RICE ENGINEERING
105 School Creek Trail | Luxemburg, WI 54217
(P) 920.617.1042 | (F) 920.617.1100

Privacy Divider System
Divider/Guard Calculations

Project Location:
USA
REI Project # R23-08-261

Prepared for:
East & West Alum Craft Ltd. - Burnaby, BC
2/14/2024

Design Criteria:

1. Railing live loads per **Building Code: IBC 2021 and IRC 2021**
   Guardrails
   - 200 pound concentrated load in any direction on handrails and top rails of guards
   - 50 lb concentrated load over 1 ft^2 of infill area
   - Concentrated load and uniform loads need not be assumed to act concurrently
2. Metal railing deflections per ICC-ES AC273 and IBC.
3. Aluminum members designed per AA, "Aluminum Design Manual".
4. Member sizes, grade, alloy and strengths shall be as recommended in the calculation package.
5. Stainless steel screws (ASTM A193) & bolts (ASTM F593) to be **condition "CW", 300 Series, group 1 or 2, Fy= 65 ksi.**
6. All other fasteners shall be the size and strength as is recommended in the calculation package.
7. Aluminum welds to be **5356 filler alloy unless otherwise noted.**
8. **Concrete slabs and curbs, structural steel, masonry units, wood blocking, and all other anchorage substrates designed by others.**
9. Shim dis-similar metals. Maximum recommended shim height for guardrails is 1/2", full bearing shims.
10. Design of material separation to prevent reaction between dissimilar materials **not designed by Rice Engineering Inc.**
11. Wood substrates are assumed to be **Southern Pine, SG=0.55 minimum unless otherwise noted.**

Disclaimer:

This Certification is limited to the structural design of structural components of this guardrail or divider system.
It does NOT include responsibility for:

- Structural design of misc. hardware (latches, hinges, etc.).
- Structural design of concrete slabs and other masonry units
- Structural design of wood blocking or wood framing
- Structural design of all other anchorage substrates
- Glass breakage due to airborne debris or foreign objects
- The manufacture, assembly, or installation of the system.
- Quantities of materials or dimensional accuracy of drawings

The structural calculations contained within this report are not intended to be submitted as project specific structural calculations. Rice Engineering assumes no liability for use of calculations. If project specific calculations are required, please contact Rice Engineering, 920-617-1042. The analysis within this report provides an acceptable engineered design for the divider to resist the specified loading, as well as the requirements outlined in IBC 2021 and IRC 2021.

RICE ENGINEERING
105 School Creek Trail | Luxemburg, WI 54217
(P) 920.617.1042 | (F) 920.617.1100

Privacy Divider System
Divider/Guard Calculations

Project Location:
USA
REI Project # R23-08-261

Prepared for:
East & West Alum Craft Ltd. - Burnaby, BC
2/14/2024

Page:	Description:	Date:	Revision:
PL	Project Location	9/6/23	
E1	Elevations	9/6/23	
1-1D	Base Plate	9/6/23	
2	Lag Screws	9/6/23	
3-3A	Base Plate	9/6/23	
4-4.1	Deck Board Infill	9/6/23	
4.2-4.2A	Guard Rail	9/6/23	
5	Channel Check	9/6/23	
	RISA FEA Model	9/16/23	
	RISA Post Check	9/16/23	

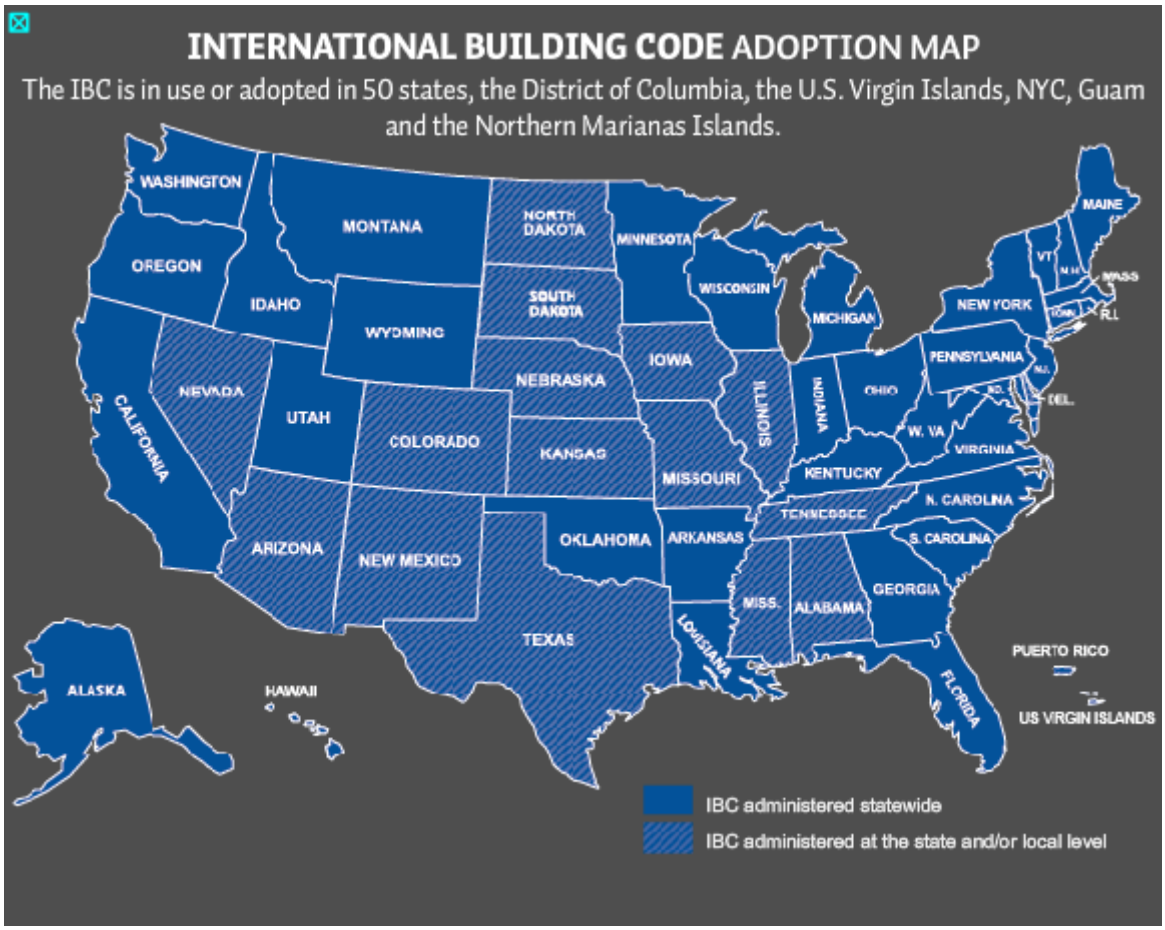
Disclaimer:

This Certification is limited to the structural design of structural components of this guardrail or divider system.
It does NOT include responsibility for:

- Structural design of misc. hardware (latches, hinges, etc.).
- Structural design of concrete slabs and other masonry units
- Structural design of wood blocking or wood framing
- Structural design of all other anchorage substrates
- Glass breakage due to airborne debris or foreign objects
- The manufacture, assembly, or installation of the system.
- Quantities of materials or dimensional accuracy of drawings

The structural calculations contained within this report are not intended to be submitted as project specific structural calculations. Rice Engineering assumes no liability for use of calculations. If project specific calculations are required, please contact Rice Engineering, 920-617-1042. The analysis within this report provides an acceptable engineered design for the divider to resist the specified loading, as well as the requirements outlined in IBC 2021 and IRC 2021.

Project Location	Detail Ref.	Sheet No: PL



International Building Code 2021 Analysis

50 plf uniform load in any direction on top rail

200# concentrated load in any direction on top rail

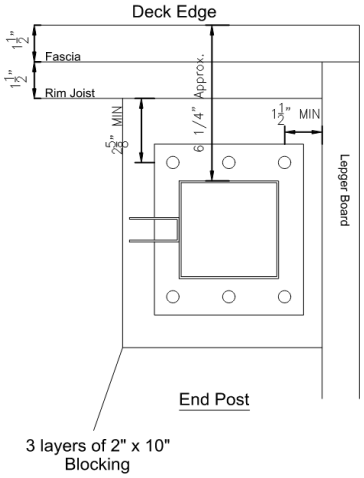
50# concentrated load applied to 1 square foot of infill

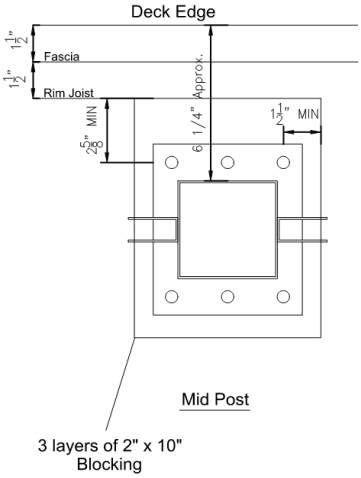
Note: Compliance with the IBC also means compliance with the IRC for this divider system.

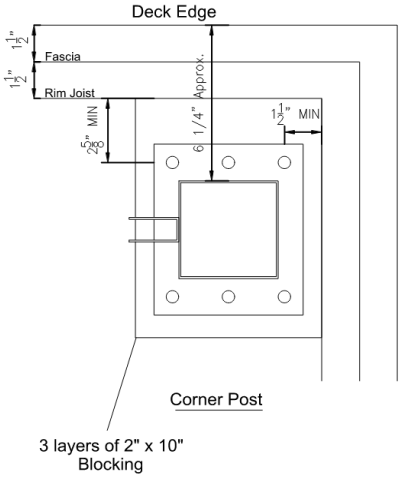
RICE ENGINEERING Template: REI-MC-5700	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150 Engineer: JDB Date: 9/6/2023 Chk By:	Sheet No: PL Rev: Date:

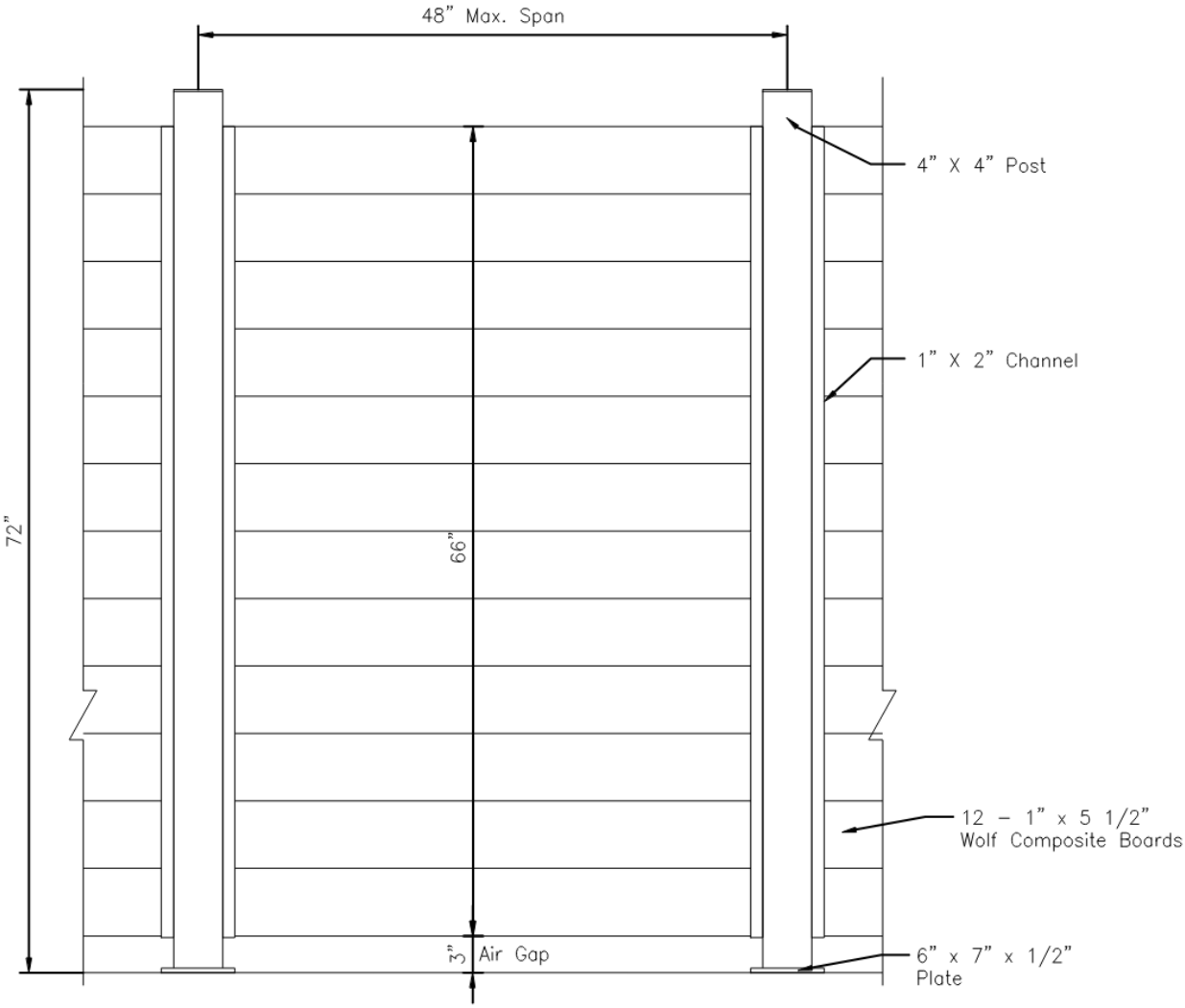
Note: *Wood Blocking, Concrete, CMU and all other anchorage substrates designed by others*

Elevations	Detail Ref.	Sheet No:
		E1









Privacy Divider Elevation

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description:	Job No: R23-06-150	
		Privacy Divider - East & West	Engineer: JDB	Sheet No: E1
			Date: 9/6/2023	Rev:
Template: REI-MC-5701			Chk By:	Date:

4'0" Post Spacing, 6' 0" Height, 25 psf Wind Load

Base Plate	Detail Ref.	Sheet No: 1

$R_{LL} := 200$ lb $\quad R_{WL} := 288 \cdot 2 = 576$ lb

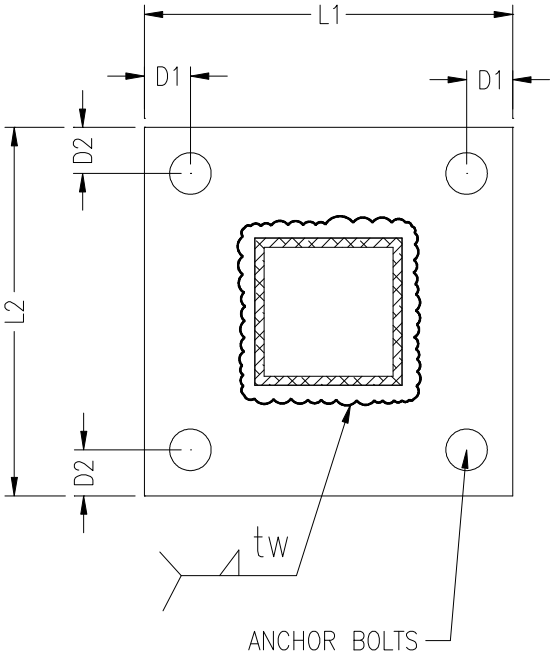
$M_{LL} := 8400$ in·lb $\quad M_{WL} := 10782 \cdot 2 = 21564$ in·lb

$R_{max} := \max(R_{LL}, R_{WL})$ $\quad R_{max} = 576$ lb

$M_{max} := \max(M_{LL}, M_{WL})$ $\quad M_{max} = 21564$ lb·in

$b := 4$ in (post width)

$d := 4$ in (post depth)



Chk Weld to Base Plate:

Base Metal: 6061-T6 $\quad$ *Filler Alloy :* 5356 $\quad t_w := 0.1875$ in

$F_{vub} = 15000$ psi $\quad F_{vuf} = 17000$ psi $\quad n_u := 1.95$

$F_{tub} = 24000$ psi $\quad F_{tuf} = 35000$ psi

$b_w := b + 0.5 \cdot (0.707 \cdot t_w) = 4.07$ in

$d_w := d + 0.5 \cdot (0.707 \cdot t_w) = 4.07$ in

$A_w := t_w \cdot 0.707 \cdot (2 \cdot b_w + 2 d_w) = 2.16$ in^2

$S_w := \frac{t_w \cdot 0.707 \cdot d_w}{3} \cdot \left[(3 \cdot b_w) + d_w\right] = 2.92$ in^3

$A_b := t_w \cdot (2 \cdot b_w + 2 d_w) = 3.05$ in^2

$S_b := \frac{t_w \cdot d_w}{3} \cdot \left[(3 \cdot b_w) + d_w\right] = 4.13$ in^3

$$I_f := \sqrt{\left(\frac{R_{max}}{A_w \cdot \frac{F_{vuf}}{n_u}}\right)^2 + \left[\frac{M_{max}}{\left(S_w \cdot \frac{F_{vuf}}{n_u}\right)}\right]^2} = 0.85$$

$$I_b := \sqrt{\left(\frac{R_{max}}{A_b \cdot \frac{F_{vub}}{n_u}}\right)^2 + \left[\frac{M_{max}}{\left(S_b \cdot \frac{F_{tub}}{n_u}\right)}\right]^2} = 0.42$$

Use 3/16" Fillet Weld All Around
5356 filler alloy

Chk Anchor Bolts:

$V_b := \frac{R_{max}}{6}$ $\quad V_b = 96$ lb

$T_b := \frac{M_{max}}{(L2 - D2) \cdot 0.85 \cdot 3}$ $\quad T_b = 1353$ lb

*****See Next Sheet For Calculations*****

Use (6) 3/8" Dia. SS Lag Screws
300 Series Stainless Steel

Thread Penetration: 5" Min.
Edge Distance: 2"
End Distance: 3-1/2"
Spacing: as shown
Assume S.G. = 0.55 (So. Pine)

*****Install per NDS Guidelines*****

Chk Base Plate:

$L1 := 6$ in $\quad D1 := 0.75$ in

$L2 := 7$ in $\quad D2 := 0.75$ in

assume load is in the direction of L2

$L := L2 - (2 \cdot D2)$ $\quad L = 5.5$ in

$A := \frac{L - d}{2}$ $\quad A = 0.75$ in

$B := L - A$ $\quad B = 4.75$ in

$P := \frac{M_{max}}{d}$ $\quad P = 5391$ lb

$M_{pl} := \frac{P \cdot A \cdot B}{L}$ $\quad M_{pl} = 3492$ in·lb

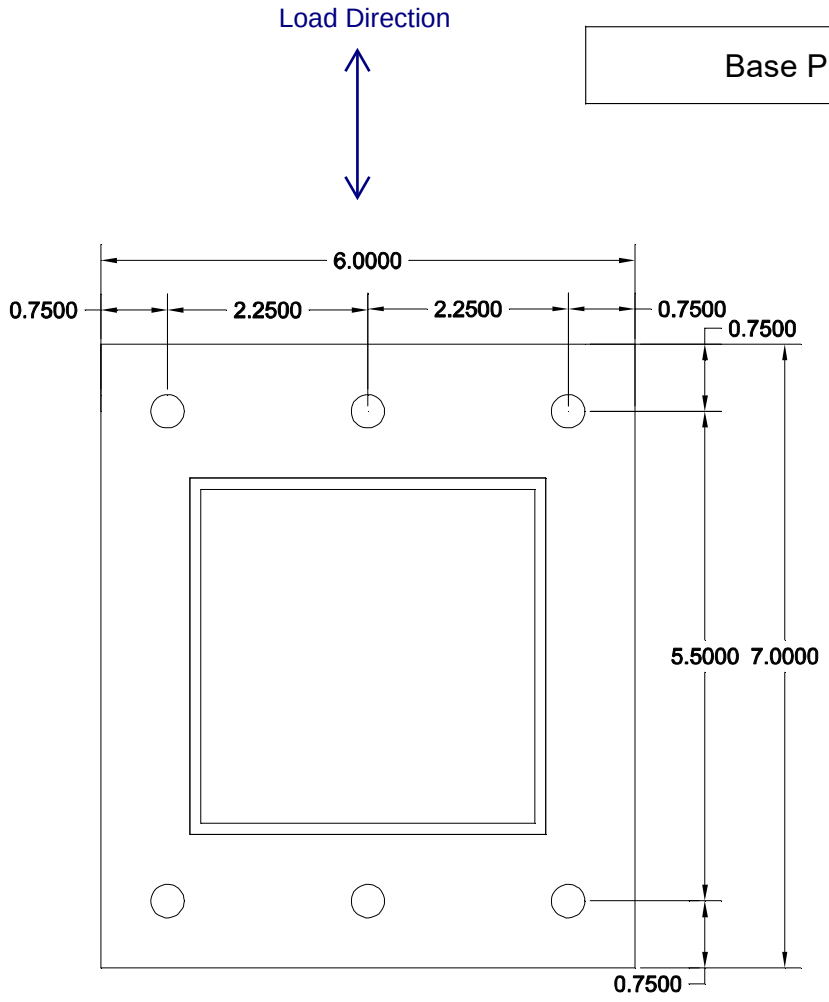
$t_{req} := \sqrt{\frac{M_{pl} \cdot 6}{\frac{1.5 \cdot 15000}{1.65} \cdot L1}}$ $\quad t_{req} = 0.506$ in

1% Over OK, Partial Weld Reduction

Use 1/2" x 7" x 6" Plate
6061-T6 alloy

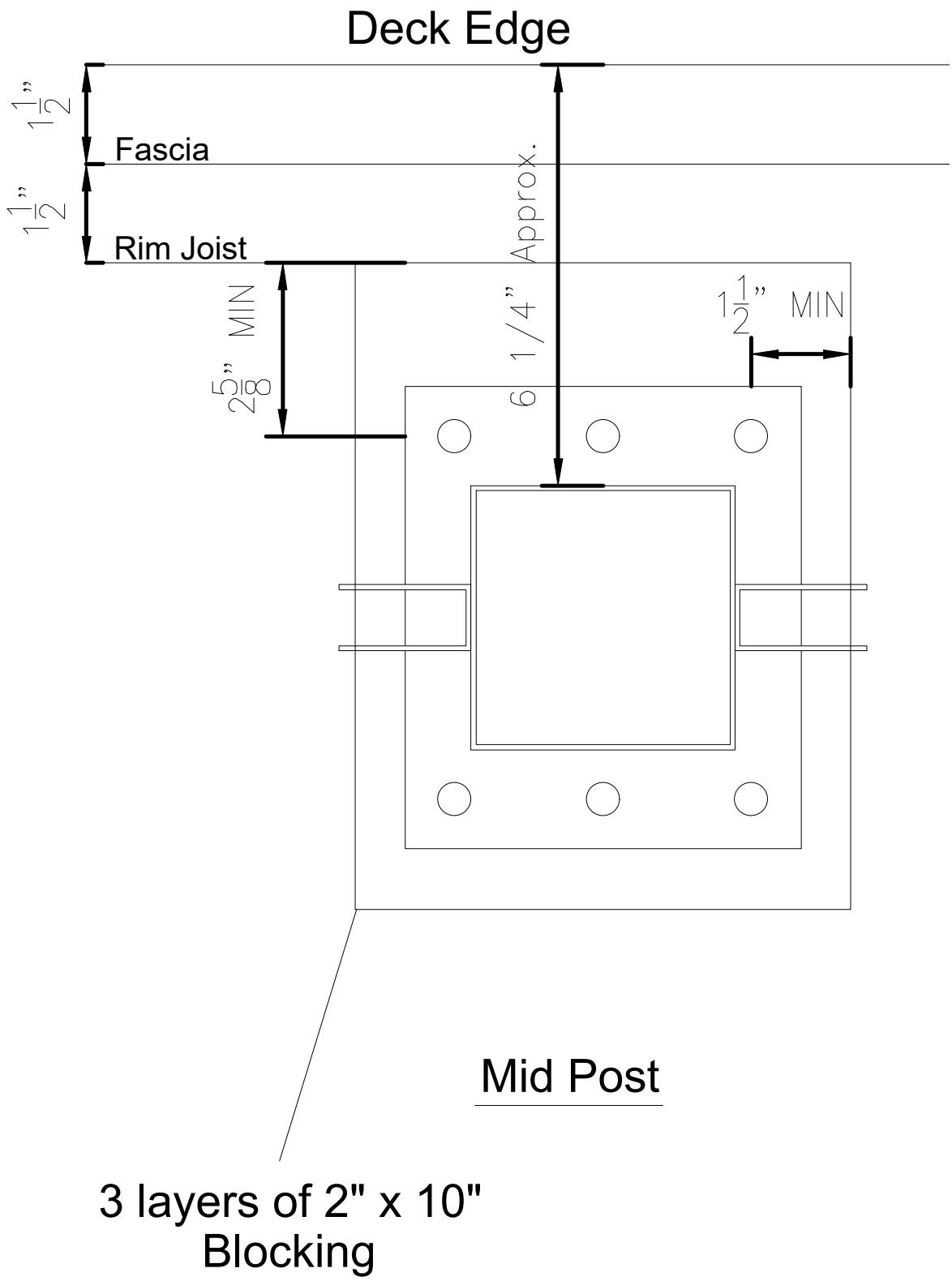
RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150 Engineer: JDB $\quad$ Sheet No: 1 Date: 9/6/2023 $\quad$ Rev: Chk By: $\quad$ Date:

Base Plate	Detail Ref.	Sheet No: 1 A



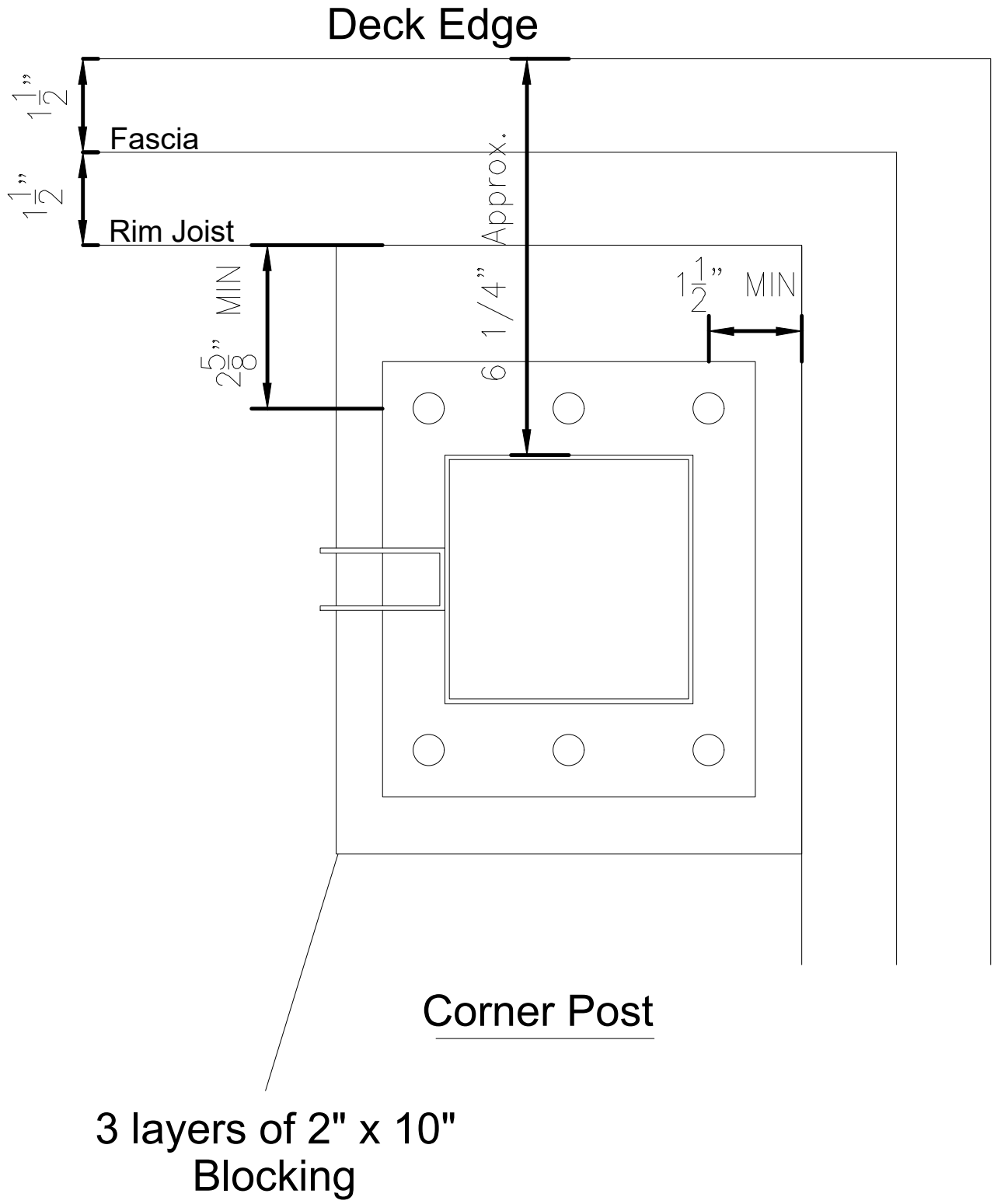
RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150 Engineer: JDB Date: 9/6/2023 Chk By:	Sheet No: 1 A Rev: Date:

Base Plate	Detail Ref.	Sheet No: 1 B



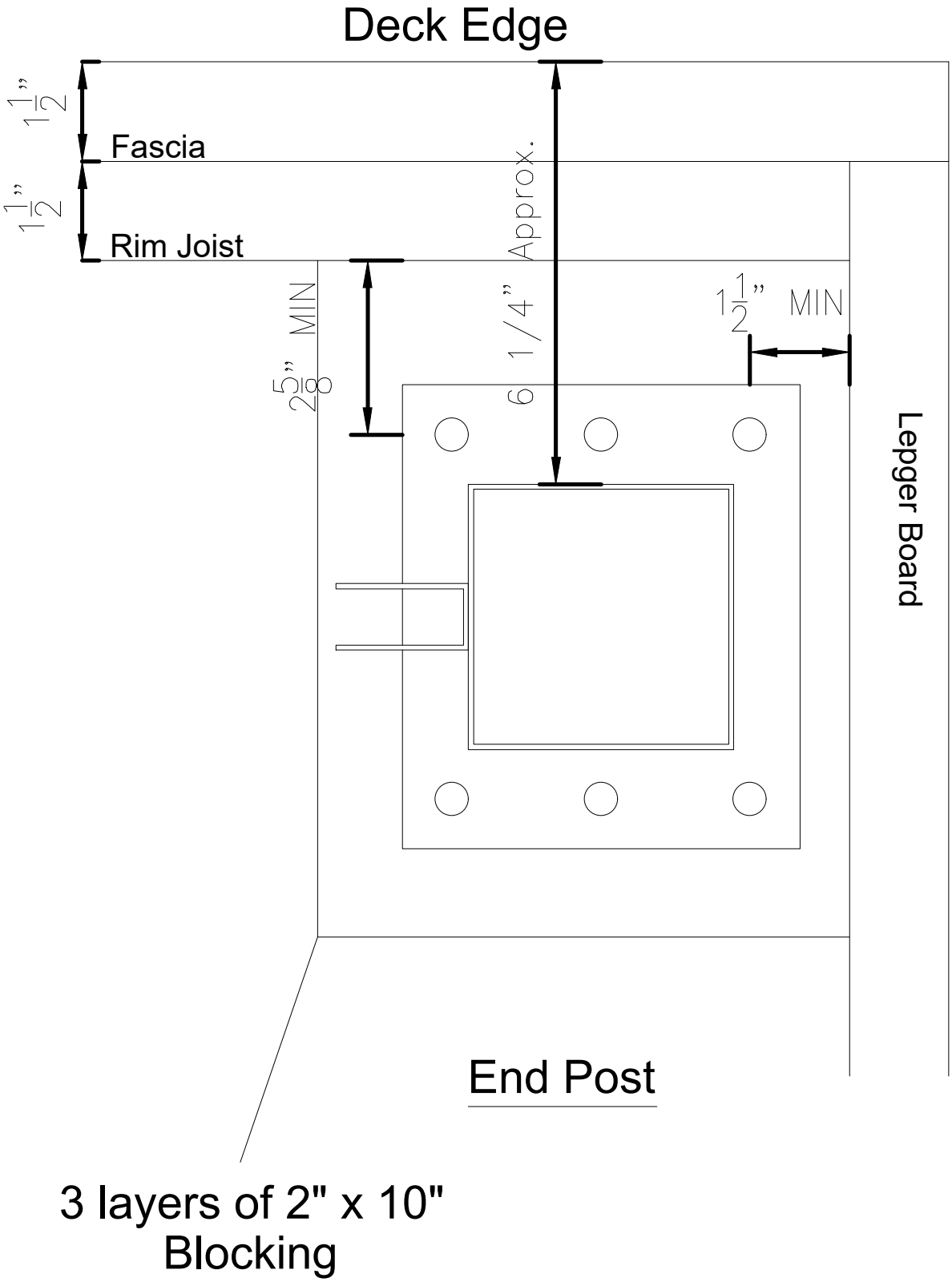
RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150 Engineer: JDB Date: 9/6/2023 Chk By:	Sheet No: 1 B Rev: Date:

Base Plate	Detail Ref.	Sheet No: 1 C



RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 1 C
			Date: 9/6/2023	Rev:
			Chk By:	Date:

Base Plate	Detail Ref.	Sheet No: 1 D



3 layers of 2" x 10"
Blocking

RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 1 D
			Date: 9/6/2023	Rev:
			Chk By:	Date:

Dowel Type Fastener Capacity (NDS 2012)

Lag Screws	Detail Ref.	Sheet No: 2

$V_{pos} := 96 \cdot lbf$ $\quad V_{neg} := 96 \cdot 2 \cdot lbf = 192\,lbf$

$T_{pos} := 1353 \cdot lbf$ $\quad T_{neg} := 1353 \cdot lbf$

3/8 in Lag Screw

$l_m := p$ thickness of main member, in.

$l_s := 0.5$ thickness of side member, in

6061-T6 Hole

$F_{yb} = 45000$ bending yield strength, psi.

$D = 0.375$ unthreaded shank diameter of screw, in.

$D_r = 0.27$ root diameter of screw

$F_{es} = 39000$ bearing strength, psi

$G = 0.55$ Material = "Mixed Maple Southern Pine"

Mixed Maple Southern Pi $\quad G = 0.55$

$p := 5$ penetration, in

$t_{shim} := 1$ maximum thickness of shim, in

$C_D := 1.6$ load duration factor, 10.3.2

$C_M := 0.70$ wet service factor, 10.3.3

$C_t := 1.0$ temperature factor, 10.3.4

$C_g := 1.0$ group action factor, 10.3.6

$C_\Delta := 1.0$ geometry factor, 11.5.1

$C_{eg} := 1.0$ end grain factor, 11.5.2

$C_{di} := 1.0$ diaphragm factor, 11.5.3

$\theta := 90$ angle of Shear load to grain, degree

Calculations

$K_\theta := 1 + 0.25 \cdot \frac{\theta}{90} = 1.25 \qquad R_e := \frac{F_{em}}{F_{es}} = 0.11 \qquad R_t := \frac{l_m}{l_s} = 10$

$$k_1 := \frac{\sqrt{R_e + 2 \cdot R_e^2 \cdot \left(1 + R_t + R_t^2\right) + R_t^2 \cdot R_e^3} - R_e \cdot \left(1 + R_t\right)}{1 + R_e} = 0.44$$

$$k_2 := -1 + \sqrt{2 \cdot \left(1 + R_e\right) + \frac{2 \cdot F_{yb} \cdot \left(1 + 2 \cdot R_e\right) \cdot D_r^2}{3 \cdot F_{em} \cdot l_m^2}} = 0.5$$

$$k_3 := -1 + \sqrt{\frac{2 \cdot \left(1 + R_e\right)}{R_e} + \frac{2 \cdot F_{yb} \cdot \left(2 + R_e\right) \cdot D_r^2}{3 \cdot F_{em} \cdot l_s^2}}$$

$$K_D := \begin{cases} 2.2 & \text{if } D_r \le 0.17 \\ \text{otherwise} \begin{cases} 10 \cdot D_r + 0.5 & \text{if } 0.17 < D_r \le 0.25 \\ 0 & \text{otherwise} \end{cases} \end{cases} = 0$$

$$R_{d1} := \begin{cases} K_D & \text{if } D_r \le 0.25 \\ 4.0 \cdot K_\theta & \text{if } 0.25 < D_r \le 1 \quad \text{otherwise} \end{cases} = 5$$

$$R_{d2} := \begin{cases} K_D & \text{if } D_r \le 0.25 \\ 3.6 \cdot K_\theta & \text{if } 0.25 < D_r \le 1 \quad \text{otherwise} \end{cases} = 4.5$$

$$R_{d3} := \begin{cases} K_D & \text{if } D_r \le 0.25 \\ 3.2 \cdot K_\theta & \text{if } 0.25 < D_r \le 1 \quad \text{otherwise} \end{cases} = 4$$

$$Z_{Im} := \frac{D_r \cdot l_m \cdot F_{em}}{R_{d1}} = 1109.39 \qquad Z_{Is} := \frac{D_r \cdot l_s \cdot F_{es}}{R_{d1}} = 1033.5 \qquad Z_{II} := \frac{k_1 \cdot D_r \cdot l_s \cdot F_{es}}{R_{d2}} = 507.38 \qquad Z_{IIIm} := \frac{k_2 \cdot D_r \cdot l_m \cdot F_{em}}{\left(1 + 2R_e\right) \cdot R_{d3}} = 567$$

$$Z_{IIIs} := \frac{k_3 \cdot D_r \cdot l_s \cdot F_{em}}{\left(2 + R_e\right) \cdot R_{d3}} = 262.39 \qquad Z_{IV} := \frac{D_r^2}{R_{d3}} \cdot \sqrt{\frac{2 \cdot F_{em} \cdot F_{yb}}{3 \cdot \left(1 + R_e\right)}} = 186.97$$

$$Z_1 := \min\left(Z_{Im}, Z_{Is}, Z_{II}, Z_{IIIm}, Z_{IIIs}, Z_{IV}\right) = 186.97$$

$W_1 = 351.84$

$$R_{pos} := \sqrt{T_{pos}^2 + V_{pos}^2} = 1356.4\ lbf \qquad R_{neg} := \sqrt{T_{neg}^2 + V_{neg}^2} = 1366.56\ lbf$$

$$\alpha_{pos} := \operatorname{atan}\left(T_{pos} \cdot V_{pos}^{-1}\right) = 85.94 \cdot deg \qquad \alpha_{neg} := \operatorname{atan}\left(T_{neg} \cdot V_{neg}^{-1}\right) = 81.92 \cdot deg$$

Results

$Z' := Z_1 \cdot C_D \cdot C_M \cdot C_t \cdot C_g \cdot C_\Delta \cdot C_{eg} \cdot C_{di} \cdot lbf = 209\ lbf$ **Allowable Shear**

$W' := W_1 \cdot C_D \cdot C_M \cdot C_t \cdot C_{eg} \cdot p_{ten} \cdot lbf = 1478\ lbf$ **Allowable Tension**

$$Z_{\alpha pos} := \frac{W' \cdot Z'}{W' \cdot \left(\cos\left(\alpha_{pos}\right)\right)^2 + Z' \cdot \left(\sin\left(\alpha_{pos}\right)\right)^2} = 1434.2\ lbf \qquad Int_{pos} := \frac{R_{pos}}{Z_{\alpha pos}} = 0.95$$

$$Z_{\alpha neg} := \frac{W' \cdot Z'}{W' \cdot \left(\cos\left(\alpha_{neg}\right)\right)^2 + Z' \cdot \left(\sin\left(\alpha_{neg}\right)\right)^2} = 1319.9\ lbf \qquad Int_{neg} := \frac{R_{neg}}{Z_{\alpha neg}} = 1.04$$

Fastener = "3/8 in Lag Screw"
Predrill = "Predrill Holes at 60% - 75% D"
Penetration = "Verify Blocking Thickness"
Material = "Mixed Maple Southern Pine"

4% Over OK (load is conservative and based on (3) screws effective in shear instead of (6) screws.)

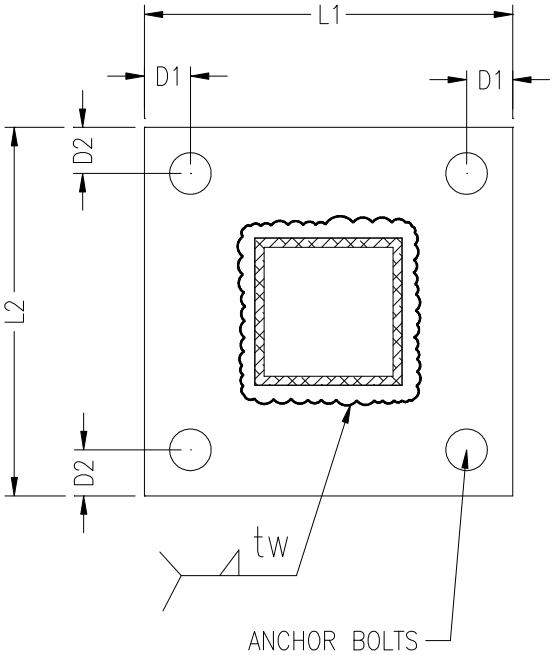
Base Plate	Detail Ref.	Sheet No: 3

$R_{LL} := 200$ lb $\quad R_{WL} := 288 \cdot 2 = 576$ lb

$M_{LL} := 8400$ in·lb $\quad M_{WL} := 10782 \cdot 2 = 21564$ in·lb

$R_{max} := \max(R_{LL}, R_{WL})$ $\quad R_{max} = 576$ lb

$M_{max} := \max(M_{LL}, M_{WL})$ $\quad M_{max} = 21564$ lb·in



Chk Anchor Bolts:

$A_w := 2 \cdot 2.5 - 0.4375^2 \cdot \frac{3.141}{4} = 4.85$ in^2

$V_b := \frac{R_{max}}{4}$ $\quad V_b = 144$ lb

$T_b := \frac{M_{max}}{(L2 - D2) \cdot 0.85 \cdot 2}$ $\quad T_b = 2416$ lb

$V_{bwood} := 209$ lb

$V_{ball} := 1614$ lb

$T_{ball} := 3100$ lb

$f_{perp} := \frac{T_b}{A_w} = 498$ psi

$F_{perp} := 620$ psi

$I := \left(\frac{V_b}{V_{ball}}\right)^2 + \left(\frac{T_b}{T_{ball}}\right)^2 = 0.62 \quad < \quad 1.0$

Use (4) 3/8" Dia. SS Thru-Bolts
300 Series Stainless Steel, Fu = 100 ksi
Thread Penetration: 5" Min.
Edge Distance: 1-1/2" Min.
End Distance: 2-5/8" min.
Spacing: as shown
Assume S.G. = 0.55 (So. Pine)

Use 2" x 2-1/2" x 1/8" thk Steel Washer Plate min.

Thru-Bolt Option

$b := 4$ in (post width)

$d := 4$ in (post depth)

Chk Weld to Base Plate:

Base Metal: 6061-T6 $\quad$ *Filler Alloy :* 5356 $\quad t_w := 0.1875$ in

$F_{vub} = 15000$ psi $\quad F_{vuf} = 17000$ psi $\quad n_u := 1.95$

$F_{tub} = 24000$ psi $\quad F_{tuf} = 35000$ psi

$b_w := b + 0.5 \cdot (0.707 \cdot t_w) = 4.07$ in

$d_w := d + 0.5 \cdot (0.707 \cdot t_w) = 4.07$ in

$A_w := t_w \cdot 0.707 \cdot (2 \cdot b_w + 2 d_w) = 2.16$ in^2

$S_w := \frac{t_w \cdot 0.707 \cdot d_w}{3} \cdot [(3 \cdot b_w) + d_w] = 2.92$ in^3

$A_b := t_w \cdot (2 \cdot b_w + 2 d_w) = 3.05$ in^2

$S_b := \frac{t_w \cdot d_w}{3} \cdot [(3 \cdot b_w) + d_w] = 4.13$ in^3

$$I_f := \sqrt{\left(\frac{R_{max}}{A_w \cdot \frac{F_{vuf}}{n_u}}\right)^2 + \left[\frac{M_{max}}{\left(S_w \cdot \frac{F_{vuf}}{n_u}\right)}\right]^2} = 0.85$$

$$I_b := \sqrt{\left(\frac{R_{max}}{A_b \cdot \frac{F_{vub}}{n_u}}\right)^2 + \left[\frac{M_{max}}{\left(S_b \cdot \frac{F_{tub}}{n_u}\right)}\right]^2} = 0.42$$

Use 3/16" Fillet Weld All Around
5356 filler alloy

Chk Base Plate:

$L1 := 7$ in $\quad D1 := 0.75$ in

$L2 := 6$ in $\quad D2 := 0.75$ in

assume load is in the direction of L2

$L := L1 - (2 \cdot D1)$ $\quad L = 5.5$ in

$A := \frac{L - d}{2}$ $\quad A = 0.75$ in

$B := L - A$ $\quad B = 4.75$ in

$P := \frac{M_{max}}{d}$ $\quad P = 5391$ lb

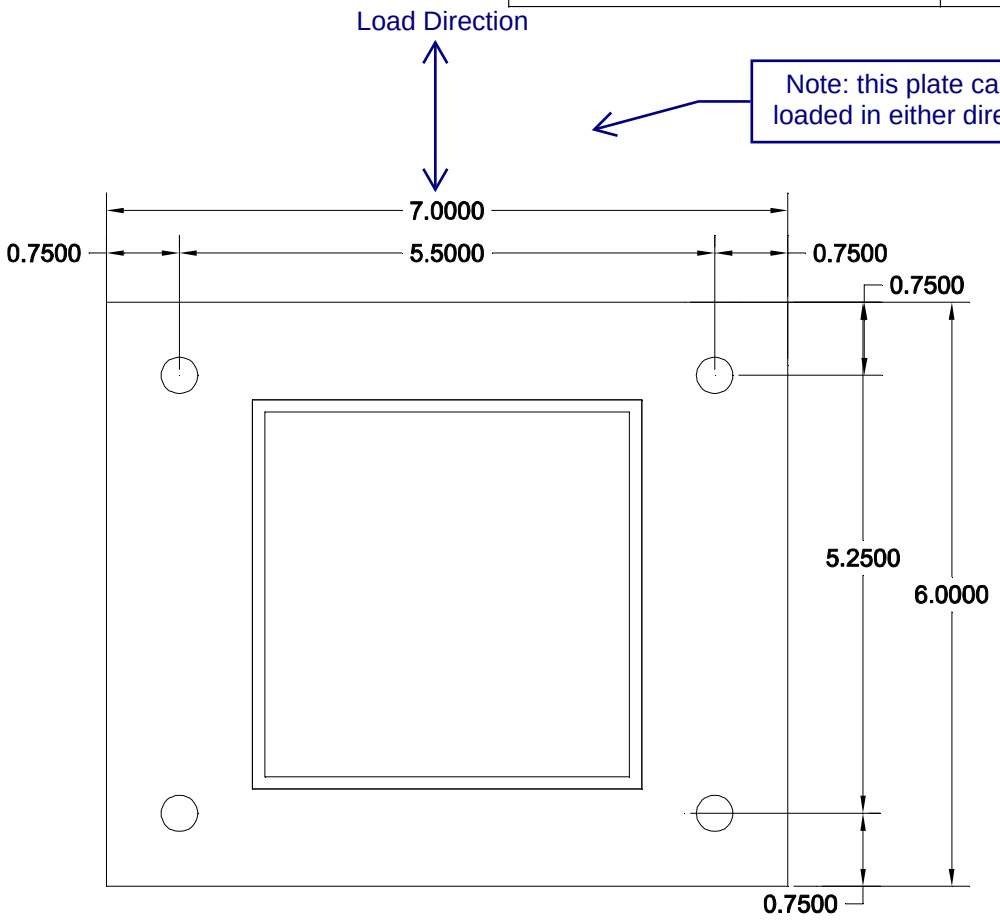
$M_{pl} := \frac{P \cdot A}{2}$ $\quad M_{pl} = 2022$ in·lb

$$t_{req} := \sqrt{\frac{M_{pl} \cdot 6}{\frac{1.5 \cdot 15000}{1.65} \cdot L2 \cdot 0.85}} \quad t_{req} = 0.418 \text{ in}$$

Use 1/2" x 6" x 7" Plate
6061-T6 alloy

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 3
			Date: 9/6/2023	Rev:
Template: REI-MC-5780			Chk By:	Date:

Base Plate	Detail Ref.	Sheet No: 3 A



RICE ENGINEERING Template: REI-MC-5780	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 3 A
			Date: 9/6/2023	Rev:
			Chk By:	Date:

Deck Board Infill	Detail Ref.	Sheet No: 4

Inputs:

$b := 25.4\,mm = 1\,in$

$d := 139.7\,mm = 5.5\,in$

$DL_{dn} := 25 \cdot psf$

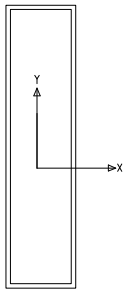
$DL_{up} := 25 \cdot psf$

$L := 48 \cdot in - 4in = 44\,in$

$L_b := L$

$\theta := 0deg$

$P := 50lbf$



$EI := 269000\,kN \cdot mm^2 = 93734 \cdot lbf \cdot in^2$

Use 1" x 5-1/2" Inteplast Deck or Wolf Serenity Deck Solid Profile 44" Max Length

$TW_s := 0 \cdot in$

$TW_w := d \cdot \cos(\theta) + b \cdot \sin(\theta) = 5.5\,in$

Calculations:

All Calculations Below This Line Are Automatic

$TL := \max(DL_{dn}, DL_{up}) = 25 \cdot psf$

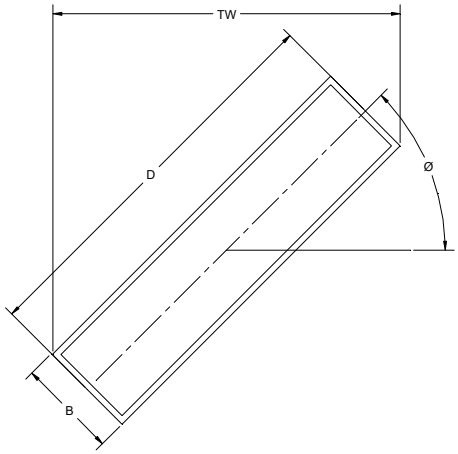
$TW := \max(TW_s, TW_w) = 5.5\,in$

$w_{yWL} := DL_{up} \cdot TW \cdot \cos(\theta) = 0.95 \cdot pli$

$w_{yTL} := TL \cdot TW \cdot \cos(\theta) = 0.95 \cdot pli$

$w_y := \max(w_{yTL}, w_{yWL}) = 0.95 \cdot pli$

Note: This detail does not work for fall protection. (See sheet 4.1 for additional tube support).



Wind Load Check

$M_y := \frac{w_y \cdot L_b^2}{8} = 231\,in \cdot lbf$

$M_{yall} := \frac{236600\,N \cdot mm}{1.67} = 1254\,in \cdot lbf$

$\Delta_{yWL} := \frac{5 \cdot w_y \cdot L_b^4}{384 \cdot EI} = 0.5\,in$

$\Delta_{yWLall} := \frac{L_b}{60} = 0.73\,in$

$R_{blades} := \frac{L}{2} \cdot w_y = 21.01\,lbf$

$Blades := \begin{cases} \text{"OK"} & \text{if } \max\left(\frac{\Delta_{yWL}}{\Delta_{yWLall}}\right) \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

Infill Live Load Check

$M_{LL} := \frac{P \cdot L}{4 \cdot (2)} = 275\,in \cdot lbf$

Note: (2) deck boards effective for 12" x 12" load area.

$M_{yall} = 1254\,in \cdot lbf$

$\Delta_{yWL} := \frac{P \cdot L^3}{48 \cdot EI \cdot (2)} = 0.47\,in$

$\Delta_{yWLall} = 0.73\,in$

$w := TW \cdot TL$

$w = 0.955 \cdot pli$

$R_{blades} = 21\,lbf$

$Blades = \text{"OK"}$

RICE ENGINEERING Template: REI-MC-5211	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 4
			Date: 9/6/2023	Rev:
			Chk By:	Date:

Material requirements

Table 1. Test results for basic physical and mechanical properties

Property	Unit	Requirement	Result [1]
Dimensional change – coefficient of linear thermal expansion – longitudinal	°C−1	$< 2 \times 10^{-5}$	3.39×10^{-5} [2]
Dimensional change – coefficient of linear thermal expansion – transverse	°C−1	$< 2 \times 10^{-5}$	3.98×10^{-5} [2]
Dimensional change – coefficient of linear expansion (swelling) – oven-dry to vacuum pressure soak	%	≤ 0.5, by 80% of specimens	- 0.40
Strength and stiffness – Inteplast Deck and Wolf Serenity Deck – flexural rigidity (EI)	$kN \cdot mm^2$	≥ 300 000	269 000 [3]
Strength and stiffness – Inteplast Deck and Wolf Serenity Deck – moment capacity (M_r)	N·mm	≥ 190 000	329 300

Deck Board Infill	Detail Ref.	Sheet No: 4.1

Inputs:

$b := 25.4\,mm = 1\,in$

$d := 139.7\,mm = 5.5\,in$

$DL_{dn} := 25 \cdot psf$

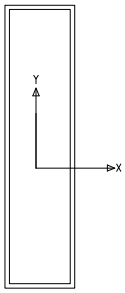
$DL_{up} := 25 \cdot psf$

$L := 25.25 \cdot in - 4in - 2in = 19.25\,in$

$L_b := L$

$\theta := 0deg$

$P := 200\,lbf$



$TW_s := 0 \cdot in$

$TW_w := d \cdot \cos(\theta) + b \cdot \sin(\theta) = 5.5\,in$

$EI := 269000\,kN \cdot mm^2 = 93734 \cdot lbf \cdot in^2$

Use 1" x 5-1/2" Inteplast Deck or Wolf Serenity Deck Solid Profile 21.25" Max Length without added tube support

Calculations:

All Calculations Below This Line Are Automatic

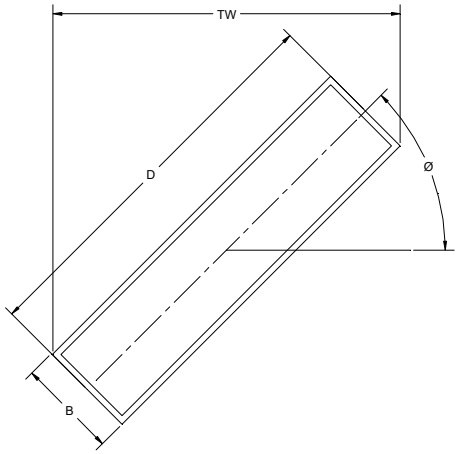
$TL := \max(DL_{dn}, DL_{up}) = 25 \cdot psf$

$TW := \max(TW_s, TW_w) = 5.5\,in$

$w_{yWL} := DL_{up} \cdot TW \cdot \cos(\theta) = 0.95 \cdot pli$

$w_{yTL} := TL \cdot TW \cdot \cos(\theta) = 0.95 \cdot pli$

$w_y := \max(w_{yTL}, w_{yWL}) = 0.95 \cdot pli$



Wind Load Check

$M_y := \frac{w_y \cdot L_b^2}{8} = 44\,in \cdot lbf$

$M_{yall} := \frac{236600\,N \cdot mm}{1.67} = 1254\,in \cdot lbf$

$\Delta_{yWL} := \frac{5 \cdot w_y \cdot L_b^4}{384 \cdot EI} = 0.02\,in$

$\Delta_{yWLall} := \frac{L_b}{60} = 0.32\,in$

Infill Live Load Check

$M_{LL} := \frac{P \cdot L}{4 \cdot (1)} = 963\,in \cdot lbf$

$M_{yall} = 1254\,in \cdot lbf$

$\Delta_{yWL} := \frac{P \cdot L^3}{48 \cdot EI \cdot (1)} = 0.32\,in$

$\Delta_{yWLall} = 0.32\,in$

$R_{blades} := \frac{L}{2} \cdot w_y = 9.19\,lbf$

$Blades := \begin{cases} \text{"OK"} & \text{if } \max\left(\frac{\Delta_{yWL}}{\Delta_{yWLall}}\right) \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

$w := TW \cdot TL$

$w = 0.955 \cdot pli$

$R_{blades} = 9\,lbf$

$Blades = \text{"OK"}$

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 4.1
			Date: 9/6/2023	Rev:
Template: REI-MC-5211			Chk By:	Date:

Top Rail	Detail Ref.	Sheet No: 4.2

Inputs:

$b := 1$ in

$t := 0.125$ in

$d := 2$ in

$SPA_p := 44$ in Post Spacing

$L_b := 44$ in Unbraced Length

Railing Loading:

$W_h := 50$ plf Horizontal Uniform Load

$W_v := 50$ plf Vertical uniform load (Simultaneous ☐)

$P := 200$ lb Concentrated Load

Rail Construction:

☐ Welded within 1" of Maximum Moment

Use 2" x 1" x 1/8" Wall Tube
(6005-T5 or better)

Railing Material:

6005A-T6□1 Aluminum

Railing Properties:

$A := VAL(\text{"Area :"}, Shape) = 0.69$ in^2

$I_x := VAL(\text{"I.x :"}, Shape) = 0.33$ in^4

$I_y := VAL(\text{"I.y :"}, Shape) = 0.11$ in^4

$S_x := VAL(\text{"S.x :"}, Shape) = 0.33$ in^3

$S_y := VAL(\text{"S.y :"}, Shape) = 0.21$ in^3

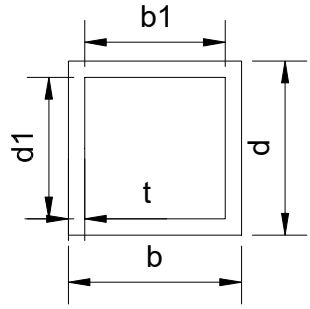
$Z_x := VAL(\text{"Z.x :"}, Shape) = 0.43$ in^3

$Z_y := VAL(\text{"Z.y :"}, Shape) = 0.25$ in^3

$J := VAL(\text{"J = "}, Shape) = 0.24$ in^4

$b_1 := b - 2t = 0.75$ in

$d_1 := d - 2t = 1.75$ in



Calculations:

All Calculations Below This Line Are Automatic

$$E := \begin{cases} 10100000 & \text{if } M1 < 7 \\ 29000000 & \text{otherwise} \end{cases} = 10100000 \text{ psi}$$

$$w_h := \frac{W_h}{12} = 4.17 \text{ pli} \qquad w_v := \frac{W_v}{12} = 4.17 \text{ pli}$$

$$M_{y1} := \frac{w_h \cdot SPA_p^2}{8} = 1008 \text{ in}\cdot\text{lb}$$

$$M_{x1} := \frac{w_v \cdot SPA_p^2}{8} = 1008 \text{ in}\cdot\text{lb}$$

$$M_{y2} := \frac{P \cdot SPA_p}{4} = 2200 \text{ in}\cdot\text{lb}$$

$$M_{x2} := M_{y2}$$

$$f_{by} := \frac{\max(M_{y1}, M_{y2})}{S_y} = 10462 \text{ psi}$$

$$f_{bx} := \frac{\max(M_{x1}, M_{x2})}{S_x} = 6632 \text{ psi}$$

$$f_{bmax} := \begin{cases} \max\left[\left(\frac{M_{x1}}{Z_x} + \frac{M_{y1}}{Z_y}\right)\cdot S, \max\left(\frac{M_{x2}}{Z_x}, \frac{M_{y2}}{Z_y}\right)\right] & \text{if } M1 \ge 7 \\ \max\left[\left(\frac{M_{x1}}{S_x} + \frac{M_{y1}}{S_y}\right)\cdot S, \max\left(\frac{M_{x2}}{S_x}, \frac{M_{y2}}{S_y}\right)\right] & \text{otherwise} \end{cases} = 10462 \text{ psi}$$

$$\Delta_y := \max\left(\frac{5 \cdot w_v \cdot SPA_p^4}{384 \cdot E \cdot I_x}, \frac{P \cdot SPA_p^3}{48 \cdot E \cdot I_x}\right) = 0.11 \text{ in}$$

$$\Delta_x := \max\left(\frac{5 \cdot w_h \cdot SPA_p^4}{384 \cdot E \cdot I_y}, \frac{P \cdot SPA_p^3}{48 \cdot E \cdot I_y}\right) = 0.33 \text{ in}$$

$$\Delta_{max} := \max(\Delta_y, \Delta_x) = 0.33 \text{ in}$$

$$\Delta_{allow} := \frac{L_b}{96} = 0.46 \text{ in}$$ per ICC-ES AC 273

$$RAIL := \left[\max\left(\begin{pmatrix} \Delta_{max} \div \Delta_{allow} \\ f_{bmax} \div F_b \end{pmatrix}\right)\right]$$

Allowable Stress Coefficients:

X1 = 23.9	X5 = 23.9	X9 = 21.2	X13 = 33	X17 = 40.5	
X2 = 0.24	X6 = 0.24	X10 = 20.8	X14 = 580	X18 = 0.26	
X3 = 1685	X7 = 1685	X11 = 27.3	X15 = 27.6	X19 = 77	
X4 = 23599	X8 = 23599	X12 = 0.29	X16 = 49.3	X20 = 1563	

Material Properties:

$F_{ty} = 35000$ psi

$F_{cy} = 35000$ psi

$F_{tu} = 38000$ psi

$F_{ySTL} = 0$ psi

$$S_r := \frac{2 \cdot L_b \cdot S_x}{\sqrt{I_y \cdot J}} = 181.99$$

[F.3.1]
$$F_{bAL} := \begin{cases} \left[\left(X1 - X2\sqrt{S_r}\right)\cdot 1000\right] & \text{if } S_r \le X3 \\ \frac{X4}{S_r} & \text{otherwise} \end{cases} = 20689 \text{ psi}$$

[F.8.1.1] [F.8.1.2]
$$F_{bAL2} := \min\left(\min\left(\frac{F_{ty}}{1.65}, \frac{F_{tu}}{1.95}\right), \min\left(\frac{1.30 \cdot F_{ty}}{1.65}, \frac{1.42 \cdot F_{tu}}{1.95}\right)\right) = 19487 \text{ psi}$$

$$S_{rf} := b_1 \cdot t^{-1} = 6 \quad [F.8.2.1]$$

[B.5.4.2]
$$F_{bAL3} := \begin{cases} X9 \cdot 1000 & \text{if } S_{rf} < X10 \\ \text{otherwise} \\ \quad \begin{cases} (X11 - X12 \cdot S_{rf})\cdot 1000 & \text{if } S_{rf} \le X13 \\ \frac{X14}{S_{rf}}\cdot 1000 & \text{otherwise} \end{cases} \end{cases} = 21200 \text{ psi}$$

$$S_{rw} := d_1 \cdot t^{-1} = 14 \quad [F.8.2.2]$$

[B.5.5.1]
$$F_{bAL4} := \begin{cases} X15 \cdot 1000 & \text{if } S_{rw} < X16 \\ \text{otherwise} \\ \quad \begin{cases} (X17 - X18 \cdot S_{rw})\cdot 1000 & \text{if } S_{rw} \le X19 \\ \frac{X20}{S_{rw}}\cdot 1000 & \text{otherwise} \end{cases} \end{cases} = 27600 \text{ psi}$$

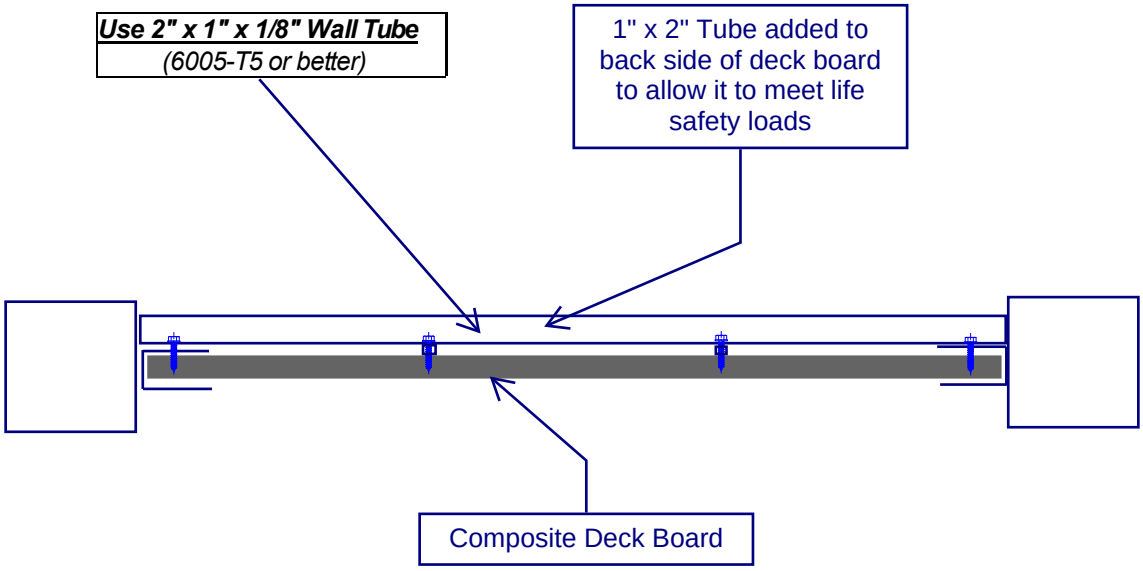
$$F_{bSTL} := \frac{F_{ySTL}}{1.67} = 0 \text{ psi}$$

$$F_b := \max(\min(F_{bAL}, F_{bAL2}, F_{bAL3}, F_{bAL4}), F_{bSTL}) = 19487 \text{ psi}$$

RAIL = "0.73 < 1.00 ∴ PASS"

RICE ENGINEERING Template: REI-MC-5713	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150 Engineer: JDB Date: 9/6/2023 Chk By:	Sheet No: 4.2 Rev: Date:

Top Rail	Detail Ref.	Sheet No: 4.2 A



RICE ENGINEERING Template: REI-MC-5713	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 4.2 A
			Date: 9/6/2023	Rev:
			Chk By:	Date:

Channel Check	Detail Ref.	Sheet No: 5

Inputs:

$DL_{dn} := 25$ psf

$DL_{up} := 25$ psf

$WL_{Lat} := 25$ psf *horizontal wind*

$L := 71.5$ in

$L_b := 12$ in

$b := 1.91$ in

$d := 1.21$ in

$t := 0.09$ in

$w := \frac{20}{5.5} = 3.636$ pli

Section Properties:

$I_x := 0.165$ in^4

$I_y := 0.116$ in^4

$S_x := 0.144$ in^3

$S_y := 0.192$ in^3

$A := 0.437$ in^2

$E := 10100000$ psi

- [x] 6063-T5
- [ ] 6063-T6
- [ ] 6005-T5
- [ ] 6061-T6

Use 1.21" x 1.91" x 0.09" thk
AL. Channel as shown (6063-T5)

$TW_{wk} := d = 1.21$ in

$TW_{st} := b = 1.91$ in

- [ ] Welded within 1 inch of Mmax

$J := \frac{(2 \cdot b \cdot t^3) + d \cdot t^3}{3}$ $J = 0$ in^4

Calculations:

All Calculations Below This Line Are Automatic

Check Channel:

$M_y := \frac{w \cdot L_b^2}{8} = 65.45$ in·lb

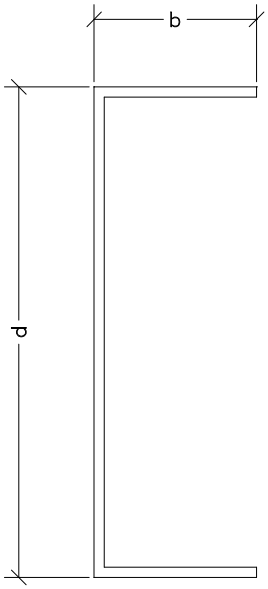
$\Delta_y := \frac{5 \cdot w \cdot L_b^4}{384 \cdot E \cdot I_x} = 0.001$ in

$\Delta_{yall} := \frac{L_b}{120} = 0.100$ in

$f_{by} := \frac{M_y}{S_y} = 341$ psi

$F_{by} = 12500$ psi

$r_y := \frac{1}{1.7} \cdot \sqrt{\frac{I_y \cdot d}{S_x} \cdot \left[.5 + \sqrt{1.25 + .152 \cdot \left(\frac{J}{I_y}\right) \cdot \left(\frac{L_b}{d}\right)^2}\right]}$



Check Screws:

$V := 1.14 \, w \cdot L_b = 49.75$ lb

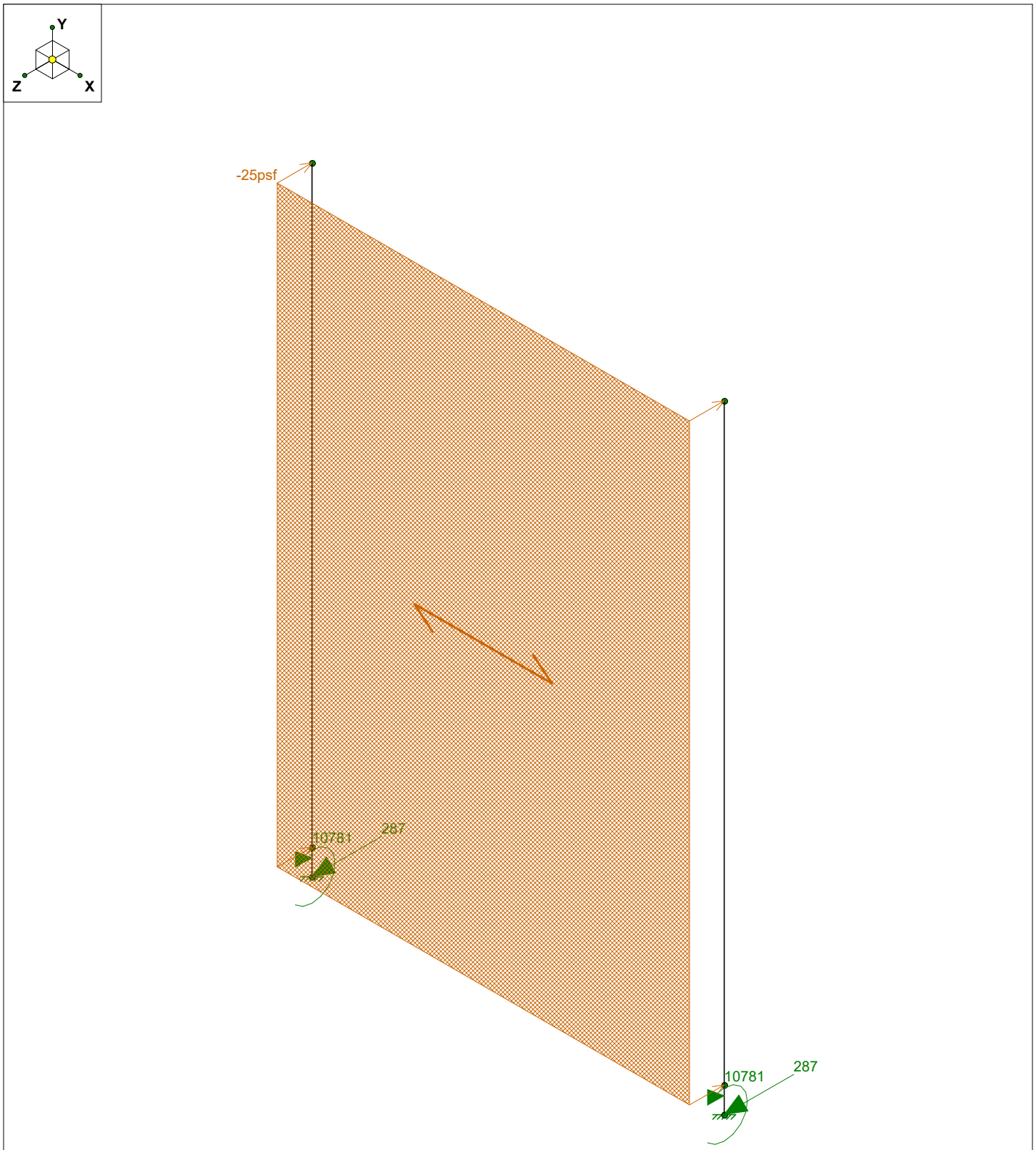
$V_{all} := 292$ lb

Use #10 S.S. Screws at 12" O.C. Max.
(300 Series S.S., Cond. CW, Fy = 65 ksi)
1/8" Min. Thread Engagement

$CHANNEL := \begin{cases} \text{"OK"} & \text{if } \frac{f_{by}}{F_{by}} \le 1 \wedge \frac{\Delta_y}{\Delta_{yall}} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

CHANNEL = "OK"

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **Privacy Divider - East & West**	Job No: R23-06-150	
			Engineer: JDB	Sheet No: 5
			Date: 9/6/2023	Rev:
Template: REI-MC-5214			Chk By:	Date:



Loads: BLC 1,
Results for LC 1,
Reaction and Moment Units are lb and lb-in

Rice Engineering		SK - 1
Joe Bauer		June 16, 2023 at 1:52 PM
		Model 1.r3d

POST CHECK

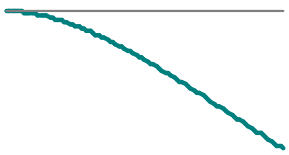
Beam: ***M2***

Shape: **RT4X4X0.125**
Material: **6061-T6 W**
Length: **72 in**
I Joint: **N4**
J Joint: **N6**
LC 2:
Code Check: **0.999 (bending)**
Report Based On 97 Sections

Dy — **in**

Deflection Allowable
= 74.5"*2/120 = 1.242"
:. Deflection is OK

Dz — **in**

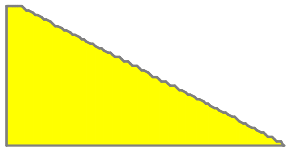


-.721 at 72 in

A — **lb**

Vy — **lb**

575 at 3 in

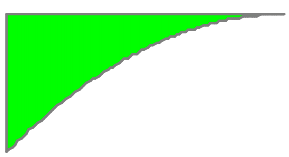


Vz — **lb**

T — **lb-in**

Mz — **lb-in**

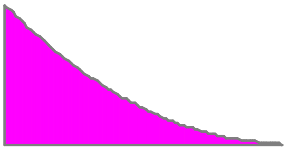
My — **lb-in**



-21562.5 at 0 in

fa — **psi**

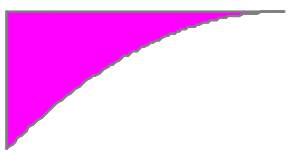
8891.753 at 0 in



fc — **psi**

Fb = 9000 psi :. Stress is OK

ft — **psi**



-8891.753 at 0 in

Fb = 9000 psi :. Stress is OK

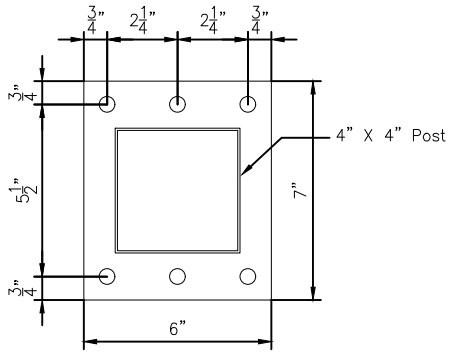
AA ADM1-10: ASD - Building Code Check

Max Bending Check	**0.999**	Max Shear Check	**0.116 (z)**	Max Defl Ratio	**L/10000**
Location	**0 in**	Location	**3 in**	Location	**0 in**
Equation	**H.1-1**			Span	**1**

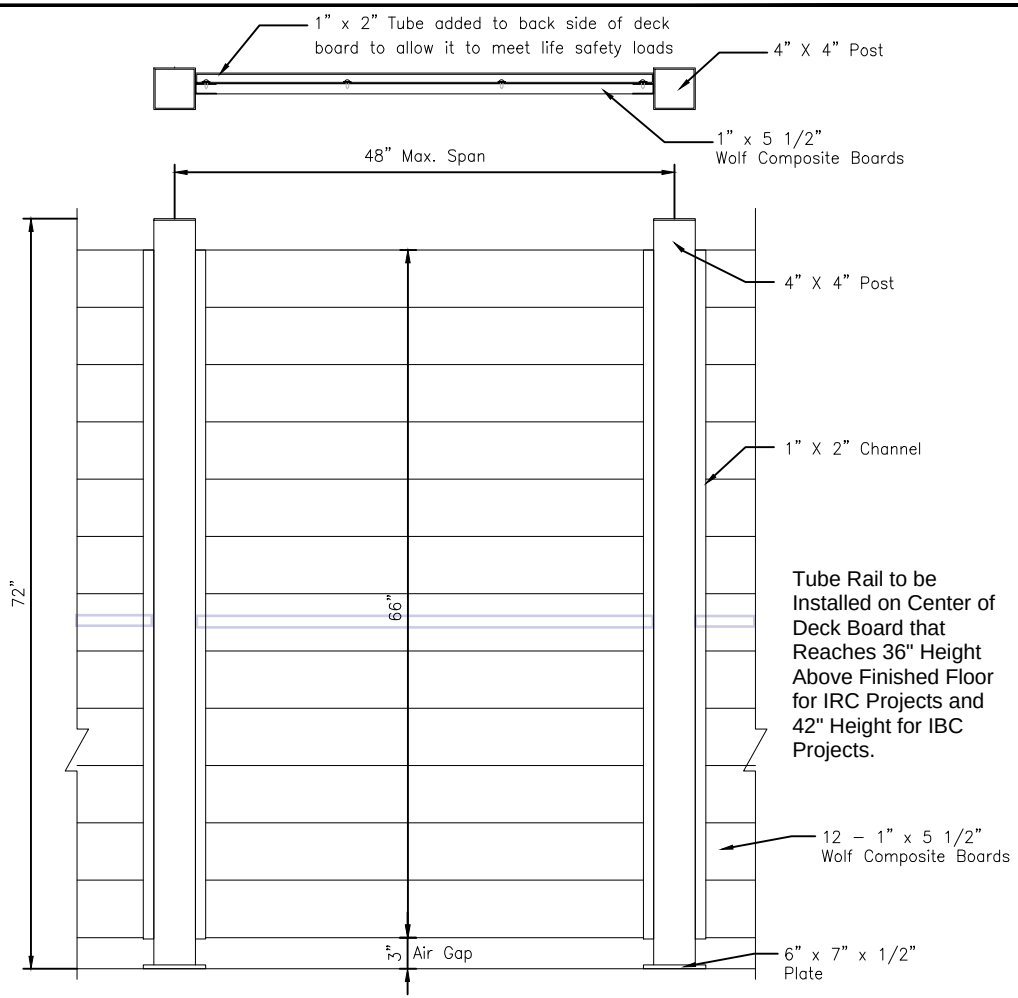
		Slender. Limit S1	S2	Slender. Ratio S	Gov Eqn
Pnt/om	**17636.364 lb**				**D.2-1**
Pnc/om	**12995.264 lb**		**133.3**	**45.5**	**E.3-2**
Mny/om	**21582.616 lb-in**	**28.2**	**57.5**	**30**	**B.5.4.2**
Mnz/om	**21582.616 lb-in**	**28.2**	**57.5**	**30**	**B.5.4.2**
Vny/om	**4943.182 lb**	**47.5**	**126.3**	**30**	**G.1-1**
Vnz/om	**4943.182 lb**	**47.5**	**126.3**	**30**	**G.1-1**

	y-y	z-z
Lb	**72 in**	**72 in**
KL/r	**45.537**	**45.537**

L Comp Top	**72 in**
L Comp Bot	**72 in**
Torque Length	**72 in**
Tau_b	**1**
Cb	**1**



6"x7"x1/2" Plate
(Typical Plate Detail)
4" x 4" Post

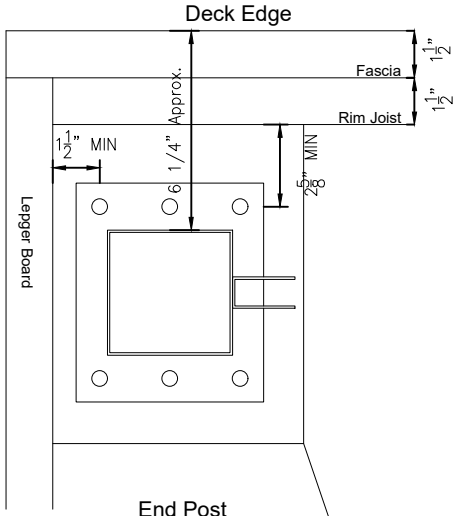


Tube Rail to be Installed on Center of Deck Board that Reaches 36" Height Above Finished Floor for IRC Projects and 42" Height for IBC Projects.

Privacy Divider Elevation

-Note:
On Residential Projects Requiring Fall Guard Protection
Attach 1" x 2" Aluminum Stiffener to TheBackside Of
The Composite Deck Board Using Qty 4- #14SS Screws
To Attach The Aluminum Stiffener To The Composite Infill.

Title: Privacy Divider	Drawing No. SK01	Scale: 3"=1'-0"	**S.T.A.R.** ***SYSTEM INTERNATIONAL LTD.***
The structural calculations contained within this report are not intended to be submitted as project specific structural calculations. Rice Engineering assumes no liability for use of calculations. A generic wind load of 25 psf was used in the system calculations. Wind loads will vary based on project location and an engineer should confirm the site specific wind load for each project.	Drawn By: CS	Date: Nov. 16, 2023	*ALUMINUM RAILING & FENCING*
	Checked By:	Revision:	



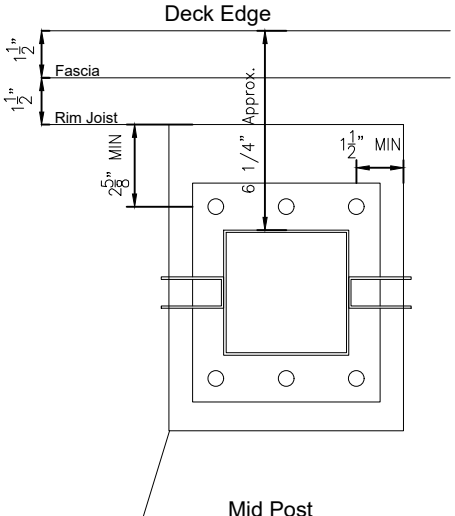
End Post

3 layers of 2" x 10" Blocking

Use (6) 3/8" Dia. SS Lag Screws
300 Series Stainless Steel

Thread Penetration: 5" Min.
Edge Distance: 2"
End Distance: 3-1/2"
Spacing: as shown
Assume S.G. = 0.55 (So. Pine)

*****Install per NDS Guidelines*****



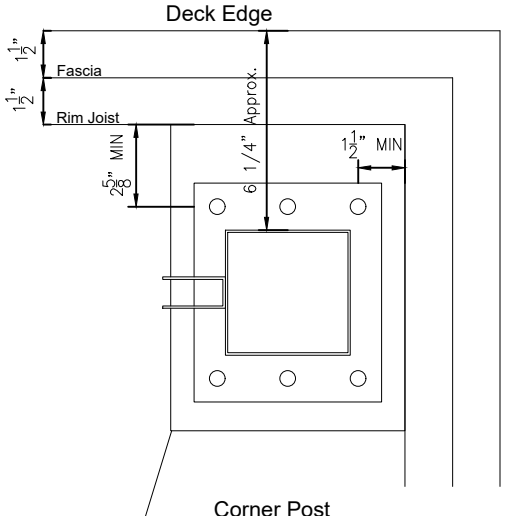
Mid Post

3 layers of 2" x 10" Blocking

Use (6) 3/8" Dia. SS Lag Screws
300 Series Stainless Steel

Thread Penetration: 5" Min.
Edge Distance: 2"
End Distance: 3-1/2"
Spacing: as shown
Assume S.G. = 0.55 (So. Pine)

*****Install per NDS Guidelines*****



Corner Post

3 layers of 2" x 10" Blocking

Use (6) 3/8" Dia. SS Lag Screws
300 Series Stainless Steel

Thread Penetration: 5" Min.
Edge Distance: 2"
End Distance: 3-1/2"
Spacing: as shown
Assume S.G. = 0.55 (So. Pine)

*****Install per NDS Guidelines*****

Title: Privacy Divider	Drawing No. SK02	Scale: 3"=1'-0"	**S.T.A.R.** ***SYSTEM INTERNATIONAL LTD.***
	Drawn By: CS	Date: Nov. 16, 2023	*ALUMINUM RAILING & FENCING*
	Checked By:	Revision:	