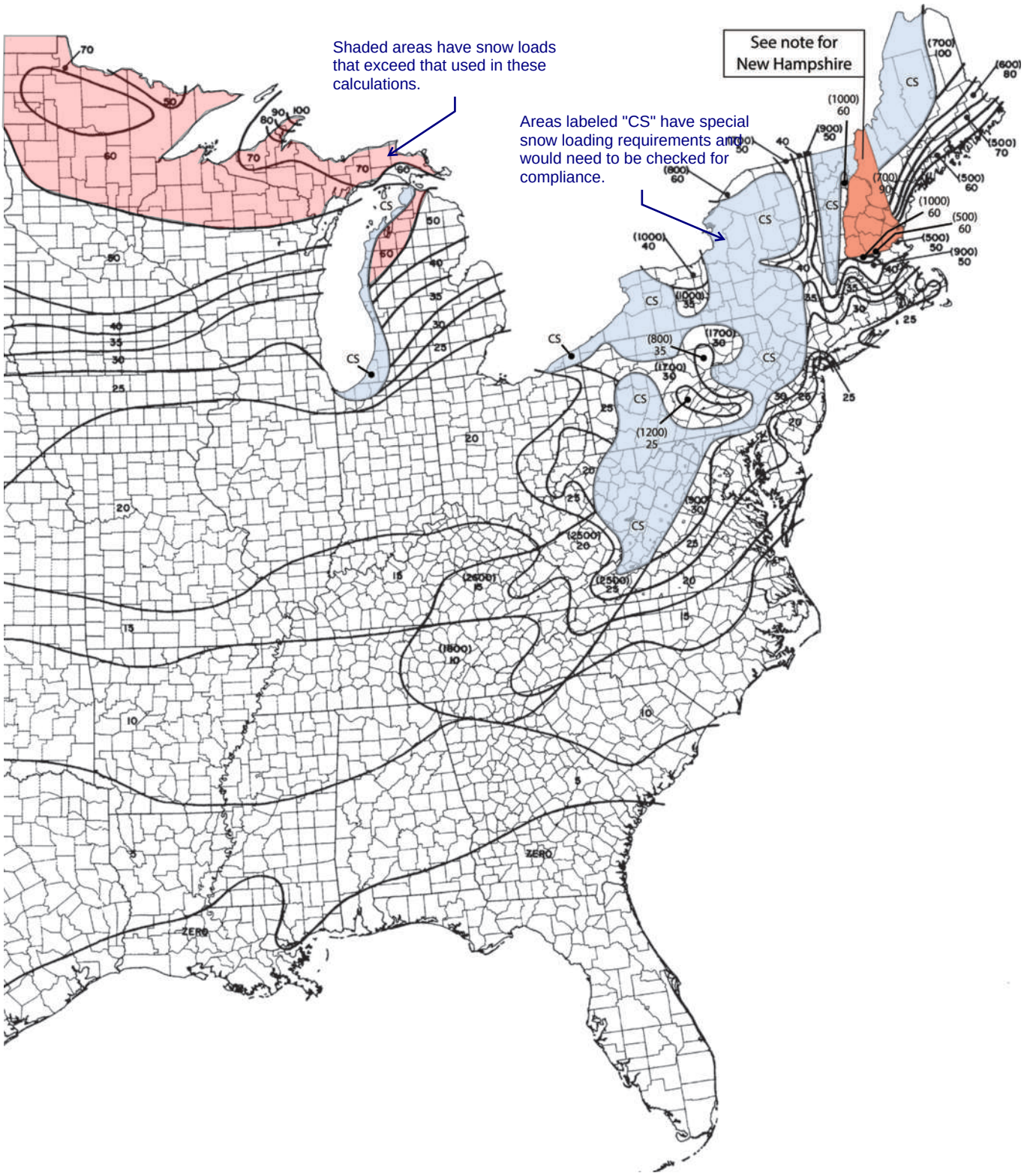


FIGURE 7.2-1 (*Continued*)

hip, and gable roofs with slopes less than 15° and to curved roofs where the vertical angle from the eaves to the crown is less than 10°. The minimum roof snow load for low-slope roofs shall be obtained using the following formula:

Where p_g is 20 lb/ft^2 (0.96 kN/m^2) or less:

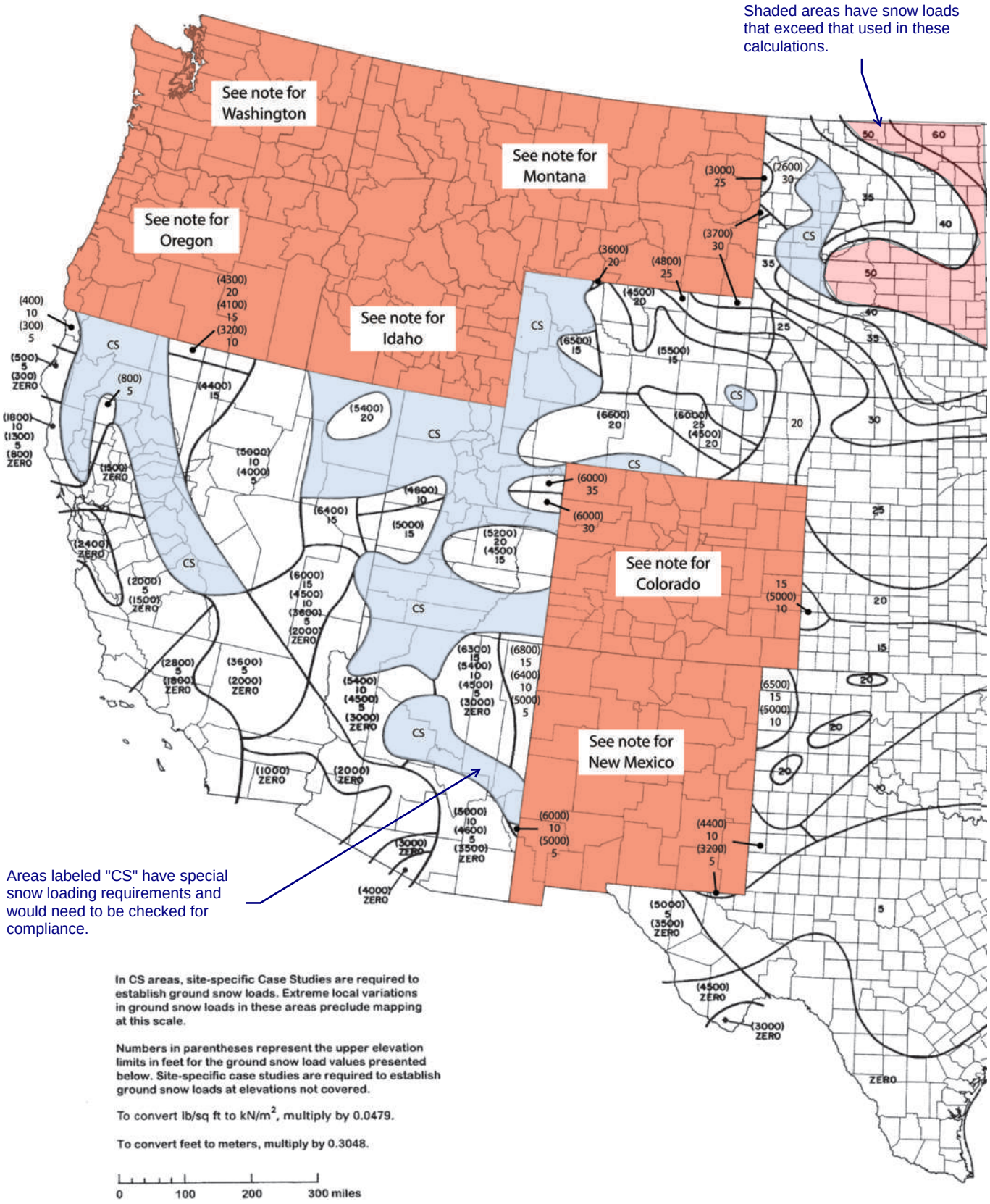
$$p_m = I_s p_g \quad (\text{Importance Factor times } p_g)$$

Where p_g exceeds 20 lb/ft^2 (0.96 kN/m^2):

$$p_m = 20(I_s) \quad (20 \text{ lb/ft}^2 \text{ times Importance Factor})$$

$$p_m = 0.96(I_s) \quad (0.96 \text{ kN/m}^2 \text{ times Importance Factor})$$

This minimum roof snow load is a separate uniform load case. It need not be used in determining or in combination with drift, sliding, unbalanced, or partial loads.



Note: See Table 7.2-2 for Colorado; see Table 7.2-3 for Idaho; see Table 7.2-4 for Montana; see Table 7.2-5 for Washington; see Table 7.2-6 for New Mexico; see Table 7.2-7 for Oregon; see Table 7.2-8 for New Hampshire.

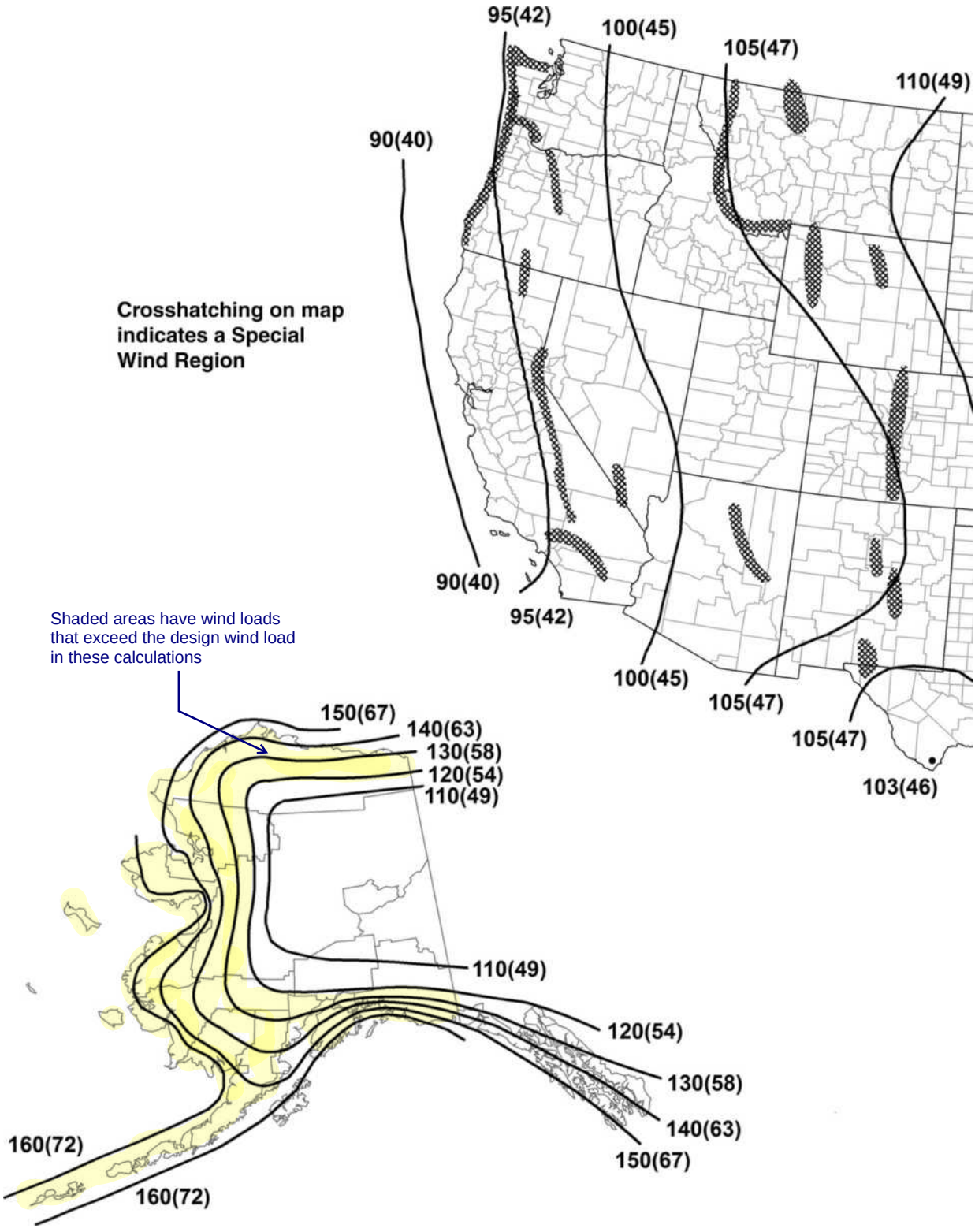
FIGURE 7.2-1 Ground Snow Loads, p_g, for the United States (lb/ft^2)

7.3.1 Exposure Factor, C_e. The value for C_e shall be determined from Table 7.3-1.

7.3.2 Thermal Factor, C_t. The value for C_t shall be determined from Table 7.3-2.

7.3.3 Importance Factor, I_s. The value for I_s shall be determined from Table 1.5-2 based on the Risk Category from Table 1.5-1.

7.3.4 Minimum Snow Load for Low-Slope Roofs, p_m. A minimum roof snow load, p_m, shall only apply to monoslope,

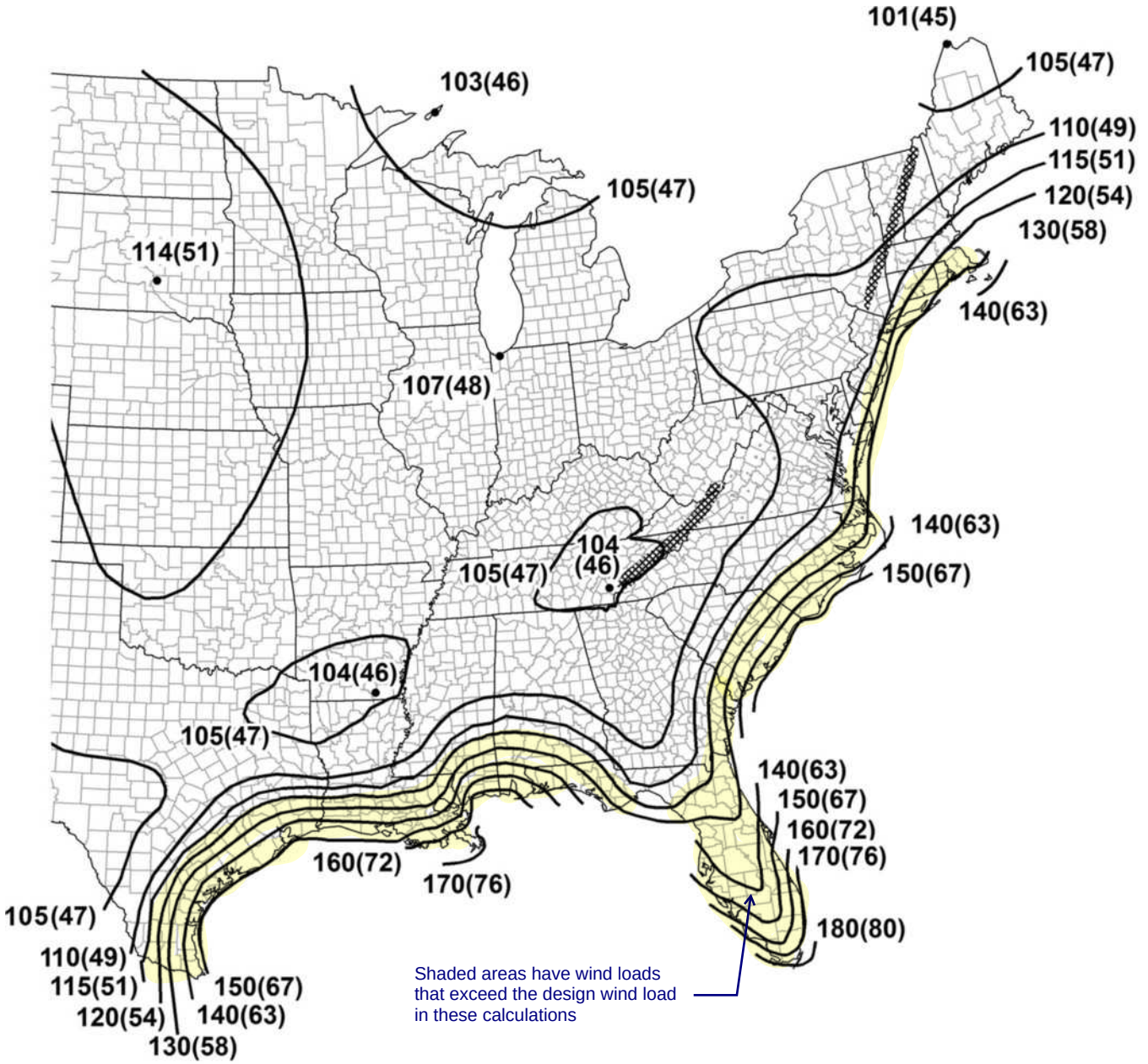


Notes

1. Values are nominal design 3-s gust wind speeds in mi/h (m/s) at 33 ft (10 m) above ground for Exposure Category C.
2. Linear interpolation is permitted between contours. Point values are provided to aid with interpolation.
3. Islands, coastal areas, and land boundaries outside the last contour shall use the last wind speed contour.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.
5. Wind speeds correspond to approximately a 7% probability of exceedance in 50 years (Annual Exceedance Probability = 0.00143, MRI = 700 years).
6. Location-specific basic wind speeds shall be permitted to be determined using www.atcouncil.org/windspeed.

FIGURE 26.5-1B Basic Wind Speeds for Risk Category II Buildings and Other Structures

continues



Location	V (mph)	V (m/s)
Guam	195	(87)
Virgin Islands	165	(74)
American Samoa	160	(72)
Hawaii	See Figure 26.5-2B	

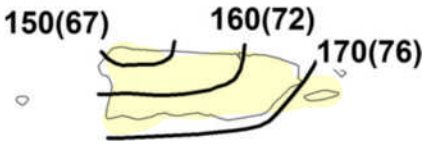


FIGURE 26.5-1B (***Continued***). **Basic Wind Speeds for Risk Category II Buildings and Other Structures**

ASCE-7/16: Combination of Loads

Design Loads	Detail Ref.	Sheet No: 01

Generic Input Variables:

Risk Category: II — Table 1.5-1 & Table 1.5-2

Importance Factors: $I_s = 1$ $I_i = 1$ $I_w = 1$ $I_p = 1$

Mean Roof Height: $h \equiv 20 \cdot ft$ *(Includes Parapet)*

Canopy Height: $z \equiv 10 \cdot ft$

Canopy Projection: $L_{uww} \equiv 2.5 \cdot ft$

Building Width: $L_{width} \equiv 300 \cdot ft$

Building Length: $L_{length} \equiv 300 \cdot ft$

Upwind Fetch Distance: $L_u \equiv 300 \cdot ft$

Canopy Slope: $\theta \equiv 0 \cdot deg$

Building Roof Slope: $\alpha \equiv 0 \cdot deg$

Exposure Factor = Fully Exposed — Table 7-3-1

Thermal Factor = Thermal = "Unheated & Open Air"

Roof Form = Monoslope

☐ Sloped Glazing is Applicable — IBC 2404.2

Ice Input Variables:

Ice Thickness: $t \equiv 1.5 \cdot in$ — Figure 10-2 West — Figure 10-2 East

Concurrent Wind: $V_i \equiv 40 \cdot mph$

Wind Input Variables:

Chapter 30.11

Exposure Category: B — Figure 26.5-1A, Figure 26.5-1B

Wind Velocity: $V \equiv 120 \cdot mph$ — Figure 26.5-1C, Figure 26.5-1D

Structure = Buildings: C&C

Directionality Factor: $K_d = 0.85$ — Table 26.6-1

Topographic Factor: $K_{zt} \equiv 1.0$ — Figure 26.8-1

Effective Wind Area: $EWA \equiv 1 \cdot sq\ ft$

Internal Pressure Coefficients:

Open Buildings

Enclosure = "Open Buildings"

GCpi1 = 0 — Table 26.13-1

GCpi2 = 0 — Table 26.13-1

Snow Input Variables:

☐ Leeward Drift is Not Applicable

Ground Snow Load: $P_g \equiv 50 \cdot psf$ — Figure 7.2-1 West & Figure 7.2-1 East

Thermal Factor: $C_t = 1.2$ — Table 7-3-2

Exposure Factor: $C_e := \text{Table 7-2}_{I_{terr}, I_{exp}} = 0.9$

☑ Unobstructed Slippery Surface? — Sloped Roof Snow Loads — Figure 7.4-1

$W := 0.5 \cdot \min(L_{width}, L_{length}) = 150 \cdot ft$ Horizontal Distance From Eave to Ridge

Dead Load & Ice Input Variables:

Qty	Member Properties	Member Length	Circumscribing Diameter	
$n_f \equiv 1$	$A_1 \equiv 0.862 \cdot in^2$	$L_1 \equiv 60 \cdot in$	$D_{c1} \equiv 5.5 \cdot in$	Fascia
$n_b \equiv 4$	$A_2 \equiv 1.173 \cdot in^2$	$L_2 \equiv 60 \cdot in$	$D_{c2} \equiv 6 \cdot in$	Infill Type 1
$n_{b1} \equiv 0$	$A_3 \equiv 0 \cdot in^2$	$L_3 \equiv 0 \cdot in$	$D_{c3} \equiv 0 \cdot in$	Infill Type 2
$n_{b2} \equiv 0$	$A_4 \equiv 0 \cdot in^2$	$L_4 \equiv 0 \cdot in$	$D_{c4} \equiv 0 \cdot in$	Hanger Rods
$n_o \equiv 2$	$t_o \equiv 0.25 \cdot in$ $d_o \equiv 5 \cdot in$	$L_5 \equiv 30 \cdot in$		Outrigger

$t_g \equiv 0.0 \cdot in$ Glass Thickness — $W_1 \equiv 0 \cdot in$ — $L_6 \equiv 0 \cdot in$ — Glass Panel Size

$t_a \equiv 0 \cdot in$ Alum Panel Thickness — $W_2 \equiv 0 \cdot in$ — $L_7 \equiv 0 \cdot in$ — Alum Panel Size

Live Load Input Variables:

Type = "Custom: LL = 0psf"

$LL := psf \cdot LL' = 0 \cdot psf$

Table 4.3-1

Roof Live Load Input Variables:

$L_r := 20 \cdot psf$ — 4.8 Reduction in Roof Live Loads

Seismic Input Variables:

Spectral Response: $S_s \equiv 0.125$ *Mapped Spectral Response Acceleration at Short Periods* (Figure 22-1)

$S_1 \equiv 0.066$ *Mapped Spectral Response Acceleration at Long Periods* (Figure 22-2)

Component Factors: $a_p \equiv 2.5$ *Component Amplification Factor* (Table 13.5-1)

$R_p \equiv 1.5$ *Component Response Modification Factor* (Table 13.5-1)

Site Soil Class = D *(Assume Site Class "D" if Unknown per Section 20.1)*

Design Loads	Detail Ref.	Sheet No: 01 A

Wind Load Calculations:

$V = 120 \cdot mph$ $K_{zt} = 1$ $I_w = 1$

$K_d = 0.85$ $r = 0.5$

External Pressure Coefficients.: *Internal Pressure:*

Figure 30.11-1B

$GCp\_lat = 1$ $GC_{ptop} = -1.1$ $GCpi1 = 0$

$GCpup = -0.6$ $GC_{pbot} = -0.9$ $GCpi2 = 0$

$GC_{ppos} = 0.8$

Corner Zone Dimension:

$a = \max(\min(30.0 \cdot ft, 8.0 \cdot ft, 10 \cdot ft), 12.0 \cdot ft, 3 \cdot ft) = 12 \cdot ft$

Velocity pressure Coefficients:

$K_{zh} = 0.70 \cdot psf$ At Elevation $h = 20 \cdot ft$

$K_{zz} = 0.70 \cdot psf$ At Elevation $z = 10 \cdot ft$

Velocity pressures:

$q_h := 0.00256 \cdot K_{zh} \cdot K_{zt} \cdot K_d \cdot (V\ ^2) \cdot I_w = 21.93 \cdot psf$

$q_z := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot (V\ ^2) \cdot I_w = 21.93 \cdot psf$

Calculated Pressures:

$W_{up} := \min[q_h \cdot (GCpup), -16 \cdot psf] = -16 \cdot psf$

$W_{dn} := \max(q_h \cdot GC_{ppos}, 16 \cdot psf) = 17.55 \cdot psf$

$W_{lat} := \max(q_h \cdot GCp\_lat, 16 \cdot psf) = 21.93 \cdot psf$

Dead Load Calculations:

$WT = 40.71 lbf$

$D := \frac{WT}{L_1 \cdot L_5} = 3.26 \cdot psf$

Ice Load Calculations:

$f_z = 0.89$ $t_d = 1.33 in$

$q_{zi} := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot (V_i\ ^2) = 2.44 \cdot psf$

$W_i := q_{zi} \cdot (0.85) \cdot 2.0 = 4.14 \cdot psf$

$D_i = 13.38 \cdot psf$

Seismic Load Calculations:

$F_a = 1.6$ Short-Period Site Coefficient (Table 11.4-1)

$F_v = 2.4$ Long-Period Site Coefficient (Table 11.4-2)

$S_{DS} = 0.133$ Design Spec. Resp. Acc. at Short Period (Eqn 11.4-3)

$S_{D1} = 0.11$ Design Spec.Resp. Acc. At Long Period (Eqn 11.4-4)

$f_p := \left(\frac{0.4 \cdot a_p \cdot S_{DS}}{R_p \div I_p}\right) \cdot \left[1 + \left[2 \cdot \left(\frac{z}{h}\right)\right]\right] = 0.18$ (Eqn 13.3-1)

$f_{pmin} := 0.3 \cdot S_{DS} \cdot I_p = 0.04$ (Eqn 13.3-3)

$f_{pmax} := 1.6 \cdot S_{DS} \cdot I_p = 0.21$ (Eqn 13.3-2)

$F_p := \max(f_{pmin}, \min(f_{pmax}, f_p)) = 0.18$

Vertical Seismic: $E_v := 0.2 \cdot S_{DS} \cdot D = 0.09 \cdot psf$

Horizontal Seismic: $E_h := (F_p) \cdot D = 0.58 \cdot psf$

Snow Load Calculations:

$P_g = 50 \cdot psf$ Ground Snow Load

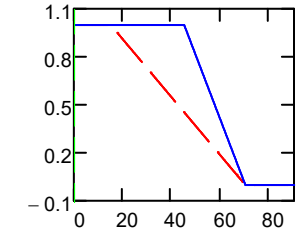
$C_t = 1.2$ Thermal Factor

$C_s = 1$ Roof Slope Factor

$C_e = 0.9$ Exposure Factor

$I_s = 1$ Importance Factor

FIGURE 7-2



7.3 Flat Roof Snow Loads

7.3-1 Flat Roof Snow Load

$P_{f\_7.3.1} := 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot P_g = 37.8 \cdot psf$

7.3.4 Minimum Snow Load for Low-Slope Roofs

$\theta.min\_7.3.4 = 15\ deg$

$P_m := \left[\begin{array}{l} (P_g \le 20 \cdot psf) \cdot I_s \cdot P_g \ldots \\ + (P_g > 20 \cdot psf) \cdot I_s \cdot 20 \cdot psf \end{array}\right] \cdot (\theta < \theta min\_7.3.4 \cdot deg) = 20 \cdot psf$

$P_f := \max(P_m, P_{f\_7.3.1}) = 37.8 \cdot psf$

7.4 Sloped Roof Snow Loads

7.4-1 Sloped Roof (Balanced) Snow Load

$P_{s\_7.4} := C_s \cdot P_f = 37.8 \cdot psf$

7.6 Unbalanced Snow Load

7.7-1 Density of Snow

$\gamma := \min(0.13 \cdot P_g \div psf + 14, 30) \cdot pcf = 20.5 \cdot pcf$

$h_d(\_l_u, \_p_g, \_I_s) \equiv \left[\left(0.43 \cdot \sqrt[3]{\max\left(\frac{\_l_u}{ft}, 20\right)} \cdot \sqrt[4]{\frac{\_p_g}{psf} + 10} - 1.5\right) \cdot \sqrt{\_I_s}\right] \cdot ft$

7.9 Sliding Snow

$USE := \left(chkBox1 \wedge \alpha > \operatorname{atan}\left(\frac{0.25}{12}\right)\right) \vee \left(\neg chkBox1 \wedge \alpha > \operatorname{atan}\left(\frac{2}{12}\right)\right) = 0$

$\omega_{sliding} := USE \cdot [[0.4 \cdot P_f \cdot W \cdot \min[1, L_{uww} \div (15 \cdot ft)]]] = 0$

$len_{sliding} := \min(L_{uww}, 15 \cdot ft) = 2.5 \cdot ft$

$P_{s\_7.9} := \omega_{sliding} \div len_{sliding} = 0 \cdot psf$

7.10 Rain-On-Snow

$W := L_{uww} = 2.5 \cdot ft$

$P_{s\_7.10} := \left|\left(P_g \le 20 \cdot psf\right) \wedge \left(P_g \ne 0 \cdot psf\right) \wedge \left[\frac{\theta}{deg} < \left[\frac{W}{ft \cdot (50)}\right]\right]\right| \cdot 5 \cdot psf = 0 \cdot psf$

Balanced Snow Load: $P_s := P_{s\_7.4} + \max(P_{s\_7.9}, P_{s\_7.10})$

$S_b := P_s = 37.8 \cdot psf$

7.7 Drifts on Lower Roofs (Aerodynamic Shade)

$h_b := P_{s\_7.4} \div \gamma = 1.84 \cdot ft$

$h_c := (h - z) - h_b = 8.16 \cdot ft$

Leeward Drift

7.7.1 Lower Roof of a Structure

$L_{ulw} := \max[(L_u), 20 \cdot ft] = 300 \cdot ft$

$h_{dlw} := h_d(L_{ulw}, P_g, I_s) \cdot [[0 \text{ on error}(h_c \div h_b)]] \ge 0.2] = 6.51 \cdot ft$

$w_{lw} := if(h_{dlw} \le h_c, 4 \cdot h_{dlw}, 4 \cdot h_{dlw}\ ^2 \div h_c) = 26.05 \cdot ft$

Windward Drift

7.7.1 Lower Roof of a Structure

$L_{uww} = 2.5 \cdot ft$

$h_{dww} := \sqrt{(I_s \cdot P_g \cdot L_{uww}) \div (4 \cdot \gamma)} = 1.23 \cdot ft$

$w_{ww} := if(h_{dww} \le h_c, 4 \cdot h_{dww}, 4 \cdot h_{dww}\ ^2 \div h_c) = 4.94 \cdot ft$

$h_{d\_max} := (P_g \ne 0) \cdot ft \cdot minPos[[\max(h_{dlw} \cdot \neg chkBox2, h_{dww})\ h_c\ (0.6 \cdot L_{uww})] \div ft]$

$P_{d1} := h_{d\_max} \cdot \gamma = 30.75 \cdot psf$ Pressure of Drift At Building $h_{d\_max} = 1.5 \cdot ft$

$w := \max(w_{lw} \cdot \neg chkBox2, w_{ww}) = 26.05 \cdot ft$

$P_{d2} := 0 \cdot psf$ Pressure of Drift At Fascia

Snow Drift (Uniform Pressure): $S_d := 0.5 \cdot (P_{d1} + P_{d2}) + P_{f\_7.3.1} = 53 \cdot psf$

RICE ENGINEERING Template: REI-MC-5209	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170 Engineer: MPM Sheet No: 01 A Date: 12/21/2021 Rev: Chk By: Date:

Load Combinations:

Loads (Unfactored):

$D = 3.26 \cdot psf$	*Dead Load*
$S_b = 37.8 \cdot psf$	*Balanced Snow Load*
$S_d = 53.18 \cdot psf$	*Drift plus Balanced Snow Load*
$W_{up} = -16 \cdot psf$	*Uplift Wind Load (Unfactored)*
$W_{dn} = 17.55 \cdot psf$	*Downward Wind Load (Unfactored)*
$W_{lat} = 21.93 \cdot psf$	*Lateral Wind Load (Unfactored)*
$D_i = 13.38 \cdot psf$	*Dead Load Due to Ice (Snow Load Controls)*
$W_i = 4.14 \cdot psf$	*Concurrent Wind Load with Ice Load (Snow Load Controls)*
$E_h = 0.58 \cdot psf$	*Horizontal Seismic Load*
$E_v = 0.09 \cdot psf$	*Vertical Seismic Load*
$LL = 0 \cdot psf$	*Live Load*
$L_r = 20 \cdot psf$	*Reduced Roof Live Load*

Canopy is a lower roof and per C2.3.4 the effects of freezing rain are included in the snow drift loads

Results ASD

Load Cases:

"LC"	"[ASD LC]"
"1"	D
"2"	$D + 0.7 \cdot D_i + LL$
"3"	$D + \max(0.7 \cdot D_i + 0.7 W_i, S_d, L_r)$
"4"	$D + 0.75 \cdot LL + 0.75 \cdot (\max(S_b, L_r))$
"5"	$D + 0.6 \cdot W_{dn}$
"5a"	$D + 0.7 \cdot (E_h + E_v)$
"6"	$D + 0.75 \cdot LL + 0.75 \cdot (0.6 \cdot W_{dn}) + 0.75 \cdot (\max(S_b, L_r))$
"6a"	$D + 0.75 \cdot LL + 0.75 \cdot [0.7 \cdot (E_h + E_v)] + 0.75 \cdot S_b$
"7"	$0.6 \cdot D + 0.6 \cdot W_{up}$
"7a"	$0.6 \cdot D + 0.7 \cdot D_i + 0.7 \cdot W_i$
"IBC 8"	$(0.6 W_{dn} - D) \cdot chkBox3$
"IBC 8a"	$(0.6 W_{dn} + D + 0.5 \cdot S_d) \cdot chkBox3$
"IBC 8b"	$(0.3 \cdot W_{dn} + D + S_d) \cdot chkBox3$

RESULTS =

"LC"	"[ASD LC]"
"1"	3.26
"2"	12.62
"3"	56.43
"4"	31.61
"5"	13.78
"5a"	3.72
"6"	39.5
"6a"	31.96
"7"	−7.65
"7a"	14.22
"IBC 8"	0
"IBC 8a"	0
"IBC 8b"	0

·psf

"LC"	"[LRFD LC]"
"1"	$1.4D$
"2"	$1.2D + 1.6LL + 0.5 \cdot \max(S_b, L_r)$
"2a"	$1.2D + 1.6LL + 0.2 \cdot D_i + 0.5 \cdot S_b$
"3"	$1.2D + 1.6 \cdot (\max(L_r, S_d)) + 0.5 \cdot (\max(W_{dn}, LL))$
"4"	$1.2D + 1.0 \cdot W_{dn} + 1.0LL + 0.5 \cdot (\max(L_r, S_b))$
"4a"	$1.2D + 1.0LL + D_i + W_i + 0.5 \cdot S_b$
"5"	$1.2 \cdot D + 1.0 \cdot (E_h + E_v) + 1.0LL + 0.2 \cdot S_b$
"6"	$0.9 \cdot D + 1.0 \cdot W_{up}$
"6a"	$0.9 \cdot D + D_i + W_i$
"7"	$0.9D + 1.0 \cdot (E_h + E_v)$
"IBC 8"	$(1.0 W_{dn} - D) \cdot chkBox3$
"IBC 8a"	$(1.0 W_{dn} + D + 0.5 \cdot S_d) \cdot chkBox3$
"IBC 8b"	$(0.5 W_{dn} + D + S_d) \cdot chkBox3$

Use 57 psf (Downward)

Use 8 psf (Upward)

Use 14 psf (Laterally)

→ "ASD"

105 School Creek Trail
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www.rice-inc.com

Project Description:

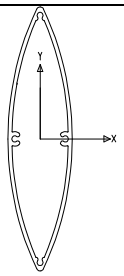
AGS Quick-ship Sunshades

Job No:	R21-12-170		
Engineer:	MPM	Sheet No:	01 B
Date:	12/21/2021	Rev:	
Chk By:		Date:	

6 in Airfoil Blade	Detail Ref.	Sheet No: 2

Inputs:

$DL_{dn} := 57$ psf
$DL_{up} := 8$ psf
$L := 60$ in
$L_b := 60$ in
$D := 6$ in
$B := 1.578$ in
$\theta := 45$ deg
$E := 10100000$ psi



Section Properties:

$I_x := 3.466$ in^4
$I_y := 0.335$ in^4
$S_x := 1.156$ in^3
$S_y := 0.425$ in^3
$J := 1.058$ in^4
$A := 1.173$ in^2

☐ 6063-T5
☑ 6063-T6
☐ 6005-T5
☐ 6061-T6

Use 6" Airfoil
as shown (6063-T6)

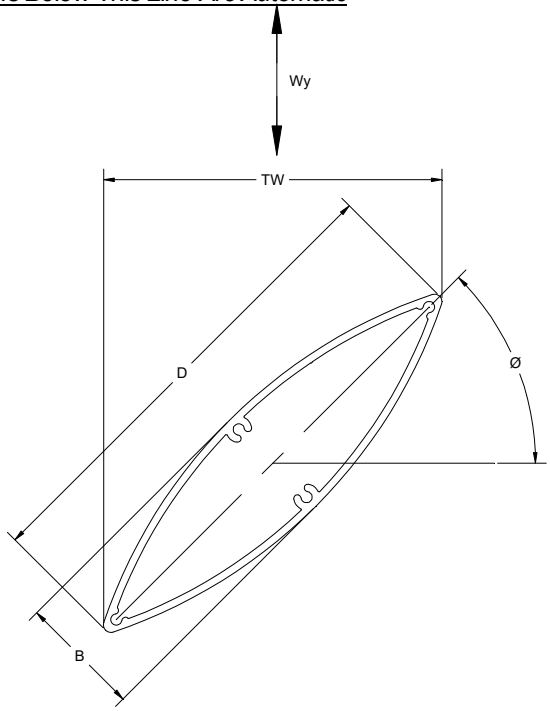
☐ Welded within 1 inch of Mmax

$TW := \max(D \cdot \cos(\theta \cdot deg), B) = 4.24$ in

Calculations:

$\phi := 90 - \theta = 45$ deg

All Calculations Below This Line Are Automatic



$w_y := \max(DL_{dn}, DL_{up}) \cdot \frac{TW}{144} = 1.68$ pli

$w_{yWL} := DL_{up} \cdot \frac{TW}{144} = 0.24$ pli

$w_{st} := w_y \cdot \cos(\phi \, deg) = 1.19$ pli

$w_{wk} := w_y \cdot \sin(\phi \cdot deg) = 1.19$ pli

$M_x := \frac{w_{st} \cdot L^2}{8} = 534$ in·lb

$\Delta_x := \frac{5 \cdot w_{st} \cdot L^4}{384 \cdot E \cdot I_x} = 0.01$ in

$\Delta_{xall} := \frac{L}{120} = 0.5$ in

$f_{bx} := \frac{M_x}{S_x} = 462$ psi

$S_r := \frac{2 \cdot L_b \cdot S_x}{\sqrt{I_y \cdot J}} = 233$

$F_{bx} = 14563$ psi

$M_y := \frac{w_{wk} \cdot L_b^2}{8} = 534$ in·lb

$\Delta_{yDL} := \frac{5 \cdot w_{wk} \cdot L_b^4}{384 \cdot E \cdot I_y} = 0.06$ in

$\Delta_{yDLall} := \frac{L_b}{60} = 1$ in

$\Delta_{yWL} := \frac{5 \cdot w_{yWL} \cdot \sin(\phi \cdot deg) \cdot L_b^4}{384 \cdot E \cdot I_y} = 0.01$ in

$\Delta_{yWLall} := \frac{L_b}{120} = 0.5$ in

$f_{by} := \frac{M_y}{S_y} = 1257$ psi

$F_{by} = 18000$ psi

$I := \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} = 0.1$

$R_{blades} := \frac{w_y \cdot L}{2} = 50.38$

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

Uniform Load For Outriggers:

$w_y = 1.68$ pli

$R_{blades} = 50.4$ lb

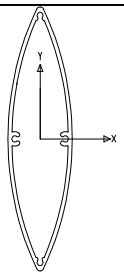
$Blades = \text{"OK"}$

RICE ENGINEERING Template: REI-MC-5210	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170 Engineer: MPM / Sheet No: 2 Date: 12/21/2021 / Rev: Chk By: / Date:

5 in Airfoil Blade	Detail Ref.	Sheet No: 2

Inputs:

$DL_{dn} := 57$ psf
$DL_{up} := 8$ psf
$L := 60$ in
$L_b := 60$ in
$D := 5$ in
$B := 1.562$ in
$\theta := 45$ deg
$E := 10100000$ psi



Section Properties:

$I_x := 2.572$ in^4
$I_y := 0.358$ in^4
$S_x := 1.028$ in^3
$S_y := 0.781$ in^3
$J := 1.058$ in^4
$A := 1.173$ in^2

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

Use 5" Airfoil
as shown (6063-T6)

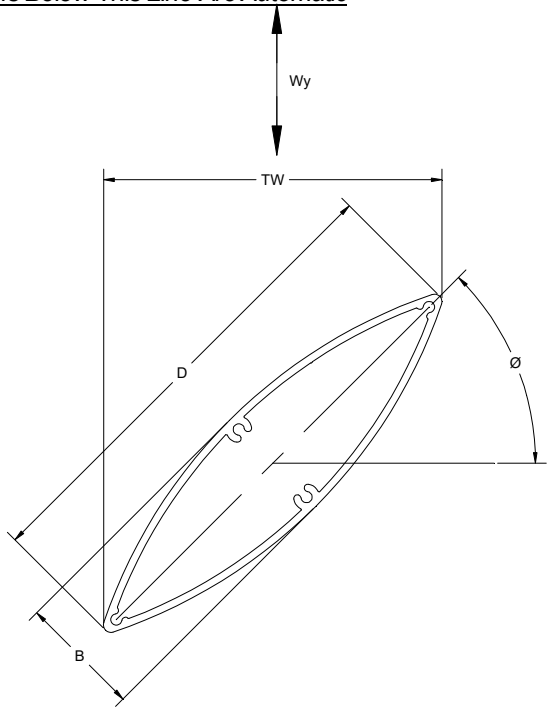
- [ ] Welded within 1 inch of Mmax

$TW := \max(D \cdot \cos(\theta \cdot deg), B) = 3.54$ in

Calculations:

$\phi := 90 - \theta = 45$ deg

All Calculations Below This Line Are Automatic



$w_y := \max(DL_{dn}, DL_{up}) \cdot \frac{TW}{144} = 1.4$ pli

$w_{yWL} := DL_{up} \cdot \frac{TW}{144} = 0.2$ pli

$w_{st} := w_y \cdot \cos(\phi \, deg) = 0.99$ pli

$w_{wk} := w_y \cdot \sin(\phi \cdot deg) = 0.99$ pli

$M_x := \frac{w_{st} \cdot L^2}{8} = 445$ in·lb

$\Delta_x := \frac{5 \cdot w_{st} \cdot L^4}{384 \cdot E \cdot I_x} = 0.01$ in

$\Delta_{xall} := \frac{L}{120} = 0.5$ in

$f_{bx} := \frac{M_x}{S_x} = 433$ psi

$S_r := \frac{2 \cdot L_b \cdot S_x}{\sqrt{I_y \cdot J}} = 200$

$F_{bx} = 14718$ psi

$M_y := \frac{w_{wk} \cdot L_b^2}{8} = 445$ in·lb

$\Delta_{yDL} := \frac{5 \cdot w_{wk} \cdot L_b^4}{384 \cdot E \cdot I_y} = 0.05$ in

$\Delta_{yDLall} := \frac{L_b}{60} = 1$ in

$\Delta_{yWL} := \frac{5 \cdot w_{yWL} \cdot \sin(\phi \cdot deg) \cdot L_b^4}{384 \cdot E \cdot I_y} = 0.01$ in

$\Delta_{yWLall} := \frac{L_b}{120} = 0.5$ in

$f_{by} := \frac{M_y}{S_y} = 570$ psi

$F_{by} = 18000$ psi

$I := \frac{f_{bx}}{F_{bx}} + \frac{f_{by}}{F_{by}} = 0.06$

$R_{blades} := \frac{w_y \cdot L}{2} = 41.98$

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

Uniform Load For Outriggers:

$w_y = 1.4$ pli

$R_{blades} = 42$ lb

$Blades = \text{"OK"}$

RICE ENGINEERING Template: REI-MC-5210	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170 Engineer: MPM / Sheet No: 2 Date: 12/21/2021 / Rev: Chk By: / Date:

3 in Round	Detail Ref.	Sheet No: 04

Inputs:

$DL_{dn} := 57$ psf

$DL_{up} := 8$ psf

$L := 60$ in

$L_b := 60$ in

$d := 3$ in

$t := 0.125$ in

☐ Welded within 1 inch of Mmax

- ☐ 6063-T5
- ☑ 6063-T6
- ☐ 6005-T5
- ☐ 6061-T6

Use 3" Dia. Round Blade
as shown (6063-T6)

Calculations:

All Calculations Below This Line Are Automatic

$TW := d = 3$ in

$TL := \max(DL_{dn}, DL_{up}) = 57$ psf

$w_y := \frac{TL \cdot TW}{144} = 1.188$ pli

$w_x := \frac{DL_{up} \cdot TW}{144} = 0.167$ pli

$M := \frac{w_y \cdot L^2}{8} = 534.38$ in·lb

$\Delta_{TL} := \frac{5 \cdot w_y \cdot L^4}{384 \cdot E \cdot I} = 0.026$ in

$\Delta_{TLall} := \frac{L}{60} = 1$ in

$\Delta_{WL} := \frac{5 \cdot w_x \cdot L^4}{384 \cdot E \cdot I} = 0$ in

$\Delta_{WLall} := \frac{L}{120} = 0.5$ in

$f_b := \frac{M}{S_t} = 1050$ psi

$S_r := \frac{r_b}{t} = 11.5$

$F_b = 18000$ psi

$BLADES := \begin{cases} \text{"OK"} & \text{if } \frac{\Delta_{TL}}{\Delta_{TLall}} \le 1 \wedge \frac{\Delta_{WL}}{\Delta_{WLall}} \le 1 \wedge \frac{f_b}{F_b} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

$R_{blade} := \frac{\max(w_x, w_y) \cdot L}{2}$

Section Properties:

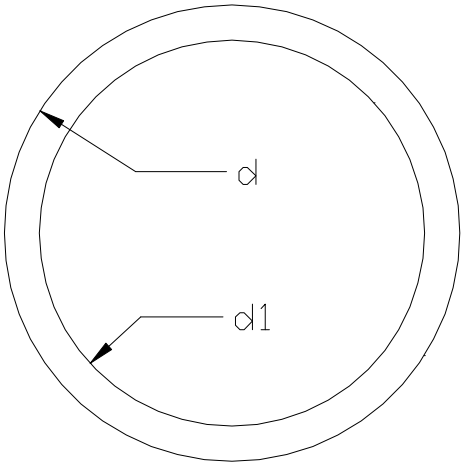
$E := 10100000$ psi

$A := 0.792 = 0.792$ in^2

$I := 0.764 = 0.764$ in^4

$S_t := 0.509 = 0.509$ in^3

$r_b := 0.5 \cdot (d - t)$



BLADES = "OK"

$R_{blade} = 36$ lb

RICE ENGINEERING Template: REI-MC-5212	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170	
			Engineer: MPM	Sheet No: 04
			Date: 12/21/2021	Rev:
			Chk By:	Date:

Fascia Channel	Detail Ref.	Sheet No: 5

Inputs:

$DL_{dn} := 57$ psf

$DL_{up} := 8$ psf

$WL_{Lat} := 14$ psf *horizontal wind*

$L := 60$ in

$L_b := 60$ in

$b := 1.5$ in

$d := 5$ in

$t := 0.100$ in

Section Properties:

$I_x := 3.175$ in^4

$I_y := 0.315$ in^4

$S_x := 1.269$ in^3

$S_y := 0.351$ in^3

$A := 0.862$ in^2

$E := 10100000$ psi

$J := 0.002$ in^4

- ☐ 6063-T5
- ☑ 6063-T6
- ☐ 6005-T5
- ☐ 6061-T6

Use 5" x 1.5"
AL. Channel as shown (6063-T6)

$TW_{wk} := d = 5$ in

$TW_{st} := b = 1.5$ in

☐ Welded within 1 inch of Mmax

in^4

Calculations:

All Calculations Below This Line Are Automatic

$TL := \max(DL_{dn}, DL_{up}) = 57$ psf

$w_y := \frac{TL \cdot TW_{st}}{144} = 0.594$ pli

$w_x := \frac{WL_{Lat} \cdot TW_{wk}}{144} = 0.486$ pli

$M_x := \frac{w_y \cdot L^2}{8} = 267.19$ in·lb

$\Delta_x := \frac{5 \cdot w_y \cdot L^4}{384 \cdot E \cdot I_x} = 0.003$ in

$\Delta_{xall} := \frac{L}{120} = 0.500$ in

$f_{bx} := \frac{M_x}{S_x} = 211$ psi

$S_r := \frac{L_b}{r_y} = 70.7$

$F_{bx} = 11541$ psi

$M_y := \frac{w_x \cdot L_b^2}{8} = 218.75$ in·lb

$\Delta_y := \frac{5 \cdot w_x \cdot L_b^4}{384 \cdot E \cdot I_y} = 0.026$ in

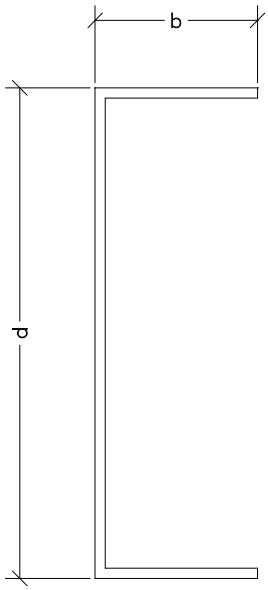
$\Delta_{yall} := \frac{L_b}{120} = 0.500$ in

$f_{by} := \frac{M_y}{S_y} = 623$ psi

$F_{by} = 20000$ psi

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

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



$$R_{fascia} := \frac{\max(w_x, w_y) \cdot L}{2}$$

BLADES = "OK"

$R_{fascia} = 17.81$ lb

RICE ENGINEERING Template: REI-MC-5214	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170 Engineer: MPM / Sheet No: 5 Date: 12/21/2021 / Rev: Chk By: / Date:

Flat Plate Outrigger Panel (Trap Loading)	Detail Ref.	Sheet No: 6

Inputs:

$DL_{up} := 8$ psf — $P_{d1} := 30.75$ psf — snow drift at wall

$WL_{Lat} := 14$ psf — $P_{d2} := 0$ psf — snow drift at fascia

$L := 28.5$ in

$L_b := 4$ in — $S_b := 37.8$ psf — balanced snow load

$d := 5$ in — $DL_{dn} := 3.26$ psf — dead load

$t := 0.25$ in

$TW := 30$ in

$E := 10100000$ psi

$N := 2$ *No. of Outriggers effective for weak axis wind load*

Alloy and Temper

- ☐ 6063-T5
- ☐ 5052-H32
- ☑ 6063-T6
- ☐ 6061-T6
- ☐ Welded within 1 inch of Mmax

Use 1/4" x 5" Al. Plate as shown (6063-T6)

Calculations:

All Calculations Below This Line Are Automatic

$TL := \max(DL_{dn} + S_b, DL_{up}) = 41.06$ psf

$w_x := \frac{WL_{Lat} \cdot d}{144} = 0.486$ pli

$w_{ywall} := \frac{P_{d1} \cdot TW}{144} = 6.406$ pli

$w_{yfascia} := \frac{P_{d2} \cdot TW}{144} = 0.000$ pli

$w_y := \frac{(S_b + DL_{dn}) \cdot TW}{144} = 8.554$ pli

$F_y := \frac{1}{2} \cdot (w_{ywall} - w_{yfascia}) \cdot L = 91.29$ lb

$M_{x1} := F_y \cdot \frac{1}{3} \cdot L = 867.25$ in·lb

$M_x := \frac{(w_y + w_{yfascia}) \cdot L^2}{2} = 3474.06$ in·lb

$\Delta_x := \frac{(w_y + w_{yfascia}) \cdot L^4}{8 \cdot E \cdot I_x} + \Delta_{x.1} = 0.031$ in

$\Delta_{x.1} := \frac{F_y \cdot \left(\frac{1}{3} \cdot L\right)^2}{6 \cdot E \cdot I_x} \cdot \left(3 \cdot L - \frac{1}{3} \cdot L\right) = 0$ in

$\Delta_{xall} := \frac{2L}{120} = 0.475$ in

$f_{bx} := \frac{M_x + M_{x1}}{S_x} = 4167.65$ psi

$S_r := \frac{d}{t} \cdot \sqrt{\frac{L_b}{d}} = 17.89$

$F_{bx} = 18401$ psi

$M_y := \frac{w_x \cdot L^2}{2 \cdot N} = 99$ in·lb

$\Delta_y := \frac{w_x \cdot L_b^4}{8 \cdot E \cdot I_y \cdot N} = 0.000$ in

$\Delta_{yall} := \frac{2 \cdot L_b}{120} = 0.067$ in

$f_{by} := \frac{M_y}{S_y} = 1895$ psi

$F_{by} = 20000$ psi

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

Section Properties:

$A := d \cdot t = 1.250$ in²

$I_x := \frac{t \cdot d^3}{12} = 2.604$ in⁴

$I_y := \frac{d \cdot t^3}{12} = 0.007$ in⁴

$S_x := \frac{t \cdot d^2}{6} = 1.042$ in³

$S_y := \frac{d \cdot t^2}{6} = 0.052$ in³

Anchorage Reactions:

$R_y := w_y \cdot L + w_{yfascia} \cdot L + F_y$ → $R_y = 335.08$ lb

$R_x := w_x \cdot L$ → $R_x = 13.85$ lb

$M_r := M_x + M_{x1}$ → $M_r = 4341.31$ in·lb

$OUTRIGGERS = \text{"OK"}$

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170	
			Engineer: MPM	Sheet No: 6
			Date: 12/21/2021	Rev:
Template: REI-MC-5220.A			Chk By:	Date:

Flat Plate Outrigger Panel (Trap Loading)	Detail Ref.	Sheet No: 7

Inputs:

$DL_{up} := 8$ psf

$WL_{Lat} := 14$ psf

$L := 28.5$ in

$L_b := 4$ in

$d := 4$ in

$t := 0.25$ in

$TW := 30$ in

$P_{d1} := 30.75$ psf snow drift at wall

$P_{d2} := 0$ psf snow drift at fascia

$S_b := 37.8$ psf balanced snow load

$DL_{dn} := 3.26$ psf dead load

$E := 10100000$ psi

$N := 2$ *No. of Outriggers effective for weak axis wind load*

Alloy and Temper

- ☐ 6063-T5
- ☐ 5052-H32
- ☑ 6063-T6
- ☐ 6061-T6
- ☐ Welded within 1 inch of Mmax

Use 1/4" x 4" Al. Plate as shown (6063-T6)

Calculations:

All Calculations Below This Line Are Automatic

$TL := \max(DL_{dn} + S_b, DL_{up}) = 41.06$ psf

$w_x := \frac{WL_{Lat} \cdot d}{144} = 0.389$ pli

$w_{ywall} := \frac{P_{d1} \cdot TW}{144} = 6.406$ pli

$w_{yfascia} := \frac{P_{d2} \cdot TW}{144} = 0.000$ pli

$w_y := \frac{(S_b + DL_{dn}) \cdot TW}{144} = 8.554$ pli

$F_y := \frac{1}{2} \cdot (w_{ywall} - w_{yfascia}) \cdot L = 91.29$ lb

$M_{x1} := F_y \cdot \frac{1}{3} \cdot L = 867.25$ in·lb

$M_x := \frac{(w_y + w_{yfascia}) \cdot L^2}{2} = 3474.06$ in·lb

$\Delta_x := \frac{(w_y + w_{yfascia}) \cdot L^4}{8 \cdot E \cdot I_x} + \Delta_{x.1} = 0.060$ in

$\Delta_{x.1} := \frac{F_y \cdot \left(\frac{1}{3} \cdot L\right)^2}{6 \cdot E \cdot I_x} \cdot \left(3 \cdot L - \frac{1}{3} \cdot L\right) = 0.01$ in

$\Delta_{xall} := \frac{2L}{120} = 0.475$ in

$f_{bx} := \frac{M_x + M_{x1}}{S_x} = 6511.96$ psi

$S_r := \frac{d}{t} \cdot \sqrt{\frac{L_b}{d}} = 16$

$F_{bx} = 19404$ psi

$M_y := \frac{w_x \cdot L^2}{2 \cdot N} = 79$ in·lb

$\Delta_y := \frac{w_x \cdot L_b^4}{8 \cdot E \cdot I_y \cdot N} = 0.000$ in

$\Delta_{yall} := \frac{2 \cdot L_b}{120} = 0.067$ in

$f_{by} := \frac{M_y}{S_y} = 1895$ psi

$F_{by} = 20000$ psi

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

Section Properties:

$A := d \cdot t = 1.000$ in^2

$I_x := \frac{t \cdot d^3}{12} = 1.333$ in^4

$I_y := \frac{d \cdot t^3}{12} = 0.005$ in^4

$S_x := \frac{t \cdot d^2}{6} = 0.667$ in^3

$S_y := \frac{d \cdot t^2}{6} = 0.042$ in^3

Anchorage Reactions:

$R_y := w_y \cdot L + w_{yfascia} \cdot L + F_y$ → $R_y = 335.08$ lb

$R_x := w_x \cdot L$ → $R_x = 11.08$ lb

$M_r := M_x + M_{x1}$ → $M_r = 4341.31$ in·lb

OUTRIGGERS = "OK"

RICE ENGINEERING
Template: REI-MC-5220.A

105 School Creek Trail
Luxemburg, WI 54217
Phone: (920) 617-1042
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www.rice-inc.com

Project Description: **AGS Quick-ship Sunshades**

Job No:	R21-12-170		
Engineer:	MPM	Sheet No:	7
Date:	12/21/2021	Rev:	
Chk By:		Date:	

Inputs:

Face Mount T-Bracket	Detail Ref.	Sheet No: 8

Bracket Dimensions:

$A_{dist} := 3.5$ in — *Dist from bldg to outer bolt*

$B1 := 1$ in $C1 := 1$ in

$B2 := 4$ in $C2 := 2$ in

$B3 := 1$ in $C3 := 1$ in

$D := 2$ in $t1 := 0.375$ in

$t2 := 0.375$ in

Thru Bolts:

$n_b := 3$ *No. of bolts*

$d_b := 0.375$ in *dia. thru bolts*

$N := 16$ *threads per inch*

$t_o := 0.25$ in *thickness of outrigger*

$n_o := 2$ *No. of outriggers*

Alloy and Temper

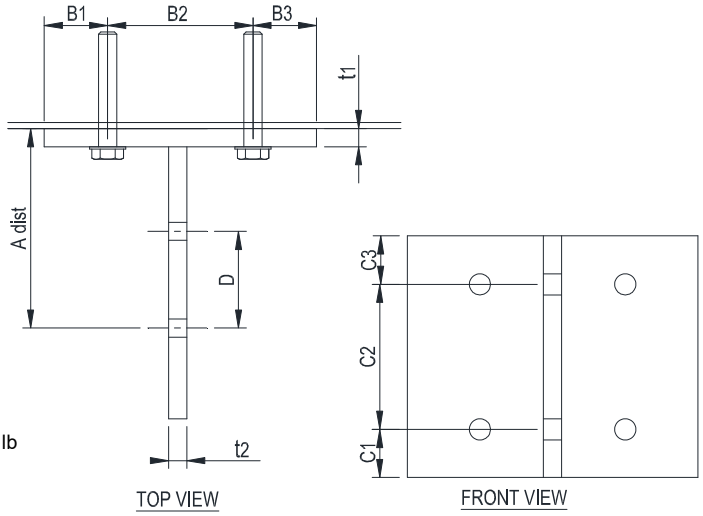
- ☐ 6063-T5
- ☐ 6063-T6
- ☑ 6061-T6

Reactions:

$R_{y1} := 356$ lb $R_{y2} := 356$ lb

$R_{z1} := 15$ lb $R_{z2} := 15$ lb

$M_{x1} := 5344$ in·lb $M_{x2} := 5344$ in·lb



Calculations:

All Calculations Below This Line Are Automatic

$D_c = 1.25$ in *Radius of bolt pattern*

$A := A_{dist} - D_c = 2.25$ in *dist. to CL thru bolts*

$R_y := R_{y1} + R_{y2} = 712$ lb $R_z := R_{z1} + R_{z2} = 30$ lb

$M_r := M_{x1} + M_{x2} = 10688$ in·lb

$b_s := \max(D, C2) = 2$

Check Thru Bolts (for 2 and 4 Bolt Patterns):

$$V_b := \sqrt{\left(\frac{R_y}{n_b}\right)^2 + \left(\frac{R_z}{n_b}\right)^2 + \left(\frac{M_r}{n_b \cdot D_c}\right)^2} = 2860 \text{ lb}$$

$$A_R := 0.7854 \cdot \left(d_b - \frac{1.2269}{N}\right)^2 = 0.07 \text{ in}^2$$

$$f_v := \frac{V_b}{n_o \cdot A_R} = 20459 \text{ psi}$$

$F_v := 23094$ psi

$$f_{p1} := \frac{V_b}{n_o \cdot t_o \cdot d_b} = 15253 \text{ psi}$$

$F_{p1} := 31000$ psi *Allowable, 6063-T6 Outrigger*

$$f_{p2} := \frac{V_b}{t1 \cdot d_b} = 203 \text{ psi}$$

$F_{p2} := 23000 \cdot T1 + 31000 \cdot T2 + 39000 \cdot T3 = 3900($ psi

$$BOLTS := \begin{cases} \text{"OK"} & \text{if } \frac{f_v}{F_v} < 1 \wedge \frac{f_{p1}}{F_{p1}} < 1 \wedge \frac{f_{p2}}{F_{p2}} < 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

BOLTS = "OK"

Use (3) - 3/8" Dia. S.S. Thru Bolts
300 Series (Fy = 65,000 psi)

Check Backplate:

$M_{max} := M_r + R_y \cdot A = 12290$ in·lb

$$P := \frac{M_{max}}{C1 + C2 + C3} + R_z = 3103 \text{ lb}$$

$$M_{wk} := \frac{P \cdot B2}{8} = 1551 \text{ in·lb}$$

$F_b := 12500 \cdot T1 + 20000 \cdot T2 + 28000 \cdot T3 = 28000$ psi

$$L_{eff} := \frac{M_{wk} \cdot 6}{F_b \cdot t1^2} = 2.36 \text{ in}$$

$$PLATE := \begin{cases} \text{"OK AS SHOWN"} & \text{if } L_{eff} \le 0.85 \cdot (C1 + C2 + C3) \\ \text{"OVERSTRESSED"} & \text{otherwise} \end{cases}$$

PLATE = "OK AS SHOWN"

Use Extruded T-Bracket - 4" or 5" Long
3/8" thk Knife Plate, 3/8" thk Back Plate

RICE ENGINEERING
Template: REI-MC-5251

105 School Creek Trail
Luxemburg, WI 54217
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Project Description:
AGS Quick-ship Sunshades

Job No:	R21-12-170		
Engineer:	MPM	Sheet No:	8
Date:	12/21/2021	Rev:	
Chk By:		Date:	

Face Mount T-Bracket	Detail Ref.	Sheet No: 8 A

Check Thru Bolt Anchors :

$V_{b1} := \frac{R_y}{2} = 356 \quad lb$

$T_b := \frac{M_{max}}{2(C1 + C2 + C3)\cdot 0.85} + \frac{R_z}{2} = 1822 \quad lb$

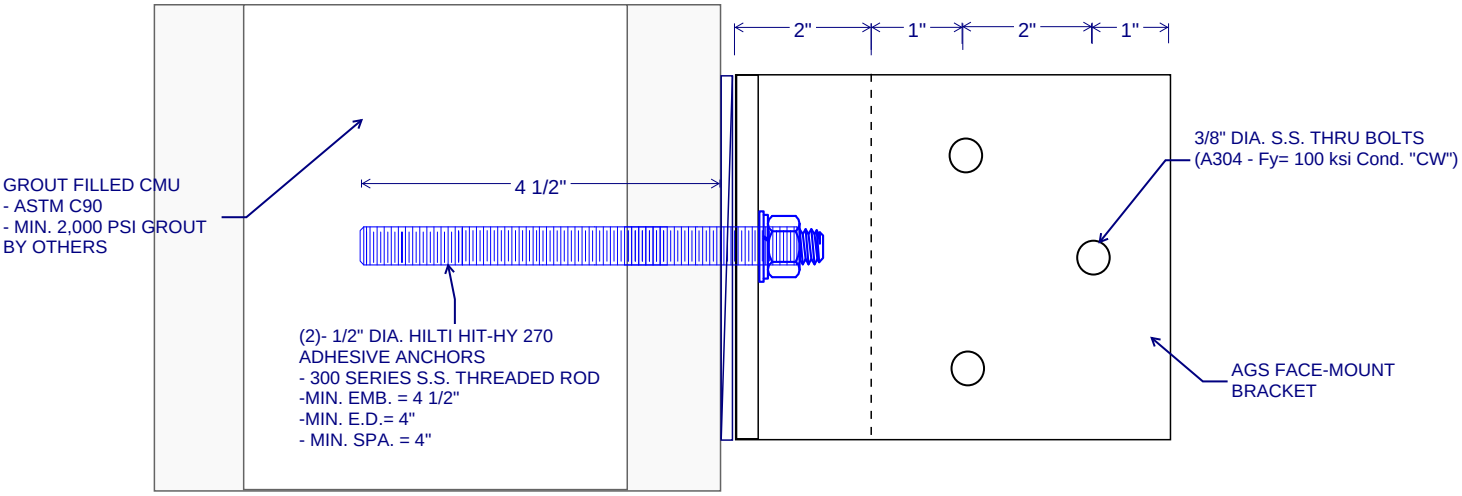
$V_{all} := 1614 \quad lb$ Per AAMA TIR-A9-2014

$T_{all} := 3100 \quad lb$

$THRUBOLT := \begin{cases} \text{"OK"} & \text{if } \left(\frac{V_{b1}}{V_{all}}\right)^2 + \left(\frac{T_b}{T_{all}}\right)^2 \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

THRUBOLT = "OK"

Use (2) - 3/8" Dia. S.S. Thru Bolts
300 Series (Fy = 65,000 psi)



RICE ENGINEERING Template: REI-MC-5251	105 School Creek Trail Luxemburg, WI 54217 Phone: (920)845-1042 Fax: (920)845-1048 www.rice-inc.com	Project Description: **AGS Quick-ship Sunshades**	Job No: R21-12-170 Engineer: MPM / Sheet No: 8 A Date: 12/21/2021 / Rev: Chk By: / Date:

Face Mount T-Bracket	Detail Ref.	Sheet No: 8 B

Check CMU Anchors :

$V_{b1} := \frac{R_y}{2} = 356$ lb

$T_b := \frac{M_{max}}{2(C1 + C2 + C3)\cdot 0.85} + \frac{R_z}{2} = 1822$ lb

$V_{all} := \min(0.70\cdot 1495, 6480) = 1047$ lb Per ESR 4143

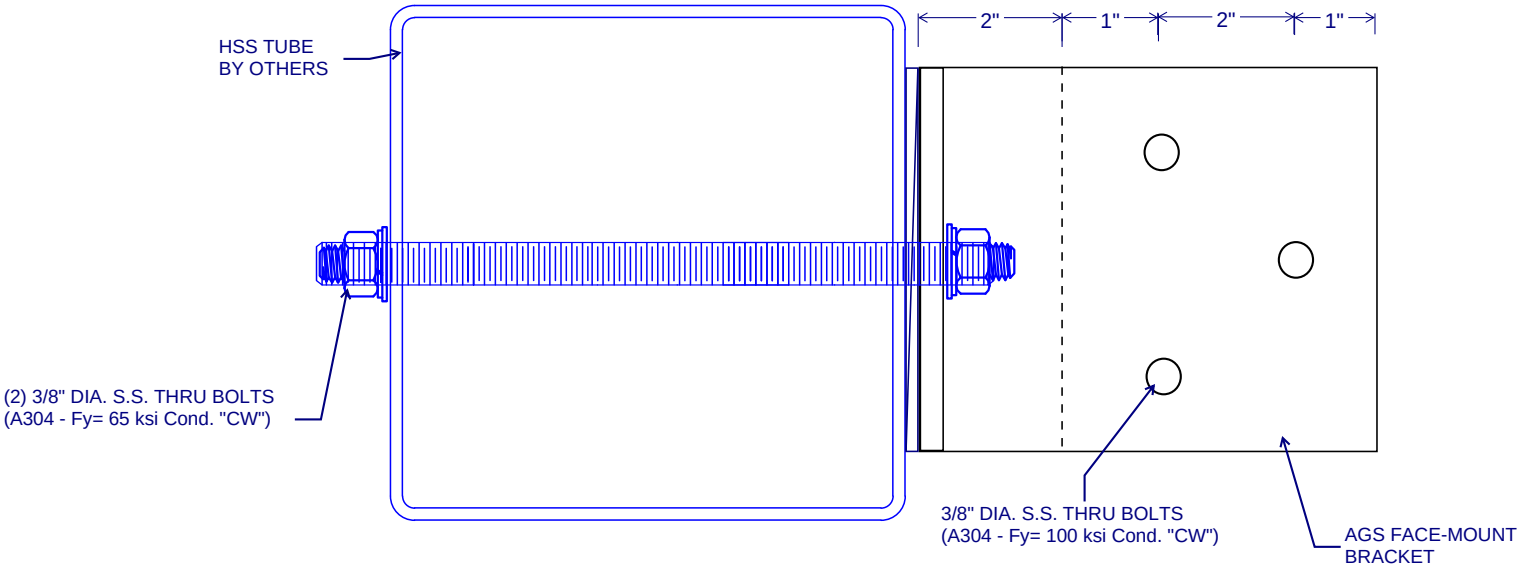
$T_{all} := \min(1.0\cdot 2035, 3335) = 2035$ lb

$$HITHY270 := \begin{cases} \text{"OK"} & \text{if } \left(\frac{V_{b1}}{V_{all}}\right)^2 + \left(\frac{T_b}{T_{all}}\right)^2 \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$$\left(\frac{V_{b1}}{V_{all}}\right)^{1.67} + \left(\frac{T_b}{T_{all}}\right)^{1.67} = 1$$

HITHY270 = "OK"

Use (2) 1/2" Diameter Hilti HIT-HY 270 adhesive anchor with HAS SS Rod
(300 Series, Fy = 65ksi)
Embed = 4-1/2"
Min. Spacing = 4"
Min. Edge Dist. = 4"
Assume grout filled masonry conforming to ASTM C90, f'm = 2,000 psi, grout conforming to ASTM C476
(Designed By Others)



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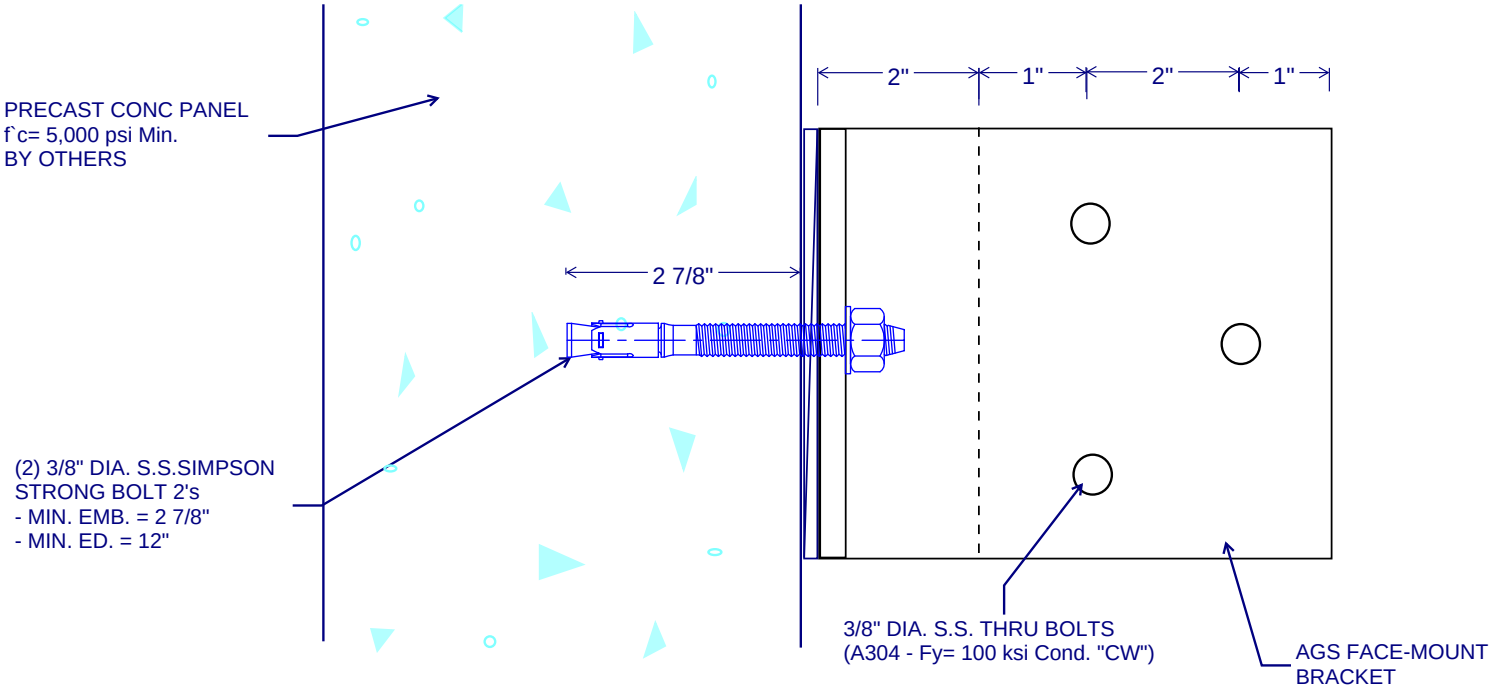
Check Concrete Anchors :

Face Mount T-Bracket	Detail Ref.	Sheet No: 8 C

Use (2) 3/8" Diameter Simpson S.S. Strong-Bolt2
(300 Series, Fy = 65ksi)
Embed = 2 7/8" Min.
Min. Spacing = 4"
Min. Edge Dist. = 12"
Assume 5,000 psi min. Precast Concrete
(Designed By Others)



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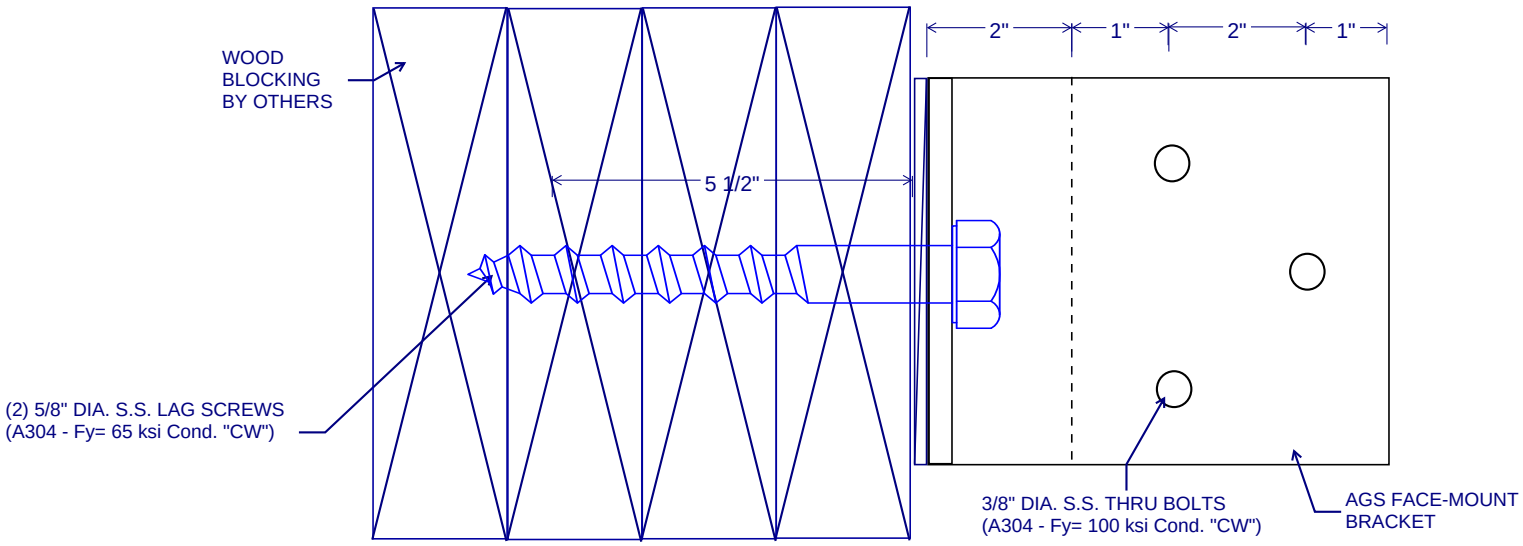
Face Mount T-Bracket	Detail Ref.	Sheet No: 8 D



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Curtain Wall T-Bracket	Detail Ref.	Sheet No: 9

Inputs:

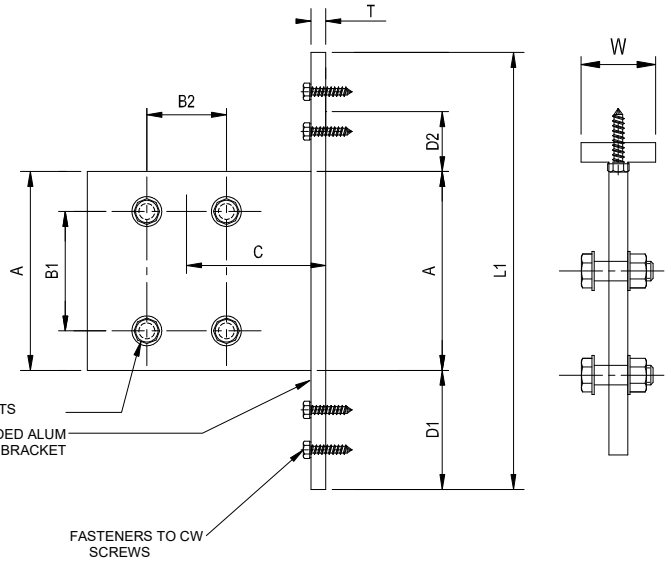
Alloy and Temper

- ☐ 6063-T5
- ☐ 6063-T6
- ☑ 6061-T6

$A_{dist} := 3.5$ in *Dist from bldg to outer bolt*

Bracket Dimensions:

t1 := 0.375	in	
t2 := 0.375	in	
W := 1.375	in	
A := 8	in	
B1 := 2	in	
B2 := 0	in	
C := 2.5	in	
D1 := 3	in	
D2 := 1	in	



Use D2 = dist. to CL of fast. pattern if using more than 1 fast. effective. Use D2= dist. to first fast. otherwise

Thru Bolts:

$n_b := 2$		*No. of bolts effective*
$d_b := 0.375$	in	*dia. thru bolts*
N := 16		*threads per inch*
$t_o := 0.25$	in	*thickness of outrigger*
$n_o := 2$		*No. of Outriggers*

Fasteners:

$t_{pp} := 0.125$	in	*Pressure Plate Thickness*
Thr := 0.5	in	*Screw Boss Thread Eng.*
$T_{max} := 1061$	lb	*Max Fastener Tension*
$V_{max} := 400$	lb	*Max Fastener Shear*
$t_{max} := 0.3373$	in	*Min. Thk. for Max Tension*
$n_f := 6$		*No. of Fasteners*
$n_{fe} := 3$		*Fasteners effective in tension.*
$t_f := 0.25$	in	*Fastener Diameter*

Reactions:

$R_{y1} := 335$	lb	$R_{y2} := 335$	lb
$R_{z1} := 14$	lb	$R_{z2} := 14$	lb
$M_{x1} := 4342$	lb·in	$M_{x2} := 4342$	lb·in

Calculations:

All Calculations Below This Line Are Automatic

$M_r := M_{x1} + M_{x2} = 8684$ in·lb

$R_y := R_{y1} + R_{y2} = 670$ lb

$R_z := R_{z1} + R_{z2} = 28$ lb

$D_c := 2$ in *Radius of bolt pattern*

$A := A_{dist} - D_c = 1.5$ in *dist. to CL thru bolts*

$b_s := \max(B1, B2) = 2$

$L := A + D2$

$a := D2$

$b := A$

$L1 := A + D1 \cdot 2 = 14$

Check Thru Bolts (for 3 Bolt Patterns):

$$V_b := \sqrt{\left(\frac{R_y}{n_b}\right)^2 + \left(\frac{R_z}{n_b}\right)^2 + \left(\frac{M_r}{n_b \cdot D_c}\right)^2} = 2197 \text{ lb}$$

$$A_R := 0.7854 \cdot \left(d_b - \frac{1.2269}{N}\right)^2 = 0.07 \text{ in}^2$$

$$f_v := \frac{V_b}{n_o \cdot A_R} = 15714 \text{ psi}$$

$F_v := 23094$ psi

$$f_{p1} := \frac{V_b}{n_o \cdot t_o \cdot d_b} = 1171\text{(} \text{ psi}$$

$F_{p1} := 31000$ psi *Allowable, 6063-T6 Outrigger*

$$f_{p2} := \frac{V_b}{t1 \cdot d_b} = 156\text{(} \text{ psi}$$

$F_{p2} := 23000 \cdot T1 + 31000 \cdot T2 + 39000 \cdot T3 = 39\text{(}$ psi

BOLTS := "OK" if $\frac{f_v}{F_v} < 1 \wedge \frac{f_{p1}}{F_{p1}} < 1 \wedge \frac{f_{p2}}{F_{p2}} < 1$, "FAIL" otherwise

BOLTS = "OK"

Use (3) - 3/8" Dia. S.S. Thru Bolts
300 Series (Fy = 65,000 psi)

Check "T" Bracket:

$M_{tot} := M_r + R_y \cdot C$ $\quad M_{tot} = 10359$ lb·in

$$P := \frac{M_{tot}}{A} + \frac{R_z}{(2)} \quad P = 1309 \text{ lb}$$

$$M_{pl} := \frac{P \cdot a \cdot b^2}{2L^3} \cdot (a + 2L) \quad M_{pl} = 1092 \text{ lb·in}$$

$F_{by} := 14500 \cdot T1 + 22700 \cdot T2 + 31800 \cdot T3$ $\quad F_{by} = 31800$ psi

$$t_{reqd} := \sqrt{\frac{M_{pl} \cdot 6}{F_{by} \cdot W}} \quad t_{reqd} = 0.387 \text{ in}$$

BRACKET := "OK" if $t_{reqd} \le 1.05\,t1$, "FAILS" otherwise

BRACKET = "OK"

Use 3/8" Ext. Aluminum "T" Bracket (6061-T6)

Check Fasteners into CurtainWall (Assume 6063-T6):

$V := R_y \div n_f = 111.67$ lb $\quad V_{all} := \min(V_{max}, 31000 \cdot t_f \cdot t_{pp}) = 400$ lb

$$T := \frac{P \cdot b^2 \cdot (a + 2L)}{2 \cdot L^3 \cdot n_{fe}} + \frac{R_z}{n_f} = 369 \text{ lb}$$

$$T_{all} := \min\left[T_{max}, \frac{(0.325 \cdot Thr) + t_{pp}}{t_{max}} \cdot T_{max}\right] = 904 \text{ lb}$$

FASTENERS := "OK" if $\left(\frac{V}{V_{all}}\right)^2 + \left(\frac{T}{T_{all}}\right)^2 \le 1$, "FAIL" otherwise

FASTENERS = "OK"

Use (x) - 1/4" x 20 S.S. Screws Cond "CW"
Min. 3/4" thread eng. into 6063-T6 Mullion
Recommend Pre-Drill Into CW Mullion
Design of CW Mullion By Others

RICE ENGINEERING
Template: REI-MC-5253

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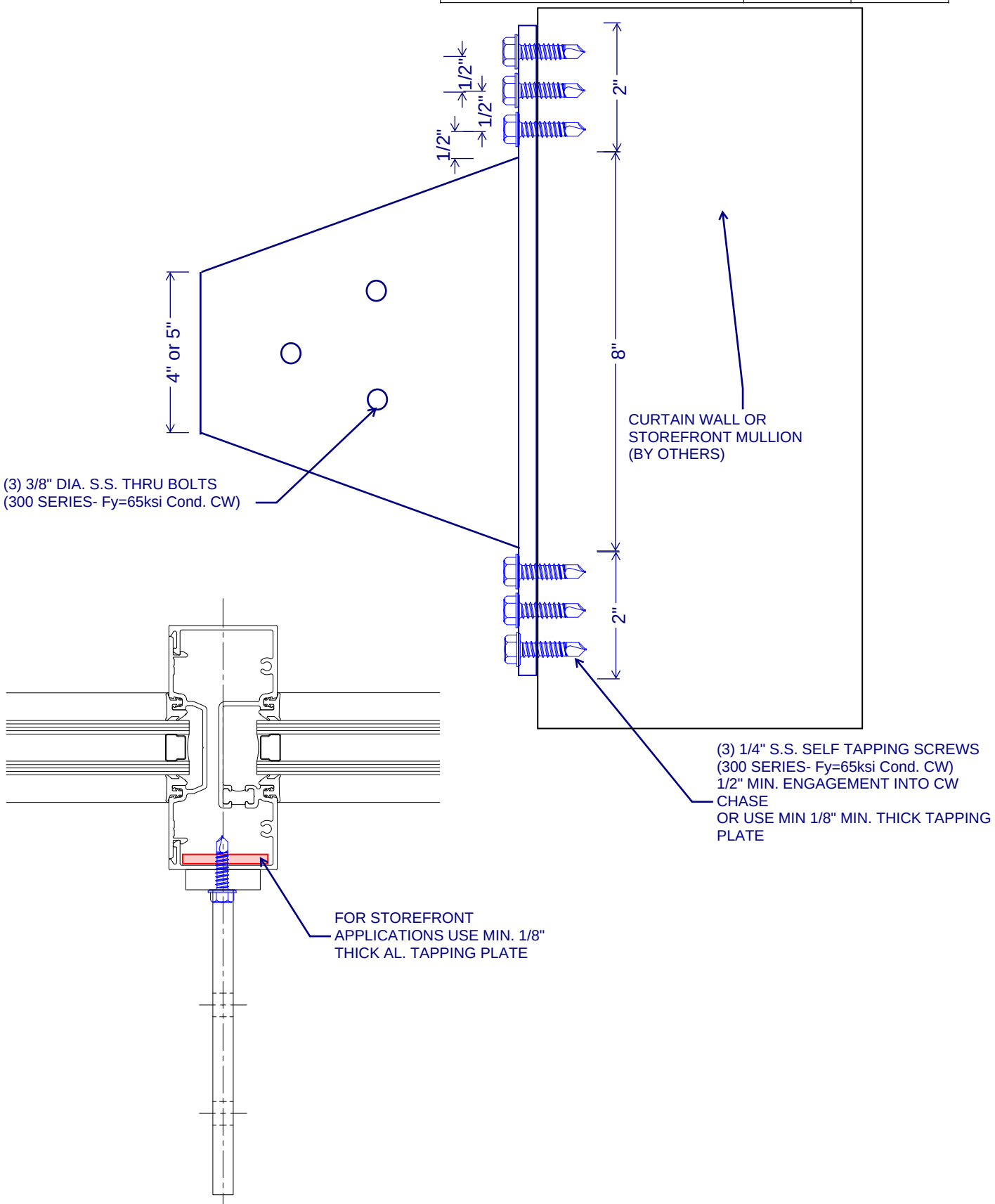
Project Description: **AGS Quick-ship Sunshades**

Job No:	R21-12-170		
Engineer:	MPM	Sheet No:	9
Date:	12/21/2021	Rev:	
Chk By:		Date:	

Curtain Wall T-Bracket	Detail Ref.	Sheet No: 9 A



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