Structural Consultants
ADVANTAGE GROUP
ENGINEERS, INC.

Principals:
Robin R. Hahn P.E.
Raymond J. Brake P.E.

2/3/2022

Superior Aluminum Products, Inc.
555 E. Main Street
PO Box 430
Russia, OH 45363

Attn: Scott Guggenbiller
Re: PSI Property Services
Project No. 21937.87

Dear Mr Guggenbiller:

At your request, I have analyzed the proposed guardrail system for the PSI Property Services project for the Park Terrace Condominium Association project, located at 212-218 Locust St. SE, Vienna, VA 22180. My review is limited to sheet X0119239 dated 10-20-2021.

The project consists of 9000 series guardrails connected to existing wood framed deck structures. No architectural or structural drawings have been provided. AGE has not visited the site to observe the condition of the existing structure. All information provided in this submittal is an assumption, which shall be verified by the architect or structural engineer of record, and the G.C. The architect and structural engineer of record shall verify that all existing framing is adequate to support guardrail connections and guardrail forces.

Posts shall be reinforced with 2.3”x2.3”x.25” x 2-7/8” reinforcing bar. Guardrail posts shall be connected to the wood structure per the attached details SK-1 through SK-4.

The approver/approvers shall verify all connection details accurately represent the structural components and notify Advantage Group Engineers immediately of any discrepancies.

The guardrail system described in this letter will be adequate to support the minimum code required loads. The structural analysis and calculations are attached.

Sincerely,

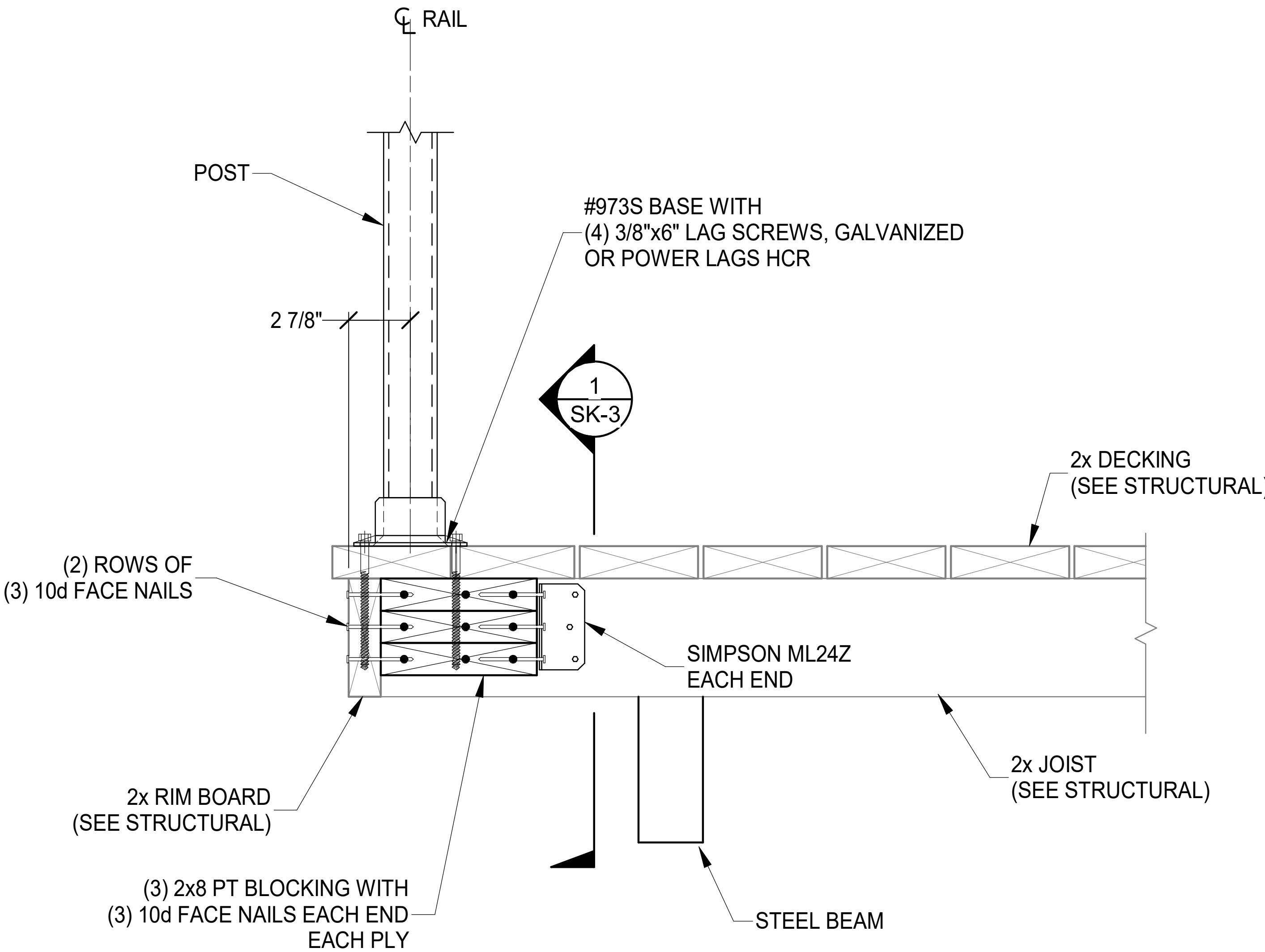
COMMONWEALTH OF VIRGINIA
2/3/2022
KYLE CHRISTOPHER JENKINS
Lic. No. 0402057572
PROFESSIONAL ENGINEER

Kyle Jenkins, P.E.
Advantage Group Engineers, Inc.

Structural Consultants
ADVANTAGE GROUP
ENGINEERS, INC.

1527 Madison Avenue
Cincinnati, Ohio 45206
Phone: (513) 396-8900

Project:	PSI PROPERTY SERVICES		
Client:	SUPERIOR ALUMINUM		
Proj. No.:	21937.87	Date:	12/29/2021
Design Team:	KCJ / SJ	Dwg:	SK-1



SK-1 JOISTS PER PENDICULAR TO RAIL

SCALE 1 1/2" = 1'-0"

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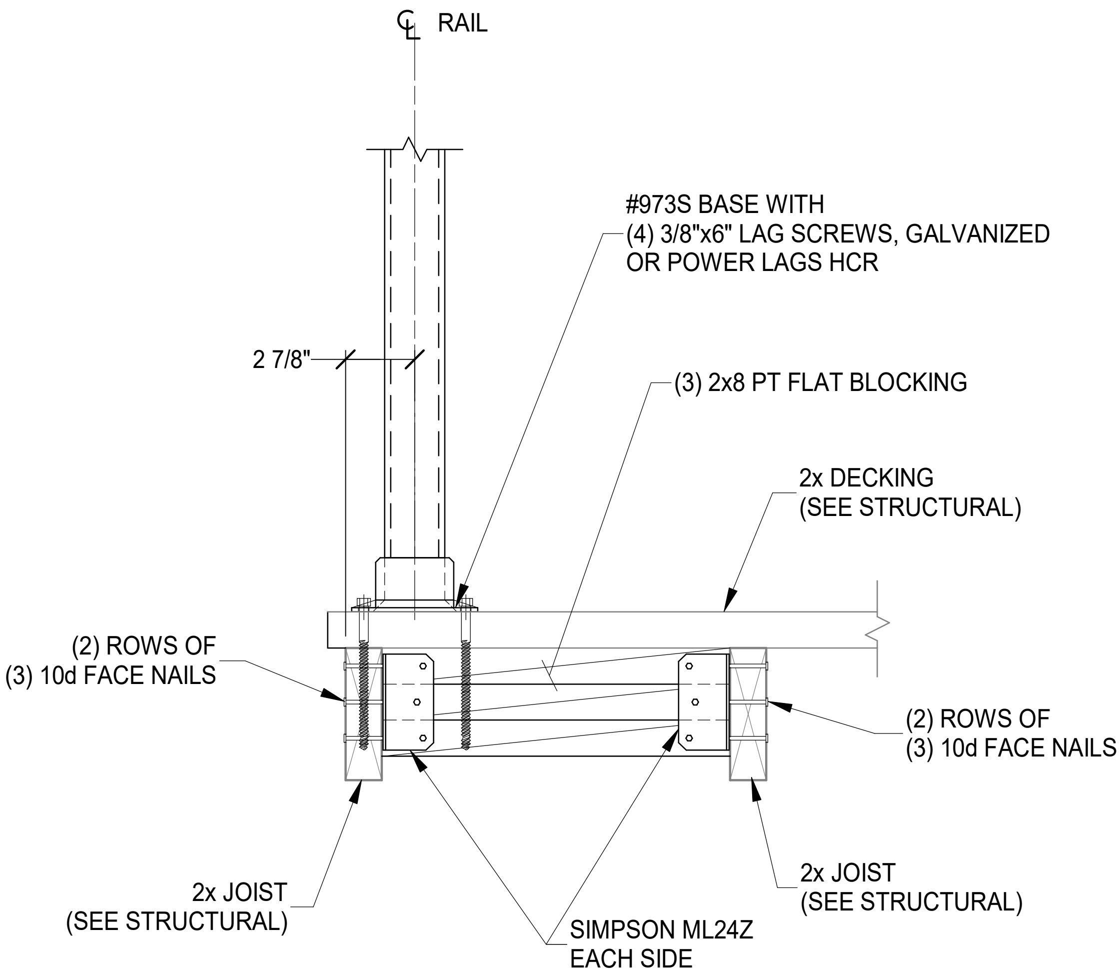
Project:	PSI PROPERTY SERVICES		
Client:	SUPERIOR ALUMINUM		
Proj. No.:	21937.87	Date:	12/29/2021
Design Team:	KCJ / SJ	Dwg:	SK-2



SK-2 JOISTS PARALLEL TO RAIL

SCALE 1 1/2" = 1'-0"

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ENGINEERS, INC.

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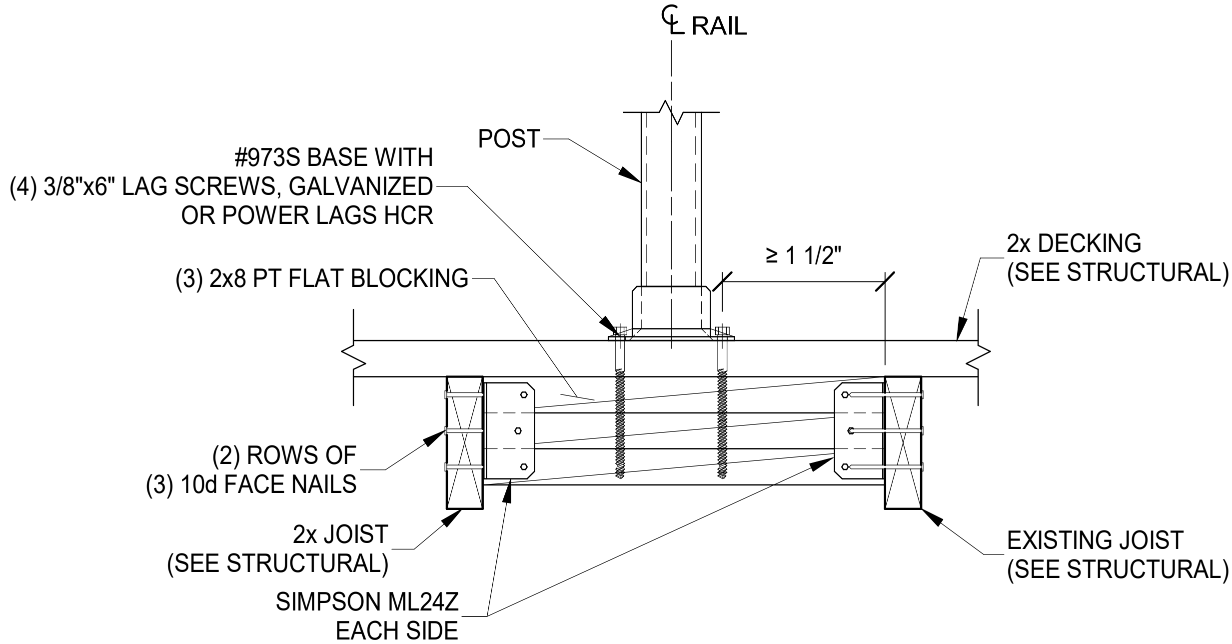
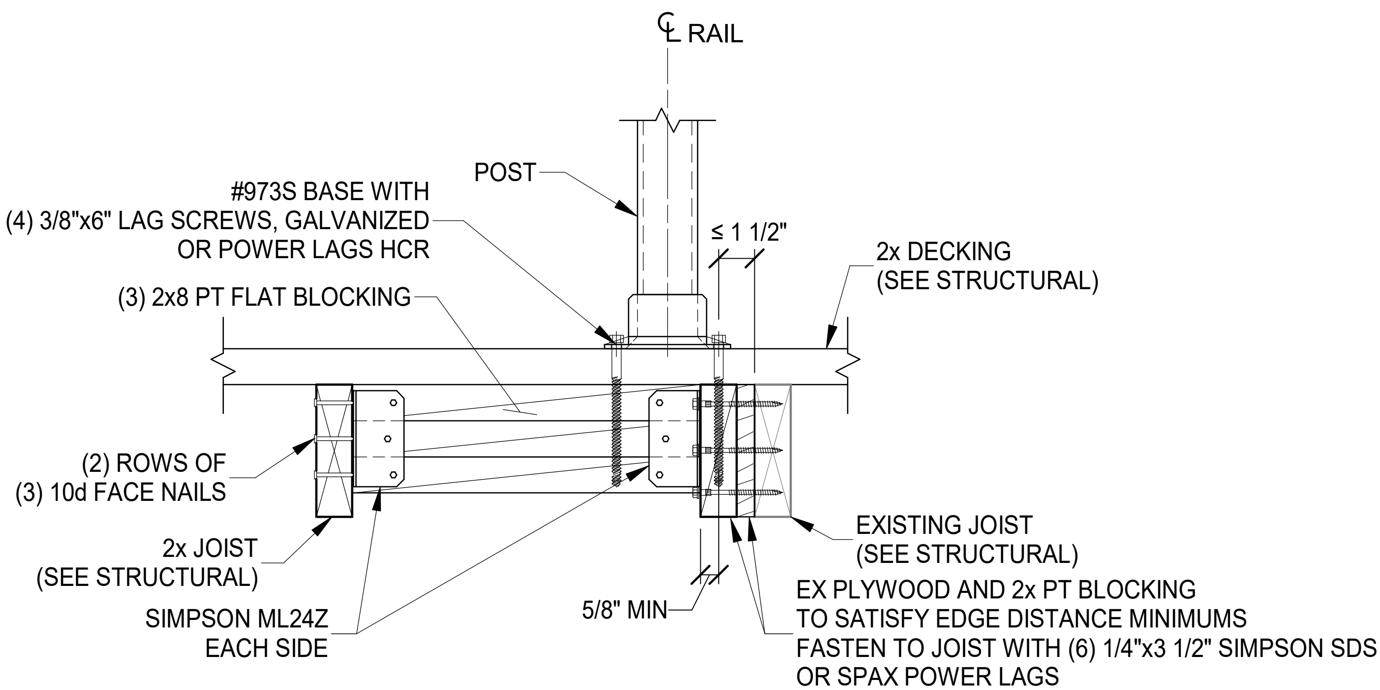
Project:	PSI PROPERTY SERVICES
Client:	SUPERIOR ALUMINUM
Proj. No.:	21937.87
Date:	12/29/2021
Design Team:	KCJ / SJ
Dwg:	SK-3



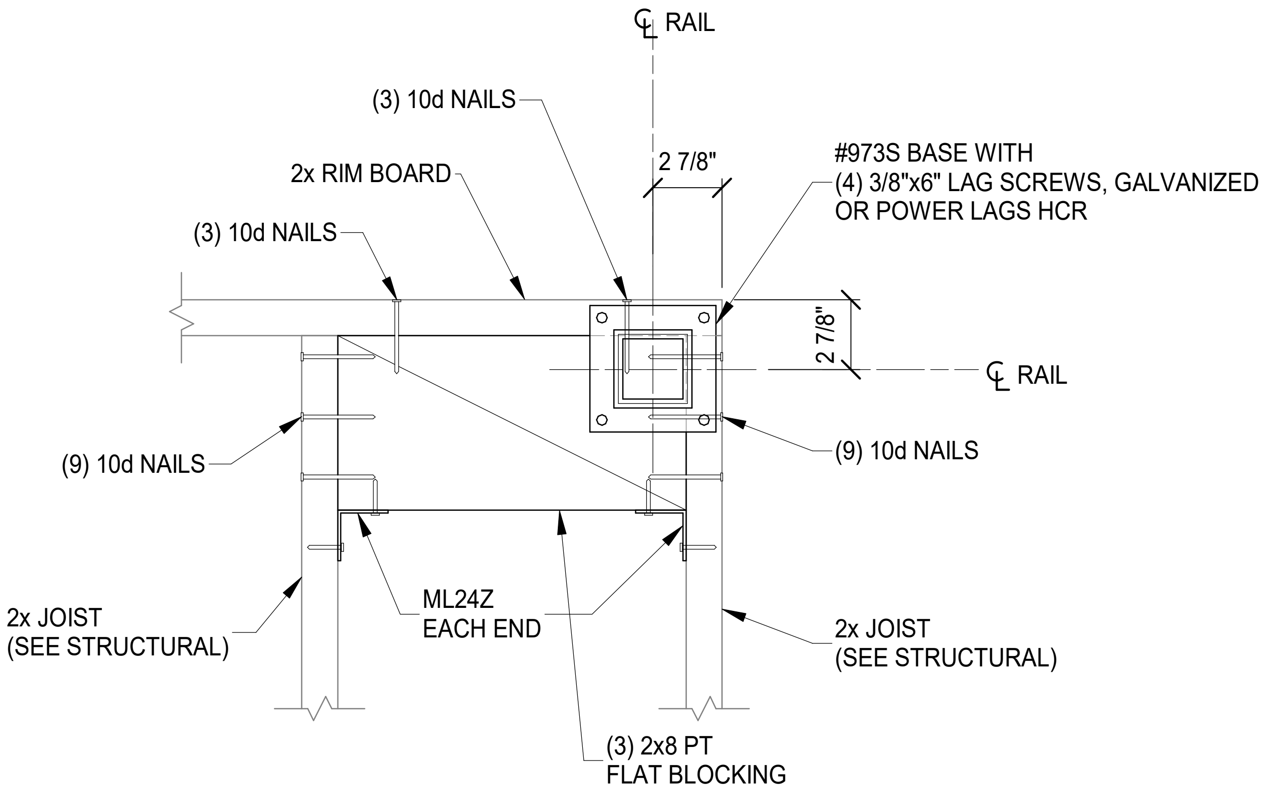
SK-3 LAG SCREW A MINIMUM OF 1 1/2" FROM JOIST

SCALE 1 1/2" = 1'-0"



SK-3 LAG SCREW @ JOIST OR LESS THAN 1 1/2" FROM JOIST

SCALE 1 1/2" = 1'-0"



SK-4 PLAN DETAIL @ CORNER POST

SCALE 1 1/2" = 1'-0"

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Ph. 513.396.8900

Project:
Client:
Project No.: Date:
Engineer: Sheet

DESIGN LOADS (PER ASCE 7)

- 200# CONCENTRATED LOAD APPLIED TO TOP RAIL IN ANY DIRECTION, AT ANY POINT
- 50#/ft UNIFORM LOAD APPLIED IN ANY DIRECTION TO ENTIRE LENGTH OF TOP RAIL
- 50# HORIZONTAL LOAD APPLIED ON AN AREA NOT TO EXCEED 1'x1' TO INTERMEDIATE RAILS
- LOADS DO NOT ACT CONCURRENTLY

MINIMUM MECHANICAL PROPERTIES

- TABLE 3.3-1 ALUMINUM DESIGN MANUAL

6063-T6 $\begin{cases} F_{ty} = 25\text{ ksi} \\ F_{cy} = 25\text{ ksi} \end{cases}$

6063-T4 $\begin{cases} F_{ty} = 15\text{ ksi} \\ F_{cy} = 15\text{ ksi} \end{cases}$

6063-T5 $\begin{cases} F_{ty} = 15\text{ ksi} \\ F_{cy} = 15\text{ ksi} \end{cases}$

MEMBERS

- POSTS - 2½" SQUARE w/ MACHINED OPENINGS
- PICKETS - ¾" SQUARE @ 4½" ON CENTER
- TOP RAIL - 902 TOP RAIL
- POST BASE - #9735
- FASTENERS - ALL STAINLESS STEEL

TOP RAIL PROPERTIES - SEE PRINTOUT FOR CALCULATION

$I_{xx} = 1.869\text{ in}^4$

$S_{xx} = 0.763\text{ in}^3$

$I_{yy} = 0.635\text{ in}^4$

$S_{yy} = 0.471\text{ in}^3$

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Project No.: Date:
Engineer: Sheet

ADM2020 TABLE 2-21 6063-T6 (UNWELDED)

LIMITING SLENDERNESS = SIDEWALL OF RAIL IN UNIFORM COMPRESSION WHEN SUBJECT TO LATERAL LOADS

$\lambda = b/t = 3.125''/0.075 = 42 \quad \lambda > \lambda_2 = 39 \Rightarrow F/\Omega = \frac{484}{\lambda} = \boxed{11.5\text{ Ksi}}$

GOVERNS

BOTTOM RAIL PROPERTIES - SEE PRINTOUT FOR CALCS

$I_{xx} = .207\text{ in}^4 \quad S_x = \frac{I_{xx}}{Y} = \frac{.207\text{ in}^4}{.5''} = .0414\text{ in}^3$

$I_{yy} = .0701\text{ in}^4 \quad S_y = \frac{I_{yy}}{x} = \frac{.0701\text{ in}^4}{15/16} = .0762\text{ in}^3$

LIMITING VALUES (2020 ALUMINUM DESIGN MANUAL)

TOP EDGE Check $b/t = 1''/.075 = 13.3 \leq S_1 = \frac{B_p - F_{cy}}{5.1(D_p)} = 22.8$

ALLOWABLE COMPRESSIVE STRESS = $F_{cy}/\Omega_y = 15.2$ Ksi

SIDE LEGS CHECK $b/t = 0.75/0.075 = 10 \geq S_1 = 7.3 \Rightarrow F/\Omega = 19 - 6.53\cdot(10) = \boxed{13.7\text{ Ksi}}$

GOVERNS

PICKET PROPERTIES 6063-T5

$S_x = \frac{a^4 - b^4}{6a} = \frac{.75^4 - .65^4}{6(.75)} = .0306\text{ in}^3$

$\lambda = $ Check $b/t = .75''/.05'' = 15 \leq S_1 = 25.6$

$\Rightarrow$ ALLOWABLE COMPRESSIVE STRESS = $F/\Omega = \boxed{9.7\text{ Ksi}}$ GOVERNS

ADM TABLE 2-20 6063-T5 (UNWELDED)

LIMITING SLENDERNESS = WALL OF PICKET IN UNIFORM COMPRESSION WHEN SUBJECT TO LATERAL LOAD

3/4" SQUARE PICKET

Table 2-20

ALLOWABLE STRESSES F/Ω FOR BUILDING-TYPE STRUCTURES (UNWELDED)

6063 - T5 **ASTM B221 0.000 to 0.500 in. thick**
6063 - T52 **ASTM B221 0.000 to 1.000 in. thick**

F_{ty} = 16 k/in^2 E = 10,100 k/in^2
F_{cy} = 16 k/in^2 k_t = 1
F_{tu} = 22 k/in^2

Allowable Stresses F/Ω (k/in^2)	Section	F/Ω
Axial Tension		
axial tension stress on net effective area	D.2b	11.3
axial tension stress on gross area	D.2a	9.7
Shear or torsion		
Shear or torsion rupture	G, H.2	6.8
Bearing		
bolts or rivets on holes	J.3.6a, J.4.6	22.6
bolts on slots, pins on holes, flat surfaces	J.3.6b, J.6.5, J.8	15.0
screws in holes	J.5.5.1	14.7

		Slenderness λ	F/Ω for $\lambda \le \lambda_1$	λ_1	F/Ω for $\lambda_1 < \lambda < \lambda_2$	λ_2	F/Ω for $\lambda \ge \lambda_2$
Axial Compression							
member buckling	E.2	kL/r	9.7	18.8	$0.00008\ \lambda^2 - 0.065\ \lambda + 10.9$	99	$51{,}352\ /\lambda^2$
Flexure							
lateral-torsional buckling	F.4	see F.4.2		-	see F.4	99	$60{,}414\ /\lambda^2$
Elements - Uniform Compression							
flat elements supported on one edge in columns whose buckling axis is not an axis of symmetry	B.5.4.1	b/t	9.7	8.2	$11.8 - 0.260\ \lambda$	19	$2{,}417\ /\lambda^2$
flat elements supported on one edge in all other columns and all beams	B.5.4.1	b/t	9.7	8.2	$11.8 - 0.260\ \lambda$	15.9	$122\ /\lambda$
flat elements supported on both edges	B.5.4.2	b/t	9.7	25.6	$11.8 - 0.083\ \lambda$	50	$382\ /\lambda$
flat elements supported on both edges and with an intermediate stiffener	B.5.4.4	λ_s	9.7	18.8	$10.5 - 0.044\ \lambda$	99	$60{,}414\ /\lambda^2$
round hollow elements	B.5.4.5	$(R_b/t)^{1/2}$	9.7	6.1	$11.6 - 0.320\ \lambda$	16.6	$3{,}776\ /[\lambda^2(1+\lambda/35)^2]$
flat elements - direct strength method	B.5.4.6	λ_{eq}	9.7	41.0	$11.8 - 0.052\ \lambda$	80	$611\ /\lambda$
Elements - Flexural Compression							
flat elements supported on both edges	B.5.5.1	b/t	14.5	36.1	$17.2 - 0.072\ \lambda$	119	$1{,}017\ /\lambda$
flat elements supported on tension edge, compression edge free	B.5.5.2	b/t	14.5	6.7	$17.2 - 0.389\ \lambda$	29	$4{,}932\ /\lambda^2$
flat elements supported on both edges and with a longitudinal stiffener	B.5.5.3	b/t	14.5	81.0	$17.2 - 0.032\ \lambda$	266	$2{,}280\ /\lambda$
round hollow elements	B.5.5.4	$(R_b/t)^{1/2}$	$17.5 - 0.917\ \lambda$	9.8	$11.6 - 0.320\ \lambda$	16.6	$3{,}776\ /[\lambda^2(1+\lambda/35)^2]$
flat elements - direct strength method	B.5.5.5	λ_{eq}	14.5	23.5	$17.2 - 0.111\ \lambda$	77	$661\ /\lambda$
Elements - Shear							
flat elements supported on both edges	G.2	b/t	5.8	43.6	$7.2 - 0.031\ \lambda$	96	$38{,}665\ /\lambda^2$
flat elements supported on one edge	G.3	b/t	5.8	18.2	$7.2 - 0.073\ \lambda$	40	$6{,}713\ /\lambda^2$
pipes and round or oval tubes	G.4	$2.9(R_b/t)^{5/8}(L_v/R_b)^{1/4}$	5.8	87.3	$9.3 - 0.040\ \lambda$	96	$50{,}264\ /\lambda^2$
Torsion							
pipes and round or oval tubes	H.2.1	$2.9(R_b/t)^{5/8}(L_s/R_b)^{1/4}$	5.8	43.6	$7.2 - 0.031\ \lambda$	96	$38{,}665\ /\lambda^2$

902 TOP RAIL

Table 2-21

ALLOWABLE STRESSES F/Ω FOR BUILDING-TYPE STRUCTURES (UNWELDED)

6063 - T6 **ASTM B221, B241, B429 0.000 to 1.000 in. thick**

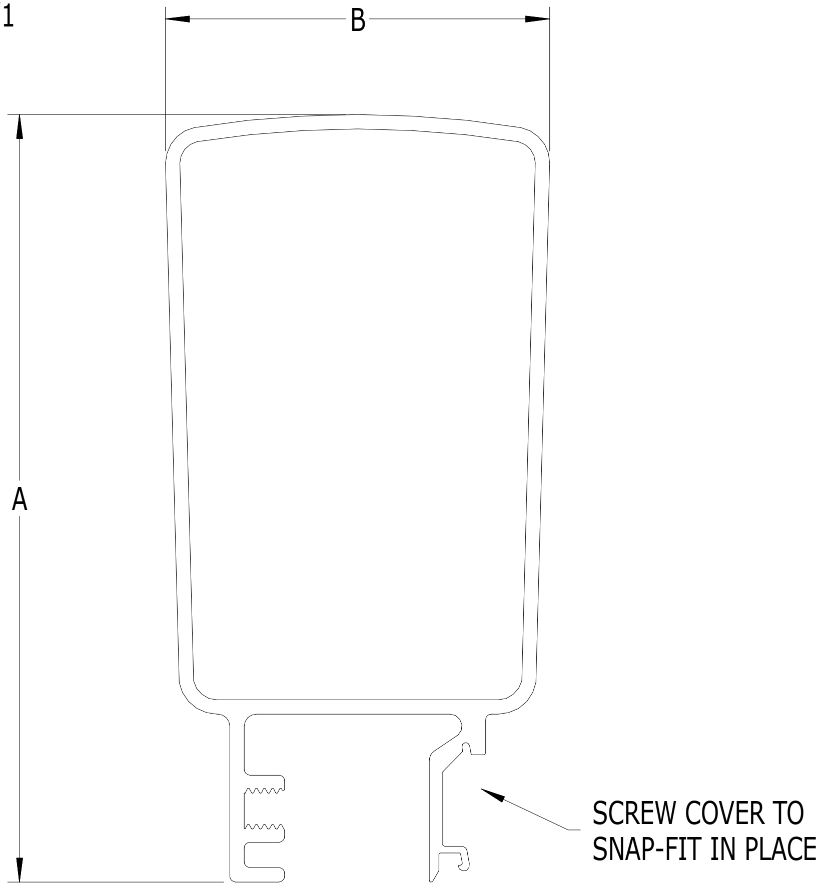
F_{ty} = 25 k/in^2
F_{cy} = 25 k/in^2
F_{tu} = 30 k/in^2

E = 10,100 k/in^2
k_t = 1

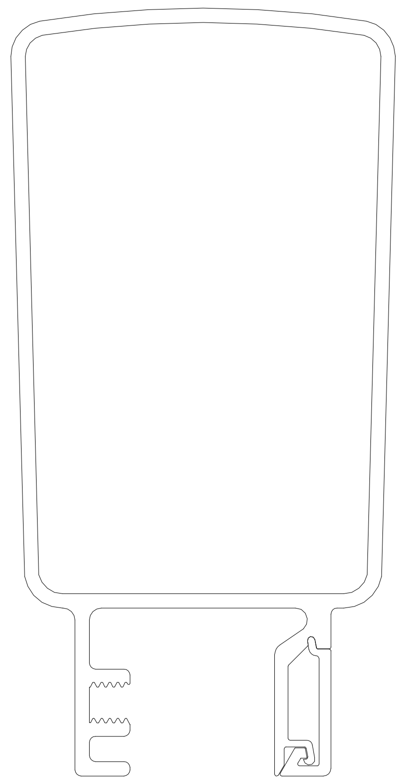
Allowable Stresses F/Ω (k/in^2)	Section	F/Ω
Axial Tension		
axial tension stress on net effective area	D.2b	15.4
axial tension stress on gross area	D.2a	15.2
Shear or torsion		
Shear or torsion rupture	G, H.2	9.2
Bearing		
bolts or rivets on holes	J.3.6a, J.4.6	30.8
bolts on slots, pins on holes, flat surfaces	J.3.6b, J.6.5, J.8	20.5
screws in holes	J.5.5.1	20.0

		Slenderness λ	F/Ω for $\lambda \le \lambda_1$	λ_1	F/Ω for $\lambda_1 < \lambda < \lambda_2$	λ_2	F/Ω for $\lambda \ge \lambda_2$
Axial Compression							
member buckling	E.2	kL/r	15.2	18.2	0.00022 λ^2 - 0.133 λ + 17.5	78	51,352 $/\lambda^2$
Flexure							
lateral-torsional buckling	F.4	see F.4.2		-	see F.4	78	60,414 $/\lambda^2$
Elements - Uniform Compression							
flat elements supported on one edge in columns whose buckling axis is not an axis of symmetry	B.5.4.1	b/t	15.2	7.3	19.0 - 0.530 λ	15	2,417 $/\lambda^2$
BOT flat elements supported on one edge in all other columns and all beams	B.5.4.1	b/t	15.2	7.3	19.0 - 0.530 λ	12.6	155 $/\lambda$
TOP+BOT flat elements supported on both edges	B.5.4.2	b/t	15.2	22.8	19.0 - 0.170 λ	39	484 $/\lambda$
flat elements supported on both edges and with an intermediate stiffener	B.5.4.4	λ_s	15.2	18.2	16.7 - 0.088 λ	78	60,414 $/\lambda^2$
round hollow elements	B.5.4.5	$(R_b/t)^{1/2}$	15.2	5.6	18.5 - 0.593 λ	13.7	3,776 $/[\lambda^2(1+\lambda/35)^2]$
flat elements - direct strength method	B.5.4.6	λ_{eq}	15.2	36.5	19.0 - 0.106 λ	63	775 $/\lambda$
Elements - Flexural Compression							
flat elements supported on both edges	B.5.5.1	b/t	22.7	34.7	27.9 - 0.150 λ	93	1,298 $/\lambda$
flat elements supported on tension edge, compression edge free	B.5.5.2	b/t	22.7	6.5	27.9 - 0.810 λ	23	4,932 $/\lambda^2$
flat elements supported on both edges and with a longitudinal stiffener	B.5.5.3	b/t	22.7	77.8	27.9 - 0.067 λ	208	2,910 $/\lambda$
round hollow elements	B.5.5.4	$(R_b/t)^{1/2}$	27.7 - 1.70 λ	8.4	18.5 - 0.593 λ	13.7	3,776 $/[\lambda^2(1+\lambda/35)^2]$
flat elements - direct strength method	B.5.5.5	λ_{eq}	22.7	22.6	27.9 - 0.231 λ	60	844 $/\lambda$
Elements - Shear							
flat elements supported on both edges	G.2	b/t	9.1	38.7	11.5 - 0.062 λ	76	38,665 $/\lambda^2$
flat elements supported on one edge	G.3	b/t	9.1	16.1	11.5 - 0.150 λ	32	6,713 $/\lambda^2$
pipes and round or oval tubes	G.4	$2.9(R_b/t)^{5/8}(L_v/R_b)^{1/4}$	9.1	72.2	15.0 - 0.081 λ	76	50,264 $/\lambda^2$
Torsion							
pipes and round or oval tubes	H.2.1	$2.9(R_b/t)^{5/8}(L_s/R_b)^{1/4}$	9.1	38.7	11.5 - 0.062 λ	76	38,665 $/\lambda^2$

SCALE: 1/1



#902 TOP RAIL



#902 TOP RAIL WITH
#907 SCREW COVER

#902 - 2" WIDE x 4" HIGH TOP RAIL WITH SCREW COVER

LABEL	A	B
DIMENSION	4"	2"

Superior
Aluminum Products, Inc.

TOP RAIL

Section Properties: Bottom Rail

Command: MASSPROP

Select objects: Specify opposite corner: 1 found

Select objects:

---------------- REGIONS ----------------

Area: 0.2401 sq in

Perimeter: 7.9292 in

Bounding box: X: -0.6890 -- 0.9310 in

Y: -0.4788 -- 0.3333 in

Centroid: X: 0.0000 in

Y: 0.0000 in

Moments of inertia: X: 0.0169 sq in sq in

Y: 0.0670 sq in sq in

Product of inertia: XY: 0.0066 sq in sq in

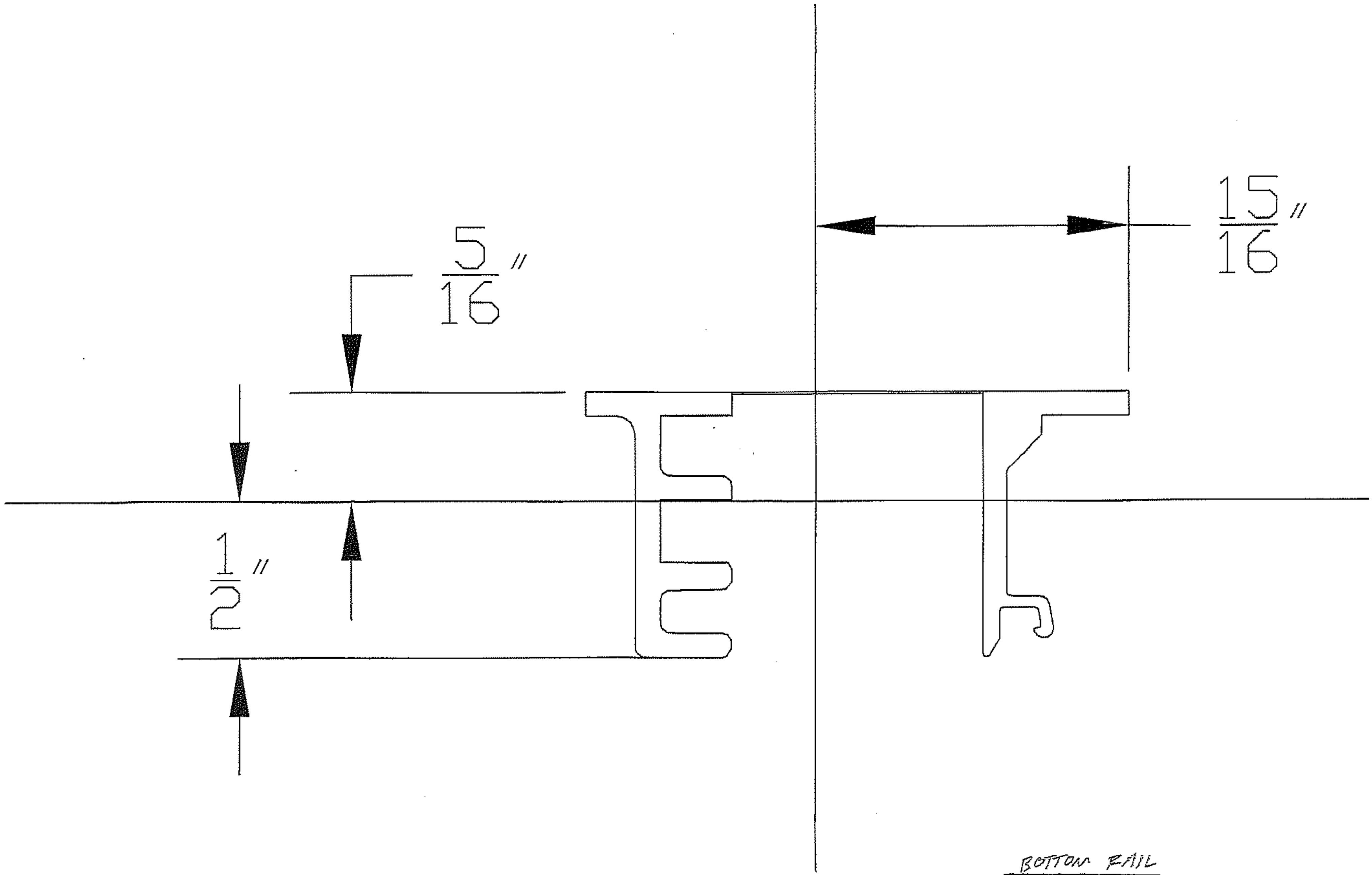
Radii of gyration: X: 0.2656 in

Y: 0.5283 in

Principal moments (sq in sq in) and X-Y directions about centroid:

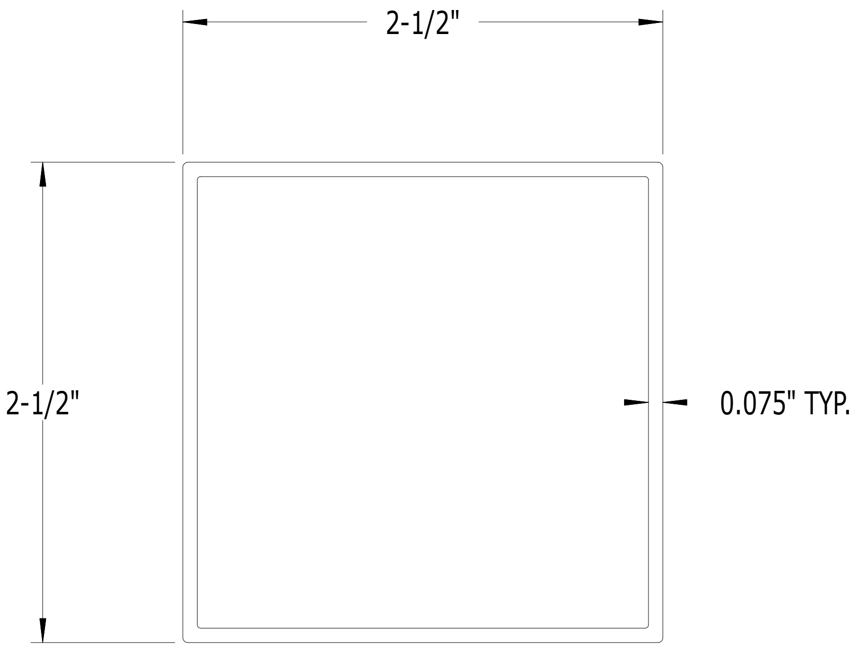
I: 0.0161 along [0.9918 0.1278]

J: 0.0678 along [-0.1278 0.9918]



BOTTOM RAIL

SCALE: 1/1



PART NO.	DESCRIPTION
990	2-1/2" SQ. TUBING FOR POSTS

Superior Aluminum Products, Inc.

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ENGINEERS, INC.
1527 Madison Rd.
Cincinnati, OH 45206
Ph. 513.396.8900

Project:
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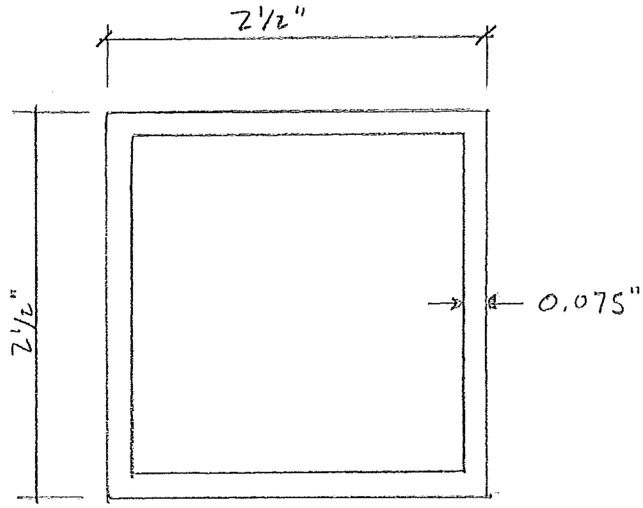
Project No.: Date:
Engineer: Sheet

#990 2½" x 2½" x 0.075" POST



SECTION PROPERTIES

$$I_x = I_y = \frac{2.5''(2.5'')^3 - 2.35''(2.35'')^3}{12} = 0.7137\ in^4$$

$$S_x = S_y = \frac{0.7137\ in^3}{(2.5''/2)} = 0.571\ in^3$$

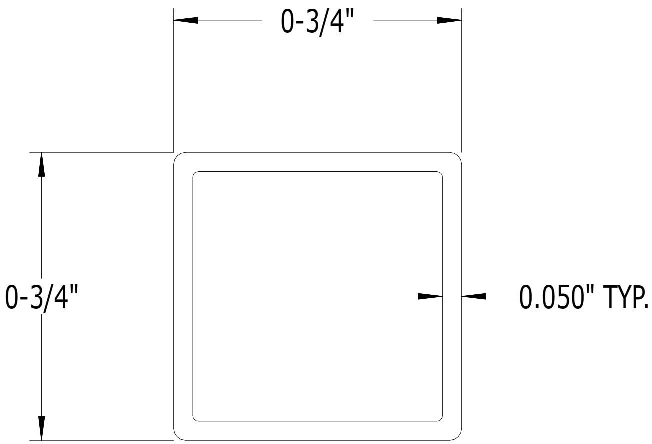
SEE TABLE 2-21 6063-T6

ADM 2020 LIMITING STRESS BASED ON SLENDERNESS OF SIDEWALL & LOCAL LIMITS OF ELEMENTS IN UNIFORM COMPRESSION

$$\lambda = \frac{b}{t} \quad \lambda = \frac{2.5 - 0.075 \cdot 2}{0.075} = 31.33 \geq \lambda_1 = 22.8 \quad \leq \lambda_2 = 39$$

$$\Rightarrow \frac{F}{\Omega} = 19.0 - 0.17 \cdot (31.33) = \boxed{13.67\ ksi}$$

SCALE: 2/1



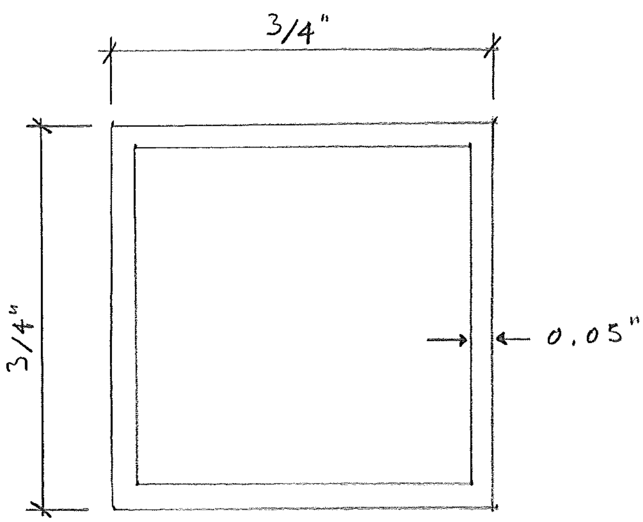
PART NO.	DESCRIPTION
429	3/4" SQ. TUBING FOR PICKETS

Superior Aluminum Products, Inc.

Structural Consultants
ADVANTAGE GROUP
ENGINEERS, INC.
1527 Madison Rd.
Cincinnati, OH 45206
Ph. 513.396.8900

Project:
Client:
Project No.: Date:
Engineer: Sheet

#429 3/4" x 3/4" x 0.05" PICKET



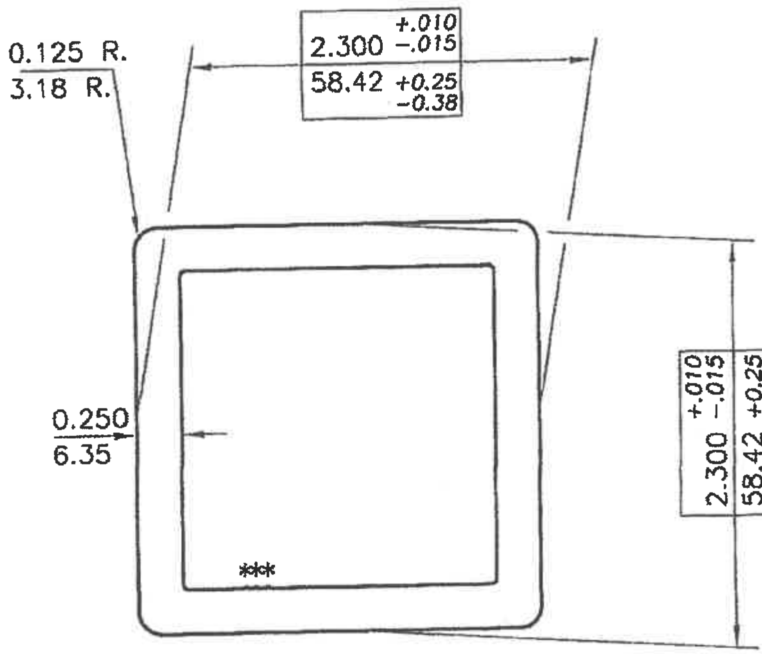
SECTION PROPERTIES

$$I_x = I_y = \frac{0.75''(0.75'')^3 - 0.65''(0.65'')^3}{12} = 0.0115\,in^4$$

$$S_x = S_y = \frac{0.0115\,in^4}{(0.75''/2)} = 0.0306\,in^3$$

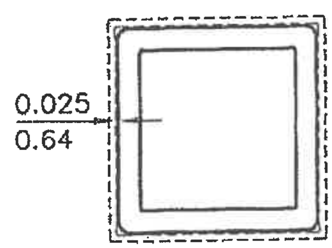
CUSTOMER	PART NO.	DIE NO.	DASH
SUPERIOR ALUMINUM PRODUCTS	–	AH–57657	1
DESCRIPTION: INSERT TUBE	TARRIF# 7604.21.00.00	PROPOSAL# 14005–2A	
INDALEX LIMITED 5675 Kennedy Road Mississauga, Ontario L4Z 2H9	DATE / SYM	REVISION	

NO SURFACES EXPOSED.



ACTUAL SIZE

NOTE:
MATES WITH 14005–1



SCALE 1:2

UNMARKED RADII = 0.030(0.76) R.

(*) = 0.010(0.25) R. X 0.010(0.25)H. INDALEX I.D. MARKS

INDALEX ALUMINUM SOLUTIONS

UNSPECIFIED WALL THICKNESS	0.250(6.35)		
EST. AREA 2.038 IN^2 1315 MM^2	OUT PER. 8.985 IN 228 MM		
EST. WT. 2.445 LBS/FT. 3.639 KG/M	FACTOR 7		
EST. PER. 16.168 IN 411 MM	C.C.D. 3.145 IN 80 MM		
DWN BY S.B.	ALLOY 6063–T6	SCALE 1:1	DATE 07/03/15

BREAK ALL CORNERS .016"R (0.41 mm)R UNLESS OTHERWISE NOTED.

STANDARD ALUMINUM ASSOCIATION TOLERANCES TO APPLY UNLESS OTHERWISE SPECIFIED

Structural Consultants
ADVANTAGE GROUP
ENGINEERS, INC.
1527 Madison Rd.
Cincinnati, OH 45206
Ph. 513.396.8900

Project:
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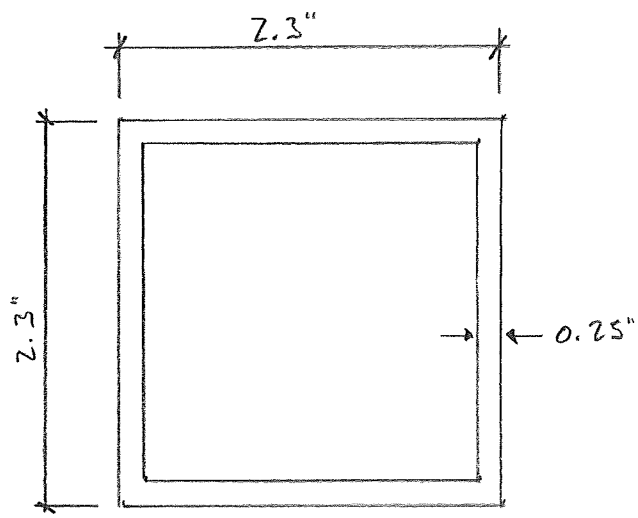
Engineer: Sheet

#990 REINFORCEMENT BAR



SECTION PROPERTIES

$$I_x = I_y = \frac{2.3"(2.3")^3 - 1.8"(1.8")^3}{12} = 1.457 \text{ in}^4$$

$$S_x = S_y = \frac{0.1457 \text{ in}^4}{(2.3"/2)} = 1.267 \text{ in}^3$$

Structural Consultants ADVANTAGE GROUP ENGINEERS, INC.	1527 Madison Rd	Project:	PSI Property Services	
	2nd Floor	Client:	Superior Aluminum Products	
	Cincinnati, Ohio 4520	Project #:	21937.87	Date: 12/29/2021
	Ph 513-313-6567	Engineer:	KCJ	Sheet: 1

Analysis of Aluminum Guardrail Systems

Description: Series 9000 Guardrail with #902 Top Rail - Single Span Rail Check

Section and Material Properties:

$F_{y,\ 6063\text{-}T6}$	=	11.5	ksi
$F_{y,\ 6063\text{-}T5}$	=	9.7	ksi
$I_{y,\ Top\ Rail}$	=	0.479	in^4
$S_{y,\ Top\ Rail}$	=	0.479	in^3
$I_{x,\ Top\ Rail}$	=	1.13	in^4
$S_{x,\ Top\ Rail}$	=	0.65	in^3
$I_{y,\ Bottom\ Rail}$	=	0.0731	in^4
$S_{y,\ Bottom\ Rail}$	=	0.0835	in^3
$I_{x,\ Bottom\ Rail}$	=	0.0203	in^4
$S_{x,\ Bottom\ Rail}$	=	0.0406	in^3
I_{post}	=	0.7137	in^4
S_{post}	=	0.571	in^3
$S_{pickets}$	=	0.0306	in^3

Load Analysis

Is Top Rail Continuous or Segmented =	Segmented	
Smallest number of post spaces in system =	1	
Max Post Spacing =	4.83	ft
Rail Height above post base =	42	in
Picket Height =	39	in

				KSI	
Top Rail Horizontal Moment =	2.898	k-in	Top Rail Stress =	**6.05**	**OK**
Top Rail Vertical Moment =	2.847	k-in	Top Rail Stress =	**4.38**	**OK**
Bottom Rail Vertical Moment =	0.051	k-in	Bottom Rail Stress =	**1.26**	**OK**
Bottom Rail Horizontal Moment =	0.725	k-in	Bottom Rail Stress =	**8.68**	**OK**
Picket Moment =	0.244	k-in	Picket Stress =	**7.97**	**OK**

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	2nd Floor	Client:	Superior Aluminum Products		
	Cincinnati, Ohio 4520	Project #:	21937.87	Date:	12/29/2021
	Ph 513-313-6567	Engineer:	KCJ	Sheet:	1

Analysis of Aluminum Guardrail Systems

Description: Series 9000 Guardrail with #902 Top Rail - Post check

Section and Material Properties:

$F_{y,\ 6063\text{-}T6}$	=	15.1	ksi
$F_{y,\ 6063\text{-}T5}$	=	9.7	ksi
$I_{y,\ Top\ Rail}$	=	0.479	in^4
$S_{y,\ Top\ Rail}$	=	0.479	in^3
$I_{x,\ Top\ Rail}$	=	1.13	in^4
$S_{x,\ Top\ Rail}$	=	0.65	in^3
$I_{y,\ Bottom\ Rail}$	=	0.0731	in^4
$S_{y,\ Bottom\ Rail}$	=	0.0835	in^3
$I_{x,\ Bottom\ Rail}$	=	0.0203	in^4
$S_{x,\ Bottom\ Rail}$	=	0.0406	in^3
I_{post}	=	0.7137	in^4
S_{post}	=	0.571	in^3
$S_{pickets}$	=	0.0306	in^3

Load Analysis

Is Top Rail Continuous or Segmented =	Continuous
Smallest number of post spaces in system =	2
Max Post Spacing =	4.5 ft
Rail Height above post base =	41.25 in
Picket Height =	39 in

				KSI	
Top Rail Horizontal Moment =	2.192	k-in	Top Rail Stress =	**4.58**	**OK**
Top Rail Vertical Moment =	2.154	k-in	Top Rail Stress =	**3.31**	**OK**
Bottom Rail Vertical Moment =	0.039	k-in	Bottom Rail Stress =	**0.95**	**OK**
Bottom Rail Horizontal Moment =	0.675	k-in	Bottom Rail Stress =	**8.08**	**OK**
Picket Moment =	0.244	k-in	Picket Stress =	**7.97**	**OK**
Horiz Force at Intermediate Post =	0.225	kip			
Horiz Force at End Post =	0.164	kip			
Moment at Base, Interm Post =	9.28	k-in	Post Stress =	**16.25**	**REINFORCE!**
Moment at Base, End Post =	6.77	k-in	Post Stress =	**11.85**	**OK**

Reinforce Post

$S_{reinforcing}$	=	1.267	in^3	$F_{y,\ reinf}$ =	15.1	ksi
$I_{reinforcing}$	=	1.457	in^4			
$M_{reinforcing}$	=	6.23	k-in	Reinforcing Stress =	**4.92**	**OK**
M_{post}	=	3.05	k-in	Post Stress =	**5.34**	**OK**
$L_{reinforcing}$	=	2.93	in.	<= Length of reinforcing above base		

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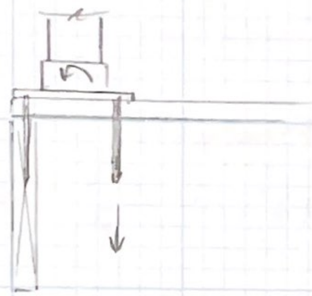
POST CONNECTION

2x12 JOISTS @ 16" TO 24" o.c.

$P_{max} = 225\#$ $M = 225 \times 42 = 9{,}450\#\text{-in}$



$T = C = \frac{M}{d}$

$d = 4.75" - .5" = 4.25"$

$T = C = \frac{9450}{4.25} = 2223\#$

$f_{ct} = \frac{2223}{(1)(5.25)} = 423\ psi$ OK

$T_{lag} = \frac{2223}{2} = 1112\#$

3/8" x 5" Power lag:

$w' = (465)(1.6)(.7) = 521\#/in$

3/8" lag screw

$w' = (352)(1.6)(.7) = 394\#/in$ governs

$L_{pen} = \frac{1112}{394} = 2.82"$

$L_{req'd} = .5 + 1.5 + 2.82 + 7/32 = 5"$ $T\text{-}E = 2.8"$ OK

∴ 3/8" x 5" LAG screw or Power lag

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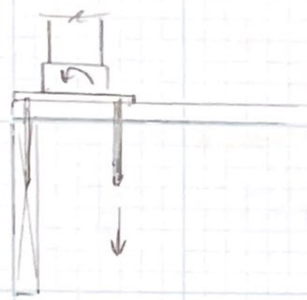
Project: PSI Property Services
Client:
Project No.: 21957.87 Date: 12/29/21
Engineer: KLS Sheet 1

POST CONNECTION

2x12 JOISTS @ 16" TO 24" o.c.

$P_{max} = 225\#$ $M = 225 \times 42 = 9{,}450\#\text{-in}$



$T = C = \frac{M}{d}$

$d = 4.75" - .5" = 4.25"$

$T = C = \frac{9450}{4.25} = 2223\#$

$f_{c\perp} = \frac{2223}{(1)(5.25)} = 423\ psi$ OK

$T_{lag} = \frac{2223}{2} = 1112\#$

3/8" x 5" Power lag:

$w' = (465)(1.6)(.7) = 521\#/in$

3/8" lag screw

$w' = (352)(1.6)(.7) = 394\#/in$ governs

$L_{pen} = \frac{1112}{394} = 2.82"$

$L_{req'd} = .5 + 1.5 + 2.82 + 7/32 = 5"$ T-E = 2.8" OK

∴ 3/8" x 5" LAG screw or Power lag