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

Cielo Heavy Duty Post System
Windscreen Calculations

Project Location:
Los Angeles, California
REI Project # R26-06-013

Prepared for:
CRLaurence - Los Angeles, CA
7/22/2026

Design Criteria:

1. Compliance with IBC 2012, IBC 2015, IBC 2018, IBC2021, IBC2024, ASCE 7-10, ASCE 7-16, and ASCE 7-22
2. The Cielo System has been designed for the following:
   A) 200 lb over 1 ft^2 of infill glass applied at 42" above finished floor at the center of the panel width
   B) 50 lb/ft uniform load applied to the glass at 42" above finished floor across the full panel width
   C) Wind Loads from 15 PSF to 80 PSF over windscreen dimensions varying from 36" to 60" wide by 6'-0" to 8'-0" tall
3. The seismic anchorage design information provided in this calculation package is for reference only and is not applicable for risk Category III or IV buildings and/or all buildings that fall within Seismic Design Categories D, E or F; a licensed design professional should be consulted for Cielo system installations in these locations.
4. Stainless steel / steel members designed per "AISC Steel Construction Manual"
5. Member sizes, grade, alloy and strengths shall be as recommended in the calculation package
6. Stainless steel fasteners to be minimum Condition "CW", 300 Series, Fu=100 ksi
7. Carbon steel fasteners to be minimum SAE Grade 5, Fu= 120 ksi (Hot Dip Galvanized for exterior conditions)
8. All other fasteners shall be the size and strength as is recommended in the calculation package
9. Cement or epoxy based grout shall be a minimum F'c= 10,500 psi, non-metallic, non-shrink.
10. Concrete slabs to be F'c=4,000 psi min., normal weight with 6" min. slab thickness for surface mount stanchions and 8" min. slab thickness for embedded stanchions. Calculations assume cracked concrete.
11. Anchorage for Seismic Category D, E & F regions should be designed by a licensed professional.
12. Lightweight concrete slabs and/or corrugated metal deck slabs should not be used to anchor the Cielo system posts.
13. Concrete anchors shall be as recommended in the calculation package. Installer is responsible for maintaining the fastener spacing, edge distance, end distance, embedment depth and minimum substrate thickness that is recommended in the calculation package
14. Concrete anchors shall be installed per manufacturer's recommended installation procedures, including recommended ambient temperatures for chemical/adhesive anchors
15. Structural steel, concrete slabs, concrete curbs, masonry units and all other host structure substrates designed by others
16. All glass is to be 9/16" thick fully tempered and laminated (1/4" FT x 0.060" SGP x ¼" SGP) with exposed edges polished; maximum/minimum glass lite to be 5'-0" Wide x 8'-0" Tall.
17. Per IBC, glass has been designed using a safety factor of 4 in determining the allowable flexural stress (24,000/4= 6,000 psi)
18. Per IBC, glass panels need to be manufactured from an approved safety glazing material conforming to CPSC 16 CFR 1201 (II). The glass manufacturer is responsible to provide acceptable safety glass conforming to the IBC & CPSC provisions.
19. Fully tempered glass is susceptible to breakage due to impact on the glass edge by airborne debris, as well as the possibility of spontaneous breakage due to nickel sulfide contamination. In the case of accidental breakage, laminated glass minimizes the risk of falling glass. Laminated glass in exterior applications where glass edges are exposed should be protected from water, moisture, or humidity infiltration to prevent delamination of the glass layers. Our analysis of this system verifies code compliance for stress and deflection but does not include analysis of potential glass delamination due to water, moisture and humidity infiltration.
20. Shim dis-similar metals. Maximum recommended shim height for the Cielo system is 1/4". Use full bearing structural shims.
21. Design of material separation to prevent reaction between dissimilar materials not designed by Rice Engineering Inc.
22. Due to the large amount of data involved for the engineering of this divider system, only information pertinent to the worst-case design scenarios have been included in this calculation package. Please contact CR Laurence if additional information is needed.

Disclaimer:

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

- Structural design of hardware, clevises, and turnbuckles.
- 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:

SIGNED / SEALED VERSION OF THIS REPORT IS AVAILABLE UPON REQUEST. PLEASE PROVIDE SITE SPECIFIC TECHNICAL DOCUMENTS SHOWING PROJECT ADDRESS, DESIGN INTENT, SPECIAL CODE REQUIREMENTS AND HOST STRUCTURE ANCHORAGE SUBSTRATE.

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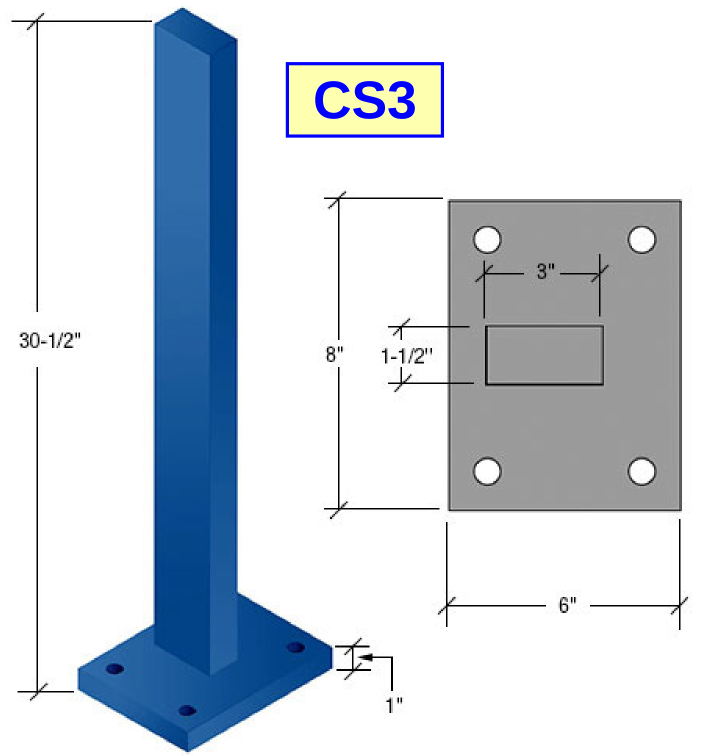
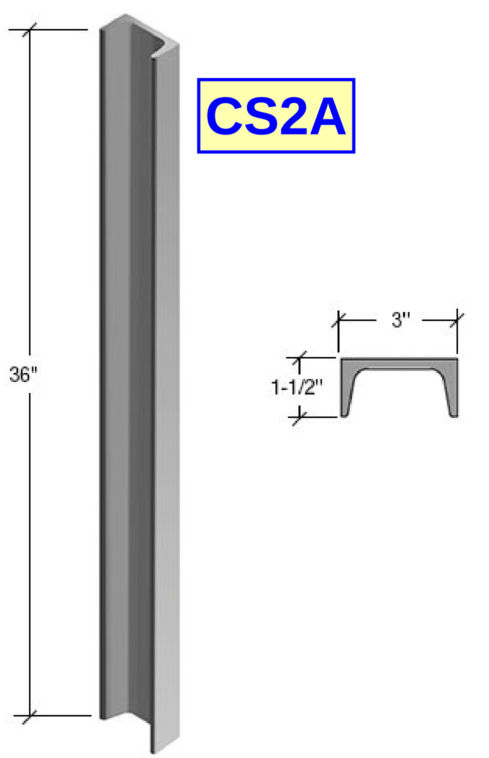
***NOTE:* STRUCTURAL STEEL, CONCRETE, CMU, MASONRY, WOOD/STEEL STUD WALLS, WOOD BLOCKING AND ALL OTHER HOST STRUCTURE ANCHORAGE SUBSTRATES ARE ASSUMED DESIGNED BY OTHERS**

CIELO SYSTEM - AVAILABLE STANCHION SELECTIONS	Detail Ref.	Sheet No: E1

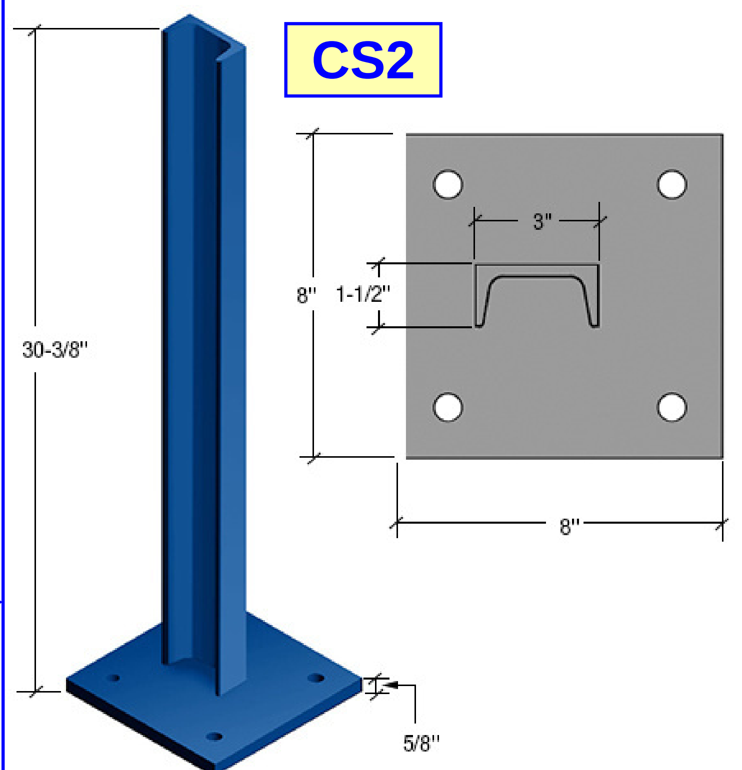
NOTE: THIS STANCHION LAYOUT IS MEANT TO BE USED WITH THRU BOLTS INTO STRUCTURAL STEEL. IF THIS BASE PLATE / STANCHION LAYOUT IS BEING USED WITH A CONCRETE ANCHORAGE SUBSTRATE, CONTACT CR LAURENCE FOR MAX ALLOWABLE POST HEIGHT / POST SPACING DIMENSIONS.





CORE MOUNT STANCHION

STANCHION CAN BE MOUNTED TO CONCRETE OR STEEL



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			Engineer: KEP	Sheet No: E1
			Date: 6/5/2026	Rev:
			Chk By:	Date:

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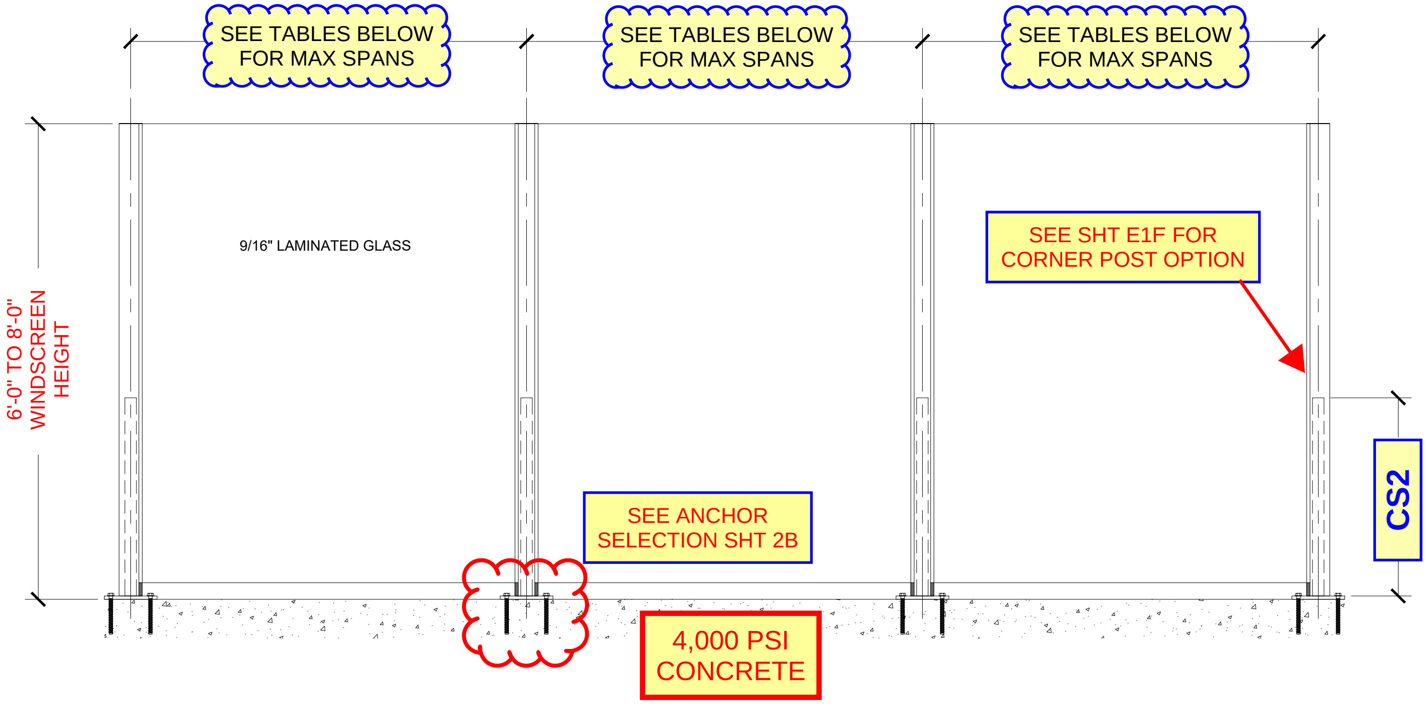
CIELO SYSTEM - ANCHORAGE TO 4,000 PSI CONCRETE	Detail Ref.	Sheet No: E1 A



6'-0" Tall Windscreen W/ 4,000 psi Concrete

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	N/A
35	OK	OK	OK	N/A	N/A
40	OK	OK	N/A	N/A	N/A
45	OK	N/A	N/A	N/A	N/A
50	N/A	N/A	N/A	N/A	N/A

7'-0" Tall Windscreen W/ 4,000 psi Concrete

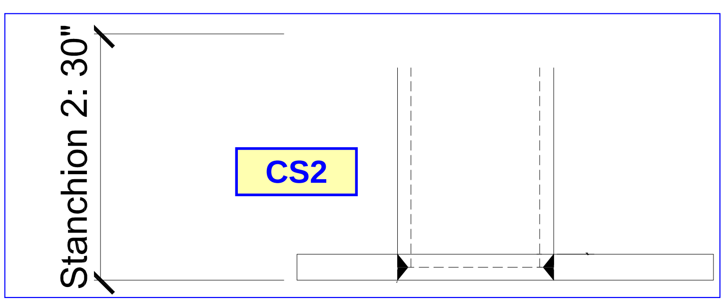
POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	N/A	N/A
30	OK	OK	N/A	N/A	N/A
35	OK	N/A	N/A	N/A	N/A
40	N/A	N/A	N/A	N/A	N/A

8'-0" Tall Windscreen W/ 4,000 psi Concrete

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	N/A	N/A
25	OK	N/A	N/A	N/A	N/A
30	N/A	N/A	N/A	N/A	N/A



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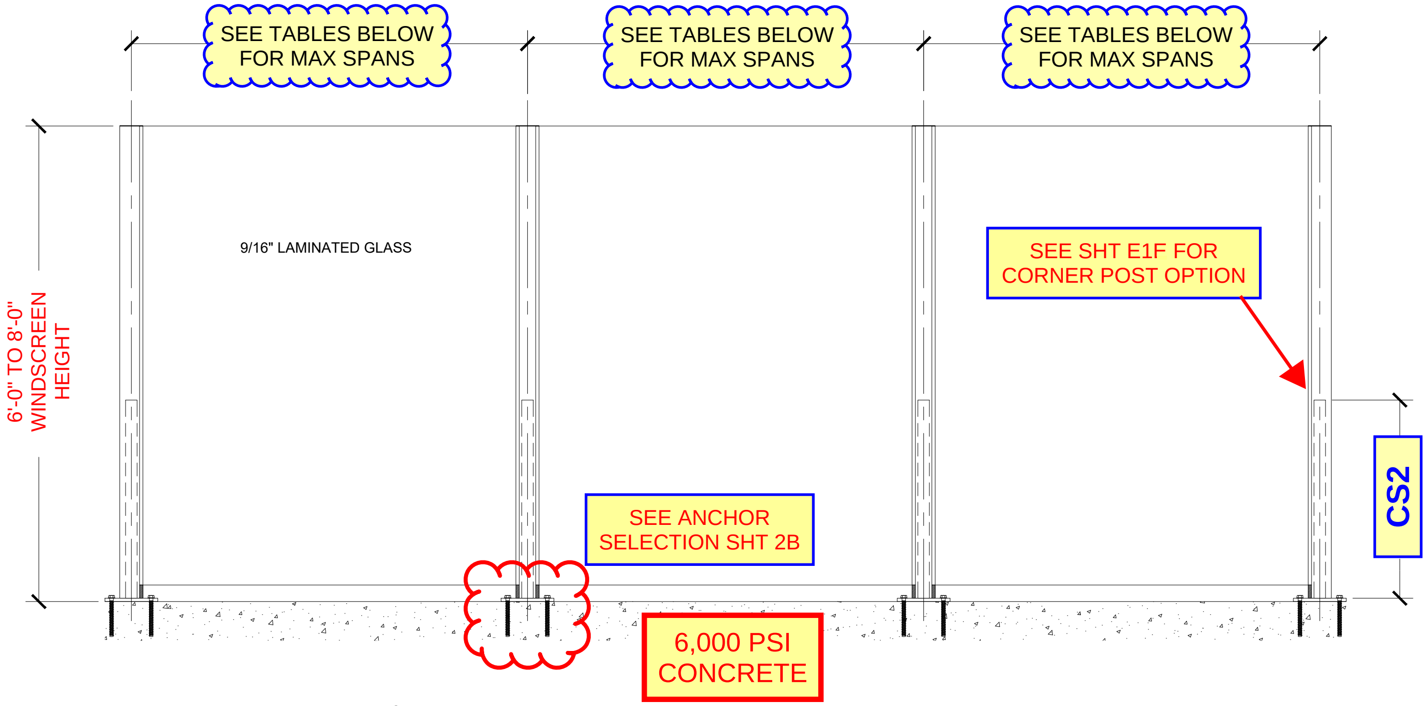
CIELO SYSTEM - ANCHORAGE TO 6,000 PSI CONCRETE	Detail Ref.	Sheet No: E1 B



6'-0" Tall Windscreen W/ 6,000 psi Concrete

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	N/A
45	OK	OK	OK	N/A	N/A
50	OK	OK	N/A	N/A	N/A
55	OK	N/A	N/A	N/A	N/A
60	OK	N/A	N/A	N/A	N/A
65	N/A	N/A	N/A	N/A	N/A

7'-0" Tall Windscreen W/ 6,000 psi Concrete

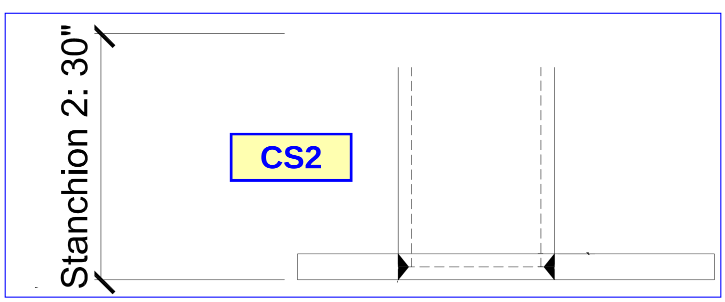
POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	N/A	N/A
35	OK	OK	N/A	N/A	N/A
40	OK	N/A	N/A	N/A	N/A
45	N/A	N/A	N/A	N/A	N/A

8'-0" Tall Windscreen W/ 6,000 psi Concrete

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	N/A	N/A
30	OK	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A	N/A



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Project Description:	Job No:	R26-06-013		
Cielo Windscreen 2026	Engineer:	KEP	Sheet No:	E1 B
	Date:	6/5/2026	Rev:	
	Chk By:		Date:	

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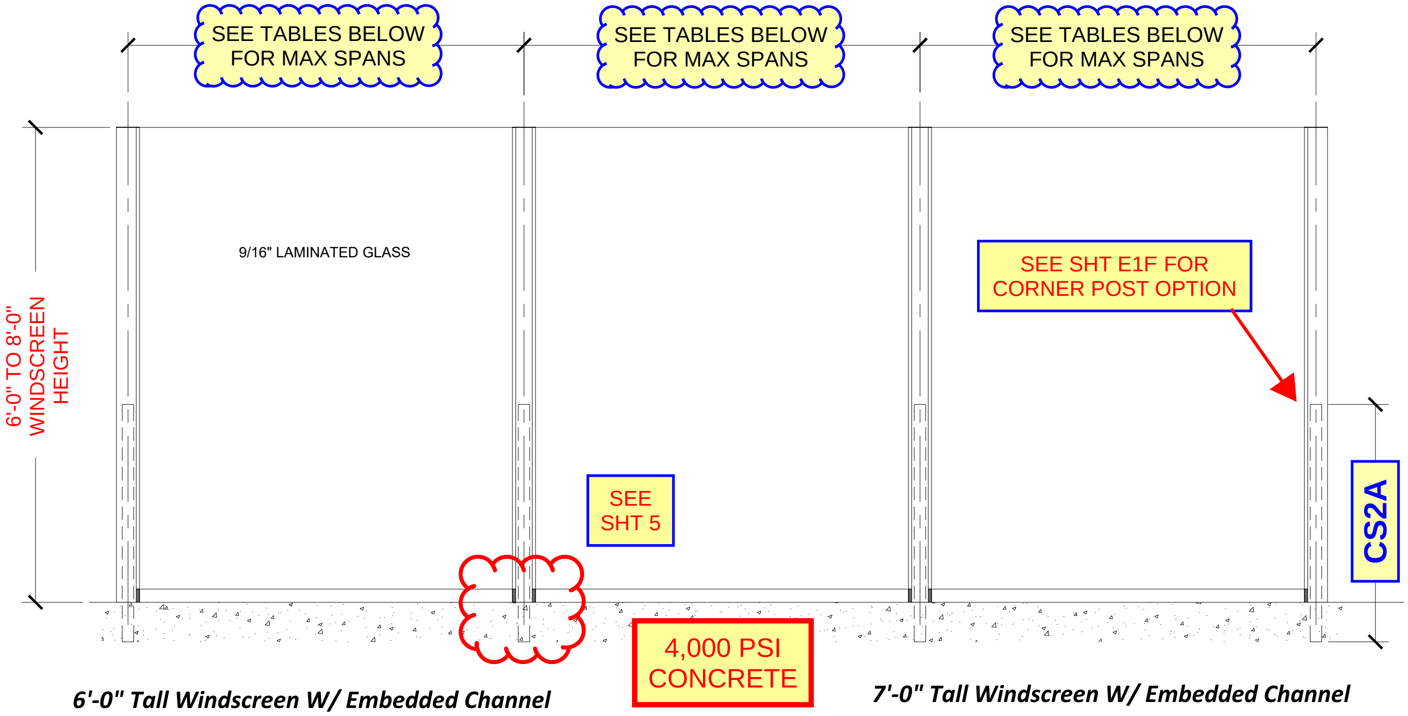
CIELO SYSTEM - EMBEDDED IN 4,000 PSI CONCRETE	Detail Ref.	Sheet No: E1 C



6'-0" Tall Windscreen W/ Embedded Channel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	OK
45	OK	OK	OK	OK	N/A
50	OK	OK	OK	N/A	N/A
55	OK	OK	N/A	N/A	N/A
60	OK	N/A	N/A	N/A	N/A
65	OK	N/A	N/A	N/A	N/A

7'-0" Tall Windscreen W/ Embedded Channel

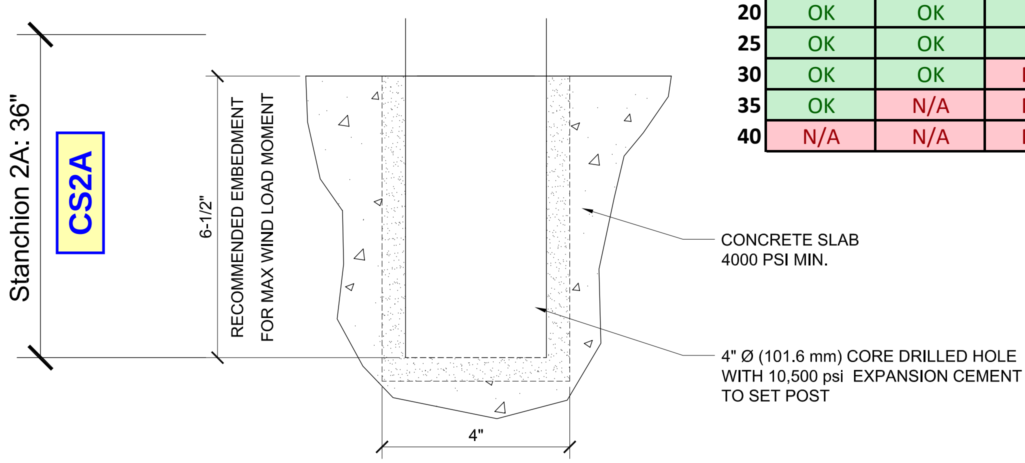
POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	N/A	N/A
40	OK	OK	N/A	N/A	N/A
45	OK	N/A	N/A	N/A	N/A
50	OK	N/A	N/A	N/A	N/A

8'-0" Tall Windscreen W/ Embedded Channel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	N/A
30	OK	OK	N/A	N/A	N/A
35	OK	N/A	N/A	N/A	N/A
40	N/A	N/A	N/A	N/A	N/A



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Job No:	R26-06-013		
Engineer:	KEP	Sheet No:	E1 C
Date:	6/5/2026	Rev:	
Chk By:		Date:	

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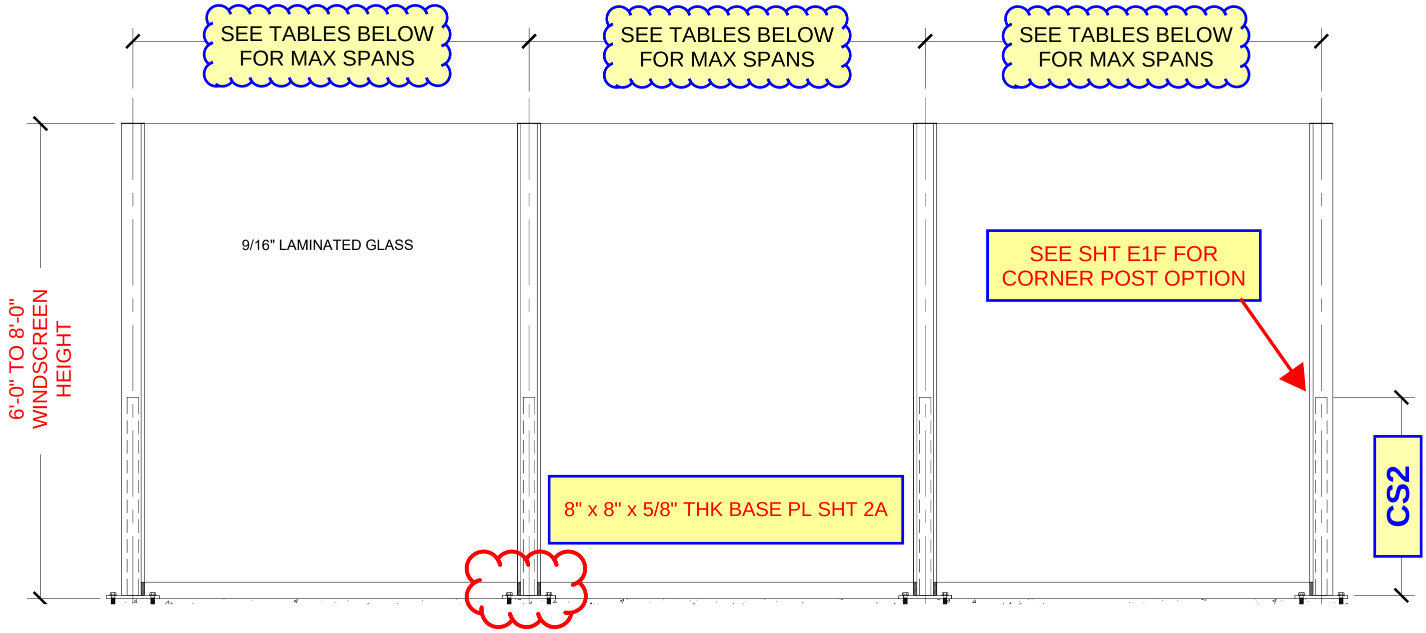
CIELO SYSTEM - SURFACE MOUNT 8" x 8" x 5/8" PLATE TO STEEL	Detail Ref.	Sheet No: E1 D



6'-0" Tall Windscreen: 5/8" Base Plate Anchored to Steel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	N/A
45	OK	OK	OK	N/A	N/A
50	OK	OK	N/A	N/A	N/A
55	OK	N/A	N/A	N/A	N/A
60	OK	N/A	N/A	N/A	N/A
65	N/A	N/A	N/A	N/A	N/A

7'-0" Tall Windscreen: 5/8" Base Plate Anchored to Steel

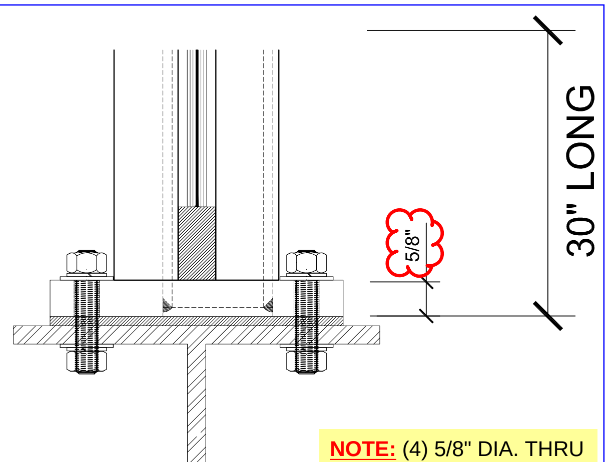
POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	N/A	N/A
35	OK	OK	N/A	N/A	N/A
40	OK	N/A	N/A	N/A	N/A
45	N/A	N/A	N/A	N/A	N/A

8'-0" Tall Windscreen: 5/8" Base Plate Anchored to Steel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	N/A	N/A
30	OK	N/A	N/A	N/A	N/A
35	N/A	N/A	N/A	N/A	N/A



NOTE: (4) 5/8" DIA. THRU BOLTS OR DRILL/TAP 5/16" THK 36ksi STEEL

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Template:

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Cielo Windscreen 2026	Engineer:	KEP	Sheet No:	E1 D
	Date:	6/5/2026	Rev:	
	Chk By:		Date:	

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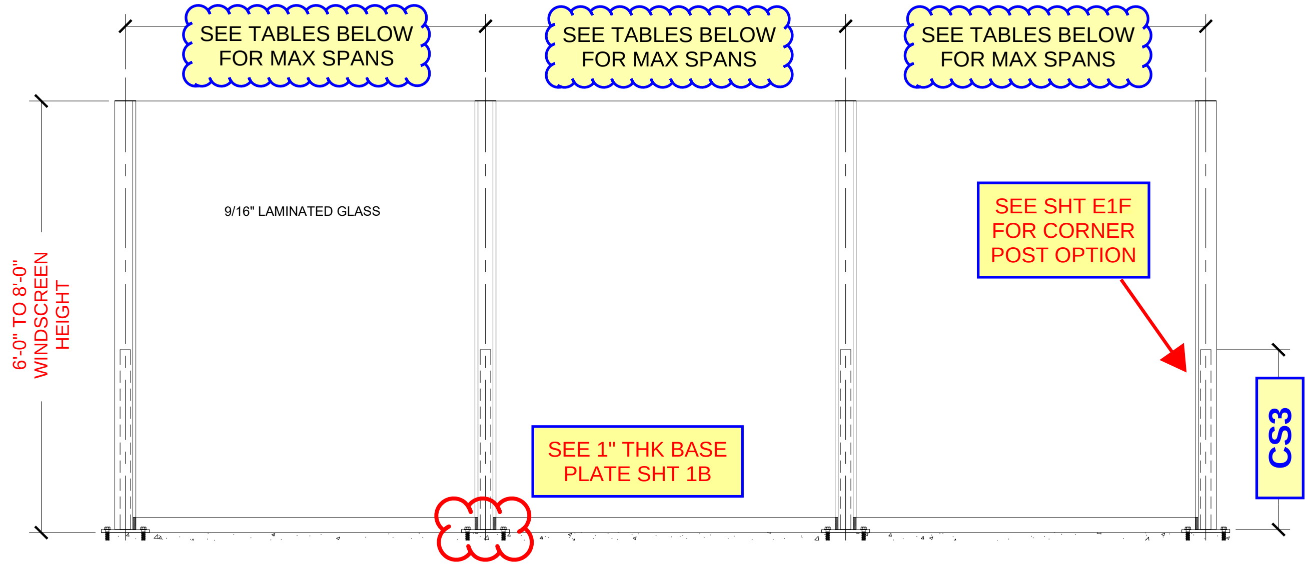
CIELO SYSTEM - SURFACE MOUNT 6" x 8" x 1" PLATE TO STEEL	Detail Ref.	Sheet No: E1 E



6'-0" Tall Windscreen Anchored to Steel

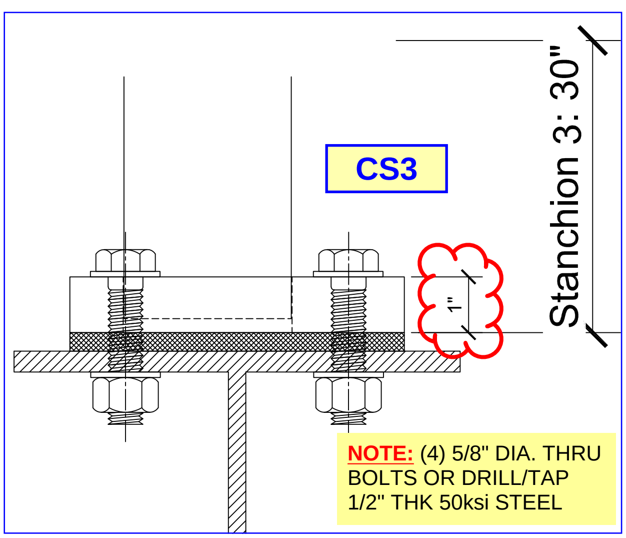
POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	OK
45	OK	OK	OK	OK	OK
50	OK	OK	OK	OK	OK
55	OK	OK	OK	OK	OK
60	OK	OK	OK	OK	OK
65	OK	OK	OK	OK	OK
70	OK	OK	OK	OK	OK
75	OK	OK	OK	OK	OK
80	OK	OK	OK	OK	OK

7'-0" Tall Windscreen Anchored to Steel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	OK
45	OK	OK	OK	OK	OK
50	OK	OK	OK	OK	OK
55	OK	OK	OK	OK	OK
60	OK	OK	OK	OK	N/A
65	OK	OK	OK	OK	N/A
70	OK	OK	OK	N/A	N/A
75	OK	OK	N/A	N/A	N/A
80	OK	OK	N/A	N/A	N/A



8'-0" Tall Windscreen Anchored to Steel

POST SPACING (Inches)

PSF	36	42	48	54	60
15	OK	OK	OK	OK	OK
20	OK	OK	OK	OK	OK
25	OK	OK	OK	OK	OK
30	OK	OK	OK	OK	OK
35	OK	OK	OK	OK	OK
40	OK	OK	OK	OK	OK
45	OK	OK	OK	OK	OK
50	OK	OK	OK	OK	N/A
55	OK	OK	OK	N/A	N/A
60	OK	OK	N/A	N/A	N/A
65	OK	N/A	N/A	N/A	N/A
70	OK	N/A	N/A	N/A	N/A
75	OK	N/A	N/A	N/A	N/A
80	N/A	N/A	N/A	N/A	N/A

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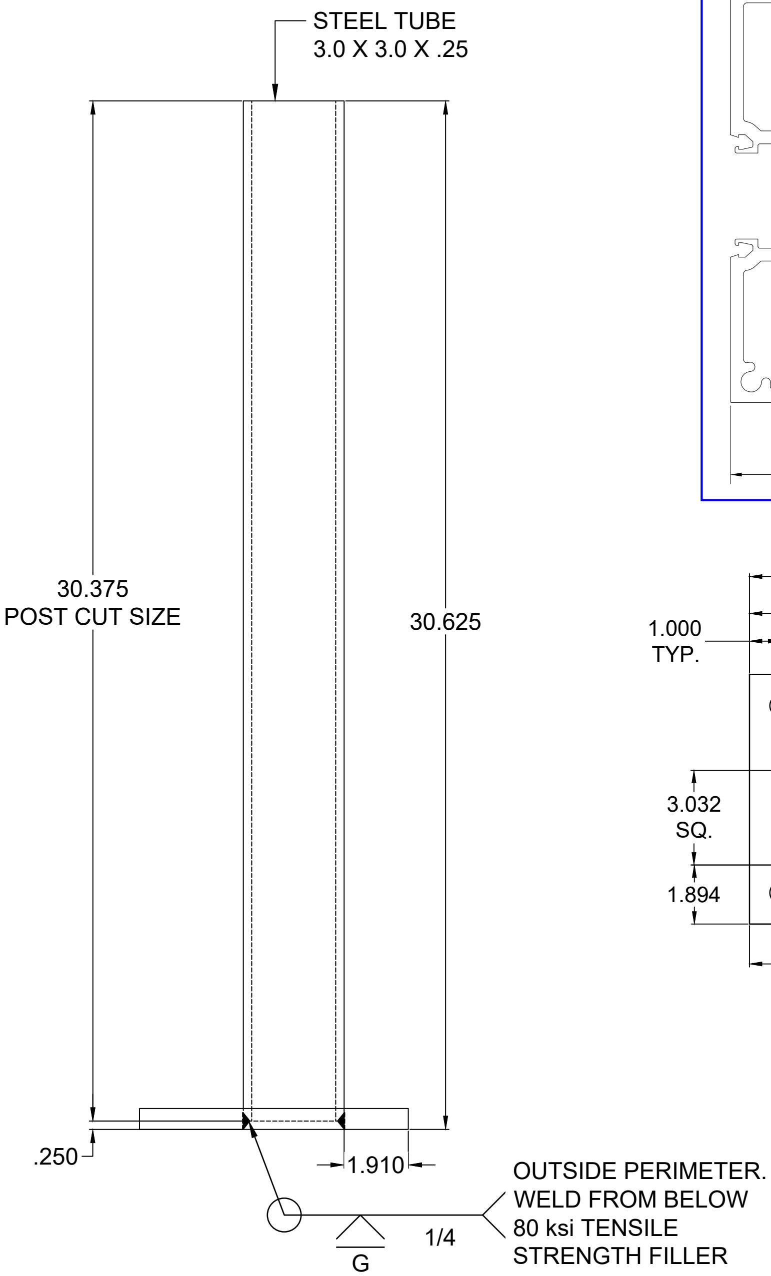
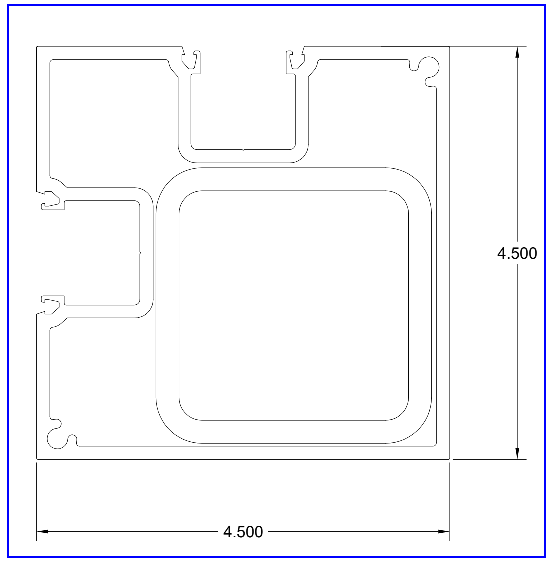
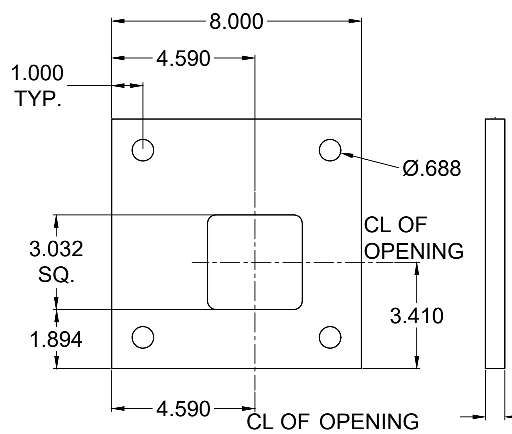
CIELO SYSTEM - SURFACE MOUNT CORNER STANCHIONS	Detail Ref.	Sheet No: E1 F



FRONT VIEW





CS4 - 5/8" THK
CS5 - 1" THK

NOTES:

1) ANCHORS FOR THE CORNER POST CONDITIONS WILL BE THE SAME AS THOSE USED FOR THE TYPICAL ANCHOR LOCATIONS OF THE CIELO WINDSCREEN SYSTEM

2) BASE PLATE DIMENSIONS AND THICKNESSES WILL BE THE SAME AS THE PLATES THAT ARE BEING USED FOR THE TYPICAL AREAS OF THE CIELO WINDSCREEN SYSTEM

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TYPICAL CORNER POST & STANCHION LAYOUT

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			Engineer: KEP	Sheet No: E1 F
			Date: 6/5/2026	Rev:
			Chk By:	Date:

Cielo System - 1-1/2" x 3" Stanchion Analysis	Detail Ref.	Sheet No: 1

Bar Properties:

$H_p := 30\text{in}$

$L_b := 0.5 \cdot H_p = 15 \cdot \text{in}$

$d_p := 3\text{in}$

$t_p := 1.5\text{in}$

$Z_x := 3.375\text{in}^3$

$S_x := 2.25\text{in}^3$

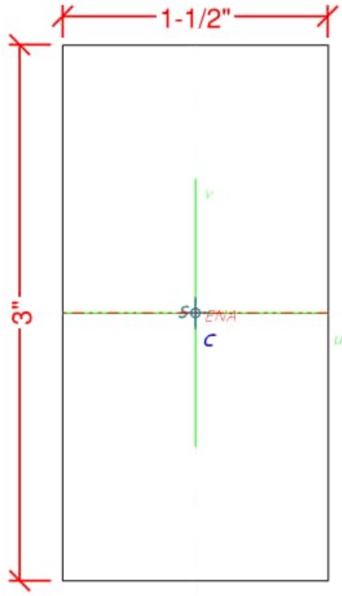
$C_b := 1$

Material Information:

$F_y := 46\text{ksi}$

$E_{st} := 29000\text{ksi}$

$\Omega_c := 1.67$



Ix	(in^4)	+3.375
Iy	(in^4)	+0.844
Ixy	(in^4)	+0.
Io	(in^4)	+4.219
rx	(in)	+0.866
ry	(in)	+0.433
ro	(in)	+0.968
Y top (in)		+1.5
Y bot (in)		+1.5
Sx top (in^3)		+2.25
Sx bot (in^3)		+2.25
X right (in)		+0.75
X left (in)		+0.75
Sy right (in^3)		+1.125
Sy left (in^3)		+1.125
Zpx	(in^3)	+3.375
Zpy	(in^3)	+1.687

Area	+4.5 in^2

Torsion and Shear	
J(Torsion)	+2.319 in^4

Check Bar Capacity: AISC Steel Construction Manual

$\frac{L_b \cdot d_p}{t_p^2} = 20 \qquad \frac{0.08 \cdot E_{st}}{F_y} = 50.43 \qquad \frac{1.9 \cdot E_{st}}{F_y} = 1197.83$

$M_p := F_y \cdot Z_x = 155250 \cdot \text{in} \cdot \text{lbf} \qquad M_y := F_y \cdot S_x = 103500 \cdot \text{in} \cdot \text{lbf}$

$$M_n := \begin{cases} \left(\min\left(M_p, 1.6 \cdot M_y\right)\right) & \text{if } \frac{L_b \cdot d_p}{t_p^2} \le \frac{0.08 \cdot E_{st}}{F_y} \\ \min\left[C_b \cdot \left(1.52 - 0.274 \cdot \frac{L_b \cdot d_p}{t_p^2} \cdot \frac{F_y}{E_{st}}\right) \cdot M_y, M_p\right] & \text{if } \left(\frac{0.08 \cdot E_{st}}{F_y}\right) < \frac{L_b \cdot d_p}{t_p^2} \le \left(\frac{1.9 \cdot E_{st}}{F_y}\right) \\ \left[\min\left[\frac{1.9E_{st}}{\left(\frac{L_b \cdot d_p}{t_p^2}\right)} \cdot S_x, M_p\right]\right] & \text{otherwise} \end{cases}$$

$M_n = 155250 \cdot \text{in} \cdot \text{lbf}$

$$\boxed{M_{all1} := \frac{M_n}{\Omega_c} = 92964 \cdot \text{in} \cdot \text{lbf}}$$

$TW := 60\text{in} \qquad WL := 80\text{psf} \qquad H_{ws} := 72\text{in}$

$$\boxed{M_{max} := TW \cdot WL \cdot \frac{H_{ws}^2}{2} = 86400 \cdot \text{in} \cdot \text{lbf}} \qquad \boxed{V_{max} := TW \cdot WL \cdot H_{ws} = 2400\text{lbf}}$$

$I_{st} := \frac{M_{max}}{M_{all1}} = 0.93$

STANCHION DOES NOT LIMIT DESIGN

Use 1-1/2" x 3" Steel Bar
46 ksi Yield Strength Minimum

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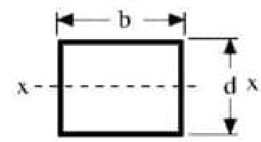
			Engineer: KEP	Sheet No: 1
			Date: 6/5/2026	Rev:
			Chk By:	Date:

Cielo System - 1-1/2" x 3" Stanchion Analysis	Detail Ref.	Sheet No: 1 A

Check Weld Capacities:

$F_u := 70000\,psi$ ***E70XX Filler*** $\Omega := 1.88$



$$S_w = bd + \frac{d^2}{3}$$

Worst Case Stanchion Weld at Steel Anchorage

$b_{st} := 1.5in$ $d_{st} := 3in$ $t_w := 0.5in$ (thickness of weld)

$b_w := b_{st}$ $b_w = 1.5 \cdot in$

$d_w := d_{st}$ $d_w = 3 \cdot in$

$S_w := t_w \cdot \left(b_w \cdot d_w + \frac{d_w^{\,2}}{3}\right)$ $S_w = 3.75 \cdot in^3$

$f_w := \frac{M_{max}}{S_w} = 23040\,psi$ $f_w = 23040\,psi$

$F_w := \frac{0.6 \cdot F_u}{\Omega} = 22340\,psi$ $F_w = 22340\,psi$

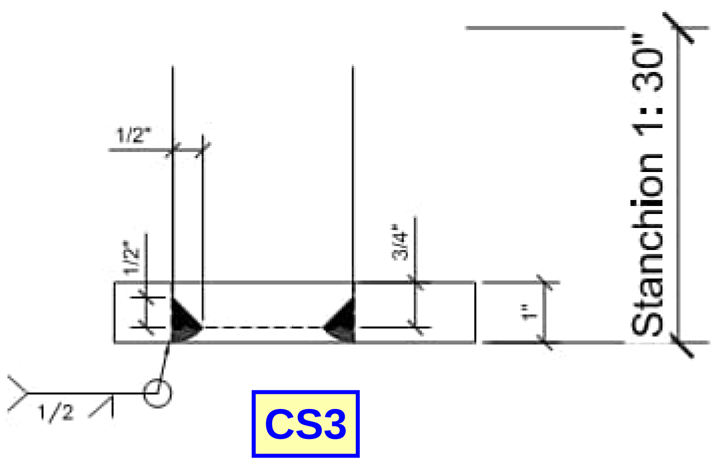
$I_w := \frac{f_w}{F_w} = 1.03$ ***WELD LIMITS DESIGN***

View of Weld From Below

Use 1/2" Bevel Weld All Around, As Noted
70 ksi tensile strength filler alloy

NOTE: WELDS WERE TESTED TO 7,200 LB AT 30" A.F.F. A VIEW OF THE TESTED WELD IS ABOVE W/ NO SIGNS OF FAILURE. TOTAL MOMENT TESTED WAS 216,600 IN-LB

NOTE: STANCHIONS ARE PASSED PART WAY THRU BASE PLATES AND ARE BEVEL WELDED FROM BELOW W/ ADDED FILLET WELD TO THE BOTTOM EDGE; SEE DETAIL BELOW FOR TYP WELD



1-1/2" x 3" x 30" tall stanchion with 1" thick steel plate

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			Engineer: KEP	Sheet No: 1 A
			Date: 6/5/2026	Rev:
			Chk By:	Date:

$d := 3in$ $b := 1.5in$ $F_y := 50ksi$ $t_{pl1} := 1in$

Cielo System - 1-1/2" x 3" Stanchion Analysis	Detail Ref.	Sheet No: 1 B

Chk Base Plate at Steel Anchorage:

$L1 := 6in$ $D1 := 1in$

$L2 := 8in$ $D2 := 1in$

$L := L2 - (2 \cdot D2)$ $L = 6 \cdot in$

$A := \frac{L - d}{2}$ $A = 1.5 \cdot in$

$B := L - A$ $B = 4.5 \cdot in$

$P := \frac{M_{max}}{d}$ $P = 28800 lbf$

$M_{pl} := \frac{P \cdot A \cdot B}{L}$ $M_{pl} = 32400 \cdot in \cdot lbf$

$t_{req1} := \sqrt{\frac{M_{pl} \cdot 6}{0.75 \cdot F_y \cdot L1}}$ $t_{req1} = 0.93 \cdot in$

$I_{pl1} := \frac{t_{req1}}{t_{pl1}} = 0.93$

BASE PLATE DOES NOT LIMIT DESIGN

<u>Use 6" x 8" x 1" Thk Plate (See Tables Sht E1D)</u>
ASTM A572 Gr 50, Fy= 50 ksi Steel

Max Load for 5/8" Thk Base Plate at Steel Anchorage:

$M_{alt} := 40000 in \cdot lbf$ $t_{pl2} := 0.63in$

$P_2 := \frac{M_{alt}}{d}$ $P_2 = 13333 lbf$

$M_{pl2} := \frac{P_2 \cdot A \cdot B}{L}$ $M_{pl2} = 15000 \cdot in \cdot lbf$

$t_{req2} := \sqrt{\frac{M_{pl2} \cdot 6}{0.75 \cdot F_y \cdot L1}}$ $t_{req2} = 0.632 \cdot in$

$I_{pl2} := \frac{t_{req2}}{t_{pl2}} = 1$

<u>Use 6" x 8" x 5/8" Thk Plate (See Tables Sht E1C)</u>
ASTM A572, Fy= 50 ksi Steel, (See Welds Sht 2A)

<u>Check Bolt Capacities: (Min. 1/2" Thread Eng. into 50 ksi Min. Steel)</u>

$t_{st} := 0.5in$ $n := \frac{11}{in}$ $A_{TSI} := 0.13in^2$

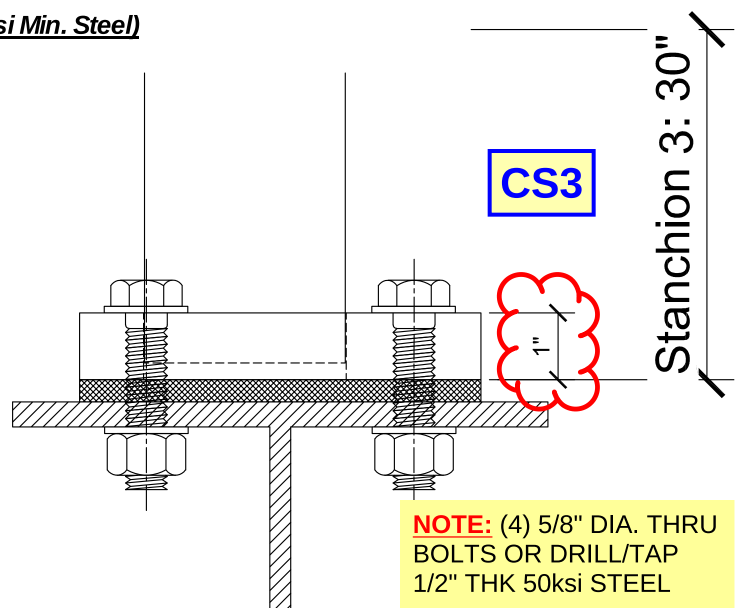
$F_{TU} := 65ksi$ $SF := 3$ $d_b := 0.625in$

$D_{PL} := 6in$ *Depth of Plate* $D_{ED} := 1in$ *Bolt Edge Dist*

$T_{Bmax} := t_{st} \cdot n \cdot A_{TSI} \cdot \frac{F_{TU}}{SF \cdot \sqrt{3}} = 8944 lbf$

$M_{all4} := 2 \cdot T_{Bmax} \cdot (D_{PL} - D_{ED}) = 89441 \cdot in \cdot lbf$

$I_{bolt} := \frac{M_{max}}{M_{all4}} = 0.97$



NOTE: (4) 5/8" DIA. THRU BOLTS OR DRILL/TAP 1/2" THK 50ksi STEEL

<u>Use (4) - 5/8" Dia. Thru Bolts or Drill / Tap</u>
300 Series S.S., Cond. CW, Fu= 100 ksi Min
*or ASTM A449 (**HDG**), Fu= 120 ksi Min*
Min. 1/2" thread Eng. to Grade 50 steel or Better

<u>NOTE:</u> THIS STANCHION LAYOUT IS MEANT TO BE USED WITH THRU BOLTS INTO STRUCTURAL STEEL. IF THIS BASE PLATE / STANCHION LAYOUT IS BEING USED WITH A CONCRETE ANCHORAGE SUBSTRATE, CONTACT CR LAURENCE FOR MAX ALLOWABLE POST HEIGHT / POST SPACING DIMENSIONS.

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Cielo System - C3x5 Channel Stanchion Analysis	Detail Ref.	Sheet No: 2

Bar Properties:

$H_p := 30in$

$L_b := 0.5 \cdot H_p = 15 \cdot in$

$d_p := 3in$

$t_p := 1.5in$

$Z_x := 1.54in^3$

$S_x := 1.25in^3$

$r_y := 0.41in$

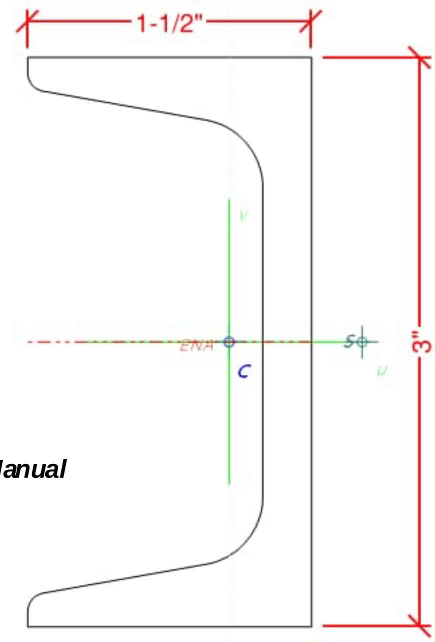
$C_b := 1$

Material Information:

$F_y := 50ksi$

$E_{st} := 29000ksi$

$\Omega_c := 1.67$



Ix	(in^4)	+1.871
Iy	(in^4)	+0.245
Ixy	(in^4)	+0.
Io	(in^4)	+2.116
rx	(in)	+1.122
ry	(in)	+0.406
ro	(in)	+1.193
Y top (in)		+1.5
Y bot (in)		+1.5
Sx top (in^3)		+1.247
Sx bot (in^3)		+1.247
X right (in)		+0.436
X left (in)		+1.064
Sy right (in^3)		+0.563
Sy left (in^3)		+0.23
Zpx	(in^3)	+1.536
Zpy	(in^3)	+0.464
Area		+1.487 in^2
J(Torsion)		+0.047 in^4

Check Channel Capacity: AISC Steel Construction Manual

$M_p := F_y \cdot Z_x = 77000 \cdot in \cdot lbf$

$L_p := 1.76 \cdot r_y \cdot \sqrt{\frac{E_{st}}{F_y}} = 17.38 \cdot in$ $\geq$ Lb, ***LTB Not Applicable***

$M_n := M_p = 77000 \cdot in \cdot lbf$

$\boxed{M_{all1} := \frac{M_n}{\Omega_c} = 46108 \cdot in \cdot lbf}$

$TW := 60in$ $\quad WL := 30psf$ $\quad H_{ws} := 84in$

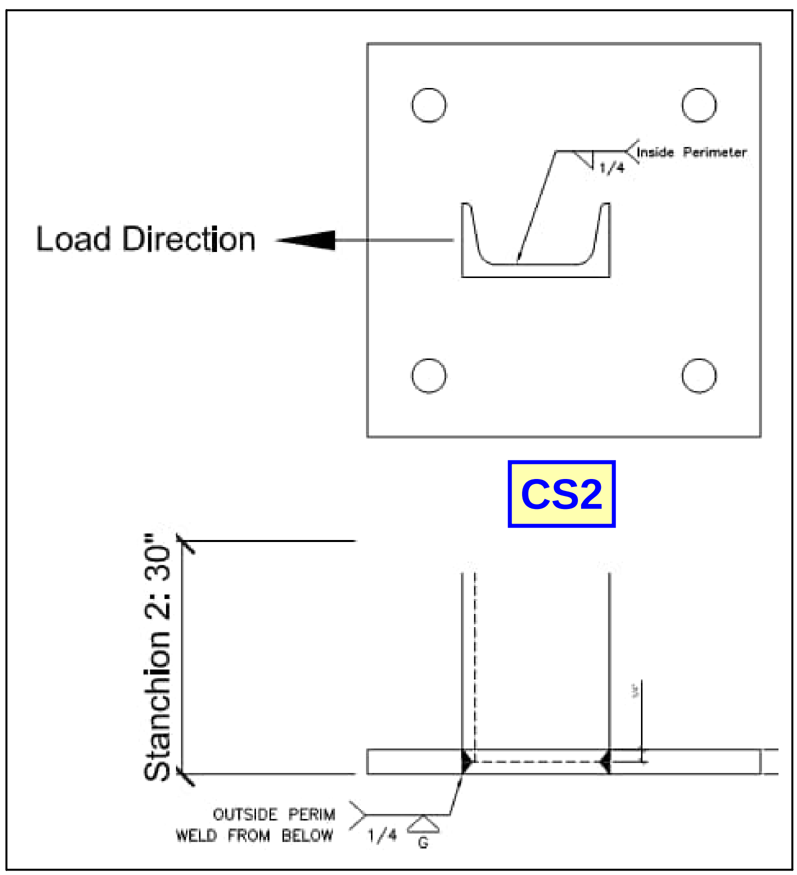
$\boxed{V_{max} := TW \cdot WL \cdot H_{ws} = 1050lbf}$

$\boxed{M_{max} := TW \cdot WL \cdot \frac{H_{ws}^2}{2} = 44100 \cdot in \cdot lbf}$

$I_{st} := \frac{M_{max}}{M_{all1}} = 0.96$

STANCHION DOES NOT LIMIT DESIGN

Use C3x5 Steel Channel
Grade 50, Fy= 50 ksi Min



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Cielo System - C3x5 Channel Stanchion Analysis	Detail Ref.	Sheet No: 2 A

Check Weld Capacities:

$F_u := 70000\,psi$ ***E70XX Filler*** $\Omega := 2$

Worst Case Channel Weld at Concrete Anchorage

$b_{st} := 1.5in$ $d_{st} := 3in$ $t_w := 0.25in$ (thickness of weld)

$b_w := b_{st} = 1.5 \cdot in$ $b_{w2} := 1.11in$

$d_w := d_{st} = 3 \cdot in$ $d_{w2} := 1.63in$

$S_{w1} := 1.25in^3$ $S_{w2} := 0.707 \cdot t_w \cdot \left(b_{w2} \cdot d_{w2} + \frac{d_{w2}^2}{6} \right) = 0.4 \cdot in^3$

$S_{w3} := 0.707 \cdot t_w \cdot \left(b_w \cdot d_w \right) = 0.8\,in^3$

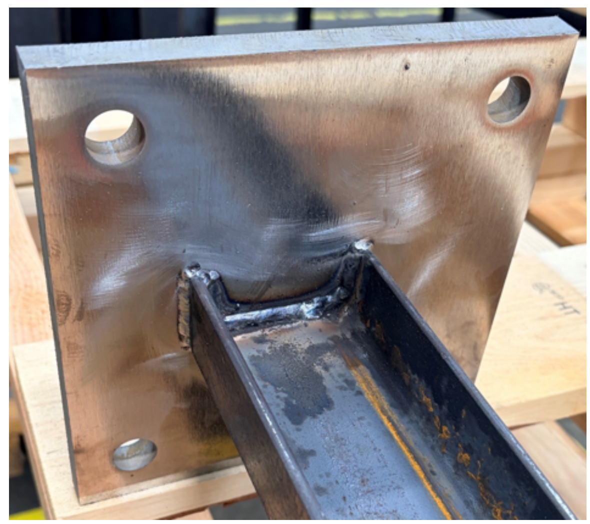
$S_{wtot} := S_{w1} + S_{w2} + S_{w3} = 2.44 \cdot in^3$

$f_w := \frac{M_{max}}{S_{wtot}} = 18048\,psi$ $f_w = 18048\,psi$

$F_w := \frac{0.6 \cdot F_u}{\Omega} = 21000\,psi$ $F_w = 21000\,psi$

$I_w := \frac{f_w}{F_w} = 0.86$ ***WELD DOES NOT LIMIT DESIGN***

Use Welds As Noted (Sht 2) & As Shown
70 ksi tensile strength filler alloy



Chk Base Plate at Concrete Anchorage:

$d := 3in$ $b := 1.5in$ $F_y := 50ksi$

$L1 := 8in$ $D1 := 1in$

$L2 := 8in$ $D2 := 1in$

$L := L2 - (2 \cdot D2) = 6 \cdot in$

$A := \frac{L - (d - 1in)}{2} = 2 \cdot in$

$B := L - A = 4 \cdot in$

$P := \frac{M_{max}}{d} = 14700\,lbf$

$M_{pl} := \frac{P \cdot A \cdot B}{L} = 19600\,lbf \cdot in$

$t_{req} := \sqrt{\frac{M_{pl} \cdot 6}{0.75 \cdot F_y \cdot L1}} = 0.63 \cdot in$ ***BASE PLATE LIMITS DESIGN***

Use 8" x 8" x 5/8" Thk Plate
ASTM A572 Gr 50, Fy= 50 ksi Min.

Check Bolt Capacities: (Min. 5/16" Thread Eng. into 36 ksi Min. Steel)

$t_{st} := 0.313in$ $n := \frac{11}{in}$ $A_{TSI} := 0.13in^2$ $F_{TU} := 58ksi$ $SF := 3$ $d_b := 0.625in$

$D_{PL} := 8in$ *Depth of Plate* $D_{ED} := 1in$ *Dist of Bolt From Edge of Plate*

$T_{Bmax} := (t_{st} - 0.25in) \cdot \left[3 \cdot n \cdot A_{TSI} \cdot F_{TU} \div \left(SF \cdot \sqrt{3} \right) \right] + (0.375in - t_{st}) \cdot (1.7 \cdot d_b \cdot F_{TU} \div SF) = 4290\,lbf$

$M_{all4} := 2 \cdot T_{Bmax} \cdot (D_{PL} - D_{ED}) = 60065 \cdot in \cdot lbf$

Use (4) - 5/8" Dia. Thru Bolts or Drill / Tap
300 Series S.S., Cond. CW, Fu= 100 ksi Min
*or ASTM A449 (**HDG**), Fu= 120 ksi Min*
Min. 5/16" thread engagement to A36 steel or Better

Cielo System - C3x5 Channel Stanchion Analysis	Detail Ref.	Sheet No: 2 B

Chk Concrete Anchorage:

Worst Case Load at 4,000 psi Concrete

$TW_2 := 42in$ $\quad WL_2 := 30psf$ $\quad H_{ws2} := 84in$

$V_{max2} := TW_2 \cdot WL_2 \cdot H_{ws2} = 735lbf$

$M_{max2} := TW_2 \cdot WL_2 \cdot \frac{H_{ws2}^2}{2} = 30870 \cdot in \cdot lbf$

$V_{a1} := V_{max2} \cdot 0.6^{-1} = 1225lbf$ **⇐ For Profis**

$M_{a1} := M_{max2} \cdot 0.6^{-1} = 51450 \cdot in \cdot lbf$ **⇐ For Profis**

SEE SHT 2C THRU 2D FOR PROFIS DATA

Use (4) 5/8" Dia SS Hilti Kwik Bolt TZ
AISI 304SS (Typical) or AISI 316SS (Coastal Areas)

Embedment: h_{EF}= 3.25" | h_{NOM}= 3.75"
Edge Distance: 6" Front/Back Edge | 4" From End
Min. Slab Thickness: 6"
*Concrete Strength: **f'c= 4,000 psi**, Normal Wt., Cracked*

Install per Manufacturer's instructions

Worst Case Load at 6,000 psi Concrete

$TW_3 := 36in$ $\quad WL_3 := 60psf$ $\quad H_{ws3} := 72in$

$V_{max3} := TW_3 \cdot WL_3 \cdot H_{ws3} = 1080lbf$

$M_{max3} := TW_3 \cdot WL_3 \cdot \frac{H_{ws3}^2}{2} = 38880 \cdot in \cdot lbf$

$V_{a2} := V_{max3} \cdot 0.6^{-1} = 1800lbf$ **⇐ For Profis**

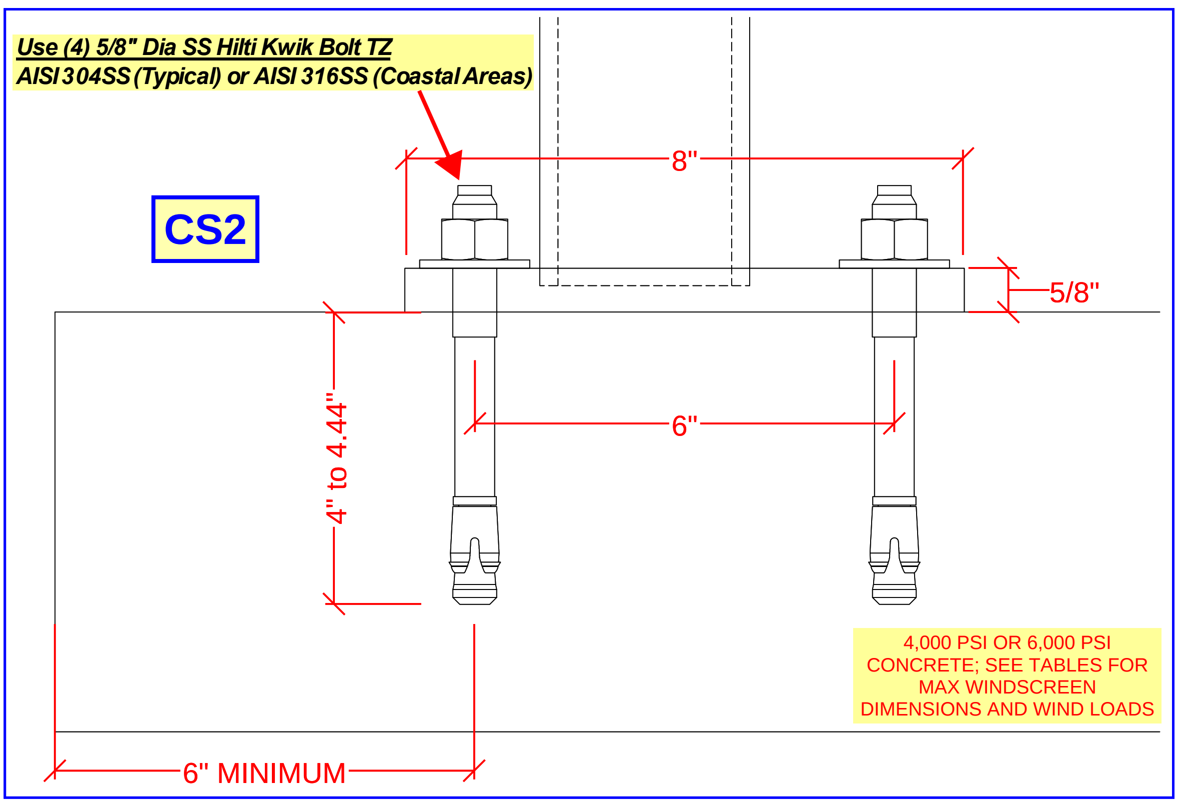
$M_{a2} := M_{max3} \cdot 0.6^{-1} = 64800 \cdot in \cdot lbf$ **⇐ For Profis**

SEE SHT 2E THRU 2F FOR PROFIS DATA

Use (4) 5/8" Dia SS Hilti Kwik Bolt TZ
AISI 304SS (Typical) or AISI 316SS (Coastal Areas)

Embedment: h_{EF}= 4" | h_{NOM}= 4.5"
Edge Distance: 6" Front/Back Edge | 4" From End
Min. Slab Thickness: 6"
*Concrete Strength: **f'c= 6,000 psi**, Normal Wt., Cracked*

Install per Manufacturer's instructions



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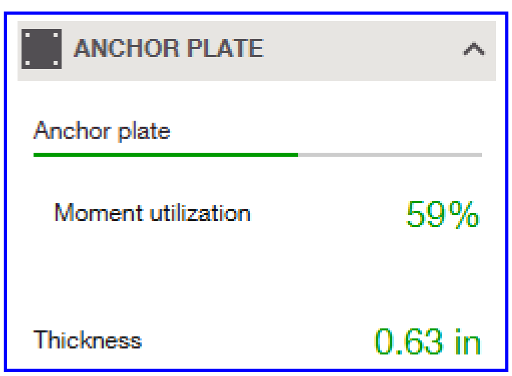
			Engineer: KEP	Sheet No: 2 B
			Date: 6/5/2026	Rev:
			Chk By:	Date:

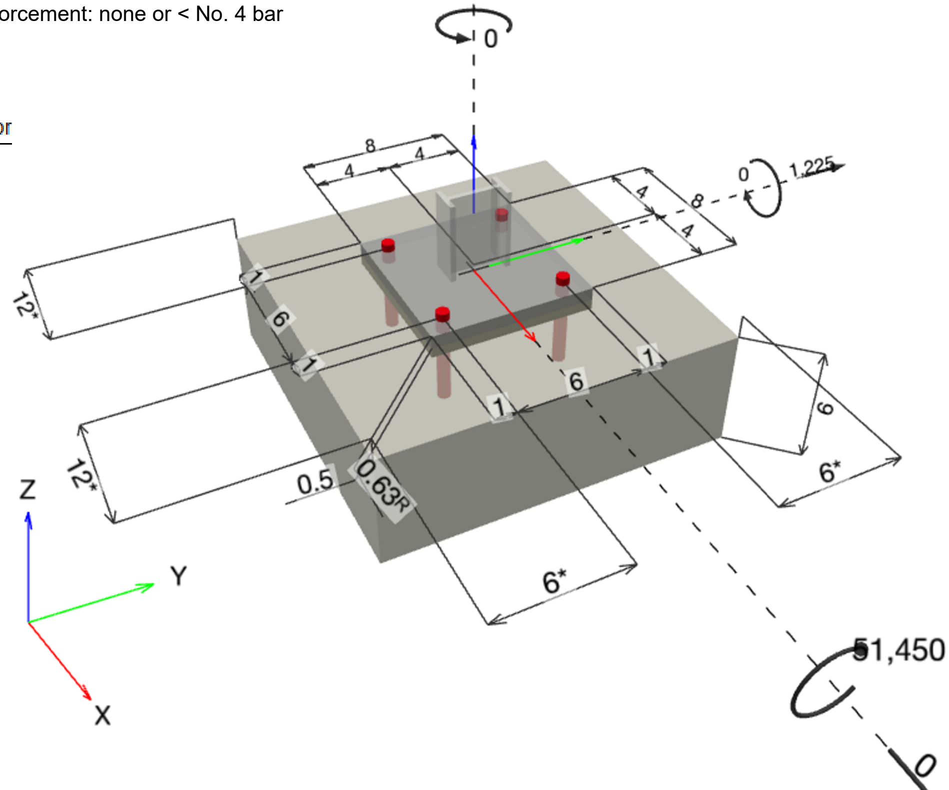
1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - SS 304 5/8 (3 1/4) hnom2**
Item number:	KB-TZ2 5/8 SS304
Specification text:	HILTI ∅ 5/8 IN KWIK BOLT TZ2 - SS 304 WITH 3.75 IN NOMINAL EMBEDMENT DEPTH PER ICC-ES ESR-4266 , HAMMER DRILL BIT INSTALLATION PER MPII
Effective embedment depth:	$h_{ef,act}$ = 3.250 in., h_{nom} = 3.750 in.
Material:	AISI 304
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2025 | 12/1/2027
Proof:	Design Method ACI 318-19 / Mech
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	grouted standoff; restraint level (anchor plate): 2.00; e_b = 0.500 in.; t = 0.630 in.
	grout compressive strength > f_c' = 4,000 psi
Anchor plate^R :	l_x x l_y x t = 8.000 in. x 8.000 in. x 0.630 in.;
Profile:	M shape (AISC), ; (L x W x T x FT) = 3.000 in. x 1.500 in. x 0.260 in. x 0.250 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 6.000 in.
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar

Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear for
1	0	306
2	0	306
3	3,731	306
4	3,731	306





1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 0; V_y = 1,225; M_x = -51,450; M_y = 0; M_z = 0;	no	95

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi\ N_n$	Status
Steel Strength*	3,731	14,132	27	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	7,462	8,171	92	OK

* highest loaded anchor **anchor group (anchors in tension)

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi\ V_n$	Status
Steel Strength*	306	6,427	5	OK
Steel failure (with lever arm)*	306	1,768	18	OK
Pryout Strength**	1,225	28,429	5	OK
Concrete edge failure in direction y+**	1,225	5,451	23	OK

* highest loaded anchor **anchor group (relevant anchors)

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.913	0.225	5/3	95	OK

$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- User is responsible for evaluating the hole bearing capacity in case of shear forces.
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

Fastening meets the design criteria!

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - SS 304 5/8 (4) hnom3**
Item number:	KB-TZ2 5/8 SS304
Specification text:	HILTI ⌀ 5/8 IN KWIK BOLT TZ2 - SS 304 WITH 4.5 IN NOMINAL EMBEDMENT DEPTH PER ICC-ES ESR-4266 , HAMMER DRILL BIT INSTALLATION PER MPII
Effective embedment depth:	$h_{ef,act}$ = 4.000 in., h_{nom} = 4.500 in.
Material:	AISI 304
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2025 | 12/1/2027
Proof:	Design Method ACI 318-19 / Mech
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	grouted standoff; restraint level (anchor plate): 2.00; e_b = 0.500 in.; t = 0.630 in.
	grout compressive strength > f_c' = 6,000 psi
Anchor plate^R :	l_x x l_y x t = 8.000 in. x 8.000 in. x 0.630 in.;
Profile:	M shape (AISC), ; (L x W x T x FT) = 3.000 in. x 1.500 in. x 0.260 in. x 0.250 in.
Base material:	cracked concrete, 6000, f_c' = 6,000 psi; h = 6.000 in.
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

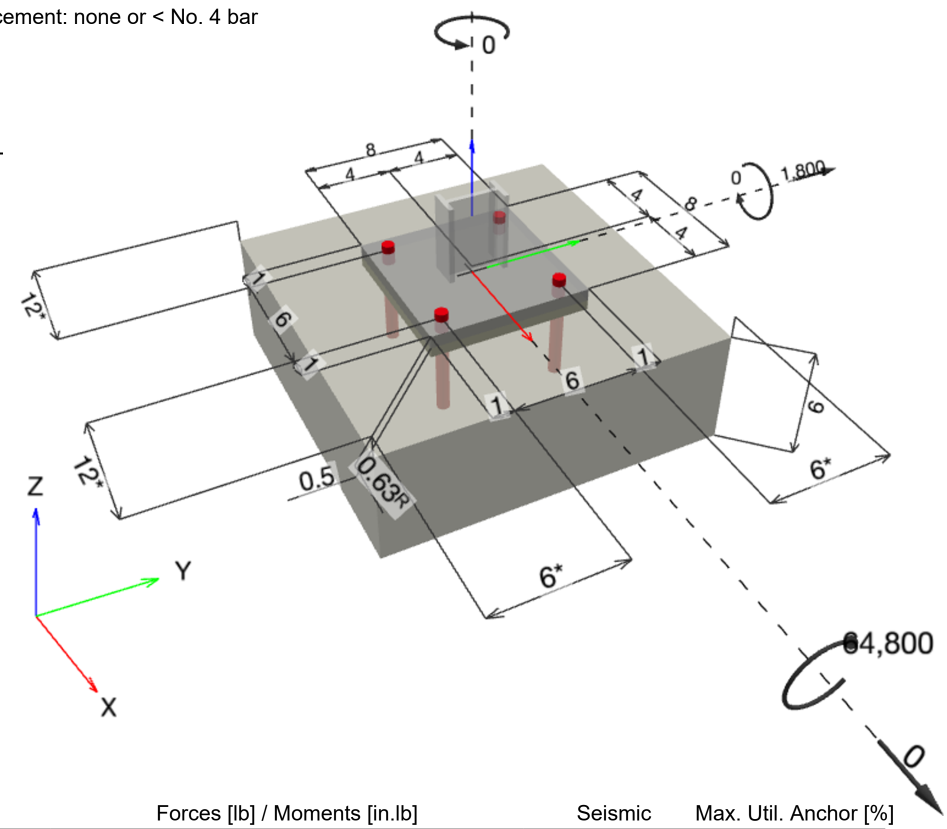
Anchor	Tension force	Shear force
1	0	450
2	0	450
3	4,688	450
4	4,688	450

ANCHOR PLATE

Anchor plate

Moment utilization 75%

Thickness 0.63 in



1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 0; V_y = 1,800; M_x = -64,800; M_y = 0; M_z = 0;	no	98

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	4,688	14,132	34	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	9,376	10,271	92	OK

* highest loaded anchor **anchor group (anchors in tension)

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	450	6,427	8	OK
Steel failure (with lever arm)*	450	1,605	29	OK
Pryout Strength**	1,800	33,184	6	OK
Concrete edge failure in direction y+**	1,800	6,959	26	OK

* highest loaded anchor **anchor group (relevant anchors)

5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.913	0.280	5/3	98	OK

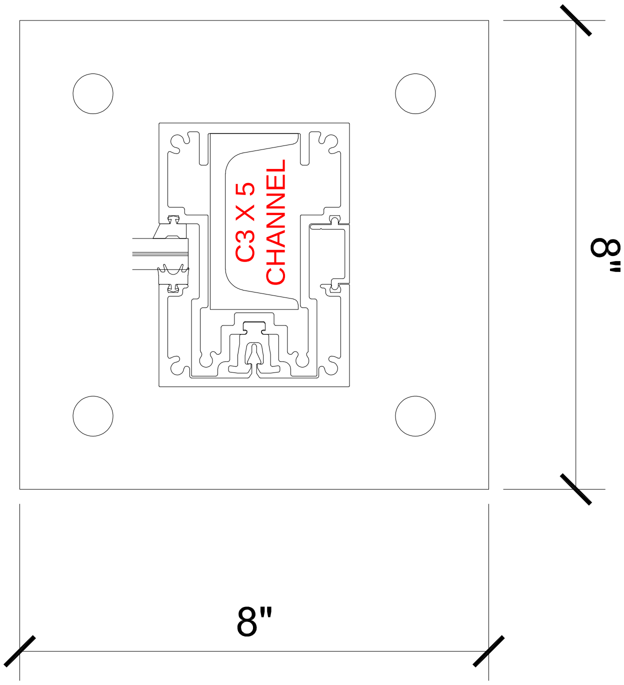
$\beta_{NV} = \beta_N^{\zeta} + \beta_V^{\zeta} <= 1$

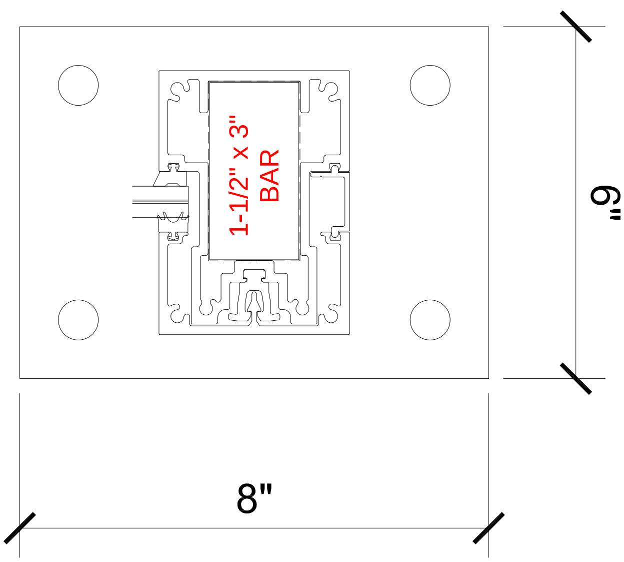
6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- User is responsible for evaluating the hole bearing capacity in case of shear forces.
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.

Fastening meets the design criteria!

Worst Case Post/Stanchion Analysis	Detail Ref.	Sheet No: 3





Design Loads per RISA:

Load For Post Alone:

$R_1 := 1225$ lb

$M_1 := 40000$ lb·in

Load at Base:

$R_2 := 2400$ lb

$M_2 := 86400$ lb·in

Post Properties:

$I_{x1} := 6.46$ in^4

$S_{x1} := 2.67$ in^3

$E_p := 10100000$ psi

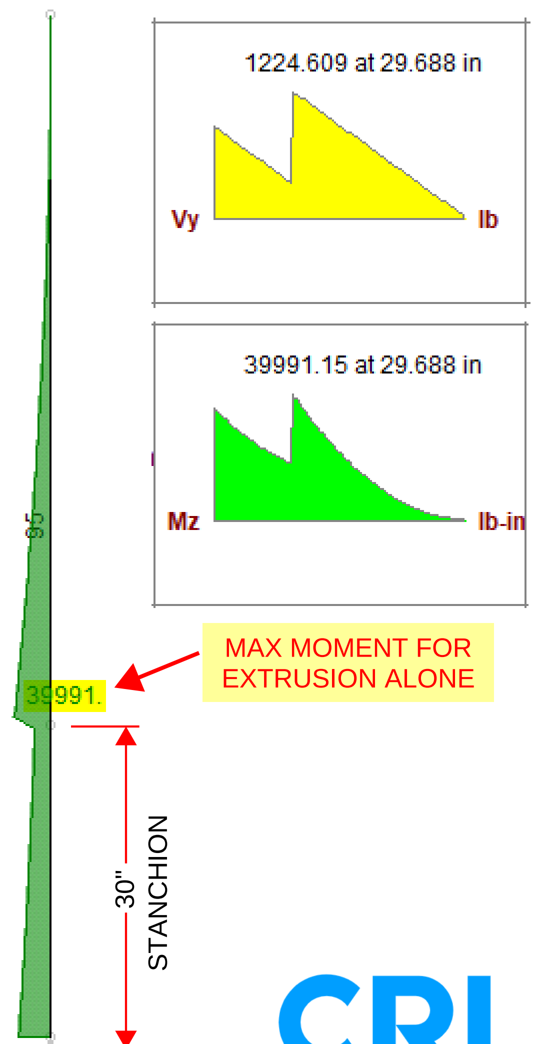
Stanchion Properties:

$I_{x2} := 3.38$ in^4

$S_{x2} := 2.25$ in^3

$E_{st} := 29000000$ psi

$M_{allst} := 86400$ in·lb



Chk Post Stress:

$$f_{bp1} := \frac{M_1}{S_{x1}} = 14981 \quad \text{psi}$$

$$R_m := \frac{(I_{x1} \cdot E_p)}{(I_{x1} \cdot E_p + I_{x2} \cdot E_{st})} = 0.4 \qquad M_3 := R_m \cdot M_2 = 34528 \quad \text{lb} \cdot \text{in}$$

$$f_{bp2} := \frac{R_m \cdot M_3}{S_{x1}} = 5168 \quad \text{psi}$$

$$F_{bp2} := 21200 \quad \text{psi} \qquad I_2 := \frac{\max(f_{bp1}, f_{bp2})}{F_{bp2}} = 0.71$$

Use Cielo Extruded Post
Max Post Spacing/Height per Tables
6005-T5 or 6061-T6 Alloy

CRL

RICE ENGINEERING Template:	105 School Creek Trail Luxemburg, WI 54217 Phone: (920)845-1042 Fax: (920)845-1048 www.rice-inc.com	Project Description: **Cielo Windscreen 2026**	Job No: R26-06-013	
			Engineer: KEP	Sheet No: 3
			Date: 6/5/2026	Rev:
			Chk By:	Date:

Worst Case Post/Stanchion Analysis	Detail Ref.	Sheet No: 3 A

Chk Glazing Channel:

$WL := 80psf$ $\quad F_y := 14.5ksi$

$TW := 1in$ $\quad t_{ext} := 0.15in$

$PS := 60in$

$ecc := 1.5in$

$P := 0.5 \cdot WL \cdot TW \cdot PS = 17 lbf$

$M_{pl} := P \cdot ecc = 25 \cdot in \cdot lbf$

$t_{req} := \sqrt{\dfrac{6 \cdot M_{pl}}{F_y \cdot TW}} = 0.1 \cdot in$

$I_{ext} := \dfrac{t_{req}}{t_{ext}} = 0.68$

Use Cielo Snap Extrusion, As Drawn
6063-T5 Alby or Better

Chk NC900 Clips:

$T_{all} := \dfrac{344lbf}{2.5} = 138lbf$ ⇐ ***Sht Z3***

$w := WL \cdot PS = 33 \cdot pli$

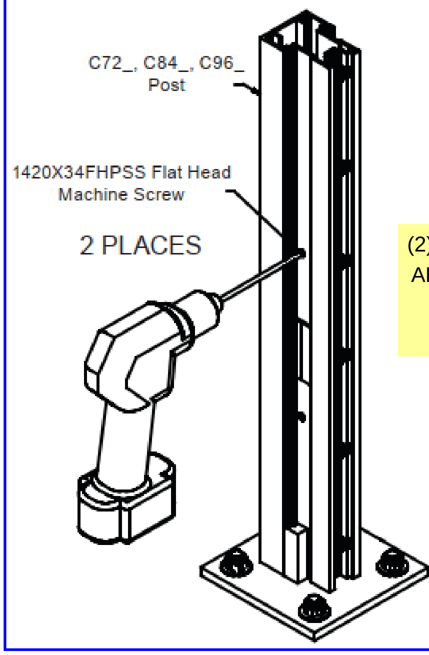
$S_{max} := \dfrac{T_{all}}{w} = 4.13 \cdot in$

Use NC900 Clips Spaced As Noted *
HDPE, Tested to 350 LB Pullout

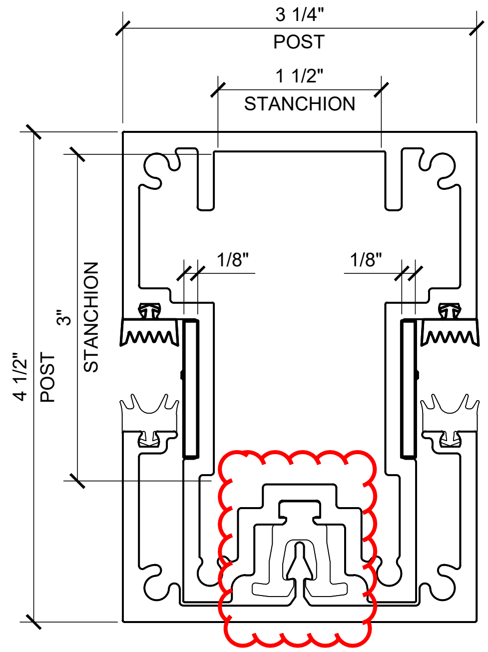
Catalog Number: **NC900**

- For Horizontal and Vertical Face Caps
- Direct Pull Load is 350 Pounds
- Injected Molded
- Fully Tested to Insure Strength and Durability

Secure/lock-on every post with (2) 1/4-20 X 3/4" Flat Head Screw to every stanchion.



(2) 1/4"-20 SS SCREWS AS SHOWN ARE "OK" PER INSPECTION; NON-STRUCTURAL & USED TO PREVENT UPLIFT OF POST



* **NOTE:** FOR WIND LOADS GREATER THAN **50 PSF**, USE NC900 CLIPS EVERY **4" O.C.**

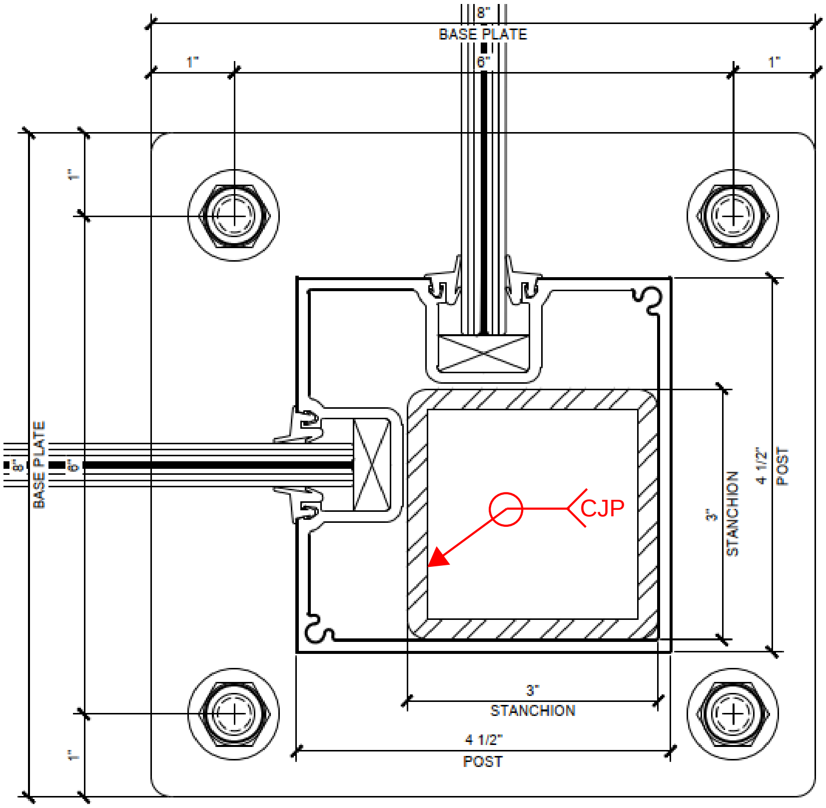
* USE NC900 CLIPS EVERY 6" O.C.

CRL

RICE ENGINEERING Template:	105 School Creek Trail Luxemburg, WI 54217 Phone: (920)845-1042 Fax: (920)845-1048 www.rice-inc.com	Project Description: **Cielo Windscreen 2026**	Job No: R26-06-013	
			Engineer: KEP	Sheet No: 3 A
			Date: 6/5/2026	Rev:
			Chk By:	Date:

NOTE: ANCHOR SCENARIOS FOR THE CORNER POST STANCHION SHOULD FOLLOW THE APPROPRIATE ATTACHMENT METHOD FROM SHT 1B OR SHT'S 2A THRU 2F

Worst Case Corner Post/Stanchion Analysis	Detail Ref.	Sheet No: 4



Design Loads per RISA:

Load For Post Alone:

$R_1 := 1225$ lb

$M_1 := 40000$ lb·in

Load at Base:

$R_2 := 2400$ lb

$M_2 := 86400$ lb·in

Post Properties:

$I_{x1} := 8.2$ in^4

$S_{x1} := 3.5$ in^3

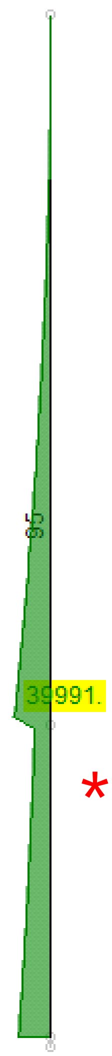
$E_p := 10100000$ psi

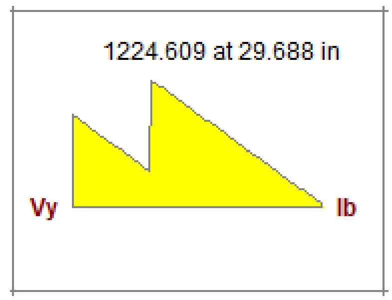
Stanchion Properties:

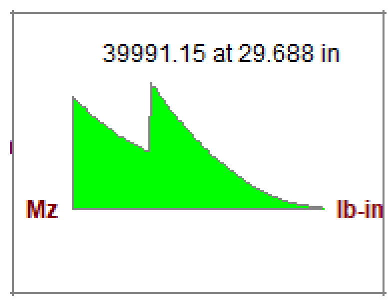
$I_{x2} := 3.02$ in^4

$S_{x2} := 2.01$ in^3

$E_{st} := 29000000$ psi







Chk Stanchion:

$Z_{st} := 2.48\ in^3$ $F_y := 46000$ ksi $\Omega := 1.67$

$$M_{allst} := \frac{Z_{st} \cdot F_y}{\Omega} = 68311 \quad in \cdot lb$$

$$I_{st} := \frac{*0.75 \cdot M_2}{M_{allst}} = 0.95$$

Use 3" x 3" x 1/4" Corner Post Stanchion
Max Post Spacing/Height per Tables
ASTM A500, Gr B, Fy= 46 ksi Min.

Chk Post Stress:

$$f_{bp1} := \frac{M_1}{S_{x1}} = 11429 \quad psi$$

$$R_m := \frac{(I_{x1} \cdot E_p)}{(I_{x1} \cdot E_p + I_{x2} \cdot E_{st})} = 0.49$$

$$f_{bp2} := \frac{R_m \cdot M_2}{S_{x1}} = 11998 \quad psi$$

$F_{bp2} := 19000$ psi

$$I_2 := \frac{\max(f_{bp1}, f_{bp2})}{F_{bp2}} = 0.63$$

Use Cielo Extruded Corner Post
Max Post Spacing/Height per Tables
6005-T5 or 6061-T6 Alloy

* **NOTE:** REACTIONS SHOWN AT THE TOP OF THIS SHEET ARE CONSERVATIVE SINCE CORNER POSTS WILL SEE 1/2 OF THE TOTAL LOAD TYPICAL POST WILL RECEIVE. A FACTOR OF 0.75 WAS APPLIED TO THE REACTION FOR THE STANCHION ANALYSIS.

CRL

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920)845-1042 Fax: (920)845-1048 www.rice-inc.com	Project Description: **Cielo Windscreen 2026**	Job No: R26-06-013	
Template:			Engineer: KEP	Sheet No: 4
			Date: 5/28/2021	Rev:
			Chk By:	Date:

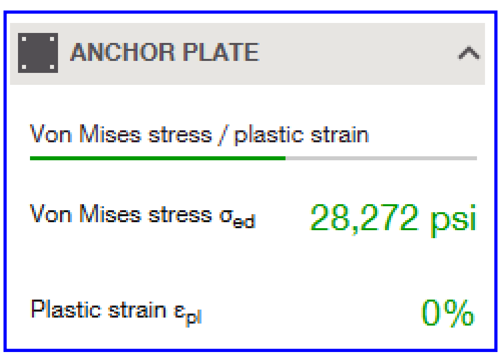
# 1 Anchor Design	Worst Case Corner Post/Stanchion Analysis	Detail Ref.	Sheet No: 4 A

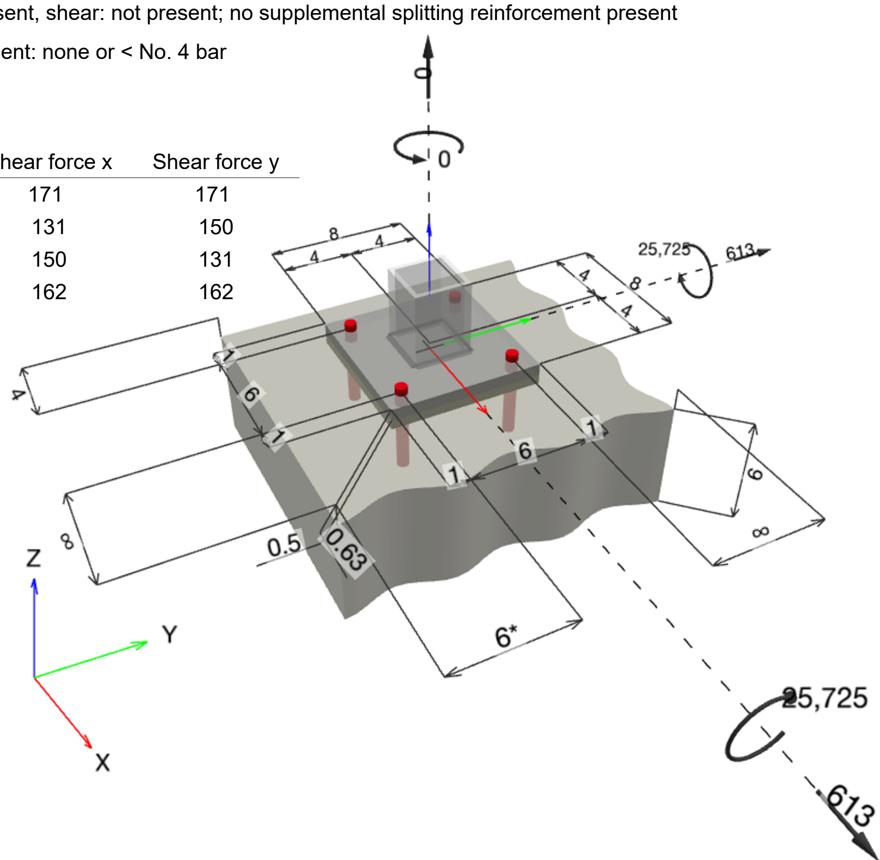
1.1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - SS 304 5/8 (3 1/4) hnom2**
Item number:	KB-TZ2 5/8 SS304
Specification text:	HILTI ∅ 5/8 IN KWIK BOLT TZ2 - SS 304 WITH 3.75 IN NOMINAL EMBEDMENT DEPTH PER ICC-ES ESR-4266 , HAMMER DRILL BIT INSTALLATION PER MPII
Effective embedment depth:	$h_{ef,act}$ = 3.250 in., h_{nom} = 3.750 in.
Material:	AISI 304
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2025 | 12/1/2027
Proof:	Design Method ACI 318-19 / Mech
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	grouted standoff; restraint level (anchor plate): 2.00; e_b = 0.500 in.; t = 0.630 in.
	grout compressive strength > f_c' = 4,000 psi
Anchor plate^{CBFEM} :	l_x x l_y x t = 8.000 in. x 8.000 in. x 0.630 in.;
Profile:	Square HSS (AISC), HSS3X3X.250; (L x W x T) = 3.000 in. x 3.000 in. x 0.250 in.
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 6.000 in.
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar

Anchor reactions [lb]
Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	3,919	242	171	171
2	1,955	199	131	150
3	1,950	199	150	131
4	-0	228	162	162





1.1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 613; V_y = 613; M_x = -25,725; M_y = 25,725; M_z = 0;	no	96

1.3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	3,919	14,132	28	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	7,824	8,204	96	OK

* highest loaded anchor **anchor group (anchors in tension)

1.4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	242	6,427	4	OK
Steel failure (with lever arm)*	242	1,736	14	OK
Pryout Strength**	867	25,403	4	OK
Concrete edge failure in direction x-**	613	8,177	8	OK

* highest loaded anchor **anchor group (relevant anchors)
When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

1.5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.954	0.139	1.000	92	OK

$\beta_{NV} = (\beta_N + \beta_V) / 1.2 <= 1$

1.6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, ACI318, IS1946, AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.
- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!

# 1 Anchor Design	Worst Case Corner Post/Stanchion Analysis	Detail Ref.	Sheet No: 4 C

1.1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - SS 304 5/8 (3 1/4) hnom2**
Item number:	2210279 KB-TZ2 5/8x6 SS304
Specification text:	HILTI ⌀ 5/8 IN KWIK BOLT TZ2 - SS 304 WITH 3.75 IN NOMINAL EMBEDMENT DEPTH PER ICC-ES ESR-4266 , HAMMER DRILL BIT INSTALLATION PER MPII
Effective embedment depth:	$h_{ef,act}$ = 3.250 in., h_{nom} = 3.750 in.
Material:	AISI 304
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2025 | 12/1/2027
Proof:	Design Method ACI 318-19 / Mech
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	grouted standoff; restraint level (anchor plate): 2.00; e_b = 0.500 in.; t = 0.630 in.
	grout compressive strength > f_c' = 6,000 psi
Anchor plate[CBFEM] :	l_x x l_y x t = 8.000 in. x 8.000 in. x 0.630 in.;
Profile:	Square HSS (AISC), HSS3X3X.250; (L x W x T) = 3.000 in. x 3.000 in. x 0.250 in.
Base material:	cracked concrete, 6000, f_c' = 6,000 psi; h = 6.000 in.
Installation:	**Hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: not present, shear: not present; no supplemental splitting reinforcement present
	edge reinforcement: none or < No. 4 bar

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

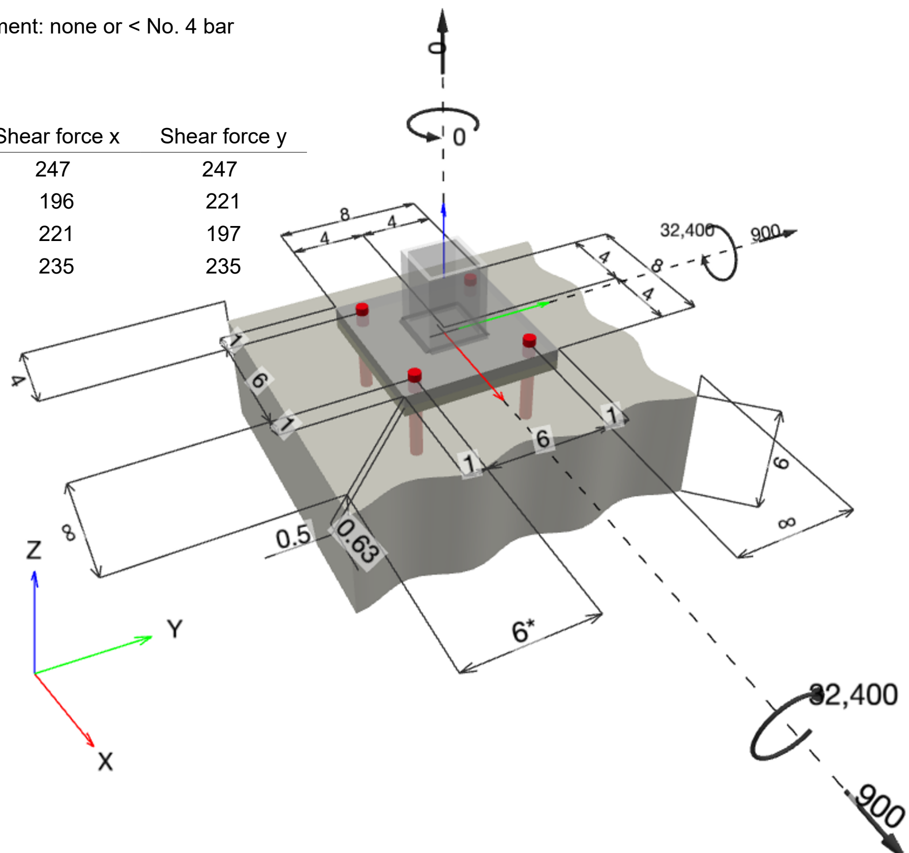
Anchor	Tension force	Shear force	Shear force x	Shear force y
1	4,948	350	247	247
2	2,288	295	196	221
3	2,280	295	221	197
4	-0	333	235	235

ANCHOR PLATE

Von Mises stress / plastic strain

Von Mises stress σ_{ed} 35,536 psi

Plastic strain ε_{pl} 0%



1.1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 900; V_y = 900; M_x = -32,400; M_y = 32,400; M_z = 0;	no	100

1.3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	4,948	14,132	36	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	9,517	9,837	97	OK

* highest loaded anchor **anchor group (anchors in tension)

1.4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	350	6,427	6	OK
Steel failure (with lever arm)*	350	1,561	23	OK
Pryout Strength**	1,273	31,113	5	OK
Concrete edge failure in direction x-**	900	10,014	9	OK

* highest loaded anchor **anchor group (relevant anchors)
When the input edge distance is set to "infinity", edge breakout verification is not performed in that direction

1.5 Combined tension and shear loads, per ACI 318-19 section 17.8

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.967	0.224	1.000	100	OK

$\beta_{NV} = (\beta_N + \beta_V) / 1.2 <= 1$

1.6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, ACI318, IS1946, AS 5216:2021, ETAG 001/Annex C, EOTA TR029 etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with CBFEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- The equations presented in this report are based on imperial units. When inputs are displayed in metric units, the user should be aware that the equations remain in their imperial format.
- Condition A applies where the potential concrete failure surfaces are crossed by supplementary reinforcement proportioned to tie the potential concrete failure prism into the structural member. Condition B applies where such supplementary reinforcement is not provided, or where pullout or pryout strength governs.
- ACI 318 does not specifically address anchor bending when a stand-off condition exists. PROFIS Engineering calculates a shear load corresponding to anchor bending when stand-off exists and includes the results as a shear Design Strength!
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- For additional information about ACI 318 strength design provisions, please go to https://viewer.joomag.com/profis-design-guide-us-en-summer-2021/0841849001625154758?short&/
- Attention! In case of compressive anchor forces a buckling check as well as the proof of the local load transfer into and within the base material (incl. punching) has to be done separately.
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-19, Section 26.7.
- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (EN1992-4, AS5216, etc.). This means load re-distribution on the anchors due to elastic deformations of the anchor plate are not considered - the anchor plate is assumed to be sufficiently stiff, in order not to be deformed when subjected to the design loading. PROFIS Engineering calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid anchor plate assumption is valid is not carried out by PROFIS Engineering. Input data and results must be checked for agreement with the existing conditions and for plausibility!

Embedded Stanchion / Grout Analysis	Detail Ref.	Sheet No: 5

Chk conc. grout:

$R_{max} := 1215$ lb

$M := 44100$ lb·in

$f'_{c1} := 10500$ psi *Grout Strength* $\quad \phi := 0.65$

$f'_{c2} := 4000$ psi *Conc. Strength* $\quad LF := 1.67$ *(Load Factor)*

$L := 6.5$ in

$D_1 := 1.5$ in *(Post Width)* $\quad c := \frac{L}{2}$

$D_2 := 4$ in *(Grout Pocket Width)*

EXTERIOR ANCHORING & PATCHING CEMENT

Wet compressive strength, psi 2" Cube molds, moistcured	
1 hr after set	4,100
3 hr after set	4,100
6 hr after set	5,100
1 day	8,100
3 days	9,300
28 days	10,500

Assume Whitney stress block for bearing distribution:

$$\beta_1 := \max\left(\begin{pmatrix} 0.85 - .05\cdot\frac{f'_{c1} - 4000}{1000} \\ 0.65 \end{pmatrix}\right) \qquad \beta_1 = 0.65$$

$$a_1 := \beta_1 \cdot c = 2.11$$

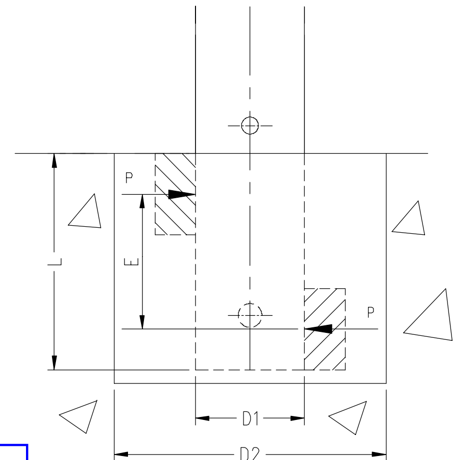
$A_1 := a_1 \cdot D_1 \qquad A_1 = 3.17$ in *(Bearing Area)*

$E_1 := L - a_1 \qquad E_1 = 4.39$ in *(Load Eccentricity)*

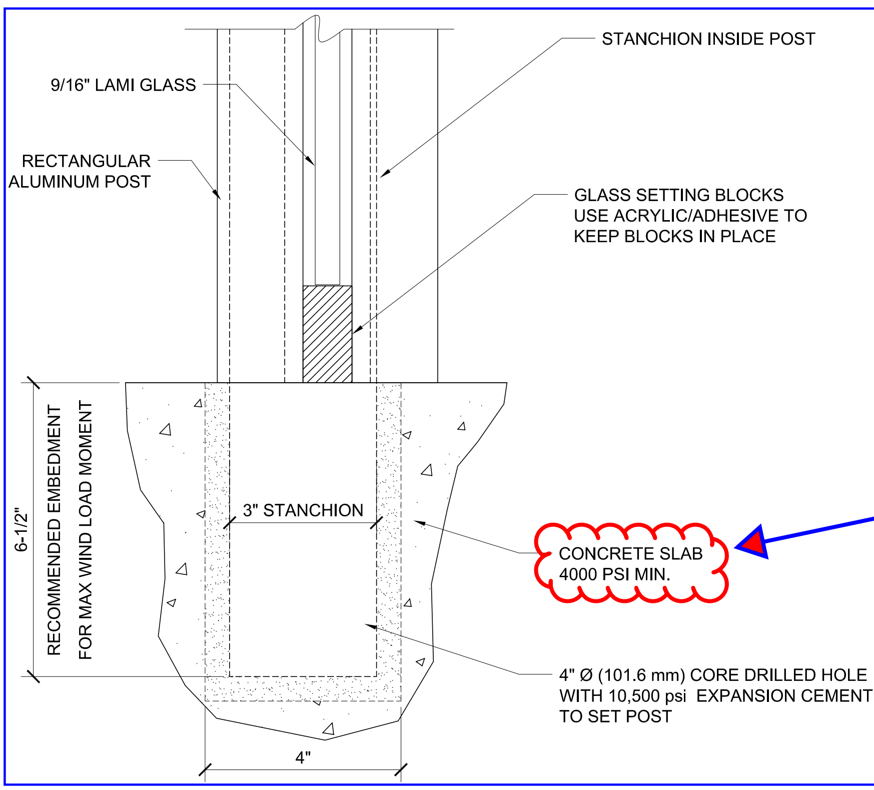
$P_1 := \frac{M}{E_1} + \frac{R_{max}}{2} \qquad P_1 = 10659$ lb *(Bearing Load)*

$\phi F_{p1} := \phi \cdot 0.85 \cdot A_1 \cdot f'_{c1} \qquad \phi F_{p1} = 18383$ lb *(Allowable Bearing Load)*

$I_1 := \frac{LF \cdot P_1}{\phi F_{p1}} \qquad \boxed{I_1 = 0.97}$



Use 6,000 psi, non-shrink/non-metallic, Kwixset Anchoring Cement or Equal; 6-1/2" Min. Embedment As Shown



NOTE: SIGNIFICANT BEARING AND BREAK-OUT LOADS WILL BE IMPOSED ON THE CONCRETE SLAB / CURB. THE EOR OR CONCRETE ENGINEER NEEDS TO ENSURE PROPER EDGE DISTANCE AND SLAB DEPTH IS AVAILABLE TO RESOLVE MOMENTS / SHEARS IMPOSED BY THE EMBEDDED WINDSCREEN STANCHION

RICE ENGINEERING

105 School Creek Trail
Luxemburg, WI 54217
Phone: (920) 617-1042
Fax: (920) 617-1100
www.rice-inc.com

Template:	Project Description: Cielo Windscreen 2026	Job No: R26-06-013	
		Engineer: KEP	Sheet No: 5
		Date: 6/5/2026	Rev:
		Chk By:	Date:

Inputs:

$L := 60in = 1524 \cdot mm$ Length of Glass

$t := 0.5in = 12.7 \cdot mm$ Overall thickness of Glass

Use 9/16" Thick Fully Tempered & Laminated Glass Panels
6mm FT x 1.524mm SGP x 6mm FT
Maximum Panel Size : 60" x 96"

Results from SJ Mepla:

$\Delta := 17.86mm = 0.7 in$ Maximum Deflection

$Stress := 36 \frac{N}{mm^2}$ Maximum Stress

Reference Sheets 6A-6D for SJ Mepla Glass Report

Glass Type:	*Probability of Breakage:*	*Load Type:*
☑ Fully Tempered	☑ < 1/1000	☑ Uniform/Point Load
☐ Heat Strengthened	☐ 1/1000	☐ 50 PLF
☐ Annealed	☐ 8/1000	

Calculations:

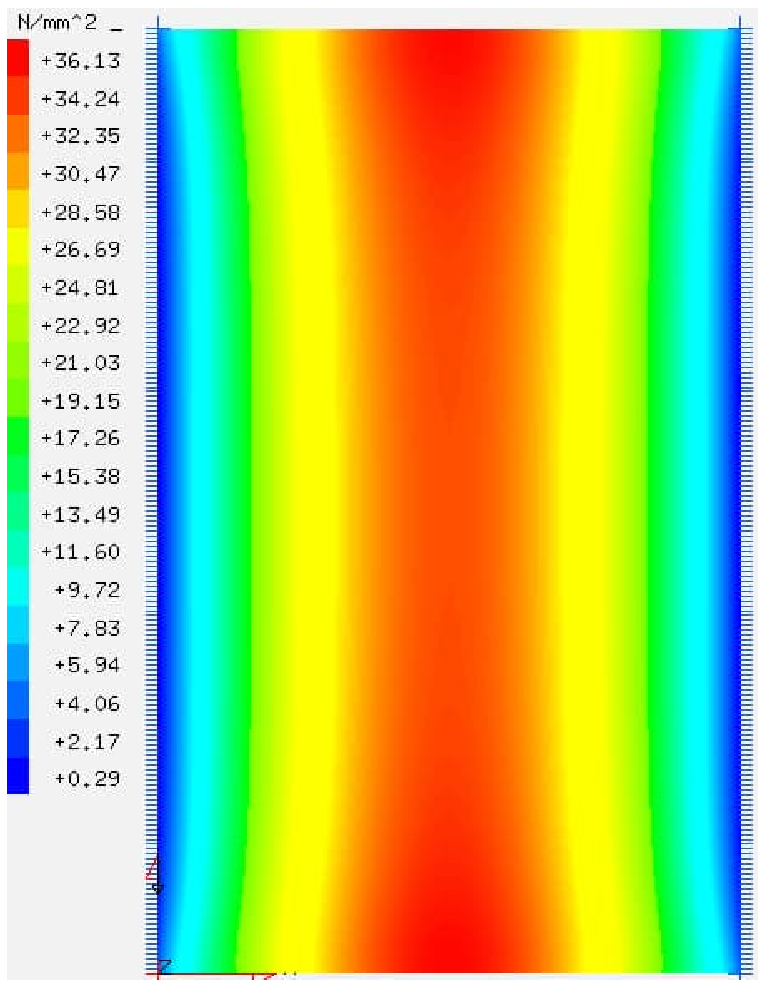
All Calculations Below This Line Are Automatic

Check Deflection:

$\Delta meet := \frac{L}{\Delta} = 85$ GLASS MEETS L / 35 DEFLECTION CRITERIA

SILICONE_AT_JOINTS = "NOT REQUIRED FOR LOAD CASE"

DEFLECTION = "OK"



Check Stress:

(Per GANA Glazing Manual 2010)

$f_b := Stress = 36 \cdot \frac{N}{mm^2}$ $f_b = 5221 psi$

$F_b = 41.37 \cdot \frac{N}{mm^2}$ $F_b = 6000 psi$

$STRESS := \begin{cases} \text{"OK"} & \text{if } f_b \le F_b \\ \text{"FAIL"} & \text{otherwise} \end{cases}$

STRESS = "OK"

SJ MEPLA Calculation protocol:

Geometry:

Edge	Borderpoint mm	mm	Arccenter mm	mm	Direction of rotation +/-
1	0.00	0.00			
2	1473.20	0.00			
3	1473.20	2388.00			
4	0.00	2388.00			

Supports:

Edge supports:

Edge	Type of supports	
2	w	: fixed - u,v,φ,θ : free (simply supported)
4	w	: fixed - u,v,φ,θ : free (simply supported)

Spring supports:

Package	Layer	x mm	y mm	z mm	C_x N/mm	C_y N/mm	C_z N/mm	C_φ Nmm	C_θ Nmm
1	1	1473.2	0.0	0.0	0.000e+00	1.000e+04	0.000e+00	0.00e+00	0.00e+00
1	1	0.0	0.0	0.0	0.000e+00	1.000e+04	0.000e+00	0.00e+00	0.00e+00

Layers:

Layer order:

Package	Layer	Description
1	3	Glass, fully toughened
1	2	SG5000 <50°C, ASTM E1300, wind load until 3 sec
1	1	Glass, fully toughened

Mechanical properties:

Package	Layer	E-mod. N/mm²	ν	Thickness mm	Density kg/m³	αt 1/K	ΔT K
1	3	71705.00	0.23	6.00	2550.00	1.0000e-05	0.00
1	2	78.80	0.49	1.52	950.00	1.5000e-04	0.00
1	1	71705.00	0.23	6.00	2550.00	1.0000e-05	0.00

Loads:

Face loads:
- constant distributed:

Package	pressure N/mm²
1	3.83000e-03

Dead weight:
Inclination of pane: 90.00° degree
Direction vector of gravity acceleration [g = 9.81 m/s²]:

ex	ey	ez
0.00000	-1.00000	0.00000

Calculation approaches:
small deflections, linear
static calculation

Characteristics of the finite element mesh:
Element size : 25.0 mm
Number of elements : 5510
Number of nodes : 22347 (per package)
Number of unknown : 200741

Calculation results:

Minimum and maximum displacements w:

Package	x (mm)	y (mm)	w (mm)	
1	0.00	0.00	0.00	(min)
	736.60	2388.00	17.86	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	733.74	12.57	36.12	36.12
		(bottom)	2.86	2365.70	3.64	
1	1	(top)	1450.66	2.83	9.68	9.68
		(bottom)	1460.50	2.83	6.38	

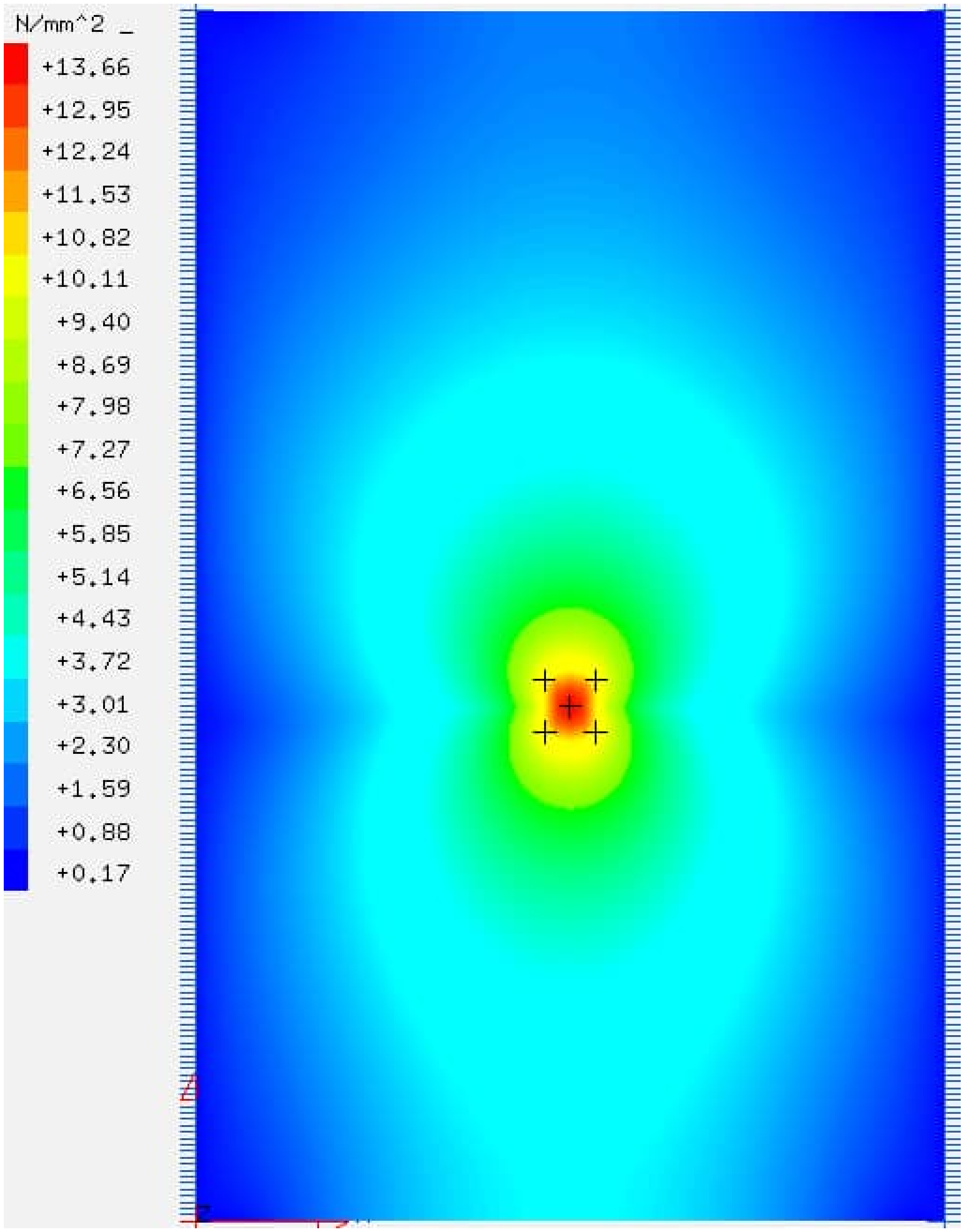
Max. Equivalent Von Mises stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	739.46	2.83	36.10	36.10
		(bottom)	22.54	2365.70	6.10	
1	1	(top)	1470.34	2.83	17.30	35.98
		(bottom)	733.74	2385.17	35.98	

Springs:

Package (x / y)	Layer	u mm	v mm	w mm	φ rad	θ rad	Fx N	Fy N	Fz N	M_φ Nmm
(1473.20 / 0.00)										
1	1	-0.13	-0.06	-0.00	0.0396	0.0000	-0.00	-553.01	-0.00	0.00
(0.00 / 0.00)										
1	1	0.13	-0.06	0.00	-0.0396	0.0000	0.00	-553.01	0.00	-0.00

$F_{B\_CL} := 553N = 124lbf$



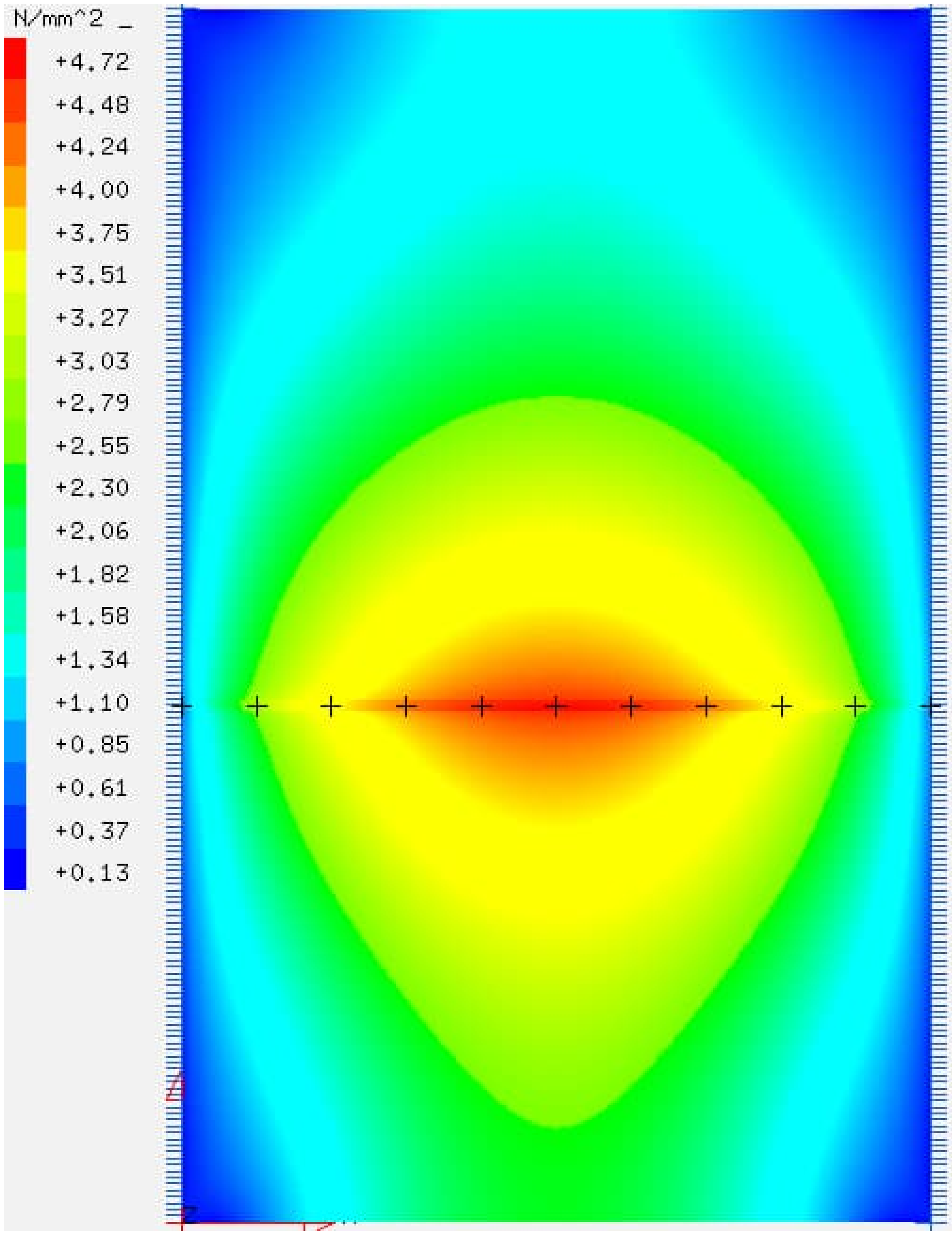
Minimum and maximum displacements w:

Package	Position x (mm)	Position y (mm)	Displacement w (mm)	
1	0.00	0.00	0.00	(min)
	736.60	1005.47	2.57	(max)

Maximum principal stress:

Package	Layer		x (mm)	y (mm)	σ (N/mm²)	σ (max) (N/mm²)
1	3	(top)	739.46	1018.04	13.66	13.66
		(bottom)	886.14	1018.04	1.03	

Cielo System - Glass Analysis (80 PSF WL)	Detail Ref.	Sheet No: 6 D



Minimum and maximum displacements w:

Package	- Position- x mm	y mm	Displacement w mm	
1	0.00	0.00	0.00	(min)
	736.60	1005.47	1.82	(max)

Maximum principal stress:

Package	Layer		x mm	y mm	σ N/mm²	σ (max) N/mm²
1	3	(top)	733.74	1008.31	4.72	4.72
		(bottom)	2.86	1093.45	0.70	

CRL

RICE ENGINEERING	105 School Creek Trail Luxemburg, WI 54217 Phone: (920) 617-1042 Fax: (920) 617-1100 www.rice-inc.com	Project Description:	Job No:	R26-06-013
		Cielo Windscreen 2026	Engineer: KEP	Sheet No: 6 D
			Date: 6/5/2026	Rev:
Template: REI-MC-5403			Chk By:	Date:

TABLE 20.9: Fastener Capacity

STAINLESS STEEL - Alloy Groups 1, 2 and 3, Condition CW (UNC Treads)

Nominal Fastener Diameter & Threads per Inch	D Nominal Thread Diameter (in)	A(S) Tensile Stress Area (in2)	A(R) Thread Root Area (in2)	Allow able Tension (lbs)	Allow able Shear Single (lbs)	Allow able Shear Double (lbs)	Allow able Bearing (lbs) 1/8" Steel A36	Allow able Bearing (lbs) 1/8" Aluminum 6063-T5	Allow able Bearing (lbs) 1/8" Aluminum 6063-T6	Minimum Material Thickness (lbs) to Equal Tensile Capacity of Fastener (in) A36	Minimum Material Thickness 6063-T5	Minimum Material Thickness 6063-T6	Maximum Tensile Load (lbs) for Available 3/8" Plate Thickness 3/8" Steel A36	3/8" Aluminum 6063-T5	3/8" Aluminum 6063-T6
#6-32	0.1380	0.0091	0.0078	303	150	300	900	253	345	0.1335	0.2538	0.1943	303	303	303
#8-32	0.1640	0.0140	0.0124	467	239	477	1,070	301	410	0.1733	0.3356	0.2466	467	467	467
#10-24	0.1900	0.0175	0.0151	584	292	583	1,240	348	475	0.1872	0.3410	0.2501	584	584	584
#12-24	0.2160	0.0242	0.0214	805	411	822	1,409	396	540	0.2269	> 3/8"	0.3016	805	734	805
1/4-20	0.2500	0.0318	0.0280	1,061	538	1,076	1,631	458	625	0.2534	> 3/8"	0.3373	1,061	865	1,061
5/16-18	0.3125	0.0524	0.0469	2,097	1,083	2,166	2,039	573	781	0.2867	> 3/8"	> 3/8"	2,097	1,303	1,776
3/8-16	0.3750	0.0775	0.0699	3,100	1,614	3,228	2,447	688	938	0.3181	> 3/8"	> 3/8"	3,100	1,572	2,144
7/16-14	0.4375	0.1063	0.0961	4,252	2,220	4,440	2,855	802	1,094	0.3442	> 3/8"	> 3/8"	4,252	1,873	2,554
1/2-13	0.5000	0.1419	0.1292	5,676	2,984	5,968	3,263	917	1,250	> 3/8"	> 3/8"	> 3/8"	5,642	2,140	2,918
9/16-12	0.5625	0.1819	0.1664	7,278	3,842	7,685	3,670	1,031	1,406	> 3/8"	> 3/8"	> 3/8"	6,444	2,444	3,333
5/8-11	0.6250	0.2260	0.2071	9,040	4,782	9,564	4,078	1,146	1,563	> 3/8"	> 3/8"	> 3/8"	7,148	2,711	3,697
3/4-10	0.7500	0.3345	0.3091	11,372	6,022	12,045	4,894	1,375	1,875	> 3/8"	> 3/8"	> 3/8"	8,612	3,266	4,454
7/8-9	0.8750	0.4617	0.4285	15,583	8,351	16,701	5,709	1,604	2,188	> 3/8"	> 3/8"	> 3/8"	10,158	3,853	5,254
1-8	1.0000	0.6057	0.5630	20,444	10,970	21,940	6,525	1,833	2,500	> 3/8"	> 3/8"	> 3/8"	11,696	4,437	6,050

STAINLESS STEEL - Alloy Groups 1, 2 and 3, Condition CW (Spaced Threads)

Nominal Fastener Diameter & Threads per Inch	D Nominal Thread Diameter (in)	K Basic Minor Diameter (in)	A(R) Thread Root Area (in2)	Allow able Tension (lbs)	Allow able Shear Single (lbs)	Allow able Shear Double (lbs)	Allow able Bearing (lbs) 1/8" Steel A36	Allow able Bearing (lbs) 1/8" Aluminum 6063-T5	Allow able Bearing (lbs) 1/8" Aluminum 6063-T6	Minimum Material Thickness (lbs) to Equal Tensile Capacity of Fastener (in) A36	Minimum Material Thickness 6063-T5	Minimum Material Thickness 6063-T6	Maximum Tensile Load (lbs) for Available 3/8" Plate Thickness 3/8" Steel A36	3/8" Aluminum 6063-T5	3/8" Aluminum 6063-T6
#6-20	0.1380	0.0990	0.0077	257	148	296	900	253	345	0.1191	0.1695	0.1378	257	257	257
#8-18	0.1640	0.1160	0.0106	352	203	407	1,070	301	410	0.1437	0.1930	0.1567	352	352	352
#10-16	0.1900	0.1350	0.0143	477	275	551	1,240	348	475	0.1528	0.2225	0.1805	477	477	477
#12-14	0.2160	0.1570	0.0194	645	373	745	1,409	396	540	0.1820	0.2610	0.2115	645	645	645
1/4-14	0.2500	0.1850	0.0269	896	517	1,035	1,631	458	625	0.2181	0.2994	0.2379	896	896	896
5/16-12	0.3125	0.2360	0.0437	1,750	1,010	2,020	2,039	573	781	0.2839	> 3/8"	0.2990	1,750	1,681	1,750
3/8-12	0.3750	0.2990	0.0702	2,809	1,622	3,243	2,447	688	938	> 3/8"	> 3/8"	> 3/8"	2,773	2,017	2,751

Group 1,2,3-Cond. CW	≤ 5/8" Dia.	≥ 3/4" Dia.	For Diameters < 3/4"	Effective Area (UNC Threads)	Effective Area (Spaced Threads)
F_U (Min. Ultimate Tensile Strength)	100,000 psi	85,000 psi	$F_T = F_U/SF$	$A(R) = \pi\ (D-1.2269/N)^2 / 4$	$A(R) = \pi K^2/4$
F_T (Allow. Tensile Stress, D≤1/4")	33,333 psi	N/A psi	Allow able Tension = $F_T[A(S)]$	$A(S) = \pi\ (D-0.9743/N)^2 / 4$	$A(S) = \pi K^2/4$
F_T (Allow. Tensile Stress, D> 1/4")	40,000 psi	33,750 psi	F_V = Fu / (SF x sq rt (3))		
F_V (Allowable Shear Strass; D≤1/4")	19,245 psi	N/A psi	Allowable Single Shear $=F_V[A(R)]$		
F_V (Allowable Shear Strass; D>1/4")	23,094 psi	19,486 psi			

NOTE 11:

1. Values are taken from AISC, ASTM, IFI, SAE and AA documents. K values for spaced threads are taken as the minimum values in IFI Fastener Handbook, 6th Ed. 2. Safety Factor used for fasteners with diameters 1/4" or less is 3.0, Safety Factor used for fasteners with diameters 5/16" or greater is 2.5.

3. Fasteners with diameters of 3/4" and greater are fabricated from different material than fasteners less than 3/4" in diameter.

4. For diameters of 3/4" and greater, F_y=45,00 psi. For these, tensile and shear yields govern the allowable tension and shear values (i.e., 0.75 F_y<F_u/SF

TABLE 20.3: Fastener Capacity

SAE Grade 5 Steel for Diameters up thru 9/16" (UNC Threads)
ASTM A 449 Steel for Diameters 5/8" and Over (UNC Threads)

Nominal Fastener Diameter & Threads per Inch	D Nominal Thread Diameter (in)	A(S) Tensile Stress Area (in2)	A(R) Thread Root Area (in2)	Allow able Tension (lbs)	Allow able Shear Single (lbs)	Allow able Shear Double (lbs)	Allow able Bearing (lbs) 1/8" Steel A36	Allow able Bearing (lbs) 1/8" Aluminum 6063-T5	Allow able Bearing (lbs) 1/8" Aluminum 6063-T6	Minimum Material Thickness (lbs) to Equal Tensile Capacity of Fastener (in) A36	Minimum Material Thickness 6063-T5	Minimum Material Thickness 6063-T6	Maximum Tensile Load (lbs) for Available 3/8" Plate Thickness 3/8" Steel A36	3/8" Aluminum 6063-T5	3/8" Aluminum 6063-T6
#6-32	0.1380	0.0091	0.0078	363	180	360	900	253	345	0.1602	0.3046	0.2268	363	363	363
#8-32	0.1640	0.0140	0.0124	560	286	573	1,070	301	410	0.2079	> 3/8"	0.2953	560	522	560
#10-24	0.1900	0.0175	0.0151	701	350	700	1,240	348	475	0.2246	> 3/8"	0.3001	701	643	701
#12-24	0.2160	0.0242	0.0214	967	493	986	1,409	396	540	0.2594	> 3/8"	0.3619	967	734	967
1/4-20	0.2500	0.0318	0.0280	1,273	646	1,291	1,631	458	625	0.2745	> 3/8"	> 3/8"	1,273	865	1,179
5/16-18	0.3125	0.0524	0.0469	2,517	1,299	2,599	2,039	573	781	0.3144	> 3/8"	> 3/8"	2,517	1,303	1,776
3/8-16	0.3750	0.0775	0.0699	3,719	1,937	3,874	2,447	688	938	0.3518	> 3/8"	> 3/8"	3,719	1,572	2,144
7/16-14	0.4375	0.1063	0.0961	5,103	2,664	5,328	2,855	802	1,094	> 3/8"	> 3/8"	> 3/8"	4,937	1,873	2,554
1/2-13	0.5000	0.1419	0.1292	6,811	3,581	7,162	3,263	917	1,250	> 3/8"	> 3/8"	> 3/8"	5,642	2,140	2,918
9/16-12	0.5625	0.1819	0.1664	8,733	4,611	9,222	3,670	1,031	1,406	> 3/8"	> 3/8"	> 3/8"	6,444	2,444	3,333
5/8-11	0.6250	0.2260	0.2071	10,848	5,738	11,477	4,078	1,146	1,563	> 3/8"	> 3/8"	> 3/8"	7,148	2,711	3,697
3/4-10	0.7500	0.3345	0.3091	16,054	8,565	17,130	4,894	1,375	1,875	> 3/8"	> 3/8"	> 3/8"	8,612	3,266	4,454
7/8-9	0.8750	0.4617	0.4285	22,163	11,876	23,753	5,709	1,604	2,188	> 3/8"	> 3/8"	> 3/8"	10,158	3,853	5,254
1-8	1.0000	0.6057	0.5630	29,076	15,601	31,203	6,525	1,833	2,500	> 3/8"	> 3/8"	> 3/8"	11,696	4,437	6,050

	SAE Grade 5 (≤ 9/16")	ASTM A449 (≥ 5/8")	For All Diameters	Effective Area (UNC Threads)	Effective Area (Spaced Threads)
F_U (Min. Ultimate Tensile Strength)	120,000 psi	120,000 psi	$F_T = F_U/SF$	$A(R) = \pi\ (D-1.2269/N)^2 / 4$	$A(R) = \pi K^2/4$
F_T (Allow. Tensile Stress, D≤1/4")	40,000 psi	N/A	Allow able Tension = $F_T[A(S)]$	$A(S) = \pi\ (D-0.9743/N)^2 / 4$	$A(S) = \pi K^2/4$
F_T (Allow. Tensile Stress, D> 1/4")	48,000 psi	48,000 psi	F_V = Fu / (SF x sq rt (3))		
F_V (Allowable Shear Strass; D≤1/4")	23,094 psi	N/A	Allowable Single Shear $=F_V[A(R)]$		
F_V (Allowable Shear Strass; D>1/4")	27,713 psi	27,713 psi			

6063-T6												
Nominal Thread Diameter & Thread Per Inch	D Nominal Thread Diameter (Inch)	TSA(I) Internal Thread Stripping Area Sq. In./Thread	Aluminum Thickness (Inches)									
			0.060	0.072	0.080	0.094	0.125	0.156	0.188	0.250	0.312	0.375
			Allowable Pullout (Pounds)									
#8-32	0.1640	0.010270	83	100	132	155	206	273	341	474	592	712
#10-24	0.1900	0.016864	96	116	153	180	239	324	413	584	729	876
#12-24	0.2160	0.019273	110	132	174	204	271	370	471	668	833	1001
1/4-20	0.2500	0.027234	127	152	201	236	314	431	552	786	981	1179
5/16-18	0.3125	0.037983	--	--	--	354	471	648	831	1184	1478	1776
3/8-16	0.3750	0.051581	--	--	--	--	565	780	1001	1429	1784	2144
7/16-14	0.4375	0.070205	--	--	--	--	--	918	1185	1702	2125	2554
1/2-13	0.5000	0.086405	--	--	--	--	--	1049	1354	1946	2428	2918

6063-T6

F_U (Tensile Ultimate Strength)	30000	psi
F_Y (Tensile Yield Strength)	25000	psi

Shading indicates transition region.

NOTE 26:

1. *Each table lists allowable pull-out (internal threads) values. SF = 3.0 for D ≤ 0.25"; SF = 2.5 for D ≥ 0.3125". Fastener allowable strength (basic tension and external threads) needs to be checked separately.*
2. *For pilot hole sizes refer to tables 21.1 to 21.7*
3. *Fastener pullout not shown for aluminum thickness less than approximately 2 threads, unless tested at a lesser thickness.*
4. *Multiple fastener connections and embrittlement need to be checked separately.*

6061-T6												
Nominal Thread Diameter & Thread Per Inch	D Nominal Thread Diameter (Inch)	TSA(I) Internal Thread Stripping Area Sq. In./Threa	Aluminum Thickness (Inches)									
			0.060	0.072	0.080	0.094	0.125	0.156	0.188	0.250	0.312	0.375
			Allowable Pullout (Pounds)									
#8-32	0.1640	0.010270	117	140	185	217	288	366	446	601	750	901
#10-24	0.1900	0.016864	135	162	214	251	334	435	539	740	923	1110
#12-24	0.2160	0.019273	154	184	243	286	380	495	615	846	1055	1268
1/4-20	0.2500	0.027234	178	213	281	331	440	578	720	996	1243	1494
5/16-18	0.3125	0.037983	--	--	--	496	660	868	1083	1500	1872	2250
3/8-16	0.3750	0.051581	--	--	--	--	792	1044	1305	1811	2260	2716
7/16-14	0.4375	0.070205	--	--	--	--	--	1229	1545	2156	2691	3235
1/2-13	0.5000	0.086405	--	--	--	--	--	1405	1766	2464	3076	3697

6061-T6

F_U (Tensile Ultimate Strength)	38000	psi
F_Y (Tensile Yield Strength)	35000	psi

Shading indicates transition region.

Glass Informational Bulletin **GANA FGMD 05-1212 (2018)**

Physical and Mechanical Properties of Typical Soda Lime Float Glass

Glass is a brittle material. It will act elastically until it fractures at ultimate load. That ultimate load will vary, depending upon the type and duration of the loads applied and the distribution, orientation and severity of the inhomogeneties and micro-flaws that exist in the surface of the glass. Because of this nature, glass cannot be engineered in the same way as other building envelope materials that have a predictable, specific strength. In those cases, factors can be (and are) assigned to help assure that breakage does not occur at the selected design load.

Because the ultimate strength of glass does vary, its strength can best be described statistically. Architects and engineers who wish to specify a design factor for glass in buildings must choose the anticipated wind load, its duration and the probability of glass breakage (defined as x per 1000 lites of glass at the initial occurrence of the design load). The International Building Code (IBC) currently used in the United States references ASTM E1300, which commonly uses a conservative factor of 8 per 1000 for vertical glazing.

Glass manufacturers can provide the appropriate data for determining the expected performance of their products. However, it remains the responsibility of the design professional to review these performance criteria and determine if they are suitable for the intended application. The following is a summary of the average physical and mechanical properties of soda lime float glass produced in North America.

- Modulus of Elasticity (E) is the mathematical description of an object or substance's tendency to be deformed elastically (i.e., non-permanently) when a force is applied to it. The elastic modulus of an object is defined as the slope of its stress-strain curve in the elastic deformation region.

  Modulus of Elasticity for glass is ~ 10.4×10^6 psi (71.7 GPa)

- Modulus of Rigidity (Shear) (G) is defined as the ratio of shear stress to the shear strain.

  ~ 4.3×10^6 psi (29.6 GPa)

- Poisson's Ratio (v) is the ratio, when a sample object is stretched, of the contraction (perpendicular to the applied load), to the extension (in the direction of the applied load).

  ~ 0.22

- Coefficient of Linear Thermal Expansion (α) defines the change in the length of an object with a change in temperature. Specifically, it measures the fractional change in volume per degree change in temperature at a constant pressure.

  ~ 4.6 x 10^{-6} strain per °F (8.3 x 10^{-6} strain per °C)

- Density (ρ) of a material is defined as its mass per unit volume

  ~ 157 lb/ft^3 (2500 kg/m^3)

- Modulus of Rupture (MOR) (Flexure)[a] is defined as a material's ability to resist deformation under load.

Glass Type	(mean)	(design: 8 in 1000)[b]
Annealed Glass	6,000 psi (41 MPa)	2,800 psi (19 MPa)
Heath Strengthened Glass	12,000 psi (83 MPa)	5,600 psi (39 MPa)
Fully Tempered Glass	24,000 psi (166 MPa)	11,200 psi (77 MPa)

note a - These are approximate values for short load durations (under 1 minute) for undamaged glass in four-sided support.
note b - Probability of breakage - note that these values are for the surface of the glass (not the edge) and do not take into consideration area effects.

- Hardness characterizes the scratch resistance of various minerals through the ability of a harder material to scratch a softer material

  Knoop's Scale ~ 470 - 605kg/mm^2

- Specific heat capacity (*C*) a measurable physical quantity that characterizes the amount of heat that is required to change an object's temperature by a given amount.

  ~ 0.20 - 0.21 Btu/lb x °F (0.84 - 0.88 J/ kg x K)

- Thermal conductivity (*k*) is the rate at which heat flows through a material between points at different temperatures, measured in watts per meter per degree.

  ~ 0.52 - 0.57 Btu/hr *x* ft x °F (0.9 - 1.0W K^{-1} m^{-1})

GANA FGMD 05-1212 (2018)

Allowable Design Stresses for Various Probabilities of Breakage (60 Second Load Duration)			
Probability of Breakage (breaks per 1,000 lites)	**Annealed** [a] psi (MPa)	**Heat-Strengthened** [b] psi (MPa)	**Fully Tempered** [c] psi (MPa)
1.0	1,900 (13.10)	4,700 (32.41)	10,200 (70.33)
2.0	2,200 (15.17)	5,000 (34.47)	10,500 (72.40)
3.0	2,350 (16.20)	5,150 (35.51)	10,700 (73.77)
4.0	2,500 (17.24)	5,300 (36.54)	10,850 (74.81)
5.0	2,600 (17.93)	5,400 (37.23)	10,950 (75.50)
6.0	2,700 (18.62)	5,450 (37.58)	11,050 (76.19)
7.0	2,750 (18.96)	5,550 (38.27)	11,150 (76.88)
8.0	2,800 (19.31)	5,600 (38.61)	11,200 (77.22)

(a) Coefficient of variation assumed to be 22%
(b) Coefficient of variation assumed to be 15%
(c) Coefficient of variation assumed to be 10%

The design stresses presented in Table 11 can be converted to 3-second duration design stresses by multiplying them by a load duration transformation factor of 1.21.

For selection of relatively thick glass as used in viewing windows for large aquariums, glass railings, glass mullions, and animal enclosures, finite element analysis, finite difference analysis, or conventional engineering mechanics equations can be used to calculate stresses. Experience has shown that allowable stress ranges for such applications are as follows:

Annealed Glass	600 - 1,200 psi (4 - 8 MPa)
Heat-Strengthened Glass	1,200 - 3,000 psi (8 - 21 MPa)
Fully Tempered Glass	2,400 - 6,000 psi (17 - 41 MPa)

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AMERICAN SOCIETY FOR QUALITY CONTROL

Submitted by: International Aluminum Corp.
767 Monterey Pass Road
P.O. Box 6
Monterey Park, CA 91765-0006

Date: August 13, 2002

Attn: Greg Hall

Report No.: 32351-R
P. O. No. 80838

REPORT

Lab Sample No.	Clips:
32351-1	White NC900 Face Clips, Delrin 100:16A, 16B, 16C
32351-2	Black NC900 Face Clips, Wellman annealed: 18A, 18B, 18C
32351-3	Black NC800 Face Clips.

PROCEDURE

Clips from the above samples were tested in triplicate for pull-out strength per IAC ENG-0002. Clips are tested in ambient conditions and after "accelerated weathering".

"Weathered" specimens were exposed to sunshine carbon-arc (ASTM G-153) accelerated weathering for 100 hours to simulate approximately 6 months outdoor exposure. These specimens were then exposed to -5 ± 3°F for a period of 4-6 hours. Specimens were removed from the freezer, engaged in the appropriate mullion and face cover, and testing initiated within 30 seconds of removal from the freezer.

One clip was used per pull at rates of 1, 2, and 3 in/min. for each set of three specimens. Samples were prepared by twisting the base of the clip in the TW700 mullion followed by engaging the appropriate face cover (TW812 for NC800; TW912 for NC900) by snapping on with a strike of a glazing mallet perpendicular to and directly over the plastic clip.

RESULTS

Test rate: 1 in/min

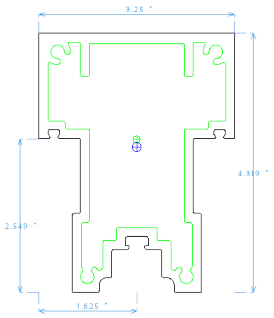
Sample	Direct Pull Loads (lbf) Non-Weathered	Direct Pull Loads (lbf) Weathered
32351-1a		
1	293.9	337.4
2	293.9	343.6
3	279.0	349.8
(Avg)	288.9	343.6
(SD)	(8.6)	(6.2)

Section Properties and Stresses Analysis Results

	Axes X-Y	Centroidal Axes	Principal Axes
Ix (in^4)	+6.464	+6.464	+6.464
Iy (in^4)	+3.117	+3.117	+3.117
Ixy (in^4)	+0.	+0.	+0.
Io (in^4)	+9.581	+9.581	+9.581
rx (in)	+1.489	+1.489	+1.489
ry (in)	+1.034	+1.034	+1.034
ro (in)	+1.813	+1.813	+1.813
Y top (in)		+1.899	+1.899
Y bot (in)		+2.42	+2.42
Sx top (in^3)		+3.404	+3.404
Sx bot (in^3)		+2.671	+2.671
X right (in)		+1.625	+1.625
X left (in)		+1.625	+1.625
Sy right (in^3)		+1.918	+1.918
Sy left (in^3)		+1.918	+1.918
Zpx (in^3)		+3.864	+3.864
Zpy (in^3)		+2.759	+2.759
Max Mx (lb.in)		+42731.881	+42731.881
Max My (lb.in)		+30692.367	+30692.367
Mpx (lb.in)		+61823.178	+61823.178
Mpy (lb.in)		+44137.116	+44137.116
SFx		+1.447	+1.447
SFy		+1.438	+1.438
IMax (in^4)			+6.464
IMin (in^4)			+3.117
Theta (Deg)			+0.

Elastic Neutral Axis	
In (in^4)	+6.464
ENA Angle(°)	+0.
Y top (in)	+1.899
Y bot (in)	+2.42
Sx top (in^3)	+3.404
Sx bot (in^3)	+2.671
X right (in)	+1.625
X left (in)	+1.625
Sy right (in^3)	+1.918
Sy left (in^3)	+1.918
Zpx (in^3)	+3.864
Zpy (in^3)	+2.759
Max Mx (lb.in)	+42731.881
Max My (lb.in)	+30692.367
Mpx (lb.in)	+61823.178
Mpy (lb.in)	+44137.116
SFx	+1.447
SFy	+1.438
Torque Max (lb.in)	+29733.901

Buckling	
jy (monosymmetry)	+0.985 in
jx (monosymmetry)	+0. in
Cxrt Shear Constant	+0.746 in^2
Cyrt Shear Constant	+0.993 in^2
ßtf Torsional-flexural	+0.776
a Torsional-Bending	+0.495 in



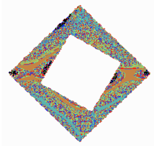
Area	+2.916 in^2
Mass/L	+0.286 lb/ in
Xc	+0. in
Yc	+0. in
NA (Deg)	+0.0 Deg
PNA (x,y)	(+0.0,+0.22)

Torsion and Shear	
J(Torsion)	+3.185 in^4
Cw(Warping)	+0.294 in^6
Xs (Shear)	+0. in
Ys (Shear)	+0.975 in
Ax	+1.392 in^2
Kx	+0.477
Ay	+1.392 in^2
Ky	+0.477
Ios	+12.353 in^4
ros	+2.058 in
Swx	+3.04 in^5
Swy	-0.001 in^5
Dsc	+0.975 in

Composite Section	
Ref. Aluminium 606	+10000000. psi
Transf. Area	+2.916 in^2
Xcc	+0. in
Ycc	+0. in

Stressses	Yield & Max/Min
Sig-yield T	+16000. psi
Sig-yield C	-16000. psi
Tau yield	+30000. psi
Sig-x max T)	+37.443 psi
Sig-x max C)	-29.373 psi
Fpt	+23325.926 lb
Fpc	+23325.926 lb

Loads	
Moment Mx	+100. lb.in
Moment My	+0. lb.in
Axial N [.0,.0]	+0. lb
Torque Tz	+100. lb.in
Bimoment Bw	+10000. lb.in²
Shear Vx	+100. lb



Section Design and Calculation Report

Approved by:

ShapeDesigner SaaS

Section Properties and Stresses Analysis Results

	Axes X-Y	Centroidal Axes	Principal Axes
Ix (in^4)	+3.375	+3.375	+3.375
Iy (in^4)	+0.844	+0.844	+0.844
Ixy (in^4)	+0.	+0.	+0.
Io (in^4)	+4.219	+4.219	+4.219
rx (in)	+0.866	+0.866	+0.866
ry (in)	+0.433	+0.433	+0.433
ro (in)	+0.968	+0.968	+0.968
Y top (in)		+1.5	+1.5
Y bot (in)		+1.5	+1.5
Sx top (in^3)		+2.25	+2.25
Sx bot (in^3)		+2.25	+2.25
X right (in)		+0.75	+0.75
X left (in)		+0.75	+0.75
Sy right (in^3)		+1.125	+1.125
Sy left (in^3)		+1.125	+1.125
Zpx (in^3)		+3.375	+3.375
Zpy (in^3)		+1.687	+1.687
Max Mx (lb.in)		+134999.997	+134999.997
Max My (lb.in)		+67500.007	+67500.007
Mpx (lb.in)		+202499.996	+202499.996
Mpy (lb.in)		+101249.998	+101249.998
SFx		+1.5	+1.5
SFy		+1.5	+1.5
IMax (in^4)			+3.375
IMin (in^4)			+0.844
Theta (Deg)			+0.

Elastic Neutral Axis	
In (in^4)	+3.375
ENA Angle(°)	+0.
Y top (in)	+1.5
Y bot (in)	+1.5
Sx top (in^3)	+2.25
Sx bot (in^3)	+2.25
X right (in)	+0.75
X left (in)	+0.75
Sy right (in^3)	+1.125
Sy left (in^3)	+1.125
Zpx (in^3)	+3.375
Zpy (in^3)	+1.687
Max Mx (lb.in)	+134999.997
Max My (lb.in)	+67500.007
Mpx (lb.in)	+202499.996
Mpy (lb.in)	+101249.998
SFx	+1.5
SFy	+1.5
Torque Max (lb.in)	+0.

Buckling	
jy (monosymmetry)	+0. in
jx (monosymmetry)	+0. in
Cxrt Shear Constant	+3. in^2
Cyrt Shear Constant	+3. in^2
ßtf Torsional-flexural	+1.
a Torsional-Bending	+0.507 in

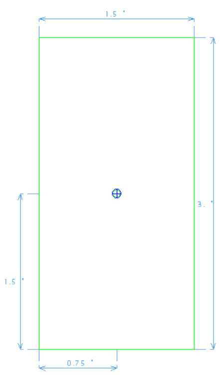
Area	+4.5 in^2
Mass/L	+1.278 lb/ in
Xc	+0. in
Yc	+0. in
NA (Deg)	+0.0 Deg
PNA (x,y)	(+0.0,+0.0)

Torsion and Shear	
J(Torsion)	+2.319 in^4
Cw(Warping)	+0.231 in^6
Xs (Shear)	+0. in
Ys (Shear)	+0. in
Ax	+3.75 in^2
Kx	+0.833
Ay	+3.75 in^2
Ky	+0.833
Ios	+4.219 in^4
ros	+0.968 in
Swx	+0. in^5
Swy	+0. in^5
Dsc	+0. in

Composite Section	
Ref. Steel	+29000000. psi
Transf. Area	+4.5 in^2
Xcc	+0. in
Ycc	+0. in

Stressses	Yield & Max/Min
Sig-yield T	+60000. psi
Sig-yield C	-60000. psi
Tau yield	+0. psi
Sig-x max T)	+44.444 psi
Sig-x max C)	-44.444 psi
Fpt	+134999.997 lb
Fpc	+134999.997 lb

Loads	
Moment Mx	+100. lb.in
Moment My	+0. lb.in
Axial N [.0,.0]	+0. lb
Torque Tz	+100. lb.in
Bimoment Bw	+10000. lb.in²
Shear Vx	+100. lb



System Units: Section Material Identification:

Length:[in]
Mass :[lb]
Stress:[psi]

[Steel]: E=+29000000. [psi]; Nu=0.29; Ro=+0.284[lb/in³]

Date : 09-03-2020 / 06:49:33
Engineer :
Client :
Comment :
Project Ref.:
Project Name: UNTITLED

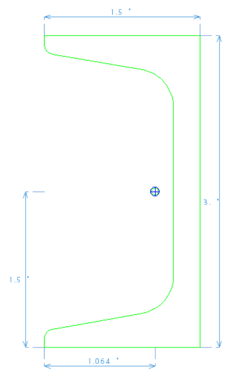
SHT S3

Section Properties and Stresses Analysis Results

	Axes X-Y	Centroidal Axes	Principal Axes
Ix (in^4)	+1.871	+1.871	+1.871
Iy (in^4)	+0.245	+0.245	+0.245
Ixy (in^4)	+0.	+0.	+0.
Io (in^4)	+2.116	+2.116	+2.116
rx (in)	+1.122	+1.122	+1.122
ry (in)	+0.406	+0.406	+0.406
ro (in)	+1.193	+1.193	+1.193
Y top (in)		+1.5	+1.5
Y bot (in)		+1.5	+1.5
Sx top (in^3)		+1.247	+1.247
Sx bot (in^3)		+1.247	+1.247
X right (in)		+0.436	+0.436
X left (in)		+1.064	+1.064
Sy right (in^3)		+0.563	+0.563
Sy left (in^3)		+0.23	+0.23
Zpx (in^3)		+1.536	+1.536
Zpy (in^3)		+0.464	+0.464
Max Mx (lb.in)		+74830.197	+74830.197
Max My (lb.in)		+13825.619	+13825.619
Mpx (lb.in)		+92178.272	+92178.272
Mpy (lb.in)		+27811.103	+27811.103
SFx		+1.232	+1.232
SFy		+2.012	+2.012
IMax (in^4)			+1.871
IMin (in^4)			+0.245
Theta (Deg)			+0.

Elastic Neutral Axis	
In (in^4)	+1.871
ENA Angle(°)	+0.
Y top (in)	+1.5
Y bot (in)	+1.5
Sx top (in^3)	+1.247
Sx bot (in^3)	+1.247
X right (in)	+0.436
X left (in)	+1.064
Sy right (in^3)	+0.563
Sy left (in^3)	+0.23
Zpx (in^3)	+1.536
Zpy (in^3)	+0.464
Max Mx (lb.in)	+74830.197
Max My (lb.in)	+13825.619
Mpx (lb.in)	+92178.272
Mpy (lb.in)	+27811.103
SFx	+1.232
SFy	+2.012
Torque Max (lb.in)	+0.

Buckling	
jy (monosymmetry)	+0. in
jx (monosymmetry)	+1.482 in
Cxrt Shear Constant	+0.645 in^2
Cyrt Shear Constant	+0.628 in^2
ßtf Torsional-flexural	+0.743
a Torsional-Bending	+3.983 in



Area	+1.487 in^2
Mass/L	+0.422 lb/ in
Xc	+0. in
Yc	+0. in
NA (Deg)	+0.0 Deg
PNA (x,y)	(+0.0,+0.0)

Torsion and Shear	
J(Torsion)	+0.047 in^4
Cw(Warping)	+0.287 in^6
Xs (Shear)	+0.702 in
Ys (Shear)	+0. in
Ax	+0.862 in^2
Kx	+0.58
Ay	+0.862 in^2
Ky	+0.58
Ios	+2.85 in^4
ros	+1.384 in
Swx	+0. in^5
Swy	-1.314 in^5
Dsc	+0.702 in

Composite Section	
Ref. Steel	+29000000. psi
Transf. Area	+1.487 in^2
Xcc	+0. in
Ycc	+0. in

Stressses	Yield & Max/Min
Sig-yield T	+60000. psi
Sig-yield C	-60000. psi
Tau yield	+0. psi
Sig-x max T)	+80.182 psi
Sig-x max C)	-80.182 psi
Fpt	+44606.324 lb
Fpc	+44606.324 lb

Loads	
Moment Mx	+100. lb.in
Moment My	+0. lb.in
Axial N [.0,.0]	+0. lb
Torque Tz	+100. lb.in
Bimoment Bw	+10000. lb.in²
Shear Vx	+100. lb

Section Properties and Stresses Analysis Results

	Axes X-Y	Centroidal Axes	Principal Axes
Ix (in^4)	+8.233	+8.233	+8.05
Iy (in^4)	+8.238	+8.238	+8.421
Ixy (in^4)	+0.186	+0.186	+0.
Io (in^4)	+16.471	+16.471	+16.471
rx (in)	+1.629	+1.629	+1.611
ry (in)	+1.629	+1.629	+1.647
ro (in)	+2.304	+2.304	+2.304
Y top (in)		+2.149	+3.033
Y bot (in)		+2.351	+3.318
Sx top (in^3)		+3.831	+2.654
Sx bot (in^3)		+3.503	+2.426
X right (in)		+2.35	+3.176
X left (in)		+2.15	+3.175
Sy right (in^3)		+3.505	+2.651
Sy left (in^3)		+3.832	+2.652
Zpx (in^3)		+4.502	+4.048
Zpy (in^3)		+4.504	+4.324
Max Mx (lb.in)		+105076.513	+72789.388
Max My (lb.in)		+105141.711	+79538.536
Mpx (lb.in)		+135062.409	+121427.056
Mpy (lb.in)		+135107.524	+129728.522
SFx		+1.285	+1.668
SFy		+1.285	+1.631
IMax (in^4)			+8.421
IMin (in^4)			+8.05
Theta (Deg)			+44.672

Elastic Neutral Axis	
In (in^4)	+8.225
ENA Angle(°)	+1.291
Y top (in)	+2.197
Y bot (in)	+2.403
Sx top (in^3)	+3.744
Sx bot (in^3)	+3.423
X right (in)	+2.398
X left (in)	+2.202
Sy right (in^3)	+3.439
Sy left (in^3)	+3.745
Zpx (in^3)	+4.503
Zpy (in^3)	+4.502
Max Mx (lb.in)	+102697.874
Max My (lb.in)	+103164.537
Mpx (lb.in)	+135078.507
Mpy (lb.in)	+135068.342
SFx	+1.315
SFy	+1.309
Torque Max (lb.in)	+70491.69

Buckling	
jy (monosymmetry)	-0.692 in
jx (monosymmetry)	+0.692 in
Cxrt Shear Constant	+1.011 in^2
Cyrt Shear Constant	+1.012 in^2
ßtf Torsional-flexural	+0.772
a Torsional-Bending	+0.949 in

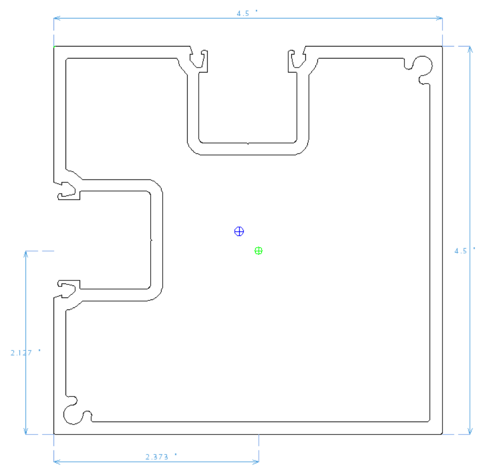
Area	+3.103 in^2
Mass/L	+0.304 lb/ in
Xc	+0. in
Yc	+0. in
NA (Deg)	+1.29 Deg
PNA (x,y)	(-0.01,+0.42)

Torsion and Shear	
J(Torsion)	+6.965 in^4
Cw(Warping)	+2.357 in^6
Xs (Shear)	+0.885 in
Ys (Shear)	-0.885 in
Ax	+1.518 in^2
Kx	+0.489
Ay	+1.519 in^2
Ky	+0.49
Ios	+21.331 in^4
ros	+2.622 in
Swx	-7.455 in^5
Swy	-7.451 in^5
Dsc	+1.252 in

Composite Section	
Ref. Aluminium 606	+10000000. psi
Transf. Area	+3.103 in^2
Xcc	+0. in
Ycc	+0. in

Stressses	Yield & Max/Min
Sig-yield T	+30000. psi
Sig-yield C	-30000. psi
Tau yield	+30000. psi
Sig-x max T)	+29.205 psi
Sig-x max C)	-26.703 psi
Fpt	+46542.014 lb
Fpc	+46542.014 lb

Loads	
Moment Mx	+100. lb.in
Moment My	+0. lb.in
Axial N [.0,.0]	+0. lb
Torque Tz	+100. lb.in
Bimoment Bw	+10000. lb.in²
Shear Vx	+100. lb



System Units: Section Material Identification:

Length:[in] [Aluminium 6063 - T6(extruded)]: E=+10000000. [psi]; Nu=0.33; Ro=+0.098[lb/in³]

Mass :[lb]

Stress:[psi]

Date : 05-28-2021 / 15:12:03
Engineer :
Client :
Comment :
Project Ref.:
Project Name: UNTITLED

SHT S4