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ENGINEERING
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ENGINEER'S REVIEW
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ENGINEER'S REVIEW IS FOR GENERAL CONFORMANCE TO THE DESIGN CONCEPT AND CONTRACT DOCUMENTS. REVIEW OF THE SPECIALTY STRUCTURAL ENGINEERS (SSE) DESIGN IS FOR CONFORMANCE TO DESIGN CRITERIA AND COMPATIBILITY WITH THE DESIGN OF THE BUILDING AND DOES NOT RELIEVE THE SSE OF RESPONSIBILITY FOR THAT DESIGN. MARKINGS OR COMMENTS SHALL NOT BE CONSTRUED AS RELIEVING THE CONTRACTOR FROM COMPLIANCE WITH THE PROJECT PLANS AND SPECIFICATIONS, NOT DEPARTURES THEREFROM. THE CONTRACTOR REMAINS RESPONSIBLE FOR DETAILS AND ACCURACY; FOR CONFIRMING AND CORRELATING ALL QUANTITIES AND DIMENSIONS; FOR SELECTION FABRICATION PROCESSES, FOR TECHNIQUES OF ASSEMBLY; AND FOR PERFORMING WORK IN A SAFE MANNER.

McDonalds 036-0034
Trellis Calculations
All-Lite Order No.: 264399

Project Location:
12005 North Center Street
Portland, Oregon
REI Project # R17-08-248

Prepared for:
PCI Industries
Fort Worth, TX
8/16/2018

16-251735-DFS-01-CO

Design Criteria:

1. Design Loads per Code (IBC 2015, ASCE 7-10)
   - Trellis Load Acting Down: 37.9 PSF
   - Trellis Load Acting Up: 20.0 PSF
2. Aluminum extrusions shall be alloy **6063-T5 and 6061-T6/6005-T5** or better. Formed aluminum panels shall be alloy **5052-H32** or better. Members designed per the Aluminum Association, "Aluminum Design Manual".
3. Deflection to be **L/120 max.** for main span members. Deflection to be **2L/120** for cantilever members.
4. Screws and bolts shall be **stainless steel alloy groups 1, 2 or 3 (300 series only condition CW Fy = 65 ksi, Fu = 110 ksi minimum,** as shown in calculations.
5. Field and shop welding shall be **E70 or better,** aluminum filler alloy to be **5356.**
6. Concrete anchors shall be the size, embed depth and spacing as per the calculations. Anchors shall be installed per the manufacturer's specifications. Use **Hilti or equal.**
7. Concrete masonry is assumed to be **ASTM C90, Type II, Grout filled (2,000 psi min.).**
8. Design of material separation to prevent reaction between dissimilar materials **not designed by Rice Engineering Inc.**
9. Wood Screws shall conform to **ANSI/ASME Standard B18.6.1-1981, minimum bending yield strengths of Fby=70 ksi,** Lag Screws shall conform to **ANSI/ASME Standard B18.6.1-1981, minimum bending yield strengths of Fby=45 ksi,**
10. Wood is assumed to be **Hem-Fir, SG = 0.43.**
11. Threaded rods shall be **SAE Grade 5** or better with diameters and locations as shown on calculations.

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Disclaimer:

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

- Structural design of hardware, glass lites, gaskets, and sealants.
- Design of material separation to prevent reaction between dissimilar materials.
- Design of air and water infiltration prevention.
- The manufacture, assembly, or installation of the system.
- Quantities of materials or dimensional accuracy of drawings

Engineers Design Approval Stamp:

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REGISTERED PROFESSIONAL
ENGINEER
85382 PE
OREGON
MAY 10, 2011
BRADLEY J. KUEHL
08/16/2018
EXPIRES: 6/30/19

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Note: Strikethrough indicates Not Used (~~SAMPLE~~)

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Design Parameters	Detail Ref.	Sheet No: 01

ALL-LITE

A Division of PCI Industries, Inc.

Project Information:

McDonalds Site ID: 036-0034
All-Lite Order Number: 264399
REI Project Number: R17-08-248
Location: Portland, OR

Construction Options:

Maximum Trellis Length:	$L_t := 88 \cdot in$	
Number of Stiffeners:	$N_s := 2$	
Shroud Outside Diameter:	$D_{shdo} := 1.314 \cdot in$	
Shroud Inside Diameter:	$D_{shdi} := 1.08 \cdot in$	
Shroud Length:	$L_{bshd} := 44.2 \cdot in$	
Tributary Width (Typical Panel):	$T_{wtyp} := 28 \cdot in$	
Tributary Width (End Panel):	$T_{wend} := 25.75 \cdot in$	
Number of End Stiffeners:	$N_{es} := 1$	
Shroud Angle:	$\theta_s := 44.1 deg$	
Number of Tie-Back Anchor Bolts:	$N_{tba} := 2$	per bracket
Mounting Rail Anchor Spacing:	$SPA_{lag} := 36 \cdot in$	
Mounting Rail Anchor Spacing (welded rods):	$SPA_{wd} := 40 \cdot in$	
Maximum Distance from Vertical Load to Substrate (Mounting Rail/ Upper Shroud Clip:	$e_7 := 2.25 \cdot in$	

Design Variables:

Wind Speed:	$V := 120$	mph
Ice Thickness:	$t_i := 1.25$	in
Wind Speed w/ ice:	$V_i := 30$	mph
Ground Snow Load:	$P_g := 20$	psf
Short Period Ground Acceleration:	$S_s := 94.5$	%
Short Period Site Coefficient:	$F_a := 1.1$	
Live Load:	$LL := 0$	psf

ASCE 7-10

Design Loads	Detail Ref.	Sheet No: 2

Wind Input Variables:

Building Category	II		Table 1.5-1
Mean Roof Height	$h := 20$	ft	
Sunshade Height	$z := 12$	ft	Table-30.3-1
Exposure	$E := "C"$		
Wind Velocity	$V = 120$	mph	Figure 26.5-1A, Figure 26.5-1B, Figure 26.5-1C
Topographic Factor	$K_{zt} := 1.0$		Figure 26.8-1
Directionality Factor	$K_d := 0.85$		Table 26.6-1
Effective Wind Area	$EWA := 29.33\ ft^2$		
ASD Conversion Factor	$\Phi := 0.6$		
Building Width	$L_1 := 50$	ft	
Building Length	$L_2 := 100$	ft	
Roof Slope:	$\theta := 0$	deg	
Roof Edge Zone:	$a_z = 5$	ft	

Internal Pressure Coefficients:

$GCpi1 := 0$

$GCpi2 := -0$

Note: Internal pressure coefficients from Table 26.11-1

External Pressure Coefficients.:

$GCplat = 1$

$GCp1 = -1$	CZ
$GCp2 = 1$	CZ
$GCp3 = -1$	Typ
$GCp4 = 1$	Typ

Note: External Pressure coefficients from: Figure 30.4-2A, Figure 30.6-1

Ice Input Variables:

Ice Thickness:	$t_i = 1.25$	in	Figure 10-2A, Figure 10-2B
Concurrent Wind:	$V_i = 30$	mph	
Importance Factor:	$I_i = 1$		Table 1.5-2

Snow Input Variables:

Ground Snow Load:	$P_g = 20$	psf	Figure 7-1A, Figure 7-1B
Thermal Factor:	$C_t := 1.2$		Table 7-3
Exposure Factor:	$C_e := 0.9$		Table 7-2
Importance Factor:	$I_s = 1$		Table 1.5-2
Roof Slope Factor:	$C_s := 1.0$		Figure 7-2
Clear Height:	$h_c = 8$	ft	
Parapet Height:	$h_p := 0$	ft	
Sunshade Projection:	$L_{uww} := 4$	ft	

$$L_{ulw} := \max\left[0.85\cdot\left(\left(\max(L_1, L_2) - 5h_p\right)\right), 25\right] = 85$$

Upwind Roof Length: $L_{ulw} = 85$ ft

Seismic Input Variables:

$S_s = 94.5$ %	Mapped Spectral Response Acceleration at Short Periods (Figure 22-1A),(Figure 22-1B)
$a_p := 2.5$	Component Amplification Factor (Table 13.5-1)
$R_p := 1.5$	Component Response Modification Factor (Table 13.5-1)
$I_p = 1$	Component Importance Factor (See Section 13.1.3)

Soil Site Class: D

$F_a = 1.1$ Short-Period Site Coefficient (Table 11.4-1)

NOTE: Enter perimeter in inches, length, and number of each type of member to calculate ice weights.

Member Data:

PERIMETERS		LENGTHS		NUMBER	AREA				
$D_{c1} := 8$	in	$L_1 := 88$	in	$n_1 := 1$	$A_1 := 1.309$	in^2	rear fascia	$V_1 := A_1 \cdot L_1 \cdot n_1 = 115.192$	in^3
$D_{c2} := 8$	in	$L_2 := 48$	in	$n_2 := 2$	$A_2 := 1.438$	in^2	outrigger	$V_2 := A_2 \cdot L_2 \cdot n_2 = 138.048$	in^3
$D_{c3} := 0$	in	$L_3 := 88$	in	$n_3 := 1$	$A_3 := 4.8$	in^2	infil panel	$V_3 := A_3 \cdot L_3 \cdot n_3 = 422.4$	in^3
$D_{c4} := 8$	in	$L_4 := 88$	in	$n_4 := 1$	$A_4 := 1.337$	in^2	front fascia	$V_4 := A_4 \cdot L_4 \cdot n_4 = 117.656$	in^3
$D_{c5} := 0$	in	$L_5 := 88$	in	$n_5 := 1$	$A_5 := 0.82$	in^2	mounting rail	$V_5 := A_5 \cdot L_5 \cdot n_5 = 72.16$	in^3
$D_{c6} := 0$	in	$L_6 := 44$	in	$n_6 := 4$	$A_6 := 0.81$	in^2	stiffener	$V_6 := A_6 \cdot L_6 \cdot n_6 = 142.56$	in^3
$D_{c7} := 1.32$	in	$L_7 := 50$	in	$n_7 := 2$	$A_7 := 0.31$	in^2	shroud	$V_7 := A_7 \cdot L_7 \cdot n_7 = 31$	in^3
$D_{c8} := 0$	in	$L_8 := 6$	in	$n_8 := 1$	$A_8 := 6.2$	in^2	brackets	$V_8 := A_8 \cdot L_8 \cdot n_8 = 37.2$	in^3

$SQFT := 29.33\ ft^2$

NOTE: Calculate the solid area of the sunshade in the same plane as the applied wind load. (Ex. calculate the solid area as seen from directly above if wind load is applied downward.) USE THE WORST CASE FOR THESE CALCULATIONS.

Design Loads	Detail Ref.	Sheet No: 3

Wind Load Calculations:

Velocity pressure Coefficients:

$K_{zh} = 0.90$ psf

$K_{zz} = 0.85$ psf

Velocity pressures:

$q_h := 0.00256 \cdot K_{zh} \cdot K_{zt} \cdot K_d \cdot V^2 = 28.201$

$q_z := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot V^2 = 26.634$

Calculated Pressures (ASD):

$$\boxed{W_{upcz} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp1 - GCpi1)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_h \cdot GCp1 - q_h \cdot GCpi1\right) & \text{otherwise} \end{cases} = -16.921}$$ psf

$$\boxed{W_{dncz} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp2 - GCpi2)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_z \cdot GCp2 - q_h \cdot GCpi2\right) & \text{otherwise} \end{cases} = 16.921}$$ psf

$$\boxed{W_{up} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp3 - GCpi1)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_h \cdot GCp3 - q_h \cdot GCpi1\right) & \text{otherwise} \end{cases} = -16.921}$$ psf

$$\boxed{W_{dn} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp4 - GCpi2)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_z \cdot GCp4 - q_h \cdot GCpi2\right) & \text{otherwise} \end{cases} = 16.921}$$ psf

$$\boxed{W_{lat} := \Phi \cdot q_h \cdot GC_{plat} + 5 = 21.921}$$ psf

Dead Load Calculations:

$$WT := \frac{(V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7 + V_8) \cdot 165}{1728} = 102.764 \text{ lb}$$

$$\boxed{D := \frac{WT}{SQFT} = 3.504}$$ psf

Ice Load Calculations:

$$f_z := \begin{cases} \left(\frac{z}{33}\right)^{0.10} & \text{if } 0 < z < 900 \\ 1.4 & \text{otherwise} \end{cases} = 0.904$$

$t_d := 1.0 \cdot t_i \cdot I_i \cdot f_z \cdot K_{zt}^{0.35} = 1.13$ in

$q_{zi} := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot V_i^2 = 1.665$ psf

$W_i := q_{zi} \cdot \Phi \cdot (GCp4 - GCpi1) = 0.999$ psf

$$\boxed{WT_i := \frac{V_{1i} + V_{2i} + V_{3i} + V_{4i} + V_{5i} + V_{6i} + V_{7i} + V_{8i}}{1728} \cdot 56 = 313.803}$$ lb

$$\boxed{D_i := \frac{WT_i}{SQFT} = 10.699}$$ psf

Snow Load Calculations:

$P_f := 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot P_g = 15.12$ psf

$$\boxed{S_b := P_f \cdot C_s = 15.12}$$ psf *Balanced Snow Load*

$$\gamma := \begin{cases} 0.13 \cdot P_g + 14 & \text{if } P_g \le 123 \\ 30 & \text{otherwise} \end{cases} = 16.6$$ pcf

$h_b := \frac{S_b}{\gamma} = 0.911$ ft

$$h_{ratio} := \begin{cases} \frac{h_{c'}}{h_b} & \text{if } h_b > 0 \\ 0 & \text{otherwise} \end{cases} = 7.783$$

$$h_{dlw} := \begin{cases} \left(0.43 \cdot \sqrt[3]{L_{ulw}} \cdot \sqrt[4]{P_g + 10} - 1.5\right) & \text{if } h_{ratio} \ge 0.2 \\ 0 & \text{otherwise} \end{cases} = 2.925$$ ft

$h_{dww} := \left(0.43 \cdot \sqrt[3]{L_{uww}} \cdot \sqrt[4]{P_g + 10} - 1.5\right) \cdot 0.75 = 0.073$ ft

$h_{d1} := \max(h_{dlw}, h_{dww}) = 2.925$ ft

$h_{rep} = 1$ ft

$h_d := \max(0, \min(h_{d1}, h_{c'}, h_{rep})) = 1$ ft

$P_{d1} := h_d \cdot \gamma = 16.6$ psf *at wall*

$$w := \begin{cases} 4 \cdot h_{d1} & \text{if } h_{d1} \le h_{c'} \\ \frac{4 \cdot h_{d1}^2}{h_{c'}} & \text{otherwise} \end{cases} = 11.699$$ ft

$$P_{d2} := \begin{cases} 0 & \text{if } L_{uww} \ge w \\ \left[h_d - \left(\frac{h_d \cdot L_{uww}}{w}\right)\right] \cdot \gamma & \text{otherwise} \end{cases} = 10.924$$ psf *at fascia*

$$\boxed{S_d := \begin{cases} \left(\frac{P_{d1} + P_{d2}}{2} + S_b\right) & \text{if } P_g > 0 \\ 0 & \text{otherwise} \end{cases} = 28.882}$$ psf *Balanced plus Drift Load*

Seismic Load Calculations:

$S_{MS} := F_a \cdot \frac{S_s}{100} = 1.04$ $\quad S_{DS} := \left(\frac{2}{3}\right) S_{MS} = 0.693$

$$f_p := \left(\frac{0.4 \cdot a_p \cdot S_{DS} \cdot WT}{\frac{R_p}{I_p}}\right) \cdot \left[1 + \left[2 \cdot \left(\frac{z}{h}\right)\right]\right] = 104.449$$

$f_{pmin} := 0.3 \cdot S_{DS} \cdot I_p \cdot WT = 21.365$

$f_{pmax} := 1.6 \cdot S_{DS} \cdot I_p \cdot WT = 113.944$

$$F_p := \begin{cases} f_p & \text{if } f_p > f_{pmin} \wedge f_p < f_{pmax} \\ f_{pmin} & \text{if } f_p < f_{pmin} \\ f_{pmax} & \text{if } f_p > f_{pmax} \end{cases} = 104.449$$

$$\boxed{E := \frac{F_p}{SQFT} = 3.561}$$

Load Combinations:

Design Loads	Detail Ref.	Sheet No: 4

Loads:

$D = 3.504$ psf *Dead Load* *(Make Dead Load equal to 0 if it will be added in RISA)*

$S_b = 15.12$ psf *Balanced Snow Load*

$S_d = 28.882$ psf *Drift plus Balanced Snow Load*

$W_{upcz} = -16.921$ psf *Corner Zone Uplift Wind Load*

$W_{up} = -16.921$ psf *Typical Uplift Wind Load*

$W_{dn} = 16.921$ psf *Downward Wind Load*

$W_{lat} = 21.921$ psf *Lateral Wind Load (fascia and outriggers)*

$D_i = 10.699$ psf *Dead Load Due to Ice*

$W_i = 0.999$ psf *Concurrent Wind Load with Ice Load*

$E = 3.561$ psf *Seismic Load*

$LL = 0$ psf *Live Load*

Load Cases:

$L1 := D$ $L1 = 3.504$ psf

$L2 := D + D_i + LL$ $L2 = 14.203$ psf

$L3 := D + \max(D_i + 0.7W_i, S_d)$ $L3 = 32.386$ psf

$L4 := D + 0.75S_d + 0.75LL$ $L4 = 25.165$ psf

$L5 := D + W_{dn}$ $L5 = 20.424$ psf

$L5A := D + 0.7E$ $L5A = 5.997$ psf

$L6 := D + 0.75W_{dn} + 0.75LL + 0.75S_d$ $L6 = 37.856$ psf

$L6A := D + 0.7E + 0.75LL + 0.75S_d$ $L6A = 27.658$ psf

$L7 := 0.6D + W_{upcz}$ $L7 = -14.818$ psf

$L7A := 0.6D + W_{up}$ $L7A = -14.818$ psf

$L7B := 0.6D + D_i + 0.7W_i$ $L7B = 13.5$ psf

$L8 := 0.6D + 0.7E$ $L8 = 4.595$ psf

$L9 := D + \max(D_i + 0.7W_i, S_b)$ $L9 = 18.624$ psf

$L10 := D + 0.75S_b + 0.75LL$ $L10 = 14.844$ psf

$L11 := D + 0.75W_{dn} + 0.75LL + 0.75S_b$ $L11 = 27.534$ psf

$L11A := D + 0.7E + 0.75LL + 0.75S_b$ $L11A = 17.337$ psf

$LoadDN1 := \max(L1, L2, L3, L4, L5, L5A, L6, L6A, L7B, L8) = 37.856$ psf *Maximum Downward Load if snow drift applies*

$LoadDN2 := \max(L1, L2, L9, L10, L5, L5A, L11, L11A, L7B, L8) = 27.534$ psf *Maximum Downward Load if snow drift does not apply*

$LoadUP1 := L7 = -14.818$ psf *Maximum Uplift (Corner Zones)*

$LoadUP2 := L7A = -14.818$ psf *Maximum Uplift (Typical)*

$LoadLAT := W_{lat} = 21.921$ psf *Maximum Horizontal Wind Load*

$DnLoad := \max(LoadDN1, LoadDN2, 20)\cdot psf = 37.86\cdot psf$

$UpLoad := \min(LoadUP1, LoadUP2, -20)\cdot psf = -20\cdot psf$

Panel Infill	Detail Ref.	Sheet No: 5

Chk Infill Panels:

$DL_{max} := \max(DnLoad, |UpLoad|) = 37.86 \cdot psf$

$a := 44 \cdot in$ panel length

$b := \max(T_{wtyp}, T_{wend}) = 28 \cdot in$ max panel tributary width

$t := 0.100 \cdot in$ panel thickness

Use 0.1" thick Panel
as shown (5052-H32)

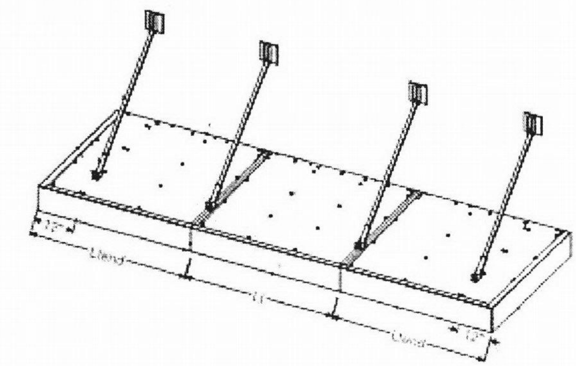
$q := DL_{max} = 38 \cdot psf$ panel uniform load

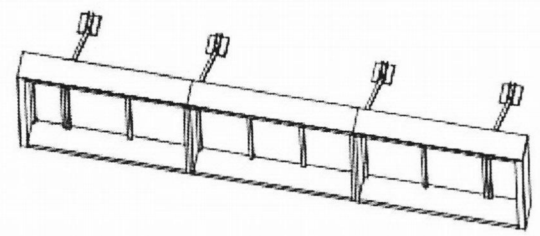
$E := 10100000 \cdot psi$ modulus of elasticity

$\nu := 0.316$ poisson's ratio

$D_f := 0.216 \cdot in$ Fastener Diameter

$F_{ty} := 23 \cdot ksi$ Side member tensile yield strength





Calculations

The relations among load, deflection and stress are expressed by numerical values of the dimensionless coefficients shown below (It is assumed that ν is equal to or near 0.316):

$$coef_q = \frac{q \cdot b^4}{E \cdot t^4} \qquad coef_y = \frac{y}{t}$$

$$coef_{\sigma d} = \frac{\sigma_d \cdot b^2}{E \cdot t^2} \qquad coef_\sigma = \frac{\sigma \cdot b^2}{E \cdot t^2}$$

The collected data for these coefficients is listed below. For any given value of qb^4/Et^4, values for the other three coefficients may be interpolated.
The stresses and deflection at the center of the plate are found here:

$$coef_q := (0\ \ 12.5\ \ 25\ \ 50\ \ 75\ \ 100\ \ 125\ \ 150\ \ 175\ \ 200\ \ 250)^T$$

$$coef_y := (0\ \ 0.625\ \ 0.879\ \ 1.18\ \ 1.37\ \ 1.53\ \ 1.68\ \ 1.77\ \ 1.88\ \ 1.96\ \ 2.12)^T$$

$$coef_{\sigma d} := (0\ \ 1.06\ \ 2.11\ \ 3.78\ \ 5.18\ \ 6.41\ \ 7.65\ \ 8.60\ \ 9.55\ \ 10.60\ \ 12.30)^T$$

$$coef_\sigma := (0\ \ 4.48\ \ 6.81\ \ 9.92\ \ 12.25\ \ 14.22\ \ 16.0\ \ 17.50\ \ 18.90\ \ 20.30\ \ 22.80)^T$$

$$y := \text{linterp}\left(coef_q, coef_y, \frac{q \cdot b^4}{E \cdot t^4}\right) \cdot t \cdot 1.5 \qquad y = 0.272 \cdot in < \qquad y_{all} := \frac{b}{60} = 0.467 \cdot in$$

$$\sigma_d := \text{linterp}\left(coef_q, coef_{\sigma d}, \frac{q \cdot b^4}{E \cdot t^4}\right) \cdot \left(\frac{E \cdot t^2}{b^2}\right) \qquad \sigma_d = 1156.79\,psi$$

$$\sigma := \text{linterp}\left(coef_q, coef_\sigma, \frac{q \cdot b^4}{E \cdot t^4}\right) \cdot \left(\frac{E \cdot t^2}{b^2}\right) \qquad \sigma = 2326.501\,psi$$

$$PANELS := \begin{cases} \text{"OK"} & \text{if } \sigma \le 16500 \cdot psi \wedge y \le y_{all} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Fastener check:

$$T_{max} := 1.143 \cdot b \cdot |UpLoad| \cdot \frac{a}{3} = 65\,lbf$$

$$t_D := \min\left(\frac{t}{D_f}, 1.1\right) = 0.463$$

$$T_{pov} := \left[\frac{(0.27 + 1.45 \cdot t_D) \cdot D_f \cdot t \cdot F_{ty}}{3}\right] = 156\,lbf$$

$T_{all} := 286 \cdot lbf$ AAMA TIR Table 22.12

$$FASTENERS := \begin{cases} \text{"OK"} & \text{if } \left(\frac{T_{max}}{T_{all}}\right) \le 1 \wedge \frac{T_{max}}{T_{pov}} \le 1.0 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

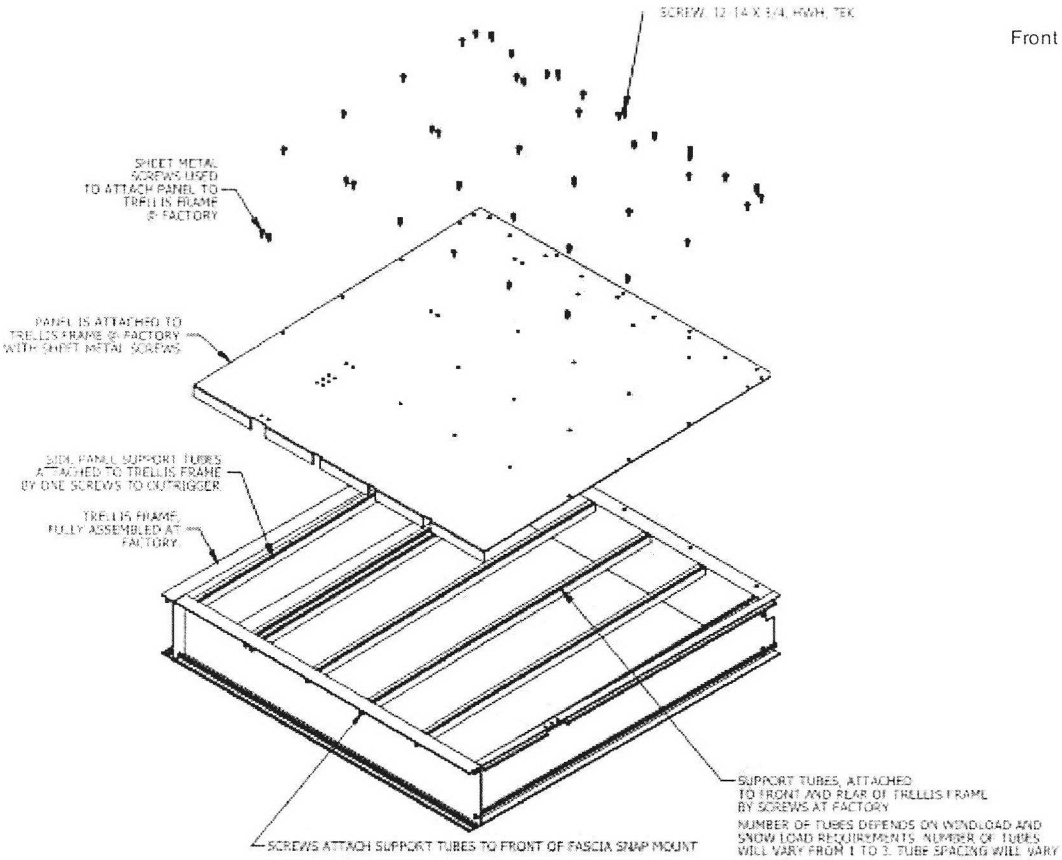
Use #12 Tek S.S. Fasteners
Max. O.C. Spacing = 12"
Min. Edge/End Dist. = 1/2"
Full Thread Eng. into Rear Fascia
(300 Series Stainless Steel, Condition CW)

Use #12 Tek S.S. Fasteners
Max. O.C. Spacing = 14.67"
Min. Edge/End Dist. = 1/2"
Full Thread Eng. into Stiffener
(300 Series Stainless Steel, Condition CW)

PANELS = "OK"

FASTENERS = "OK"

Panel Edge	Detail Ref.	Sheet No:
		6



Front Panel Edge Properties:

$I_{xpe} := 0.087 \cdot in^4$

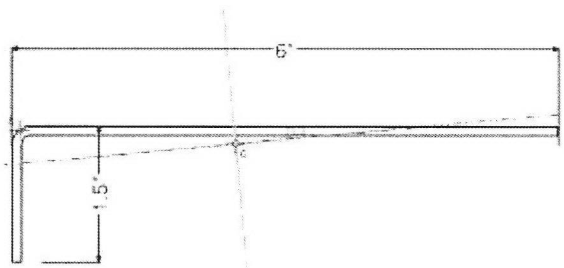
$I_{ype} := 2.75 \cdot in^4$

$S_{xpetop} := 0.45 \cdot in^3$

$S_{xpebot} := 0.067 \cdot in^3$

$t_{pe} := 0.100 \cdot in$

$d_{leg} := 1.5 \cdot in$



Chk Unsupported Panel Edge:

$$w := \frac{b \cdot DL_{max}}{2} = 3.68 \cdot \frac{lbf}{in}$$

$$R_{xmax} := \frac{w \cdot b}{4} = 26\,lbf$$

$$M_{xmax} := \frac{w \cdot b^2}{12} = 240 \cdot lbf \cdot in$$

$$\Delta_{xact} := \frac{w \cdot b^4}{120 \cdot E \cdot I_{xpe}} = 0.021 \cdot in$$

$$\Delta_{xallow} := \frac{b}{60} = 0.467 \cdot in$$

$$f_{pe} := \frac{M_{xmax}}{S_{xpebot}} = 3588.867\,psi$$

$$F_{pe} := 18100 \cdot psi$$

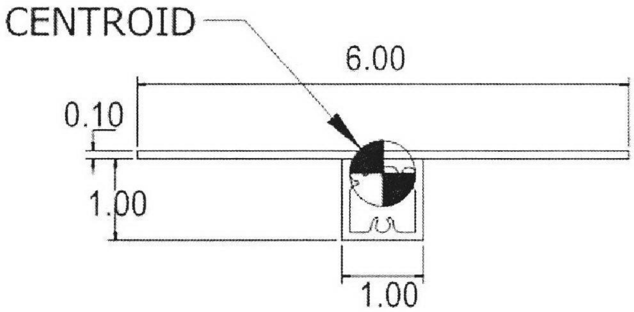
$$PANELEND := \begin{cases} \text{"OK"} & \text{if } f_{pe} < F_{pe} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{PANELEND = \text{"OK"}}$

RICE ENGINEERING Template:	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **McDonalds 036-0034** **Portland, OR**	Job No: R17-08-248	
			Engineer: KLG	Sheet No: 6
			Date: 8/18/17	Rev:
			Chk By:	Date: 2/23/18

Stiffener	Detail Ref.	Sheet No: 7

Chk Stiffener Tubes:



Tube Section Properties

Input B: 1 in
Input D: 1 in
Input t: 0.1 in
=========================

A=	0.360 in^2
A_m=	0.810 in^2
P_m=	3.600 in
J=	0.073 in^4
Ix=	0.049 in^4
Iy=	0.049 in^4
Sx=	0.098 in^3
Sy=	0.098 in^3
Zx=	0.122 in^3
Zy =	0.122 in^3
r =	0.370 in

Stiffener Tube Properties:

$I_{xstf} := 0.049 \cdot in^4$

$I_{ystf} := 0.049 \cdot in^4$

$S_{xstf} := 0.098 \cdot in^3$

$J_{stf} := 0.073 \cdot in^4$

$L_{bstf} := 14.67 \cdot in$

Use 1" x 1" x 0.100" wall Tube
Spaced 22" o.c. (max.)
as shown (6005A-T61 or 6005-T5)

Use (3) #10 S.S. Fasteners @ Front Fascia & (1) #10 S.S. Fastener @ Rear Fascia to attached to Trellis Frame
Min. Thread Eng.= 5/8"
(300 Series Stainless Steel, Condition CW)

Chk Stiffener Tube:

$w_{7typ} := T_{wtyp} \cdot DL_{max} = 7.361 \cdot \frac{lbf}{in}$

$R_{7typ} := \frac{(w_{7typ}) \cdot a}{2} = 162\,lbf$

$w_{7end} := T_{wend} \cdot DL_{max} = 6.769 \cdot \frac{lbf}{in}$

$R_{7end} := \frac{(w_{7end}) \cdot a}{2} = 149\,lbf$

$S_{rstf} := \frac{2 \cdot L_{bstf} \cdot S_{xstf}}{\sqrt{I_{ystf} \cdot J_{stf}}} = 48.076$

typical trellis:

$M_{7typ} := \frac{w_{7typ} \cdot a^2}{8} = 1781 \cdot lbf \cdot in$

$f_{bstf} := \frac{\max(M_{7typ}, M_{7end})}{S_{xstf}} = 18177\,psi$

end trellis:

$M_{7end} := \frac{w_{7end} \cdot a^2}{8} = 1638 \cdot lbf \cdot in$

$\Delta_{end} := \frac{5}{384} \cdot \frac{w_{7end} \cdot a^4}{E \cdot I_{xstf}} = 0.668 \cdot in$

$$F_{bstf} := \begin{cases} (21200 \cdot psi) & \text{if } S_{rstf} < 123 \\ \left[\left(23.9 - 0.238\sqrt{S_{rstf}}\right) \cdot 1000 \cdot psi\right] & \text{if } 123 \le S_{rstf} \le 1685 \\ \left(\frac{23599}{S_{rstf}} \cdot 1000 \cdot psi\right) & \text{otherwise} \end{cases} = 21200 \cdot psi$$

$F_{bwk} := 27600 \cdot psi$

$\Delta_{typ} := \frac{5}{384} \cdot \frac{w_{7typ} \cdot a^4}{E \cdot I_{xstf}} = 0.726 \cdot in$

$\Delta_{stall} := \frac{a}{60} = 0.73 \cdot in$

$$STIFFENER := \begin{cases} \text{"OK"} & \text{if } f_{bstf} \le \max(F_{bstf}, F_{bwk}) \wedge \left(\frac{\Delta_{typ}}{\Delta_{stall}}\right) \le 1.0 \wedge \Delta_{end} \le \Delta_{stall} \\ \text{"FAILS"} & \text{otherwise} \end{cases}$$

Chk Stiffener Connection to Fascia:

bearing:

$n := 1$ fastener quantity

$D_6 := 0.19 \cdot in$ screw diameer

$\Omega := 3$

rear channel:

$d_e := 0.8 \cdot in$ distance from center of hole to end of rear channel

$t_{ch} := 0.081 \cdot in$ nominal thickens of rear channel

$F_{tu} := 22 \cdot ksi$ tensile strength of rear channel

$R_n := \min\left(\frac{d_e \cdot t_{ch} \cdot F_{tu}}{\Omega}, \frac{2 \cdot D_6 \cdot t_{ch} \cdot F_{tu}}{\Omega}\right) = 225.72\,lbf$

$V_{stf} := \frac{\max(R_{7typ}, R_{7end})}{n} = 162\,lbf$ $\quad V_{7all} := 275 \cdot lbf$

$$FASTENERS6 := \begin{cases} \text{"OK"} & \text{if } V_{stf} < V_{7all} \wedge V_{stf} \le R_n \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{FASTENERS = \text{"OK"}}$

$\boxed{STIFFENER = \text{"OK"}}$

Front Fascia Typical Trellis	Detail Ref.	Sheet No: 8

Fascia Properties:

$b_f := 1.875\cdot in$ $\quad I_{xf} := 12.302\cdot in^4$ $\quad T_{wend} = 25.75\cdot in$

$d_f := 8\cdot in$ $\quad I_{yf} := 0.521\cdot in^4$ $\quad T_{wtyp} = 28\cdot in$

$t_f := 0.1\cdot in$ $\quad E = 10100000\ psi$

$$S_{xf} := \frac{I_{xf}}{4\cdot in} = 3.076\cdot in^3$$

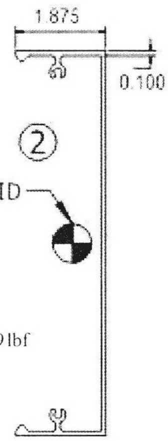
$$J_f := \frac{t_f^3}{3}\cdot d_f + \frac{t_f^3}{3}\cdot 2\cdot b_f = 0.004\cdot in^4$$

$$L_{bfdn} := \max\left(\frac{L_t}{N_s+1}\right) = 29.333\cdot in \qquad L_{bfup} := L_t = 88\cdot in$$

$R1 := T_{wtyp}\cdot DL_{max}\cdot a\cdot 0.5 = 162\,lbf$ $\quad R4 := T_{wend}\cdot DL_{max}\cdot a\cdot 0.5 = 149\,lbf$

$R2 := 0.5\cdot R1 = 81\,lbf$ $\quad R3 := 0.5R4 = 74\,lbf$

$R5 := 6\cdot in\cdot DL_{max}\cdot a\cdot 0.5 = 35\,lbf$



Use 8" x 1.875" x 0.1" wall Channel
as shown (6063-T52)

Use (2) #10 S.S. Fasteners per end attached to Trellis Frame
Min. Thread Eng. = 5/8"
(300 Series Stainless Steel, Condition CW)

Area: 1.337
Perimeter: 26.498
Bounding box: X: -1.170 -- 0.705
Y: -4.000 -- 4.000
Centroid: X: 0.255
Y: 0.000
Moments of inertia: X: 12.302
Y: 0.521
Product of inertia: XY: 0.000
Radii of gyration: X: 3.033
Y: 0.624

Principal moments and X-Y directions about centroid:
I: 0.434 along [0.000 1.000]
J: 12.302 along [-1.000 0.000]

Chk Fascia:

downward load:

$$M_{fintdn} := \begin{cases} (R1\cdot T_{wtyp}) & \text{if } N_s = 2 \\ \left[R1\cdot T_{wtyp} + \frac{(R1)\cdot(L_t)}{4}\right] & \text{if } N_s = 3 \\ R1\cdot T_{wtyp} + R1\cdot 2\cdot T_{wtyp} & \text{otherwise}\end{cases} = 4534\cdot lbf\cdot in$$

$$r_{yefdn} := \frac{1}{1.7}\cdot\sqrt{\frac{I_{yf}\cdot d_f}{S_{xf}}\left[-.5 + \sqrt{1.25 + .152\cdot\frac{J_f}{I_{yf}}\cdot\left(\frac{L_{bfdn}}{d_f}\right)^2}\right]} = 0.541\cdot in$$

$$S_{rfdn} := \frac{L_{bfdn}}{r_{yefdn}} = 54.188$$

$$F_{bfdn} := \begin{cases} (10.5 - .036S_{rfdn})\cdot 1000\cdot psi & \text{if } S_{rfdn} \le 119 \\ \left(\frac{86996}{S_{rfdn}^2}\cdot 1000\cdot psi\right) & \text{otherwise}\end{cases} = 8549\,psi$$

$$f_{bfdn} := \frac{(M_{fintdn})}{S_{xf}} = 1474\,psi$$

$$\Delta_{fint} := \begin{cases} \left[\frac{R1\cdot(T_{wtyp})}{24\cdot E\cdot I_{xf}}\cdot\left[3\cdot L_t^2 - 4\cdot(T_{wtyp})^2\right]\right] & \text{if } N_s = 2 \\ \left[\frac{R1\cdot(T_{wtyp})}{24\cdot E\cdot I_{xf}}\cdot\left[3\cdot L_t^2 - 4\cdot(T_{wtyp})^2\right] + \frac{(R1)\cdot(L_t)^3}{48\cdot E\cdot I_{xf}}\right] & \text{if } N_s = 3 \\ \frac{R1\cdot(T_{wtyp})}{24\cdot E\cdot I_{xf}}\cdot\left[3\cdot L_t^2 - 4\cdot(T_{wtyp})^2\right] + \frac{R1\cdot(2\cdot T_{wtyp})}{24\cdot E\cdot I_{xf}}\cdot\left[3\cdot L_t^2 - 4\cdot(2\cdot T_{wtyp})^2\right] & \text{otherwise}\end{cases}$$

upward load:

$$M_{fintup} := \frac{|UpLoad|}{DnLoad}\cdot M_{fintdn} = 2396\cdot lbf\cdot in$$

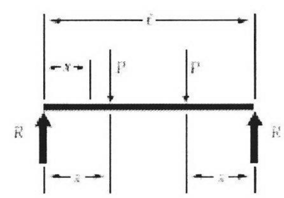
$$r_{yefup} := \frac{1}{1.7}\cdot\sqrt{\frac{I_{yf}\cdot d_f}{S_{xf}}\left[-.5 + \sqrt{1.25 + .152\cdot\frac{J_f}{I_{yf}}\cdot\left(\frac{L_{bfup}}{d_f}\right)^2}\right]} = 0.564\cdot in$$

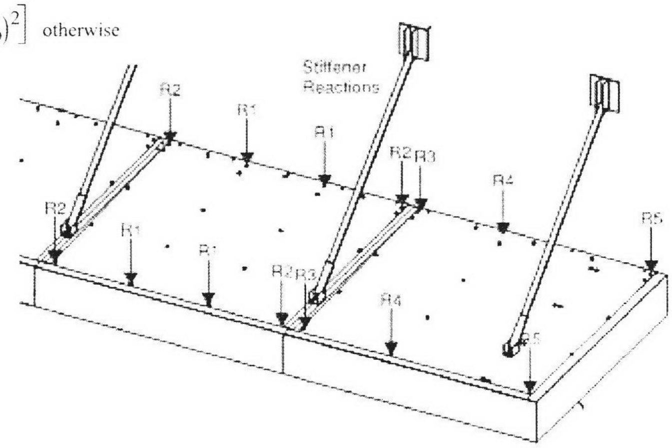
$$S_{rfup} := \frac{L_{bfup}}{r_{yefup}} = 156.039$$

$$F_{bfup} := \begin{cases} (10.5 - .036S_{rfup})\cdot 1000\cdot psi & \text{if } S_{rfup} \le 119 \\ \left(\frac{86996}{S_{rfup}^2}\cdot 1000\cdot psi\right) & \text{otherwise}\end{cases} = 3573\,psi$$

$= 779\,psi$

$= 0.031\cdot in$





$$\Delta_{fall} := \frac{L_t}{120} = 0.733\cdot in$$

$$R_{fas} := \begin{cases} (R1 + R2) & \text{if } N_s = 2 \\ (R1 + R2 + 0.5R1) & \text{if } N_s = 3 \\ 2\cdot R1 + R2 & \text{otherwise}\end{cases} = 243\,lbf$$

Front Fascia - End Trellis	Detail Ref.	Sheet No: 8A

downward load:

$M_{fend1} := (R5 \cdot 12 \cdot in) = 416 \cdot lbf \cdot in$

$M_{fend2} := \dfrac{R5 \cdot 12 \cdot in \cdot T_{wend}}{2 \cdot T_{wend}} = 208.207 \cdot lbf \cdot in$

$M_{tot} := \max(M_{btw}, M_{fend1}) = 1917 \cdot lbf \cdot in$

$f_{bfedn} := \dfrac{M_{tot}}{S_{xf}} = 623\,psi$

$$M_{btw} := \begin{cases} \left(\dfrac{R4 \cdot T_{wend} \cdot T_{wend}}{2 \cdot T_{wend}}\right) & \text{if } N_{es} = 1 \\ \dfrac{2 \cdot R4 \cdot T_{wend} \cdot T_{wend}}{2 \cdot T_{wend}} & \text{otherwise} \end{cases} = 1917 \cdot lbf \cdot in$$

upward load:

$M_{totup} := \dfrac{|UpLoad|}{DnLoad} \cdot M_{tot} = 1013 \cdot lbf \cdot in$

$f_{bfeup} := \dfrac{M_{totup}}{S_{xf}} = 329\,psi$

$$R_{1end} := \begin{cases} \left(\dfrac{R5 \cdot 12 \cdot in}{2 \cdot T_{wend}}\right) & \text{if } N_{es} = 1 \\ \dfrac{R5 \cdot 12 \cdot in}{3 \cdot T_{wend}} & \text{otherwise} \end{cases} = 8\,lbf$$

$$R_{1btwn} := \begin{cases} \left(\dfrac{R4 \cdot T_{wend}}{2 \cdot T_{wend}}\right) & \text{if } N_{es} = 1 \\ \dfrac{2 \cdot R4 \cdot T_{wend} \cdot 1.5}{3 \cdot T_{wend}} & \text{otherwise} \end{cases} = 74\,lbf$$

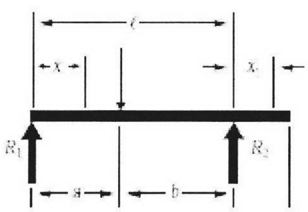
$$\Delta_{fend} := \frac{R4 \cdot 12 \cdot in \cdot T_{wend}}{6 \cdot E \cdot I_{xf} \cdot 2 \cdot T_{wend}} \cdot \left[(2 \cdot T_{wend})^2 - (T_{wend})^2\right] = 0.002 \cdot in$$

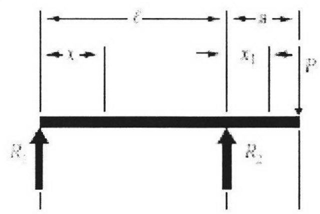
$$\Delta_{btwn} := \begin{cases} \left[\dfrac{R4 \cdot T_{wend} \cdot T_{wend} \cdot (T_{wend} + 2 \cdot T_{wend}) \cdot \sqrt{3 \cdot T_{wend} \cdot (T_{wend} + 2 \cdot T_{wend})}}{27 \cdot E \cdot I_{xf} \cdot (2 \cdot T_{wend})}\right] & \text{if } N_{es} = 1 \\ \dfrac{2 \cdot R4 \cdot (1.5 \cdot T_{wend} \cdot 1.5 \cdot T_{wend}) \cdot (1.5 T_{wend} + 2 \cdot 1.5 T_{wend}) \cdot \sqrt{3 \cdot 1.5 T_{wend} \cdot (1.5 T_{wend} + 2 \cdot 1.5 T_{wend})}}{27 \cdot E \cdot I_{xf} \cdot (2 \cdot 1.5 T_{wend})} & \text{otherwise} \end{cases} = 0.0034 \cdot in$$

$\Delta_{ftot} := \Delta_{btwn} - \Delta_{fend} = 0.001 \cdot in$

$\Delta_{falle} := \dfrac{2 \cdot T_{wend}}{120} = 0.429 \cdot in$

$R_{1tot} := R_{1end} + R_{1btwn} + R3 = 157\,lbf$





Chk Fascia Connection to Outriggers:

bearing:

$n_7 := 2$ fastener quantity

$t_{ch7} := 0.1 \cdot in$ nominal thickens of front channel

$F_{tuf7} := 22 \cdot ksi$ tensile strength of front channel

$d_{ef7} := 0.75 \cdot in$ distance from center of hole to end of front channel

$D_6 := 0.19 \cdot in$ screw diameer

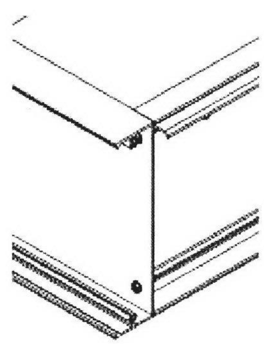
$$R_{n7} := \min\left(\frac{d_{ef7} \cdot t_{ch7} \cdot F_{tuf7}}{\Omega}, \frac{2 \cdot D_6 \cdot t_{ch7} \cdot F_{tuf7}}{\Omega}\right) = 279\,lbf$$

$$V_7 := \begin{cases} \left(\dfrac{R1 + R2}{n_7}\right) & \text{if } N_s = 2 \\ \dfrac{R1 + 0.5 \cdot R1 + R2}{n_7} & \text{otherwise} \end{cases} = 121\,lbf$$

$L_o := 36 \cdot in$

$a_o := 12 \cdot in$

$$T_7 := \begin{cases} \left[\dfrac{R1}{L_o \cdot \tan(\theta_s) \cdot n_7} \cdot (L_o + a_o)\right] & \text{if } N_{es} = 1 \\ \dfrac{1.5 \cdot R1}{L_o \cdot \tan(\theta_s) \cdot n_7} \cdot (L_o + a_o) & \text{otherwise} \end{cases} = 111\,lbf$$



$T_{7all} := 477 \cdot lbf \qquad V_{7all} := 275 \cdot lbf$

$$I_7 := \left(\frac{\max(V_7, R_{1tot})}{V_{7all}}\right)^2 + \left(\frac{T_7}{T_{7all}}\right)^2 = 0.381$$

$$FASTENERS7 := \begin{cases} \text{"OK"} & \text{if } I_7 < 1 \wedge V_7 \le R_{n7} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$$FASCIA := \begin{cases} \text{"OK"} & \text{if } \dfrac{\max(f_{bfdn}, f_{bfedn})}{F_{bfdn}} < 1.0 \wedge \dfrac{\max(f_{bfup}, f_{bfeup})}{F_{bfup}} < 1.0 \wedge \Delta_{fint} < \Delta_{fall} \wedge \Delta_{ftot} \le \Delta_{falle} \\ \text{"FAILS"} & \text{otherwise} \end{cases}$$

$\boxed{FASCIA = \text{"OK"}}$

$\boxed{FASTENERS7 = \text{"OK"}}$

Outrigger	Detail Ref.	Sheet No: 9

Outrigger Properties:

$b_o := 1.693 \cdot in$ $\quad I_{xo} := 11.154 \cdot in^4$

$d_o := 8 \cdot in$

$t_o := 0.125 \cdot in$ $\quad I_{yo} := 0.180 \cdot in^4$

$A_o := 1.438 \cdot in^2$

$$S_{xo} := \frac{I_{xo}}{4.251 \cdot in} = 2.624 \cdot in^3$$

$$S_{yo} := \frac{I_{yo}}{1.457 \cdot in} = 0.124 \cdot in^3$$

$$J_o := \frac{t_o^3}{3} \cdot d_o + \frac{t_o^3}{3} \cdot 2 \cdot b_o = 0.007 \cdot in^4$$

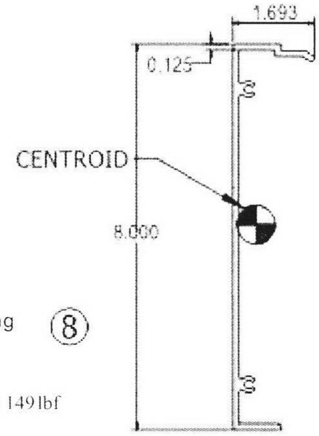
$L_{bo} := 0 \cdot in$ Continuously braced by stiffener tube in bending

$L_{boa} := 48 \cdot in$ No bracing for axial buckling

$R1 := T_{wtyp} \cdot DL_{max} \cdot a \cdot 0.5 = 162\, lbf$ $\quad R4 := T_{wend} \cdot DL_{max} \cdot a \cdot 0.5 = 149\, lbf$

$R2 := 0.5 \cdot R1 = 81\, lbf$ $\quad R3 := 0.5 R4 = 74\, lbf$

$R5 := 6 \cdot in \cdot DL_{max} \cdot a \cdot 0.5 = 35\, lbf$



8

Use 8" x 1/8" thk Channel
as shown (6005A-T61 or 6005-T5)

Area: 1.438
Perimeter: 23.485
Bounding box: X: -0.237 -- 1.457
Y: -4.251 -- 3.749
Centroid: X: 0.000
Y: 0.000
Moments of inertia: X: 11.154
Y: 0.180
Product of inertia: XY: 0.379
Radii of gyration: X: 2.785
Y: 0.354
Principal moments and X-Y directions about centroid:
I: 0.167 along [0.034 0.999]
J: 11.167 along [-0.999 0.034]

Chk Outrigger:

$$R_s := \begin{cases} (R3 + 0.5 \cdot R4) & \text{if } N_{es} = 1 \\ R3 + R4 & \text{otherwise} \end{cases} = 149\, lbf$$

$$R_{yf} := \max\left[\left(R_{fas}\right), \left(R_s\right)\right] = 243\, lbf$$

downward:

$$M_{o1} := \left(R_{yf} \cdot a_o\right) = 2915 \cdot in \cdot lbf$$

$$f_{bo} := \frac{M_{o1}}{S_{xo}} = 1111\, psi$$

$$r_{yo} := \frac{1}{1.7} \cdot \sqrt{\frac{I_{yo} \cdot d_o}{S_{xo}} \left[-.5 + \sqrt{1.25 + .152 \cdot \frac{J_o}{I_{yo}} \cdot \left(\frac{L_{bo}}{d_o}\right)^2}\right]} = 0.343 \cdot in$$

$$S_{ro} := \frac{L_{bo}}{r_{yo}} = 0$$

$$F_{bo} := \begin{cases} (23.9 - 0.124 S_{ro}) \cdot 1000 \cdot psi & \text{if } S_{ro} \le 79 \\ \left(\frac{86996}{S_{ro}^2} \cdot 1000 \cdot psi\right) & \text{otherwise} \end{cases} = 23900\, psi$$

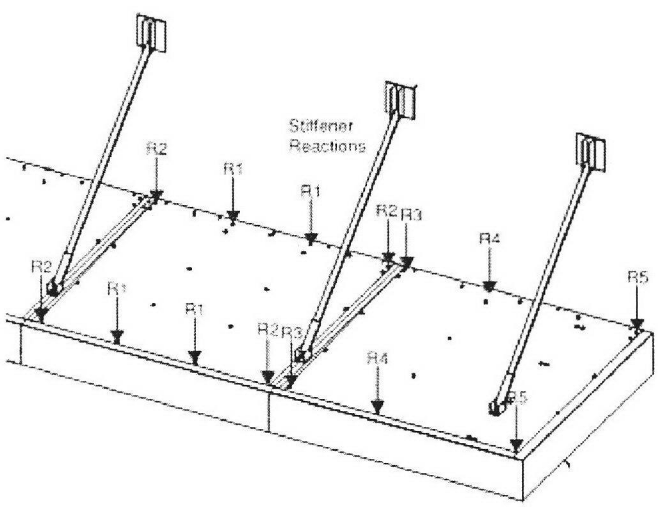
upward:

$$f_{boup} := \frac{|UpLoad|}{DnLoad} \cdot f_{bo} = 587\, psi$$

$$r_{youp} := \frac{1}{1.7} \cdot \sqrt{\frac{I_{yo} \cdot d_o}{S_{xo}} \left[-.5 + \sqrt{1.25 + .152 \cdot \frac{J_o}{I_{yo}} \cdot \left(\frac{L_{boa}}{d_o}\right)^2}\right]} = 0.368 \cdot in$$

$$S_{roup} := \frac{L_{boa}}{r_{youp}} = 130.297$$

$$F_{boa} := \begin{cases} (23.9 - 0.124 S_{ro}) \cdot 1000 \cdot psi & \text{if } S_{roup} \le 79 \\ \left(\frac{86996}{S_{roup}^2} \cdot 1000 \cdot psi\right) & \text{otherwise} \end{cases} = 5124.23\, psi$$



Downward Outrigger Reactions:

$$R_{o1d} := \frac{R_{yf} \cdot a_o}{L_o} = 81\,lbf$$

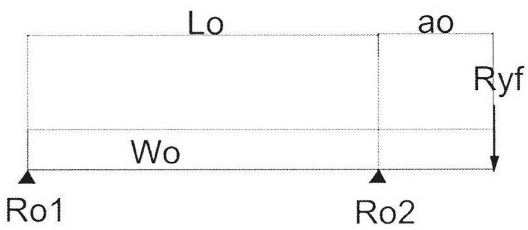
$$R_{o2d} := \frac{R_{yf}}{L_o} \cdot (L_o + a_o) = 324\,lbf$$

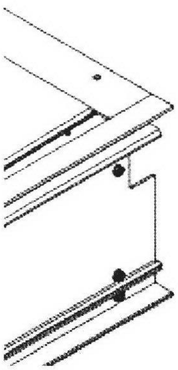
Upward Outrigger Reactions:

$$R_{o1u} := -R_{o1d} \cdot \frac{UpLoad}{DnLoad} = 43\,lbf$$

$$R_{o2u} := -R_{o2d} \cdot \frac{UpLoad}{DnLoad} = 171\,lbf$$

$a_o = 12 \cdot in$ $\quad L_o = 36 \cdot in$





Axial Load:

$$P_o := R_{o2d} \div \tan(\theta_s) = 334\,lbf$$

$$f_{ao} := \frac{P_o}{A_o} = 232\,psi$$

$$S_{ax} := \frac{1.0 \cdot L_{boa}}{r_{yo}} = 140$$

$$F_{ao} := \frac{51352 \cdot 1000 \cdot psi}{S_{ax}^2} = 2616\,psi$$

Use (4) #10 S.S. Fasteners per end attached to Trellis Frame
Min Thread Eng. = 5/8"
(300 Series Stainless Steel, Condition CW)

Deflection:

$$\Delta_o := \frac{R_{yf} \cdot a_o^2}{3 \cdot E \cdot I_{xo}} \cdot (L_o + a_o) = 0.005 \cdot in \qquad \Delta_{oall} := \frac{2 \cdot a_o}{120} = 0.2 \cdot in$$

$$\Delta_{btw} := 0.06415 \cdot \left(\frac{R_{yf} \cdot a_o \cdot L_o^2}{E \cdot I_{xo}}\right) = 0.002 \cdot in \qquad \Delta_{bwall} := \frac{L_o}{120} = 0.3 \cdot in$$

Chk Outrigger Connection to Rear Fascia:

bearing:

$n_9 := 4$ fastener quantity $\qquad d_{ef9} := 0.75 \cdot in$

$t_{ch9} := 0.125 \cdot in$ nominal thickens of front channel $\qquad D_9 := 0.19 \cdot in$

$F_{tuf9} := 38 \cdot ksi$ tensile strength of front channel

$$R_{n9} := \min\left(\frac{d_{ef9} \cdot t_{ch9} \cdot F_{tuf9}}{\Omega}, \frac{2 \cdot D_9 \cdot t_{ch9} \cdot F_{tuf9}}{\Omega}\right) = 602\,lbf$$

$$V_9 := \sqrt{\left(\frac{R_{o1d}}{n_9}\right)^2 + \left[\frac{R_{o2d}}{L_o \cdot \tan(\theta_s) \cdot n_9} \cdot (L_o + a_o)\right]^2} = 113\,lbf$$

$T_{9all} := 477 \cdot lbf \qquad V_{9all} := 275 \cdot lbf$

$$I_9 := \left(\frac{V_9}{V_{9all}}\right) = 0.412$$

$$FASTENERS9 := \begin{cases} \text{"OK"} & \text{if } I_9 < 1 \wedge V_9 \le R_{n9} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$$OUTRIGGER := \begin{cases} \text{"OK"} & \text{if } \max\left(\frac{f_{bo}}{F_{bo}}, \frac{f_{boup}}{F_{boa}}\right) + \frac{f_{ao}}{F_{ao}} \le 1 \wedge \left(\frac{\Delta_o}{\Delta_{oall}}\right) < 1.0 \wedge \frac{\Delta_{btw}}{\Delta_{bwall}} \le 1.0 \\ \text{"FAILS"} & \text{otherwise} \end{cases}$$

$\boxed{FASTENERS9 = \text{"OK"}}$

$\boxed{OUTRIGGER = \text{"OK"}}$

End Outrigger	Detail Ref.	Sheet No: 10

End Outrigger Properties:

$I_{xeo} := 0.049in^4 \cdot 2 = 0.098 \cdot in^4$

$I_{yeo} := 0.049 \cdot in^4 \cdot 2 = 0.098 \cdot in^4$

$S_{xeo} := 0.098 \cdot in^3 \cdot 2 = 0.196 \cdot in^3$

$A_{eo} := 0.36 \cdot in^2 \cdot 2 = 0.72 \cdot in^2$

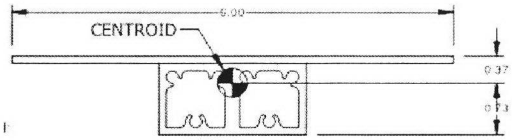
$J_{eo} := 0.073 \cdot in^4 \cdot 2 = 0.146 \cdot in^4$

$L_{beo} := 14.67 \cdot in$

$L_{eo} := 36 \cdot in$

$a_{eo} := 12 \cdot in$

$w_{eo} := DL_{max} \cdot \left[\left(T_{wend} \cdot 0.5\right) + 6 \cdot in\right] = 4.962 \cdot \frac{lbf}{in}$



Tube Section Properties

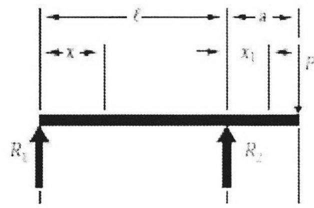
Input B:	1 in
Input D:	1 in
Input t:	0.1 in
A=	0.360 in^2
A_m=	0.810 in^2
P_m=	3.600 in
J=	0.073 in^4
Ix=	0.049 in^4
Iy=	0.049 in^4
Sx=	0.098 in^3
Sy=	0.098 in^3
Zx=	0.122 in^3
Zy =	0.122 in^3
r =	0.370 in

Use (2) 1" x 1" x 0.100" wall Tubes
as shown (6005A-T61 or 6005-T5)

Use (3) #10 S.S. Fasteners @ Front Fascia & (1) #10 S.S. Fastener @ Rear Fascia to attached to Trellis Frame
Min. Thread Eng. = 5/8"
(300 Series Stainless Steel, Condition CW)

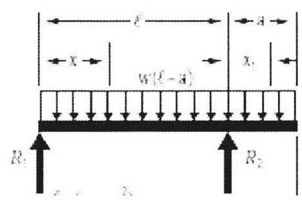
Chk Outrigger:

$$R_{yf10} := \begin{cases} \left[\left(T_{wend} + 12 \cdot in\right) \cdot DL_{max} \cdot a \cdot 0.5\right] & \text{if } N_{es} = 1 \\ \left(1.5 \cdot T_{wend} + 12 \cdot in\right) \cdot DL_{max} \cdot a \cdot 0.5 & \text{otherwise} \end{cases} = 218\,lbf$$



$$M_{eo1} := \left(R_{yf10} \cdot a_{eo}\right) + \frac{w_{eo} \cdot a_{eo}^2}{2} = 2977 \cdot lbf \cdot in$$

$$f_{beo} := \frac{M_{eo1}}{S_{xeo}} = 15190\,psi$$



$$S_{reo} := \frac{2 \cdot L_{beo} \cdot S_{xeo}}{\sqrt{I_{yeo} \cdot J_{eo}}} = 48.076$$

$$F_{beo} := \begin{cases} (21200 \cdot psi) & \text{if } S_{reo} < 123 \\ \left[\left(23.9 - 0.238\sqrt{S_{reo}}\right) \cdot 1000 \cdot psi\right] & \text{if } 123 \le S_{reo} \le 1685 \\ \left(\frac{23599}{S_{reo}} \cdot 1000 \cdot psi\right) & \text{otherwise} \end{cases} = 21200\,psi$$

$$\Delta_{hangpt} := \frac{R_{yf10} \cdot a_{eo}}{6 \cdot E \cdot I_{xeo}} \cdot \left(2 \cdot a_{eo} \cdot L_{eo} + 3 \cdot a_{eo} \cdot a_{eo} - a_{eo}^2\right) = 0.508 \cdot in$$

$$\Delta_{hang} := \frac{w_{eo} \cdot a_{eo}}{24 \cdot E \cdot I_{xeo}} \cdot \left[\left(4 \cdot a_{eo}\right)^2 \cdot L_{eo} - \left(L_{eo}\right)^3 + 6 \cdot \left(a_{eo}\right)^2 \cdot a_{eo} - 4 \cdot a_{eo} \cdot \left(a_{eo}\right)^2 + \left(a_{eo}\right)^3\right] = 0.104 \cdot in$$

$$\Delta_{tot10} := \Delta_{hangpt} - \Delta_{hang} = 0.404 \cdot in$$

$$\Delta_{all9h} := \frac{2 \cdot a_{eo}}{120} = 0.2 \cdot in$$

Downward Outrigger Reactions:

$$R_{eo1d} := \frac{w_{eo}}{2L_{eo}} \cdot \left(L_{eo}^2 - a_{eo}^2\right) + \frac{R_{yf10} \cdot a_{eo}}{L_{eo}} = 152\,lbf$$

$$R_{eo2d} := \frac{w_{eo}}{2L_{eo}} \cdot \left(L_{eo} + a_{eo}\right)^2 + \frac{R_{yf10}}{L_{eo}} \cdot \left(L_{eo} + a_{eo}\right) = 450\,lbf$$

Upward Outrigger Reactions:

$$R_{eo1u} := -R_{eo1d} \cdot \frac{UpLoad}{DnLoad} = 80.394\,lbf$$

$$R_{eo2u} := -R_{eo2d} \cdot \frac{UpLoad}{DnLoad} = 237.685\,lbf$$

Axial Load:

$$P_{eo} := R_{eo2d} \div \tan\left(\theta_s\right) = 464\,lbf$$

$$f_{ao1} := \frac{P_{eo}}{A_{eo}} = 645\,psi$$

$$S_{aeox} := \frac{2 \cdot L_{beo} \cdot S_{xeo}}{\sqrt{I_{yeo} \cdot J_{eo}}} = 48.076$$

$$F_{ao1} := \left(23.9 - 0.238 \cdot \sqrt{S_{aeox}}\right) \cdot 1000 \cdot psi = 22250\,psi$$

Fasteners:

$n_{10} := 2$ fastener quantity

$$V_{10} := \left(\max\left(R_{yf10}, R_{eo1d}\right)\right) \div n_{10} = 109\,lbf$$

$$ENDOUTRIGGER := \begin{cases} \text{"OK"} & \text{if } \frac{f_{beo}}{F_{beo}} + \frac{f_{ao1}}{F_{ao1}} \le 1.0 \wedge \frac{\Delta_{hang}}{\Delta_{all9h}} \le 1.0 \wedge V_{10} \le \min\left(R_n, V_{7all}\right) \\ \text{"FAILS"} & \text{otherwise} \end{cases}$$

$\boxed{ENDOUTRIGGER = \text{"OK"}}$

Tie-back Shroud	Detail Ref.	Sheet No: 11

Shroud Properties:

$A_{shd} := 0.306 \cdot in^2$ $\quad \Omega_r := 1.95$ $\quad D_{hole} := 0.397 \cdot in$

$I_{shd} := 0.043 \cdot in^4$ $\quad \Omega_y := 1.50$ $\quad Max_{tol} := 0.015 \cdot in$

$t := 0.085 \cdot in$ $\quad ED := 0.75 \cdot in$

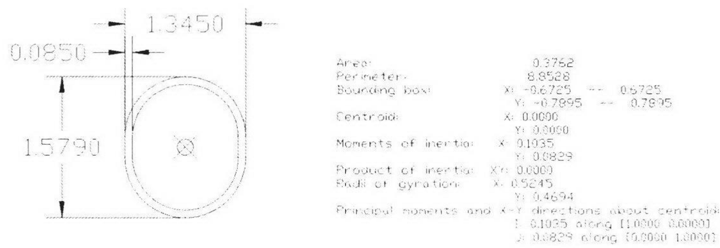
$S_{shd} := 0.080 \cdot in^3$ $\quad k_t := 1.0$ $\quad D := 0.375 \cdot in$

$F_{tu} := 38 \cdot ksi$ $\quad F_{ty} := 35 \cdot ksi$

$r_{yshd} := \sqrt{\dfrac{I_{shd}}{A_{shd}}} = 0.031\ ft$ $\quad F_{su} := 0.6 \cdot F_{tu} = 22.8 \cdot ksi$ $\quad F_{sy} := 0.6 \cdot F_{ty} = 21 \cdot ksi$

$L_{nv} := ED - 0.5 \cdot (D_{hole} + Max_{tol}) = 0.544 \cdot in$

Use Alum. Shroud
3/4" Min. from center of fastener to end of shroud as shown (6061-T6)



Shroud Forces:

$$T_{shd} := \frac{\max(2R_{o2d}, R_{eo2d})}{\sin(\theta_s)} = 931\ lbf$$

$$C_{shd} := \frac{\max(2R_{o2u}, R_{eo2u})}{\sin(\theta_s)} = 492\ lbf$$

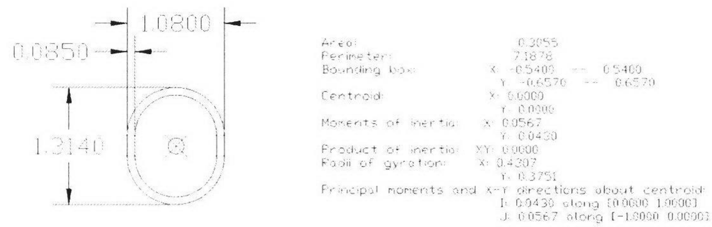
Chk Shroud in Compression:

$k_{shd} := 1$ *per ADM 2010 Section C.3*

$$S_{cshd} := \frac{k_{shd} \cdot L_{bshd}}{r_{yshd}} = 117.909$$

$$f_{cshd} := \frac{C_{shd}}{A_{shd}} = 1607\ psi$$

$$F_{cshd} := \begin{cases} \left[(20.3 - 0.127 \cdot S_{cshd}) \cdot 1000 \cdot psi\right] & \text{if } S_{cshd} < 66 \\ \left(\dfrac{51352}{S_{cshd}^2}\right) \cdot 1000 \cdot psi & \text{otherwise} \end{cases} = 3694 \cdot psi$$



$A_{nv} := L_{nv} \cdot t = 0.046 \cdot in^2$

$A_{gv} := ED \cdot t = 0.064 \cdot in^2$

$b_e := 0.9003 \cdot in$

$d_e := ED = 0.75 \cdot in$

$R := ED = 0.75 \cdot in$

Chk Shroud in Tension:

$$f_{tshd} := \frac{T_{shd}}{A_{shd}} = 3042\ psi$$

$$C_r := 1 - 0.275 \cdot \sqrt{1 - \frac{D^2}{D_{hole}^2}} = 0.91$$

$F_{tshd} := 21200 \cdot psi$

C_r greater than 0.90 therefore $C_r := 1.0$

Shear Rupture : Section J.7.2 (Alum. Design Manual 2015)

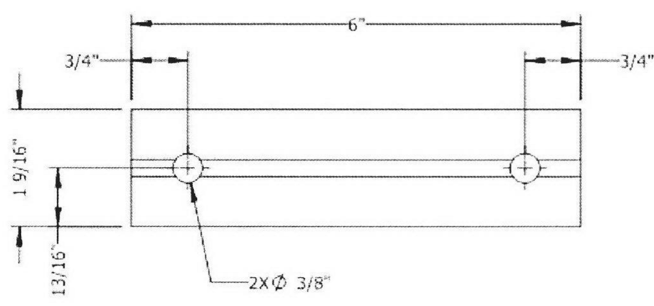
$$R_{nr} := F_{su} \cdot \frac{4 \cdot A_{nv}}{k_t \cdot \Omega_r} = 2163 \cdot lbf$$

Shear Yeilding: Section J.7.2 (Alum. Design Manual 2015)

$$R_{ny} := \frac{F_{sy} \cdot 4 \cdot A_{gv}}{\Omega_y} = 3570 \cdot lbf$$

Bolt Bearing: Section J.3.6 (Alum. Design Manual 2015)

$$R_{nb} := 2 \cdot \frac{d_e \cdot t \cdot F_{tu}}{\Omega_r} = 2485\ lbf \quad \text{not more than} \quad 2 \cdot \frac{2 \cdot D \cdot t \cdot F_{tu}}{\Omega_r} = 2485\ lbf$$



LOWER TIE BACK ROD
SEE SHEET D-5 FOR ADDITIONAL SPECIFICATIONS

Single Plane Fracture Beyond Pinhole: ASME BTH-1-2014

(Design of Below-the-Hook Lifting Devices)

$$P_b := C_r \cdot \frac{F_{tu}}{\Omega_r} \left[1.13 \cdot \left(R - \frac{D_{hole}}{2} \right) + \frac{0.92 \cdot b_e}{1 + \dfrac{b_e}{D_{hole}}} \right] \cdot t \cdot 2 = 2904\ lbf \quad \text{Eqn. 3-49}$$

$$SHROUD := \begin{cases} \text{"OK"} & \text{if } \dfrac{f_{cshd}}{F_{cshd}} \le 1.0 \wedge \dfrac{f_{tshd}}{F_{tshd}} \le 1.0 \wedge T_{shd} \le R_{nr} \wedge T_{shd} \le R_{ny} \wedge T_{shd} \le R_{nb} \wedge T_{shd} \le P_b \\ \text{"FAILS"} & \text{otherwise} \end{cases}$$

$\boxed{SHROUD = \text{"OK"}}$

Shroud Clip Properties:

$t_c := 0.160 \cdot in$ $\quad L_c := 3.75 \cdot in$

$e_1 := 0.469 \cdot in$

$e_2 := 0.845 \cdot in$

Use 3/8" Dia. S.S. Thru Bolt to Shroud
(300 Series Stainless Steel, Condition CW)

Use 0.16" thick Bent Channel
as shown (5052-H32)

Chk Thru Bolt Connection:

$d_b := 0.375 \cdot in$

$N_b := 16$ threads per inch

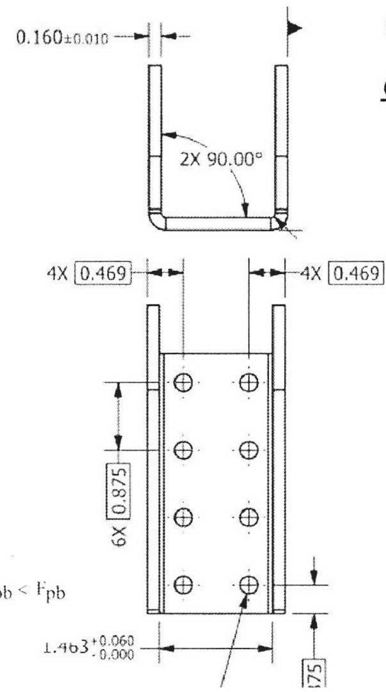
$V_{12} := 2R_{o2max} = 647.754\,lbf$

$V_{all12} := 3228 \cdot lbf$

$$f_{pb} := 2\frac{R_{o2max}}{2 \cdot t_c \cdot d_b} = 5397.949\,psi$$

$F_{pb} := 31800 \cdot psi$

$$THRUBOLTS := \begin{cases} \text{"OK"} & \text{if } V_{12} < V_{all12} \wedge f_{pb} < F_{pb} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$



$R_{o2max} := \max(R_{o2u}, R_{o2d}, 0.5 \cdot R_{eo2u}, 0.5 \cdot R_{eo2d}) = 323.877\,lbf$

Chk Clips to Outriggers:

$M_c := R_{o2max} \cdot e_1 = 152 \cdot lbf \cdot in$

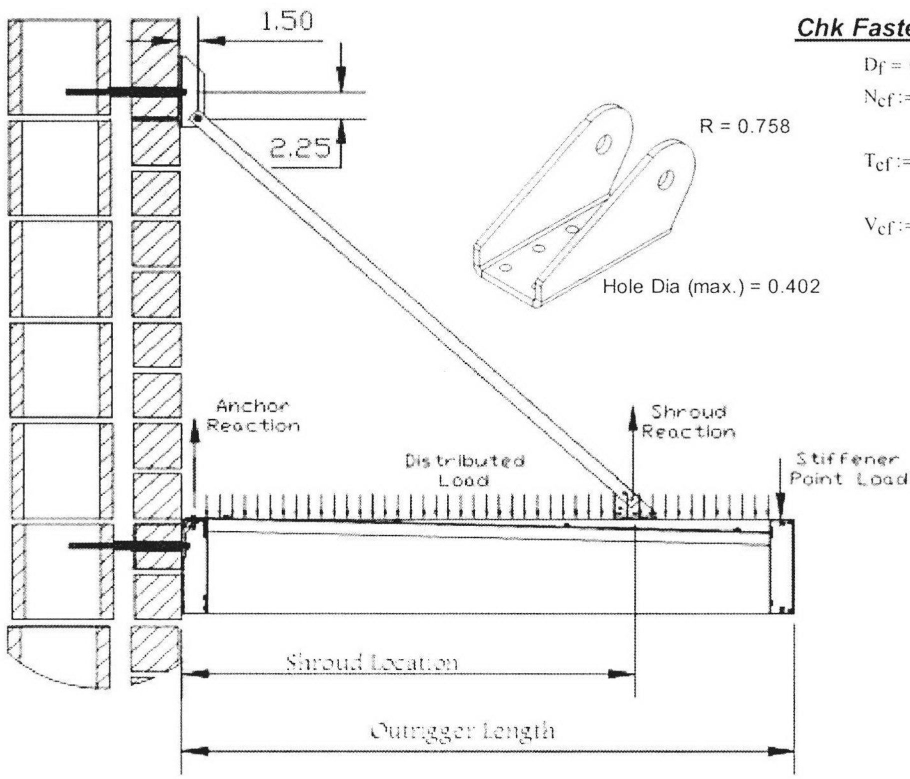
$$S_{cl} := \frac{L_c \cdot t_c^2}{6} = 0.016 \cdot in^3$$

$$f_{bc} := \frac{M_c}{S_{cl}} = 9493.643\,psi$$

$F_{bc} := 16500 \cdot psi$

$$CLIPS := \begin{cases} \text{"OK"} & \text{if } f_{bc} \le F_{bc} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Use (8) #12 S.S. Fasteners attached to Outrigger
Full Thread Eng. into Outrigger
(300 Series Stainless Steel, Condition CW)



Free Body Diagram of Loads on Outrigger & Shroud

Chk Fasteners to Outriggers:

$D_f = 0.216 \cdot in$ $\quad t_{out} := 0.125 \cdot in$

$N_{cf} := 8$ $\quad F_{tyout} := 35 \cdot ksi$

$$T_{cf} := \frac{2 \cdot R_{o2max}}{0.5N_{cf}} + \frac{P_o \cdot 2 \cdot 1.375 \cdot in}{2.5625 \cdot in \cdot (0.5N_{cf})} = 252\,lbf$$

$$V_{cf} := \frac{P_o \cdot 2}{N_{cf}} = 84\,lbf \qquad V_{cfall} := 373 \cdot lbf$$

$$t_D := \min\left(\frac{t_{out}}{D_f}, 1.1\right) = 0.579$$

$$T_{cfpov} := \left[\frac{(0.27 + 1.45 \cdot t_D) \cdot D_f \cdot t_{out} \cdot F_{tyout}}{3}\right] = 349\,lbf$$

$T_{cfall} := 380 \cdot lbf$ AAMA TIR Table 22.12

$$I_{cf} := \left(\frac{V_{cf}}{V_{cfall}}\right)^2 + \left(\frac{T_{cf}}{T_{cfall}}\right)^2 = 0.489$$

$$FAST := \begin{cases} \text{"OK"} & \text{if } T_{cf} \le T_{cfpov} \wedge I_{cf} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{FAST = \text{"OK"}}$

$\boxed{CLIPS = \text{"OK"}}$

$\boxed{THRUBOLTS = \text{"OK"}}$

$\Omega_r := 1.95$

$\Omega_y := 1.50$

$t_c := 0.16 \cdot in$

$k_t := 1.0$

$F_{tuc} := 22 \cdot ksi$

$F_{suc} := 0.6 \cdot F_{tuc} = 13.2 \cdot ksi$

$OR := 0.758 \cdot in$

$D_{hole} := 0.397 \cdot in$

$Max_{tolc} := 0.005 \cdot in$

$ED_c := OR = 0.063\ ft$

$D := 0.375 \cdot in$

$F_{tyc} := 16 \cdot ksi$

$F_{syc} := 0.6 \cdot F_{tyc} = 9.6 \cdot ksi$

$L_{nvc} := ED_c - 0.5 \cdot \left(D_{hole} + Max_{tolc}\right) = 0.557 \cdot in$

$A_{nvc} := L_{nvc} \cdot t_c = 0.089 \cdot in^2$

$A_{gvc} := ED_c \cdot t_c = 0.121 \cdot in^2$

$R_c := ED_c = 0.758 \cdot in$

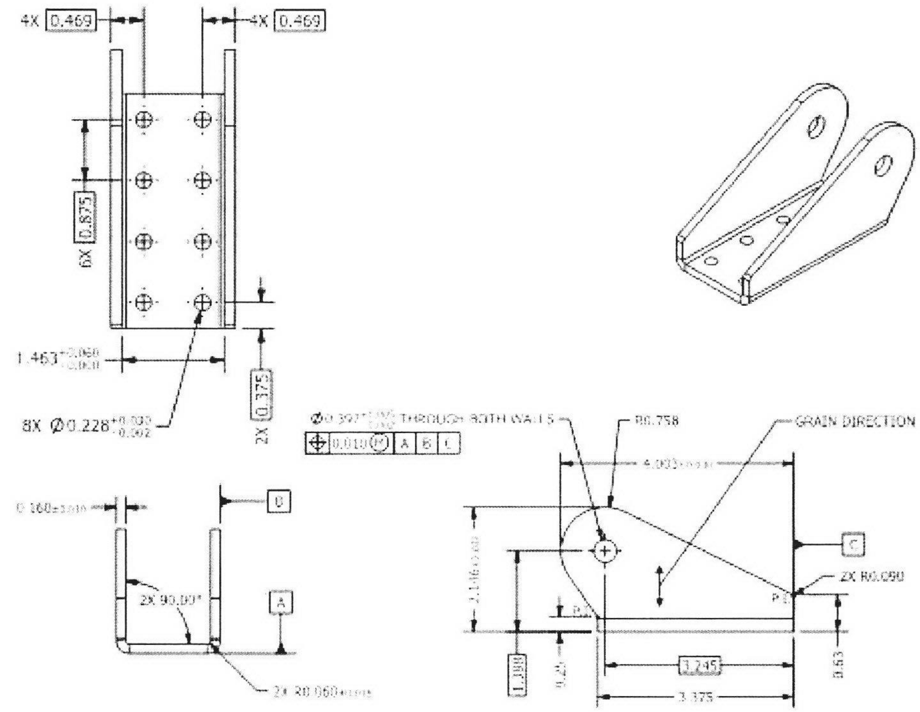
$b_{ec} := L_{nvc} = 0.557 \cdot in$

$d_{ec} := ED_c = 0.758 \cdot in$

$Rc := ED_c = 0.758 \cdot in$

$$C_r := 1 - 0.275 \cdot \sqrt{1 - \frac{D^2}{D_{hole}^{\ 2}}} = 0.91$$

Cr greater than 0.90 therefore $C_r := 1.0$



Shear Rupture (CONTROLS): Section J.7.2 (Alum. Design Manual 2015)

$$R_{nc} := F_{suc} \cdot \frac{4 \cdot A_{nvc}}{k_t \cdot \Omega_r} = 2413 \cdot lbf$$

Shear Yeilding: Section J.7.2 (Alum. Design Manual 2015)

$$R_{nyc} := \frac{F_{syc} \cdot 4 \cdot A_{gvc}}{\Omega_y} = 3105 \cdot lbf$$

Bolt Bearing: Section J.3.6 (Alum. Design Manual 2015)

$$R_{nbc} := 2 \cdot \frac{d_{ec} \cdot t_c \cdot F_{tuc}}{\Omega_r} = 2737\,lbf$$ not more than $$R_{nbcmax} := 2 \cdot \frac{2 \cdot D \cdot t_c \cdot F_{tuc}}{\Omega_r} = 2708\,lbf$$

Single Plane Fracture Beyond Pinhole: Eqn. 3-49: ASME BTH-1-2014 (Design of Below-the-Hook Lifting Devices)

$$P_{bc} := C_r \cdot \frac{F_{tuc}}{\Omega_r} \cdot \left[1.13 \cdot \left(R_c - \frac{D_{hole}}{2}\right) + \frac{0.92 \cdot b_{ec}}{1 + \frac{b_{ec}}{D_{hole}}}\right] \cdot t_c \cdot 2 = 3052\,lbf$$

Check Block Material Shear:

$$f_{vtb} := \frac{T_{shd}}{2 \cdot 0.16 \cdot in \cdot (0.758 \cdot in - 0.5 \cdot 0.402 \cdot in)} = 5222\,psi$$

$F_{vtb} := 8000 \cdot psi$

$$CLIPS2 := \begin{cases} \text{"OK"} & \text{if } f_{vtb} \le F_{vtb} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$$CLIPS3 := \begin{cases} \text{"OK"} & \text{if } T_{shd} \le R_{nc} \wedge T_{shd} \le R_{nyc} \wedge T_{shd} \le R_{nbc} \wedge T_{shd} \le P_{bc} \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{CLIPS2 = \text{"OK"}}$

$\boxed{CLIPS3 = \text{"OK"}}$

Top Shroud Anchor	Detail Ref.	Sheet No: 13

Shroud Bracket Properties:

$t_{bkt} := 0.25 \cdot in$

$L_{bkt} := 6 \cdot in$

$e_3 := 1.3 \cdot in$

$e_4 := 2.36 \cdot in$

$e_5 := 0.485 \cdot in$

$e_6 := 3.75 \cdot in$ vertical anchor spacing
4 bolt bracket

Chk Brackets:

$f_{pbkt} := \frac{T_{shd}}{d_b \cdot t_{bkt}} = 9929 psi$

$F_{pbkt} := 43100 \cdot psi$

$R_{hz} := 2\frac{R_{o2max}}{\tan(\theta_s)} = 668 lbf$

$R_{vt} := 2R_{o2max} = 648 lbf$

$M_{bkt} := R_{hz} \cdot (e_4) = 1577 \cdot lbf \cdot in$

$S_{bktst} := 0.2284 \cdot in^3$

$f_{bbktst} := \frac{M_{bkt}}{S_{bktst}} = 6907 psi$

$F_{bst} := 19500 \cdot psi$

$M_{wk} := \frac{R_{hz} \cdot 3.644 \cdot in}{4} = 609 \cdot lbf \cdot in$

$S_{bkt} := \frac{L_{bkt} \cdot t_{bkt}^2}{6} = 0.063 \cdot in^3$

$f_{bbkt} := \frac{M_{wk}}{S_{bkt}} = 9743 psi$

$F_{bbkt} := 27600 \cdot psi$

$\Omega_r := 1.95$

$\Omega_y := 1.50$

$t_{up} := 0.188 \cdot in$ $D_{hole} := 0.397 \cdot in$ $ED_{up} := 0.64 \cdot in$

$k_t := 1.0$ $Max_{tolup} := 0.015 \cdot in$ $D := 0.375 \cdot in$

$d_{eup} := ED_{up} = 0.053 ft$

$R_{up} := ED_{up} = 0.053 ft$

$L_{nvup} := ED_{up} - 0.5 \cdot (D_{hole} + Max_{tolup}) = 0.434 \cdot in$

$b_{eup} := L_{nvup} = 0.036 ft$

$F_{tup} := 38 \cdot ksi$ $F_{tyup} := 35 \cdot ksi$ $A_{gvup} := ED_{up} \cdot t_{up} = 0.12 \cdot in^2$

$F_{sup} := 0.6 \cdot F_{tup} = 22.8 \cdot ksi$ $F_{syup} := 0.6 \cdot F_{tyup} = 21 \cdot ksi$ $A_{nvup} := L_{nvup} \cdot t_{up} = 0.082 \cdot in^2$

$C_r := 1 - 0.275 \cdot \sqrt{1 - \frac{D^2}{D_{hole}^2}} = 0.91$ Cr greater than 0.90 therefore $C_r := 1.0$

Shear Rupture (CONTROLS): Section J.7.2 (Alum. Design Manual 2015)

$R_{nup} := F_{sup} \cdot \frac{4 \cdot A_{nvup}}{k_t \cdot \Omega_r} = 3816 \cdot lbf$

Shear Yeilding: Section J.7.2 (Alum. Design Manual 2015)

$R_{nyup} := \frac{F_{syup} \cdot 4 \cdot A_{gvup}}{\Omega_y} = 6738 \cdot lbf$

Bolt Bearing: Section J.3.6 (Alum. Design Manual 2015)

$R_{nbup} := 2 \cdot \frac{d_{eup} \cdot t_{up} \cdot F_{tup}}{\Omega_r} = 4689 lbf$

not more than $R_{nbcmax} := 2 \cdot \frac{2 \cdot D \cdot t_{up} \cdot F_{tup}}{\Omega_r} = 5495 lbf$

Single Plane Fracture Beyond Pinhole:

Eqn. 3-49: ASME BTH-1-2014 (Design of Below-the-Hook Lifting Devices)

$$P_{bup} := C_r \frac{F_{tup}}{\Omega_r} \cdot \left[1.13 \cdot \left(R_{up} - \frac{D_{hole}}{2} \right) + \frac{0.92 \cdot b_{eup}}{1 + \frac{b_{eup}}{D_{hole}}} \right] \cdot t_{up} \cdot 2 = 5053 lbf$$

$$BRACKETS := \begin{cases} \text{"OK"} \text{ if } f_{pbkt} \le F_{pbkt} \wedge \left(\frac{f_{bbkt}}{F_{bbkt}} + \frac{f_{bbktst}}{F_{bst}} \right) \le 1.0 \wedge T_{shd} \le \min(R_{nup}, R_{nyup}, R_{nbup}, P_{bup}) \\ \text{"FAIL"} \text{ otherwise} \end{cases}$$

Use Extruded Bracket
0.64" Min. from center of shroud fastener to end/edge of bracket as shown (6005-T61 or 6005-T5)

$BRACKETS = \text{"OK"}$

Lag Screws	Detail Ref.	Sheet No: 14

$R_{hz} = 668\,lbf$ $\quad R_{vt} = 648\,lbf$

$e_4 = 2.36\cdot in$

$e_3 = 1.3\cdot in$

$e_5 = 0.485\cdot in$

$L_{bkt} = 6\cdot in$

$e_6 = 3.75\cdot in$

Screw Forces:

$r := \begin{pmatrix} UpLoad \\ DnLoad \end{pmatrix}$

2 - Bolt Analysis:

Downward Load:

$$T_{lag2dn} := \frac{R_{hz}\cdot(e_4) - R_{vt}\cdot(e_3)}{0.5\cdot L_{bkt}\cdot 0.85\cdot 2} + \frac{R_{hz}}{2} = 478\,lbf$$

$$V_{lag2dn} := \frac{R_{vt}}{2} = 324\,lbf$$

Upward Load:

$$T_{lag2up} := \frac{\left|r\cdot R_{hz}\cdot(e_4) - r\cdot R_{vt}\cdot(e_3)\right|}{0.5\cdot L_{bkt}\cdot 0.85\cdot 2} + \frac{r\cdot R_{hz}}{2} = 253\,lbf$$

$$V_{lag2up} := \frac{r\cdot R_{vt}}{2} = 171\,lbf$$

$$T_{lag2} := \max(T_{lag2dn}, T_{lag2up}) = 478\,lbf$$

$$V_{lag2} := \max(V_{lag2dn}, V_{lag2up}) = 324\,lbf$$

4 - Bolt Analysis:

Downward Load:

$$T_{lag4dn} := \frac{R_{hz}\cdot(e_5 + 0.5\cdot e_6) - R_{vt}\cdot(e_3)}{e_6\cdot 2} + \frac{R_{hz}}{4} = 265\,lbf$$

$$V_{lag4dn} := \frac{R_{vt}}{4} = 162\,lbf$$

Upward Load:

$$T_{lag4up} := \frac{r\cdot R_{hz}\cdot(e_5 + 0.5\cdot e_6) - r\cdot R_{vt}\cdot(e_3)}{e_6\cdot 2} + \frac{r\cdot R_{hz}}{4} = 140\,lbf$$

$$V_{lag4up} := \frac{r\cdot R_{vt}}{4} = 86\,lbf$$

$$T_{lag4} := \max(T_{lag4dn}, T_{lag4up}) = 265\,lbf$$

$$V_{lag4} := \max(V_{lag4dn}, V_{lag4up}) = 162\,lbf$$

$$T_{lag} := \begin{vmatrix} T_{lag2} \text{ if } N_{tba} = 2 \\ T_{lag4} \text{ otherwise} \end{vmatrix} = 2128$$

$$V_{lag} := \begin{vmatrix} V_{lag2} \text{ if } N_{tba} = 2 \\ V_{lag4} \text{ otherwise} \end{vmatrix} = 1441$$

bending:

$$M_{14} := (V_{lag})\cdot(e_7) = 729\cdot in\cdot lbf$$

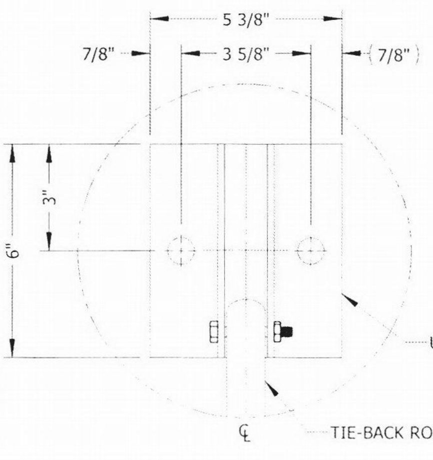
$$S_{14} := \frac{\pi\cdot(0.625\cdot in)^3}{32} = 0.024\cdot in^3$$

$$f_{b14} := M_{14} \div S_{14} = 30403\,psi$$

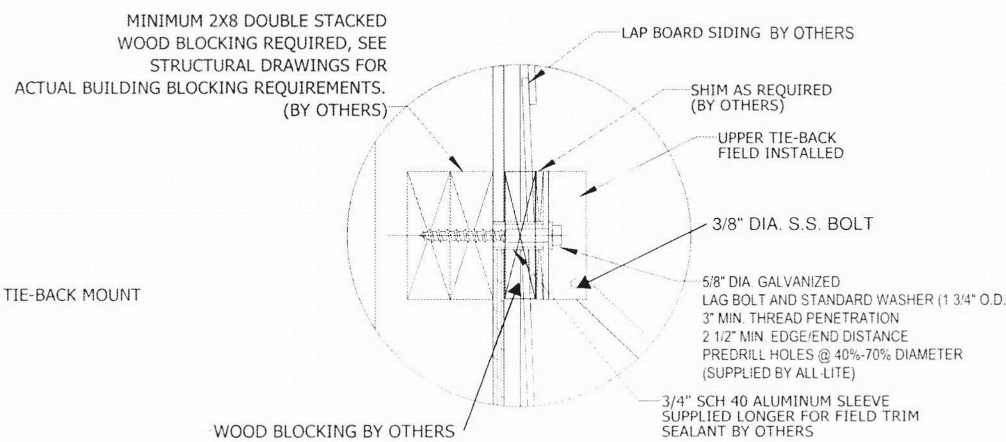
$$F_{b14} := 45000\cdot psi\cdot 0.75 = 33750\,psi$$

$$BENDING14 := \begin{vmatrix} \text{"OK" if } \dfrac{f_{b14}}{F_{b14}} \le 1.0 \\ \text{"FAIL" otherwise} \end{vmatrix}$$

Use (2) 5/8" Dia. Galv. Lag Screws
3" Min. Thread Penetration
2 1/2" Edge/End Distance
as shown (Fy = 45,000 psi)



UPPER TIE-BACK (H / D-1) BOLT LOCATION
SCALE: 3" = 1' D-1



TRELLIS (F / D-1) TIE-BACK DETAIL
SCALE: 2" = 1' D-1

$\boxed{BENDING14 = \text{"OK"}}$

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description: **McDonalds 036-0034** **Portland, OR**	Job No:	R17-08-248
			Engineer: KLG	Sheet No: 14
			Date: 8/18/17	Rev:
Template:			Chk By:	Date: 8/14/18

Dowel Type Fastener Capacity (NDS 2012)

Lag Screws	Detail Ref.	Sheet No: 14A

$V_{pos} := \frac{V_{lag}}{lbf} = 323.9$ $\quad V_{neg} := \frac{V_{lag}}{lbf} = 323.9$

$T_{pos} := \frac{T_{lag}}{lbf} = 478.4$ $\quad T_{neg} := \frac{T_{lag}}{lbf} = 478.4$

5/8 in Lag Screw

$l_m := 3$ thickness of main member, in.

$l_s := 0.25$ thickness of side member, in

6061-T6 Hole

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

$D = 0.625$ unthreaded shank diameter of screw, in.

$D_r = 0.471$ root diameter of screw

$F_{es} = 43000$ bearing strength, psi

Spruce Pine-Fir

$p := 3$ penetration, in

$t_{shim} := 0.25$ maximum thickness of shim, in

$C_{Dd} := 1.15$ snow load duration factor, 10.32

$C_{Du} := 1.6$ wind load duration factor, 10.3.2

$C_M := 1.0$ 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 load to grain, degree

Calculations

$K_\theta := 1 + 0.25 \cdot \frac{\theta}{90} = 1.25$ $\quad R_e := \frac{F_{em}}{F_{es}} = 0.051$ $\quad R_t := \frac{l_m}{l_s} = 12$

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

$$k_1 := \frac{\sqrt{R_e + 2 \cdot R_e^2 \cdot \left(1 + R_t + R_t^2\right) + R_t^2 \cdot R_e^3} - R_e \cdot (1 + R_t)}{1 + R_e} = 0.265$$

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

$$k_2 := -1 + \sqrt{2 \cdot (1 + R_e) + \frac{2 \cdot F_{yb} \cdot (1 + 2 \cdot R_e) \cdot D_r^2}{3 \cdot F_{em} \cdot l_m^2}} = 0.573$$

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

$$k_3 := -1 + \sqrt{\frac{2 \cdot (1 + R_e)}{R_e} + \frac{2 \cdot F_{yb} \cdot (2 + R_e) \cdot D_r^2}{3 \cdot F_{em} \cdot l_s^2}} = 10.865$$

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

$Z_{Im} := \frac{D_r \cdot l_m \cdot F_{em}}{R_{d1}} = 619.831$ $\quad Z_{Is} := \frac{D_r \cdot l_s \cdot F_{es}}{R_{d1}} = 1012.65$ $\quad Z_{II} := \frac{k_1 \cdot D_r \cdot l_s \cdot F_{es}}{R_{d2}} = 298.415$ $\quad Z_{IIIm} := \frac{k_2 \cdot D_r \cdot l_m \cdot F_{em}}{(1 + 2R_e) \cdot R_{d3}} = 402.684$

$Z_{IIIs} := \frac{k_3 \cdot D_r \cdot l_s \cdot F_{em}}{(2 + R_e) \cdot R_{d3}} = 342.039$ $\quad Z_{IV} := \frac{D_r^2}{R_{d3}} \cdot \sqrt{\frac{2 \cdot F_{em} \cdot F_{yb}}{3 \cdot (1 + R_e)}} = 438.824$

$Z_1 := \min\left(Z_{Im}, Z_{Is}, Z_{II}, Z_{IIIm}, Z_{IIIs}, Z_{IV}\right) = 298.415$

$W_1 = 344.395$

$R_{pos} := \sqrt{T_{pos}^2 + V_{pos}^2} = 577.734$ $\quad R_{neg} := \sqrt{T_{neg}^2 + V_{neg}^2} = 577.734$

$\alpha_{pos} := \operatorname{atan}\left(T_{pos} \cdot V_{pos}^{-1}\right) = 55.903 \cdot deg$ $\quad \alpha_{neg} := \operatorname{atan}\left(T_{neg} \cdot V_{neg}^{-1}\right) = 55.903 \cdot deg$

Results

$Z'_d := Z_1 \cdot C_{Dd} \cdot C_M \cdot C_t \cdot C_g \cdot C_\Delta \cdot C_{eg} \cdot C_{di} = 343.2$ lb **Allowable Downward Shear**

$W'_d := W_1 \cdot C_{Dd} \cdot C_M \cdot C_t \cdot C_{eg} \cdot P_{ten} = 891.1$ lb **Allowable Downward Tension**

$Z'_u := Z_1 \cdot C_{Du} \cdot C_M \cdot C_t \cdot C_g \cdot C_\Delta \cdot C_{eg} \cdot C_{di} = 477.5$ lb **Allowable Upward Shear**

$W'_u := W_1 \cdot C_{Du} \cdot C_M \cdot C_t \cdot C_{eg} \cdot P_{ten} = 1239.8$ lb **Allowable Upward Tension**

Fastener = "5/8 in Lag Screw"
Predrill = "Predrill Holes at 40% - 70% D"
Penetration = "Verify Blocking Thickness"
Material = "Spruce Pine-Fir"

$$Z_{\alpha pos} := \frac{W'_d \cdot Z'_d}{W'_d \cdot \left(\cos(\alpha_{pos})\right)^2 + Z'_d \cdot \left(\sin(\alpha_{pos})\right)^2} = 593.4 \quad Z_{\alpha neg} := \frac{W'_u \cdot Z'_u}{W'_u \cdot \left(\cos(\alpha_{neg})\right)^2 + Z'_u \cdot \left(\sin(\alpha_{neg})\right)^2} = 825.6$$

$$LAGSCREWS := \begin{cases} \text{"OK" if } \frac{T_{pos}}{W'_d} \le 1 \wedge \frac{V_{pos}}{Z'_d} \le 1 \wedge \frac{R_{pos}}{Z_{\alpha pos}} \le 1.03 \wedge \frac{T_{neg}}{W'_u} \le 1 \wedge \frac{V_{neg}}{Z'_u} \le 1 \wedge \frac{R_{neg}}{Z_{\alpha neg}} \le 1.03 \\ \text{"FAIL" otherwise} \end{cases}$$

LAGSCREWS = "OK"

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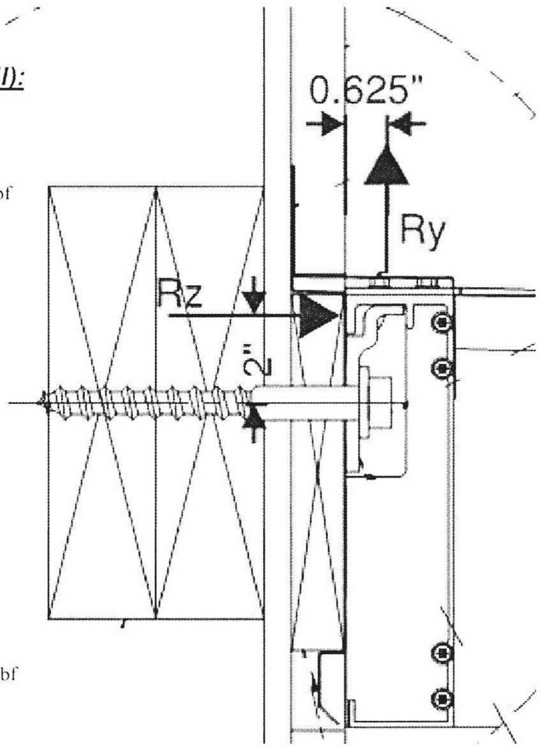
			Engineer: KLG	Sheet No: 14A
			Date: 8/18/17	Rev:
			Chk By:	Date:

$SPA_{lag} = 36 \cdot in$

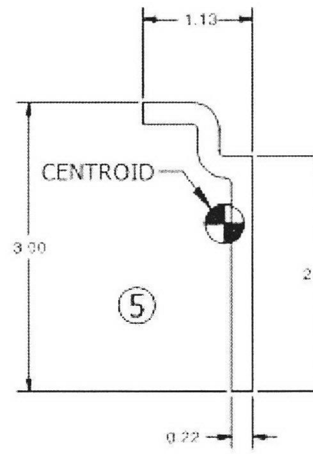
$e_5 := 0.625 \cdot in$

$e_6 := 2 \cdot in$



Use 0.22" thk Extruded Bracket
as shown (6005A-T61 or 6005-T5)

Use #12 Tek S.S. Fasteners
Max. O.C. Spacing = 12"
Min. Edge/End Dist. = 0.324"
Full Thread Eng. into Bracket
(304 - Cond. CW)



Local Bending (Mounting Rail):

$R_{unid} := DnLoad \cdot \frac{a}{2} \cdot 1.143 \cdot SPA_{lag} = 238\,lbf$

$R_{ydn} := \max(R_{o1d} \cdot 2, R_{eo1d}, R_{unid}) = 238\,lbf$

$M_{ymr} := R_{ydn} \cdot e_5 = 149 \cdot lbf \cdot in$

$S_{mr} := \frac{(0.22 \cdot in)^2 \cdot 12 \cdot in}{6} = 0.097 \cdot in^3$

$f_{bmr} := \frac{M_{ymr}}{S_{mr}} = 1537\,psi$

$F_{bwk} = 27600\,psi$

Local Bending Check (Rear Fascia)

$R_{uniu} := |UpLoad| \cdot \frac{a}{2} \cdot 1.143 \cdot 12 \cdot in = 42\,lbf$

$R_{yup} := \max(2 \cdot R_{o1u}, R_{eo1u}, R_{uniu}) = 86\,lbf$

$M_{yrf} := R_{yup} \cdot 1.375 \cdot in = 118 \cdot in \cdot lbf$

$S_{rf} := \frac{(0.081 \cdot in)^2 \cdot 12 \cdot in}{6} = 0.013 \cdot in^3$

$f_{brf} := \frac{M_{yrf}}{S_{rf}} = 8965\,psi$

$F_{brf} := 12600 \cdot psi$

Fastener Check (Panel to Rail)

uplift:

$t_{mr} := 0.22 \cdot in$

$D_f = 0.216 \cdot in$ $\quad F_{tymr} := 35 \cdot ksi$

$T_{mr} := \max(R_{o1u}, R_{eo1u}, R_{uniu}) = 80\,lbf$

$t_{D1} := \min\left(\frac{t_{mr}}{D_f}, 1.1\right) = 1.019$

$T_{mrpov} := \left[\frac{(0.27 + 1.45 \cdot t_{D1}) \cdot D_f \cdot t_{mr} \cdot F_{tymr}}{3}\right] = 968\,lbf$

$T_{mrall} := 700 \cdot lbf$ AAMA TIR Table 22.12

$I_{mr} := \left(\frac{T_{mr}}{T_{mrall}}\right) = 0.115$

$$FASTmr := \begin{cases} \text{"OK"} & \text{if } T_{mr} \le T_{mrpov} \wedge I_{mr} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

Bending Check (Mounting Rail):

strong axis:

$M_2 := SPA_{lag}^2 \cdot DnLoad \cdot \frac{a}{2} \cdot 0.10 = 750 \cdot lbf \cdot in$

$f_{bstrdw} := \frac{M_2}{S_{xmr}} = 13687\,psi$

$I_{xmr} := 0.069 \cdot in^4$ $\quad d_{mr} := 3 \cdot in$

$I_{ymr} := 0.06 \cdot in^4$ $\quad J_{mr} = 0.021 \cdot in^4$

$S_{xmr} := \frac{I_{xmr}}{1.26 \cdot in} = 0.055 \cdot in^3$

$S_{ymr} := \frac{I_{ymr}}{0.29 \cdot in} = 0.207 \cdot in^3$

$r_{ymr} := \frac{1}{1.7} \cdot \sqrt{\frac{I_{ymr} \cdot d_{mr}}{S_{xmr}} \left[-.5 + \sqrt{1.25 + .152 \cdot \frac{J_{mr}}{I_{ymr}} \cdot \left(\frac{SPA_{lag}}{d_{mr}}\right)^2}\right]} = 1.691 \cdot in$

$S_{rmr} := \frac{SPA_{lag}}{r_{ymr}} = 21.291$

$$F_{bmr} := \begin{cases} (19500 \cdot psi) & \text{if } S_{rmr} < 35.5 \\ \left[(23.9 - 0.124 S_{rmr}) \cdot 1000 \cdot psi\right] & \text{if } 35.5 \le S_{rmr} \le 79 \\ \left(\frac{86996}{S_{rmr}^2} \cdot 1000 \cdot psi\right) & \text{otherwise} \end{cases} = 19500\,psi$$

weak axis:

$f_{bwk} := \frac{P_u \cdot SPA_{lag}}{4 \cdot S_{ymr}} = 15362\,psi$

$F_{bwk} = 27600\,psi$

Load to Anchors

downward load:

$V_{dn} := R_{ydn} = 238\,lbf$

$T_{dn} := \frac{R_{ydn} \cdot e_7}{1.0 \cdot in} = 535\,lbf$

uplift:

$P_u := \max\left[R_{eo2u} \div \tan(\theta_s), (R_{o2u} \div \tan(\theta_s)) \cdot 2\right] = 353\,lbf$

$T_{up} := \left|\frac{P_u \cdot 3 \cdot in}{1 \cdot in} - \frac{R_{yup} \cdot e_5}{2 \cdot in}\right| = 1033\,lbf$ *conservative*

$V_{up} := R_{yup} = 86\,lbf$

$$MNTGRAIL := \begin{cases} \text{"OK"} & \text{if } \frac{f_{brf}}{F_{brf}} \le 1.0 \wedge \frac{f_{bstrdw}}{F_{bmr}} \le 1.0 \wedge \frac{f_{bmr}}{F_{bwk}} \le 1.0 \wedge \frac{f_{bwk}}{F_{bwk}} \le 1.0 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{FASTmr = \text{"OK"}}$

$\boxed{MNTGRAIL = \text{"OK"}}$

Mounting Rail Anchors	Detail Ref.	Sheet No: 16

$n_{lag} := 2$ anchors effective

Forces on Lag Screws Upward:

$V_{int} := \frac{V_{up}}{lbf \cdot n_{lag}} = 43$

$T_{int} := \frac{T_{up}}{lbf \cdot n_{lag}} = 516.351$

$R_{int} := \sqrt{T_{int}^2 + V_{int}^2} = 518$

$\alpha_{int} := \operatorname{atan}\left(\frac{T_{int}}{V_{int}}\right) \cdot \frac{180}{\pi} = 85.264$ angle of load to wood, degree

$Z' := \min(Z'_d, Z'_u) = 343.177$

$Z'_{\alpha int} := \frac{(W' \cdot Z')}{W' \cdot \left(\cos\left(\alpha_{int} \cdot \frac{\pi}{180}\right)\right)^2 + Z' \cdot \left(\sin\left(\alpha_{int} \cdot \frac{\pi}{180}\right)\right)^2} = 881.527$

$UPLAGS := \begin{cases} \text{"OK"} & \text{if } \frac{T_{int}}{W'} \le 1 \wedge \frac{V_{int}}{Z'} \le 1 \wedge \frac{R_{int}}{Z'_{\alpha int}} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

$\boxed{UPLAGS = \text{"OK"}}$

bending:

$M_{15} := \max(V_{int}, V_{ext}) \cdot lbf \cdot (e_7) = 268 \cdot in \cdot lbf$

$S_{15} := \frac{\pi \cdot (0.625 \cdot in)^3}{32} = 0.024 \cdot in^3$

$f_{b16} := M_{15} \div S_{15} = 11170\ psi$

$F_{b16} := 45000 \cdot psi \cdot 0.75 = 33750\ psi$

$BENDING16 := \begin{cases} \text{"OK"} & \text{if } \frac{f_{b16}}{F_{b16}} \le 1.0 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

$\boxed{BENDING16 = \text{"OK"}}$

Forces on Lag Screws Downward:

$V_{ext} := \frac{V_{dn}}{lbf \cdot n_{lag}} = 119$

$T_{ext} := \frac{T_{dn}}{lbf \cdot n_{lag}} = 268$

$R_{ext} := \sqrt{T_{ext}^2 + V_{ext}^2} = 292.979$

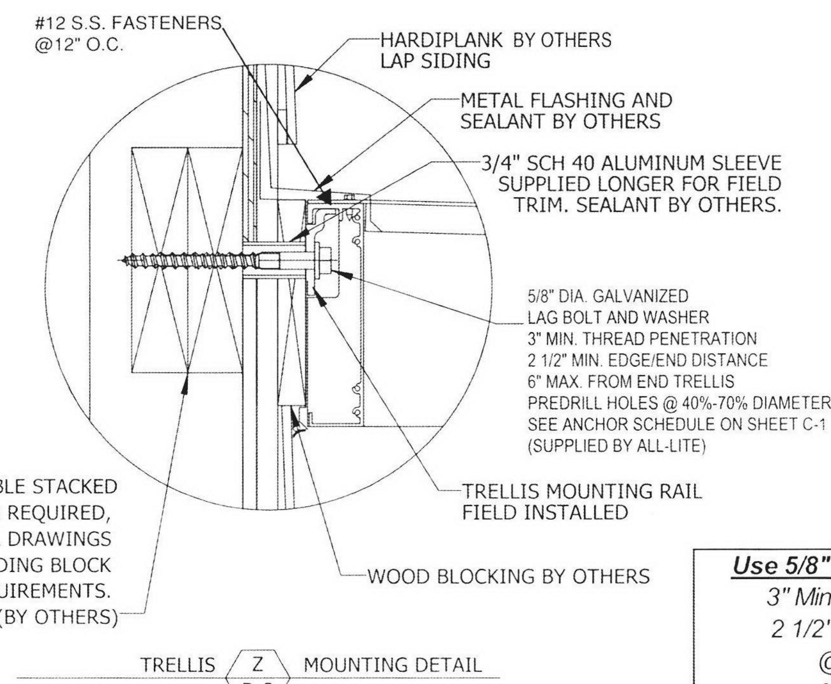
$\alpha_{ext} := \operatorname{atan}\left(\frac{T_{ext}}{V_{ext}}\right) \cdot \frac{180}{\pi} = 66.038$ angle of load to wood, degree

$W' := \min(W'_d, W'_u) = 891.121$

$Z'_{\alpha ext} := \frac{(W' \cdot Z')}{W' \cdot \left(\cos\left(\alpha_{ext} \cdot \frac{\pi}{180}\right)\right)^2 + Z' \cdot \left(\sin\left(\alpha_{ext} \cdot \frac{\pi}{180}\right)\right)^2} = 705.353$

$DNLAGS := \begin{cases} \text{"OK"} & \text{if } \frac{T_{ext}}{W'} \le 1.08 \wedge \frac{V_{ext}}{Z'} \le 1 \wedge \frac{R_{ext}}{Z'_{\alpha ext}} \le 1.08 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

$\boxed{DNLAGS = \text{"OK"}}$



TRELLIS Z MOUNTING DETAIL
SCALE: 2" = 1' D-2 D-2

Use 5/8" Dia. Galv. Lag Screws
3" Min. Thread Penetration
2 1/2" Edge/End Distance
@ 36" o.c. (max.)
6" max. from end
as shown (Fy = 45,000 psi)

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Threaded Bolt Allowables:

$V_{iball} := 2690$ lb

$T_{iball} := 5085$ lb

Check Upward Bolts:

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

$\boxed{INTBOLTS = \text{"OK"}}$

bending :

$$M_{15} := \max(V_{ext}, V_{int}) \cdot lbf \cdot (e_7) = 268 \cdot in \cdot lbf$$

$$S_{20} := \frac{\pi \cdot (0.625 \cdot in)^3}{32} = 0.024 \cdot in^3$$

$$f_{b20} := M_{15} \div S_{20} = 11170\ psi$$

$$F_{b20} := 36000 \cdot psi \cdot 0.75 = 27000\ psi$$

$$BENDING20 := \begin{cases} \text{"OK"} & \text{if } \frac{f_{b20}}{F_{b20}} \le 1.0 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{BENDING20 = \text{"OK"}}$

Threaded Bolt Allowables:

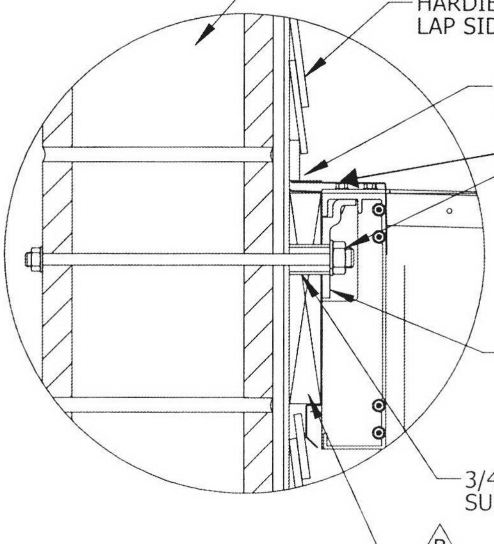
$V_{eball} := 2690$ lb

$T_{eball} := 5085$ lb

Check Downward Bolts:

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

$\boxed{EXTBOLTS = \text{"OK"}}$



TRELLIS (G / D-1) MOUNTING DETAIL
SCALE: 2" = 1' D-1

C

Use Extruded Bracket
as shown (6061-T6)

Use 5/8" Dia. Threaded Bolts (Grade 2)
@ 36" o.c. (max.)
6" max. from end
as shown (Fy = 36,000 psi or better)

Project Information:

McDonalds Site ID:	036-0034
All-Lite Order Number:	264399
REI Project Number:	R17-08-248
Location:	Portland, OR

Construction Options:

Maximum Fascia Length:	$L_c := 96$	in
Maximum Banding Height:	$L_{bh} := 16$	in
Maximum Projection Length:	$L_p := 18$	in
Number of Mullion Fasteners:	$N_{sfscrews} := 4$	per clip angle
Number of Mullion Angle Bolts:	$N_{sfbolts} := 2$	per clip angle
Number of Wall Anchors:	$N_{tba} := 2$	per outrigger

Design Variables:

Wind Speed:	$V := 120$	mph
Ice Thickness:	$t_i := 1.25$	in
Wind Speed w/ ice:	$V_i := 30$	mph
Ground Snow Load:	$P_g := 20$	psf
Short Period Ground Acceleration:	$S_s := 94.5$	%
Short Period Site Coefficient:	$F_a := 1.1$	
Live Load:	$LL := 0$	psf

ASCE 7-10

Design Loads	Detail Ref.	Sheet No: 51

Wind Input Variables:

Building Category II Table 1.5-1

Mean Roof Height $h := 20$ ft

Sunshade Height $z := 12$ ft Table-30.3-1

Exposure $E := "C"$

Wind Velocity $V = 120$ mph Figure 26.5-1A, Figure 26.5-1B Figure 26.5-1C

Topographic Factor $K_{zt} := 1.0$ Figure 26.8-1

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

Effective Wind Area $EWA := 29.33\ ft^2$

ASD Conversion Factor $\Phi := 0.6$

Building Width $L_1 := 50$ ft

Building Length $L_2 := 100$ ft

Roof Slope: $\theta := 0$ deg

Roof Edge Zone: $a_z = 5$ ft

Internal Pressure Coefficients: *Note: Internal pressure coefficients from* Table 26.11-1

$GCpi1 := 0$

$GCpi2 := -0$

External Pressure Coefficients.: *Note: External Pressure coefficients from:* Figure 30.4-2A Figure 30.6-1

$GC_{plat} = 1$

$GCp1 = -1$ CZ

$GCp2 = 1$ CZ

$GCp3 = -1$ Typ

$GCp4 = 1$ Typ

Ice Input Variables:

Ice Thickness: $t_i = 1.25$ in Figure 10-2A Figure 10-2B

Concurrent Wind: $V_i = 30$ mph

Importance Factor: $I_i = 1$ Table 1.5-2

Snow Input Variables:

Ground Snow Load: $P_g = 20$ psf Figure 7-1A Figure 7-1B

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

Exposure Factor: $C_e := 0.9$ Table 7-2

Importance Factor: $I_s = 1$ Table 1.5-2

Roof Slope Factor: $C_s := 1.0$ Figure 7-2

Clear Height: $h_c = 8$ ft

Parapet Height: $h_p := 4$ ft

Sunshade Projection: $L_{uww} := \frac{L_p}{12} = 1.5$ ft

$L_{ulw} := \max[0.85\cdot((\max(L_1, L_2) - 5h_p)), 25] = 68$

Upwind Roof Length: $L_{ulw} = 68$ ft

Seismic Input Variables:

$S_s = 94.5$ % *Mapped Spectral Response Acceleration at Short Periods* (Figure 22-1A),(Figure 22-1B)

$a_p := 2.5$ *Component Amplification Factor* (Table 13.5-1)

$R_p := 1.5$ *Component Response Modification Factor* (Table 13.5-1)

$I_p = 1$ *Component Importance Factor* (See Section 13.1.3)

Soil Site Class: D

$F_a = 1.1$ *Short-Period Site Coefficient* (Table 11.4-1)

NOTE: Enter perimeter in inches, length, and number of each type of member to calculate ice weights.

Member Data:

PERIMETERS		LENGTHS		NUMBER	AREA			
$D_{c1} := 8$	in	$L_1 := L_c \div 12$	in	$n_1 := 2$	$A_1 := 2.44$	in^2	$V_1 := A_1 \cdot L_1 \cdot n_1 = 39.04$	in^3
$D_{c2} := 8$	in	$L_2 := L_p \div 12$	in	$n_2 := 2$	$A_2 := 2.44$	in^2	$V_2 := A_2 \cdot L_2 \cdot n_2 = 7.32$	in^3
$D_{c3} := 0$	in	$L_3 := 0$	in	$n_3 := 0$	$A_3 := 0$	in^2	$V_3 := A_3 \cdot L_3 \cdot n_3 = 0$	in^3
$D_{c4} := 0$	in	$L_4 := 0$	in	$n_4 := 0$	$A_4 := 0$	in^2	$V_4 := A_4 \cdot L_4 \cdot n_4 = 0$	in^3
$D_{c5} := 0$	in	$L_5 := 0$	in	$n_5 := 0$	$A_5 := 0$	in^2	$V_5 := A_5 \cdot L_5 \cdot n_5 = 0$	in^3
$D_{c6} := 0$	in	$L_6 := 0$	in	$n_6 := 0$	$A_6 := 0$	in^2	$V_6 := A_6 \cdot L_6 \cdot n_6 = 0$	in^3
$D_{c7} := 0$	in	$L_7 := 0$	in	$n_7 := 0$	$A_7 := 0$	in^2	$V_7 := A_7 \cdot L_7 \cdot n_7 = 0$	in^3
$D_{c8} := 0$	in	$L_8 := 0$	in	$n_8 := 0$	$A_8 := 0$	in^2	$V_8 := A_8 \cdot L_8 \cdot n_8 = 0$	in^3

$SQFT := 2.9167\ ft^2$

NOTE: Calculate the solid area of the sunshade in the same plane as the applied wind load. (Ex. calculate the solid area as seen from directly above if wind load is applied downward.) USE THE WORST CASE FOR THESE CALCULATIONS.

Design Loads	Detail Ref.	Sheet No: 52

Wind Load Calculations:

Velocity pressure Coefficients:

$K_{zh} = 0.90$ psf

$K_{zz} = 0.85$ psf

Velocity pressures:

$q_h := 0.00256 \cdot K_{zh} \cdot K_{zt} \cdot K_d \cdot V^2 = 28.201$

$q_z := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot V^2 = 26.634$

Calculated Pressures (ASD):

$$\boxed{W_{upcz} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp1 - GCpi1)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_h \cdot GCp1 - q_h \cdot GCpi1\right) & \text{otherwise} \end{cases} = -16.921} \quad \text{psf}$$

$$\boxed{W_{dncz} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp2 - GCpi2)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_z \cdot GCp2 - q_h \cdot GCpi2\right) & \text{otherwise} \end{cases} = 16.921} \quad \text{psf}$$

$$\boxed{W_{up} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp3 - GCpi1)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_h \cdot GCp3 - q_h \cdot GCpi1\right) & \text{otherwise} \end{cases} = -16.921} \quad \text{psf}$$

$$\boxed{W_{dn} := \begin{cases} \left[\Phi \cdot q_h \cdot (GCp4 - GCpi2)\right] & \text{if } h \le 60 \\ \left(\Phi \cdot q_z \cdot GCp4 - q_h \cdot GCpi2\right) & \text{otherwise} \end{cases} = 16.921} \quad \text{psf}$$

$$\boxed{W_{lat} := \Phi \cdot q_h \cdot GC_{plat} + 5 = 21.921} \quad \text{psf}$$

Dead Load Calculations:

$$WT := \frac{(V_1 + V_2 + V_3 + V_4 + V_5 + V_6 + V_7 + V_8) \cdot 165}{1728} = 4.427 \quad \text{lb}$$

$$\boxed{D := \frac{WT}{SQFT} = 1.518} \quad \text{psf}$$

Ice Load Calculations:

$$f_z := \begin{cases} \left(\frac{z}{33}\right)^{0.10} & \text{if } 0 < z < 900 \\ 1.4 & \text{otherwise} \end{cases} = 0.904$$

$t_d := 1.0 \cdot t_i \cdot I_i \cdot f_z \cdot K_{zt}^{0.35} = 1.13$ in

$q_{zi} := 0.00256 \cdot K_{zz} \cdot K_{zt} \cdot K_d \cdot V_i^2 \cdot I_w = 1.665$ psf

$W_i := -q_{zi} \cdot \Phi \cdot (GCp3 - GCpi1) = 0.999$ psf

$$\boxed{WT_i := \frac{V_{1i} + V_{2i} + V_{3i} + V_{4i} + V_{5i} + V_{6i} + V_{7i} + V_{8i}}{1728} \cdot 56 = 19.952} \quad \text{lb}$$

$$\boxed{D_i := \frac{WT_i}{SQFT} = 6.841} \quad \text{psf}$$

Snow Load Calculations:

$P_f := 0.7 \cdot C_e \cdot C_t \cdot I_s \cdot P_g = 15.12$ psf

$\boxed{S_b := P_f \cdot C_s = 15.12}$ psf *Balanced Snow Load*

$$\gamma := \begin{cases} 0.13 \cdot P_g + 14 & \text{if } P_g \le 123 \\ 30 & \text{otherwise} \end{cases} = 16.6 \quad \text{pcf}$$

$h_b := \frac{S_b}{\gamma} = 0.911$ ft

$$h_{ratio} := \begin{cases} \frac{h_{c'}}{h_b} & \text{if } h_b > 0 \\ 0 & \text{otherwise} \end{cases} = 7.783$$

$$h_{dlw} := \begin{cases} \left(0.43 \cdot \sqrt[3]{L_{ulw}} \cdot \sqrt[4]{P_g + 10} - 1.5\right) & \text{if } h_{ratio} \ge 0.2 \\ 0 & \text{otherwise} \end{cases} = 2.608 \quad \text{ft}$$

$h_{dww} := \left(0.43 \cdot \sqrt[3]{L_{uww}} \cdot \sqrt[4]{P_g + 10} - 1.5\right) \cdot 0.75 = -0.261$ ft

$h_{d1} := \max(h_{dlw}, h_{dww}) = 2.608$ ft

$h_{rep} = 0.3'$ ft

$h_d := \min(h_{d1}, h_{c'}, h_{rep}) = 0.375$ ft

$P_{d1} := h_d \cdot \gamma = 6.225$ psf *at wall*

$$w := \begin{cases} 4 \cdot h_{d1} & \text{if } h_{d1} \le h_{c'} \\ \frac{4 \cdot h_{d1}^2}{h_{c'}} & \text{otherwise} \end{cases} = 10.43 \quad \text{ft}$$

$$P_{d2} := \begin{cases} 0 & \text{if } L_{uww} \ge w \\ \left[h_d - \left(\frac{h_d \cdot L_{uww}}{w}\right)\right] \cdot \gamma & \text{otherwise} \end{cases} = 5.33 \quad \text{psf} \quad \textit{at fascia}$$

$$\boxed{S_d := \begin{cases} \left(\frac{P_{d1} + P_{d2}}{2} + S_b\right) & \text{if } P_g > 0 \\ 0 & \text{otherwise} \end{cases} = 20.897} \quad \text{psf}$$

Balanced plus Drift Load

Seismic Load Calculations:

$S_{MS} := F_a \cdot \frac{S_s}{100} = 1.04$ $\quad S_{DS} := \left(\frac{2}{3}\right) S_{MS} = 0.693$

$$f_p := \left(\frac{0.4 \cdot a_p \cdot S_{DS} \cdot WT}{\frac{R_p}{I_p}}\right) \cdot \left[1 + \left[2 \cdot \left(\frac{z}{h}\right)\right]\right] = 4.499$$

$f_{pmin} := 0.3 \cdot S_{DS} \cdot I_p \cdot WT = 0.92$

$f_{pmax} := 1.6 \cdot S_{DS} \cdot I_p \cdot WT = 4.908$

$$F_p := \begin{cases} f_p & \text{if } f_p > f_{pmin} \wedge f_p < f_{pmax} \\ f_{pmin} & \text{if } f_p < f_{pmin} \\ f_{pmax} & \text{if } f_p > f_{pmax} \end{cases} = 4.499$$

$$\boxed{E := \frac{F_p}{SQFT} = 1.543}$$

Load Combinations:

Design Loads	Detail Ref.	Sheet No: 53

Loads:

$D = 1.518$	psf	*Dead Load*	*(Make Dead Load equal to 0 if it will be added in RISA)*
$S_b = 15.12$	psf	*Balanced Snow Load*	
$S_d = 20.897$	psf	*Drift plus Balanced Snow Load*	
$W_{upcz} = -16.921$	psf	*Corner Zone Uplift Wind Load*	
$W_{up} = -16.921$	psf	*Typical Uplift Wind Load*	
$W_{dn} = 16.921$	psf	*Downward Wind Load*	
$W_{lat} = 21.921$	psf	*Lateral Wind Load (fascia and outriggers)*	
$D_i = 6.841$	psf	*Dead Load Due to Ice*	
$W_i = 0.999$	psf	*Concurrent Wind Load with Ice Load*	
$E = 1.543$	psf	*Seismic Load*	
$LL = 0$	psf	*Live Load*	

Load Cases:

$L1 := D$	$L1 = 1.518$	psf
$L2 := D + D_i + LL$	$L2 = 8.358$	psf
$L3 := D + 0.7D_i + 0.7W_i + S_b$	$L3 = 22.125$	psf
$L4 := D + 0.75S_b + 0.75LL$	$L4 = 12.858$	psf
$L5 := D + W_{dn}$	$L5 = 18.438$	psf
$L5A := D + 0.7E$	$L5A = 2.598$	psf
$L6 := D + 0.75W_{dn} + 0.75LL + 0.75S_b$	$L6 = 25.548$	psf
$L6A := D + 0.7E + 0.75LL + 0.75S_b$	$L6A = 13.938$	psf
$L7 := 0.6D + W_{upcz}$	$L7 = -16.01$	psf
$L7A := 0.6D + W_{up}$	$L7A = -16.01$	psf
$L7B := 0.6D + 0.7D_i + 0.7W_i$	$L7B = 6.398$	psf
$L8 := 0.6D + 0.7E$	$L8 = 1.99$	psf

$LoadDN1 := \max(L1, L2, L3, L4, L5, L5A, L6, L6A, L7B, L8) = 25.548$ psf

$DnLoad := LoadDN1 = 25.5$ psf *Maximum Downward Load*

$LoadUP1 := L7 = -16.01$ psf

$LoadUP2 := L7A = -16.01$ psf

$UpLoad := \min(LoadUP1, LoadUP2) = -16$ psf *Maximum Uplift Load*

$LoadLAT := W_{lat} = 21.921$ psf *Maximum Horizontal Wind Load*

$TL := \max(DnLoad, |UpLoad|, W_{lat}) = 25.5$ psf

Front Fascia	Detail Ref.	Sheet No: 54

Fascia Properties:

$b_f := 1.875$ in

$d_f := 8$ in

$t_f := 0.10$ in

$I_{xf} := 12.302$ in^4

$I_{yf} := 0.521$ in^4

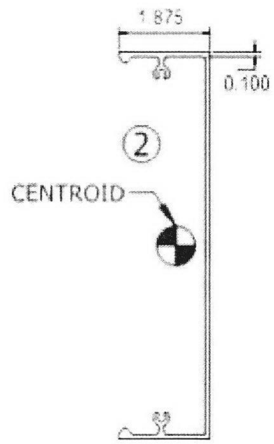
$S_{xf} := I_{xf} \div 4 = 3.075$ in^3

$S_{yf} := I_{yf} \div 1.170 = 0.445$ in^3

$J_f := \dfrac{\left(2 \cdot b_f \cdot t_f^{\,3}\right) + d_f \cdot t_f^{\,3}}{3} = 0.004$ in^4

$r_{yf} = 0.89$ in

$E_f := 10100000$ psi



Area: 1.337
Perimeter: 26.498
Bounding box: X: -1.170 -- 0.705
Y: -4.000 -- 4.000
Centroid: X: 0.255
Y: 0.000
Moments of inertia: X: 12.302
Y: 0.521
Product of inertia: XY: 0.000
Radii of gyration: X: 3.033
Y: 0.624

Principal moments and X-Y directions about centroid:
I: 0.434 along [0.000 1.000]
J: 12.302 along [-1.000 0.000]

Chk Fascia:

$w_{yf} := \dfrac{W_{lat} \cdot L_{bh}}{144} = 2.436$ pli — wind load perpendicular to blade governs weak axis check

$w_{xf} := \max\left(\dfrac{W_{lat} \cdot L_{bh} \cdot \sin(45deg)}{144}, \dfrac{TL \cdot b_f}{144}\right) = 1.722$ pli

$R_{yf} := \max\left(w_{xf}, w_{yf}\right) \cdot L_c = 234$ lb

$M_{xf} := \dfrac{w_{xf} \cdot L_c^{\,2}}{8} = 1984$ in·lb

$\Delta_{xf} := \dfrac{5 \cdot w_{xf} \cdot L_c^{\,4}}{384 \cdot E_f \cdot I_{xf}} = 0.015$ in

$\Delta_{xallf} := \dfrac{L_c}{120} = 0.800$ in

$f_{bxf} := \dfrac{M_{xf}}{S_{xf}} = 645$ psi

$S_{rf} := \dfrac{L_c}{r_{yf}} = 107.9$

$$F_{bxf} := \begin{cases} 9500 & \text{if } S_{rf} < 23 \\ \text{otherwise} & \begin{cases} \left(10.5 - 0.036 S_{rf}\right) \cdot 1000 & \text{if } S_{rf} \le 119 \\ \dfrac{87000}{S_{rf}^{\,2}} \cdot 1000 & \text{otherwise} \end{cases} \end{cases} = 6617.09 \text{ psi}$$

Use 8" x 1.875" x 0.10" wall Channel
as shown (6063-T52)

$M_{yf} := \dfrac{w_{yf} \cdot L_c^{\,2}}{8} = 2805.834$ in·lb

$\Delta_{yf} := \dfrac{5 \cdot w_{yf} \cdot L_c^{\,4}}{384 \cdot E_f \cdot I_{yf}} = 0.512$ in

$\Delta_{yallf} := \dfrac{L_c}{120} = 0.800$ in

$f_{byf} := \dfrac{M_{yf}}{S_{yf}} = 6301$ psi

$F_{byf} := 12500$ psi

$$FASCIA := \begin{cases} \text{"OK"} & \text{if } \dfrac{\Delta_{xf}}{\Delta_{xallf}} \le 1 \wedge \dfrac{f_{bxf}}{F_{bxf}} \le 1 \wedge \dfrac{f_{byf}}{F_{byf}} \le 1 \wedge \dfrac{\Delta_{yf}}{\Delta_{yallf}} \le 1 \\ \text{"FAIL"} & \text{otherwise} \end{cases}$$

$\boxed{FASCIA = \text{"OK"}}$

Outrigger	Detail Ref.	Sheet No: 55

Use 8" x 0.125" wall Channel
as shown (6005A-T61 or 6005-T5)

Outrigger Properties:

$L_o := L_p = 18$ in

$d_o := 8$ in

$I_{xo} := 11.154$ in^4

$I_{yo} := 0.180$ in^4

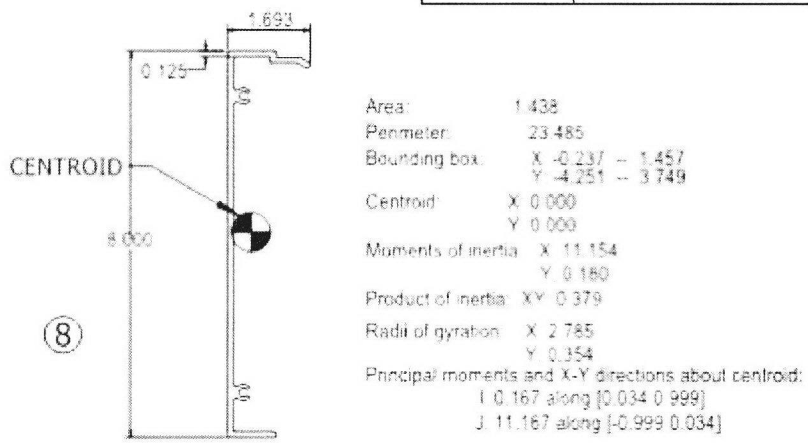
$S_{xo} := \dfrac{I_{xo}}{4.251} = 2.624$ in^3

$S_{yo} := \dfrac{I_{yo}}{1.457} = 0.124$ in^3

$J_o := 0.0068$ in^4

$r_{yo} = 0.439$ in

$E_o := 10100000$ psi



Chk Outrigger:

$M_o := R_{yf} \cdot L_o = 4208.751$ in·lb

$f_{bo} := \dfrac{M_o}{S_{xo}} = 1604.034$ psi

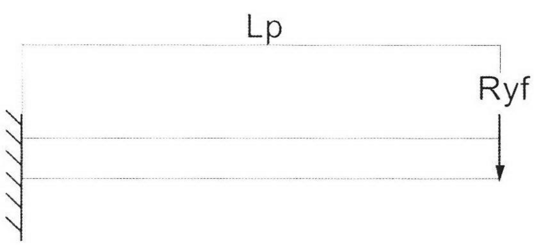
$S_{ro} := \dfrac{L_o}{r_{yo}} = 41.011$

$F_{bo} := \begin{cases} \left[(23.9 - 0.124 \cdot S_{ro}) \cdot 1000\right] & \text{if } S_{ro} < 79 \\ \dfrac{86996}{S_{ro}} & \text{otherwise} \end{cases} = 18814.655$ psi

$\Delta_o := \dfrac{R_{yf} \cdot L_o^3}{3 \cdot E_o \cdot I_{xo}} = 0.004$ in

$\Delta_{oall} := \dfrac{2 \cdot L_o}{120} = 0.3$ in

$OUTRIGGER := \begin{cases} \text{"OK"} & \text{if } f_{bo} < F_{bo} \wedge \Delta_o < \Delta_{oall} \\ \text{"FAILS"} & \text{otherwise} \end{cases}$



Downward Outrigger Reactions:

$M_{od} := M_o = 4208.751$ in·lb

$R_{od} := R_{yf} = 233.819$ lb

Upward Outrigger Reactions:

$M_{ou} := -M_o \cdot \dfrac{UpLoad}{DnLoad} = 2637.445$ in·lb

$R_{ou} := -R_{od} \cdot \dfrac{UpLoad}{DnLoad} = 146.525$ lb

$M_{omax} := \max(M_{od}, M_{ou}) = 4209$ in·lb

$R_{ymax} := \max(R_{od}, R_{ou}) = 234$ lb

$\boxed{OUTRIGGER = \text{"OK"}}$

Input Reactions:

Threaded Bolt Anchors	Detail Ref.	Sheet No: 62

$M_{od} = 4209$ in·lb $\quad M_{ou} = 2637$ in·lb

$R_{od} = 234$ lb $\quad R_{ou} = 147$ lb

Anchor Forces:

$T_{pos} = 526.094$ lb $\quad T_{neg} = 329.681$ lb $\quad T_{max} = 526.094$ lb

$V_{pos} = 116.91$ lb $\quad V_{neg} = 73.262$ lb $\quad V_{max} = 116.91$ lb

$R_{pos} = 538.927$ lb $\quad R_{neg} = 337.723$ lb

Threaded Bolt Allowables:

$V_{tball} := 2690$ lb

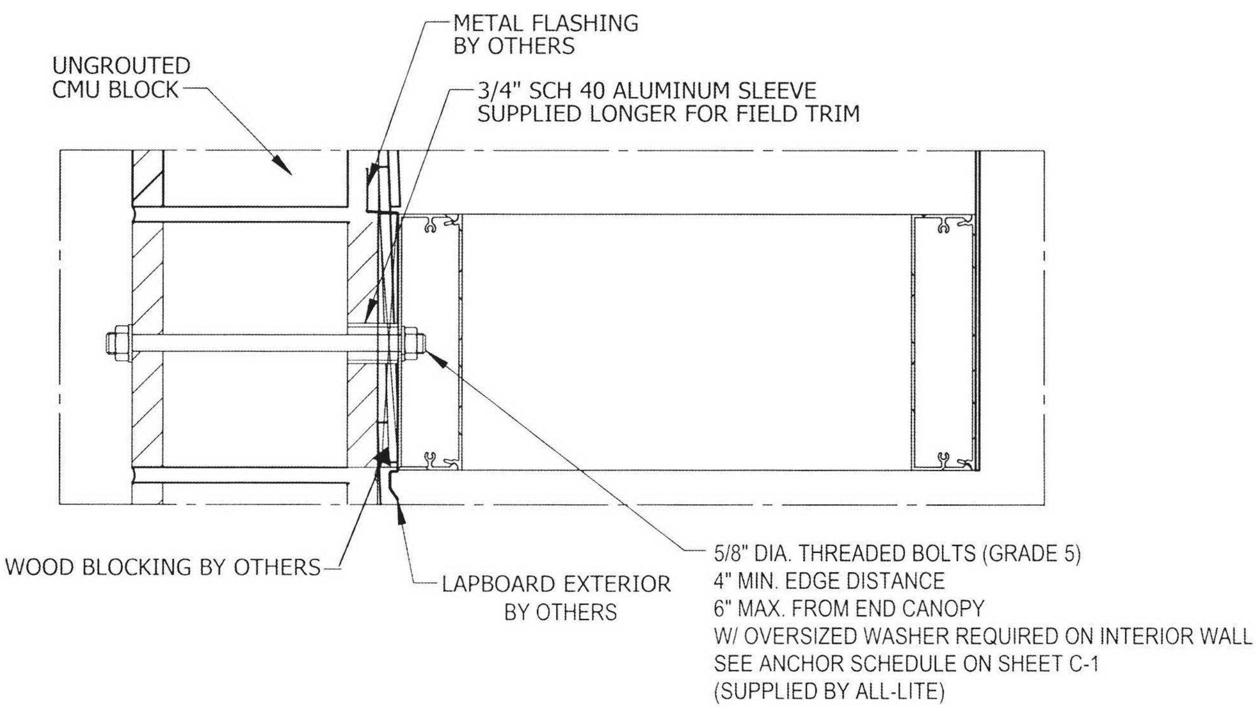
$T_{tball} := 5085$ lb

Check Interior Bolts:

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

$\boxed{TBOLTS = \text{"OK"}}$

Use (2) 5/8" Dia. Threaded Bolts
as shown (Fy = 30,000 psi or better)



CANOPY (R / D-3) MOUNTING DETAIL
SCALE: 2" = 1' D-3

TABLE 11

STAINLESS STEEL - Alloy Groups 1, 2 and 3, Condition CW

Nominal Thread Diameter & Thread/Inch	D Nominal Thread Diameter (Inch)	A(S) Tensile Stress Area (Sq. In.)	A(R) Thread Root Area (Sq. In.)	Allowable Tension (Pounds)	Allowable Shear		Bearing (Pounds)			Minimum Material Thickness to Equal Tensile Capacity of Fastener (In.)		
					Single (Pounds)	Double (Pounds)	1/8" St. A36	1/8" AL 6063-T5	1/8" AL 6063-T6	A36	6063-T5	6063-T6
#6-32	0.1380	0.0091	0.0078	364	180	360	1201	276	414	0.126	0.274	0.198
#8-32	0.1640	0.0140	0.0124	560	286	573	1427	328	492	0.162	0.368	0.261
#10-24	0.1900	0.0175	0.0152	700	351	702	1653	380	570	0.170	0.372	0.267
#12-24	0.2160	0.0242	0.0214	968	494	988	1879	432	648	0.200	0.450	0.321
1/4-20	0.2500	0.0318	0.0280	1272	647	1293	2175	500	750	0.226	0.541	0.360
5/16-18	0.3125	0.0524	0.0469	2096	1083	2166	2719	625	938	0.284	- - -	0.459
3/8-16	0.3750	0.0775	0.0699	3100	1614	3229	3262	750	1125	0.341	- - -	0.553
7/16-14	0.4375	0.1063	0.0961	4252	2219	4439	3906	875	1313	0.395	- - -	0.642
1/2-13	0.5000	0.1419	0.1292	5676	2984	5967	4350	1000	1500	0.456	- - -	0.745
9/16-12	0.5625	0.1819	0.1664	7276	3843	7686	4894	1125	1688	0.510	- - -	0.836
5/8-11	0.6250	0.2260	0.2071	9040	4783	9566	5437	1250	1875	0.563	- - -	0.923
3/4-10	0.7500	0.3345	0.3091	11289	6023	12046	6525	1500	2250	0.590	- - -	0.963
7/8-9	0.8750	0.4617	0.4286	15582	8352	16703	7612	1750	2625	0.686	- - -	1.123
1-8	1.0000	0.6057	0.5630	20442	10970	21941	8700	2000	3000	0.778	- - -	1.276

	DIAMETER Up Thru 5/8"	DIAMETER 3/4" and Over
F_u (Min. Ultimate Tensile Strength)	110,000 psi	85,000 psi
F_y (Min. Tensile Yield Strength)	65,000 psi	45,000 psi
F_t (Allowable Tensile Stress)	40,000 psi	33,750 psi
F_v (Allowable Shear Stress)	23,094 psi	19,486 psi

$$A(R) = 0.7854\left[D - \frac{1.2269}{N}\right]^2$$

$$A(S) = 0.7854\left[D - \frac{0.9743}{N}\right]^2$$

For Diameters Up Thru 5/8":

$$F_t = 0.40F_u$$

$$\text{Allowable tension} = 0.40F_u[A(S)]$$

$$F_v = \frac{0.40}{\sqrt{3}}F_u$$

$$\text{Allowable shear (Single)} = \frac{0.40}{\sqrt{3}}F_u[A(R)]$$

For Diameters 3/4" and Over:

$$F_t = 0.75F_y$$

$$\text{Allowable tension} = 0.75F_y[A(S)]$$

$$F_v = \frac{0.75}{\sqrt{3}}F_y$$

$$\text{Allowable shear (Single)} = \frac{0.75}{\sqrt{3}}F_y[A(R)]$$

In Tables 9 thru 15, for Group Type and Condition Definitions see pages 21 and 22.