# STRUCTURAL CALCULATIONS

Branch ENGINEERING inc
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SURVEYING

**DATE:** November 5, 2024

**PROJECT: 18-220** ***LO-PRO*** **BEAM MOUNT**

**BY:** JOSHUA ANNETT, P.E.
**CHECKED BY:** RICK HERNANDEZ, P.E., S.E. (OR and WA)
RON DERRICK, P.E., (CA)

**PROJECT DESCRIPTION & SCOPE OF SERVICES:**
Structural design in accordance with the 2021 International Building Code (IBC) for the above referenced project as follows:

Wood-Bolted Connection Analysis | Steel Assembly Analysis

Should conditions differ from those depicted in this report or accompanying drawings, contact this office for further direction. The analyses contained herein is for the ***LO-PRO*** BEAM MOUNT only. Branch Engineering, Inc. has not reviewed any framing or foundation elements for any structure considered to be supporting the above referenced product and/or the connected patio roof.

**SPECIAL INSPECTION:**
None

**NOTES:**
Analysis based upon drawing file containing renderings of ***LO-PRO*** BEAM MOUNT, supplied by Woodstone Structures, LLC February 2022.
No analysis of supporting structure or supporting framing has been conducted in conjunction with this report. Consult a local Engineer for each individual installation scenario.
See additional notes below "***LO-PRO*** BEAM MOUNT Allowable Loads" table.

Josh Annett 2024.11.05 11:40:22-08'00'
REGISTERED PROFESSIONAL ENGINEER #104978PE
DIGITALLY SIGNED
OREGON
MAY 14, 2024
JOSHUA J. ANNETT
RENEWS: DEC. 31, 2025

Digitally signed by Ricardo Hernandez
RICARDO A HERNANDEZ
STATE OF WASHINGTON
50932
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER
RENEWS: OCTOBER 20, 2026
DIGITALLY SIGNED

Ron Derrick
Digitally signed by Ron Derrick
Date: 2024.11.05 12:44:40 -08'00'
REGISTERED PROFESSIONAL ENGINEER
RONALD J. DERRICK
NO. 46,576
CIVIL
STATE OF CALIFORNIA
DIGITALLY SIGNED
Expires: JUNE 30, 2025

# STRUCTURAL ENGINEERING REPORT

**PROJECT: 18-220** ***LO-PRO* BEAM MOUNT**
**CLIENT:** **WOODSTONE STRUCTURES, LLC**
**REPORT BY:** **BRANCH ENGINEERING, INC.**

## *LO-PRO* BEAM MOUNT

DESCRIPTION:

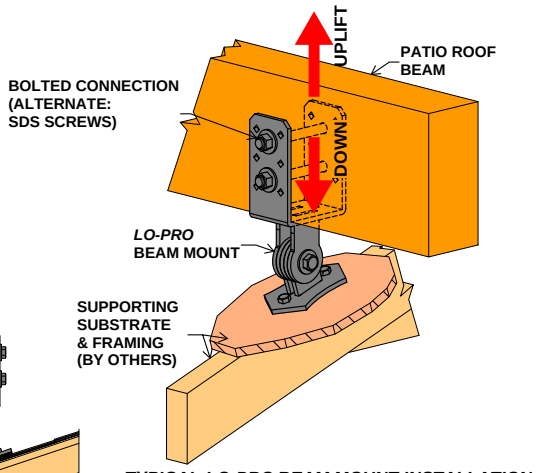
This structural engineering report has been requested by Woodstone Structures, LLC for preliminary analysis of a proprietary product called, "***LO-PRO* Beam Mount**." The objective of this analysis is to report the allowable capacity of the product, in its current configuration, for use in supporting vertical loading in both the downward direction and in uplift.

ASSUMED MATERIAL:

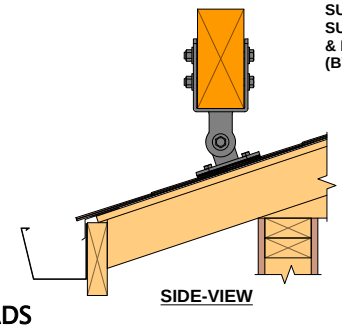
STEEL PLATE - 1/4" ASTM A36
(2) 1/2" DIA. ASTM A307 BOLT
(1) 5/8" DIA. ASTM A449 (GRADE 8) BOLT
(2) 3/8" DIA. ASTM A307 LAG SCREW
BEAM - SPECIES PER TABLE (NOT SUPPLIED)

OPTIONS:

Variable pitch per table.
Installation on 4x blocking.
(12) ¼"x1½" SDS SCREWS




**TYPICAL *LO-PRO* BEAM MOUNT INSTALLATION**



**SIDE-VIEW**

## *LO-PRO* BEAM MOUNT ALLOWABLE LOADS

| ROOF PITCH | DOUG-FIR G=0.50 | | | | | HEM-FIR G=0.43 | | | | | WESTERN CEDAR G=0.36 | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) |
| | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| SIDEWALL | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1490 | 1355 |
| 12:12 | 2105 | 2105 | 2105 | 2105 | 1460 | 2105 | 2105 | 2105 | 2105 | 1460 | 2105 | 2105 | 2105 | 2105 | 1355 |
| 8:12 | 2685 | 2685 | 2685 | 2685 | 1575 | 2685 | 2685 | 2685 | 2685 | 1575 | 2685 | 2685 | 2685 | 2685 | 1355 |
| 6:12 | 3330 | 3330 | 3330 | 3330 | 1660 | 3330 | 3330 | 3330 | 3330 | 1620 | 3330 | 3330 | 3330 | 3330 | 1355 |
| 5:12 | 3805 | 3805 | 3805 | 3805 | 1725 | 3505 | 3805 | 3805 | 3805 | 1620 | 3680 | 3805 | 3805 | 3805 | 1355 |
| 4:12 | 4350 | 4350 | 4350 | 4350 | 1810 | 3505 | 3895 | 3895 | 3895 | 1620 | 3680 | 4090 | 4090 | 4090 | 1355 |
| 2:12 | 4350 | 4350 | 4350 | 4350 | 1885 | 3505 | 3895 | 3895 | 3895 | 1620 | 3680 | 4090 | 4090 | 4090 | 1355 |
| 0:12 | 4350 | 4350 | 4350 | 4350 | 1885 | 3505 | 3895 | 3895 | 3895 | 1620 | 3680 | 4090 | 4090 | 4090 | 1355 |

NOTES:

1. FOR ***LO-PRO* BEAM MOUNT** INSTALLED ON THE FACE OF A VERTICAL WALL, USE "SIDEWALL".
2. ALLOWABLE LOADS SHOWN ARE FOR A SINGLE ***LO-PRO* BEAM MOUNT** INSTALLED AT THE INDICATED ROOF SLOPE. ALL INSTALLATIONS SHOULD USE MIN. OF (3) ***LO-PRO* BEAM MOUNT** BRACKETS, UNLESS APPROVED BY ENGINEER.
3. ANALYSIS AND ALLOWABLE LOADS ARE FOR THE STEEL BRACKET ONLY.
4. CONSULT WITH A LOCAL ENGINEER FOR EACH INDIVIDUAL INSTALLATION.
5. NO DESIGN OF SUPPORTING OR SUPPORTED FRAMING HAS BEEN CONDUCTED. CONSULT AN INDEPENDENT ENGINEER FOR DESIGN OF SUCH FRAMING.
6. UPLIFT LOADS HAVE BEEN INCREASED FOR WIND OR SEISMIC LOADING, WITH NO FURTHER INCREASE ALLOWED.
7. ALLOWABLE LOADS ARE FOR VERTICAL LOADS ONLY. LATERAL BRACING MUST BE SUPPLIED BY OTHER LATERAL FORCE RESISTING SYSTEMS DESIGNED BY OTHERS. LATERAL BRACING SYSTEMS MUST BE INDEPENDENT FROM THE ***LO-PRO* BEAM MOUNT** BRACKET.
8. UP TO 1/4" VERTICAL MOVEMENT WITHIN ***LO-PRO* BEAM MOUNT** MAY BE EXPECTED WHEN THE ***LO-PRO* BEAM MOUNT** BRACKET IS LOADED AT OR NEAR LOADS SHOWN ABOVE.
9. ALLOWABLE LOADS SHOWN ARE FOR DRY-SERVICE CONDITIONS ONLY (MOISTURE CONTENT <19%). FOR WET-SERVICE CONDITIONS, MULTIPLY BY 0.7.
10. BOLT HOLES SHALL BE A MINIMUM OF 1/32" AND A MAXIMUM OF 1/16" LARGER THAN THE BOLT DIAMETER (PER NDS SEC. 11)
11. FASTENERS CONNECTING ***LO-PRO* BEAM MOUNT** TO BEAM SHALL HAVE MINIMUM OF 2" END DISTANCE.
12. INSTA-PITCH BAR IS ASSUMED TO BE INSTALLED IN A PLUMB CONDITION.
13. WELDING ON ***LO-PRO* BEAM MOUNT** BRACKET AT BASE PLATE CONNECTION TO DOUBLE-PLATE KNUCKLE IS ASSUMED TO BE COMPLETED IN ACCORDANCE WITH THE CURRENT VERSION OF AWS D1.1 OR OTHER GOVERNING DOCUMENTS AND PERIODIC SPECIAL INSPECTION PROVIDED IN ACCORDANCE WITH 2018 IBC SECTION 17. WELD ASSUMED TO BE EQUIVALENT TO (2) 1/8" FILLET WELDS 1-1/2" LONG AT EACH SLOT IN BASE PLATE.
14. ALLOWABLE LOADS HAVE BEEN BASED ON THE FULL STEEL TENSILE CAPACITY OF THE PROVIDED LAG SCREWS. WHERE INSTALLED CONDITIONS RESULT IN THE WITHDRAWAL CAPACITY OF THE LAG SCREW BEING LESS THAN ITS FULL TENSILE CAPACITY, REDUCE ALLOWABLE UPLIFT LOADS BASED ON THE RATIO OF WITHDRAWAL CAPACITY TO FULL TENSILE CAPACITY OF 1241 LBS.
15. BASEPLATE MAY EXPERIENCE YIELDING AT THE ABOVE STATED UPLIFT CAPACITY. SUBSEQUENT REPLACEMENT MAY BE REQUIRED.
16. MINIMUM BEAM SIZE FOR FULL ALLOWABLE UPLIFT LOAD IS 4X8. FOR INSTALLATIONS USING 4X6 BEAM, MULITPLY UPLIFT ALLOWABLE LOAD BY 0.67.

# STRUCTURAL ENGINEERING REPORT

## *LO-PRO* BEAM MOUNT (cont.)

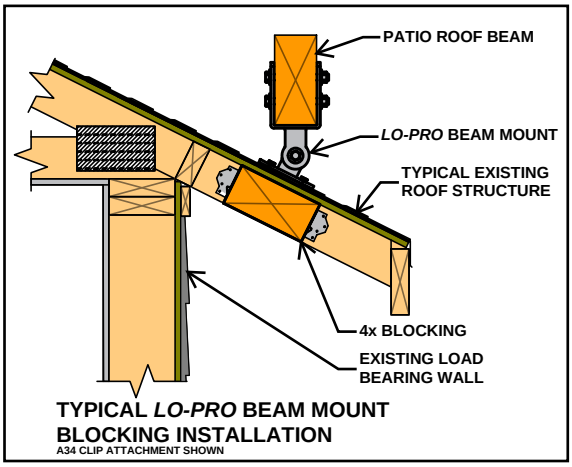
## OPTIONAL BLOCKING INSTALLATION

INSTALLATION OPTION:

The ***LO-PRO* BEAM MOUNT** may be installed on blocking between rafters or truss members, where sufficient framing does not exist. For this installation a length of 4x blocking is added between existing roof supporting members and secured with either framing clips, lag screws, or nails. Actual capacity may vary depending on the available existing roof members. Consult a local Engineer for each individual scenario.

ASSUMED MATERIALS:

***LO-PRO* BEAM MOUNT** BRACKET & ALL INCLUDED ACCESSORIES
4x8 #2 DF BLOCKING AT EACH ***LO-PRO* BEAM MOUNT** (22½" MAX LENGTH)
(4) SIMPSON STRONG-TIE A34 FRAMING CLIPS
& ASSOCIATED FASTENERS (NOT SUPPLIED)
OR NAILS OR LAG SCREWS PER TABLES BELOW (NOT SUPPLIED)




**TYPICAL *LO-PRO* BEAM MOUNT BLOCKING INSTALLATION**
A34 CLIP ATTACHMENT SHOWN

### *LO-PRO* BEAM MOUNT ALLOWABLE LOAD NEAR THE END OF 4x BLOCKING

| ROOF PITCH | (2) A34 w/ #9x1.5" SD EA. END | | | | | (2) A34 w/ 0.131x1.5" NAILS EA. END | | | | | (6) 10d NAIL AT 1.5" SPACING EA. END | | | | | (3) 3/8" LAG SCREWS AT EQ. SPACING EA. END | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) |
| | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| 12:12 | 454 | 505 | 505 | 505 | 505 | 335 | 372 | 372 | 372 | 372 | 312 | 347 | 399 | 434 | 555 | 179 | 199 | 229 | 248 | 318 |
| 8:12 | 508 | 565 | 565 | 565 | 565 | 366 | 407 | 407 | 407 | 407 | 316 | 351 | 404 | 439 | 562 | 182 | 203 | 233 | 253 | 324 |
| 6:12 | 562 | 624 | 624 | 624 | 624 | 397 | 442 | 442 | 442 | 442 | 325 | 362 | 416 | 452 | 579 | 189 | 209 | 241 | 262 | 335 |
| 5:12 | 601 | 667 | 667 | 667 | 667 | 420 | 467 | 467 | 467 | 467 | 333 | 370 | 425 | 462 | 592 | 193 | 215 | 247 | 269 | 344 |
| 4:12 | 652 | 725 | 725 | 725 | 725 | 450 | 500 | 500 | 500 | 500 | 343 | 381 | 438 | 477 | 610 | 200 | 222 | 255 | 278 | 355 |
| 2:12 | 816 | 907 | 907 | 907 | 907 | 541 | 601 | 601 | 601 | 601 | 374 | 416 | 478 | 520 | 666 | 220 | 244 | 281 | 305 | 391 |
| 0:12 | 1152 | 1280 | 1280 | 1280 | 1280 | 711 | 790 | 790 | 790 | 790 | 427 | 474 | 545 | 593 | 758 | 253 | 281 | 323 | 351 | 450 |

### *LO-PRO* BEAM MOUNT ALLOWABLE LOAD AT MID-SPAN OF 4x BLOCKING

| ROOF PITCH | (2) A34 w/ #9x1.5" SD EA. END | | | | | (2) A34 w/ 0.131x1.5" NAILS EA. END | | | | | (6) 10d NAIL AT 1.5" SPACING EA. END | | | | | (3) 3/8" LAG SCREWS AT EQ. SPACING EA. END | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) | DEAD ONLY (90) | FLOOR (100) | SNOW (115) | ROOF (125) | UPLIFT (160) |
| | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| 12:12 | 757 | 841 | 841 | 841 | 841 | 657 | 730 | 730 | 730 | 730 | 625 | 694 | 798 | 868 | 1111 | 358 | 397 | 457 | 497 | 636 |
| 8:12 | 804 | 894 | 894 | 894 | 894 | 714 | 793 | 793 | 793 | 793 | 633 | 703 | 808 | 879 | 1125 | 365 | 405 | 466 | 507 | 648 |
| 6:12 | 855 | 951 | 951 | 951 | 951 | 772 | 857 | 857 | 857 | 857 | 651 | 723 | 832 | 904 | 1157 | 377 | 419 | 482 | 524 | 670 |
| 5:12 | 893 | 992 | 992 | 992 | 992 | 813 | 904 | 904 | 904 | 904 | 666 | 740 | 851 | 925 | 1184 | 387 | 430 | 494 | 537 | 688 |
| 4:12 | 941 | 1046 | 1046 | 1046 | 1046 | 868 | 964 | 964 | 964 | 964 | 686 | 763 | 877 | 953 | 1220 | 400 | 444 | 511 | 555 | 711 |
| 2:12 | 1087 | 1208 | 1208 | 1208 | 1208 | 1034 | 1149 | 1149 | 1149 | 1149 | 749 | 832 | 957 | 1040 | 1331 | 440 | 488 | 562 | 610 | 781 |
| 0:12 | 1341 | 1490 | 1490 | 1490 | 1490 | 1341 | 1490 | 1490 | 1490 | 1490 | 853 | 948 | 1090 | 1185 | 1517 | 506 | 562 | 646 | 703 | 899 |

NOTES:

1. ALLOWABLE LOADS SHOWN ARE FOR A SINGLE ***LO-PRO* BEAM MOUNT** INSTALLED AT THE INDICATED ROOF SLOPE, AND SECURED TO 4x8 #2 DF BLOCKING SPANNING BETWEEN EXISTING ROOF MEMBERS.
2. ANALYSIS AND ALLOWABLE LOADS ARE FOR THE BLOCKING, CLIPS, AND/OR FASTENERS ONLY.
3. CONSULT WITH A LOCAL ENGINEER FOR EACH INDIVIDUAL INSTALLATION.
4. NO DESIGN OF SUPPORTING OR SUPPORTED FRAMING HAS BEEN CONDUCTED. CONSULT AN INDEPENDENT ENGINEER FOR DESIGN OF SUCH FRAMING.
5. LOADS MAY BE REDUCED TO LESS THAN 200 POUNDS WHERE LOAD IS APPLIED TO A SINGLE 2x4 RAFTER OR TRUSS TAIL CANTILEVERING 18" BEYOND BEARING WALL.
6. UPLIFT LOADS HAVE BEEN INCREASED FOR WIND OR SEISMIC LOADING, WITH NO FURTHER INCREASE ALLOWED.
7. ALLOWABLE LOADS ARE FOR VERTICAL LOADS ONLY. LATERAL BRACING MUST BE SUPPLIED BY OTHER LATERAL FORCE RESISTING SYSTEMS DESIGNED BY OTHERS. LATERAL BRACING SYSTEMS MUST BE INDEPENDENT FROM THE ***LO-PRO* BEAM MOUNT** SUPPORT BRACKET & POSTS.
8. ALLOWABLE LOADS SHOWN ARE FOR DRY-SERVICE CONDITIONS ONLY (MOISTURE CONTENT <19%). FOR WET-SERVICE CONDITIONS, MULTIPLY BY 0.7.
9. SEE ***LO-PRO* BEAM MOUNT** ALLOWABLE LOAD TABLE FOR ADDITIONAL INFORMATION RELATING TO THE ALLOWABLE CAPACITY OF THE ***LO-PRO* BEAM MOUNT**.
10. LAG SCREWS SHALL HAVE A SUFFICIENT LENGTH (NOT INCLUDING THE LENGTH OF THE TAPERED TIP) SUCH THAT THE MINIMUM PENETRATION LENGTH INTO THE BLOCKING IS NOT LESS THAN 3" (8D), WHERE "D" IS THE LAG SCREW DIAMETER.
11. WHERE LAG SCREW PENETRATION LENGTH (P) IS LESS THAN 8D BUT NOT LESS THAN 4D, TABULATED VALUES ABOVE SHALL BE MULTIPLIED BY P/8D.
12. EXISTING ROOF SUPPORTING MEMBER MINIMUM END DISTANCE FOR LAG SCREWS SHALL BE 7D.
13. MINIMUM EDGE DISTANCE FOR LAG SCREWS SHALL BE 4D.
14. MINIMUM SPACING BETWEEN ROWS OF LAG SCREW SHALL BE 5D.

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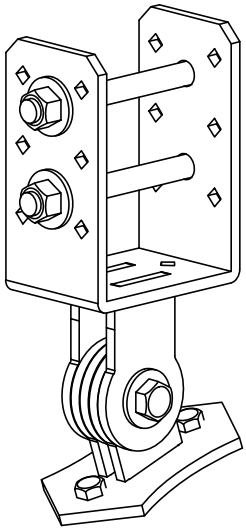
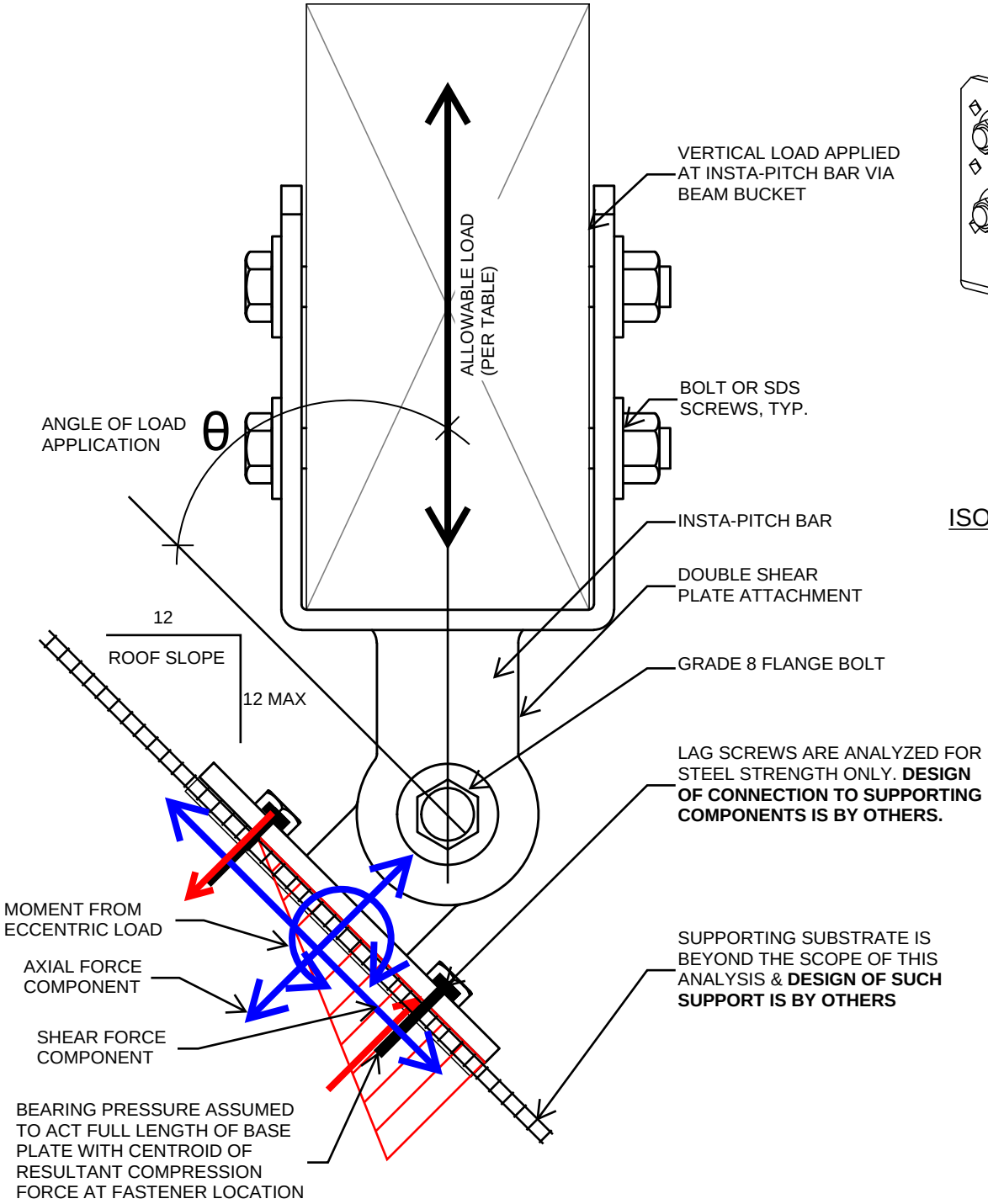
PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.

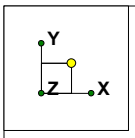
PATIO ROOF RISER SKETCH & CALCULATION ORIENTATION/AXES



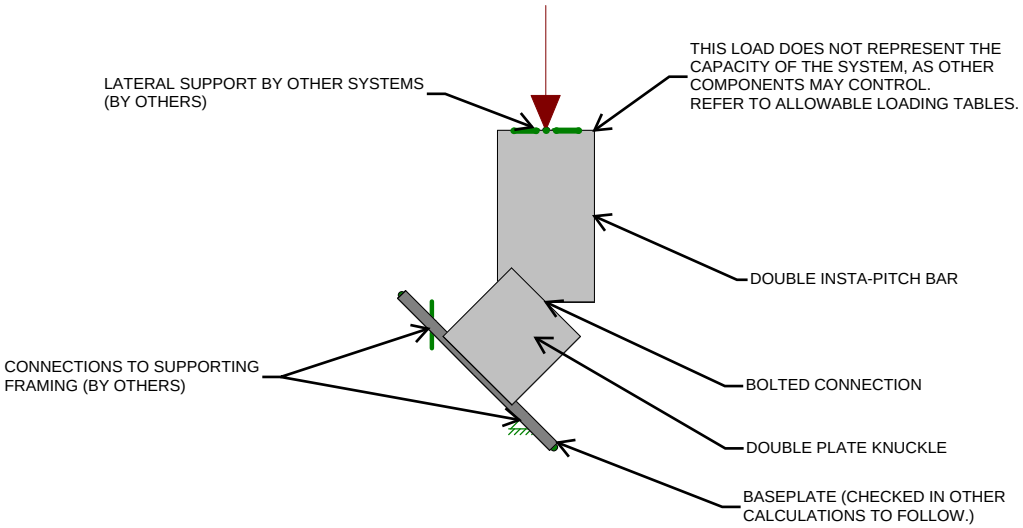
ISOMETRIC VIEW




NOTE: SKETCH IS NOT TO SCALE
NOT FOR CONSTRUCTION




ASSEMBLY COMPRESSION CHECK




Loads: BLC 1,

| | | |
|---|---|---|
| BRANCH ENGINEERING,... | LO-PRO BEAM MOUNT | |
| JOSHUA ANNETT | | |
| 18-220 | | |

## Hot Rolled Steel Properties

| | Label | E [ksi] | G [ksi] | Nu | Therm (\1E5 F) | Density[lb/ft^3] | Yield[ksi] |
|---|---|---|---|---|---|---|---|
| 1 | A36 Gr.36 | 29000 | 11154 | .3 | .65 | 490 | 36 |

## Hot Rolled Steel Section Sets

| | Label | Shape | Type | Design List | Material | Design Rules | A [in2] | I (90,270) [in4] | I (0,180) [in4] |
|---|---|---|---|---|---|---|---|---|---|
| 1 | HR1A | PL1/4x2.25 | Beam | None | A36 Gr.36 | Typical | .563 | .003 | .237 |
| 2 | HR2 | PL1/4x2.25 | Column | None | A36 Gr.36 | Typical | .563 | .003 | .237 |

## Member Primary Data

| | Label | I Joint | J Joint | Rotate(deg) | Section/Shape | Type | Design List | Material | Design Rules |
|---|---|---|---|---|---|---|---|---|---|
| 1 | BASE | N1 | N2 | 90 | HR1A | Beam | None | A36 Gr.36 | Typical |
| 2 | PL1 | N3 | N4 | | HR1A | Beam | None | A36 Gr.36 | Typical |
| 3 | INSTA PITCH B... | N4 | N5 | | HR2 | Column | None | A36 Gr.36 | Typical |
| 4 | PL2 | N3 | N4 | | HR1A | Beam | None | A36 Gr.36 | Typical |

## Hot Rolled Steel Design Parameters

| | Label | Shape | Length[in] | Lb-out[in] | Lb-in[in] | Lcomp top[in] | Lcomp bot[in] | L-torqu... | K-out | K-in | Cb | Function |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | BASE | HR1A | 5 | | | Lb out | | | | | | |
| 2 | PL1 | HR1A | 2.25 | | | Lb out | | | | | | |
| 3 | INSTA PIT... | HR2 | 4 | | | Lb out | | | | | | |
| 4 | PL2 | HR1A | 2.25 | | | Lb out | | | | | | |

## Joint Loads and Enforced Displacements (BLC 1 : )

| | Joint Label | L,D,M | Direction | Magnitude[(lb,lb-ft), (in,rad), (lb*s^2/in, lb*s^2*in)] |
|---|---|---|---|---|
| 1 | N5 | L | Y | -6500 |

## Load Combinations

| | Description | So... | P... | S... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... | BLC | Fac... |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | CAPACITY | Yes | Y | | 1 | 1.6 | | | | | | | | | | | | | | | | | | |

## Member AISC 15th(360-16): LRFD Steel Code Checks (By Combination)

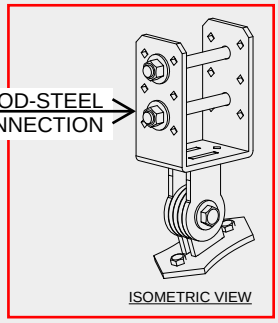
| | LC | Member | Shape | UC Max | Loc[in] | Shear UC | Loc[in] | phi*Pnc[lb] | phi*Pnt[lb] | phi*Mn[lb-ft] | Cb | Eqn |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | PL1 | PL1/4x2.25 | .986 | 0 | .546 | 0 | 17351.297 | 18241.2 | 853.2 | 1.667 | H1-1a |
| 2 | 1 | INSTA PITCH ... | PL1/4x2.25 | .668 | 0 | .000 | 0 | 15574.094 | 18241.2 | 836.716 | 1 | H1-1a |
| 3 | 1 | PL2 | PL1/4x2.25 | .986 | 0 | .546 | 0 | 17351.297 | 18241.2 | 853.2 | 1.667 | H1-1a |

**UC≤1.0 = OK!**

AMERICAN WOOD COUNCIL



*Codes & Standards > Calculators & Software > Connection Calculator*




| | |
|---|---|
| **Design Method** | Allowable Stress Design (ASD) |
| **Connection Type** | Lateral loading |
| **Fastener Type** | Bolt |
| **Loading Scenario** | Double Shear - Wood Main Member |
| | Submit Initial Values |

| | |
|---|---|
| **Main Member Type** | Douglas Fir-Larch |
| **Main Member Thickness** | 3.5 in. |
| **Main Member: Angle of Load to Grain** | 90 |
| **Side Member Type** | Steel |
| **Side Member Thickness** | 1/4 in. |
| **Side Member: Angle of Load to Grain** | 0 |
| **Fastener Diameter** | 1/2 in. |
| **Load Duration Factor** | C_D = 1.0 |
| **Wet Service Factor** | C_M = 1.0 |
| **Temperature Factor** | C_t = 1.0 |

**Calculate Connection Capacity**

Connection Yield Mode Descriptions | Limits of Use

Diaphragm Factor Help | Load Duration Factor Help | Technical Help

Show Printable View

# Connection Yield Modes

| | |
|---|---|
| Im | 1103 lbs. |
| Is | 4350 lbs. |
| IIIs | 1026 lbs. |
| IV | 1194 lbs. |

| | |
|---|---|
| **Adjusted ASD Capacity** | **1026 lbs.** |

ASD CAPACITY FOR (2) BOLTS = 2 * 1026# = 2052#

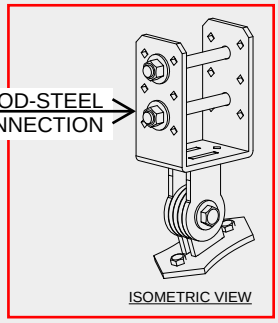
- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for steel side members 1/4 in. thick, and ASTM A653 Grade 33 Steel is assumed for steel side members less than 1/4 in. thick.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

The Connection Calculator was designed and created by Cameron Knudson, Michael Dodson and David Pollock at Washington State University. Support for development of the Connection Calculator was provided by American Wood Council.

AMERICAN WOOD COUNCIL






| | |
|---|---|
| Design Method | Allowable Stress Design (ASD) |
| Connection Type | Lateral loading |
| Fastener Type | Bolt |
| Loading Scenario | Double Shear - Wood Main Member |

Submit Initial Values

| | |
|---|---|
| Main Member Type | Hem-Fir |
| Main Member Thickness | 3.5 in. |
| Main Member: Angle of Load to Grain | 90 |
| Side Member Type | Steel |
| Side Member Thickness | 1/4 in. |
| Side Member: Angle of Load to Grain | 0 |
| Fastener Diameter | 1/2 in. |
| Load Duration Factor | C_D = 1.0 |
| Wet Service Factor | C_M = 1.0 |
| Temperature Factor | C_t = 1.0 |

Calculate Connection Capacity

Connection Yield Mode Descriptions | Limits of Use | Diaphragm Factor Help | Load Duration Factor Help | Technical Help | Show Printable View

# Connection Yield Modes

| | |
|---|---|
| Im | 893 lbs. |
| Is | 4350 lbs. |
| IIIs | 933 lbs. |
| IV | 1078 lbs. |

| | |
|---|---|
| **Adjusted ASD Capacity** | **893 lbs.** |

ASD CAPACITY FOR (2) BOLTS = 2 * 893# = 1786#

- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for steel side members 1/4 in. thick, and ASTM A653 Grade 33 Steel is assumed for steel side members less than 1/4 in. thick.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

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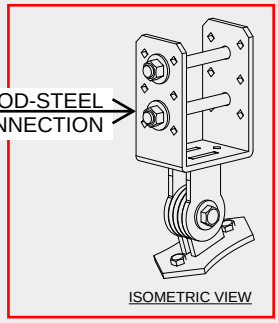


| | |
|---|---|
| Design Method | Allowable Stress Design (ASD) |
| Connection Type | Lateral loading |
| Fastener Type | Bolt |
| Loading Scenario | Double Shear - Wood Main Member |

Submit Initial Values

| | |
|---|---|
| Main Member Type | Western Cedars |
| Main Member Thickness | 3.5 in. |
| Main Member: Angle of Load to Grain | 90 |
| Side Member Type | Steel |
| Side Member Thickness | 1/4 in. |
| Side Member: Angle of Load to Grain | 0 |
| Fastener Diameter | 1/2 in. |
| Load Duration Factor | C_D = 1.0 |
| Wet Service Factor | C_M = 1.0 |
| Temperature Factor | C_t = 1.0 |

Calculate Connection Capacity

Connection Yield Mode Descriptions | Limits of Use | Diaphragm Factor Help | Load Duration Factor Help | Technical Help | Show Printable View

# Connection Yield Modes

| | |
|---|---|
| Im | 683 lbs. |
| Is | 4350 lbs. |
| IIIs | 825 lbs. |
| IV | 946 lbs. |

| | |
|---|---|
| **Adjusted ASD Capacity** | **683 lbs.** |

ASD CAPACITY FOR (2) BOLTS = 2 * 683# = 1366#

- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for steel side members 1/4 in. thick, and ASTM A653 Grade 33 Steel is assumed for steel side members less than 1/4 in. thick.

While every effort has been made to insure the accuracy of the information presented, and special effort has been made to assure that the information reflects the state-of-the-art, neither the American Wood Council nor its members assume any responsibility for any particular design prepared from this on-line Connection Calculator. Those using this on-line Connection Calculator assume all liability from its use.

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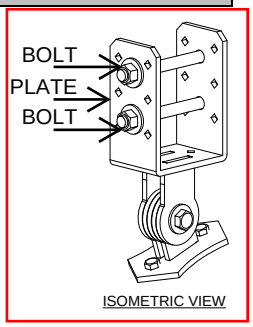
PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: (2) 0.5 BLT-PL

## Bolted Shear Connection Design for Bolts in Standard Holes

| | | | | | | |
|---|---|---|---|---|---|---|
| Steel thickness: | **0.25 in** | **x 2 PLs** | **0.5 in** | $F_y$: | 36 ksi | |
| Steel width: | **2.25 in** | | | $F_u$: | 58 ksi | |
| Steel specification: | **A36** | | | $\phi F_{nv}$: | 20.25 ksi | |
| Bolt diameter, d: | **0.5 in** | | | $A_{gv}$: | 2.5 in$^2$ | Shear Yielding |
| Bolt specification: | **A307** | | | $A_g$: | 1.13 in$^2$ | Tensile Yielding |
| Thread condition: | **N** | | | $A_{nv}$: | 2.03 in$^2$ | Shear Rupture |
| Bolt Hole Preparation Method: | **Punch** | | | $A_e$: | 0.81 in$^2$ | Tensile Rupture |
| Threaded Part $F_u$: | **60 ksi** | | | $A_{nv}$: | 2.03 in$^2$ | Block Shear |
| Bolt spacing, s: | **4 in** | | | $A_{gv}$: | 2.50 in$^2$ | Block Shear |
| End distance, $L_{ev}$: | **1 in** | | | $A_{nt}$: | 0.41 in$^2$ | Block Shear |
| Side distance, $L_{eh}$: | **1.125 in** | | | $U_{bs}$: | 1 | Block Shear |
| Number of bolts in row: | **2** | | | U: | 1 | Shear Lag Factor |
| Number of rows: | **1** | | | | | |



ISOMETRIC VIEW

| | | Φ | Ω | ASD CAPACITY |
|---|---|---|---|---|
| Shear Yielding: | $\phi R_n$ = 54.00 kip | 1.00 | 1.5 | 36.00 kip |
| Tensile Yielding: | $\phi R_n$ = 36.45 kip | 0.90 | 1.67 | 24.25 kip |
| Shear Rupture: | $\phi R_n$ = 53.02 kip | 0.75 | 2 | 35.34 kip |
| Tensile Rupture: | $\phi R_n$ = 35.34 kip | 0.75 | 2 | 23.56 kip |
| Block Shear Rupture: | $\phi R_n$ = 58.17 kip | 0.75 | 2 | 38.78 kip |
| Bolt Shear Strength: | $\phi R_n$ = 7.95 kip | 0.75 | 2 | 5.30 kip |
| Bearing Strength at Bolt Hole: | $\phi R_n$ = 35.89 kip | 0.75 | 2 | 23.93 kip |

**ASD Connection Design Strength: 5.30 kips**

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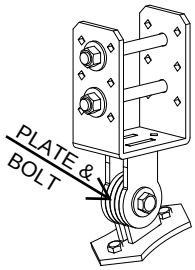
PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: 0.625 FLNG BLT-PL

## Bolted Shear Connection Design for Bolts in Standard Holes

| | | | | | | |
|---|---|---|---|---|---|---|
| Steel thickness: | **0.25 in** | **x 2 PLs** | **0.5 in** | $F_y$: | 36 ksi | |
| Steel width: | **2.25 in** | | | $F_u$: | 58 ksi | |
| Steel specification: | **A36** | | | $\phi F_{nv}$: | 50.625 ksi | |
| Bolt diameter, d: | **0.5625 in** | | | $A_{gv}$: | 0.5 in$^2$ | Shear Yielding |
| Bolt specification: | **A490** | | | $A_g$: | 1.13 in$^2$ | Tensile Yielding |
| Thread condition: | **N** | | | $A_{nv}$: | 0.34 in$^2$ | Shear Rupture |
| Bolt Hole Preparation Method: | **Drill** | | | $A_e$: | 0.81 in$^2$ | Tensile Rupture |
| Threaded Part $F_u$: | **150 ksi** | | | $A_{nv}$: | 0.34 in$^2$ | Block Shear |
| Bolt spacing, s: | **0 in** | | | $A_{gv}$: | 0.50 in$^2$ | Block Shear |
| End distance, $L_{ev}$: | **1 in** | | | $A_{nt}$: | 0.41 in$^2$ | Block Shear |
| Side distance, $L_{eh}$: | **1 in** | | | $U_{bs}$: | 1 | Block Shear |
| Number of bolts in row: | **1** | | | U: | 1 | Shear Lag Factor |
| Number of rows: | **1** | | | | | |



ISOMETRIC VIEW

| | | Φ | Ω | ASD CAPACITY |
|---|---|---|---|---|
| Shear Yielding: | $\phi R_n$ = 10.80 kip | 1.00 | 1.5 | 7.20 kip |
| Tensile Yielding: | $\phi R_n$ = 36.45 kip | 0.90 | 1.67 | 24.25 kip |
| Shear Rupture: | $\phi R_n$ = 8.97 kip | 0.75 | 2 | 5.98 kip |
| Tensile Rupture: | $\phi R_n$ = 35.34 kip | 0.75 | 2 | 23.56 kip |
| Block Shear Rupture: | $\phi R_n$ = 25.77 kip | 0.75 | 2 | 17.18 kip |
| Bolt Shear Strength: | $\phi R_n$ = 12.58 kip | 0.75 | 2 | 8.39 kip |
| Bearing Strength at Bolt Hole: | $\phi R_n$ = 17.94 kip | 0.75 | 2 | 11.96 kip |

**ASD Connection Design Strength: 5.98 kips**

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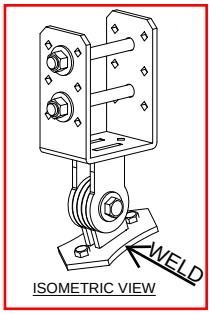
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: WELD

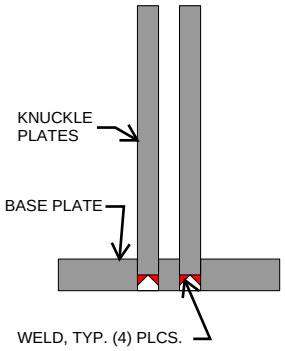
## Combined Strength of Weld in Axial, Shear, & Bending

| | | | |
|---|---|---|---|
| ROOF SLOPE | | 2:12 ← MAX CASE | |
| Axial Force, $P_u$ | | **3340.6 lb** | |
| Design Shear, $V_u$ | | **556.8 lb** | |
| Design Moment, $M_u$ | | **92.8 lb-ft** | |
| Design Torque, $T_u$ | | **0 lb-ft** | |
| BASE METAL Thickness | | **0.25 in** | |
| ATTACHED PART Thickness | | **0.25 in** | |
| | | FILLET | |
| Depth of Preparation, S | | **0 in** | |
| Weld type | | 2 | |
| d | | 1.5 in | |
| b | | 0.5 in | |
| Section Modulus of Weld | | 0.75 sq in | |
| Reduction Factor for Weld, ϕ | | 0.75 | |
| $F_{EXX}$ | | 70 ksi | |
| Weld Size Specified | | 0.125 in | |
| | | | UNTIY CHECK |
| Axial Stress in Weld | $f_a$ | 12.600 ksi | 0.40 |
| Shear Stress in Weld | $f_v$ | 2.100 ksi | 0.07 |
| Bending Stress in Weld | $f_b$ | 16.800 ksi | 0.53 |
| Torsional Stress in Weld | $f_t$ | 0.000 ksi | 0.00 |
| Allowable Stress in Weld | $F_w$ | 32 ksi | |
| Combined Unity Check | | 1.00 | OK |

weld configuration

1 2 3 4 5 6 7 8 9 10




| ROOF SLOPE | SIDEWALL | 12:12 | 8:12 | 6:12 | 5:12 | 4:12 | 2:12 | 0:12 | |
|---|---|---|---|---|---|---|---|---|---|
| $f_a$ | 0.00 | 2.81 | 4.22 | 5.62 | 6.63 | 7.88 | 12.60 | 17.10 | ksi |
| $f_v$ | 2.81 | 2.81 | 2.81 | 2.81 | 2.76 | 2.63 | 2.10 | 0.00 | ksi |
| $f_b$ | 22.50 | 22.50 | 22.50 | 22.50 | 22.11 | 21.00 | 16.80 | 0.00 | ksi |
| **TOAL UC** | **0.80** | **0.89** | **0.94** | **0.98** | **1.00** | **1.00** | **1.00** | **0.54** | |

OK FOR ALL LOADS AT VARYING PITCH
(SEE BRACKET STABILITY CALC TO FOLLOW)

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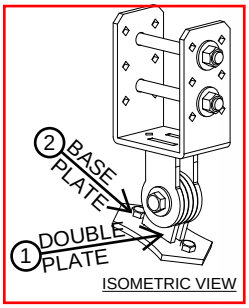
## BASE PLATE GEOMETRY PARAMETERS



ISOMETRIC VIEW

$N := 5\ in$ Base plate length

$s_N := 3\ in$ Anchor spacing

$B := 2.5\ in$ Base plate width

## MATERIAL SPECIFICATIONS

$\Omega_b := 1.67$

$F_y := 36\ ksi$ Steel yield stress

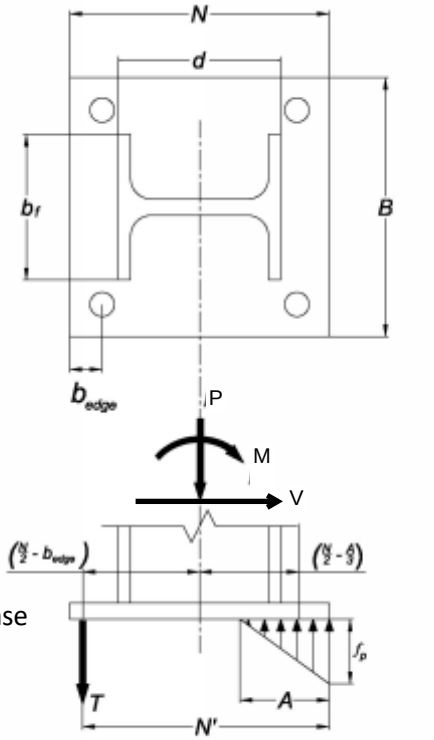
$t_p := 0.25\ in$ Steel plate thickness

$t_{pBP} := 0.375\ in$ Base plate steel thickness

SEE SHEET: "STATICS (WOOD SPECIES)"

## DESIGN FORCES

Tension Side of Base Plate



GENERIC BASE PLATE SHOWN
*Figure B.3. General definition of variables.*

$P := 1491\ lb$ Downward axial force at column base

$V := 1491\ lb$ Shear at attachment

$L := 2\ in$ Attachment moment arm

$M_{max} := V \cdot L = 2982\ lb \cdot in$ Moment at base of attachment

STEEL BASE PLATE DESIGN

## ① DOUBLE PLATE ATTACHMENT BENDING

$d := 1.5\ in$ Width of connecting bending element at baseplate

$n_{pl} := 2$ Number of plates at attachment

$S_x := \frac{n_{pl} \cdot t_p \cdot d^2}{6} = 0.19\ in^3$ Elastic section modulus of engaged portion of baseplate

$M_\Omega := \Omega_b^{-1} \cdot F_y \cdot S_x = 4041.92\ lb \cdot in$ Moment strength of baseplate

$$BendingCheck := \frac{M_{max}}{M_\Omega} = 0.74$$

## ② TENSION FORCE AT ANCHOR

$T := 1241\ lb$ Max tension at anchor line (Lag screw yielding)



Created with PTC Mathcad Express. See www.mathcad.com for more information.

## ② BASE PLATE BENDING - TENSION

$d := 1.5\ in$ Width of connecting bending element at baseplate

$x := \left(s_N - 0.95 \cdot d\right) \cdot 0.5 = 0.79\ in$ Effective cantilever distance of baseplate to tension anchor

$b := min\left(\frac{2 \cdot x}{\cos\left(45\ °\right)}, 2.5\ in\right) = 2.23\ in$ Effective width of baseplate engaged in bending

$Z_x := \frac{b \cdot {t_{pBP}}^2}{4} = 0.08\ in^3$ Plastic section modulus of engaged portion of baseplate

$m := T \cdot x = 977.29\ lb \cdot in$ Moment at tension side of baseplate

$M_\Omega := {\Omega_b}^{-1} \cdot F_y \cdot Z_x = 1688.05\ lb \cdot in$ Moment strength of baseplate

Moment at Base Plate - Case 1

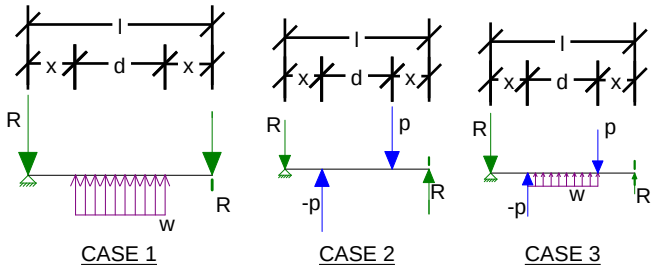
$M_1 := 1396\ lb \cdot in$ ← SEE MODEL RESULTS NEXT PAGE

Moment at Base Plate - Case 2

$M_2 := 663\ lb \cdot in$ ← SEE MODEL RESULTS NEXT PAGE

Moment at Base Plate - Case 3 (Max at 2:12)

$M_3 := 1176\ lb \cdot in$ ← SEE MODEL RESULTS NEXT PAGE




$$BendingCheck := \frac{\max\left(M_1, M_2, M_3\right)}{M_\Omega} = 0.83$$

## ② SHEAR AT BASE PLATE - STEEL AT GAP BETWEEN KNUCKLE PLATE INSET IN BASE PLATE

$\Omega_V := 1.67$

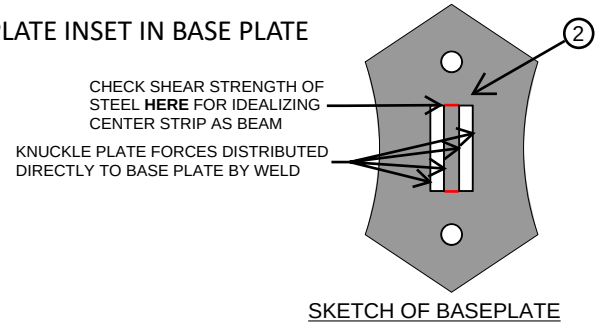
$C_v := 1.0$

$b := 0.25\ in$

$t_{pBP} = 0.38\ in$

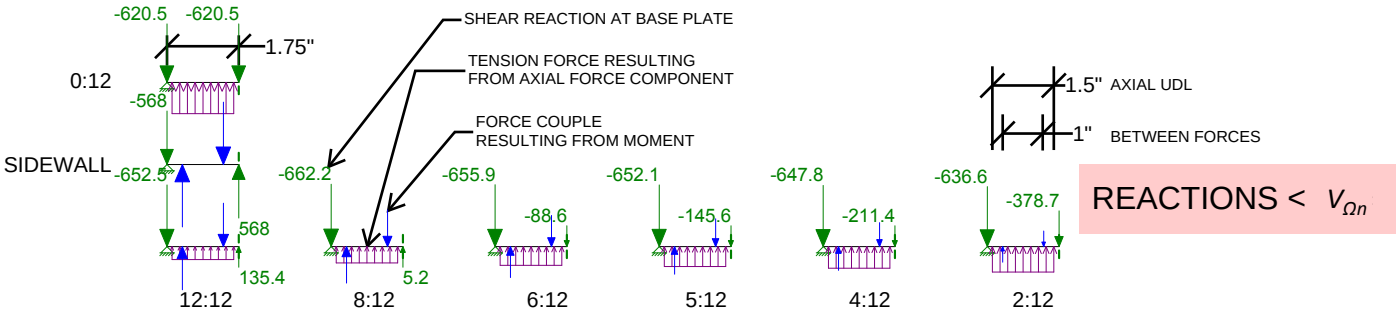
$A_w := b \cdot t_{pBP} = 0.09\ in^2$

$V_{\Omega n} := {\Omega_V}^{-1} \cdot 0.6\ F_y \cdot A_w \cdot C_v = 1212.57\ lbf$




SKETCH OF BASEPLATE

BEAM MODELS OF STRIP BETWEEN KNUCKLE PLATES - LOAD CASE FACTOR = 0.5




REACTIONS < $V_{\Omega n}$



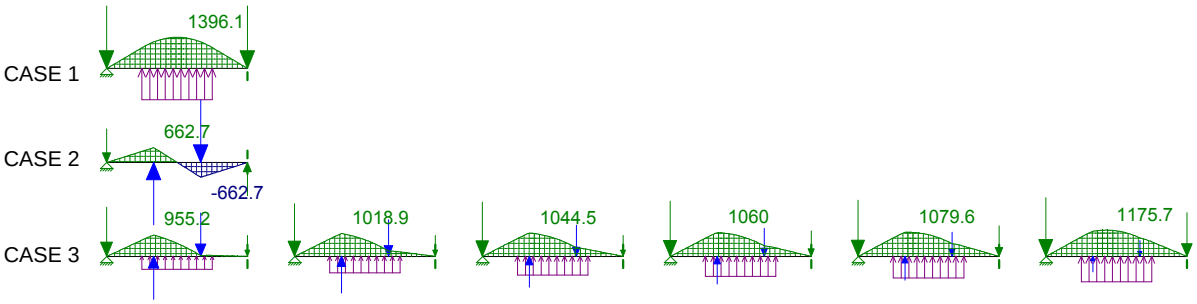
Created with PTC Mathcad Express. See www.mathcad.com for more information.

Company : BRANCH ENGINEERING, INC.
Designer : JOSHUA ANNETT
Job Number :
Model Name :

Checked By: RICK HERNANDEZ, P.E., S.E.

## *Maximum Member Section Forces (By Combination)*

| | | LC | Member Label | | Axial[lb] | Loc[in] | Shear[lb] | Loc[in] | Moment[lb-in] | Loc[in] |
|---|---|---|---|---|---|---|---|---|---|---|
| CASE 1 | 1 | 1 | M1 | max | 0 | 0 | 1241.003 | 2.25 | 1396.128 | 1.5 |
| | 2 | | | min | 0 | 0 | -1241.002 | 0 | 0 | 0 |
| CASE 2 | 3 | 1 | M2 | max | 0 | 0 | 1325.387 | 1 | 662.693 | 1 |
| | 4 | | | min | 0 | 0 | -662.693 | 0 | -662.693 | 2 |
| CASE 3 | 5 | 1 | M3 | max | 0 | 0 | 1242.415 | 1.969 | 955.151 | 1 |
| | 6 | | | min | 0 | 0 | -976.696 | 0 | 0 | 0 |
| | 7 | 1 | M4 | max | 0 | 0 | 1189.271 | 1.969 | 1018.94 | 1 |
| | 8 | | | min | 0 | 0 | -1046.315 | 0 | 0 | 0 |
| | 9 | 1 | M5 | max | 0 | 0 | 1127.222 | 1.969 | 1044.49 | 1 |
| | 10 | | | min | 0 | 0 | -1075.514 | 0 | 0 | 0 |
| | 11 | 1 | M6 | max | 0 | 0 | 1089.549 | 1.969 | 1060.002 | 1 |
| | 12 | | | min | 0 | 0 | -1093.243 | 0 | 0 | 0 |
| | 13 | 1 | M7 | max | 0 | 0 | 1046.081 | 1.969 | 1079.641 | 1.063 |
| | 14 | | | min | 0 | 0 | -1113.698 | 0 | 0 | 0 |
| | 15 | 1 | M8 | max | 0 | 0 | 935.434 | 1.969 | 1175.683 | 1.281 |
| | 16 | | | min | 0 | 0 | -1165.767 | 0 | 0 | 0 |



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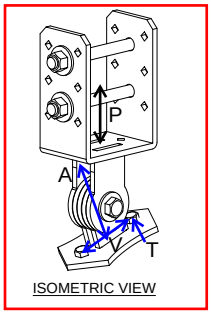
PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (DF)

## LO-PRO BEAM MOUNT BRACKET CONNECTION STABILITY (OVERTURNING & SLIDING AT ANCHORED BASE)

| HARDWARE MOMENT ARM, L | ANCHOR SPACING, S | CL COL TO ANCH, A' | EDGE OF BEARING TO ANCHOR, N' | LENGTH OF BEARING, A |
|---|---|---|---|---|
| 2 in | 3 in | 1.5 in | 3.75 in | 3.75 in |
| 2 in | | 0 in | 1.25 in | 1.25 in |

G= 0.5

COMPRESSION PERPENDICULAR TO GRAIN 625



ISOMETRIC VIEW

### ASD CAPACITY OF VARIOUS COMPONENTS

| | | |
|---|---|---|
| | 6500 lb | ASSEMBLY CAPACITY - RISA 2D |
| | 5301 lb | (2) 1/2" BOLTS THRU 1/4" PLATE |
| | 5981 lb | 5/8" BOLT THRU 1/4" PLATE |
| Z = | 8290 lb | DOUBLE SHEAR STEEL SIDE - STEEL MAIN |
| Z = | 2052 lb | DOUBLE SHEAR STEEL SIDE - WOOD MAIN |
| Z = | 1500 lb | (3) SDS SCREWS EA. WAY |
| Z = | 6016 lb | COMPRESSION PERP TO GRAIN |
| Z = | 1491 lb | SHEAR STRENGTH OF SINGLE LAG |
| W = | 1241 lb | TENSILE STRENGTH OF LAG BOLT |

ROOT DIAMETER OF LAG SCREW, Dr 0.265

### ASD CAPACITIES CONTROLLING CAPACITY OF OVERALL ASSEMBLY

**5981 lb** MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1500 lb** MINIMUM UPLIFT CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1491 lb** SHEAR STRENGTH OF SINGLE LAG (SLIDING RESISTANCE)

**1241 lb** TENSILE STRENGTH OF LAG BOLT (OVERTURNING RESISTANCE)

ADJUSTED ASD CAPACITY

| ROOF PITCH | DOWNWARD VERTICAL LOAD MAGNITUDE, -P | UPLIFT VERTICAL LOAD MAGNITUDE, P | ANGLE OF LOAD APPLIED, θ | AXIAL FORCE | SHEAR | MOMENT | TENSION AT ANCHOR (DOWN LOAD CASE) | TENSION AT ANCHOR (UPLIFT CASE) | UC SHEAR, V | UC TENSION, T | MAX T OR V | BASE RATED CAPACITY FOR VERTICAL DOWN LOADS | LOAD DURATION FACTOR DOWN (90) | DOWN (100) | DOWN (115) | DOWN (125) | UPLIFT (160) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (lb) | (lb) | (degrees) | (lb) | (lb) | (lb-in) | (lb) | (lb) | (%) | (%) | (%) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| SIDEWALL | 1491 | 1491 | 0.0 | 0.0 | 1491.0 | 2982.0 | 1192.8 | 1192.8 | 1.000 | 0.961 | 1.00 | 1491 | 1491 | 1491 | 1491 | 1491 | 1491 |
| 12:12 | 2109 | 1463 | 45.0 | 1491.0 | 1491.0 | 2982.1 | 596.4 | 1241.0 | 1.000 | 1.000 | 1.00 | 2109 | 2109 | 2109 | 2109 | 2109 | 1463 |
| 8:12 | 2688 | 1579 | 56.3 | 2236.5 | 1491.0 | 2982.1 | 298.2 | 1241.0 | 1.000 | 1.000 | 1.00 | 2688 | 2688 | 2688 | 2688 | 2688 | 1579 |
| 6:12 | 3334 | 1665 | 63.4 | 2982.1 | 1491.0 | 2982.1 | 0.0 | 1241.0 | 1.000 | 1.000 | 1.00 | 3334 | 3334 | 3334 | 3334 | 3334 | 1665 |
| 5:12 | 3809 | 1729 | 67.4 | 3516.4 | 1465.2 | 2930.3 | 0.0 | 1241.0 | 0.983 | 1.000 | 1.00 | 3809 | 3809 | 3809 | 3809 | 3809 | 1729 |
| 4:12 | 4402 | 1811 | 71.6 | 4175.7 | 1391.9 | 2783.8 | 0.0 | 1241.0 | 0.934 | 1.000 | 1.00 | 4402 | 4402 | 4402 | 4402 | 4402 | 1811 |
| 2:12 | 6773 | 2059 | 80.5 | 6681.2 | 1113.5 | 2227.1 | 0.0 | 1241.0 | 0.747 | 1.000 | 1.00 | 6016 | 5981 | 5981 | 5981 | 5981 | 1886 |
| 0:12 | 9070 | 2482 | 90.0 | 9069.6 | | | | 1241.0 | | 1.000 | | 6016 | 5981 | 5981 | 5981 | 5981 | 1886 |

CAPACITIES SHOWN HERE APPLY ONLY TO INSTALLATIONS USING **DOUG-FIR (G=0.50)** POST ATTACHED TO INSTA-PITCH BAR

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310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

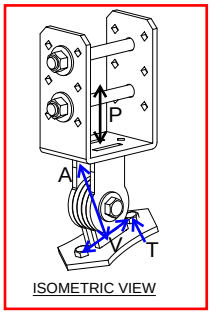
PROJECT: 18-220 WOODSTONE *LO-PRO* BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (HF)

## LO-PRO BEAM MOUNT BRACKET CONNECTION STABILITY (OVERTURNING & SLIDING AT ANCHORED BASE)

| HARDWARE MOMENT ARM, L | ANCHOR SPACING, S | CL COL TO ANCH, A' | EDGE OF BEARING TO ANCHOR, N' | LENGTH OF BEARING, A |
|---|---|---|---|---|
| 2 in | 3 in | 1.5 in | 3.75 in | 3.75 in |
| 2 in | | 0 in | 1.25 in | 1.25 in |

G= 0.43

COMPRESSION PERPENDICULAR TO GRAIN 405



ISOMETRIC VIEW

### ASD CAPACITY OF VARIOUS COMPONENTS

| | | |
|---|---|---|
| | 6500 lb | ASSEMBLY CAPACITY - RISA 2D |
| | 5301 lb | (2) 1/2" BOLTS THRU 1/4" PLATE |
| | 5981 lb | 5/8" BOLT THRU 1/4" PLATE |
| Z = | 8290 lb | DOUBLE SHEAR STEEL SIDE - STEEL MAIN |
| Z = | 1786 lb | DOUBLE SHEAR STEEL SIDE - WOOD MAIN |
| Z = | 1290 lb | (3) SDS SCREWS EA. WAY |
| Z = | 3898 lb | COMPRESSION PERP TO GRAIN |
| Z = | 1491 lb | SHEAR STRENGTH OF SINGLE LAG |
| W = | 1241 lb | TENSILE STRENGTH OF LAG BOLT |

ROOT DIAMETER OF LAG SCREW, Dr 0.265

### ASD CAPACITIES CONTROLLING CAPACITY OF OVERALL ASSEMBLY

**3898 lb** MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1290 lb** MINIMUM UPLIFT CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1491 lb** SHEAR STRENGTH OF SINGLE LAG (SLIDING RESISTANCE)

**1241 lb** TENSILE STRENGTH OF LAG BOLT (OVERTURNING RESISTANCE)

ADJUSTED ASD CAPACITY

| ROOF PITCH | DOWNWARD VERTICAL LOAD MAGNITUDE, -P | UPLIFT VERTICAL LOAD MAGNITUDE, P | ANGLE OF LOAD APPLIED, θ | AXIAL FORCE | SHEAR | MOMENT | TENSION AT ANCHOR (DOWN LOAD CASE) | TENSION AT ANCHOR (UPLIFT CASE) | UC SHEAR, V | UC TENSION, T | MAX T OR V | BASE RATED CAPACITY FOR VERTICAL DOWN LOADS | LOAD DURATION FACTOR DOWN (90) | DOWN (100) | DOWN (115) | DOWN (125) | UPLIFT (160) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (lb) | (lb) | (degrees) | (lb) | (lb) | (lb-in) | (lb) | (lb) | (%) | (%) | (%) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| SIDEWALL | 1491 | 1491 | 0.0 | 0.0 | 1491.0 | 2982.0 | 1192.8 | 1192.8 | 1.000 | 0.961 | 1.00 | 1491 | 1491 | 1491 | 1491 | 1491 | 1491 |
| 12:12 | 2109 | 1463 | 45.0 | 1491.0 | 1491.0 | 2982.1 | 596.4 | 1241.0 | 1.000 | 1.000 | 1.00 | 2109 | 2109 | 2109 | 2109 | 2109 | 1463 |
| 8:12 | 2688 | 1579 | 56.3 | 2236.5 | 1491.0 | 2982.1 | 298.2 | 1241.0 | 1.000 | 1.000 | 1.00 | 2688 | 2688 | 2688 | 2688 | 2688 | 1579 |
| 6:12 | 3334 | 1665 | 63.4 | 2982.1 | 1491.0 | 2982.1 | 0.0 | 1241.0 | 1.000 | 1.000 | 1.00 | 3334 | 3334 | 3334 | 3334 | 3334 | 1622 |
| 5:12 | 3809 | 1729 | 67.4 | 3516.4 | 1465.2 | 2930.3 | 0.0 | 1241.0 | 0.983 | 1.000 | 1.00 | 3809 | 3508 | 3809 | 3809 | 3809 | 1622 |
| 4:12 | 4402 | 1811 | 71.6 | 4175.7 | 1391.9 | 2783.8 | 0.0 | 1241.0 | 0.934 | 1.000 | 1.00 | 3898 | 3508 | 3898 | 3898 | 3898 | 1622 |
| 2:12 | 6773 | 2059 | 80.5 | 6681.2 | 1113.5 | 2227.1 | 0.0 | 1241.0 | 0.747 | 1.000 | 1.00 | 3898 | 3508 | 3898 | 3898 | 3898 | 1622 |
| 0:12 | 9070 | 2482 | 90.0 | 9069.6 | | | | 1241.0 | | 1.000 | | 3898 | 3508 | 3898 | 3898 | 3898 | 1622 |

CAPACITIES SHOWN HERE APPLY ONLY TO INSTALLATIONS USING **HEM-FIR (G=0.43)** POST ATTACHED TO INSTA-PITCH BAR

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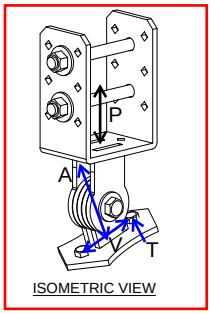
PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (WC)

## LO-PRO BEAM MOUNT BRACKET CONNECTION STABILITY (OVERTURNING & SLIDING AT ANCHORED BASE)

G= 0.36

| HARDWARE MOMENT ARM, L | ANCHOR SPACING, S | CL COL TO ANCH, A' | EDGE OF BEARING TO ANCHOR, N' | LENGTH OF BEARING, A |
|---|---|---|---|---|
| 2 in | 3 in | 1.5 in | 3.75 in | 3.75 in |
| 2 in | | 0 in | 1.25 in | 1.25 in |

COMPRESSION PERPENDICULAR TO GRAIN 425



ISOMETRIC VIEW

### ASD CAPACITY OF VARIOUS COMPONENTS

| | | |
|---|---|---|
| | 6500 lb | ASSEMBLY CAPACITY - RISA 2D |
| | 5301 lb | (2) 1/2" BOLTS THRU 1/4" PLATE |
| | 5981 lb | 5/8" BOLT THRU 1/4" PLATE |
| Z = | 8290 lb | DOUBLE SHEAR STEEL SIDE - STEEL MAIN |
| Z = | 1366 lb | DOUBLE SHEAR STEEL SIDE - WOOD MAIN |
| Z = | 1080 lb | (3) SDS SCREWS EA. WAY |
| Z = | 4091 lb | COMPRESSION PERP TO GRAIN |
| Z = | 1491 lb | SHEAR STRENGTH OF SINGLE LAG |
| W = | 1241 lb | TENSILE STRENGTH OF LAG BOLT |

ROOT DIAMETER OF LAG SCREW, Dr 0.265

### ASD CAPACITIES CONTROLLING CAPACITY OF OVERALL ASSEMBLY

**4091 lb** MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1080 lb** MINIMUM UPLIFT CAPACITY OF CONNECTIONS ABOVE BASE PLATE

**1491 lb** SHEAR STRENGTH OF SINGLE LAG (SLIDING RESISTANCE)

**1241 lb** TENSILE STRENGTH OF LAG BOLT (OVERTURNING RESISTANCE)

ADJUSTED ASD CAPACITY

| ROOF PITCH | DOWNWARD VERTICAL LOAD MAGNITUDE, -P | UPLIFT VERTICAL LOAD MAGNITUDE, P | ANGLE OF LOAD APPLIED, θ | AXIAL FORCE | SHEAR | MOMENT | TENSION AT ANCHOR (DOWN LOAD CASE) | TENSION AT ANCHOR (UPLIFT CASE) | UC SHEAR, V | UC TENSION, T | MAX T OR V | BASE RATED CAPACITY FOR VERTICAL DOWN LOADS | LOAD DURATION FACTOR DOWN (90) | DOWN (100) | DOWN (115) | DOWN (125) | UPLIFT (160) |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | (lb) | (lb) | (degrees) | (lb) | (lb) | (lb-in) | (lb) | (lb) | (%) | (%) | (%) | (lb) | (lb) | (lb) | (lb) | (lb) | (lb) |
| SIDEWALL | 1491 | 1491 | 0.0 | 0.0 | 1491.0 | 2982.0 | 1192.8 | 1192.8 | 1.000 | 0.961 | 1.00 | 1491 | 1491 | 1491 | 1491 | 1491 | 1358 |
| 12:12 | 2109 | 1463 | 45.0 | 1491.0 | 1491.0 | 2982.1 | 596.4 | 1241.0 | 1.000 | 1.000 | 1.00 | 2109 | 2109 | 2109 | 2109 | 2109 | 1358 |
| 8:12 | 2688 | 1579 | 56.3 | 2236.5 | 1491.0 | 2982.1 | 298.2 | 1241.0 | 1.000 | 1.000 | 1.00 | 2688 | 2688 | 2688 | 2688 | 2688 | 1358 |
| 6:12 | 3334 | 1665 | 63.4 | 2982.1 | 1491.0 | 2982.1 | 0.0 | 1241.0 | 1.000 | 1.000 | 1.00 | 3334 | 3334 | 3334 | 3334 | 3334 | 1358 |
| 5:12 | 3809 | 1729 | 67.4 | 3516.4 | 1465.2 | 2930.3 | 0.0 | 1241.0 | 0.983 | 1.000 | 1.00 | 3809 | 3682 | 3809 | 3809 | 3809 | 1358 |
| 4:12 | 4402 | 1811 | 71.6 | 4175.7 | 1391.9 | 2783.8 | 0.0 | 1241.0 | 0.934 | 1.000 | 1.00 | 4091 | 3682 | 4091 | 4091 | 4091 | 1358 |
| 2:12 | 6773 | 2059 | 80.5 | 6681.2 | 1113.5 | 2227.1 | 0.0 | 1241.0 | 0.747 | 1.000 | 1.00 | 4091 | 3682 | 4091 | 4091 | 4091 | 1358 |
| 0:12 | 9070 | 2482 | 90.0 | 9069.6 | | | | 1241.0 | | 1.000 | | 4091 | 3682 | 4091 | 4091 | 4091 | 1358 |

CAPACITIES SHOWN HERE APPLY ONLY TO INSTALLATIONS USING **WESTERN CEDAR (G=0.36)** POST ATTACHED TO INSTA-PITCH BAR

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Telephone: (541) 746 0637

PROJECT: 18-220 WOODSTONE LO-PRO BEAM MOUNT
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
**SHEET: 4x BLKNG**

## Wood Beam Design

**MEMBER ID:** **4x BLKNG**

**MEMBER DATA**

↑ **R1** — **SPAN** — ↑ **R2** — **O'HANG**

DL 6.6 psf
LL 0 psf
SL 20 psf
s 24 in

| | | | |
|---|---|---|---|
| INCLUDE SELF WEIGHT?: | **YES** | | |
| PROPOSED MEMBER: | **4** x **4** | | |
| SPECIES / GRADE: | **DF #2** | | |
| MULTIPLE MEMBERS ?: | **1** | | |
| SPAN: | **1.875** | ft | |
| OVERHANG: | **0** | ft | |
| CONTINUOUS SUPPORT OR $l_u$: | **1.875** | ft | |
| SERVICE CONDITION: | **dry** | | |
| REPETITIVE MEMBER FACTOR: | **1** | | |
| FLAT USE FACTOR $C_{fu}$: | **1.05** | | |
| INCISED?: | **no** | | |
| LL REDUCTION FACTOR: | **1** | | |

| | |
|---|---|
| CF: | 1.3 |
| self wt | 2.6031 lb |
| Sx | 7.15 in^3 |
| A | 12.3 in^2 |
| Fb | 900 ksi |
| Fv | 180 ksi |
| FcT | 625 ksi |
| E | 1600 ksi |

**LOAD DATA**

| Load | D start | D end | L start | L end | S start | S end | E | W | Start Loc | End Loc | ID |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Uniform 1 | **13** | – | **0** | – | **40** | – | – | – | **0** | **1.875** | |
| Uniform 2 | | – | | – | | – | – | – | **0** | **1** | |
| Uniform 3 | | – | | – | | – | – | – | **0** | **1** | |
| Uniform 4 | | – | | – | | – | – | – | **0** | **1** | |
| Uniform 5 | | – | | – | | – | – | – | **0** | **1** | |
| Uniform 6 | | – | | – | | – | – | – | **0** | **1** | |
| Point 1 | | – | **1490** | – | | | | | **0.9375** | – | |
| Point 2 | | – | | – | | | | | **1** | – | |
| Point 3 | | – | | – | | – | | | **1** | – | |
| Point 4 | | – | | | | – | | | **1** | – | |
| Tapered 1 | | | | | | | – | – | **0** | **1** | |
| Tapered 2 | | | | | | | – | – | **0** | **1** | |
| Frame Moment (+ for load to right) | | | – | – | – | – | **0** | **0** | – | – | |

max reaction based on blocking connections

LO-PRO BEAM MOUNT MIN. REACTION

**DEFLECTION REQUIREMENTS**

| | |
|---|---|
| Allowable Deflection D+L | **L / 240** |
| Allowable Deflection D+S | **L / 180** |
| Allowable Deflection L | **L / 360** |
| Allowable Deflection S | **L / 240** |
| Allowable Deflection W | **L / 180** |

**MEMBER RESULTS**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Design Moment | 705 lb-ft | | Unity: | Design Shear | 756 lb | | Unity: |
| Allowable Moment | 731 lb-ft | OK | 97% | Allowable Shear | 1470 lb | OK | 51% |

| | SPAN | | | |
|---|---|---|---|---|
| Design Deflection D+L | 0.02 | in. = L / | 1258 | OK |
| Design Deflection D+S | 0.00 | in. = L / | 29010 | OK |
| Design Deflection L | 0.02 | in. = L / | 1273 | OK |
| Design Deflection S | 0.00 | in. = L / | 40471 | OK |
| Design Deflection W | 0.00 | in. = L / | N/A | |

**JOINT REACTIONS**

| | R1 | R2 | |
|---|---|---|---|
| D | 15 | 15 | |
| L | 745 | 745 | |
| S | 38 | 38 | |
| W | 0 | 0 | |
| E | 0 | 0 | |
| D+L | 760 | 760 | |
| D+S | 52 | 52 | |
| D+0.75(L+S) | 602 | 602 | |
| Uplift | | | |
| MAX. COMBINED REACTION | 760 | 760 | 760 |

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BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
**SHEET: BLKNG CONN.**

## FASTENERS AT ENDS OF BLOCKING

LOAD PERPENDICULAR TO ROOF SURFACE

| | QTY | Z | CD | Ceg | Z' | LOAD AT END - CHECK | LOAD AT MID - CHECK |
|---|---|---|---|---|---|---|---|
| 3/8" LAG SCREWS AT EQ. SPACING EA. END | 3 | 140 | 1 | 0.67 | 281 | 281 | 562 |
| 10d NAIL AT 1.5" SPACING EA. END | 6 | 118 | 1 | 0.67 | 474 | 474 | 948 |
| A34 w/ 0.131x1.5" NAILS EA. END | 2 | 395 | 1 | 1.00 | 790 | 790 | 1490 |
| A34 w/ #9x1.5" SD EA. END | 2 | 640 | 1 | 1.00 | 1280 | 1280 | 1490 |

P*COS(ANGLE)

$$UC = 1.0 = \frac{P*COS()}{Z'_T} + \frac{P*SIN()}{Z'_{II}}$$

SOLVE FOR "P"

$$P = \left[\frac{COS()}{Z'_T} + \frac{SIN()}{Z'_{II}}\right]^{-1}$$

SUM UNITY RATIOS = 1.0 AND SOLVE TO FIND COMMON VALUE FOR LOAD FROM LO-PRO BEAM MOUNT

LOAD PARALLEL TO ROOF SURFACE

| | QTY | Z | CD | Ceg | Z' | LOAD AT END - CHECK | LOAD AT MID - CHECK |
|---|---|---|---|---|---|---|---|
| 3/8" LAG SCREWS AT EQ. SPACING EA. END | 3 | 140 | 1 | 0.67 | 281 | 281 | 562 |
| 10d NAIL AT 1.5" SPACING EA. END | 8 | 95 | 1 | 0.67 | 509 | 509 | 1018 |
| A34 w/ 0.131x1.5" NAILS EA. END | 1 | 395 | 1 | 1.00 | 395 | 395 | 790 |
| A34 w/ #9x1.5" SD EA. END | 1 | 495 | 1 | 1.00 | 495 | 495 | 990 |

P*SIN(ANGLE)

| | | END LOADING | | | | MID SPAN LOADING | | | |
|---|---|---|---|---|---|---|---|---|---|
| | ANGLE | 3/8" LAG SCREWS AT EQ. SPACING EA. END | 10d NAIL AT 1.5" SPACING EA. END | A34 w/ 0.131x1.5 " NAILS EA. END | A34 w/ #9x1.5" SD EA. END | 3/8" LAG SCREWS AT EQ. SPACING EA. END | 10d NAIL AT 1.5" SPACING EA. END | A34 w/ 0.131x1.5 " NAILS EA. END | A34 w/ #9x1.5" SD EA. END |
| SIDEWALL | 90 | 281 | 509 | 395 | 495 | 562 | 1018 | 790 | 990 |
| 12:12 | 45 | 199 | 347 | 372 | 505 | 397 | 694 | 730 | 841 |
| 8:12 | 34 | 203 | 351 | 407 | 565 | 405 | 703 | 793 | 894 |
| 6:12 | 27 | 209 | 362 | 442 | 624 | 419 | 723 | 857 | 951 |
| 5:12 | 23 | 215 | 370 | 467 | 667 | 430 | 740 | 904 | 992 |
| 4:12 | 18 | 222 | 381 | 500 | 725 | 444 | 763 | 964 | 1046 |
| 2:12 | 9 | 244 | 416 | 601 | 907 | 488 | 832 | 1149 | 1208 |
| 0:12 | 0 | 281 | 474 | 790 | 1280 | 562 | 948 | 1490 | 1490 |