DATE: August 7th, 2024

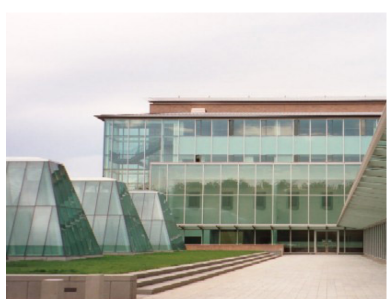
CLIENT: AV Builders

PROJECT: AV Builders TonyView

NUMBER: 2023-132

LOCATION: None – System Design

SUBJECT: Structural Calculations for the TonyView Window System and its Anchorage to the Support Structure



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EXECUTIVE SUMMARY / BASIS OF DESIGN

1. This calculation package represents the structural review of the TonyView window system, as illustrated in the window concept drawings, dated 07/26/2024 and drawn by WSE.

2. The structural conditions noted in this calculation package are based upon a “worst-case” or “by comparison” type analysis whenever possible. Other structural conditions that are noted to be “similar to” or “less severe than” the calculated condition(s) considered OK by comparison.

3. This calculation package is based on the largest TonyView application (2’-0” x 2’-0” wide by 8’-0” tall). Narrower and / or shorter applications are considered OK by Comparison to the design within this package.

4. Prior to construction, the applied loads to the TonyView window must be reviewed on a project-by-project basis by an engineer, to confirm that the loading does not exceed the design loads used within this package.

Design Criteria

5. The TonyView window system is intended to be utilized in low-rise (3 stories or less) wood framed construction. It is a hybrid system that provides vertical support to the perimeter framing, eliminating the need for a corner column. It does not provide lateral support and it is not intended to be self-supported. Top attachment to the building structure is required for lateral (wind load) support and to transfer vertical forces to the base.

6. The loads utilized in the design of the system are noted in the Design Criteria section of this calculation package, along with the maximum distances to interior load bearing columns or walls.

7. All loads are based on 2018 IBC requirements.

Verticals

8. Use of high-impact plastic shims is required under all verticals.

Horizontals

9. The horizontals are to have 4” long glass setting blocks located at ¼ points of the span.

10. Based on these setting block locations, all horizontals are OK for stress and deflection.

Anchors

11. The system designed within this package assumes anchorage into a concrete slab. Any deviation from this design condition must be reviewed by WSE and is not included in this package.

Connections

12. Internal connection between horizontal and vertical framing members have been reviewed and found to be acceptable structurally.

13. At the butt glazed mullions, the structural silicone joint width is 3/8" minimum, based on the use of structural silicone with an allowable tensile strength of 20psi, as shown in the detail in the 'Connections' section of this package.

Miscellaneous

14. The ability of the perimeter structure to safely withstand the imposed loads must be verified by others. Design of perimeter members, such as floor slabs, sheathing, studs, header beams, slabs, etc. is outside the scope of this calculation package.

15. All dissimilar materials (including but not limited to steel+aluminum and concrete+aluminum) must be adequately protected from any potential negative effects of corrosion. The design of these protections is by others.

DESIGN CRITERIA

Building Code and Referenced Standards

2018 International Building Code (2018 IBC)

ADM1-2015	Aluminum Design Manual
AISC 360-16	Specifications for Structural Steel Buildings
ACI 318-14	Building Code Requirements for Structural Concrete
AWS D1.1-15	Structural Welding Code – Steel
ASCE 7-16	Minimum Design Loads and Associated Criteria for Buildings and Other Structures

Design Loads

Wind Loads - WL: (116 mph / Exp. D / Risk Cat. III / MRH = 48 ft)

Positive Pressures, Zones 4 & 5:	+ 26.1	psf
Negative Pressures, Zone 4:	- 28.4	psf
Negative Pressures, Zone 5:	- 35.0	psf (Used 35 psf for design)

Dead Loads - DL (Loads indicated below are for the full roof / floor / wall assembly):

Roof Dead Load	20.0	psf
Wall Dead Load	11.0	psf
Floor Dead Load	15.0	psf

Live Loads - LL:

Roof Live Load	20.0	psf
Floor Live Load	40.0	psf

Snow Loads - SL:

Snow Load:	30.0	psf

Deflection Limitations

Window System

Normal to Wall

Clear Spans:	L/175 for spans up to and including 13’-6” L/240+1/4” for spans over 13’-6” but less than 40’-0”
Cantilever Spans:	2*L / 175 or 3/4”, whichever is less.
Single Lite of Glass:	L/175 or 3/4", whichever is less.
Jamb Conditions:	Subject to above, and not to exceed more than 50% of the joint width in tension or 100% of the joint width in shear.

Parallel to Wall

Horizontals:	25% of glass bite of 1/8” maximum
Net Opening:	L/360 or 1/8”, whichever is less.
Operable Units:	1/16” maximum.

Building Movements

The system does not accommodate any building movements. It is part of the support structure for all vertical loads (DL, LL, and SL)

Thermal Movements

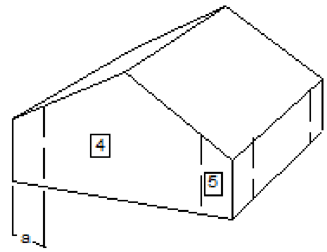
Exterior Surface Temperature Range:	0° to 180° F
Installation Temperature:	70° F
Thermal Expansion:	0.228" maximum (per 13'-6" floor spacing)

Construction Tolerances:

In and Out:	+/- 1"
Up and Down:	+/- 1"
Side to Side:	+/- 1"

ASCE 7-16 WIND LOADS (on Components and Cladding for h < 60')

(Reference: ASCE 7-16 Section 30)



Building Information

Mean Roof or Parapet Height	$h_r := 48$	ft.
Least Bldg. Width	$w := 60$	ft.
Basic Wind Speed [Fig 26.5-1 A-D]	$V := 116$	mph
Building Exposure Category:	Exposure := “D”	
Risk Category: [Table 1.5-1]	Risk := “III”	
Height Above Sea Level	$h_e := 650$	ft.

Corner Zone Width [Fig 30.4-1]

$a1 := \text{if}\left(0.10 \cdot w < 0.4 \cdot h_r, 0.10 \cdot w, 0.4 \cdot h_r\right)$

$a2 := \text{if}\left(0.04 \cdot w > 3.0, 0.04 \cdot w, 3.0\right)$

$a := \text{if}\left(a1 > a2, a1, a2\right) = 6.0$ ft

Velocity Pressure Calculation

Directionality Factor [Table 26.6-1]	$K_d := 0.85$
Assuming surrounding area is flat,Topographic Factor [Fig 26.8-1]	$K_{zt} := 1.0$
Ground Elevation Factor [Table 26.9-1]	$K_e := 1.0$

Velocity Pressure Coefficient at height z = hr, per Table 30.3-1

$z_g := \text{if}\left(\text{Exposure} = \text{“B”}, 1200, \text{if}\left(\text{Exposure} = \text{“C”}, 900, \text{if}\left(\text{Exposure} = \text{“D”}, 700, \text{“Err”}\right)\right)\right) = 700$ [Table 26.11-1]

$\alpha := \text{if}\left(\text{Exposure} = \text{“B”}, 7, \text{if}\left(\text{Exposure} = \text{“C”}, 9.5, \text{if}\left(\text{Exposure} = \text{“D”}, 11.5, \text{“Err”}\right)\right)\right) = 11.5$ [Table 26.11-1]

$z_{min} := \text{if}\left(\text{Exposure} = \text{“B”}, 30, 15\right) = 15$ ft.

$z := \text{if}\left(h_r < z_{min}, z_{min}, h_r\right) = 48.00$ ft.

Velocity Pressure Coefficient [Table 26.10-1] $K_z := 2.01 \cdot \left(\frac{z}{z_g}\right)^{\frac{2}{\alpha}} = 1.26$

Velocity Pressure [Eq. 26.10-1] $q_z := 0.00256 \cdot K_z \cdot K_{zt} \cdot K_d \cdot K_e \cdot V^2 = 36.9$ psf

Design Pressure Calculation

Minimum Wind Pressure: [Clause 30.2.2] $Q_{minp} := 16$ psf $Q_{minn} := -16$ psf

Internal Pressure Coefficient for enclosed building $GCpi := 0.18$ [Table 26.13-1]

Effective Tributary Area: (500 ft. max.) $A := 10$ ft^2

External Pressures Coefficient: [Fig 30.3-1]

$GC_{p\_45pos} := \text{if}\left(A \le 10, 1.0, 1.1766 - 0.1766 \cdot \log(A)\right) = 1.00$

$GC_{p\_4neg} := \text{if}\left(A \le 10, -1.1, -1.2766 + 0.1766 \cdot \log(A)\right) = -1.10$

$GC_{p\_5neg} := \text{if}\left(A \le 10, -1.4, -1.7532 + 0.3532 \cdot \log(A)\right) = -1.40$

Design Pressures: [Eq. 30.3-1]

Positive Wind Pressure, Zones 4&5 $Q_{pos45} := \max\left(q_z \cdot \left(GC_{p\_45pos} + GCpi\right), Q_{minp}\right) = 43.6$ psf

Negative Wind Pressure, Zone 4 $Q_{neg4} := min\left(q_z \cdot \left(GC_{p\_4neg} - GCpi\right), Q_{minn}\right) = -47.3$ psf

Negative Wind Pressure, Zone 5 $Q_{neg5} := min\left(q_z \cdot \left(GC_{p\_5neg} - GCpi\right), Q_{minn}\right) = -58.3$ psf

Factored Design Pressures - Allowable Stress Load Combinations - D + 0.6W (Section 2.4.1)

Positive Wind Pressure, Zones 4&5 $Q_{pos45f} := \max\left(0.6 \cdot q_z \cdot \left(GC_{p\_45pos} + GCpi\right), 0.6 \cdot Q_{minp}\right) = 26.1$ psf

Negative Wind Pressure, Zone 4 $Q_{neg4f} := min\left(0.6 \cdot q_z \cdot \left(GC_{p\_4neg} - GCpi\right), 0.6 \cdot Q_{minn}\right) = -28.4$ psf

Negative Wind Pressure, Zone 5 $Q_{neg5f} := min\left(0.6 \cdot q_z \cdot \left(GC_{p\_5neg} - GCpi\right), 0.6 \cdot Q_{minn}\right) = -35.0$ psf

MATERIAL SPECIFICATIONS

Aluminum

Aluminum Framing Extrusions:

Alloy and Temper:	6061-T6
Minimum Yield Strength:	F_y = 35 ksi
Minimum Ultimate Strength:	F_u = 38 ksi

Aluminum Anchor Extrusions:

Alloy and Temper:	6061-T6
Minimum Yield Strength:	F_y = 35 ksi
Minimum Ultimate Strength:	F_u = 38 ksi

Aluminum Panels and Formed Shapes:

Alloy and Temper:	3003-H14
Minimum Yield Strength:	F_y = 17 ksi
Minimum Ultimate Strength:	F_u = 20 ksi

Aluminum Plate:

Alloy and Temper:	6061-T6
Minimum Yield Strength:	F_y = 35 ksi
Minimum Ultimate Strength:	F_u = 38 ksi

Carbon Steel

Carbon Steel I-Beams:

Material:	ASTM A992
Minimum Yield Strength:	F_y = 50 ksi
Minimum Ultimate Strength:	F_u = 65 ksi

Carbon Steel HSS Members:

Material:	ASTM A500, Grade B
Minimum Yield Strength:	F_y = 46 ksi
Minimum Ultimate Strength:	F_u = 58 ksi

Carbon Steel Angles, Channels, Formed Shapes, and Flat Plates:

Material:	ASTM A36
Minimum Yield Strength:	F_y = 36 ksi
Minimum Ultimate Strength:	F_u = 58 ksi

Fasteners and Welds

Carbon Steel Fasteners

Material:	SAE J429, Grade 5 or ASTM A325
Minimum Yield Strength:	F_y = 92 ksi
Minimum Ultimate Strength:	F_u = 120 ksi

Stainless Steel Fasteners

Material:	304 Stainless Steel, Cold Worked
Minimum Yield Strength:	F_y = 65 ksi
Minimum Ultimate Strength:	F_u = 110 ksi

Welded Studs

Material:	ASTM A108, Grades 1010 Through 1020, Cold Drawn Steel, in accordance with AWS D1.1-10 Type B Studs
Minimum Yield Strength:	F_y = 50 ksi
Minimum Ultimate Strength:	F_u = 61 ksi

Carbon Steel Self-Drilling Fasteners

Dril-Flex® High Performance Structural Drill Screws with Stalgard® corrosion resistant coating as manufactured by Elco Industries, Inc.

Stainless Steel Self-Drilling Fasteners

Bi-Flex® 300 Series (18-8) Stainless Steel Bi-Metal Self Drilling Screws with Stalgard GB® corrosion resistant coating as manufactured by Elco Industries, Inc.

Tee Bolt Fasteners

Material:	Grade 8.8, Hi-Tensile Carbon Steel

Deformed Bar Anchor Studs

Material:	D2L Deformed Bar Anchors (DBA) by Nelson Stud Welding, complying with ASTM A496 and AWS D1.1-10 Type C Studs
Minimum Yield Strength:	F_y = 70 ksi
Minimum Ultimate Strength:	F_u = 80 ksi

Concrete Reinforcing Bars

Material:	ASTM A615, Grade 60
Minimum Yield Strength:	F_y = 60 ksi
Minimum Ultimate Strength:	F_u = 90 ksi

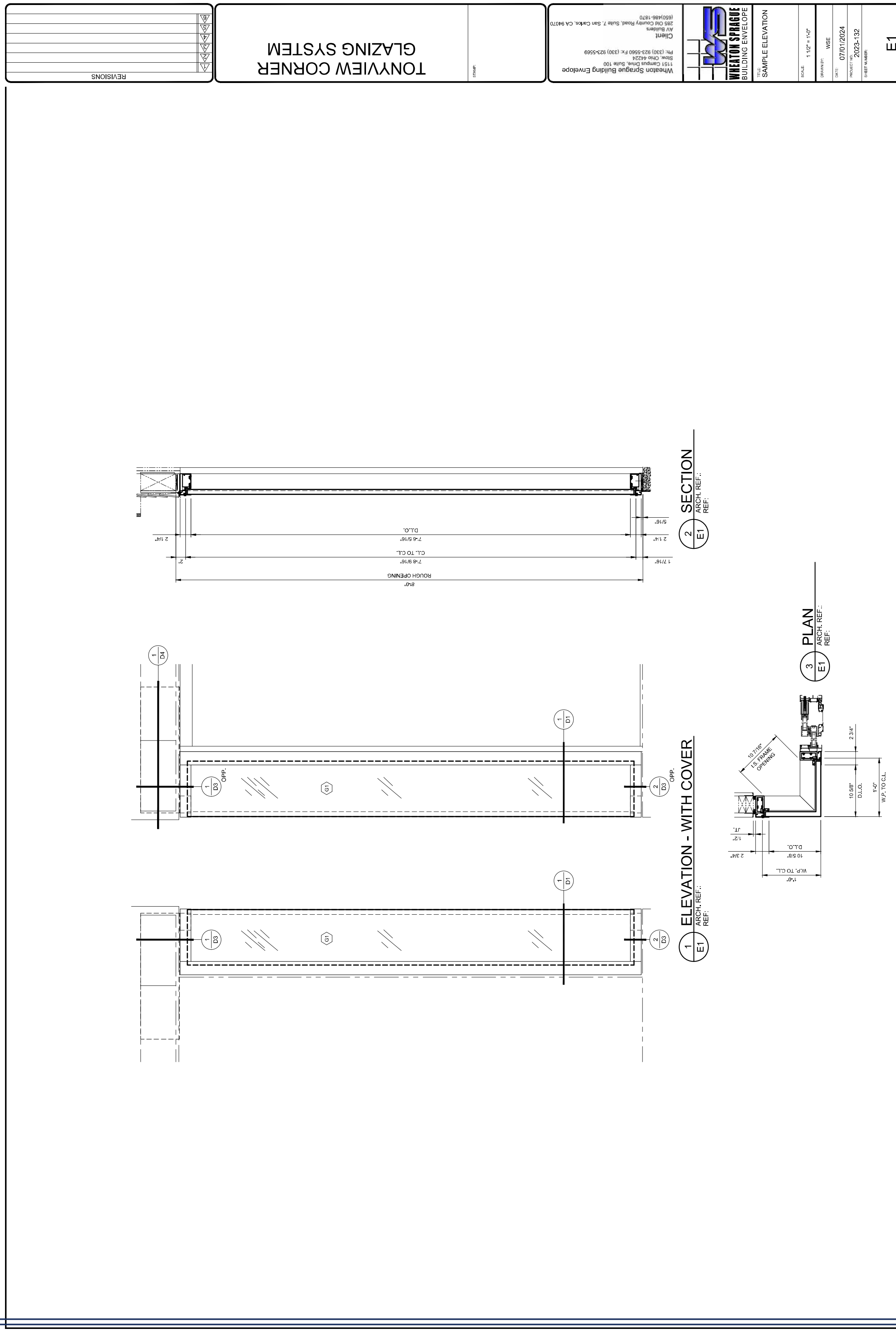
Carbon Steel Welding

Welding shall be in compliance with AWS D1.1 “Structural Welding Code – Steel” and all steel filler metal shall be E70XX electrode

Aluminum Welding

All aluminum filler metal shall be ER4043 electrode unless noted otherwise.

DESIGN DRAWINGS


REVISIONS
TONYVIEW CORNER
GLAZING SYSTEM
Wheaton Sprague Building Envelope
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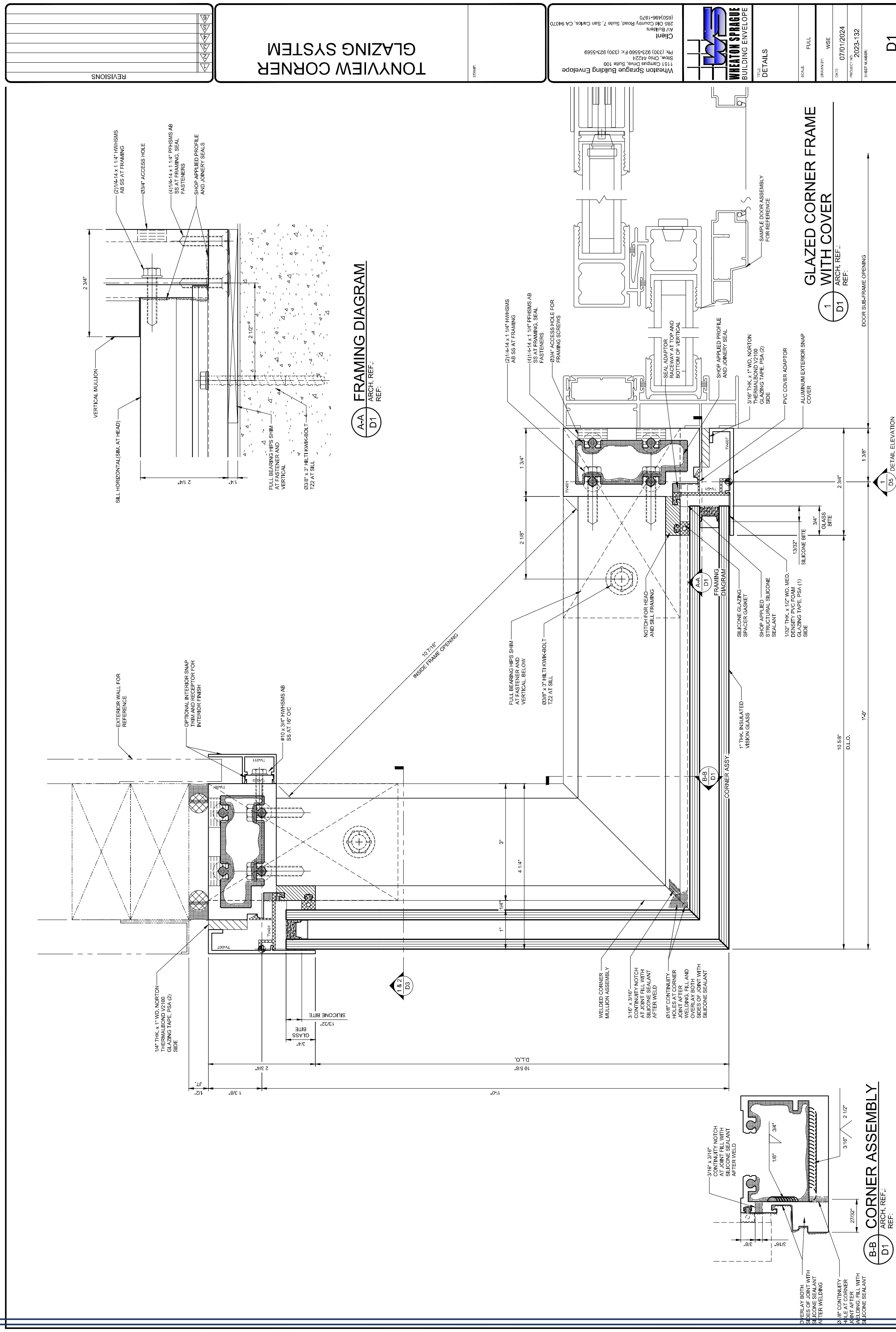
Stow, Ohio 44224
Ph: (330) 923-5560 Fx: (330) 923-5569
Client
AV Builders
285 Old County Road, Suite 7, San Carlos, CA 94070
(650)486-1870
WHEATON SPRAGUE
BUILDING ENVELOPE
SAMPLE ELEVATION
1 1/2" = 1'-0"
WSE
07/01/2024
2023-132
E1
SECTION
ARCH. REF.:
REF:
D.L.O.
C.L. TO C.L.
ROUGH OPENING
8'-0"
PLAN
ARCH. REF.:
REF:
ELEVATION - WITH COVER
ARCH. REF.:
REF:
W.P. TO C.L.
1'-0"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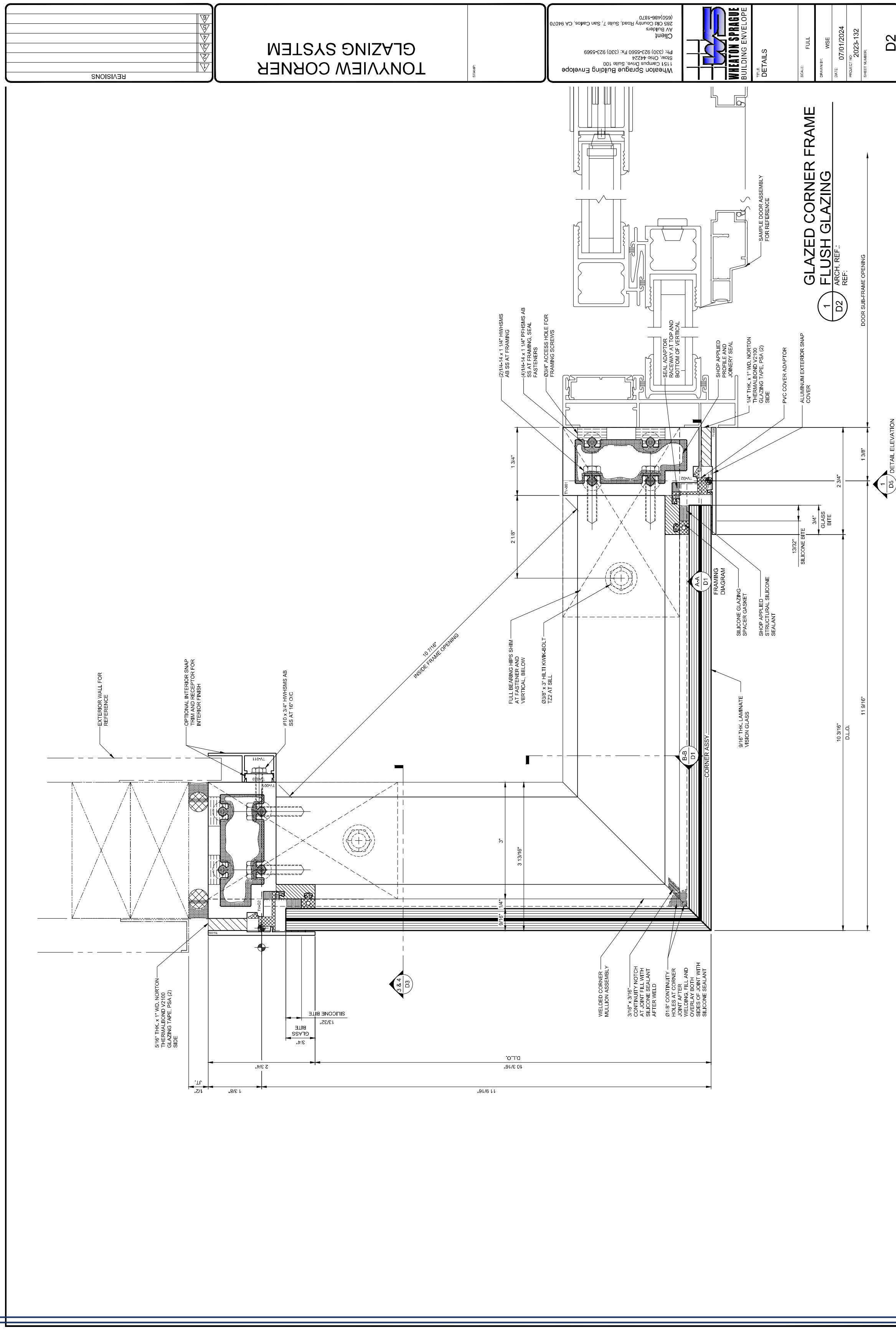
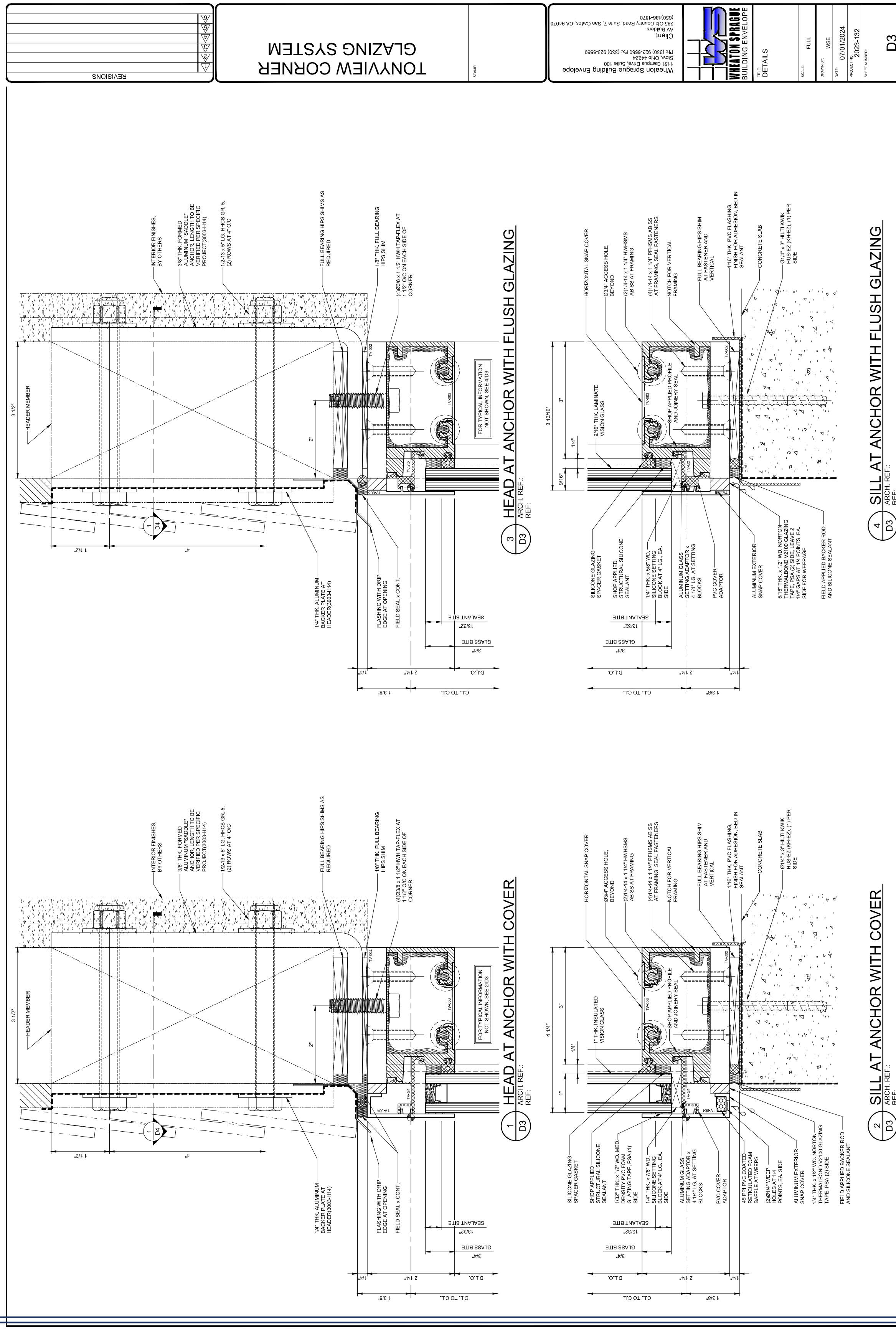
REVISIONS
WHEATON SPRAGUE BUILDING ENVELOPE
DETAILS
FULL
WSE
07/01/2024
2023-132
D1
GLAZED CORNER FRAME WITH COVER
FRAMING DIAGRAM
CORNER ASSEMBLY


TONYVIEW CORNER
GLAZING SYSTEM
REVISIONS
Wheaton Sprague Building Envelope
DETAILS
D2
GLAZED CORNER FRAME
FLUSH GLAZING
DETAIL ELEVATION
CORNER ASSY
INSIDE FRAME OPENING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REVISIONS
DETAILS
D3
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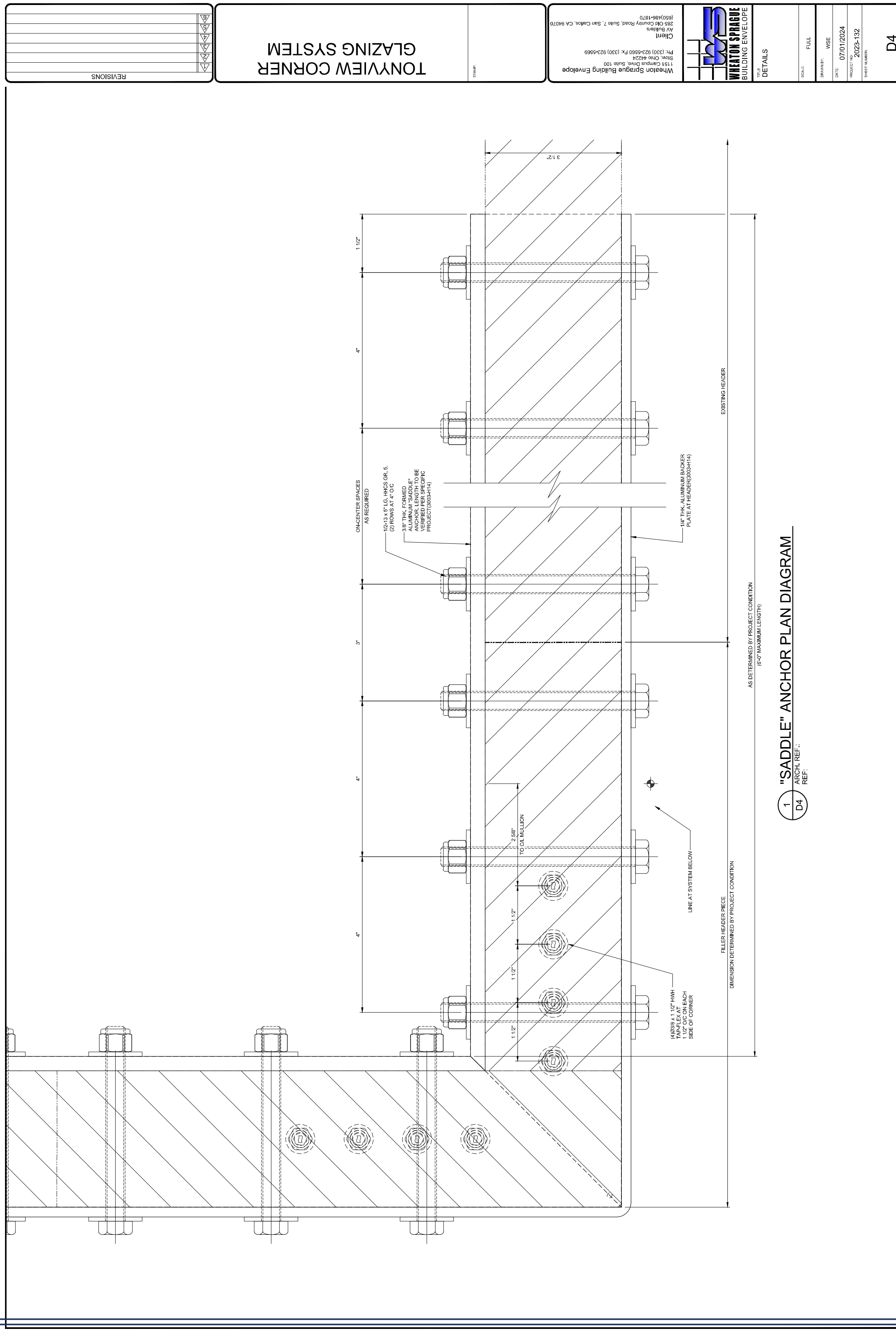
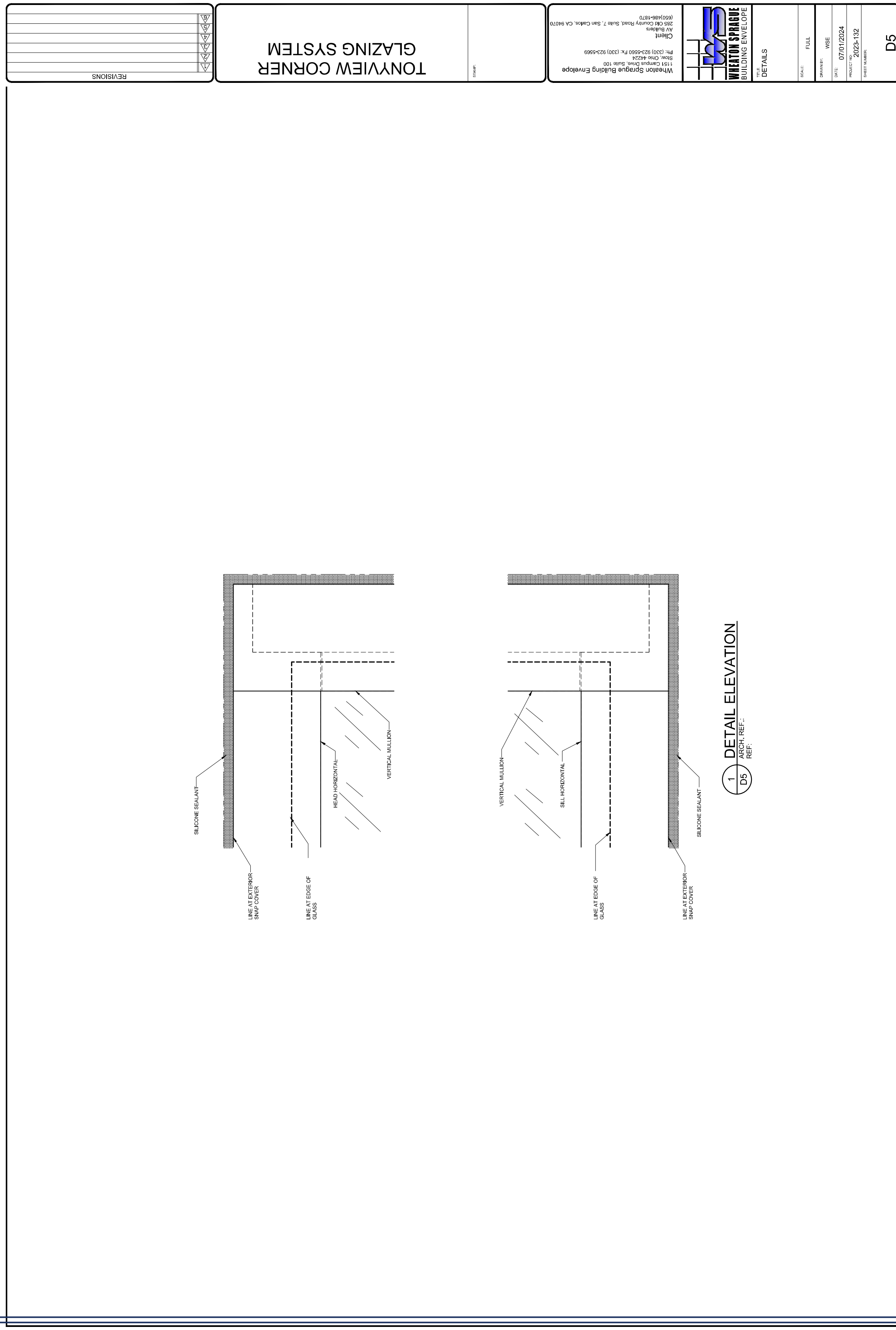
SILL AT ANCHOR WITH FLUSH GLAZING
HEAD AT ANCHOR WITH COVER
SILL AT ANCHOR WITH COVER


TONYVIEW CORNER
GLAZING SYSTEM
REVISIONS
DETAILS
FULL
WSE
07/01/2024
2023-132
D4
"SADDLE" ANCHOR PLAN DIAGRAM
EXISTING HEADER
LINE AT SYSTEM BELOW
FILLER HEADER PIECE
DIMENSION DETERMINED BY PROJECT CONDITION
AS DETERMINED BY PROJECT CONDITION
ON-CENTER SPACES AS REQUIRED
TO C.L MULLION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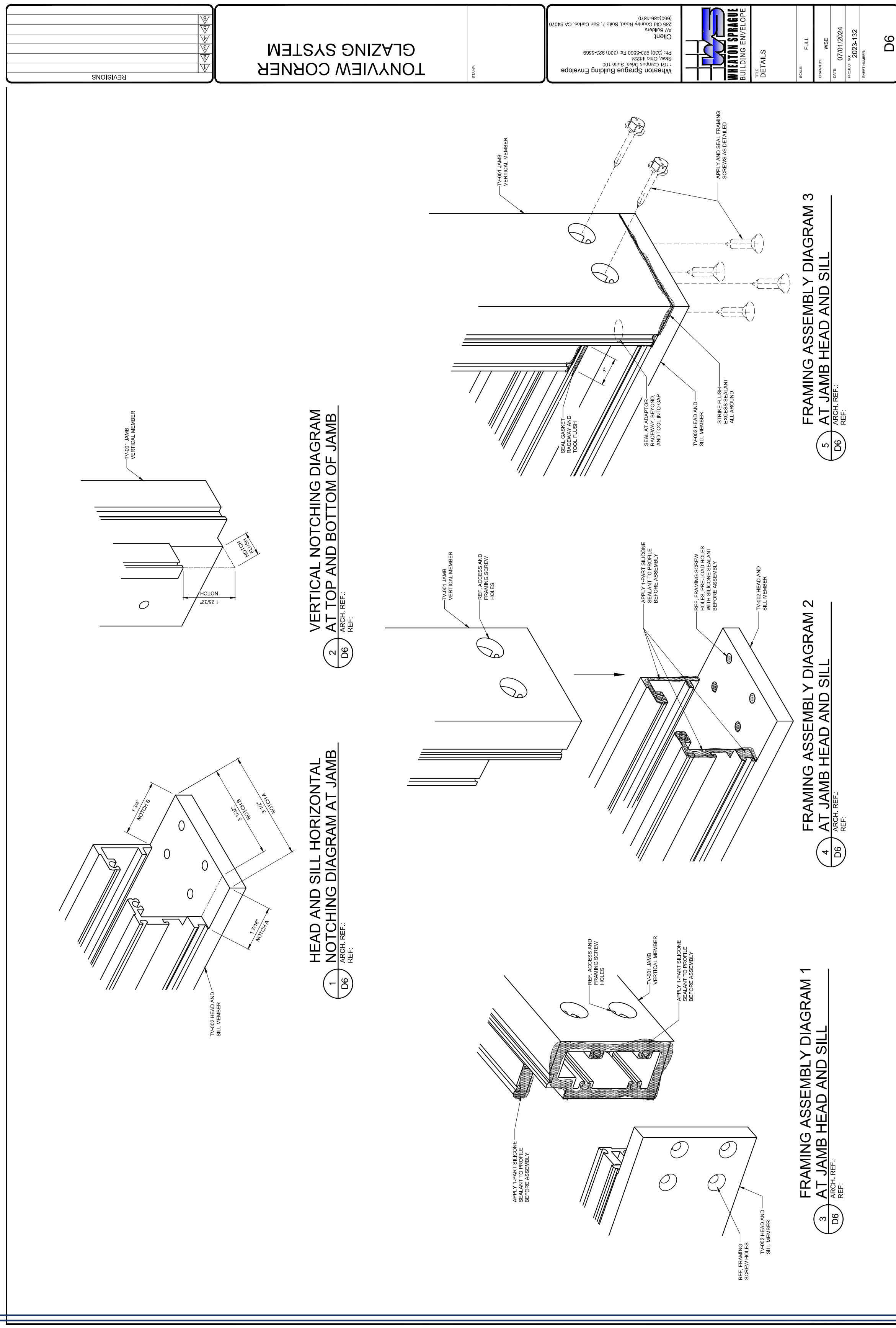
WHEATON SPRAGUE
BUILDING ENVELOPE
DETAILS
FULL
WSE
07/01/2024
2023-132
D5
DETAIL ELEVATION
ARCH. REF.:
REF.:
SILICONE SEALANT
LINE AT EXTERIOR SNAP COVER
LINE AT EDGE OF GLASS
HEAD HORIZONTAL
VERTICAL MULLION
SILL HORIZONTAL


TONYVIEW CORNER GLAZING SYSTEM
REVISIONS
WHEATON SPRAGUE BUILDING ENVELOPE
DETAILS
FULL
WSE
07/01/2024
2023-132
D6
HEAD AND SILL HORIZONTAL NOTCHING DIAGRAM AT JAMB
VERTICAL NOTCHING DIAGRAM AT TOP AND BOTTOM OF JAMB
FRAMING ASSEMBLY DIAGRAM 1 AT JAMB HEAD AND SILL
FRAMING ASSEMBLY DIAGRAM 2 AT JAMB HEAD AND SILL
FRAMING ASSEMBLY DIAGRAM 3 AT JAMB HEAD AND SILL
ARCH. REF.:
REF.:

SECTION PROPERTIES AND ALLOWABLE STRESSES

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BUILDING ENVELOPE

WHEATON & SPRAGUE ENGINEERING
Nestor Perez
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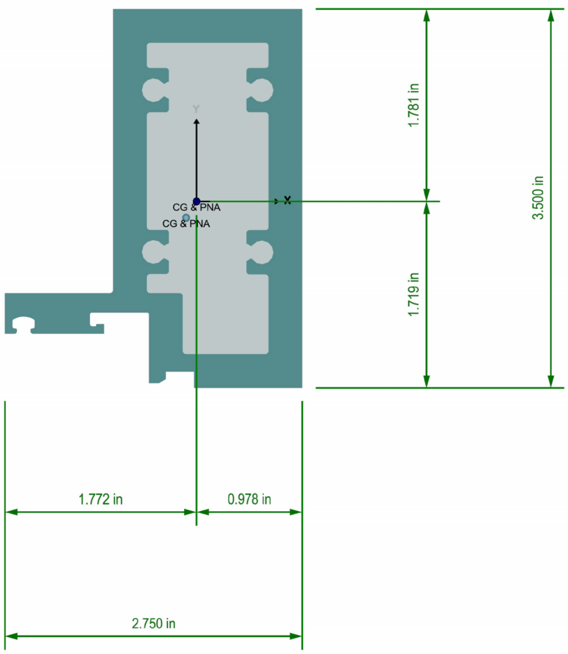
Tuesday, July 2, 2024 11:00 AM



Geometric Properties

Area	3.285	in^2
Ix	4.141	in^4
Ixy	0.284	in^4
Iy	1.763	in^4
Sx+	2.324	in^3
Sx-	2.409	in^3
Sy+	1.803	in^3
Sy-	0.995	in^3
Xc	0.000	in
Yc	0.000	in
rx	1.123	in
ry	0.733	in

Torsion Properties

Cw	0.331	in^6
H	0.985	
J	2.741	in^4
Xsc	0.160	in
Ysc	0.043	in
ro	1.351	in
B1	-0.057	in

Overall Properties

Depth	3.500	in
Perimeter	13.708	in
Weight	0.329	lb/in
Width	2.750	in

Plastic Properties

Xpna	-0.096	in
Ypna	-0.150	in
Zx	3.286	in^3
Zy	2.161	in^3

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Allowable Stresses - Jamb Mullion

Ref. Details: 1 / D1 Die Number: TV-001

Section Properties

$A_{mull} := 3.286 \cdot in^2$	Area	$L_b := 91 \cdot in$	Unbraced Length of Top Flange
$I_x := 4.141 \cdot in^4$	Inertia about X-Axis	$C_b := 1.0$	Continuous Beam Factor
$I_y := 1.763 \cdot in^4$	Inertia about Y-Axis	$F_{ty} := 35 \cdot ksi$	Yield Strength
$d := 3.5 \cdot in$	Depth of Member	$F_u := 38 \cdot ksi$	Ultimate Strength
$S_{xt} := 2.324 \cdot in^3$	Section Modulus - Top	$E := 10100 \cdot ksi$	Youngs Modulus of Elasticity
$S_{xb} := 4.409 \cdot in^3$	Section Modulus - Bottom	$G := 3800 \cdot ksi$	Shear Modulus of Elasticity
$Z_x := 3.286 \cdot in^3$	Plastic Modulus - X Axis	$\Omega_y := 1.65$	Safety Facture, Typical
$Z_y := 2.161 \cdot in^3$	Plastic Modulus - Y Axis	$\Omega_u := 1.95$	Safety Facture, Rupture
$J := 2.741 \cdot in^4$	Polar Moment of Inertia	$S_c := min(S_{xt}, S_{xb}) = 2.324\ in^3$	
$C_w := 0.3309 \cdot in^6$	Warping Constant	$K := 0.80$	Assumes Pin-Fixed Condition to calculate effective length
$r_y := 0.7326 \cdot in$	Radius of Gyration, about Y-axis		
Shape := Closed	Identify shape as "Open" or "Closed"		

$b_{uc} := 1.0650 \cdot in$	$b_{fc} := 2.8150 \cdot in$	$c_c := -1.4385 \cdot in$
$t_{uc} := 0.25 \cdot in$	$t_{fc} := 0.25 \cdot in$	$c_o := 1.3765 \cdot in$

Include << ADM 2015 - Buckling Constants.mcdx

Allowable Axial Stress Calculation

Member Buckling

$$F_e := \left(\frac{\pi^2 \cdot E \cdot C_w}{L_b^2} + G \cdot J\right) \cdot \frac{1}{I_x + I_y} = 1764868\ psi$$

$$\lambda_a := \frac{K \cdot L_b}{r_y} = 99 \qquad \lambda_b := \pi \cdot \sqrt{\frac{E}{F_e}} = 7.5$$

$$\lambda := \max(\lambda_a, \lambda_b) = 99 \qquad \lambda_1 := \frac{B_c - F_{cy}}{D_c} = 17.8 \qquad \lambda_2 := C_c = 65.7$$

$$P_{nc} := \begin{cases} F_{cy} & \text{if } \lambda \le \lambda_1 \\ (B_c - D_c \cdot \lambda) \cdot \left(0.85 + 0.15 \cdot \left(\frac{C_c - \lambda}{C_c - \lambda_1}\right)\right) & \text{else if } \lambda < C_c \\ \frac{0.85 \cdot \pi^2 \cdot E}{\lambda^2} & \text{else} \end{cases} = 8.58\ ksi$$

$$P_{allow} := \frac{P_{nc} \cdot A_{mull}}{\Omega_y} = 17.088\ kip$$

Allowable Flexural Stress Calculation - Strong Axis

F.2 Yielding and Rupture

$M_{np} := min\left(Z_x \cdot F_{ty}, 1.5 \cdot F_{ty} \cdot S_c\right) = 115.01\ kip \cdot in$

$M_{nu} := Z_x \cdot F_u = 124.868\ kip \cdot in$

$M_{n\_yield} := min\left(M_{np} \cdot \Omega_y^{-1}, M_{nu} \cdot \Omega_u^{-1}\right) = 64.035\ kip \cdot in$

F.4.2.1 & F4.2.3 Lateral Torsional Buckling - Open or Closed Shape

$M(\lambda, M, S) := \text{if}\left(\lambda < C_c, M \cdot \left(1 - \frac{\lambda}{C_c}\right) + \frac{\pi^2 \cdot E \cdot \lambda \cdot S}{C_c^{\ 3}}, \frac{\pi^2 \cdot E \cdot S}{\lambda^2}\right)$ — Moment Function, Section F.4

$r_{yet}(L_b, S) := \sqrt{\frac{I_y}{S} \cdot \left(\frac{d}{4} + \sqrt{\frac{d^2}{16} + \frac{C_w}{I_y} + \frac{0.038 \cdot J \cdot L_b^{\ 2}}{I_y}}\right)}$ — Effective Radius of Gyration Function Eq. F.4-5

$\lambda_L(r_{yet}, L_b, S_x) := \text{if}\left(Shape = \text{"C"}, 2.3 \cdot \sqrt{\frac{L_b \cdot S_x}{C_b \cdot \sqrt{I_y \cdot J}}}, \frac{L_b}{r_{yet} \cdot \sqrt{C_b}}\right)$ — Slenderness Functions, Eq. F.4-3 & Eq. F.4-6

$r_{yeff} := r_{yet}(L_b, S_c) = 4.178\ in$ — Radius of Gyration

$\lambda := \lambda_L(r_{yeff}, L_b, S_c) = 22.559$ — Slenderness

$M_{n\_LTB} := \frac{M(\lambda, M_{np}, S_c)}{\Omega_y} = 56.942\ in \cdot kip$ — Allowable Moment for Lateral Torsional Buckling

Check Local Compression Buckling per (2015 ADM) - Flat Elements Supported on One or Two Edges for Shape Strong Axis Bending

$m := \text{if}\left(c_c = -c_o, 0.65, \text{if}\left(\frac{c_o}{c_c} \le -1, \frac{1.3}{1 - \frac{c_o}{c_c}}, 1.15 + \frac{c_o}{2 \cdot c_c}\right)\right) = 0.672$

$\lambda_{fc\_b} := \frac{b_{fc}}{t_{fc}} = 11.3$ $\quad \lambda_{1\_fc\_b} := \frac{B_{br} - 1.5 \cdot F_{cy}}{m \cdot D_{br}} = 32$ $\quad \lambda_{2\_fc\_b} := \frac{k_{1b} \cdot B_{br}}{m \cdot D_{br}} = 74.7$

$\lambda_{uc\_b} := \frac{b_{uc}}{t_{uc}} = 4.3$ $\quad \lambda_{1\_uc\_b} := \frac{B_p - F_{cy}}{1.6 \cdot D_p} = 20.8$ $\quad \lambda_{2\_uc\_b} := \frac{k_{1c} \cdot B_p}{1.6 \cdot D_p} = 32.8$

B.5.4.2 - Flat Elements Supported on Both Edges - Uniform Compression

$$M_{n\_uc\_b} := \begin{cases} F_{cy} \cdot S_c \cdot \Omega_y^{-1} & \text{if } \lambda_{uc\_b} \le \lambda_{1\_uc\_b} \\ \left(B_p - 1.6 \cdot D_p \cdot \lambda_{uc\_b}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else if } \lambda_{uc\_b} < \lambda_{2\_uc\_b} \\ \left(\frac{k_{2c} \cdot \sqrt{B_p \cdot E}}{1.6 \cdot \lambda_{uc\_b}}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else} \end{cases} = 49.297\ kip \cdot in$$

B.5.5.1 - Flat Elements Supported on Both Edges - Flexural Compression

$$M_{n\_fc\_b} := \begin{cases} 1.5\ F_{cy} \cdot S_c \cdot \Omega_y^{-1} & \text{if } \lambda_{fc\_b} \le \lambda_{1\_fc\_b} \\ \left(B_{br} - m \cdot D_{br} \cdot \lambda_{fc\_b}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else if } \lambda_{fc\_b} < \lambda_{2\_fc\_b} \\ \left(\frac{k_{2b} \cdot \sqrt{B_{br} \cdot E}}{m \cdot \lambda_{fc\_b}}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else} \end{cases} = 73.9455\ in \cdot kip$$

$M_{n\_comp} := min\left(M_{n\_uc\_b}, M_{n\_fc\_b}\right) = 49.297\ kip \cdot in$

Maximum Allowable Moment, About X-Axis

$M_{allow\_x} := min\left(M_{n\_yield}, M_{n\_LTB}, M_{n\_comp}\right) = 49.297\ kip \cdot in$

Allowable Flexural Stress Calculation - Weak Axis

Maximum Allowable Moment, About Y-Axis

$M_{np\_y} := min\left(Z_y \cdot F_{ty}\right) = 75.635\ kip \cdot in$

$M_{nu\_y} := Z_y \cdot F_u = 82.118\ kip \cdot in$

$M_{allow\_y} := min\left(M_{np\_y} \cdot \Omega_y^{-1}, M_{nu\_y} \cdot \Omega_u^{-1}\right) = 42.112\ kip \cdot in$

Summary of Results:

$P_{allow} = 17.088\ kip$

$M_{allow\_x} = 49.297\ in \cdot kip$

$M_{allow\_y} = 42.112\ in \cdot kip$

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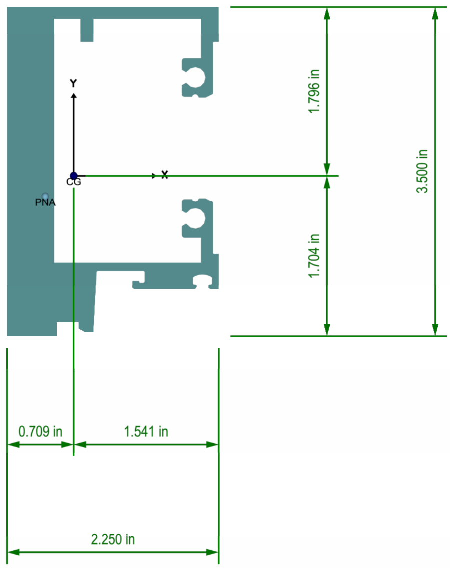
Nestor Perez
C:\Users\nperez\...\ADM 2015\TV-002.sbf
Wednesday, July 24, 2024 2:20 PM



Geometric Properties

Area	2.844	in^2
Ix	3.591	in^4
Ixy	0.131	in^4
Iy	1.386	in^4
Sx+	1.999	in^3
Sx-	2.108	in^3
Sy+	0.899	in^3
Sy-	1.955	in^3
Xc	0.000	in
Yc	0.000	in
rx	1.124	in
ry	0.698	in

Torsion Properties

Cw	3.965	in^6
H	0.583	
J	0.191	in^4
Xsc	-1.101	in
Ysc	0.195	in
ro	1.732	in
B1	0.077	in

Overall Properties

Depth	3.500	in
Perimeter	21.449	in
Weight	0.284	lb/in
Width	2.250	in

Plastic Properties

Xpna	-0.303	in
Ypna	-0.221	in
Zx	2.850	in^3
Zy	1.438	in^3

ShapeBuilder 14.00.0001
www.iesweb.com

Page 1 of 1

DESIGN OF MEMBERS FOR FLEXURE

Die #: TV-002

Description: Head / Sill Horizontal

Alloy and Temper: 6061-T6

Section Properties and Design Variables

$I_x := 3.591 \cdot in^4$	Inertia about X-Axis	$L_b := 24 \cdot in$	Unbraced Length of Top Flange
$I_y := 1.386 \cdot in^4$	Inertia about Y-Axis	$C_b := 1.0$	Continuous Beam Factor
$d := 3.5 \cdot in$	Depth of Member	$F_{ty} := 35 \cdot ksi$	Yield Strength
$S_{xt} := 1.999 \cdot in^3$	Section Modulus - Top	$F_u := 38 \cdot ksi$	Ultimate Strength
$S_{xb} := 2.108 \cdot in^3$	Section Modulus - Bottom	$E := 10100 \cdot ksi$	Youngs Modulus of Elasticity
$Z_x := 2.850 \cdot in^3$	Plastic Modulus - X Axis	$\Omega_y := 1.65$	Safety Facture, Typical
$J := 0.191 \cdot in^4$	Polar Moment of Inertia	$\Omega_u := 1.95$	Safety Facture, Rupture
$C_w := 3.965 \cdot in^6$	Warping Constant	$S_c := min(S_{xt}, S_{xb}) = 1.999\ in^3$	

Include << ADM 2015 - Buckling Constants.mcdx

STRONG AXIS FLEXURE

F.2 Yielding and Rupture

$M_{np} := min(Z_x \cdot F_{ty}, 1.5 \cdot F_{ty} \cdot S_c) = 99.75\ kip \cdot in$ $\qquad M_{nu} := Z_x \cdot F_u = 108.3\ kip \cdot in$

$M_{n\_yield} := min(M_{np} \cdot \Omega_y^{-1}, M_{nu} \cdot \Omega_u^{-1}) = 55.538\ kip \cdot in$

F.4.2.1 & F4.2.3 Lateral Torsional Buckling - Open or Closed Shape

$Shape := Open$ — Identify shape as "Open" or "Closed"

$$M(\lambda, M, S) := if\left(\lambda < C_c, M \cdot \left(1 - \frac{\lambda}{C_c}\right) + \frac{\pi^2 \cdot E \cdot \lambda \cdot S}{C_c^{\ 3}}, \frac{\pi^2 \cdot E \cdot S}{\lambda^2}\right)$$ Moment Function

$$r_{yet}(L_b, S) := \sqrt{\frac{I_y}{S} \cdot \left(\frac{d}{4} + \sqrt{\frac{d^2}{16} + \frac{C_w}{I_y} + \frac{0.038 \cdot J \cdot L_b^{\ 2}}{I_y}}\right)}$$ Effective Radius of Gyration Function

$$\lambda_L(r_{yet}, L_b, S_x) := if\left(Shape = \text{"C"}, 2.3 \cdot \sqrt{\frac{L_b \cdot S_x}{C_b \cdot \sqrt{I_y \cdot J}}}, \frac{L_b}{r_{yet} \cdot \sqrt{C_b}}\right)$$ Slenderness Function

$r_{yeff} := r_{yet}(L_b, S_c) = 1.547\ in$ — Radius of Gyration

$\lambda := \lambda_L(r_{yeff}, L_b, S_c) = 15.512$ — Slenderness

$$M_{n\_LTB} := \frac{M(\lambda, M_{np}, S_c)}{\Omega_y} = 52.789\ in \cdot kip$$ Allowable Moment for Lateral Torsional Buckling

Check Local Compression Buckling per (2015 ADM) - Flat Elements Supported on One or Two Edges for Shape Strong Axis Bending

$b_{uc} := 1.75 \cdot in$ $\quad b_{fc} := 2.59375 \cdot in$ $\quad c_c := -1.65625 \cdot in$

$t_{uc} := 0.125 \cdot in$ $\quad t_{fc} := 0.5 \cdot in$ $\quad c_o := 0.90625 \cdot in$

$$m := \text{if}\left(c_c = -c_o, 0.65, \text{if}\left(\frac{c_o}{c_c} \le -1, \frac{1.3}{1-\frac{c_o}{c_c}}, 1.15 + \frac{c_o}{2 \cdot c_c}\right)\right) = 0.876$$

$$\lambda_{fc\_b} := \frac{b_{fc}}{t_{fc}} = 5.2 \qquad \lambda_{1\_fc\_b} := \frac{B_{br} - 1.5 \cdot F_{cy}}{m \cdot D_{br}} = 24.6 \qquad \lambda_{2\_fc\_b} := \frac{k_{1b} \cdot B_{br}}{m \cdot D_{br}} = 57.3$$

$$\lambda_{uc\_b} := \frac{b_{uc}}{t_{uc}} = 14 \qquad \lambda_{1\_uc\_b} := \frac{B_p - F_{cy}}{1.6 \cdot D_p} = 20.8 \qquad \lambda_{2\_uc\_b} := \frac{k_{1c} \cdot B_p}{1.6 \cdot D_p} = 32.8$$

B.5.4.2 - Flat Elements Supported on Both Edges - Uniform Compression

$$M_{n\_uc\_b} := \begin{cases} F_{cy} \cdot S_c \cdot \Omega_y^{-1} & \text{if } \lambda_{uc\_b} \le \lambda_{1\_uc\_b} \\ \left(B_p - 1.6 \cdot D_p \cdot \lambda_{uc\_b}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else if } \lambda_{uc\_b} < \lambda_{2\_uc\_b} \\ \left(\frac{k_{2c} \cdot \sqrt{B_p \cdot E}}{1.6 \cdot \lambda_{uc\_b}}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else} \end{cases} = 42.403 \ kip \cdot in$$

B.5.5.1 - Flat Elements Supported on Both Edges - Flexural Compression

$$M_{n\_fc\_b} := \begin{cases} 1.5\ F_{cy} \cdot S_c \cdot \Omega_y^{-1} & \text{if } \lambda_{fc\_b} \le \lambda_{1\_fc\_b} \\ \left(B_{br} - m \cdot D_{br} \cdot \lambda_{fc\_b}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else if } \lambda_{fc\_b} < \lambda_{2\_fc\_b} \\ \left(\frac{k_{2b} \cdot \sqrt{B_{br} \cdot E}}{m \cdot \lambda_{fc\_b}}\right) \cdot S_c \cdot \Omega_y^{-1} & \text{else} \end{cases} = 63.6045 \ in \cdot kip$$

$$M_{n\_comp} := min\left(M_{n\_uc\_b}, M_{n\_fc\_b}\right) = 42.403 \ kip \cdot in$$

Maximum Allowable Moment, About X-Axis

$$M_{allow} := min\left(M_{n\_yield}, M_{n\_LTB}, M_{n\_comp}\right) = 42.403 \ kip \cdot in$$

WEAK AXIS FLEXURE

$S_{yl} := 1.955 \ in^3$ Section Modulus - Left $\qquad S_{yr} := 1.955 \ in^3$ Section Modulus - Right

$S_c := min\left(S_{yl}, S_{yr}\right) = 1.955 \ in^3$ $\qquad Z_y := 1.438 \cdot in^3$ Plastic Modulus - Y Axis

F.2 Yielding and Rupture-Weak Axis

$$M_{np} := min\left(Z_y \cdot F_{ty}, 1.5 \cdot F_{ty} \cdot S_c\right) = 50.33 \ kip \cdot in \qquad M_{nu} := Z_y \cdot F_u = 54.644 \ kip \cdot in$$

$$M_{n\_yield} := min\left(M_{np} \cdot \Omega_y^{-1}, M_{nu} \cdot \Omega_u^{-1}\right) = 28.023 \ kip \cdot in$$

Check Local Compression Buckling per (2015 ADM) - Flat Elements Supported on One or Two Edges for Shape Weak Axis Bending

$b_{uc} := 2.59375 \cdot in$ $\quad b_{fc} := 1.750 \cdot in$ $\quad c_c := -1.53125 \cdot in$

$t_{uc} := 0.5 \cdot in$ $\quad t_{fc} := 0.125 \cdot in$ $\quad c_o := 0.21875 \cdot in$

$$m := \text{if}\left(c_c = -c_o, 0.65, \text{if}\left(\frac{c_o}{c_c} \le -1, \frac{1.3}{1-\frac{c_o}{c_c}}, 1.15 + \frac{c_o}{2 \cdot c_c}\right)\right) = 1.079$$

$$\lambda_{fc\_o} := \frac{b_{fc}}{t_{fc}} = 14 \qquad \lambda_{1\_fc\_o} := \frac{B_{br} - 1.5 \cdot F_{cy}}{3.5 \cdot D_{br}} = 6.1 \qquad \lambda_{2\_fc\_o} := \frac{C_{br}}{3.5} = 19.1$$

$\lambda_{uc\_b} := \frac{b_{uc}}{t_{uc}} = 5.2$ $\lambda_{1\_uc\_b} := \frac{B_p - F_{cy}}{1.6 \cdot D_p} = 20.8$ $\lambda_{2\_uc\_b} := \frac{k_{1c} \cdot B_p}{1.6 \cdot D_p} = 32.8$

B.5.4.2 - Flat Elements Supported on Both Edges - Uniform Compression

$$M_{n\_uc\_b} := \text{if } \lambda_{uc\_b} \le \lambda_{1\_uc\_b} \;\; F_{cy} \cdot S_c \cdot \Omega_y^{-1} \;\; \text{else if } \lambda_{uc\_b} < \lambda_{2\_uc\_b} \;\; \left(B_p - 1.6 \cdot D_p \cdot \lambda_{uc\_b}\right) \cdot S_c \cdot \Omega_y^{-1} \;\; \text{else} \;\; \left(\frac{k_{2c} \cdot \sqrt{B_p \cdot E}}{1.6 \cdot \lambda_{uc\_b}}\right) \cdot S_c \cdot \Omega_y^{-1} = 41.47 \text{ kip} \cdot \text{in}$$

B.5.5.2 - Flat Elements Supported on One Edge - Flexural Compression

$$M_{n\_fc\_o} := \text{if } \lambda_{fc\_o} \le \lambda_{1\_fc\_o} \;\; 1.5\ F_{cy} \cdot S_c \cdot \Omega_y^{-1} \;\; \text{else if } \lambda_{fc\_o} < \lambda_{2\_fc\_o} \;\; \left(B_{br} - 3.5 \cdot D_{br} \cdot \lambda_{fc\_o}\right) \cdot S_c \cdot \Omega_y^{-1} \;\; \text{else} \;\; \left(\frac{\pi^2 \cdot E}{\left(3.5 \cdot \lambda_{fc\_o}\right)^2}\right) \cdot S_c \cdot \Omega_y^{-1} = 40.527 \text{ in} \cdot \text{kip}$$

Maximum Allowable Moment, About Y-Axis

$$M_{allow} := min\left(M_{n\_uc\_b}, M_{n\_fc\_o}, M_{n\_yield}\right) = 28.023 \text{ kip} \cdot \text{in}$$

FRAMING FINITE ELEMENT ANALYSIS

Analysis - Jamb Mullion

Mullion: TV-001

Loads, Allowable Loads, and Geometry

Loads:

$DL_{roof} := 20 \cdot psf$ $\quad LL_{roof} := 20 \cdot psf$ $\quad WL := 35 \cdot psf$

$DL_{wall} := 15 \cdot psf$ $\quad LL_{floor} := 40 \cdot psf$ $\quad SL := 30 \cdot psf$

$DL_{floor} := 15 \cdot psf$

** These are the design loads used for the initial design of the TonyView Window. Loads must be confirmed on a per project basis as they can vary depending on construction type.

Geometry - Tributary Widths, Lengths, etc.

$L_{hdr} := 10 \cdot ft$	Length of Header Beam Supported by TonyView Window
$L_{wall} := 36 \cdot ft$	Length of Wall (vertically) that is Supported by TonyView Window. Measured from top of window to roof.
$L := 91 \cdot in$	Height of TonyView window
$W_{roof} := 25 \cdot ft$	Length from wall to interior load bearing element (wall or column) at roof.
$W_{trib\_roof} := 0.5 \cdot W_{roof} = 12.5\ ft$	Half the length from wall to interior load bearing element (wall or column) at roof.
$W_{floor} := 25 \cdot ft$	Length from wall to interior load bearing element (wall or column) at floor.
$W_{trib\_floor} := 0.5 \cdot W_{floor} = 12.5\ ft$	Half the length from wall to interior load bearing element (wall or column) at floor.

Allowable Stresses

Include << Jamb - Allowable Stresses - Calculation.mcdx

$P_{allow} = 17.088\ kip$	Allowable Axial Load
$M_{allow\_x} = 49.297\ kip \cdot in$	Allowable Strong Axis Bending
$M_{allow\_y} = 42.112\ kip \cdot in$	Allowable Weak Axis Bending

Load Calculations and Checks (Used in STAAD Model)

$P_{DL\_roof} := (DL_{roof}) \cdot W_{trib\_roof} = 20.8\ \frac{lbf}{in}$ $\qquad P_{LL\_roof} := (LL_{roof}) \cdot W_{trib\_roof} = 20.8\ \frac{lbf}{in}$

$P_{DL\_wall} := (DL_{wall}) \cdot L_{wall} = 45\ \frac{lbf}{in}$ $\qquad P_{LL\_floor} := 2 \cdot (LL_{floor}) \cdot W_{trib\_floor} = 83.3\ \frac{lbf}{in}$

$P_{DL\_floor} := 2 \cdot (DL_{floor}) \cdot W_{trib\_floor} = 31.3\ \frac{lbf}{in}$ $\qquad P_{SL\_roof} := (SL) \cdot W_{trib\_roof} = 31.3\ \frac{lbf}{in}$

$P_{wl\_x} := WL \cdot 24 \cdot in \cdot 0.5 = 2.917\ \frac{lbf}{in}$ $\qquad P_{wl\_y} := WL \cdot 24 \cdot in \cdot 0.5 = 2.917\ \frac{lbf}{in}$

Stress Analysis (See following STAAD results for information)

$P_{max} := 13009 \cdot lbf$	<	$P_{allow} = 17.088\ kip$	O.K.
$M_{max\_x} := 3.049 \cdot kip \cdot in$	<	$M_{allow\_x} = 49.297\ kip \cdot in$	O.K.
$M_{max\_y} := 2.853 \cdot kip \cdot in$	<	$M_{allow\_y} = 42.112\ kip \cdot in$	O.K.
$CSR := \frac{P_{max}}{P_{allow}} + \frac{M_{max\_x}}{M_{allow\_x}} + \frac{M_{max\_y}}{M_{allow\_y}} = 0.891$	<	1.0	**if** (CSR > 1, "N.G.", "O.K.") = "O.K."

HORIZONTAL MULLION SUMMARY

Horizontal: Head / Sill   Detail: 1 and 2 / D3

Die #: TV-002

Stresses Summary:

$M_{max\_x} := 1.873 \cdot kip \cdot in$	<	$M_{allow\_x} := 42.403 \cdot kip \cdot in$	$\text{if}\left(M_{max\_x} < M_{allow\_x}, \text{"ok"}, \text{"ng"}\right) = \text{"ok"}$
$M_{max\_y} := 2.853 \cdot kip \cdot in$	<	$M_{allow\_y} := 28.023 \cdot kip \cdot in$	$\text{if}\left(M_{max\_y} < M_{allow\_y}, \text{"ok"}, \text{"ng"}\right) = \text{"ok"}$
$CSR := \frac{M_{max\_x}}{M_{allow\_x}} + \frac{M_{max\_y}}{M_{allow\_y}} = 0.146$	<	1.0	$\text{if}\left(CSR \leq 1.0, \text{"ok"}, \text{"ng"}\right) = \text{"ok"}$

Deflection

$\Delta_{max\_vert} := 0.095\ in$	<	$\Delta_{A\_vert} := 0.125\ in$	$\text{if}\left(\Delta_{max\_vert} < \Delta_{A\_vert}, \text{"ok"}, \text{"ng"}\right) = \text{"ok"}$
$\Delta_{max\_hor} := 0\ in$	<	$\Delta_{A\_hor} := \frac{24 \cdot in}{175} = 0.137\ in$	$\text{if}\left(\Delta_{max\_hor} < \Delta_{A\_hor}, \text{"ok"}, \text{"ng"}\right) = \text{"ok"}$

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	Part		
Job Title TonyView	Ref		
	By NAP	Date 7/24/2024	Chd
Client AV Builders	File TonyView.STD	Date/Time 26-Jul-2024 09:04	

Job Information

	Engineer	Checked	Approved
Name:	NAP		
Date:	7/24/2024		

Project ID	
Project Name	

Structure Type	SPACE FRAME

Number of Nodes	13	Highest Node	13
Number of Elements	15	Highest Beam	15

Number of Basic Load Cases	4
Number of Combination Load Cases	4

Included in this printout are data for:

All	The Whole Structure

Included in this printout are results for load cases:

Type	L/C	Name
Combination	5	COMBINATION LOAD CASE 5 - DL + LL
Combination	6	COMBINATION LOAD CASE 6 - DL + 0.7ξ
Combination	7	COMBINATION LOAD CASE 7 - DL + WL
Combination	8	COMBINATION LOAD CASE 8 - DL + 0.7ξ

Section Properties

Prop	Section	Area (in^2)	I_{yy} (in^4)	I_{zz} (in^4)	J (in^4)	Material
1	Prismatic General	3.285	1.763	4.141	2.741	ALUMINUM
2	Prismatic General	2.844	1.386	3.591	0.191	ALUMINUM
3	SPFR_SS_4X8	26.250	26.797	123.047	0	SPFR_SS_4X8

Primary Load Cases

Number	Name	Type
1	LOAD CASE 1 - DL	None
2	LOAD CASE 2 - LL	None
3	LOAD CASE 3 - WL	None
4	LOAD CASE 4 - SL	None

Bentley

Job Title: TonyView
Client: AV Builders
Engineer: NAP

```
STAAD SPACE TONYVIEW - MODEL 1
START JOB INFORMATION
JOB NAME TonyView
JOB CLIENT AV Builders
JOB NO 2023-123
JOB REV 0
ENGINEER NAME NAP
ENGINEER DATE 7/24/2024
END JOB INFORMATION
INPUT WIDTH 79
UNIT INCHES POUND
JOINT COORDINATES
1 0 0 0; 2 0 0 24; 3 24 0 0; 4 0 45.5 24; 5 24 45.5 0; 6 0 91 0; 7 0 91 24;
8 24 91 0; 9 0 92 0; 10 0 92 24; 11 0 92 96; 12 24 92 0; 13 96 92 0;
MEMBER INCIDENCES
1 1 2; 2 1 3; 3 2 4; 4 3 5; 5 4 7; 6 5 8; 7 6 7; 8 6 8; 9 6 9; 10 7 10;
11 8 12; 12 9 10; 13 10 11; 14 9 12; 15 12 13;
MEMBER PROPERTY
3 TO 6 10 -
11 PRIS AX 3.285 AY 3.285 AZ 3.285 IX 2.741 IY 1.763 IZ 4.141 YD 3.5 ZD 2
1 2 7 TO 8 -
9 PRIS AX 2.844 AY 2.844 AZ 2.844 IX 0.191 IY 1.386 IZ 3.591 YD 3.5 ZD 2.25
MEMBER PROPERTY AITC
12 TO 15 TABLE ST SPFR_SS_4X8
DEFINE MATERIAL START
ISOTROPIC ALUMINUM
E 1e+07
POISSON 0.33
DENSITY 0.098
ALPHA 1.28e-05
DAMP 0.03
G 3.7594e+06
TYPE ALUMINUM
ISOTROPIC SPFR_SS_4X8
E 1.5e+06
POISSON 0.15
DENSITY 0.0144676
ALPHA 3e-06
DAMP 0.06
G 652174
TYPE TIMBER
END DEFINE MATERIAL
CONSTANTS
BETA 90 MEMB 1 7
BETA -90 MEMB 2 4 6 8 11
```

```
MATERIAL ALUMINUM MEMB 1 TO 11
MATERIAL SPFR_SS_4X8 MEMB 12 TO 15
SUPPORTS
2 3 11 13 PINNED
10 12 ENFORCED BUT FY MX MY MZ
1 ENFORCED BUT FX FZ MX MY MZ
MEMBER RELEASE
7 TO 11 END MX MY MZ
1 END MY
2 END MY
LOAD 1 LOADTYPE None  TITLE LOAD CASE 1 - DL
SELFWEIGHT Y -1
MEMBER LOAD
12 TO 15 UNI Y -20.8
12 TO 15 UNI Y -45
12 TO 15 UNI Y -31.3
1 2 CON GY -50 6
1 2 CON GY -50 18
LOAD 2 LOADTYPE None  TITLE LOAD CASE 2 - LL
MEMBER LOAD
12 TO 15 UNI Y -20.8
12 TO 15 UNI Y -83.3
LOAD 3 LOADTYPE None  TITLE LOAD CASE 3 - WL
MEMBER LOAD
3 TO 6 UNI Y 2.917
3 TO 6 UNI Z 2.917
LOAD 4 LOADTYPE None  TITLE LOAD CASE 4 - SL
MEMBER LOAD
12 TO 15 UNI Y -31.3
LOAD COMB 5 COMBINATION LOAD CASE 5 - DL + LL
1 1.0 2 1.0
LOAD COMB 6 COMBINATION LOAD CASE 6 - DL + 0.75LL + 0.75SL
1 1.0 2 0.75 4 0.75
LOAD COMB 7 COMBINATION LOAD CASE 7 - DL + WL
1 1.0 3 1.0
LOAD COMB 8 COMBINATION LOAD CASE 8 - DL + 0.75LL + 0.75WL + 0.75SL
1 1.0 2 0.75 3 0.75 4 0.75
PERFORM ANALYSIS
FINISH
```

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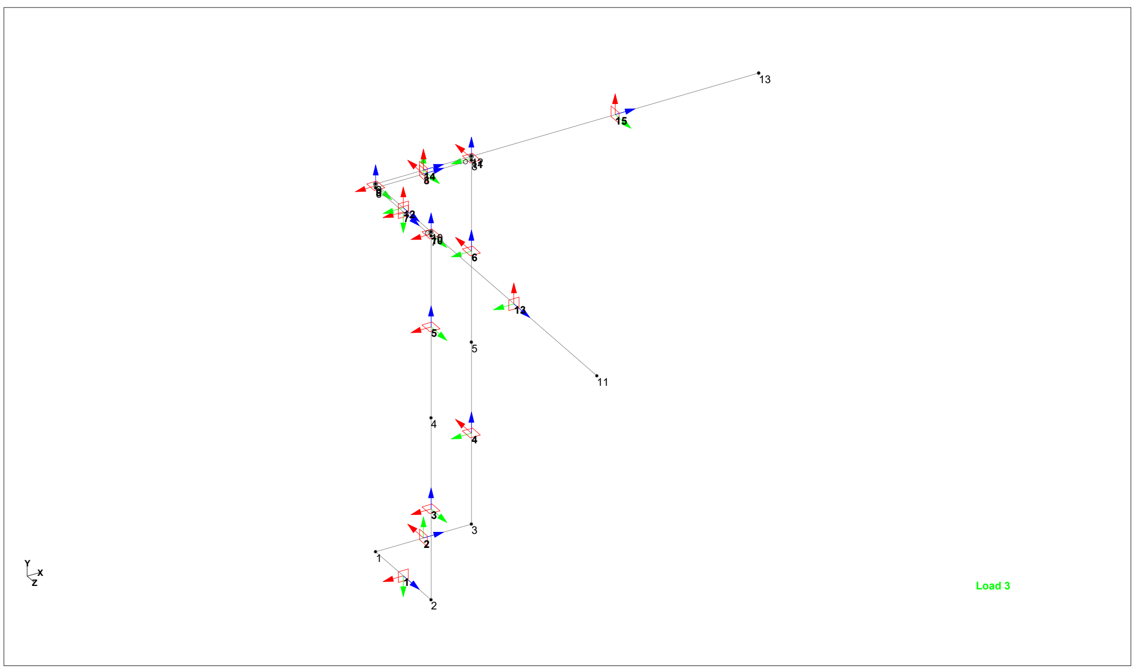
Job Title TonyView	Ref			
	By NAP	Date 7/24/2024		Chd
Client AV Builders	File TonyView.STD		Date/Time 26-Jul-2024 09:04	

Combination Load Cases

Comb.	Combination L/C Name	Primary	Primary L/C Name	Factor
5	COMBINATION LOAD CASE 5 - DL + LL	1	LOAD CASE 1 - DL	1.00
		2	LOAD CASE 2 - LL	1.00
6	COMBINATION LOAD CASE 6 - DL + 0.7ᵹ	1	LOAD CASE 1 - DL	1.00
		2	LOAD CASE 2 - LL	0.75
		4	LOAD CASE 4 - SL	0.75
7	COMBINATION LOAD CASE 7 - DL + WL	1	LOAD CASE 1 - DL	1.00
		3	LOAD CASE 3 - WL	1.00
8	COMBINATION LOAD CASE 8 - DL + 0.7ᵹ	1	LOAD CASE 1 - DL	1.00
		2	LOAD CASE 2 - LL	0.75
		3	LOAD CASE 3 - WL	0.75
		4	LOAD CASE 4 - SL	0.75



Nodes, Beams, and Beam Orientations

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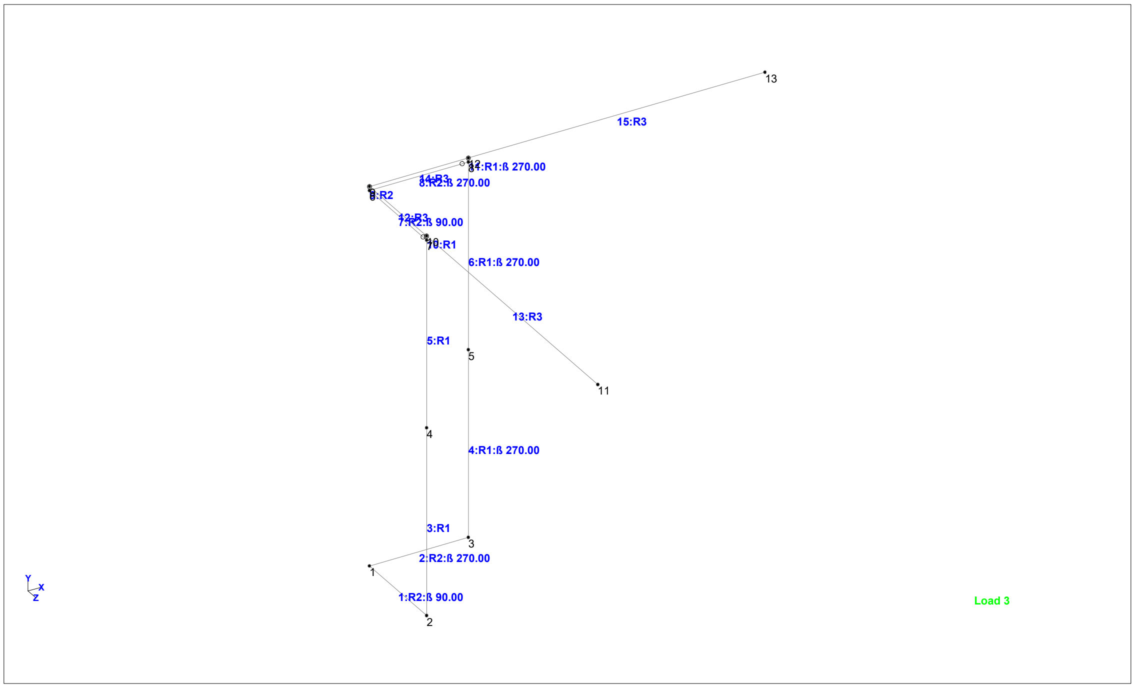
	Part		
Job Title TonyView	Ref		
	By NAP	Date 7/24/2024	Chd
Client AV Builders	File TonyView.STD	Date/Time 26-Jul-2024 09:04	



Beam Properties

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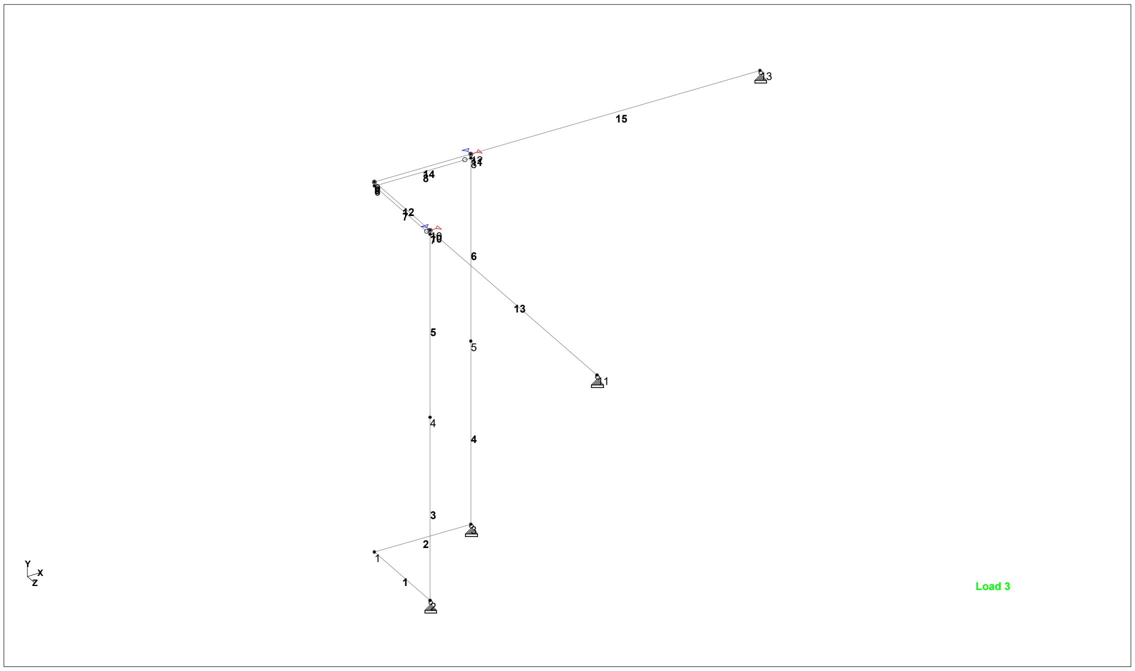
Client AV Builders	File TonyView.STD	Date/Time 26-Jul-2024 09:04	



Supports

Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	9	5:COMBINATI(	**0.001**	0.138	0.001	0.138	0.0	-0.0	-0.0
Min X	5	7:COMBINATI(	**-0.140**	-0.009	-0.065	0.155	-0.0	-0.0	-0.0
Max Y	9	5:COMBINATI(	0.001	**0.138**	0.001	0.138	0.0	-0.0	-0.0
Min Y	10	5:COMBINATI(	-0.000	**-0.036**	0.000	0.036	0.0	-0.0	-0.0
Max Z	4	7:COMBINATI(	-0.065	-0.009	**0.087**	0.109	-0.0	-0.0	0.0
Min Z	5	7:COMBINATI(	-0.140	-0.009	**-0.065**	0.155	-0.0	-0.0	-0.0
Max rX	10	5:COMBINATI(	-0.000	-0.036	0.000	0.036	**0.0**	-0.0	-0.0
Min rX	11	5:COMBINATI(	0	0	0	0	**-0.0**	0.0	-0.0
Max rY	12	8:COMBINATI(	-0.000	-0.036	-0.000	0.036	0.0	**0.0**	-0.0
Min rY	10	5:COMBINATI(	-0.000	-0.036	0.000	0.036	0.0	**-0.0**	-0.0
Max rZ	13	5:COMBINATI(	0	0	0	0	0.0	-0.0	**0.0**
Min rZ	12	5:COMBINATI(	0.000	-0.036	-0.000	0.036	0.0	0.0	**-0.0**
Max Rst	5	7:COMBINATI(	-0.140	-0.009	-0.065	**0.155**	-0.0	-0.0	-0.0

	Job No	Sheet No	Rev
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Beam Displacement Detail Summary

Displacements shown in italic indicate the presence of an offset

	Beam	L/C	d (in)	X (in)	Y (in)	Z (in)	Resultant (in)
Max X	9	5:COMBINATI(	1.000	**0.001**	0.138	0.001	0.138
Min X	4	7:COMBINATI(	45.500	**-0.140**	-0.009	-0.065	0.155
Max Y	9	5:COMBINATI(	0.700	-0.001	**0.138**	-0.001	0.138
Min Y	13	5:COMBINATI(	36.000	-0.001	**-0.322**	-0.000	0.322
Max Z	3	7:COMBINATI(	40.950	-0.064	-0.008	**0.088**	0.109
Min Z	4	7:COMBINATI(	45.500	-0.140	-0.009	**-0.065**	0.155
Max Rst	13	5:COMBINATI(	36.000	-0.001	-0.322	-0.000	**0.322**

Beam Maximum Forces by Section Property

		Axial	Shear		Torsion	Bending	
Section		Max Fx (lb)	Max Fy (lb)	Max Fz (lb)	Max Mx (lb¯in)	Max My (lb¯in)	Max Mz (lb¯in)
Prismatic General	Max +ve	13009.1	131.0	1816.6	-0	2700.4	3049.1
	Max -ve		-135.0	-2700.4	-0.0	-2853.1	-71.7
Prismatic General	Max +ve	469.1	468.6	2852.9	71.7	2852.9	879.8
	Max -ve	-2829.6	-1873.2	-122.2	-71.7	-2852.9	-1873.2
SPFR_SS_4X8	Max +ve	2836.4	8089.8	16.5	0	278.3	60004.8
	Max -ve	-474.2	-6423.0	-15.5	0	-278.3	-102E+3

Reactions

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (lb)	FY (lb)	FZ (lb)	MX (lb¯in)	MY (lb¯in)	MZ (lb¯in)
1	5:COMBINATI(	0	107.2	0	0	0	0
	6:COMBINATI(	0	107.2	0	0	0	0
	7:COMBINATI(	0	112.7	0	0	0	0
	8:COMBINATI(	0	111.3	0	0	0	0
2	5:COMBINATI(	0.5	13017.1	19.9	0	0	0
	6:COMBINATI(	0.5	12853.6	19.6	0	0	0
	7:COMBINATI(	135.0	6284.0	-109.7	0	0	0
	8:COMBINATI(	101.5	12810.6	-69.9	0	0	0
3	5:COMBINATI(	20.0	13016.8	0.5	0	0	0
	6:COMBINATI(	19.7	12853.3	0.5	0	0	0
	7:COMBINATI(	129.1	6392.5	135.0	0	0	0
	8:COMBINATI(	109.3	12891.8	101.5	0	0	0
10	5:COMBINATI(	19.4	0	-41.1	0	0	0
	6:COMBINATI(	19.2	0	-40.6	0	0	0
	7:COMBINATI(	125.4	0	-147.1	0	0	0
	8:COMBINATI(	106.2	0	-136.0	0	0	0
11	5:COMBINATI(	1.3	6423.0	-0.0	0	0	0
	6:COMBINATI(	1.3	6341.8	-0.0	0	0	0

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Reactions Cont...

		Horizontal	Vertical	Horizontal	Moment		
Node	L/C	FX (lb)	FY (lb)	FZ (lb)	MX (lb`in)	MY (lb`in)	MZ (lb`in)
	7:COMBINATI(	0.0	3104.8	-0.0	0	0	0
	8:COMBINATI(	0.8	6341.4	-0.0	0	0	0
12	5:COMBINATI(	-41.2	0	19.4	0	0	0
	6:COMBINATI(	-40.6	0	19.2	0	0	0
	7:COMBINATI(	141.4	0	120.6	0	0	0
	8:COMBINATI(	80.4	0	102.7	0	0	0
13	5:COMBINATI(	-0.0	6423.0	1.3	0	0	0
	6:COMBINATI(	-0.0	6341.7	1.3	0	0	0
	7:COMBINATI(	0.0	3106.0	1.2	0	0	0
	8:COMBINATI(	0.0	6342.3	1.7	0	0	0

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Node Displacement Summary

	Node	L/C	X (in)	Y (in)	Z (in)	Resultant (in)	rX (rad)	rY (rad)	rZ (rad)
Max X	2	5:COMBINATI(	**0**	0	0	0	-0.0	-0.0	0.0
Min X	1	6:COMBINATI(	**-0.000**	-0.000	-0.000	0.000	0.0	0.0	-0.0
Max Y	2	5:COMBINATI(	0	**0**	0	0	-0.0	-0.0	0.0
Min Y	1	7:COMBINATI(	-0.000	**-0.000**	-0.000	0.000	0.0	0.0	-0.0
Max Z	2	5:COMBINATI(	0	0	**0**	0	-0.0	-0.0	0.0
Min Z	1	6:COMBINATI(	-0.000	-0.000	**-0.000**	0.000	0.0	0.0	-0.0
Max rX	2	7:COMBINATI(	0	0	0	0	**0.0**	-0.0	0.0
Min rX	3	7:COMBINATI(	0	0	0	0	**-0.0**	-0.0	0.0
Max rY	1	6:COMBINATI(	-0.000	-0.000	-0.000	0.000	0.0	**0.0**	-0.0
Min rY	3	7:COMBINATI(	0	0	0	0	-0.0	**-0.0**	0.0
Max rZ	3	7:COMBINATI(	0	0	0	0	-0.0	-0.0	**0.0**
Min rZ	1	6:COMBINATI(	-0.000	-0.000	-0.000	0.000	0.0	0.0	**-0.0**
Max Rst	1	7:COMBINATI(	-0.000	-0.000	-0.000	**0.000**	0.0	0.0	-0.0

Beam End Forces

Sign convention is as the action of the joint on the beam.

			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (lb)	Fy (lb)	Fz (lb)	Mx (lb-in)	My (lb-in)	Mz (lb-in)
1	1	5:COMBINATI(	-0.0	-0.0	-53.6	-6.3	6.3	-0.0
		6:COMBINATI(	-0.0	-0.0	-53.6	-6.3	6.3	-0.0
		7:COMBINATI(	-0.0	-0.0	-56.3	-71.7	71.7	-0.0
		8:COMBINATI(	-0.0	-0.0	-55.7	-55.5	55.5	-0.0
	2	5:COMBINATI(	0.0	0.0	-53.1	6.3	0	-0.0
		6:COMBINATI(	0.0	0.0	-53.1	6.3	0	-0.0
		7:COMBINATI(	0.0	0.0	-50.4	71.7	0	-0.0
		8:COMBINATI(	0.0	0.0	-51.0	55.5	0	-0.0
2	1	5:COMBINATI(	-0.0	-0.0	53.6	6.3	-6.3	-0.0
		6:COMBINATI(	-0.0	-0.0	53.6	6.3	-6.3	-0.0
		7:COMBINATI(	-0.0	-0.0	56.3	71.7	-71.7	-0.0
		8:COMBINATI(	-0.0	-0.0	55.7	55.5	-55.5	-0.0
	3	5:COMBINATI(	0.0	0.0	53.1	-6.3	0	0.0
		6:COMBINATI(	0.0	0.0	53.1	-6.3	0	0.0
		7:COMBINATI(	0.0	0.0	50.4	-71.7	0	0.0
		8:COMBINATI(	0.0	0.0	51.0	-55.5	0	0.0
7	6	5:COMBINATI(	-1829.6	36.7	-81.1	0	1866.3	879.8
		6:COMBINATI(	-1806.4	36.2	-80.1	0	1842.6	868.7
		7:COMBINATI(	-2248.2	0.5	-97.0	0	2248.7	12.4
		8:COMBINATI(	-2829.6	23.3	-122.2	0	2852.9	559.0
	7	5:COMBINATI(	1829.6	-36.7	74.4	0	0	0
		6:COMBINATI(	1806.4	-36.2	73.4	0	0	0
		7:COMBINATI(	2248.2	-0.5	90.4	0	0	0
		8:COMBINATI(	2829.6	-23.3	115.5	0	0	0

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Beam End Forces Cont...

			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (lb)	Fy (lb)	Fz (lb)	Mx (lb¯in)	My (lb¯in)	Mz (lb¯in)
8	6	5:COMBINATI(	-1836.6	36.7	81.4	0	-1873.2	879.8
		6:COMBINATI(	-1813.3	36.2	80.4	0	-1849.5	868.7
		7:COMBINATI(	469.1	0.5	-16.2	0	468.6	12.4
		8:COMBINATI(	-795.9	23.3	37.5	0	-819.2	559.0
	8	5:COMBINATI(	1836.6	-36.7	-74.7	0	0	0
		6:COMBINATI(	1813.3	-36.2	-73.7	0	0	0
		7:COMBINATI(	-469.1	-0.5	22.9	0	0	0
		8:COMBINATI(	795.9	-23.3	-30.8	0	0	0

Beam Force Detail Summary

Sign convention as diagrams:- positive above line, negative below line except Fx where positive is compression. Distance d is given from beam end A.

				Axial	Shear		Torsion	Bending	
	Beam	L/C	d (in)	Fx (lb)	Fy (lb)	Fz (lb)	Mx (lb¯in)	My (lb¯in)	Mz (lb¯in)
Max Fx	8	7:COMBINATI(	0	**469.1**	0.5	-16.2	0	468.6	12.4
Min Fx	7	8:COMBINATI(	0	**-2829.6**	23.3	-122.2	0	2852.9	559.0
Max Fy	7	5:COMBINATI(	0	-1829.6	**36.7**	-81.1	0	1866.3	879.8
Min Fy	1	6:COMBINATI(	0	-0.0	**-0.0**	-53.6	-6.3	6.3	-0.0
Max Fz	8	5:COMBINATI(	0	-1836.6	36.7	**81.4**	0	-1873.2	879.8
Min Fz	7	8:COMBINATI(	0	-2829.6	23.3	**-122.2**	0	2852.9	559.0
Max Mx	2	7:COMBINATI(	0	-0.0	-0.0	56.3	**71.7**	-71.7	-0.0
Min Mx	1	7:COMBINATI(	0	-0.0	-0.0	-56.3	**-71.7**	71.7	-0.0
Max My	7	8:COMBINATI(	0	-2829.6	23.3	-122.2	0	**2852.9**	559.0
Min My	8	5:COMBINATI(	0	-1836.6	36.7	81.4	0	**-1873.2**	879.8
Max Mz	7	5:COMBINATI(	0	-1829.6	36.7	-81.1	0	1866.3	**879.8**
Min Mz	1	6:COMBINATI(	0	-0.0	-0.0	-53.6	-6.3	6.3	**-0.0**

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	By NAP	Date 7/24/2024	Chd	
Client AV Builders	File TonyView.STD	Date/Time 26-Jul-2024 09:04		

Beam End Forces

Sign convention is as the action of the joint on the beam.

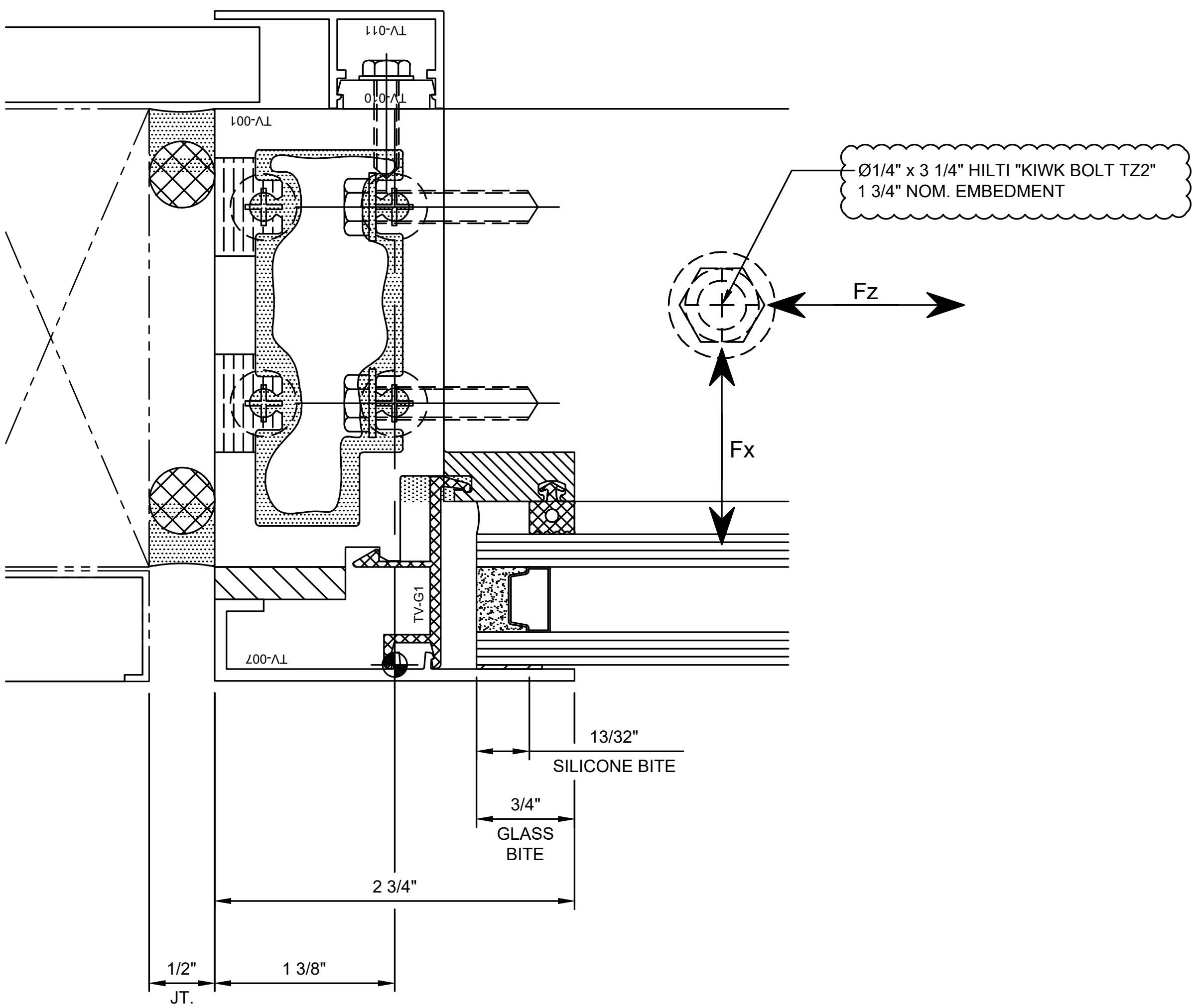
			Axial	Shear		Torsion	Bending	
Beam	Node	L/C	Fx (lb)	Fy (lb)	Fz (lb)	Mx (lb·in)	My (lb·in)	Mz (lb·in)
3	2	5:COMBINATI(	12964.0	-0.5	19.9	-0.0	0.0	-6.3
		6:COMBINATI(	12800.5	-0.5	19.6	-0.0	0.0	-6.3
		7:COMBINATI(	6233.6	-135.0	-109.7	-0.0	0.0	-71.7
		8:COMBINATI(	12759.6	-101.5	-69.9	-0.0	0.0	-55.5
	4	5:COMBINATI(	-12949.4	0.5	-19.9	0.0	-904.9	-14.9
		6:COMBINATI(	-12785.8	0.5	-19.6	0.0	-893.4	-14.7
		7:COMBINATI(	-6219.0	2.2	-23.0	0.0	1973.2	-3049.1
		8:COMBINATI(	-12745.0	1.9	-29.7	0.0	914.4	-2297.3
4	3	5:COMBINATI(	12963.7	-0.5	-20.0	-0.0	-0.0	-6.3
		6:COMBINATI(	12800.2	-0.5	-19.7	-0.0	-0.0	-6.3
		7:COMBINATI(	6342.1	-135.0	-129.1	-0.0	-0.0	-71.7
		8:COMBINATI(	12840.8	-101.5	-109.3	-0.0	-0.0	-55.5
	5	5:COMBINATI(	-12949.1	0.5	20.0	0.0	908.3	-14.9
		6:COMBINATI(	-12785.6	0.5	19.7	0.0	896.8	-14.7
		7:COMBINATI(	-6327.5	2.2	-3.7	0.0	2853.1	-3049.1
		8:COMBINATI(	-12826.2	1.9	9.7	0.0	2707.5	-2297.3

ANCHOR ANALYSIS

1
D1

A1 - SILL ANCHOR

Fx = 135 LBF
Fz = 135 LBF

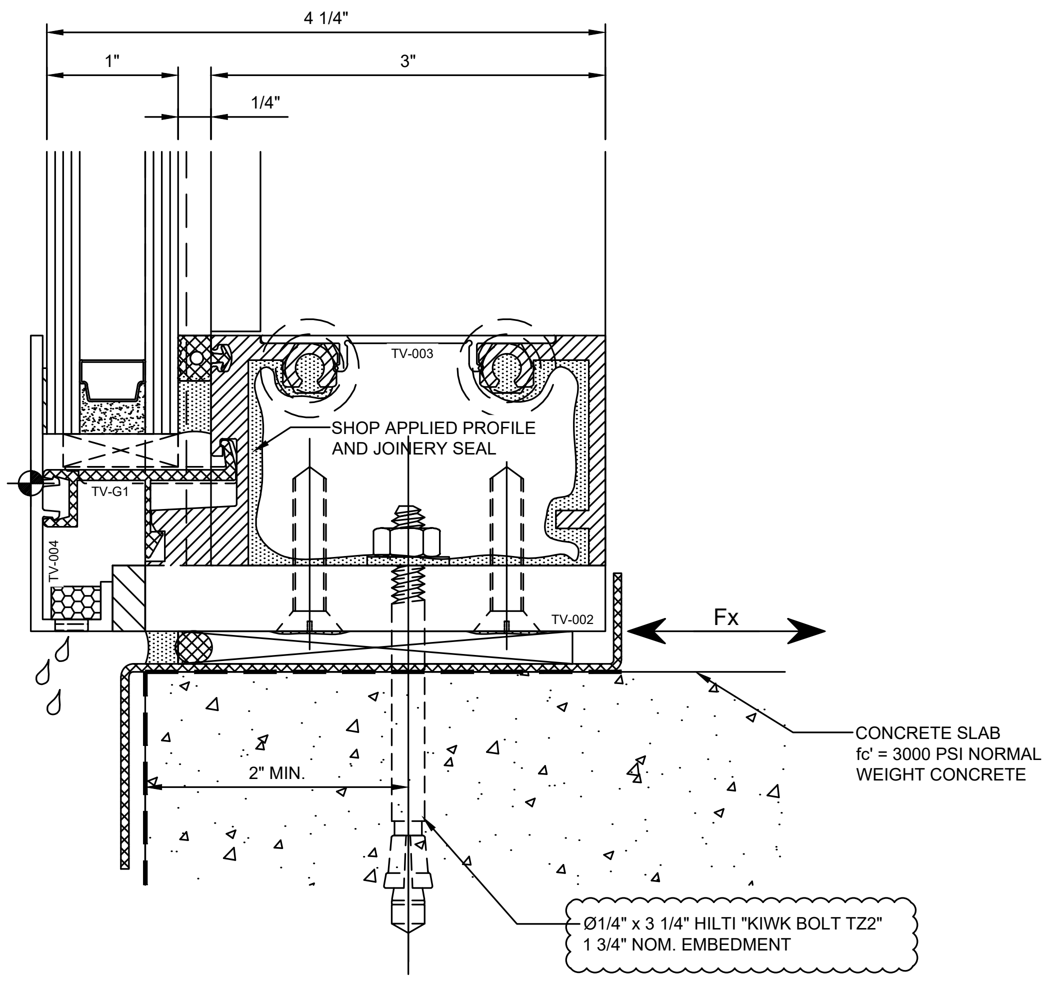


2
D3

A1 - SILL ANCHOR

Fx = 135 LBF

Fz = 135 LBF



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Company:	WSE	Page:	1
Address:	1151 Campus Drive Suite #100	Specifier:	Nestor A. Perez
Phone I Fax:	614-747-2416 |	E-Mail:	nperez@wheatonsprague.com
Design:	Sill Anchor Calculation	Date:	8/1/2024
Fastening point:			

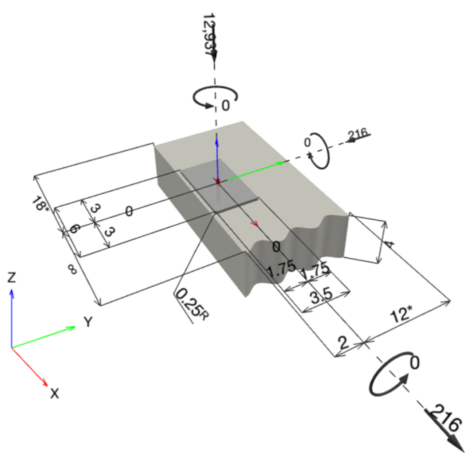
Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 1/4**
Item number:	2210174 KB-TZ2 1/4x2 1/2
Specification text:	Hilti KB-TZ2 stud anchor with 1.75 in embedment, 1/4, Carbon steel, installation per ESR-4266
Effective embedment depth:	$h_{ef,act}$ = 1.500 in., h_{nom} = 1.750 in.
Material:	Carbon Steel
Evaluation Service Report:	ESR-4266
Issued I Valid:	12/1/2023 | 12/1/2025
Proof:	Design Method ACI 318-19 / Mech
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.250 in.
Anchor plate[R] :	l_x x l_y x t = 6.000 in. x 3.500 in. x 0.250 in.; (Recommended plate thickness: not calculated)
Profile:	no profile
Base material:	cracked concrete, 3000, f_c' = 3,000 psi; h = 4.000 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

[R] - The anchor calculation is based on a rigid anchor plate assumption.

Geometry [in.] & Loading [lb, in.lb]



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Company:	WSE	Page:	2
Address:	1151 Campus Drive Suite #100	Specifier:	Nestor A. Perez
Phone I Fax:	614-747-2416 |	E-Mail:	nperez@wheatonsprague.com
Design:	Sill Anchor Calculation	Date:	8/1/2024
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = -12,937; V_x = 216; V_y = -216; M_x = 0; M_y = 0; M_z = 0;	no	57

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Company:	WSE	Page:	3
Address:	1151 Campus Drive Suite #100	Specifier:	Nestor A. Perez
Phone I Fax:	614-747-2416 |	E-Mail:	nperez@wheatonsprague.com
Design:	Sill Anchor Calculation	Date:	8/1/2024
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	-	-	-	- / -	N/A
Shear	Concrete edge failure in direction y-	305	543	- / 57	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	-	-	-	-	N/A

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

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Company:	WSE	Page:	4
Address:	1151 Campus Drive Suite #100	Specifier:	Nestor A. Perez
Phone I Fax:	614-747-2416 |	E-Mail:	nperez@wheatonsprague.com
Design:	Sill Anchor Calculation	Date:	8/1/2024
Fastening point:			

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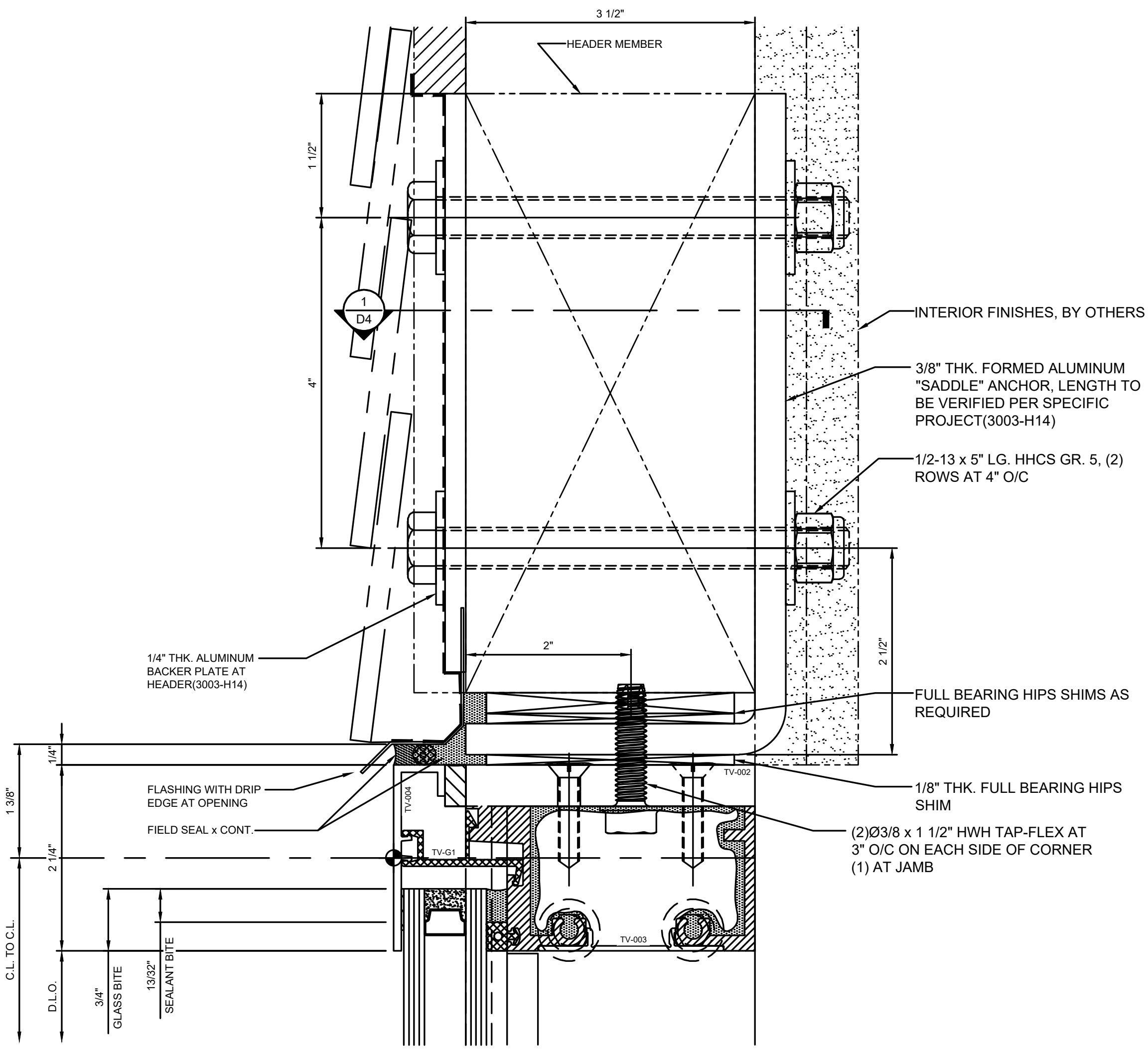
1
D3

A2 - HEAD ANCHOR

Fx = 125 LBS

Fz = 147 LBS



A1 - Head Anchor

Applied Loads

$F_x := 125 \cdot lbf$

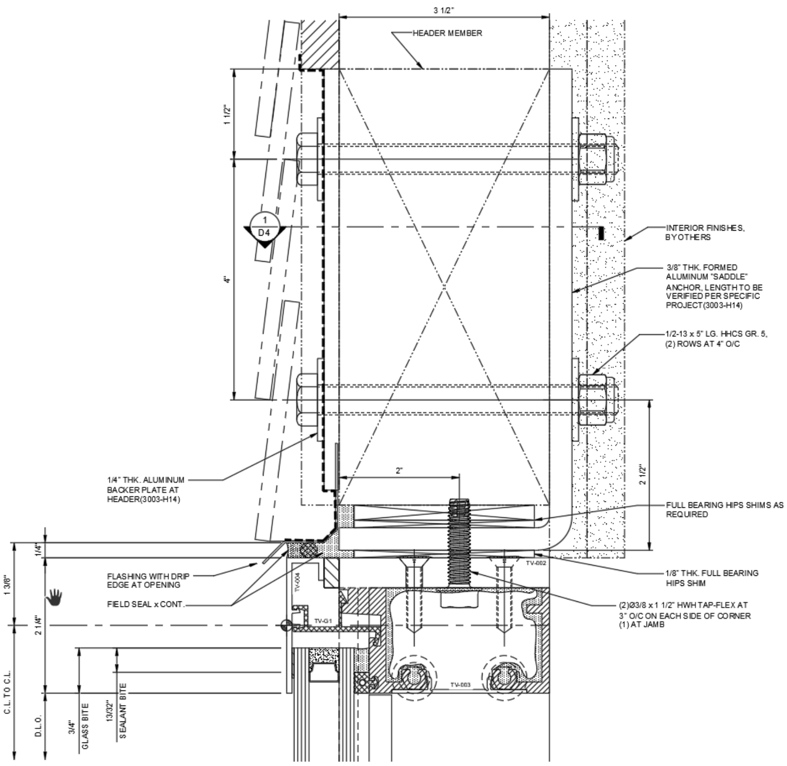
$F_z := 147 \cdot lbf$

Geometry and Material Properties

$a := 2.5 \cdot in$

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

$t_{saddle} := 0.375 \cdot in$



3/8"ø x 1 1/2" HWH Tap-Flex

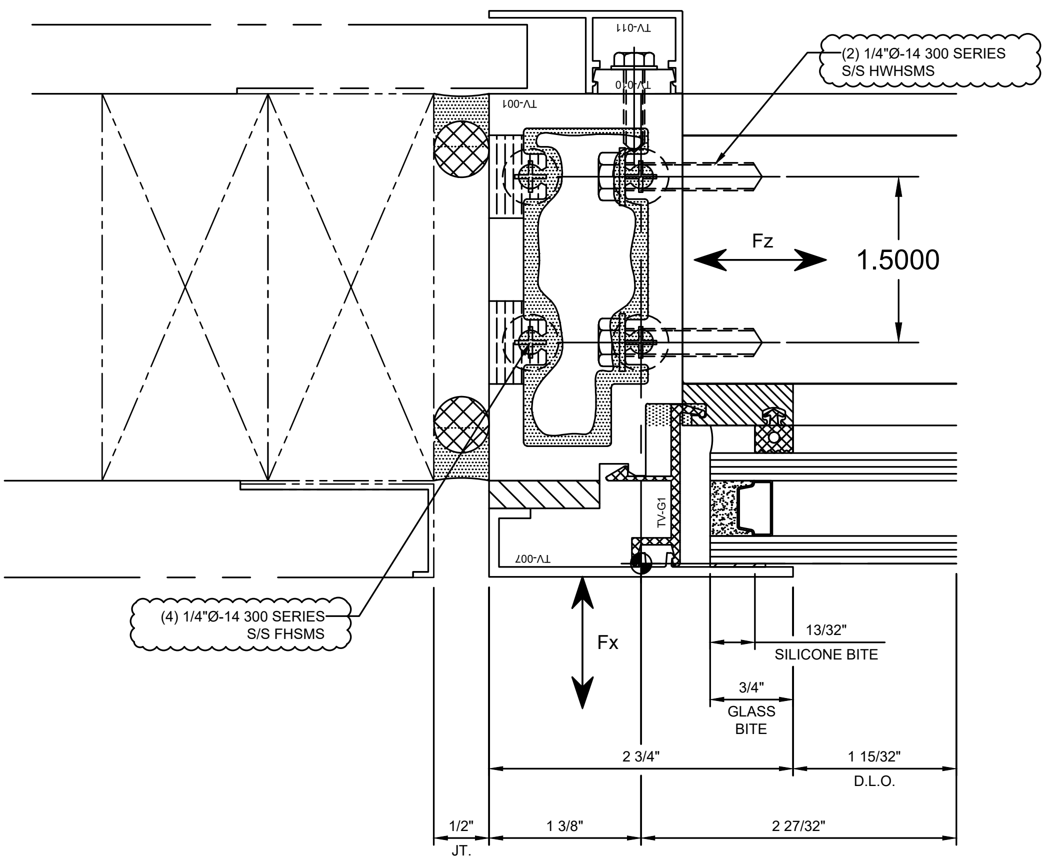
$V_{max} := \sqrt{\left(\frac{F_x}{2}\right)^2 + \left(\frac{F_z}{2}\right)^2} = 96\ lbf$ $<$ $V_{allow} := 1860\ lbf$ O.K.

Saddle Anchor

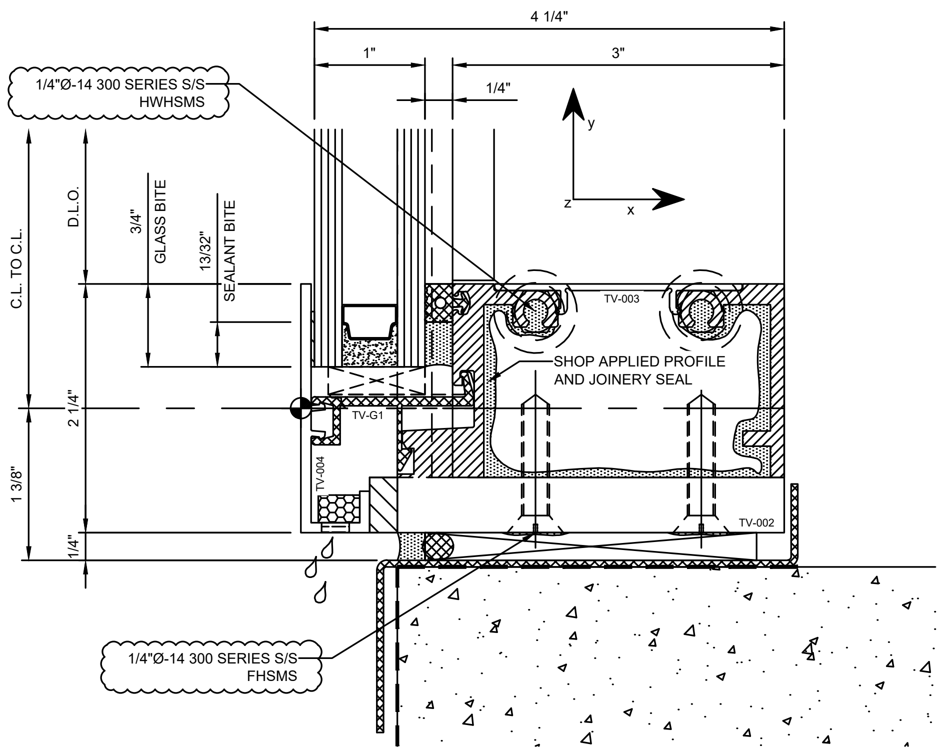
$f_{by} := \frac{F_x \cdot a}{L_{eff} \cdot t_{saddle}^{\ 2} \cdot 4^{-1}} = 1.481\ ksi$ $<$ $F_{by} := \frac{17 \cdot ksi}{1.67} = 10.18\ ksi$ O.K.

CONNECTION ANALYSIS

1 / D1 C1 - VERTICAL / HORIZONTAL CONNECTION



2 / D3 C1 - VERTICAL / HORIZONTAL CONNECTION



Connection Analysis - Sill to Vertical Connection

Applied Loads

$V_{max} := 56 \cdot lbf$ $\quad$ $F_x := 135 \cdot lbf$

$M_{max\_z} := 0.0717 \cdot kip \cdot in$ $\quad$ $F_z := 135 \cdot lbf$

$M_{max\_y} := 0.0717 \cdot kip \cdot in$

Geometry and Material Properties

$a := 1.5 \cdot in$

$b := 1.5 \cdot in$

1/4"ø-14 300 Series S/S HWHSMS - Horizontal to Vertical Connection at Screw Splines

$P_z := \frac{M_{max\_z}}{a} = 48\ lbf$ $\quad < \quad$ $V_{allow} := 517\ lbf$ $\quad$ O.K.

$T_z := \frac{M_{max\_y}}{a} = 48\ lbf$ $\quad < \quad$ $T_{allow} := 896\ lbf$ $\quad$ O.K.

$CSR := \left(\frac{P_z}{V_{allow}}\right)^2 + \left(\frac{T_z}{T_{allow}}\right)^2 = 0.011$ $\quad < \quad$ 1.0 $\quad$ O.K.

1/4"ø-14 300 Series S/S HWHSMS - Vertical Connection to Horizontal at Bottom Plate

$V_{max\_screw} := \sqrt{\left(\frac{F_x}{4}\right)^2 + \left(\frac{F_z}{4}\right)^2} = 48\ lbf$ $\quad < \quad$ $V_{allow} := 517\ lbf$ $\quad$ O.K.

$135 \cdot 1.6 = 216$

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