. Flexural rigidity of the wall about the strong axis (vertical loads) is significantly greater than the assumed vertical stiffness of the soils. This allows concentrated vertical forces from the columns to spread out evenly along the length of the wall (Figure 6.4). Vertical loads were applied to the top of the wall as uniform loads equal to column reaction forces divided by the column spacing. Flexural rigidity of the wall about the weak axis (out of plane loads) is less effective at spreading the concentrated horizontal loads (and moments) along the wall length between the columns. The out-of-plane concentrated forces and moments are distributed along the wall length equal to the column width plus four times the thickness of the concrete wall (Figure 6.4) per ACI 318-14, Section 11.2.3.1. The horizontal (and moment) forces were applied to the top of the concrete wall as uniform loads (and moments) equal to column horizontal reactions divided by $b+4t_w$. Concrete wall A is designed for pinned columns and can be used with all building sizes in this document; concrete wall B is designed for fixed columns for all building sizes in this document. Concrete wall A may not be used with fixed columns while concrete wall B may be used with pinned columns if desired.

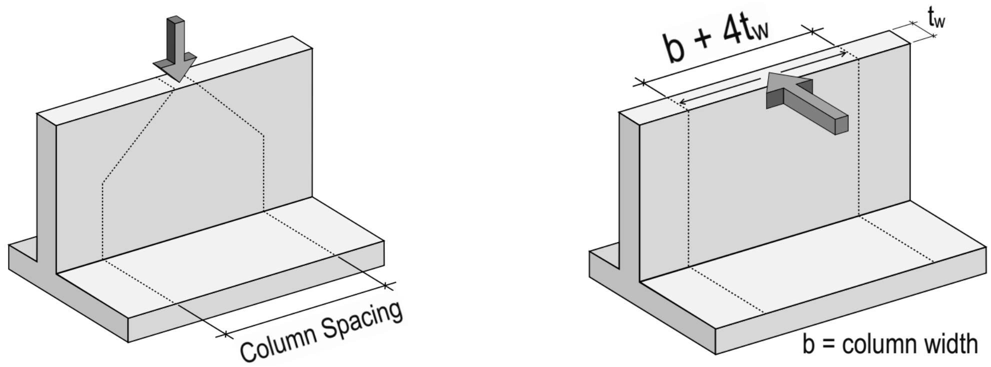


Figure 6.4*: Distribution of concentrated vertical and horizontal (out of plane) loads in continuous concrete foundation walls*

Primary and intermediate roof trusses should be designed by the truss designer to support uniform dead, snow, live and wind loads specified in the Design Criteria section of this document. Additionally, roof trusses should be designed to support concentrated point loads from the windward and leeward knee braces. These two stipulations ensure that roof trusses can function with and without the knee braces. Knee brace loads should be applied to the top chord of truss as horizontal and vertical concentrated point loads under a separate wind category (not in combination with the uniform wind loads on the top chord) and analyzed using ASD load combinations in conjunction with uniform dead and snow loads. Truss designer does not need to consider dead and snow loads from the knee braces. Such forces react to the gravity loads (effectively shorten the effective span of the truss) and do not produce the least favorable load condition. The tabulated positive "Y" values represent an upward vertical load on the truss; the negative "Y" values represent a downward vertical load on the truss. The positive "X" values represent a horizontal left-to-right load on the truss; the negative "X" values represent a horizontal right-to-left load on the truss.

Figure 6.5 shows an example of how to interpret tabulated knee brace forces. This example is based on the first design in Table 7.1 (40ft wide building, 12ft eave height, open sidewalls, pinned column base).

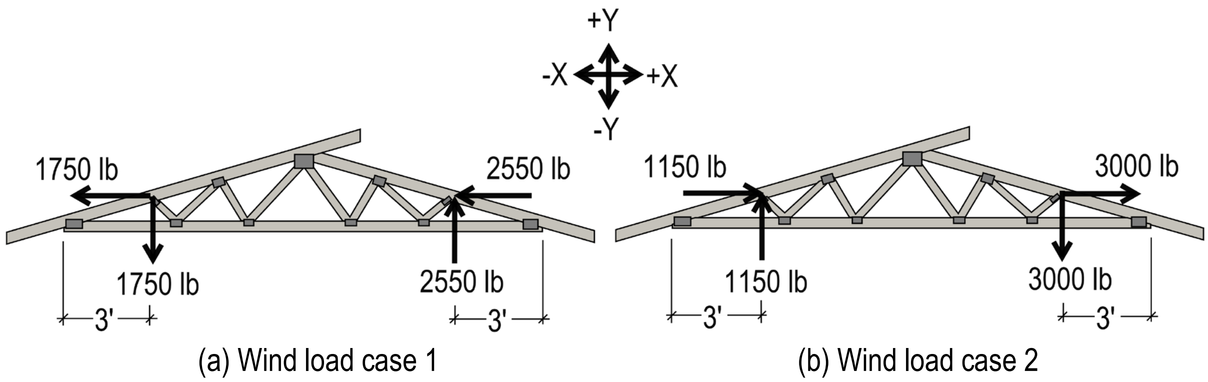


Figure 6.5*: Example of how to apply knee brace forces to the truss; values taken from the first design in the 40ft category*

The top chord of roof trusses must have a specific gravity of 0.55 or greater. This is a stipulation for the size and quantity of fasteners specified in the design tables (knee brace to truss connection, truss to column connection, truss to tie-down block connection). Building designer should provide the truss designer with the following information:

1. Wind Design Criteria: wind speed, exposure category, risk category, building mid-height, and envelope enclosure classification per ASCE 7 definitions
2. Dead and snow loads (psf)
3. Truss Spacing
4. Truss geometry (span, roof pitch, location of the knee brace intersection with the top chord)
5. Statement that a panel point is required at the intersection between the knee brace and the top chord (it may be helpful for the building designer to show this location graphically)
6. Statement that top chord of truss must have a specific gravity of 0.55 (Southern Pine or similar)
7. The “X” and “Y” knee brace forces from the design tables and the explanation of the coordinate system (a sketch similar to Figure 6.5 is recommended)
8. Statement that truss should be designed to resist uniform dead, snow and wind loads (consider all governing wind load cases per ASCE 7). Additionally, truss must be designed to support uniform dead loads, uniform snow loads, and concentrated wind loads from the knee braces. Two separate designs may be required to satisfy these criteria.
9. Instructions on how to apply knee brace forces (apply uniform dead loads to the top and bottom chords, apply uniform snow loads to the top chord, apply vertical and horizontal knee brace forces to the top chord as wind forces, do not apply uniform wind loads to the top chord in conjunction with the knee brace forces)
10. Statement that unbalanced snow load must be considered (unbalanced snow loads are specified in the Design Criteria section of this document)

7. DESIGN TABLES

The design tables are limited to building geometries, materials, and design criteria specified in this document. The user is responsible for understanding the intent and limitations of these tables as outlined in the preceding sections of this document. The user is responsible for the final design. Buildings are separated into two major groups: buildings with sheathed sidewalls and buildings with open sidewalls. This terminology should not be confused with ASCE 7 enclosure classifications (open, enclosed, partially open, partially enclosed). If sidewalls are sheathed, regardless of the envelope classification, the building belongs to the sheathed sidewalls design group in this document. If sidewalls are not sheathed, regardless of the envelope classification, the building belongs to the open sidewall design group in this document. The designs in sheathed sidewalls group are suitable for enclosed, partially enclosed, and partially open envelope classifications as defined in ASCE 7. The designs in the open sidewalls group are suitable for buildings with open and partially open envelope classifications.

This document does not include a design for buildings with one sidewall sheathed and opposite sidewall left open - a hybrid between the sheathed sidewalls and open sidewalls design groups. In such configuration, it is not recommended that open sidewall is designed using open sidewall design specifications and sheathed sidewall designed using sheathed sidewall design specifications. Instead, building designer may use the most restrictive specifications from the open sidewalls and sheathed sidewalls design groups to specify all columns, knee braces, connections, foundation, etc. Another hybrid scenario includes buildings where sidewall sheathing is not continuous along the entire length of the building. In this example, building designer may use sheathed sidewalls design group for the portion of the building that has both sidewalls sheathed and use open sidewalls design group for the portion of the building with both sidewalls open. The endwall design in hybrid buildings should follow the most restrictive design specification.

The design tables and specifications in other sections provide one connection option at each location. Building designer may specify alternative fasteners if deemed acceptable by structural analysis in accordance with the NDS. Building designer is responsible for the design and specification of all alternative fasteners. All tabulated reactions and member forces have already been adjusted by ASD load combinations and may not be reduced further. Only the “knee brace load on top chord of truss” values have not been reduced by the ASD load combinations (0.6W multiplier not applied) and represent wind loads as calculated by ASCE 7 before ASD load combinations. Knee brace loads on the top chord of truss are separated into the horizontal and vertical force vectors (X and Y). The positive Y values represent an upward vertical load on the truss; the negative Y values represent a downward vertical load on the truss. The positive X values represent a horizontal left-to-right load on the truss; the negative X values represent a horizontal right-to-left load on the truss. Additional instructions are provided in Section 6.

TABLE 7.1: DESIGN SPECIFICATIONS FOR 40 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	SIDEWALL COLUMN												
			Size	Spacing	Buckling Length Coefficients		Foundation	Connection at Bottom of Column					Connection to Truss		
					K_z	K_y		Horizontal (lb)	Uplift (lb)	Moment (lb-ft)	Downward (lb)	Connector	Uplift (lb)	Shear (lb)	Connector
12	Open	Pinned	4-ply 2x8	8 ft	2.4	2.4	Concrete Wall A	850	2350	0	6200	Pin Bracket	1850	1400	(6) 1/4"x4" structural screws
12	Open	Fixed	4-ply 2x8	8 ft	1.2	2.4	Concrete Wall B	1000	2350	2000	6200	Moment Resisting Bracket	1450	1050	(5) 1/4"x4" structural screws
12	Open	Embedded	4-ply 2x8	8 ft	1.2	1.2	Embedded 5'-0", 24"Øx8" footer, 24"Øx24" collar	700	2350	3000	6200	(1) #5 rebar through post	1750	1150	(6) 1/4"x4" structural screws
12	Sheathed	Pinned	3-ply 2x6	8 ft	2.4	1.0	Concrete Wall A	700	2550	0	6200	Pin Bracket	1300	950	(5) 1/4"x4" structural screws
12	Sheathed	Fixed	3-ply 2x6	8 ft	1.2	1.0	Concrete Wall B	850	2550	1250	6200	Moment Resisting Bracket	1300	800	(4) 1/4"x4" structural screws
12	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 5'-0", 24"Øx8" footer, 24"Øx28" collar	950	2550	2450	6200	(1) #5 rebar through post	1300	850	(4) 1/4"x4" structural screws
16	Open	Pinned	4-ply 2x8	4 ft	2.4	1.0	Concrete Wall A	450	1100	0	3100	Pin Bracket	1700	1250	(6) 1/4"x4" structural screws
16	Open	Fixed	3-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	700	2350	2800	6200	Moment Resisting Bracket	1900	1200	(6) 1/4"x4" structural screws
16	Open	Embedded	4-ply 2x8	8 ft	1.2	1.2	Embedded 5'-0", 24"Øx8" footer, 24"Øx28" collar	600	2350	3950	6200	(1) #5 rebar through post	2100	1200	(7) 1/4"x4" structural screws
16	Sheathed	Pinned	4-ply 2x8	8 ft	2.4	1.0	Concrete Wall A	950	2550	0	6200	Pin Bracket	1300	1630	(6) 1/4"x4" structural screws
16	Sheathed	Fixed	3-ply 2x6	8 ft	1.2	1.0	Concrete Wall B	950	2550	2390	6200	Moment Resisting Bracket	1300	950	(5) 1/4"x4" structural screws
16	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 5'-0", 30"Øx8" footer, 30"Øx34" collar	1300	2550	4700	6200	(1) #5 rebar through post	1300	1200	(5) 1/4"x4" structural screws
20	Open	Pinned	No Design												
20	Open	Fixed	4-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	600	2350	3650	6200	Moment Resisting Bracket	2200	1450	(7) 1/4"x4" structural screws
20	Open	Embedded	4-ply 2x8	8 ft	1.2	0.8	Embedded 4'-6", 30"Øx8" footer, 30"Øx30" collar	600	2350	4850	6200	(1) #5 rebar through post	2400	1600	(8) 1/4"x4" structural screws
20	Sheathed	Pinned	No Design												
20	Sheathed	Fixed	3-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	1300	2550	4650	6200	Moment Resisting Bracket	1300	1300	(5) 1/4"x4" structural screws
20	Sheathed	Embedded	3-ply 2x8	4 ft	1.2	1.0	Embedded 5'-0", 24"Øx8" footer, 24"Øx30" collar	800	1350	3850	3100	(1) #5 rebar through post	1300	1150	(5) 1/4"x4" structural screws

TABLE 7.1 (Cont.): DESIGN SPECIFICATIONS FOR 40 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	ENDWALL COLUMNS: Size	Spacing	Foundation	Buckling Length Coefficients K_z	K_y	Connection at Bottom: Horizontal (lb)	Uplift (lb)	Moment (lb-ft)	Downward (lb)	Connector
12	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	350	550	0	1800	Pin Bracket
12	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	1.2	1.0	400	550	650	1800	Moment Resisting Bracket
12	Open	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 18"Øx8" footer, 18"Øx24" collar	1.2	1.0	500	550	950	1800	(1) #5 rebar through post
12	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	550	650	0	1800	Pin Bracket
12	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	650	1050	1800	Moment Resisting Bracket
12	Sheathed	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	850	650	1550	1800	(1) #5 rebar through post
16	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	450	550	0	1800	Pin Bracket
16	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	500	550	950	1800	Moment Resisting Bracket
16	Open	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx24" collar	1.2	1.0	650	550	1600	1800	(1) #5 rebar through post
16	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	700	650	0	1800	Pin Bracket
16	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	850	650	1550	1800	Moment Resisting Bracket
16	Sheathed	Embedded	3-ply 2x6	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx32" collar	0.8	1.0	1050	650	2600	1800	(1) #5 rebar through post
20	Open	Pinned	No Design									
20	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	550	1550	1800	Moment Resisting Bracket
20	Open	Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	800	550	2650	1800	(1) #5 rebar through post
20	Sheathed	Pinned	No Design									
20	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	1050	650	2550	1800	Moment Resisting Bracket
20	Sheathed	Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 30"Øx8" footer, 30"Øx38" collar	0.8	1.0	1350	650	4300	1800	(1) #5 rebar through post

TABLE 7.1 (Cont.): DESIGN SPECIFICATIONS FOR 40 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	KNEE BRACE DESIGN: Member	Connection to Post	Connection to Top Chord of Truss	Max. Axial Force (lb)	KNEE BRACE LOAD ON TOP CHORD OF TRUSS: Wind Case 1, Left Brace X (lb)	Wind Case 1, Left Brace Y (lb)	Wind Case 1, Right Brace X (lb)	Wind Case 1, Right Brace Y (lb)	Wind Case 2, Left Brace X (lb)	Wind Case 2, Left Brace Y (lb)	Wind Case 2, Right Brace X (lb)	Wind Case 2, Right Brace Y (lb)
12	Open	Pinned	2x10 #2 SYP	(12) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3150	-1750	-1750	-2550	2550	1150	1150	3000	-3000
		Fixed	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2750	-1050	-1050	-1850	1850	400	400	2350	-2350
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2600	-1500	-1500	-2150	2150	1000	1000	2500	-2500
	Sheathed	Pinned	2x6 #2 SYP	(8) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	2000	-800	-800	1550	-1550	-1250	-1250	-1600	1600
		Fixed	2x6 #2 SYP	(7) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	1850	-900	-900	1450	-1450	-850	-850	-1100	1100
		Embedded	2x6 #2 SYP	(7) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	1850	-1150	-1150	1850	-1850	-1050	-1050	-1750	1750
16	Open	Pinned	2x8 #2 SYP	(9) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2350	-1300	-1300	-1950	1950	850	850	2200	-2200
		Fixed	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2600	-1750	-1750	-2300	2300	1250	1250	2600	-2600
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2700	-2100	-2100	-2650	2650	1650	1650	2900	-2900
	Sheathed	Pinned	2x8 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	2950	-920	-920	2050	-2050	-2400	-2400	-2900	2900
		Fixed	2x6 #2 SYP	(7) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	1950	-1100	-1100	1900	-1900	-1250	-1250	-1950	1950
		Embedded	2x8 #2 SYP	(9) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2450	-1550	-1550	2400	-2400	-1550	-1550	-2500	2500
20	Open	Pinned	No Design											
		Fixed	2x8 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	2850	-2400	-2400	-2900	2900	1900	1900	3150	-3150
		Embedded	2x8 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3000	-2700	-2700	-3150	3150	2250	2250	3350	-3350
	Sheathed	Pinned	No Design											
		Fixed	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2600	-1500	-1500	2400	-2400	-1700	-1700	-2650	2650
		Embedded	2x6 #2 SYP	(7) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	1850	-1050	-1050	2100	-2100	-1000	-1000	-1750	1750

TABLE 7.1 (Cont.): DESIGN SPECIFICATIONS FOR 40 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	HEADERS Member	HEADERS Connection to Post	HEADERS Connection to Truss	SIDEWALL BRACING Member Type	SIDEWALL BRACING Member Property	SIDEWALL BRACING Connection to Post	SIDEWALL BRACING Connection to Top Header	Axial Force (lb)
12	Open	Pinned	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(3) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1100
12	Open	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(3) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	950
12	Open	Embedded	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(3) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1100
12	Sheathed	Pinned	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
12	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
12	Sheathed	Embedded	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Open	Pinned	No structural header; trusses supported by columns			X	4x6 #2 SYP	(3) 1/4" structural screws	N/A	1000
16	Open	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(3) 1/4" structural screws	N/A	800
16	Open	Embedded	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(5) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1600
16	Sheathed	Pinned	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Sheathed	Embedded	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
20	Open	Pinned	No Design							
20	Open	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(3) 1/4" structural screws	N/A	950
20	Open	Embedded	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(4) 1/4" structural screws	N/A	1050
20	Sheathed	Pinned	No Design							
20	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(10) 0.177"x4" R.S. nails	(8) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
20	Sheathed	Embedded	No structural header; trusses supported by columns			29 Gauge Metal Siding over 2x wall girts				

TABLE 7.2: DESIGN SPECIFICATIONS FOR 50 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	SIDEWALL COLUMN Size	Spacing	Buckling Length Coefficients K_z	K_y	Foundation	Connection at Bottom of Column: Horizontal (lb)	Uplift (lb)	Moment (lb-ft)	Downward (lb)	Connector	Connection to Truss: Uplift (lb)	Shear (lb)	Connector
12	Open	Pinned	4-ply 2x8	8 ft	2.4	2.4	Concrete Wall A	1000	2950	0	7500	Pin Bracket	2250	1600	(7) 1/4"x4" structural screws
12	Open	Fixed	4-ply 2x8	8 ft	1.2	2.4	Concrete Wall B	1150	2950	2350	7500	Moment Resisting Bracket	1800	1150	(6) 1/4"x4" structural screws
12	Open	Embedded	4-ply 2x8	8 ft	1.2	1.2	Embedded 4'-6", 30"Øx8" footer, 30"Øx28" collar	800	2950	3500	7500	(2) #5 rebar through post	2150	1300	(7) 1/4"x4" structural screws
12	Sheathed	Pinned	3-ply 2x8	8 ft	2.4	1.0	Concrete Wall A	900	3100	0	7500	Pin Bracket	1600	1250	(6) 1/4"x4" structural screws
12	Sheathed	Fixed	3-ply 2x6	8 ft	1.2	1.0	Concrete Wall B	900	3100	1400	7500	Moment Resisting Bracket	1550	850	(5) 1/4"x4" structural screws
12	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 4'-6", 30"Øx8" footer, 30"Øx28" collar	950	3100	2500	7500	(2) #5 rebar through post	1400	950	(5) 1/4"x4" structural screws
16	Open	Pinned	4-ply 2x8	4 ft	2.4	1.0	Concrete Wall A	500	1500	0	3800	Pin Bracket	2050	1350	(7) 1/4"x4" structural screws
16	Open	Fixed	4-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	800	2950	3250	7500	Moment Resisting Bracket	2300	1450	(7) 1/4"x4" structural screws
16	Open	Embedded	4-ply 2x8	8 ft	1.2	1.2	Embedded 4'-6", 30"Øx8" footer, 30"Øx28" collar	700	2950	4650	7500	(2) #5 rebar through post	2550	1500	(8) 1/4"x4" structural screws
16	Sheathed	Pinned	4-ply 2x8	8 ft	2.4	1.0	Concrete Wall A	950	3100	0	7500	Pin Bracket	1600	1750	(6) 1/4"x4" structural screws
16	Sheathed	Fixed	3-ply 2x6	8 ft	1.2	1.0	Concrete Wall B	950	3100	2450	7500	Moment Resisting Bracket	1550	1000	(5) 1/4"x4" structural screws
16	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 5'-0", 30"Øx8" footer, 30"Øx34" collar	1300	3100	4650	7500	(2) #5 rebar through post	1550	1350	(6) 1/4"x4" structural screws
20	Open	Pinned	No Design												
20	Open	Fixed	4-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	700	2950	4300	7500	Moment Resisting Bracket	2700	1650	(8) 1/4"x4" structural screws
20	Open	Embedded	4-ply 2x8	4 ft	1.2	0.8	Embedded 4'-6", 24"Øx8" footer, 24"Øx24" collar	400	1500	3150	3800	(1) #5 rebar through post	2050	1150	(6) 1/4"x4" structural screws
20	Sheathed	Pinned	No Design												
20	Sheathed	Fixed	3-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	1300	3100	4650	7500	Moment Resisting Bracket	1550	1400	(6) 1/4"x4" structural screws
20	Sheathed	Embedded	3-ply 2x8	4 ft	1.2	1.0	Embedded 4'-6", 24"Øx8" footer, 24"Øx34" collar	800	1500	3850	3800	(1) #5 rebar through post	1600	1300	(6) 1/4"x4" structural screws

TABLE 7.2 (Cont.): DESIGN SPECIFICATIONS FOR 50 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	ENDWALL COLUMNS Size	Spacing	Foundation	Buckling Length Coefficients K_z	K_y	Connection at Bottom Horizontal (lb)	Uplift (lb)	Moment (lb-ft)	Downward (lb)	Connector
12	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	350	550	0	1800	Pin Bracket
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	1.2	1.0	400	550	650	1800	Moment Resisting Bracket
		Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 18"Øx8" footer, 18"Øx24" collar	1.2	1.0	500	550	950	1800	(1) #5 rebar through post
	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	550	650	0	1800	Pin Bracket
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	650	1050	1800	Moment Resisting Bracket
		Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	850	650	1550	1800	(1) #5 rebar through post
16	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	450	550	0	1800	Pin Bracket
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	500	550	950	1800	Moment Resisting Bracket
		Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx24" collar	1.2	1.0	650	550	1600	1800	(1) #5 rebar through post
	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	700	650	0	1800	Pin Bracket
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	850	650	1550	1800	Moment Resisting Bracket
		Embedded	3-ply 2x6	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx32" collar	0.8	1.0	1050	650	2600	1800	(1) #5 rebar through post
20	Open	Pinned	No Design									
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	550	1550	1800	Moment Resisting Bracket
		Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	800	550	2650	1800	(1) #5 rebar through post
	Sheathed	Pinned	No Design									
		Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	1050	650	2550	1800	Moment Resisting Bracket
		Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 30"Øx8" footer, 30"Øx38" collar	0.8	1.0	1350	650	4300	1800	(1) #5 rebar through post

TABLE 7.2 (Cont.): DESIGN SPECIFICATIONS FOR 50 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	Knee Brace Design: Member	Knee Brace Design: Connection to Post	Knee Brace Design: Connection to Top Chord of Truss	Knee Brace Design: Max. Axial Force (lb)	Wind Case 1 Left Brace X (lb)	Wind Case 1 Left Brace Y (lb)	Wind Case 1 Right Brace X (lb)	Wind Case 1 Right Brace Y (lb)	Wind Case 2 Left Brace X (lb)	Wind Case 2 Left Brace Y (lb)	Wind Case 2 Right Brace X (lb)	Wind Case 2 Right Brace Y (lb)
12	Open	Pinned	2x10 #2 SYP	(14) 1/4"x4" structural screws	(10) 1/4"x3" structural screws	3650	-2150	-2150	-3050	3050	1300	1300	3450	-3450
		Fixed	2x10 #2 SYP	(12) 1/4"x4" structural screws	(9) 1/4"x3" structural screws	3250	-1300	-1300	-2200	2200	500	500	2750	-2750
		Embedded	2x10 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3050	-1900	-1900	-2550	2550	1200	1200	2900	-2900
	Sheathed	Pinned	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2650	-1050	-1050	1800	-1800	-1450	-1450	-1650	1650
		Fixed	2x8 #2 SYP	(8) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2050	-1050	-1050	1600	-1600	-950	-950	-1250	1250
		Embedded	2x8 #2 SYP	(8) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2050	-1300	-1300	2000	-2000	-1200	-1200	-1900	1900
16	Open	Pinned	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2700	-1600	-1600	-2300	2300	1000	1000	2500	-2500
		Fixed	2x10 #2 SYP	(12) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3200	-2150	-2150	-2850	2850	1450	1450	3150	-3150
		Embedded	2x10 #2 SYP	(12) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3150	-2600	2600	-3150	3150	1950	1950	3350	-3350
	Sheathed	Pinned	2x10 #2 SYP	(12) 1/4"x4" structural screws	(9) 1/4"x3" structural screws	3250	-1100	-1100	2250	-2250	-2550	-2550	-3110	3110
		Fixed	2x8 #2 SYP	(8) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2150	-1200	-1200	2000	-2000	-1400	-1400	-2100	2100
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2700	-1700	-1700	2550	-2550	-1650	-1650	-2700	2700
20	Open	Pinned	No Design											
		Fixed	2x10 #2 SYP	(12) 1/4"x4" structural screws	(9) 1/4"x3" structural screws	3350	-2950	-2950	-3450	3450	2250	2250	3600	-3600
		Embedded	2x8 #2 SYP	(8) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2200	-1500	-1500	-2000	2000	1050	1050	2150	-2150
	Sheathed	Pinned	No Design											
		Fixed	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2800	-1650	-1650	2550	-2550	-1850	-1850	-2900	2900
		Embedded	2x6 #2 SYP	(8) 1/4"x4" structural screws	(5) 1/4"x3" structural screws	2000	-1150	-1150	2200	-2200	-1100	-1100	-1900	1900

TABLE 7.2 (Cont.): DESIGN SPECIFICATIONS FOR 50 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	HEADERS Member	HEADERS Connection to Post	HEADERS Connection to Truss	SIDEWALL BRACING Member Type	SIDEWALL BRACING Member Property	SIDEWALL BRACING Connection to Post	SIDEWALL BRACING Connection to Top Header	SIDEWALL BRACING Axial Force (lb)
12	Open	Pinned	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(4) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1500
12	Open	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(4) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1300
12	Open	Embedded	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(4) 1/4"x4" structural screws	(4) 1/4"x4" structural screws	1500
12	Sheathed	Pinned	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
12	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
12	Sheathed	Embedded	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Open	Pinned	No structural header; trusses supported by columns			X	4x6 #2 SYP	(4) 1/4" structural screws	N/A	1300
16	Open	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(4) 1/4" structural screws	N/A	1100
16	Open	Embedded	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(6) 1/4"x4" structural screws	(6) 1/4"x4" structural screws	2200
16	Sheathed	Pinned	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Sheathed	Embedded	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
20	Open	Pinned	No Design							
20	Open	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(4) 1/4" structural screws	N/A	1250
20	Open	Embedded	No structural header; trusses supported by columns			X	4x6 #2 SYP	(5) 1/4" structural screws	N/A	1450
20	Sheathed	Pinned	No Design							
20	Sheathed	Fixed	2-Ply 2x12 #1 SYP	(12) 0.177"x4" R.S. nails	(10) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
20	Sheathed	Embedded	No structural header; trusses supported by columns			29 Gauge Metal Siding over 2x wall girts				

TABLE 7.3: DESIGN SPECIFICATIONS FOR 60 FT WIDE BUILDING

Building Height	Side Wall Sheathing	Column Base Condition	SIDEWALL COLUMN												
			Size	Spacing	Buckling Length Coefficients		Foundation	Connection at Bottom of Column					Connection to Truss		
								Horizontal	Uplift	Moment	Downward	Connector	Uplift	Shear	Connector
(ft)					K_z	K_y		(lb)	(lb)	(lb-ft)	(lb)		(lb)	(lb)	
12	Open	Pinned	4-ply 2x8	8 ft	2.4	2.4	Concrete Wall A	1200	3400	0	9000	Pin Bracket	2550	2000	(9) 1/4"x4" structural screws
12	Open	Fixed	4-ply 2x8	8 ft	1.2	2.4	Concrete Wall B	1450	3400	2900	9000	Moment Resisting Bracket	2050	1500	(7) 1/4"x4" structural screws
12	Open	Embedded	4-ply 2x8	8 ft	1.2	1.2	Embedded 5'-0", 30"Øx8" footer, 30"Øx30" collar	1000	3400	4200	9000	(2) #5 rebar through post	2500	1650	(8) 1/4"x4" structural screws
12	Sheathed	Pinned	3-ply 2x8	8 ft	2.4	1.0	Concrete Wall A	1000	3600	0	9000	Pin Bracket	1850	1450	(6) 1/4"x4" structural screws
12	Sheathed	Fixed	3-ply 2x6	8 ft	1.2	1.0	Concrete Wall B	1000	3600	1650	9000	Moment Resisting Bracket	1850	1050	(6) 1/4"x4" structural screws
12	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 5'-0", 30"Øx8" footer, 30"Øx26" collar	1050	3600	2800	9000	(2) #5 rebar through post	1850	1300	(6) 1/4"x4" structural screws
16	Open	Pinned	4-ply 2x8	4 ft	2.4	1.0	Concrete Wall A	600	1650	0	4500	Pin Bracket	2400	1750	(8) 1/4"x4" structural screws
16	Open	Fixed	4-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	1000	3400	3900	9000	Moment Resisting Bracket	2650	1800	(9) 1/4"x4" structural screws
16	Open	Embedded	4-ply 2x8	4 ft	1.2	0.8	Embedded 4'-6", 24"Øx8" footer, 24"Øx30" collar	550	1650	3100	4500	(1) #5 rebar through post	2150	1400	(7) 1/4"x4" structural screws
16	Sheathed	Pinned	3-ply 2x8	4 ft	2.4	1.0	Concrete Wall A	600	1850	0	4500	Pin Bracket	1850	1300	(6) 1/4"x4" structural screws
16	Sheathed	Fixed	3-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	1050	3600	2850	9000	Moment Resisting Bracket	1850	1300	(6) 1/4"x4" structural screws
16	Sheathed	Embedded	3-ply 2x8	8 ft	1.2	1.0	Embedded 5'-6", 30"Øx8" footer, 30"Øx30" collar	1300	3600	4750	9000	(2) #5 rebar through post	1850	1500	(6) 1/4"x4" structural screws
20	Open	Pinned	No Design												
20	Open	Fixed	4-ply 2x8	4 ft	1.2	1.0	Concrete Wall B	550	1650	2900	4500	Moment Resisting Bracket	2250	1450	(7) 1/4"x4" structural screws
20	Open	Embedded	4-ply 2x8	4 ft	1.2	0.8	Embedded 4'-6", 24"Øx8" footer, 24"Øx30" collar	450	1650	3700	4500	(1) #5 rebar through post	2400	1450	(8) 1/4"x4" structural screws
20	Sheathed	Pinned	No Design												
20	Sheathed	Fixed	3-ply 2x8	8 ft	1.2	1.0	Concrete Wall B	1300	3600	4700	9000	Moment Resisting Bracket	1850	1550	(7) 1/4"x4" structural screws
20	Sheathed	Embedded	3-ply 2x8	4 ft	1.2	1.0	Embedded 5'-0", 24"Øx8" footer, 24"Øx30" collar	800	1850	3900	4500	(1) #5 rebar through post	1850	1200	(6) 1/4"x4" structural screws

TABLE 7.3 (Cont.): DESIGN SPECIFICATIONS FOR 60 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	ENDWALL COLUMNS Size	Spacing	Foundation	Buckling Length Coefficients K_z	K_y	Connection at Bottom Horizontal (lb)	Uplift (lb)	Moment (lb-ft)	Downward (lb)	Connector
12	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	350	550	0	1800	Pin Bracket
12	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	1.2	1.0	400	550	650	1800	Moment Resisting Bracket
12	Open	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 18"Øx8" footer, 18"Øx24" collar	1.2	1.0	500	550	950	1800	(1) #5 rebar through post
12	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	550	650	0	1800	Pin Bracket
12	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	650	1050	1800	Moment Resisting Bracket
12	Sheathed	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	850	650	1550	1800	(1) #5 rebar through post
16	Open	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	450	550	0	1800	Pin Bracket
16	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	500	550	950	1800	Moment Resisting Bracket
16	Open	Embedded	3-ply 2x6	8 ft	Embedded 4'-0", 24"Øx8" footer, 24"Øx24" collar	0.8	1.0	650	550	1600	1800	(1) #5 rebar through post
16	Sheathed	Pinned	3-ply 2x6	8 ft	Concrete Wall A	1.0	1.0	700	650	0	1800	Pin Bracket
16	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	850	650	1550	1800	Moment Resisting Bracket
16	Sheathed	Embedded	3-ply 2x6	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx32" collar	0.8	1.0	1050	650	2600	1800	(1) #5 rebar through post
20	Open	Pinned	No Design									
20	Open	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	650	550	1550	1800	Moment Resisting Bracket
20	Open	Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 24"Øx8" footer, 24"Øx28" collar	0.8	1.0	800	550	2650	1800	(1) #5 rebar through post
20	Sheathed	Pinned	No Design									
20	Sheathed	Fixed	3-ply 2x6	8 ft	Concrete Wall B	0.8	1.0	1050	650	2550	1800	Moment Resisting Bracket
20	Sheathed	Embedded	3-ply 2x8	8 ft	Embedded 4'-6", 30"Øx8" footer, 30"Øx38" collar	0.8	1.0	1350	650	4300	1800	(1) #5 rebar through post

TABLE 7.3 (Cont.): DESIGN SPECIFICATIONS FOR 60 FT WIDE BUILDING

Building Height	Side Wall Sheathing	Column Base Condition	KNEE BRACE DESIGN				KNEE BRACE LOAD ON TOP CHORD OF TRUSS							
							Wind Case 1				Wind Case 2			
			Member	Connection to Post	Connection to Top Chord of Truss	Max. Axial Force	Left Brace		Right Brace		Left Brace		Right Brace	
(ft)						(lb)	X (lb)	Y (lb)	X (lb)	Y (lb)	X (lb)	Y (lb)	X (lb)	Y (lb)
12	Open	Pinned	2x10 #2 SYP	(17) 1/4"x4" structural screws	(12) 1/4"x3" structural screws	4500	-2500	-2500	-3550	3550	1350	1350	4050	-4050
		Fixed	2x10 #2 SYP	(15) 1/4"x4" structural screws	(11) 1/4"x3" structural screws	4050	-1450	-1450	-2600	2600	400	400	3300	-3300
		Embedded	2x10 #2 SYP	(14) 1/4"x4" structural screws	(10) 1/4"x3" structural screws	3700	-2150	-2150	-3050	3050	1250	1250	3400	-3400
	Sheathed	Pinned	2x10 #2 SYP	(12) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3200	-1350	-1350	2100	-2100	-1600	-1600	-1800	1800
		Fixed	2x8 #2 SYP	(9) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2500	-1300	-1300	1850	-1850	-1050	-1050	-1350	1350
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2800	-1550	-1550	2250	-2250	-1350	-1350	-1900	1900
16	Open	Pinned	2x10 #2 SYP	(12) 1/4"x4" structural screws	(9) 1/4"x3" structural screws	3300	-1850	-1850	-2700	2700	1100	1100	2950	-2950
		Fixed	2x10 #2 SYP	(14) 1/4"x4" structural screws	(10) 1/4"x3" structural screws	3900	-2500	-2500	-3350	3350	1550	1550	3700	-3700
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2750	-1300	-1300	-2050	2050	650	650	2350	-2350
	Sheathed	Pinned	2x8 #2 SYP	(9) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2450	-1000	-1000	2000	-2000	-1350	-1350	-1700	1700
		Fixed	2x8 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	2850	-1500	-1500	2200	-2200	-1500	-1500	-2050	2050
		Embedded	2x10 #2 SYP	(11) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3050	-1900	-1900	2750	-2750	-1850	-1850	-2850	2850
20	Open	Pinned	No Design											
		Fixed	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2800	-1500	-1500	-2200	2200	850	850	2450	-2450
		Embedded	2x8 #2 SYP	(10) 1/4"x4" structural screws	(7) 1/4"x3" structural screws	2700	-1750	-1750	-2350	2350	1150	1150	2550	-2550
	Sheathed	Pinned	No Design											
		Fixed	2x10 #2 SYP	(12) 1/4"x4" structural screws	(8) 1/4"x3" structural screws	3100	-1850	-1850	2750	-2750	-2050	-2050	-3050	3050
		Embedded	2x8 #2 SYP	(9) 1/4"x4" structural screws	(6) 1/4"x3" structural screws	2300	-1800	-1800	2350	-2350	-1200	-1200	-2000	2000

TABLE 7.3 (Cont.): DESIGN SPECIFICATIONS FOR 60 FT WIDE BUILDING

Building Height (ft)	Side Wall Sheathing	Column Base Condition	HEADERS: Member	HEADERS: Connection to Post	HEADERS: Connection to Truss	SIDEWALL BRACING: Member Type	SIDEWALL BRACING: Member Property	SIDEWALL BRACING: Connection to Post	SIDEWALL BRACING: Connection to Top Header	SIDEWALL BRACING: Axial Force (lb)
12	Open	Pinned	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(5) 1/4"x4" structural screws	(6) 1/4"x4" structural screws	1950
		Fixed	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(5) 1/4"x4" structural screws	(6) 1/4"x4" structural screws	1750
		Embedded	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	WYE	2x8 #2 SYP	(5) 1/4"x4" structural screws	(6) 1/4"x4" structural screws	1950
	Sheathed	Pinned	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
		Fixed	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
		Embedded	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
16	Open	Pinned	No structural header; trusses supported by columns			X	4x6 #2 SYP	(5) 1/4" structural screws	N/A	1700
		Fixed	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	X	4x6 #2 SYP	(5) 1/4" structural screws	N/A	1450
		Embedded	No structural header; trusses supported by columns			X	4x6 #2 SYP	(5) 1/4" structural screws	N/A	1600
	Sheathed	Pinned	No structural header; trusses supported by columns			29 Gauge Metal Siding over 2x wall girts				
		Fixed	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
		Embedded	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
20	Open	Pinned	No Design							
		Fixed	No structural header; trusses supported by columns			X	4x6 #2 SYP	(5) 1/4" structural screws	N/A	1700
		Embedded	No structural header; trusses supported by columns			X	4x6 #2 SYP	(6) 1/4" structural screws	N/A	1850
	Sheathed	Pinned	No Design							
		Fixed	2-Ply 2x12 SS SYP	(16) 0.177"x4" R.S. nails	(12) 0.135"x3" R.S. nails	29 Gauge Metal Siding over 2x wall girts				
		Embedded	No structural header; trusses supported by columns			29 Gauge Metal Siding over 2x wall girts				

8. REFERENCES

ACI 318-14 Building Code Requirements for Structural Concrete and Commentary

ANSI/AITC A190.1 (2017) American National Standard: Standard for Wood Products—Structural Glued Laminated Timber

ANSI/ASAE EP484.3 (2017) Diaphragm Design of Metal-Clad, Wood-Frame Rectangular Buildings

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ANSI/AWC NDS-2018 National Design Specification (NDS) for Wood Construction with 2018 Supplement

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ICC International Building Code (IBC) 2018 Edition

NFBA Non-Diaphragm Post-Frame Building Design Guide (2018)

NFBA Post-Frame Building Design Manual (2015)

TPI/WTCA Building Component Safety Information (BCSI-B1) (2015) Guide to Good Practice for Handling, Installing, Restraining & Bracing of Metal Plate Connected Wood Trusses