About the Project:

In September of 2014, the Boles Fire swept through the small city of Weed in northern California. Over 150 structures were destroyed in the fire and many families were displaced. One of the buildings destroyed included a commercial building that once sat on what is now divided into seven lots in the eastern part Weed. Great Northern Services (GNS), a non-profit organization committed to the growth and redevelopment of the city, bought the empty seven lots to develop residential housing for work-force families who were displaced by the fire. Within the seven lots, GNS plans to develop five single family residences and two duplexes.

California Polytechnic University’s Contribution:

GNS had several goals for the project including; resiliency, passive energy design, prefabrication, constructability and low budget. In order to keep budget low and recruit creative and innovative minds, GNS turned to California Polytechnic University and the College of the Siskiyous to help with the architectural design, structural design and construction. In addition, GNS wanted these buildings to be able to be built at California Polytechnic University and transported to Weed, CA. By approaching the project with an Integrated Project Delivery (IPD) approach, California Polytechnic University combined groups of Architecture, Architectural Engineering and Construction Management students into eight teams of four to six students to take on the project. The idea of IPD is that each group is tasked with designing the architectural, structural and construction design with an integrated approach.

The Design Process and My Involvement:

Being the only Architectural Engineer of the group and the architectural design being the first step in the process, I was challenged to apply my specific knowledge of structural engineering to help inform my team what I thought the best approach was. My main goals when deciding what direction to take were keeping cost low and creating a project that could be easily prefabricated and transported. In order to achieve these goals, I created two objectives for design. First, I thought it would be best to build in four foot panels because that is the most common size plywood is manufactured in. Second, I tried to direct the design to stay fairly regular in shape so that structural member sizes wouldn’t have to vary throughout the project and roof trusses could be utilized throughout the entire length of the roof in order to reduce the need for extra roof beams, posts and foundations. This would make the project more transportable and potentially more affordable. In the end the first objective was somewhat a failure because as a team we learned that designing the house with such tight restrictions made the design feel unnatural and made the floor plan unreasonable. The second objective however, did work out. In the end the entire roof was constructed of roof trusses and there were less than six unique structural members throughout the entire structure. The next step, the structural design, included the structural calculation and planning of the building. Because I was the only member of my group with the necessary knowledge to complete this task, this part of the project was done solely by me.
Parcel Layout Overview
Site Overview and Floor Plan
Penalization Details
General

   A. Design Wind Speed (ASCE 7-10): 110 mph, Exposure C (Wood Municipal Building Code)
   B. Design Seismic Criteria (ASCE Section 12.8 using Equivalent Lateral Force procedure)

Seismic Importance Factor I: 1.0
Short Period MCE Acceleration SS: 0.736
Long Period MCE Acceleration S1: 0.328
Site Coefficients: Fa & Fv: 1.0 & 0.0, respectively
Response Modification Coefficient R: 6.5
Soil Profile Type: D

2. Governing Code Authority: City of Wee, CA

3. Design Intent: Contract documents indicate information sufficient to convey design intent. Review contract documents and verify field and existing conditions with the architect prior to proceeding with work, as design intent requires further clarification.

4. Submittals: Review for completeness and compliance with contract documents prior to submission to Structural Engineer. Submit prior to fabrication. Submittals are for general reference and does not constitute an authorization to deviate from terms and conditions of contract. When indicated, provide a professional engineer's signature and seal applicable to state where project is located. Maintain all as a copy of reviewed and accepted submittals.

5. Modifications and Substitutions: Must be accepted in writing by Structural Engineer. No modification or substitution will be accepted via shop drawing review.

6. Contract Documents: Use: Perform structural related work and develop shop drawings considering contract documents in their entirety. See architectural drawings for top of roof and roof elevations, depressions, slopes, openings, curbs, drains, trenches, slab edge locations, wall overall dimensions and locations of openings not indicated on structural drawings. Any discrepancies between architectural and structural dimensions should be confirmed with the Structural Engineer before starting work.

7. Construction Means and Methods: Not a part of contract documents. Perform construction means, methods, techniques, sequences and procedures complying with the national, state and local safety ordinances. Site visits (including structural observation) by Structural Engineer do not constitute supervision of construction means and methods.

8. Typical Details: Details identified throughout project and may not be specifically referenced hereunder. Contractor is responsible for identifying these details and extending understanding of their application prior to work performance.

Masonry

9. Specific Compressive Strength of Masonry (f’): 1500 psi

10. Concrete Block: ASTM C90, medium weight, Grade N-1, achieving a minimum compressive strength as required to meet specified compressive strength of Masonry (f’).

11. Mortar: ASTM C270, Type S conforming with IBC Section 2103.1 and attaining a minimum compressive strength at 28 days of 1800 psi. Do not use masonry cement or plastic cement.

12. Grout: ASTM C476 or IBC Table 2103.3 attaining a minimum compressive strength as required to meet specified compressive strength of masonry (f’). However, in no case shall grout compressive strength be less than 2000 psi at 28 days.


15. Reinforcing Steel: Reinforcing steel section of general notes unless indicated otherwise.

16. Reinforcing Steel Splices: Lap reinforcing steel at splices with 72 mm minimum, unless noted otherwise. Where clear distance between bars at adjacent splices is 3 inches or less, increase lap length 30 percent unless splices are staggered at least 24 bar diameters.

17. Placement: Set cells in vertical alignment.

18. Grouting: Grout solid all cells. Mechanically vibrated grout in cells.

A. Horizontal Construction Joints: Hold grout 1-1/2 inches below top of masonry unit if work is stopped one hour or longer.

B. Grout Cover Around Reinforcing Steel, Anchor Bolts and Inserts Penetrating Masonry Shell: 1 inch minimum

Earthwork and Foundations

1. Design Assumption: In lieu of more detailed soils information, existing subgrade is assumed to be class "S" in compliance with CBC Table 1806.2 with allowable bearing pressure of 1,500 psi. These values may be increased 33 percent for seismic or wind loading

2. Evaluations, Backfill and Computation of Backfill: Comply with requirements of IBC Section 1804. Contractor is responsible for all excavation, lagging, shoring, underpinning and related procedures.

3. Minimum Footing Depths: 12 inches below adjacent grade (excluding landscaping soil) or finish floor, whichever is lower.

4. Water Exposure at Building Perimeter Footings: At areas where sidewalks or pavers do not immediately adjoin structure, provide positive drainage away from structure at building perimeter. Landscape irrigation is not permitted within five feet of building perimeter footings except when enclosed in protected planters with direct drainage away from structure which complies with applicable code. Discharge from downspouts, roof drains and scuppers is not permitted onto unprotected soils within five feet of building perimeter. Refer to geotechnical report for complete requirements.

Reinforcing Steel

Reinforcing Steel

All bars unless indicated otherwise ASTM A615, Grade 40
4 bars to be welded

2. Wire Reinforcing:

ASTM A407, Grade 60


Deformed wire strands (D4 and larger only) ASTM A416

4. Lap Lengths: As shown on drawings. If lap lengths cannot be determined, verify with Structural Engineer. Lap wire fabric 1-1/2 spaces (1 foot minimum)

5. Minimum Cast-in-Place Concrete Cover:

Slabs on Grade

Min. cover to center of slab

(a) Concrete Exposed to Earth or Weather (Unformed): 3

(b) Chairs or Spacers: Plastic or plastic coated when resting on exposed surfaces.

6. Reinforcing: Bend cold unless otherwise accepted by Architect (Structural Engineer). Do not field-bend reinforcing steel bars embedded in concrete unless otherwise shown on contract documents or pre-approved by Structural Engineer.

7. Rough Carpenter

1. Structural Lumber: Grade marked Douglas Fir-Larch structural lumber complying with Standard Grading Rules No. 17 and covering the West Coast Lumber Inspection Bureau. Provide air-dry lumber with 19 percent moisture content.

2. Classifications and Grades:

Member

Size Classification Grade

Rafters and Joists Larger Than 2x4

2" to 4" thick, 2" and wider No.2

2x4 Joists and Rafters

2" to 4" thick, 2" and wider No.2

4x Beams, Headers and Stringers

2" to 4" thick, 2" and wider No.1

Beams, Headers and Stringers Larger Than 4xBeams and Stringers

No.1

4x Posts

4" thick, 4" and wider

6. Posts Larger Than 4x

Posts and Timbers

No.1


8. Pressure Treat Structural lumber in accordance with the following criteria for Comply or Masonry: See specifications. Provide hot dip galvanized or stainless steel fasteners and hardware connectors at pressure treated structural lumber.

9. Nails: Minimum nails with durable properties complying with IBC 2306.3. Install nails in compliance with CBC Chapter 23, including Table 2304.10.1.

10. Bolts: ASTM A307 bolts with standard cut washer under bolt head and nut. Provide holes for bolts 1/2 to 1/16 inch larger than nominal bolt diameter. Re-tighten bolts prior to application of sheathing or facing.

11. Lag Screws: ANSI/ASME Standard B18.2.1 for lag screw dimensions. Pre-drill all holes. Hole at shank portion to match diameter of shank. Holes at threaded portion to be 60 to 75 percent of shank diameter and equal to length of threaded portion. Use soap and lubricants to facilitate installation. Driving with hammer is not permitted.

12. Plate Washers: Provide under heads or nuts of bolts (including anchor bolts at sill plates) and lag screws of the following size minimum:

- 1/2" diameter 1/8"x2" sq. 5/8" diameter 1/8"x2-1/2" sq.
- 3/4" diameter 5/16"x3" sq. 7/8" diameter 1/4"x3" sq.
- 1" diameter 1/8"x3-1/2" sq.


14. Notching or Cutting Structural lumber: Not permitted unless specifically detailed or indicated.

15. Foundation Support: All structural elements (beams, rafters, joists) IBC Section 2308.7.

16. Wood Studs: A. Top Plate: construct with 2 pieces same width as studs. Splice as indicated.

B. Stud Wall Bracing: In Stud Walls not Plywood Sheathed: Compliance with IBC Section 2306.8.

C. Fire Blocks: IBC Section 718.

D. Notching or Boring Holes in Stud Wall: IBC Section 2306.9.5.

18. Partition Support at Floor Framing: Double joists under partitions which are parallel to joists and provide solid full depth blocking under partitions which are perpendicular to joists.

Nailing Schedule (Portfolio of IBC Table 2304.10.1)

All nails are common nails unless written acceptance by Architect (Structural Engineer) is obtained.

1. Joist to sill or girder, toenail 3-8d

2. Bridging to joist, toe nail each end 2-8d

3. 1"x8" shouler or less to each joist, face nail 2-8d

4. Wider than 1"x8" shouler to each joist, face nail 3-8d

5. 2" to joist or girder, blind and face nail 4-8d

6. 2" to joist or girder, typical face nail 16d @ 16" o/c

7. Plate to joist or blocking, typical face nail 16d @ 16" o/c

8. Stud to sole plate 2-1"x6

9. Stud to sole plate 4-8d, toe nail or 2-16d, end nail 16d @ 24" o/c

10. Double studs, face nail 16d @ 24" o/c

11. Double top plates, typical face nail 16d @ 16" o/c

12. Double top plates, lap splice 8-16d

13. Blocks between joists or rafters to top plate, toe nail 3-8d

14. Rim joist to top plate, toe nail 8d @ 3" o/c

15. Top plates, lags and intersections, face nail 5-8d

16. Continuous header, two pieces 16d @ 16" o/c along edge

17. Ceiling joist to plate, toe nail 3-8d

18. Continuous header to stud, toe nail 3-8d

19. Ceiling joists, lags over partitions, face nail 3-16d

20. Ceiling joists to rafters, face nail 4-8d

21. Rafter to plate, toe nail 3-8d

22. 1" brace to each stud plate, face nail 2-8d

23. 1 1/2" shouler to each stud plate, face nail 2-8d

24. Wider than 1"x8" sheathing to each bearing, face nail 3-8d

25. 2x4s, planks 2-16d at each bearing

26. Built-up corner studs 16d @ 16" o/c

27. Built-up girder and beams 20d @ 32" o/c at top and bottom and staggered 2-20d at ends and at each splice
PLAN NOTES:

1. SHEARWALLS TO BE 1/4" STRUCTURAL 1 PLYWOOD W/ 10d NAILS @ 6" WHERE INDICATED U.N.O.
2. EACH SHEARWALL TO HAVE HDU2-SDG2.5 HOLDDOWNS ON DEL. STUD ON EACH END.
PLAN NOTES:

1. SHEARWALLS TO BE 3/4" STRUCTURAL 1 PLYWOOD W/ 10d NAILS @ 6" WHERE INDICATED U.N.O.
2. FLOOR DIAPHRAGM TO BE BLOCKED 3/4" STRUCTURAL 1 PLYWOOD W/ 10d NAILS @ 6" EVERYWHERE
3. EACH SHEARWALL TO HAVE HDU2 - SDS2.5 HOLDDOWNS ON DBL. STUD ON EACH END
PLAN NOTES:
1. TRUSSES TO BE DESIGNED BY MANUFACTURER. DL = 14 PSF LL = 48 PSF. SEE PLAN FOR LATERAL LOADS.
2. SHEARWALLS TO BE BLOCKED ¾" STRUCTURAL 1 PLYWOOD W/ 10d NAILS @ 6" EVERYWHERE U.N.O.
3. ROOF DIAPHRAGM TO BE BLOCKED ½" STRUCTURAL 1 PLYWOOD W/ 10d NAILS @ 6" EVERYWHERE.
CALCULATION PACKAGE

STUDIO GREEN.

PROJECT ENGINEER: SPENCER SHOBE

DATE: 11/17/17
<table>
<thead>
<tr>
<th>Section</th>
<th>Page</th>
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<td>LOAD TAKEOFF</td>
<td>LT-1</td>
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<tr>
<td>VERTICAL DESIGN</td>
<td>V-1/1</td>
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<td>LATERAL DESIGN</td>
<td>L-1/1</td>
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<tr>
<td>FOUNDATION DESIGN</td>
<td>F-1/4</td>
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<tr>
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LOCATION: 780 S. DAVIS STREET WEED, CA PARCEL 1

ARCHITECT: STUDIO GREEN

OWNER: GREAT NORTHERN SERVICES

JURISDICTION: CITY OF WEED

BUILDING CODE:
GENERAL: 2015 IBC
ASCE 7-10

TIMBER DESIGN: NDS 2015

STRUCTURAL SYSTEMS:

VERTICAL: WOOD ROOF, WOOD FLOOR, WOOD WALLS
CONCRETE FOOTINGS, MASONRY STEM WALL

LATERAL: WOOD SHEAR PANELS
<table>
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<th>(PSF)</th>
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<tr>
<td>METAL ROOF</td>
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<td>MEP</td>
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<tr>
<td><strong>DEAD</strong></td>
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<tr>
<td><strong>FLOOR LIVE</strong></td>
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<tr>
<td>2x6 STUDS</td>
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<tr>
<td>GYPSUM WALL BOARD</td>
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<table>
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<tbody>
<tr>
<td>2x4 STUDS</td>
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<tr>
<td>1/2&quot; GYPSUM WALL BOARD (BOTH SIDES)</td>
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<tr>
<td><strong>TOTAL</strong></td>
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SNOW LOAD

$p_f = 60\text{ psf} \quad \text{(NEED BUILDING CODE)}$

$p_s = C_s \cdot p_f \quad \text{(ASCE 7.4-1)}$

$C_s = 0.8 \quad \text{(ASCE FIG. 7.2)}$

$p_r = (60\text{ psf})(0.8)$

$p_r = 48\text{ psf}$
[RH-1] GARAGE HEADER

\[ W = D + S = 124 \text{ PLF} \]

\[ D = (14 \text{ PSF})(2') = 24 \text{ PLF} \]

\[ S = (4.8 \text{ PSF})(2') = 96 \text{ PLF} \]

BENDING

\[ \beta_{B} = \frac{1000}{15} = 66.67 \]

\[ F_{B} = \frac{W}{L} \cdot \frac{1}{G} \cdot \frac{C_{t}}{C_{l}^2} \cdot \frac{C_{l}^2}{C_{l}} \cdot \frac{C_{l}}{C_{l}^2} \cdot \frac{C_{l}}{C_{l}^2} \]

\[ F_{B} = 126.65 \text{ psi} \]

\[ R_{B} = \frac{F_{B} \cdot 1}{G \cdot W} \]

\[ \text{ASSUME } G \times 12 \]

\[ \frac{W}{L} = \frac{1000}{15} = 66.67 \cdot 12 = 799.99 \]

\[ R_{B} = \frac{126.65 \cdot 1}{799.99} = 0.16 \]

\[ \beta_{B} = \frac{(344.96 \text{ in})(11.5)}{(35^2)} = 348.96 \text{ in} \]

\[ F_{BE} = 1.2 \beta_{B} \min. = 1.2(0.16) = 0.192 \]

\[ F_{BE} = 5635 \text{ psi} \]

\[ C_{L} = 1 + \left( \frac{F_{BE}}{F_{B}} \right) \cdot \frac{1}{1.9} \]

\[ C_{L} = 1 + \left( \frac{5635}{126.65} \right) \cdot \frac{1}{1.9} \]

\[ C_{L} = 1.99 = 0.999 \]

\[ F_{B}' = \frac{1000}{1.15} = 869.57 \text{ psi} \]

\[ F_{B}' = 1265 \text{ psi} \]
\[ S_{xx} \geq \frac{M}{F' A} \]
\[ S_{xx} \geq \frac{47,440 \text{ ft}^2}{126 \text{ ft}} \]
\[ S_{xx} \geq 374.7 \text{ in}^3 \]

**USE 6\times12 DE #1**

**SHEAR**

\[ F'V = \frac{FV}{C\theta C\theta C\theta C\theta} = 207 \text{ psi} \]

\[ F'V = \frac{V}{A} = \frac{722.4}{6325 \text{ in}^2} = 116 \text{ psi} < 207 \text{ psi} \quad \checkmark \]

**DEFLECTION**

\[ \frac{L}{360} - \frac{L}{240} = 0.12 \text{ in} - 0.08 \text{ in} = 0.04 \text{ in} \]

\[ \Delta_L = \frac{5wL^4}{384E} = \frac{5(9400)(14.12)^4}{384(1700000)(697.1)} = 0.12" < 0.53" \quad \checkmark \]

\[ \Delta_{rel} = \frac{5NL^4}{384EI} = \frac{5(14.12)(16.1)^4}{384(1700000)(697.1)} = 0.15" < 0.8" \quad \checkmark \]

**USE 6\times12 DE #1**
[RH-2] - TYP. HEADER (WORST CASE)

\[ W = D + S = 930 \text{ PLF} \]

\[ D = (14 \text{ psf})(15') = 210 \text{ PLF} \]
\[ S = (48 \text{ psf})(15') = 720 \text{ PLF} \]

**BENDING**

\[ F_{u} = F_{b} \cdot C_{a} \cdot C_{b} \cdot F_{c} \cdot C_{d} \cdot F_{e} \cdot C_{f} \cdot F_{v} \cdot C_{g} \cdot 1.15 \]

\[ F_{b} = 1725 \text{ psi} \]

\[ S_{x} > \frac{M}{F'_{L}} = \frac{12600 \text{ ft-lb}}{1725} = 7.30 \text{ in}^3 \]

**USE**

\[ S_{x} = 27.73 > 7.30 \checkmark \]

**SHEAR**

\[ F'_{v} = 140 \text{ psi} \]

\[ F'_{v} = 207 \text{ psi} \]

\[ F'_{v} = \frac{V}{A} = \frac{1400 \text{ ft-lb}}{30.25 \text{ in}^3} = 46.3 \text{ psi} = 207 \text{ psi} \checkmark \]
DEFLECTION

\[ \frac{L_2}{L_1} = 0.123 \times 0.2 \]

\[ \Delta_L = \frac{5 \times L^4}{384EI} \]

\[ = \frac{5 \times (720 / 12) \times (3.12)^4}{384 \times (1700000) \times (76.24)} \]

\[ = 0.010'' < 0.133'' \] \checkmark

\[ \Delta_L + D = \frac{5 \times (930 / 12) \times (3.12)^4}{384 \times (1700000) \times (76.24)} \]

\[ = 0.013'' < 0.12'' \] \checkmark

USE 6 x 6 DF #1
STUDIO GREEN.

PROJECT: WEED HOUSING DEVELOPMENT
BY: SPENCER SHOBE
TITLE: [FJ-1] TYP. FLOOR JOIST
DATE: 11/17/2017

W = D + L = 71 PLF

D = \((600 \text{ psf}) \times \frac{2000 \text{ sq ft}}{100 \text{ psf}}\) = 12 PLF
L = \((40 \text{ plf}) \times (15')\) = 54 PLF

BENDING

\[ F'_{b} = F_B \cdot C_6 \cdot C_{10} \cdot C_{14} \cdot C_{17} \cdot C_{21} \cdot C_{24} \cdot C_{27} \]

\[ F'_{b} = 1935 \text{ psi} \]

\[ S_{xx} \geq \frac{M}{F'_{b}} = \frac{20,800 \text{ in}^3}{1935 \text{ psi}} = 20.17 \text{ in}^3 \]

USE 2 x 10 @ 16” 0.6. \[ S_{xx} = 21.39 \text{ in}^3 > 20.17 \text{ in}^3 \]

SHEAR

\[ F'_{V} = F_{V} \cdot C_6 \cdot C_7 \cdot C_{10} \cdot C_{11} \cdot C_{14} \cdot C_{17} \cdot C_{21} \cdot C_{22} \cdot C_{24} \cdot C_{27} \]

\[ F'_{V} = 190 \text{ psi} \]

\[ F'_{V} \geq \frac{V}{A} = \frac{497 \#}{13.98 \text{ in}^2} = 35.81 \text{ psi} \leq 190 \text{ psi} \]
DEFLECTION

\[ \frac{L}{300} \times \frac{L}{240} = 0.47"', 0.7"' \]

\[ \Delta_{DL} = \frac{5NL^4}{384EI} = \frac{(5)(7\frac{1}{2})(14\frac{1}{2})^4}{384(11,800,000)(98,932)} = 0.39"' < 0.7"' \checkmark \]

\[ \Delta_{L} = \frac{5(5\frac{1}{2})(14\frac{1}{2})^4}{384(11,800,000)(98,932)} = 0.29"' < 0.47"' \checkmark \]

USE 2 x 10 DF #2 @ 16"' O.C.
[FG-1] - TYP. FLOOR GIRDER

\[ W = D + L = 756 \text{ PLF} \]

\[ D = \left( \left( \frac{3000 \text{ lb}}{2000 \text{ lb/ft}} \right) + (10 \text{ psf}) \right)(14) = 196 \]

\[ L = \left( \frac{40 \text{ psf}}{14} \right) = 560 \text{ PLF} \]

**BENDING**

\[ F''_B = F_B \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \]

\[ F''_B = 1100 \text{ psi} \]

\[ S_{xx} \geq \frac{M}{F''_B} = \frac{72000 \text{ ft} \cdot \text{in}}{1100 \text{ psi}} = 65.45 \text{ in}^2 \]

**USE** \[ 4 \times 12 \]

\[ S_{xx} = 73.8 \text{ in}^2 > 65.45 \text{ in}^2 \checkmark \]

**SHEAR**

\[ F'V = F_V \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \cdot \frac{y}{L} \]

\[ F'V = 180 \text{ psi} \]

\[ F'V \geq \frac{V}{A} = \frac{3000 \text{ lb}}{39.58 \text{ in}^2} = 76.18 \text{ psi} \leq 180 \text{ psi} \checkmark \]
DEFLECTION

\[ \frac{4}{360} \times \frac{4}{24} = 0.27'' \ , \ 0.4'' \]

\[ \Delta = \frac{(5)(75 \times 10^3)(12.8)^4}{(384)(1,700,000)(HIS.3)} \]

\[ 0.10'' < 0.40'' \quad \checkmark \]

\[ \Delta = \frac{(5)(512)(12.8)^4}{(384)(1,700,000)(15.3)} \]

\[ 0.07'' < 0.27'' \quad \checkmark \]

USE 4 X 12 DE # 1
P-1 - Garage Post

\[ F'c = \frac{F_c}{1.5} \cdot 0.85 \cdot 0.85 \cdot 0.85 \cdot 0.85 \cdot 0.6 \]

\[ F'c = 2587.5 \text{ psi} \]

\[ A^2 = \frac{P}{F'c} = \frac{992}{2587.5} \approx 0.38 \text{ in}^2 \]

\[ C_b = 0.17 + 0.375 = 0.545 \text{ in} \]

\[ C_f = 0.675 \text{ in} \]

\[ F'c_1 = 6648 \text{ psi} \]

\[ F'c_1 \geq \frac{P}{A} \]

\[ A^2 = \frac{992}{6648} \approx 1.49 \text{ in}^2 \]

\[ (5.5'' \times 5.5'') = 30.25 \text{ in}^2 > 1.49 \text{ in}^2 \checkmark \]

USE 6x6 BF #1
\[ F'c = \frac{F_c}{C_P} \cdot C_{m} \cdot C_{t} \cdot C_{l} \cdot C_{p} \]

\[ C_P = 1 + \frac{F_{ce}}{F_{c}} - \sqrt{\left(1 + \frac{F_{ce}}{2F_{c}}\right)^2 - \frac{F_{ce}}{F_{c}}} \]

\[ F_{ce} = F_c - \frac{c_p}{c_t} \cdot c_{m} \cdot c_{l} \cdot c_{p} \]

\[ F_{c} = 1500 \text{ psi} \]

\[ F_{ce} = \frac{0.822 \cdot E_{mod}}{E_{mod}} = \frac{(0.822)(620,000)}{(3,150/0.5)^2} = 11,994 \text{ psi} \]

\[ C_P = \frac{1 + \frac{11,994}{1500}}{2(0.8)} - \sqrt{\left(1 + \frac{11,994}{2(0.8)}\right)^2 - \frac{11,994}{1500}} \]

\[ C_P = 0.97 \]

\[ F'c = \frac{F_c}{C_P} = 1459 \text{ psi} \]

\[ A > \frac{F}{F'c} = \frac{6000}{1459} = 4.11 \text{ in}^2 \]

\[ A > 4.11 \text{ in}^2 \]

\[ \text{USE } 4 \times 4 \text{ PT DF#1 } \]

\[ A = 12.25 \text{ in}^2 > 4.11 \text{ in}^2 \]
## ROOF

<table>
<thead>
<tr>
<th>DIAPHRAGM</th>
<th>LOAD (PSF)</th>
<th>AREA (SF)</th>
<th>TOTAL (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ROOF</td>
<td>14.0</td>
<td>2050</td>
<td>28700</td>
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</tbody>
</table>

**TOTAL** 28700

## WALLS

<table>
<thead>
<tr>
<th>TYPE</th>
<th>HEIGHT (FT)</th>
<th>LOAD (PSF)</th>
<th>LENGTH (FT)</th>
<th>TOTAL (LBS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>EXTERIOR</td>
<td>8.5</td>
<td>12.0</td>
<td>210</td>
<td>21420</td>
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<tr>
<td>INTERIOR</td>
<td>8.5</td>
<td>8.0</td>
<td>114</td>
<td>7752</td>
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</table>

**TOTAL** 29172

**BUILDING WEIGHT** 43286
KNOWN:

\[ W = 43,246 \text{ lb} \]
\[ R = 6.5 \text{ (Wood Shear Walls) (ASCE Table 12.2-1)} \]
\[ T_x = 1.0 \text{ (ASCE Table 11.5-2)} \]
\[ S_{ps} = 0.79 \text{ (USGS Values)} \]
\[ SOIL: \text{SITE CLASS D (DEFAULT)} \]
\[ \text{RISK CATEGORY: II (ASCE Table 11.5-1)} \]

\[ V = C_S \times W \]

\[ C_S = \frac{S_{ps}}{R} \times \frac{0.595}{1.0} = 0.092 \]

\[ V = 0.092 \times 43,246 \text{ lb} \]

\[ V = 3,998 \text{ ft}^2 \]

\[ F_r = 5998 \text{ ft}^2 \]
USGS–Provided Output

\[
\begin{align*}
S_s &= 0.736 \text{ g} \\
S_{MS} &= 0.891 \text{ g} \\
S_{DS} &= 0.594 \text{ g} \\
S_l &= 0.328 \text{ g} \\
S_{ML} &= 0.572 \text{ g} \\
S_{DL} &= 0.381 \text{ g}
\end{align*}
\]

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.

For PGA\(\text{ML}\), T\(\text{L}\), C\(_{\text{MS}}\), and C\(_{\text{ML}}\) values, please [view the detailed report](https://earthquake.usgs.gov/cn1/designmaps/us/summary.php?template=minimal&latitude=41.428910000000003&longitude=-122.37938999999994&sit...).
KNOWN'S:

RISK CATEGORY: II
\( V = 110 \text{ MPH} \) (ASCE Fig. 26.5-1A)

EXPOSURE CATEGORY: C (WEED MUNICIPAL CODE)

TOPOGRAPHIC FACTOR (Kzt): 1 (ASCE 26.8.2)

\( C_{\text{net}} = 0.73 \) (IBC Tab. 1609.6.2)

\[ P_{\text{net}} = 0.00256 \cdot V^2 \cdot K_z \cdot C_{\text{net}} \cdot K_{zt} \]

\[ P_{\text{net}} = (0.00256)(110)^2(1)(0.73)(1) \]

\[ P_{\text{net}} = 22.6 \text{ PSF} \]

N-S

\[ V = (P)(A) \]

\[ V = (22.6 \text{ PSF})(991.4 \text{ sf}) \]

\[ V = 22.14 \text{ k} \]

E-W

\[ V = (P)(A) \]

\[ V = (22.6 \text{ PSF})(1100.9 \text{ sf}) \]

\[ V = 24.88 \text{ k} \]

WIND GOVERNS
PROJECT: WEED HOUSING DEVELOPMENT

TITLE: SHEAR DISTRIBUTION

DATE: 11/17/2017

\[ \begin{align*}
\text{LINE A: } & (222 \text{ PLF})(10') = 2220 \text{#} \\
\text{LINE B: } & (222 \text{ PLF})(25') = 5550 \text{#} \\
\text{LINE C: } & (222 \text{ PLF})(15') = 3330 \text{#} \\
\text{LINE D: } & (222 \text{ PLF})(1') = 444 \text{PLF} \\
\text{LINE 1: } & (225 \text{ PLF})(10') = 2250 \text{#} \\
\text{LINE 2: } & (225 \text{ PLF})(22.5') = 5063 \text{#} \\
\text{LINE 3: } & (225 \text{ PLF})(12.5') = 2813 \text{#} \\
\text{LINE 4: } & (225 \text{ PLF})(1') = 48 \text{PLF} \\
\text{LINE 5: } & (5063 \text{#}) \quad = 152 \text{ PLF} \\
\text{LINE 6: } & (2813 \text{#}) \quad = 141 \text{ PLF}
\end{align*} \]
- ASPECT RATIO CHECK

WORST CASE = 45:30 = 1.5:1
ALLOWABLE = 4:1 > 1.5:1 ✔

USE 3/4" STRUCTURAL I PLYWOOD BLOCKED W/ 6D NAILS @ 6" & 6" EVERYWHERE (SDPWS) (TL. 4.2A)

CAPACITY = 260 PLF > 225 PLF ✔
**Shearwall #1**

Use 1/2" Structural Plywood w/ 6d Nails @ 6"
Everywhere, blocked

Capacity = 280 PLF > 152 PLF ✔

- Aspect Ratio Check

Worst Case = 8.5' : 4' = 2.125 : 1
Allowable 3.5 : 1 > 2.125 : 1 ✔

**Shearwall #**

WSW 15' x 9' Simpson Strongwall

Capacity = 1920 # > (444 PLF)(1.5') = 666 # ✔
PROJECT: WEED HOUSING DEVELOPMENT

BY: SPENCER SHOBE

TITLE: STANDARD STUD CHECK

DATE: 11/17/2017

ASSUME 2" x 6" DF #2

\[ W = \text{WIND PRESSURE} \times \text{STUD SPACING} = (22.6 \text{ PSF})(1.33') = 30.1 \text{ PLF} \]

\[ P = (14 \text{ PSF})(15') + (40 \text{ PSF})(15') \times (1.33') = 1237 \text{ #} \]

**BENDING**

\[ F_b = \frac{F_b}{F_e} \cdot C_{FB} \cdot C_{AX} \cdot C_{A} \cdot C_{U} \cdot C_{P} \cdot C_{F} \]

\[ F_b = 213 \text{ PSI} \]

\[ F_e = 700 \text{ PSI} \]

\[ S_x \geq \frac{M}{F_b} = \frac{3694 \text{ #} \cdot \text{ in}}{213 \text{ PSI}} = 17 \text{ in}^2 < 7.5 \text{ in}^2 \checkmark \]

\[ f_b = \frac{M}{S_x} = 483 \text{ PSI} \]
**COMPRESSION**

\[ F'_c = \frac{F_c}{G_d} \cdot \frac{G_a}{G_f} \cdot \frac{G_t}{G_i} \cdot \frac{G_m}{G_i} \]

\[ F'_c = 2808 \text{ psi} \]

\[ F'_c > \frac{P}{A} = \frac{1237 \#}{8.25 \text{ in}^2} = 150 \text{ psi} < 2808 \text{ psi} \checkmark \]

**COMBINED**

\[ F_{C1} = (0.922) \frac{(E_{min})}{(G_{C1})^2} \cdot \frac{580,000}{(0.12/0.86)} = 123.6 \text{ psi} \]

\[ F_{C2} = (0.822) \frac{(E_{min})}{(G_{C2})^2} \cdot \frac{580,000}{(0.9/0.86)} = 92 \text{ psi} \]

\[ f_{be} = \frac{(1.2)(E_{min})}{(G_{be})^2} \cdot \frac{580,000}{(0.12/0.86)^2} = 1905 \text{ psi} \]

\[ f_c = \frac{P}{A} = 150 \text{ psi} \]

\[ f_{b1} = 0 \]

\[ f_{b2} = 183 \text{ psi} \]

\[ \left( \frac{f_c}{F_{C1}} \right)^2 + \frac{f_{b1} \cdot f_{b2}}{f_b \left( 1 - \frac{f_{b1}}{f_{C1}} \right)} + \frac{f_{b2}^2}{f_b (1 - \frac{f_{b2}}{f_{C2}}) - \left( \frac{f_{b1}}{f_{C1}} \right)^2} \]

\[ = \frac{150}{2808} + \frac{183 \text{ psi}}{2 \times 153(1 - \frac{150}{2808})} = 0.31 < 1 \checkmark \]

\[ 2 \times 10 \text{ DE #2 IS ADEQUATE} \]
WORST CASE - 4'-0" SW @ LINE 3

\[ E_M = (141 \text{ PLF}) (4') (9') - (P) (4') = 0 \]

\[ P = 1269 \text{#} \]

HOLDOWN - USE HDU2 - SDS2.5
CAPACITY = 3075# > 1269# ✓

TOP PLATE STEEP - VMAX

N-S (11, 4k)(6) = 149 PLF

E-W (12, 4k)(6) = 149 PLF ← MAX

USE LSTRA CAPACITY 149 PLF > 149 PLF ✓

ANCHOR BOLTS

USE 1/2" DIAMETER ANCHOR BOLTS @ 4' O.C., CAPACITY = 650#

DEMAND = (4') (141 PLF) = 564# < 650# ✓
STUD NAIL CONNECTION

USE 10 COMMON NAIL @ 6" O.C. STAGGERED CAPACITY = 115# (NDS Table 2L)

DEMAND = (141 PLF)(9') = 1269#

CAPACITY = (16 NAILS)(115#/NAIL) = 1840# > 1269# ✓

* TOP PLATE STRAP & STUD NAILING CONNECTION ARE * FOR PANEL TO PANEL FORCE TRANSFER
\[ W_{\text{Max}} = (14 \text{ psf} + 48 \text{ psf})(15') + (10 \text{ psf} + 90 \text{ psf})(15') + (12 \text{ psf})(9') + (78 \text{ psf})(9'/12')(2.5') \]

\[ W_{\text{Max}} = 1898 \text{ plf} \]

\[ b_d = \frac{1898 \text{ plf}}{1500 \text{ psf}} = 1.25' \]

16" x 12" CONT. F.T.C.

**REBAR**

\[ A_s = \gamma b_d \]

\[ A_s = 0.0018 \times (12") \times (1.25') \]

\[ A_s = 0.3456 \text{ in}^2 \]

USE (1) #6 \[ A_s = 0.44 \text{ in}^2 > 0.346 \checkmark \]
Footings under floor girders

\[ P_{\text{max}} = 6000 \text{#} \times (2) \left[ \frac{\text{FG}}{2} \right] \]

\[ C > \frac{P}{A} \]

\[ A > \frac{6000 \text{#}}{1500 \text{psf}} \]

\[ A > 4 \text{ ft}^2 \]

Use 2' x 2' pad footing.

**REBAR**

\[ A_s = \frac{C}{f_y} \]

\[ A_s = 0.0018 \times (24') \times (12') \]

\[ A_s = 0.518 \text{ in}^2 \]

Use (2) 5/8. \( A_s = 0.62 \text{ in}^2 > 0.518 \text{ in}^2 \) \( \checkmark \)

**SIMPSON STRONG WALL PAD FOOTINGS**

Per Simpson (see attached) \( w = 18' \)
# Strong-Wall® Wood Shearwall Standard Application on Concrete Foundation

<table>
<thead>
<tr>
<th>Strong-Wall® Wood Shearwall Model®</th>
<th>Allowable Vertical Load, P (lb)</th>
<th>2,500 psi Concrete</th>
<th>3,000 psi Concrete</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Allowable ASD Shear Load, V (lb)</td>
<td>Drift at Allowable Shear, A (in/m)</td>
<td>Anchor Tension at Allowable Shear, T (lb)</td>
</tr>
<tr>
<td>WSW12x7</td>
<td>1,000</td>
<td>1,055</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>4,000</td>
<td>1,055</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>7,500</td>
<td>1,055</td>
<td>0.31</td>
</tr>
<tr>
<td>WSW18x7</td>
<td>1,000</td>
<td>2,475</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>4,000</td>
<td>2,475</td>
<td>0.31</td>
</tr>
<tr>
<td></td>
<td>7,500</td>
<td>2,475</td>
<td>0.31</td>
</tr>
<tr>
<td>WSW24x7</td>
<td>1,000</td>
<td>5,515</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>4,000</td>
<td>5,515</td>
<td>0.29</td>
</tr>
<tr>
<td></td>
<td>7,500</td>
<td>5,515</td>
<td>0.29</td>
</tr>
</tbody>
</table>

See footnotes on page 13.
Anchorage Solutions

Curb or Stemwall Installation

Slab-on-Grade Installation

Brick Ledge Installation

Anchorage Solutions General Notes
1. The Designer may specify alternate embedment, footing size or bolt grade.
2. Footing dimensions and rebar requirements are for anchorage only.
(P-1) CAPS & BASES

DEMAND = 992 # DOWNWARD

USE ABU 662 POST BASE | CAPACITY 12000# > 992# ✓

USE FTP 62 COLUMN CAP

(P-2) CAPS & BASES

DEMAND = 6000 # DOWNWARD

USE ABU 442 POST BASE | CAPACITY 6465# > 6000# ✓

USE ECH 2 COLUMN CAP

(RH-1) DRAG STRAP

DEMAND = (44.4 PLF)(8') = 3532 #

USE MSTC 40 STRAP | CAPACITY = 4745# > 3532# ✓

DRAG TIE O STRAP

DEMAND = (152 PLF)(30') = 4560 #

USE MSTC 40 STRAP | CAPACITY = 4745# > 4560# ✓
HDU DTT Holdown

This product is preferable to similar connectors because of a) easier installation, b) higher loads, c) lower installed cost, or a combination of these features.

HDU holdowns are pre-deflected during the manufacturing process, virtually eliminating deflection under load due to material stretch. They use Simpson Strong-Tie® Strong-Drive® SDS Heavy-Duty Connector screws which install easily, reduce fastener slip, and provide a greater net section when compared to bolts.

The HDU series of holdowns are designed to replace previous versions of the product such as PHD as well as bolted holdowns. The HDU2, 4 and 5 are direct replacements for the PHD2, 5 and 6, respectively.

The DTT tension ties are designed for lighter-duty holdown applications on single or 2x posts. The new DTT1Z is installed with nails or Simpson Strong-Tie® Strong-Drive SD Connector screws and the DTT2Z installs easily with the Strong-Drive SDS Heavy-Duty Connector screws (included). The DTT1Z holdowns have been tested for use in designed shearwalls and prescriptive braced wall panels as well as prescriptive wood-deck applications (see page 209 for deck applications).

For more information on holdown options, contact Simpson Strong-Tie.

**HDU SPECIAL FEATURES:**
- Holdown designs virtually eliminate deflection due to material stretch.
- Uses Strong-Drive SDS Heavy-Duty Connector screws which install easily, reduce fastener slip, and provide a greater net section area of the post compared to bolts.
- Strong-Drive SDS Heavy-Duty Connector screws are supplied with the holdowns to ensure proper fasteners are used.
- No stud bolts to countersink at openings.

**MATERIAL:** See table

**FINISH:** HDU – Galvanized; DTT1Z and DTT2Z – ZMAX® coating; DTT2S – stainless steel

**INSTALLATION:** See General Notes on page 45.
- The HDU requires no additional washer, the DTT requires a standard cut washer (included with DTT2Z) be installed between the nut and the seat.
- Strong-Drive SDS Heavy-Duty Connector screws install best with a low speed high torque drill with a 1/4" hex head driver.

**CODES:** See page 12 for Code Reference Key Chart.

---

**Horizontal HUD Tie Offset Installation (Plan View)**
See Holdown and Tension Tie General Notes on page 45.

**Vertical HUD Installation**

---

<table>
<thead>
<tr>
<th>Model No.</th>
<th>Dimensions (in.)</th>
<th>Fasteners</th>
<th>Allowable Tension Loads (180′)</th>
<th>Code Ref.</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>W</td>
<td>H</td>
<td>B</td>
<td>Ø</td>
</tr>
<tr>
<td>DTT1Z</td>
<td>14</td>
<td>1½</td>
<td>7½</td>
<td>1″</td>
</tr>
<tr>
<td>DT1Z</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
<tr>
<td>DTT2Z</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
<tr>
<td>DTT2S-SDS2.5</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
<tr>
<td>HDU2-SDS2.5</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
<tr>
<td>HDU4-SDS2.5</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
<tr>
<td>HDU5-SDS2.5</td>
<td>14</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
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<tr>
<td>HUB8-SDS2.5</td>
<td>10</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
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<tr>
<td>HUB11-SDS2.5</td>
<td>10</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
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<tr>
<td>HUB14-SDS2.5</td>
<td>7</td>
<td>3½</td>
<td>6½</td>
<td>1½</td>
</tr>
</tbody>
</table>

1. See page 45 for Holdown and Tension Tie General Notes.
2. Noted HUD14 allowable loads are based on a 5½" wide post (6x6 min.).
3. HUD14 requires heavy hex anchor nut to achieve tabulated loads (supplied with holdown).
4. Loads are applicable to installation on either narrow or wide face of post.
# Straps & Ties

## HRS/ST/PS/HST/HTP/LSTA/LSTI/MST/MSTA/MSTC/MSTI Strap Ties

**CODES:** See page 12 for Code Reference Key Chart.

- These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.
- These products are approved for installation with the Strong-Drive® SD-2 Connector screw. See page 27 for more information.

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
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<tbody>
<tr>
<td>LSTA9</td>
<td>20</td>
<td>1% 14 9</td>
<td>8-10d</td>
<td>(160)</td>
<td>(160)</td>
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<tr>
<td>LSTA12</td>
<td>20</td>
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<td>14-10d</td>
<td>1235</td>
<td>1100</td>
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<td>18-10d</td>
<td>1235</td>
<td>1100</td>
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<tr>
<td>ST292</td>
<td>2%</td>
<td>9% 12 16</td>
<td>16-12d</td>
<td>1265</td>
<td>1120</td>
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<tr>
<td>ST212</td>
<td>2%</td>
<td>12% 161</td>
<td>16-12d</td>
<td>1530</td>
<td>1505</td>
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<tr>
<td>ST2115</td>
<td>4%</td>
<td>16% 10</td>
<td>10-16d</td>
<td>660</td>
<td>660</td>
<td></td>
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<tr>
<td>ST2215</td>
<td>4%</td>
<td>16% 20</td>
<td>20-16d</td>
<td>1875</td>
<td>1875</td>
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<tr>
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<td>1%</td>
<td>30 22-10d</td>
<td></td>
<td>1640</td>
<td>1640</td>
<td>I4, L3, L5, F2</td>
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<tr>
<td>LSTA35</td>
<td>1%</td>
<td>36 24-10d</td>
<td></td>
<td>1640</td>
<td>1640</td>
<td>I4, L3, L5, F2</td>
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<tr>
<td>LSTA49</td>
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<td>49 32-12d</td>
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<td>2975</td>
<td>2555</td>
<td>I4, L3, L5, F2</td>
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<tr>
<td>LSTA73</td>
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<td>73 48-12d</td>
<td></td>
<td>4205</td>
<td>3830</td>
<td>I4, L3, L5, F2</td>
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<tr>
<td>MSTA9</td>
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<td>9 8-10d</td>
<td></td>
<td>750</td>
<td>645</td>
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<tr>
<td>MSTA12</td>
<td>1%</td>
<td>12 10-10d</td>
<td></td>
<td>940</td>
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<tr>
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<td>2835</td>
<td>2305</td>
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</table>

1. Loads include a 60% load duration increase on the fasteners for wind or earthquake loading.
2. 100x1½ nails may be substituted where 16d sinks or 10d are specified at 100% of the table loads except where straps are installed over sheathing.
3. 10d commons may be substituted where 16d sinks are specified at 100% of table loads.
4. 16d sinks (0.148" dia. x 3½" long) or 10d commons may be substituted where 16d commons are specified at 0.84 of the table loads.
5. Use half of the nails in each member being connected to achieve the listed loads.
6. Tension loads apply for uplift when installed vertically.
7. NAILS: 16d = 0.162" dia. x 3½" long, 16d Sinker = 0.148" dia. x 3½" long, 10d = 0.148" dia. x 3" long, 10dx1½ = 0.148" dia. x 2½" long. See page 22-23 for other nail sizes and information.
Additional standoff bases are on page 232.

The AB series of retrofit adjustable post bases provide a 1" standoff for the post, are slotted for adjustability and can be installed with nails, Strong-Drive® SD Connector screws or bolts (ABU). Depending on the application needs, these adjustable standoff post bases are designed for versatility, cost-effectiveness and maximum uplift performance.

Features:
- The slot in the base enables flexible positioning around the anchor bolt, making precise post placement easier.
- The 1" standoff helps prevent rot at the end of the post and meets code requirements for structural posts installed in basements or exposed to weather or water splash.

**MATERIAL:** Variates (see table)

**FINISH:** All galvanized, most offered in ZMAX®; see Corrosion Information, pages 13-15.

**INSTALLATION:** Use all specified fasteners. See General Notes.
- See our Anchoring and Fastening Systems for Concrete and Masonry catalog, or visit www.strongtie.com for retrofit anchor options or reference technical bulletin T-ANCHORSPEC.
- Post bases do not provide adequate resistance to prevent members from rotating about the base and therefore are not recommended for non top-supported installations (such as fences or unbraced carpents).
- Place the base, load transfer plate and nut on the anchor bolt. Loosely tighten the nut.

**ABW**—Place the standoff base and then the post in the ABW and fasten on three vertical sides, using nails or Strong-Drive SD Connector screws.
- Make any necessary adjustments to post placement and tighten the nut securely on the anchor bolt.
- Bend up the fourth side of the ABW and fasten using the correct fasteners.

**ABU**—Place the standoff base and then the post in the ABU.
- Fasten using nails or Strong-Drive SD Connector screws or bolts (ABU88Z, ABU1010Z – SDS optional).

**ABA**—Place the post in the ABA.
- Fasten using nails or Strong-Drive SD Connector screws.

**CODES:** See page 12 for Code Reference Key Chart.

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

These products are approved for installation with the Strong-Drive® SD Connector screw. See page 27 for more information.

### Model No. Specifications
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</table>

Typical ABWZ Installation

Typical ABU44Z Installation

1. Uplift loads have been increased for wind or earthquake with no further increase allowed; reduce where other loads govern.
2. Downloads may not be increased for short-term loading.
3. Specifier to design concrete for uplift capacity.
4. ABU products may be installed with either bolts or nails (not both) to achieve table loads. ABU88Z, ABU88R, ABU1010Z, and ABU1010RZ may be installed with 8X-90° Strong-Drive® SDS Heavy-Duty Connector screws (sold separately) for the same table load.
5. For AB bases, higher download can be achieved by solidly packing groud under 1" standoff plate before installation. Base download on column, groud, or concrete according to the code.
6. HB dimension is the distance from the bottom of the post up to the first bolt hole.
7. Structural composite lumber columns have sides that show either the full face or the edges of the lumber strands/veneers. For SCI columns, the fasteners for these products should always be installed in the wide face.
8. Downloads shall be reduced where limited by the capacity of the post. See pages 245-246 for common post allowable loads.
9. NAILS: 16d = 0.162" dia. x 3½ long, 10d = 0.148" dia. x 3½ long, see page 22-23 for other nail sizes and information.
**PCZ/EPCZ Post Caps**

The next-generation PCZ/EPCZ post caps are designed with their post and beam flanges in-line so that one PCZ/EPCZ model can accommodate several post sizes. The PCZ/EPCZ now uses easier-to-install 10d common nails. An alternate choice of fasteners is Strong-Drive® #9x1⅛ SD Connector screws. ZMAX® finish is standard to meet exposure conditions in many environments. See additional corrosion information at www.strongtie.com/info.

**MATERIAL:** 16 gauge  
**FINISH:** ZMAX coating

**INSTALLATION:**
- Use all specified fasteners; see General Notes.  
- Do not install bolts into pilot holes.

**OPTIONS:**
- For end conditions, specify EPCZ post caps.  
- For heavy-duty applications, see CCQ and CC Series.  
- For retrofit applications, see AC and LC Series.

**CODES:** See page 12 for Code Reference Key Chart.

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These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

These products are approved for installation with the Strong-Drive® SD Connector screw. See page 27 for more information.

---

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</table>

1. Allowable loads have increased for wind or earthquake with no further increase allowed; reduce where other loads govern.  
2. Uplift loads do not apply to spliced conditions. Spliced conditions must be detailed by the Designer to transfer tension loads between spliced members by means other than the post cap.  
3. Structural composite lumber columns have sides that show either the wide face or the edges of the lumber strands/veneers. Values in the tables reflect installation into the wide face and do not allow for installation into the narrow face.  
4. Post and beam may consist of multiple members provided they are connected independently of the post cap fasteners.  
5. 10d or 2⅛ (0.148" dia. x 2⅛" long) nails may be used with no load reduction for uplift and 0.85 of the table loads for lateral.  
6. Strong-Drive® SD9x1½ Connector screws may be substituted for table fasteners with no load reduction.  
7. Models available for rough size lumber, specify RZ suffix. Ex. PC4RZ.  
8. NAILS: 1-⅞" = 0.148" dia. x 3" long. See page 22-23 for other nail sizes and information.  
9. SCREWS: SD9112 = 0.131" dia. x 1⅛" long.