STRUCTURAL CALCULATIONS

Branch ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

DATE: March 31, 2022

PROJECT: 18-220 **PATIO ROOF RISER**
136 42nd Street
Springfield, OR 97478

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

FOR: **WOODSTONE STRUCTURES, LLC**

PROJECT DESCRIPTION & SCOPE OF SERVICES:
Structural design in accordance with the 2018 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 Patio Roof Riser 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 measurements taken from Patio Roof Riser, supplied by Woodstone Structures, LLC June 2018.
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 "PRR Allowable Loads" table.

STRUCTURAL ENGINEERING REPORT

DATE: March 31, 2022
PROJECT: 18-220 PATIO ROOF RISER
CLIENT: WOODSTONE STRUCTURES, LLC
REPORT BY: BRANCH ENGINEERING, INC.

PATIO ROOF RISER (PRR)

DESCRIPTION:

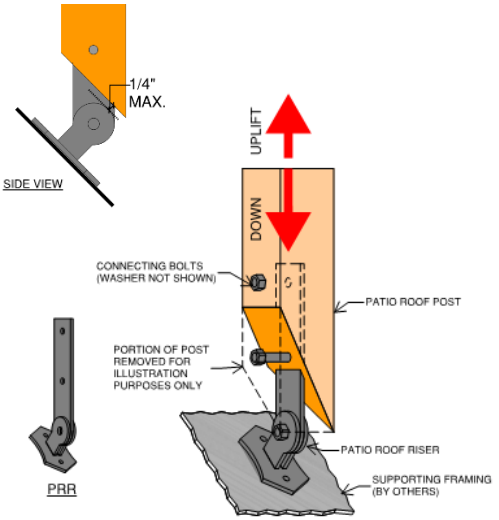
This structural engineering report has been requested by Woodstone Structures, LLC for preliminary analysis of a proprietary product called, "Patio Roof Riser." The objective of this analysis is to report the allowable capacity of the product, in its current configuration, for use in supporting vertical 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
POST - SPECIES PER TABLE (NOT SUPPLIED)

OPTIONS:

Variable pitch per table.
Installation on 4x blocking.



TYPICAL PRR INSTALLATION

PRR 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	1490
12:12	2105	2105	2105	2105	1460	2105	2105	2105	2105	1460	2025	2105	2105	2105	1460
8:12	2685	2685	2685	2685	1575	2540	2685	2685	2685	1575	2025	2255	2255	2255	1575
6:12	2780	3090	3090	3090	1660	2540	2825	2825	2825	1660	2025	2255	2255	2255	1660
5:12	2780	3090	3090	3090	1725	2540	2825	2825	2825	1725	2025	2255	2255	2255	1725
4:12	2780	3090	3090	3090	1810	2540	2825	2825	2825	1810	2025	2255	2255	2255	1810
2:12	2780	3090	3090	3090	2055	2540	2825	2825	2825	2055	2025	2255	2255	2255	2055
0:12	2780	3090	3090	3090	2480	2540	2825	2825	2825	2480	2025	2255	2255	2255	2480

NOTES:

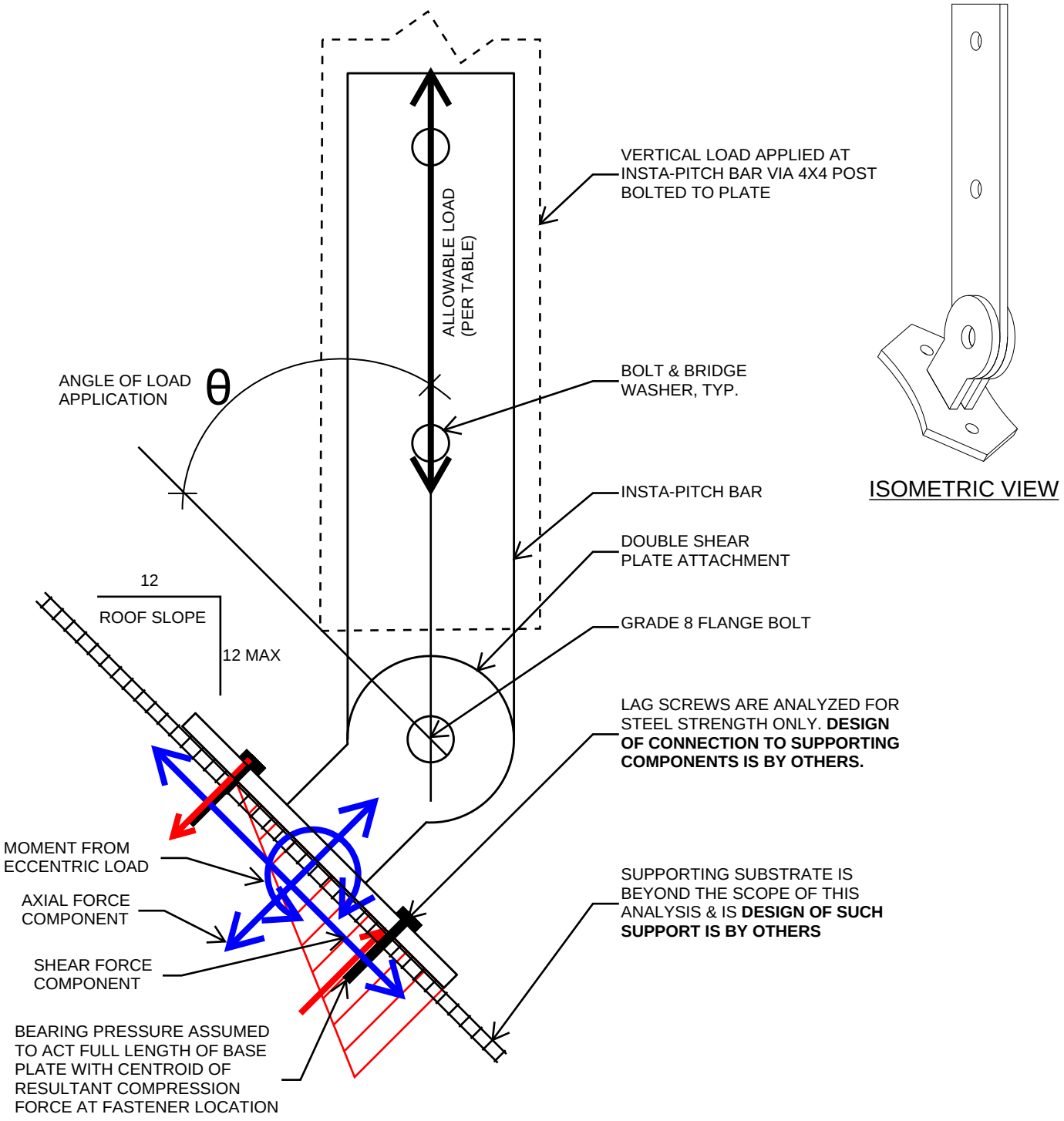
1. FOR PRR INSTALLED ON THE FACE OF A VERTICAL WALL, USE "SIDEWALL".
2. ALLOWABLE LOADS SHOWN ARE FOR A SINGLE PRR INSTALLED AT THE INDICATED ROOF SLOPE.
3. ANALYSIS AND ALLOWABLE LOADS ARE FOR THE STEEL BRACKET ONLY.
4. CONSULT WITH A LOCAL ENGINEER FOR EACH INDIVIDUAL INSTALLATION.
5. NO DESIGN OF 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 PRR SUPPORT BRACKET & POSTS.
8. UP TO 1/4" VERTICAL MOVEMENT WITHIN PRR MAY BE EXPECTED WHEN THE PRR 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. PROVIDE THE FOLLOWING MINIMUMS FOR BOLTS THRU WOOD POST & STEEL PLATE:
    a. EDGE DISTANCE = 1 INCH
    b. END DISTANCE = 2 INCHES (END OF POST TO EXTEND TO 1/4" FROM BRACKET KNUCKLE)
    c. SPACING = 4 INCHES
11. BOLT HOLES SHALL BE A MINIMUM OF 1/32" AND A MAXIMUM OF 1/16" LARGER THAN THE BOLT DIAMETER (PER NDS SEC. 12.1.3.2)
12. INSTA-PITCH BAR IS ASSUMED TO BE INSTALLED IN A PLUMB CONDITION.
13. WELDING ON PRR 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 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.

Branch ENGINEERING Inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 6/12/2018

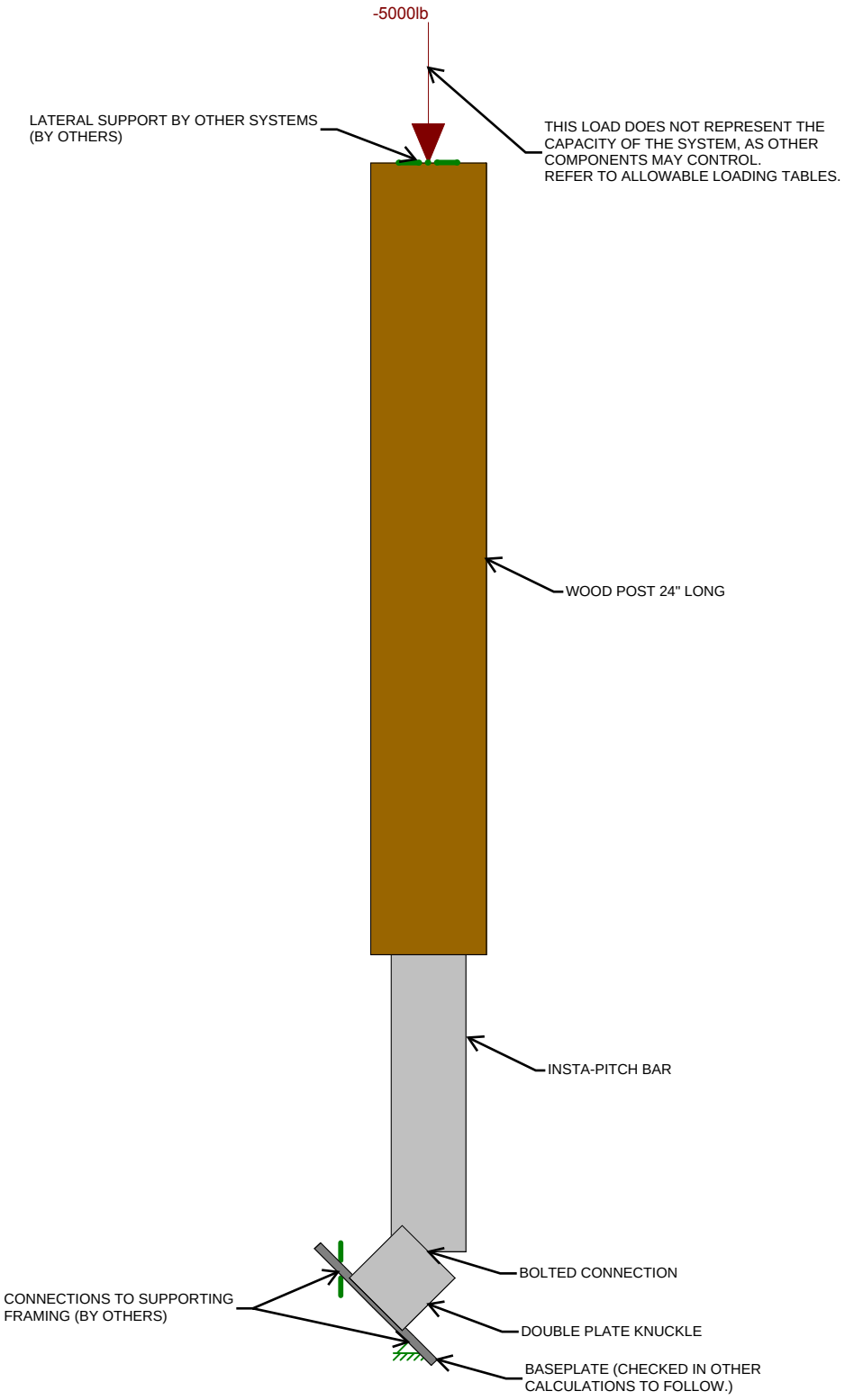
PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.

PATIO ROOF RISER SKETCH & CALCULATION ORIENTATION/AXES



NOTE: SKETCH IS NOT TO SCALE
NOT FOR CONSTRUCTION

ASSEMBLY COMPRESSION CHECK



Loads: BLC 1,

BRANCH ENGINEERING,...		
JOSHUA ANNETT	PATIO ROOF RISER	June 28, 2018 at 4:25 PM
18-220		PRR MODEL.r2d

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	POST	N5	N6		WOOD1A	Column	Rectangular	#2 HF	Typical
5	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-torq...	K-out	K-in	Cb	Function
1	BASE	HR1A	5			Lb out						La
2	PL1	HR1A	2.25			Lb out						La
3	INSTA PIT...	HR2	9			Lb out						La
4	PL2	HR1A	2.25			Lb out						La

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	N6	L	Y	-5000

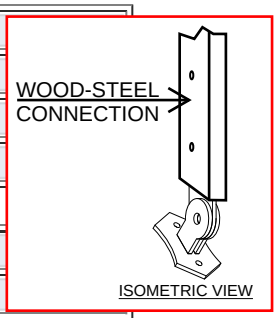
Load Combinations

	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	.735	0	.408	0	17351.297	18241.2	853.2	1.667	H1-1b
2	1	INSTA PITCH ...	PL1/4x2.25	.976	0	.000	0	8194.267	18241.2	801.892	1	H1-1a
3	1	PL2	PL1/4x2.25	.735	0	.408	0	17351.297	18241.2	853.2	1.667	H1-1b

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



Main Member Type	Steel
Main Member Thickness	1/4 in.
Main Member: Angle of Load to Grain	0
Side Member Type	Douglas Fir-Larch (North)
Side Member Thickness	1.5 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

Connection Yield Modes

Im	2719 lbs.
Is	2062 lbs.
IIIs	1547 lbs.
IV	1946 lbs.

ASD CAPACITY FOR (2) BOLTS = 2 * 1547# = 3094#

Adjusted ASD Capacity	**1547 lbs.**

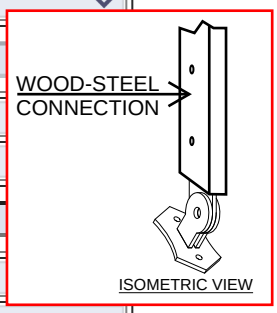
- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for 1/4 in. and thicker steel main members , and ASTM A653 Grade 33 Steel is assumed for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

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

Main Member Type	Steel
Main Member Thickness	1/4 in.
Main Member: Angle of Load to Grain	0
Side Member Type	Hem-Fir
Side Member Thickness	1.5 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



Connection Yield Modes

Im	2719 lbs.
Is	1800 lbs.
IIIs	1413 lbs.
IV	1825 lbs.

ASD CAPACITY FOR (2) BOLTS = 2 * 1413# = 2826#

Adjusted ASD Capacity	**1413 lbs.**

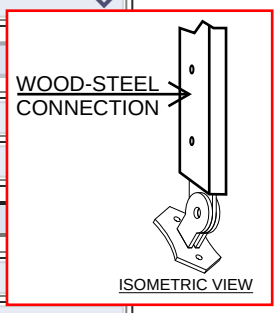
- Bolt bending yield strength of 45,000 psi is assumed.
- The Adjusted ASD Capacity is only applicable for bolts with adequate end distance, edge distance and spacing per NDS chapter 11.
- ASTM A36 Steel is assumed for 1/4 in. and thicker steel main members , and ASTM A653 Grade 33 Steel is assumed for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

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

Main Member Type	Steel
Main Member Thickness	1/4 in.
Main Member: Angle of Load to Grain	0
Side Member Type	Western Cedars
Side Member Thickness	1.5 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



Connection Yield Modes

Im	2719 lbs.
Is	1519 lbs.
IIIs	1268 lbs.
IV	1684 lbs.

ASD CAPACITY FOR (2) BOLTS = 2 * 1268# = 2536#

Adjusted ASD Capacity	**1268 lbs.**

- 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 1/4 in. and thicker steel main members , and ASTM A653 Grade 33 Steel is assumed for steel main 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.

Branch ENGINEERING Inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

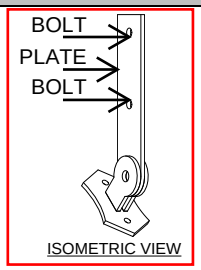
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
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**	F_y:	36	ksi	
Steel width:	**2.25 in**	F_u:	58	ksi	
Steel specification:	**A36**	ϕF_{nv}:	20.25	ksi	
Bolt diameter, d:	**0.5 in**	A_{gv}:	1.25	in^2	Shear Yielding
Bolt specification:	**A307**	A_g:	0.56	in^2	Tensile Yielding
Thread condition:	**N**	A_{nv}:	1.02	in^2	Shear Rupture
Bolt Hole Preparation Method:	**Punch**	A_e:	0.41	in^2	Tensile Rupture
Threaded Part F_u:	**60 ksi**	A_{nv}:	1.02	in^2	Block Shear
Bolt spacing, s:	**4 in**	A_{gv}:	1.25	in^2	Block Shear
End distance, L_{ev}:	**1 in**	A_{nt}:	0.20	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: ϕR_n =	27.00 kip	1.00	1.5	18.00 kip
Tensile Yielding: ϕR_n =	18.23 kip	0.90	1.67	12.13 kip
Shear Rupture: ϕR_n =	26.51 kip	0.75	2	17.67 kip
Tensile Rupture: ϕR_n =	17.67 kip	0.75	2	11.78 kip
Block Shear Rupture: ϕR_n =	29.09 kip	0.75	2	19.39 kip
Bolt Shear Strength: ϕR_n =	7.95 kip	0.75	2	5.30 kip
Bearing Strength at Bolt Hole: ϕR_n =	17.94 kip	0.75	2	11.96 kip

ASD Connection Design Strength: 5.30 kips

Branch ENGINEERING INC
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

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

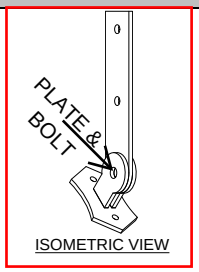
DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
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**
Steel width:	**2.25 in**
Steel specification:	**A36**
Bolt diameter, d:	**0.5625 in**
Bolt specification:	**A490**
Thread condition:	**N**
Bolt Hole Preparation Method:	**Drill**
Threaded Part F_u:	**150 ksi**
Bolt spacing, s:	**0 in**
End distance, L_{ev}:	**1 in**
Side distance, L_{eh}:	**1 in**
Number of bolts in row:	**1**
Number of rows:	**1**

F_y:	36 ksi		
F_u:	58 ksi		
ϕF_{nv}:	50.625 ksi		
A_{gv}:	0.25 in^2	Shear Yielding	
A_g:	0.56 in^2	Tensile Yielding	
A_{nv}:	0.17 in^2	Shear Rupture	
A_e:	0.41 in^2	Tensile Rupture	
A_{nv}:	0.17 in^2	Block Shear	
A_{gv}:	0.25 in^2	Block Shear	
A_{nt}:	0.20 in^2	Block Shear	
U_{bs}:	1	Block Shear	
U:	1	Shear Lag Factor	



ISOMETRIC VIEW

		Φ	Ω	ASD CAPACITY
Shear Yielding: ϕR_n =	5.40 kip	1.00	1.5	3.60 kip
Tensile Yielding: ϕR_n =	18.23 kip	0.90	1.67	12.13 kip
Shear Rupture: ϕR_n =	4.49 kip	0.75	2	2.99 kip
Tensile Rupture: ϕR_n =	17.67 kip	0.75	2	11.78 kip
Block Shear Rupture: ϕR_n =	12.89 kip	0.75	2	8.59 kip
Bolt Shear Strength: ϕR_n =	12.58 kip	0.75	2	8.39 kip
Bearing Strength at Bolt Hole: ϕR_n =	8.97 kip	0.75	2	5.98 kip

ASD Connection Design Strength: 2.99 kips

Branch ENGINEERING inc
Since 1977
civil · transportation
structural · geotechnical
SURVEYING

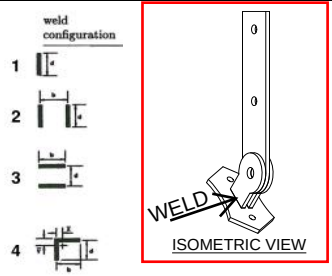
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

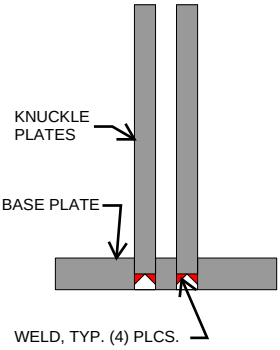
DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
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		**3340.575 lb**	
Design Shear, V_u		**556.7625 lb**	
Design Moment, Mu		**92.79375 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





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)

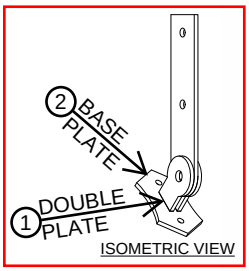
Branch ENGINEERING Since 1977
civil · transportation structural · geotechnical SURVEYING
310 5th Street
Springfield, OR
(541)746-0637

BASE PLATE GEOMETRY PARAMETERS

$N := 5\ in$ Base plate length

$s_N := 3\ in$ Anchor spacing

$B := 2.5\ in$ Base plate width



MATERIAL SPECIFICATIONS

$\Phi_b := 0.9$

$F_y := 36\ ksi$ 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

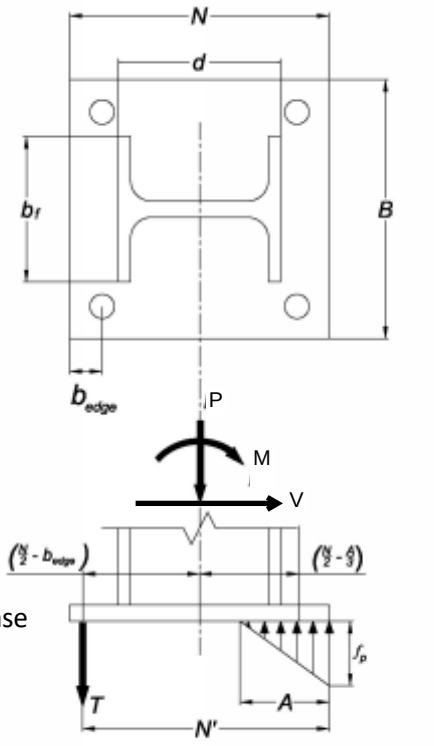
Tension Side of Base Plate

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

$V := 1491\ lb$ Shear at attacment

$L := 2\ in$ Attachment moment arm

$M_{max} := 1.6 \cdot V \cdot L = 4771.2\ lb \cdot in$ Moment at base of attachment



GENERIC BASE PLATE SHOWN

Figure B.3. General definition of variables.

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

$\Phi M_n := \Phi_b \cdot F_y \cdot S_x = 6075\ lb \cdot in$ Moment strength of baseplate

$$BendingCheck := \frac{M_{max}}{\Phi M_n} = 0.79$$

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

$m := 1.6 \cdot T \cdot x = 1563.66\ lb \cdot in$ Moment at tension side of baseplate

$\Phi M_n := \Phi_b \cdot F_y \cdot Z_x = 2537.13\ lb \cdot in$ Moment strength of baseplate

Moment at Base Plate - Case 1

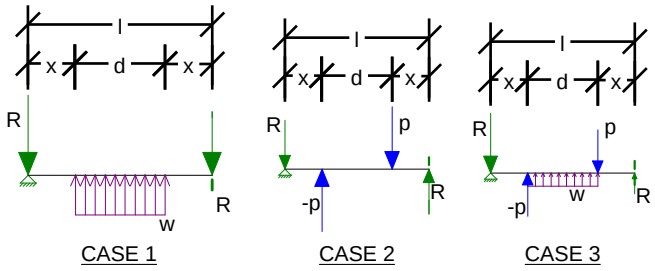
$M_1 := 1396\ lb \cdot in$ ← SEE MODEL RESULTS NEXT PAGE

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



$$BendingCheck := \frac{1.6 \cdot \max\left(M_1, M_2, M_3\right)}{\Phi M_n} = 0.88$$

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

$\Phi_V := 0.9$

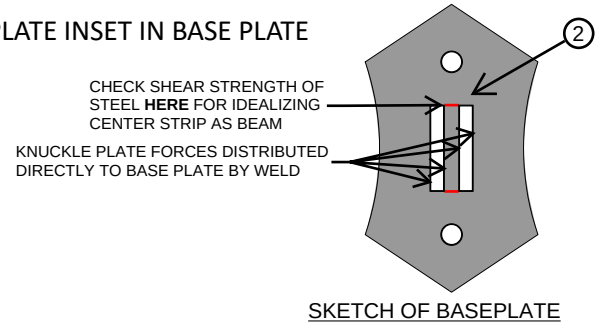
$C_v := 1.0$

$b := 0.25\ in$

$t_{pBP} = 0.38\ in$

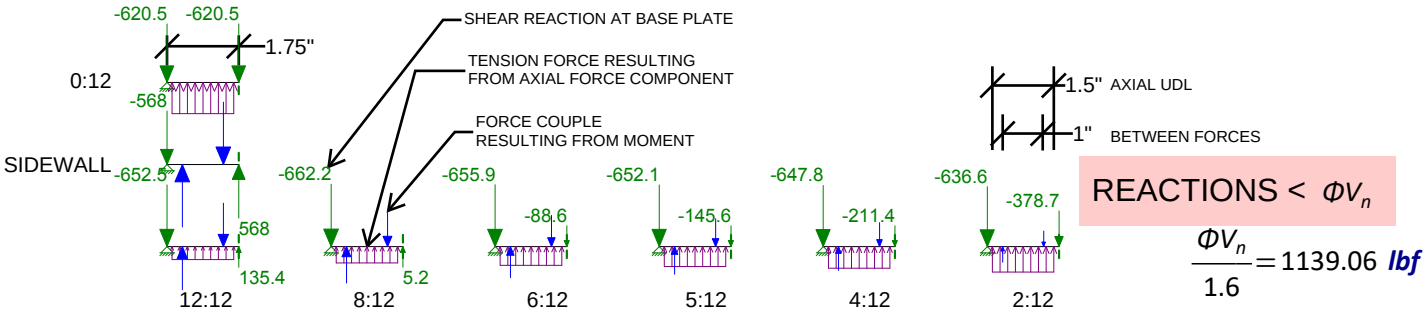
$A_w := b \cdot t_{pBP} = 0.09\ in^2$

$\Phi V_n := \Phi_V \cdot 0.6\ F_y \cdot A_w \cdot C_v = 1822.5\ lbf$



SKETCH OF BASEPLATE

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



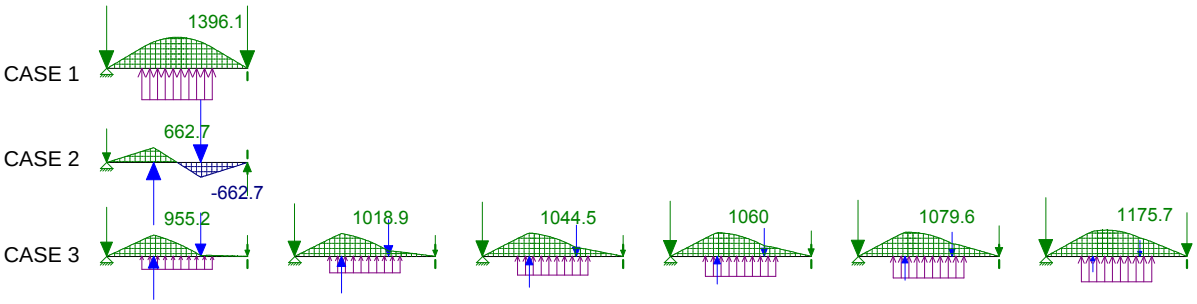
REACTIONS < ΦV_n

$\frac{\Phi V_n}{1.6} = 1139.06\ lbf$

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

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



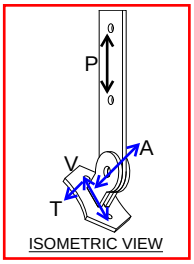
Branch ENGINEERING INC
Since 1977
civil · transportation
structural · geotechnical
SURVEYING
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (DF)

PATIO ROOF RISER 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



ISOMETRIC VIEW

ASD CAPACITY OF VARIOUS COMPONENTS

	5301 lb	(2) 1/2" BOLTS THRU 1/4" PLATE
	2991 lb	5/8" BOLT THRU 1/4" PLATE
Z =	8290 lb	DOUBLE SHEAR STEEL SIDE - STEEL MAIN
Z =	3094 lb	DOUBLE SHEAR WOOD SIDE - STEEL MAIN
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

3094 lb MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

2991 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	3094	2785	3094	3094	3094	1665
5:12	3809	1729	67.4	3516.4	1465.2	2930.3	0.0	1241.0	0.983	1.000	1.00	3094	2785	3094	3094	3094	1729
4:12	4402	1811	71.6	4175.7	1391.9	2783.8	0.0	1241.0	0.934	1.000	1.00	3094	2785	3094	3094	3094	1811
2:12	6773	2059	80.5	6681.2	1113.5	2227.1	0.0	1241.0	0.747	1.000	1.00	3094	2785	3094	3094	3094	2059
0:12	9070	2482	90.0	9069.6				1241.0		1.000		3094	2785	3094	3094	3094	2482

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

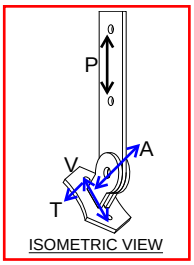
Branch ENGINEERING INC
Since 1977
civil · transportation
structural · geotechnical
SURVEYING
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (HF)

PATIO ROOF RISER 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



ISOMETRIC VIEW

ASD CAPACITY OF VARIOUS COMPONENTS

	5301 lb	(2) 1/2" BOLTS THRU 1/4" PLATE
	2991 lb	5/8" BOLT THRU 1/4" PLATE
Z =	8290 lb	DOUBLE SHEAR STEEL SIDE - STEEL MAIN
Z =	2826 lb	DOUBLE SHEAR WOOD SIDE - STEEL MAIN
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

2826 lb MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

2826 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	2543	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	2826	2543	2826	2826	2826	1665
5:12	3809	1729	67.4	3516.4	1465.2	2930.3	0.0	1241.0	0.983	1.000	1.00	2826	2543	2826	2826	2826	1729
4:12	4402	1811	71.6	4175.7	1391.9	2783.8	0.0	1241.0	0.934	1.000	1.00	2826	2543	2826	2826	2826	1811
2:12	6773	2059	80.5	6681.2	1113.5	2227.1	0.0	1241.0	0.747	1.000	1.00	2826	2543	2826	2826	2826	2059
0:12	9070	2482	90.0	9069.6				1241.0		1.000		2826	2543	2826	2826	2826	2482

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

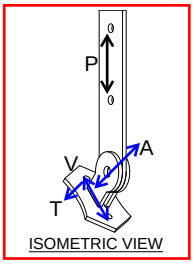
Branch ENGINEERING INC
Since 1977
civil · transportation
structural · geotechnical
SURVEYING
310 5th Street
Springfield, Oregon 97477
Telephone: (541) 746 0637

DATE: 3/31/2022

PROJECT: 18-220 WOODSTONE STRUCTURES - PRR
BY: JOSHUA ANNETT
CHECKED BY: RICK HERNANDEZ, P.E., S.E.
SHEET: STATICS (WC)

PATIO ROOF RISER 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



ISOMETRIC VIEW

ASD CAPACITY OF VARIOUS COMPONENTS

	5301 lb	(2) 1/2" BOLTS THRU 1/4" PLATE
	2991 lb	5/8" BOLT THRU 1/4" PLATE
Z =	8290 lb	DOUBLE SHEAR STEEL SIDE - STEEL MAIN
Z =	2255 lb	DOUBLE SHEAR WOOD SIDE - STEEL MAIN
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

2255 lb MINIMUM DOWNLOAD CAPACITY OF CONNECTIONS ABOVE BASE PLATE

2255 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	2030	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	2255	2030	2255	2255	2255	1579
6:12	3334	1665	63.4	2982.1	1491.0	2982.1	0.0	1241.0	1.000	1.000	1.00	2255	2030	2255	2255	2255	1665
5:12	3809	1729	67.4	3516.4	1465.2	2930.3	0.0	1241.0	0.983	1.000	1.00	2255	2030	2255	2255	2255	1729
4:12	4402	1811	71.6	4175.7	1391.9	2783.8	0.0	1241.0	0.934	1.000	1.00	2255	2030	2255	2255	2255	1811
2:12	6773	2059	80.5	6681.2	1113.5	2227.1	0.0	1241.0	0.747	1.000	1.00	2255	2030	2255	2255	2255	2059
0:12	9070	2482	90.0	9069.6				1241.0		1.000		2255	2030	2255	2255	2255	2482

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