13228 NE 20th St., Suite 100
Bellevue, WA 98005
Phone (425) 614-0949 Fax (425) 614-0950

STRUCTURAL CALCULATIONS FOR:

BARNES & NOBLE

Barnes & Noble Puyallup

Street Address: 3500 S. Meridian St.
City: Puyallup
State: Washington
Zip Code: 98373

Client:

WJCA
299 Market St.
Saddle Brook, NJ 07663

By

Project Engineer: Alex Habliston, S.E.
Principal In Charge: Alex Habliston, S.E.
Signing Principal: Alex Habliston, S.E.

ALEX D. HABLISTON
STATE OF WASHINGTON
44883
STRUCTURAL ENGINEER
PROFESSIONAL ENGINEER

12/20/2024

AUE JOB #: 24438
Date: 12/20/2024

Calculation: Design Summary {1-}

Code Summary:

Building Code: 2021 International Building Code
Local Building Code: *N/A*
Supplemental Code: 2016 ASCE 7
Risk Category: II Standard-Occupancy Building

Seismic Design Parameters:

S_S:	1.263	S_{DS}:	1.010	S_{MS}:	1.516	F_a:	1.20	I_e:	1.00
S_1:	0.436	S_{D1}:	0.813	S_{M1}:	1.219	F_V:	1.86		

Additional Analysis Check: A ground motion hazard analysis is required per Section 21.2
Use Exception: Yes
Exception to Ground Motion Hazard Analysis: A ground motion hazard analysis is not required where the value of the parameter SM1 determined by Eq. (11.4-2) is increased by 50% for all applications of SM1 in this Standard. The resulting value of the parameter SD1 determined by Eq. (11.4-4) shall be used for all applications of SD1 in this standard. As required per ASCE 7-16.
[Ref: ASCE 7-16 Section 11.4.8 -- Supplement #3]
Site Class: D (Default)
Seismic Design Category: D
Structural Height 'h_n': 20.00 ft

Dead Loads:

- Partition Walls:

Structure =	**7.10**	psf - Total		
		Metal Studs at 16" o.c.	1.50	psf
		5/8" GWB E.S.	5.60	psf
		-	0.00	psf
Special =	**2.90**	psf - Total		
		Wall Finishes	1.00	psf
		-	0.00	psf
		-	0.00	psf
		-	0.00	psf
		- Misc.	1.90	psf
		Design DL =	**10.00**	**psf**
		Total Max DL =	10.00	psf
		Total SDL =	2.90	psf

- Hanging Ceiling

Structure =	**3.20**	psf - Total		
		T' Grid	1.00	psf
		1/2" GWB	2.20	psf
		-	0.00	psf
Special =	**0.80**	psf - Total		
		-	0.00	psf
		-	0.00	psf
		-	0.00	psf
		-	0.00	psf
		- Misc.	0.80	psf
		Design DL =	**4.00**	**psf**
		Total Max DL =	4.00	psf
		Total SDL =	0.80	psf

Calculation: Seismic C&C {2-}

General Design Parameters:		IBC 2021		ASCE 7-16 Chapter 13: Seismic Design Requirements for Nonstructural Components		
Risk Category:	II	*Standard-Occupancy Building*		h_n : 20 ft	Vertical Seismic Loading:	
S_s: 1.263	S_{DS}: 1.010		I_e: 1.00	SDC: D	$F_{p,vert}$: 0.202 *W_p	
S_1: 0.436	S_{D1}: 0.813			Site Class: D (Default)		

- Interior Partition Walls (Full Height)

A2. Interior Nonstructural Walls and Partitions - All other walls and partitions

ap:	1.0	z:	20 ft	Ip:	1.0
Rp:	2.5	h:	20 ft		
Ω_o:	2.0				

F_p: 0.485 *W_p

$F_{p,max}$: 1.617 *W_p

$F_{p,min}$: 0.303 *W_p

$F_{p,horz}$: 0.485 *W_p

Ωo * $F_{p,horz}$: 0.970 *W_p

- Ceilings

A14. Ceilings - All

ap:	1.0	z:	20 ft	Ip:	1.0
Rp:	2.5	h:	20 ft		
Ω_o:	2.0				

F_p: 0.485 *W_p

$F_{p,max}$: 1.617 *W_p

$F_{p,min}$: 0.303 *W_p

$F_{p,horz}$: 0.485 *W_p

Ωo * $F_{p,horz}$: 0.970 *W_p

- Interior Partition Walls (Partial Height)

A2. Interior Nonstructural Walls and Partitions - All other walls and partitions

ap:	1.0	z:	0 ft	Ip:	1.0
Rp:	2.5	h:	20 ft		
Ω_o:	2.0				

F_p: 0.162 *W_p

$F_{p,max}$: 1.617 *W_p

$F_{p,min}$: 0.303 *W_p

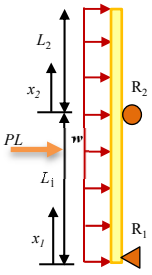
$F_{p,horz}$: 0.303 *W_p

Ωo * $F_{p,horz}$: 0.606 *W_p

Interior Partition Wall(s)
Design & Analysis

Calculation: FH_3.1 Wall {1-3}

Add. Axial Wall Load:	0 plf (1.0D)		Max $R_{2\ Horiz.}$:	0.07 k	
Stud wall assembly weight:	10 psf (1.0D)		Max $R_{1\ Horiz.}$=V_1:	0.07 k	
Non-Seismic Pressure "w_1":	5 psf [ASD]->	6.667 plf	$R_{1\ Vert.}$:	0.27 k	
Non-Seismic Parapet Pressure"w_2":	0 psf [ASD]->	0 plf	V_2:	0.00 k	
Non-Seismic Point Load:	0 k [ASD] at	0 ft above base	V_3:	0.07 k	
Seismic Fp:	0.49 *W [ASD]		M_{MAX_1}:	4.00 k-in	
Seismic Fp:	4.85 psf [ASD] ->	6.467 plf	x_1:	10.00 ft	
Seismic Point Load:	0 k [ASD] at	0 ft above base	M_{MAX_2}:	0.00 k-in	



Reactions

	Non-Seismic	Seismic
R_2	66.67 lbs	64.67 lbs
R_1	66.67 lbs	64.67 lbs

Main Span / Cantilever:

	Mmax:	4.000	k-in.
(at base)	Paxial:	0.267	kips
	Vmax:	0.067	kips

Stud span (main span) "l_1":	20	ft.
Stud span (cantilever) "l_2":	0	ft.
Allowable Deflection:	L/ 240	

Unbraced Lengths:

Lx:	20.00 ft.	Kx:	1.0
Ly:	4.00 ft.	Ky:	1.0
Lt:	4.00 ft.	Kt:	1.0

Try: 362S162-54 (50ksi) at 16 in. O.C. Spacing

Member Properties:

Fy:	50 ksi	ß:	0.5970		
Fu:	65 ksi	x_o:	-1.2830	in	
E:	29500 ksi	r_o:	2.0200	in	
G:	11300 ksi	J:	0.000451	in^4	
m:	0.3 ksi	C_w:	0.4570	in^6	
Ag:	0.422 in^2	Ixe:	0.841	in^4	
r_x:	1.438 in.				
r_y:	0.605 in.				
r_z:	in.				

Member Dimesions

Member depth:	3.625	in.
Member flange:	1.625	in.
Stiffiner Lip length:	0.500	in.
Member mil:	54	
Design Mil:	0.0566	in.
Corner Radii:	0.0849	in.
$h_{mid-line}$:	3.5684	in.
$b_{mid-line}$:	1.5684	in.
$d_{mid-line}$:	0.472	in.

K_xL_x / r_x: 166.9

K_yL_y / r_y: 79.34

Punchouts:

Punchouts?:	Yes
hole spacing:	24 in
hole depth:	1.813 in
hole length:	4.5 in
Min end length	10 in

Bending Capacity: 12.252 k-in. Allowable Moment braced at: 2.867 ft. max User Input M_{allow}: N.A. k-in. (Per CFS)

M_{al}: 13.60 k-in. (Per SFIA) M_{ad}: 12.87 k-in. (Per SFIA) $M_{a,4ft}$: 12.25 k-in. (Per CFS)

Axial Capacity: 1.432 Kips

E2) Yielding & Global Buckling: P_{ne}/W_C= 1.892 kips P_{ne}= 3.406 kips l_C: 2.331 W_C = 1.8 Fn: 8.07

E2.1) Check Flexural Buckling F_{cre}: 10.452 ksi

E2.2) Check Torsional & Flexural-Torsional Buckling F_{cre}: 9.202 ksi σ_t= 36.50 ksi σ_{ex}= 10.45 ksi

E3) Local Buckling Interacting with Yielding and Global Buckling P_{nl}/W_C= 1.432 kips P_{nl}= 2.578 kips Fn: 8.07 W_C = 1.8

E3.1) Effective Width Method

Effective $Area_{web}$: *Partially Effective* Eff. $length_{web}$: 1.530 in.

w_{web}:	3.342	in.	r_{web}:	-	l_{web}:	-	f_{web}:	- ksi	$F_{crl\ web}$:	- ksi	k_{web}: -
c_{pnch}:	0.76475	in.	r_{pnch}:	1	l_{pnch}:	0.358479706	f_{pnch}:	8.07 ksi	$F_{crl\ pnch}$:	62.8 ksi	k_{hole}: 0.43

Effective $Area_{flange}$: *Fully Effective* Eff. $length_{flg}$: 1.342 in.

w_{flg}:	1.342	in.	w/t:	23.71	S_{flg}:	77.39	$b_{1\ flg}$:	0.671 in.	$b_{2\ flg}$:	0.671 in.	
b_{flg}:	1.342	in.	r_{flg}:	1.000	l_{flg}:	0.224	f_{flg}:	8.07 ksi	$F_{crl\ flg}$:	160.6 ksi	k_{flg}: 3.387
$I_{a\ stif}$:	0.00000	$in.^4$	$I_{s\ stif}$:	0.00022	$in.^4$	n_{flg}:	0.505	D/w:	0.373		
$d_{s\ stif}$:	0.359	in.	$d'_{s\ stif}$:	0.359	in.	$R_{I\ flg}$:	1				

Effective $Area_{stiffener}$: *Fully Effective* Eff. $length_{stif}$: 0.359 in.

w_{stif}:	0.359	in.	r_{stif}:	1.000	l_{stif}:	0.168	f_{stif}:	8.07 ksi	$F_{crl\ stif}$:	285.8 ksi	k_{stif}: 0.43

Total Stud Effective Area: 0.3194 $in.^2$

E4) Distortional Buckling P_{nd}/W_C= 8.804 kips P_{nd}= 15.85 kips W_C = 1.8 l_d: 0.998 P_{crd}: 21.17 kips P_y: 21.1 kips

F_{crd}:	50.18 ksi	K_{ffe}:	-	K_{fwe}:	-	K_f:	-	K_{ffg}:	-	K_{fwg}:	-
L:	13.29	L_{crd}:	13.29	L_m:	240	A_f:	0.11546966	J_f:	0.000123305	I_{xf}:	0.00166045
I_{yf}:	0.03081963	I_{xyf}:	0.003796212	C_{wf}:	0	X_{of}:	0.602881859	h_{xf}:	-0.96551814	$\imath_{yf}/y_{of}$:	-0.05453186
t_{r_hole}:	0.04931 in.	K_{ffe}:	0.223720871	K_{fwe}:	0.178747942	K_f:	0	K_{ffg}:	0.006110495	K_{fwg}:	0.001910596
L:	14.22	L_{crd}:	14.22	L_m:	240	A_f:	0.100606186	J_f:	8.15549E-05	I_{xf}:	0.00144174
I_{yf}:	0.026852469	I_{xyf}:	0.003307556	C_{wf}:	0	X_{of}:	0.602881859	h_{xf}:	-0.96551814	$\imath_{yf}/y_{of}$:	-0.05453186

Shear Capacity: 1.016 Kips V_{ag}: 3.372 kips V_{anet}: 1.016 kips

Member Capacity Check:

Flexural unity:	0.326 OK	Flexural+Axial Unity:	0.513 OK
Axial Unity:	0.186 OK	Flexural+Shear Unity:	0.333 OK
Shear Unity:	0.066 OK		

Member Deflection Check: Wind Deflection Reduction: No

	Non-Seismic	Seismic		
Main Span Deflec. :	0.967 in.	0.938 in.	L/ 248	OK
Cant. Deflec. :	0.000 in.	0.000 in.	2L/	OK

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Project:	Barnes & Noble Puyallup	Pg. No:	F - 1
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: FH_3.1 Wall {1-3}

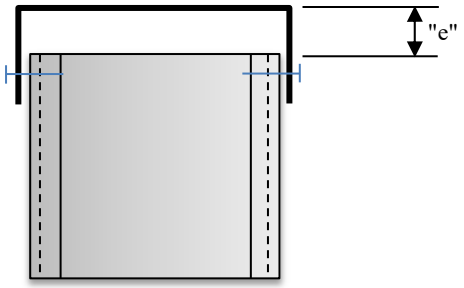
Connection to Structure Below:

Track to Stud Connection:	*Bottom Track Connection to Wall Stud*				
(AISI S211-07 Reaffirmed 2012)					
Max Reaction at Stud:	66.67	lb			
Track Condition:	Typical Condition				
Try:	362T125-33 (33ksi)		Stud Size:	362S162-54 (50ksi)	
Design Thickness:	0.0346	in.			
Fy:	33	ksi	Stud Properties:		
Fu:	45	ksi	Fy: 50	ksi	
Stud Bearing Length 'N':	1.25	in.			
Stud Web (Flat Portion) 'h':	3.342		Stud Dimesions		
Pnst:	1170	lbs	Member depth:	3.625	in.
Ω :	1.7		Design Mil:	0.0566	in.
Pallow:	688	lbs	Corner Radii:	0.0849	in.
Unity:	0.10	**OK**			

PAF & Light Gauge Steel Connection:	*Bottom Track Connection to Structure*										
Load at Stud:	66.67	lb									
Stud Spacing:	16	in o.c.									
Conn. Spacing:	16	in o.c.									
Shear Load :	66.7	lb [ASD]	Use:	0.118" Dia. Hilti X-P G3 PAF w/ 3/4" Embed. into 2,500 psi Concrete							
Tension Load :	0.0	lb [ASD]									
Load Type:	Non-Seismic		Thickness:	33	mil	Fy:	33	ksi	Fu:	45	ksi	mf :	0.75
			Design Thick:	0.0346	in.	d:	0.118	dw:	0.268	d/t :	3.41	C :	3
Effective Shear			T_{allow}:	80	lbs				V_{allow}:	120	lbs		
Fasteners #:	(1)		$T_{allow\ (pullover)}$:	208.6	lbs				$V_{allow\ (bearing)}$:	165.4	lbs		
Shear Load :	66.67	lb per fastener							$V_{allow\ (bearing\text{-}deformation)}$:	139.9	lbs		
V_{ALLOW}:	120	lbs	0.556	**OK**									
Effective Tension								Min. Spacing =	4	in.			
Fasteners #:	(1)							Min. Edge. Dist. =	3	in.			
Tension Load :	0	lb per fastener						Min. Substrate Thickness =	2.25	in.			
T_{ALLOW}:	80	lbs	0	**OK**									
Unity Check:	0.556	+	0	=	0.556	**OK**							

Connection to Structure Above:

Deflection Track Design:		
(AISI S211-07 Reaffirmed 2012)		
Load into Track:	66.67	lbs
Stud spacing:	16	in o.c.
Deflection Gap"e" :	1.00	in.
Thickness:	43	mil
Fy:	33	ksi
Design Thickness:	0.0451	in.
Effect. Track Length:	16.00	in.
Pn:	268	lbs
Ω :	2.8	
Pallow :	95.9	lbs
Unity:	0.70	**OK**



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Project:	Barnes & Noble Puyallup	Pg. No:	F - 2
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

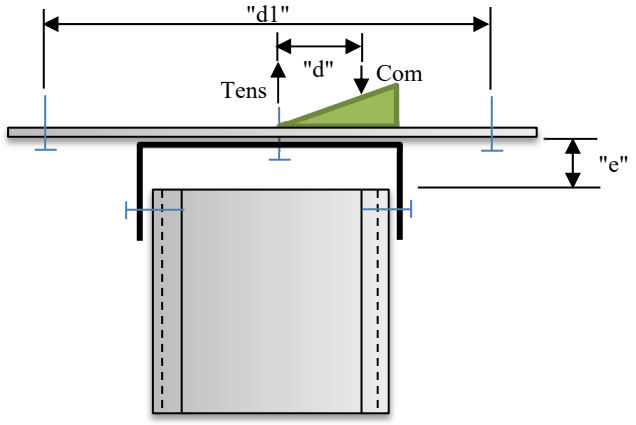
Calculation: FH_3.1 Wall {1-3}

Connection to Structure Above:

Deflection Track Connection Design — *Connection to Metal Deck Low Flute w/ Screws*

Load at Stud:	66.67	lb
Stud Spacing:	16	in o.c.
Conn. Spacing:	16	in o.c.
Load at Conn.:	66.67	lb
Eccentricity:	1	in
Moment:	66.67	lb-in
Force Couple at PL:	1.2	in
Tension Load:	55.17	lb at plate
Force Couple at Deck:	6	in
Tension Load:	11.11	lb at deck

Connection Diagrams



Light Gauge Plate Design - Flat Plate Bending — *Light Gauge Plate between Deck Low Flutes*

Loading: $M_{req.}$: 0.067 k-in.

Plate Dimension & Properties:

Plate Width 'b':	6	in.	F_y:	50	ksi.	$I_{x\text{-}x}$:	0.0001	in^4
Plate Thick:	54	mil	Ω_B:	1.67		S_x:	0.0032	in^3
Design Thick:	0.0566	in.	E:	29500	ksi.	M_{x_yeild}:	0.1602	k-in.
			Z_p:	0.0048	in^3	M_n:	0.2403	k-in.

Capacity Check:
Mn/Ω_B: 0.144 k-in.
0.46 **OK**

Screw & Light Gauge Steel Connection: — *Deflection Track to Light Gauge Plate*

Allowable Screw Capacities to CFS:

Shear Load : 66.67 lb — Shear of #8 Screw — in 43 mils (33ksi) = 244 lbs
Tension Load : 55.17 lb — Tension of #8 Screw — in 54 mils (33ksi) = 118 lbs
Pull-Over of #8 Screw — in 43 mils (33ksi) = 195 lbs

Effective Shear Fasteners #: (1)
Shear Load : 66.67 lb per fastener
V_{ALLOW}: 244 lbs 0.273 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 55.17 lb per fastener
T_{ALLOW}: 118 lbs 0.468 **OK**

Unity Check: 0.273 + 0.468 = 0.741 **OK**

Screw & Light Gauge Steel Connection: — *Light Gauge Plate Connection to Underside of Metal Deck*

Allowable Screw Capacities to CFS:

Shear Load : 66.67 lb — Shear of #8 Screw — in 33 mils (33ksi) = 164 lbs
Tension Load : 11.11 lb — Tension of #8 Screw — in 33 mils (33ksi) = 72 lbs
Pull-Over of #8 Screw — in 33 mils (33ksi) = 195 lbs

Effective Shear Fasteners #: (2)
Shear Load : 33.33 lb per fastener
V_{ALLOW}: 164 lbs 0.203 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 11.11 lb per fastener
T_{ALLOW}: 72 lbs 0.154 **OK**

Unity Check: 0.203 + 0.154 = 0.358 **OK**

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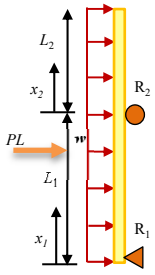
Calculation: PHS_6.1 {4-7}

Add. Axial Wall Load:	0	plf (1.0D)			Max $R_{2\ Horiz.}$:	0.04	k		
Stud wall assembly weight:	10	psf (1.0D)			Max $R_{1\ Horiz.}$=V_1:	0.04	k		
Non-Seismic Pressure "w_1":	5	psf [ASD]->	10	plf	$R_{1\ Vert.}$:	0.16	k		
Non-Seismic Parapet Pressure"w_2":	0	psf [ASD]->	0	plf	V_2:	0.00	k		
Non-Seismic Point Load:	0	k [ASD] at	0	ft above base	V_3:	0.04	k		
Seismic Fp:	0.30	*W [ASD]			M_{MAX_1}:	0.96	k-in		
Seismic Fp:	3.03	psf [ASD] ->	6.06	plf	x_1:	4.00	ft		
Seismic Point Load:	0	k [ASD] at	0	ft above base	M_{MAX_2}:	0.00	k-in		



Reactions

	Non-Seismic		Seismic	
R_2	40	lbs	24.24	lbs
R_1	40	lbs	24.24	lbs

Main Span / Cantilever:

	Mmax:	0.960	k-in.
(at base)	Paxial:	0.160	kips
	Vmax:	0.040	kips

Stud span (main span) "l_1": 8 ft.
Stud span (cantilever) "l_2": 0 ft.
L/ 240

Unbraced Lengths:

Lx:	8.00	ft.	Kx: 1.0
Ly:	4.00	ft.	Ky: 1.0
Lt:	4.00	ft.	Kt: 1.0

Try: 600S137-33 (33ksi) at 24 in. O.C. Spacing

Member Properties:

Fy:	33	ksi	ß:	0.8890	
Fu:	45	ksi	x_o:	-0.8070	in
E:	29500	ksi	r_o:	2.4160	in
G:	11300	ksi	J:	0.000127	in^4
µ:	0.3	ksi	C_w:	0.5000	in^6
Ag:	0.318	in^2	Ixe:	1.451	in^4
r_x:	2.23	in.			
r_y:	0.464	in.			
r_z:		in.			

Member Dimesions

Member depth:	6.000	in.
Member flange:	1.375	in.
Stiffiner Lip length:	0.375	in.
Member mil:	33	
Design Mil:	0.0346	in.
Corner Radii:	0.0764	in.
$h_{mid-line}$:	5.9654	in.
$b_{mid-line}$:	1.3404	in.
$d_{mid-line}$:	0.358	in.

K_xL_x/r_x: 43.05
K_yL_y/r_y: 103.4

Punchouts:

Punchouts?:	Yes	
hole spacing:	24	in
hole depth:	2.5	in
hole length:	4.5	in
Min end length	10	in

Bending Capacity: 7.760 k-in.
Allowable Moment braced at: 2.792 ft. max
User Input M_{allow}: N.A. k-in. (Per CFS)
M_{al}: 8.73 k-in. (Per SFIA) M_{ad}: 7.76 k-in. (Per SFIA) $M_{a,4ft}$: 8.21 k-in. (Per CFS)

Axial Capacity: 1.867 Kips

E2) Yielding & Global Buckling: P_{ne}/W_C= 3.509 kips P_{ne}= 6.316 kips l_C: 1.101 W_C = 1.8 Fn: 19.86

E2.1) Check Flexural Buckling: F_{cre}: 27.207 ksi
E2.2) Check Torsional & Flexural-Torsional Buckling: F_{cre}: 27.207 ksi σ_t= 34.81 ksi σ_{ex}= 157.10 ksi

E3) Local Buckling Interacting with Yielding and Global Buckling P_{nl}/W_C= 1.867 kips P_{nl}= 3.36 kips Fn: 19.86 W_C = 1.8

E3.1) Effective Width Method

Effective $Area_{web}$: *Partially Effective* Eff. $length_{web}$: 1.477 in.

w_{web}:	5.778	in.	r_{web}:	-	l_{web}:	-	f_{web}:	-	ksi	$F_{crl\ web}$:	-	ksi	k_{web}:	-
c_{pnch}:	1.639	in.	r_{pnch}:	0.45059108	l_{pnch}:	1.971676463	f_{pnch}:	19.86	ksi	$F_{crl\ pnch}$:	5.109	ksi	k_{hole}:	0.43

Effective $Area_{flange}$: *Fully Effective* Eff. $length_{flg}$: 1.153 in.

w_{flg}:	1.153	in.	w/t:	33.32	S_{flg}:	49.33	$b_{1\ flg}$:	0.577	in.	$b_{2\ flg}$:	0.577	in.		
b_{flg}:	1.153	in.	r_{flg}:	1.000	l_{flg}:	0.478	f_{flg}:	19.86	ksi	$F_{crl\ flg}$:	87.0	ksi	k_{flg}:	3.624
$I_{a\ stif}$:	0.00002	$in.^4$	$I_{s\ stif}$:	0.00005	$in.^4$	n_{flg}:	0.413	D/w:	0.325					
$d_{s\ stif}$:	0.264	in.	$d'_{s\ stif}$:	0.264	in.	$R_{I\ flg}$:	1							

Effective $Area_{stiffener}$: *Fully Effective* Eff. $length_{stif}$: 0.264 in.

w_{stif}:	0.264	in.	r_{stif}:	1.000	l_{stif}:	0.318	f_{stif}:	19.86	ksi	$F_{crl\ stif}$:	196.9	ksi	k_{stif}:	0.43

Total Stud Effective Area: 0.1692 $in.^2$

E4) Distortional Buckling P_{nd}/W_C= 2.403 kips P_{nd}= 4.326 kips W_C = 1.8 l_d: 1.887 P_{crd}: 2.946 kips P_y: 10.49 kips

F_{crd}:	9.265	ksi	K_{ffe}:	-	K_{fwe}:	-	K_f:	-	K_{ffg}:	-	K_{fwg}:	-							
L:	14.6		L_{crd}:	14.6	L_m:	96	A_f:	0.05875426	J_f:	2.34461E-05	I_{xf}:	0.000449085							
I_{yf}:	0.0113319		I_{xyf}:	0.001171007	C_{wf}:	0	X_{of}:	0.529024251	h_{xf}:	-0.81137575	$\imath_{yf}/y_{of}$:	-0.03767425							
t_{r_hole}:	0.03060	in.	K_{ffe}:	0.033319992	K_{fwe}:	0.025801613	K_f:	0	K_{ffg}:	0.001862001	K_{fwg}:	0.004519188							
L:	15.51		L_{crd}:	15.51	L_m:	96	A_f:	0.051962038	J_f:	1.62185E-05	I_{xf}:	0.000396278							
I_{yf}:	0.010021888		I_{xyf}:	0.001035634	C_{wf}:	0	X_{of}:	0.529024251	h_{xf}:	-0.81137575	$\imath_{yf}/y_{of}$:	-0.03767425							

Shear Capacity: 0.638 Kips V_{ag}: 0.638 kips V_{anet}: 0.638 kips

Member Capacity Check:

Flexural unity:	0.124 OK	Flexural+Axial Unity:	0.209 OK
Axial Unity:	0.086 OK	Flexural+Shear Unity:	0.139 OK
Shear Unity:	0.063 OK		

Member Deflection Check: Wind Deflection Reduction: No

	Non-Seismic	Seismic		
Main Span Deflec. :	0.022 in.	0.013 in.	L/ 4459	OK
Cant. Deflec. :	0.000 in.	0.000 in.	2L/	OK

13228 NE 20th St., Suite 100, Bellevue, WA 98005 | (425) 614-0949

Project:	Barnes & Noble Puyallup	Pg. No:	F - 4
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: PHS_6.1 {4-7}

Track to Stud Connection:	*Bottom Track Connection to Wall Stud*				
(AISI S211-07 Reaffirmed 2012)					
Max Reaction at Stud:	40.0 lb				
Track Condition:	Typical Condition				
Try:	600T125-33 (33ksi)	Stud Size:	600S137-33 (33ksi)		
Design Thickness:	0.0346 in.				
Fy:	33 ksi	Stud Properties:			
Fu:	45 ksi	Fy:	33 ksi		
Stud Bearing Length 'N':	1.25 in.				
Stud Web (Flat Portion) 'h':	5.778	Stud Dimesions			
Pnst:	431 lbs	Member depth:	6.000	in.	
Ω :	1.7	Design Mil:	0.0346	in.	
Pallow:	254 lbs	Corner Radii:	0.0764	in.	
Unity:	0.16 **OK**				

PAF & Light Gauge Steel Connection:	*Bottom Track Connection to Structure*									
Load at Stud:	40 lb									
Stud Spacing:	24 in o.c.									
Conn. Spacing:	12 in o.c.									
Shear Load :	20.0 lb [ASD]	Use: 0.118" Dia. Hilti X-P G3 PAF w/ 3/4" Embed. into 2,500 psi Concrete								
Tension Load :	0.0 lb [ASD]									
Load Type:	Non-Seismic	Thickness:	33	mil	Fy:	33 ksi	Fu:	45 ksi	mf :	0.75
		Design Thick:	0.0346	in.	d:	0.118	dw:	0.268	d/t :	3.41	C :	3
Effective Shear		T_{allow}:	80 lbs				V_{allow}:	120 lbs		
Fasteners #:	(1)	$T_{allow\ (pullover)}$:	208.6 lbs				$V_{allow\ (bearing)}$:	165.4 lbs		
Shear Load :	20 lb per fastener						$V_{allow\ (bearing\text{-}deformation)}$:	139.9 lbs		
V_{ALLOW}:	120 lbs 0.167 **OK**									
Effective Tension						Min. Spacing =	4	in.		
Fasteners #:	(1)					Min. Edge. Dist. =	3	in.		
Tension Load :	0 lb per fastener					Min. Substrate Thickness =	2.25	in.		
T_{ALLOW}:	80 lbs 0 **OK**									
Unity Check:	0.167 + 0 = 0.167 **OK**									

Track Member Design:	*Wall Top Track btwn HSS Stanchions*									
	Span : 4 ft.				Allow. Δ_{LL} : L/ 240					
ASD Loading:	Stud: -				Track: 600T125-33 (33ksi)				Load Distribution:	
w_TL-horz.: 20 plf	Indivdual Stud Properties:				Indivdual Track Properties:				I_{xe}	%
Ma_horz.: 0 k-in.	I_{xe}:	0.000	in^4		I_{xe}:	1.080	in^4		Track: 1.080	100%
Va_ horz: 0.08 k	M_{n_x}/Ω:	0.00	k-in.		M_{n_x}/Ω:	5.87	k-in.		Stud: 0.000	0%
Axial: 0.00 k	V_n/Ω:	0.00	k		V_n/Ω:	0.62	k		Tot. Pn/Ωo: -	k
Member Check	Flex: 0.08 **OK**		Flexural+Axial Unity:	0.08 **OK**	Deflection					
	Shear: 0.13 **OK**		Flexural+Shear Unity:	0.15 **OK**						
	Axial: 0.00 **OK**				$\Delta_{Horz.}$: 0.004 in -> L / 13275 **OK**					

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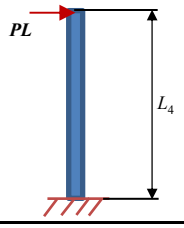
Project:	Barnes & Noble Puyallup	Pg. No:	F - 5
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: PHS_6.1 {4-7}

Track to Stud Connection:	*Top Track Connection to Wall Stud at HSS Stanchion*				
(AISI S211-07 Reaffirmed 2012)					
Max Reaction at Stud:	40.0 lb (1/2 of Load goes to each stud on each side of stanchion)				
Track Condition:	Typical Condition				
Try:	600T125-33 (33ksi)	Stud Size:	600S137-33 (33ksi)		
Design Thickness:	0.0346 in.				
Fy:	33 ksi	Stud Properties:			
Fu:	45 ksi	Fy:	33 ksi		
Stud Bearing Length 'N':	1.25 in.				
Stud Web (Flat Portion) 'h':	5.778	Stud Dimesions			
Pnst:	431 lbs	Member depth:	6.000	in.	
Ω :	1.7	Design Mil:	0.0346	in.	
Pallow:	254 lbs	Corner Radii:	0.0764	in.	
Unity:	0.16 **OK**				

HSS Stanchion Induced Loading:	HSS Stanchion Height: 8 ft	
Interior Pressure Loading	Seismic Loading	
Point Load: 0.08 k	Point Load: 0.048 k	
Moment : 7.68 k-in	Moment : 4.654 k-in	
Shear : 0.08 k	Shear : 0.048 k	



Post-Installed Anchor to Concrete:	*HSS Stanchion Connection to Concrete Slab*		
$Moment_{DL}$:	0 lb [ASD]	$Shear_{DL}$:	0 lb [ASD]
$Moment_{Seismic}$:	6649 lb-in [LRFD]	$Shear_{Seismic}$:	69.26 lb [LRFD]
$Moment_{Non-Seismic}$:	7680 lb-in [ASD]	$Shear_{Non-Seismic}$:	80 lb [ASD]
$Moment_{Total\ w/\ Seismic}$:	13297 lb-in [LRFD w/ Ωo]	$Shear_{Total\ w/\ Seismic}$:	139 lb [LRFD w/ Ωo]
$Moment_{Total\ w/\ Non-seismic}$:	12288 lb-in [LRFD]	$Shear_{Total\ w/\ Non-seismic}$:	128 lb [LRFD]

Try: - (4) 1/2" Dia. Hilti KBTZ-2 CS w/ 2-1/2" nominal embed., w/ 2" effective embed.

Non-Seismic Connection Analysis

Non-Seismic Load Type:	Interior Pressure	Unity
V_{allow}:	7591 lb [LRFD]	0.02 **OK**
M_{allow}:	19470 lb-in [LRFD]	0.63 **OK**
	Total:	0.65 **OK**

Connection Properties

Min. Conc. f'c:	3000 psi
Min. Spacing:	3.5 in
Min. Slab Thickness:	4 in
Min. Edge Dist.:	2.75 in
ICC ESR Report:	ICC ESR-4266

Seismic Connection Analysis

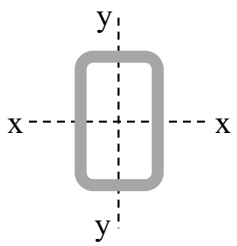
Seismic Load Type:	SDC C->F	
$Ω_o$:	2.00	Unity
V_{allow}:	7591 lb [LRFD]	0.02 **OK**
M_{allow}:	14700 lb-in [LRFD]	0.90 **OK**
	Total:	0.92 **OK**

Calculation: PHS_6.1 {4-7}

Induced Loading:

$P_{tension}$:	0 k
$P_{compression}$:	0 k
Strong Axis $M_{x:}$	7.68 k-in
Strong Axis $V_{y:}$	0.08 k
Weak-Axis $M_{y:}$	0 k-in
Weak-Axis $V_{x:}$	0 k
Torsion, T:	0 k-in
Span:	8 ft

Try: HSS3x3x1/8

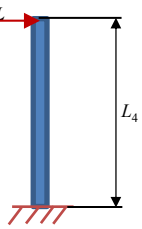


Non-Seismic Loading:

Max Point Load:	0.08 k
Max Moment:	7.68 k-in
Max Shear:	0.08 k
Max Deflection:	0.457 in

Seismic Loading:

Max Point Load:	0.048 k
Max Moment:	4.654 k-in
Max Shear:	0.048 k
Max Deflection:	0.28 in



Material Properties:

ASTM Designation:	A500 Gr B (Rect.)				
E: 29000 ksi	F_y: 46 ksi				
G: 11200 ksi	F_u: 58 ksi				
R_y: 1.4	R_t: 1.3				

Design Method: ASD

Ω_b :	1.67	Ω_t,yield :	1.67
Ω_v :	1.67	Ω_t,rupt. :	2.00
Ω_T :	1.67	Ω_c :	1.67

Section Properites: Self-Weight: 4.75 plf

A:	1.30 in^2	b_{flat}:	2.656 in	I_y:	1.78 in^4
b:	3.00 in	h_{flat}:	2.656 in	Z_y:	1.4 in^3
h:	3.00 in	I_x:	1.78 in^4	S_y:	1.19 in^3
t_{des}:	0.12 in	Z_x:	1.4 in^3	r_y:	1.17 in
b/t_{des}:	22.9	S_x:	1.19 in^3	J:	2.84 in^4
h/t_{des}:	22.9	r_x:	1.17 in	C:	1.92 in^6

Member Analysis:

Axial Unbraced Lengths:

Strong-Axis Unbraced Length, L_{b-x}:	8 ft	K_x:	2.00
Weak Axis Unbraced Length, L_{b-y}:	8 ft	K_y:	2.00

Flexural Unbraced Lengths:

Comp. Flange Unbraced Length, $L_{comp,x-x}$:	8 ft
Comp. Flange Unbraced Length, $L_{comp,y-y}$:	8 ft

Compression Limiting Slenderness:

λ_f:	22.9	λ_{rf}: 35.15	Non-slender Flange	[Table B4.1a Case 6]
λ_w:	22.9	λ_{rw}: 35.15	Non-slender Web	[Table B4.1a Case 6]

Flexural Limiting Slenderness:

$\lambda_{f,x-x}$:	22.9	λ_{pf}: 28.12	λ_{rf}: 35.15	Compact Flange	[Table B4.1b Case 17]
$\lambda_{f,y-y}$:	22.9			Compact Flange	
$\lambda_{w,x-x}$:	22.9	λ_{pw}: 60.76	λ_{rw}: 143.1	Compact Web	[Table B4.1b Case 19]
$\lambda_{w,y-y}$:	22.9			Compact Web	

Compression Capacity:

L_{c-x}/r_x:	164.1 [Governs]
L_{c-y}/r_y:	164.1 [Governs]

Flexural Buckling [Sect. E3]:

F_e :	10.63 ksi, [Eq. E3-4]
$F_{cr,\ NS}$:	9.32 ksi, [Eq. E3-2 & E3-3]

Slender Elements Adjustments [Sect. E7.1]:

$c_{1,b}$:	0.20 [Table E7.1]
$c_{2,b}$:	1.382 [Eq. E7-4]
$F_{el,b}$:	207 ksi, [Eq. E7-5]
b_e:	2.66 in
$c_{1,h}$:	0.20 [Table E7.1]
$c_{2,h}$:	1.382 [Eq. E7-4]
$F_{el,h}$:	207 ksi, [Eq. E7-5]
h_e:	2.66 in
A_e :	1.3 in^2,[Sect. E7.1]
$F_{cr,\ S}$:	N/A ksi, [Eq. E3-2 & E3-3]
P_n :	12.12 k, [Eq. E3-1, E7-1]
Pn/Ω :	7.256 k

Torsion Capacity:

F_{cr} :	27.6 ksi
T_n:	52.99 k-in
Tn/Ω:	31.73 k-in

Strong-Axis Flexural Capacity:

Yielding [AISC Sect. F7.1]:

M_p :	64.4 k-in	[AISC Eq. F7-1]

Flange Local Buckling [AISC Sect. F7.2]:

b) M_n :	N/A k-in	[AISC Eq. F7-2]
b_{ex} :	N/A in	[AISC Eq. F7-4]
S_{ex} :	N/A in^3	
c) M_n :	N/A k-in	[AISC Eq. F7-3]

Web Local Buckling [AISC Sect. F7.3]:

b) M_n :	N/A k-in	[AISC Eq. F7-5]

Lateral Torsional Buckling [AISC Sect. F7.4]:

C_b:	1.00	
L_p:	10.97 ft	[AISC Eq. F7-12]
L_r:	283.6 ft	[AISC Eq. F7-13]
b, c) M_n:	N/A k-in	[AISC Eq. F7-0 & F7-11]

Mn_x/Ω : 39 k-in

Weak-Axis Flexural Capacity:

Yielding [AISC Sect. F7.1]:

M_p :	64.4 k-in	[AISC Eq. F7-1]

Flange Local Buckling [AISC Sect. F7.2]:

b) M_n :	N/A k-in	[AISC Eq. F7-2]
b_{ex} :	N/A in	[AISC Eq. F7-4]
S_{ex} :	N/A in^3	
c) M_n :	N/A k-in	[AISC Eq. F7-3]

Web Local Buckling [AISC Sect. F7.3]:

b) M_n :	N/A k-in	[AISC Eq. F7-5]

Lateral Torsional Buckling [AISC Sect. F7.4]:

C_b:	1.00	
L_p:	10.97 ft	[AISC Eq. F7-12]
L_r:	283.6 ft	[AISC Eq. F7-13]
b, c) M_n:	N/A k-in	[AISC Eq. F7-0 & F7-11]

Mn_y/Ω : 39 k-in

Tension Capacity:

Yielding [AISC Sect. D2.a]:

P_n :	59.8 k

Rupture [AISC Sect. D2.b]:

A_{net}:	1.30 in^2	U:	1.00
P_n :	75.4 k		

Pn/Ω : 35.81 k

Strong-Axis Shear Capacity:

k_v:	5	[AISC Sect. G2.1]
A_w:	0.696 in^2	
C_{v2} :	1.00	[AISC Sect. G2.1]
Vn :	19.21 k	[AISC Eq. G2-1]

Vn_x/Ω: 11.5 k

Weak-Axis Shear Capacity:

k_v:	5	[AISC Sect. G2.1]
A_w:	0.696 in^2	
C_{v2} :	1.00	[AISC Sect. G2.1]
Vn :	19.21 k	[AISC Eq. G2-1]

Vn_y/Ω: 11.5 k

Member Check:

Shear Unity:	0.01	OK
Flexure Unity:	0.20	OK
Tension + Flexure:	0.20	OK
Compression + Flexure:	0.20	OK
Tens. + Shear + Flexure + Torsion:	0.20	OK
Comp. + Shear + Flexure + Torsion:	0.20	OK

Deflection Check:

Transient: L/ 360
D+Transient: L/ 240

$\Delta_{Transient,x-x}$:	0.46 in ->	2L /	420	OK
$\Delta_{D+Transient,x-x}$:	0.46 in ->	2L /	420	OK
$\Delta_{Transient,y-y}$:	0.00 in ->	2L /	10000	OK
$\Delta_{D+Transient,y-y}$:	0.00 in ->	2L /	10000	OK

USE HSS3x3x1/8

13228 NE 20th St., Suite 100, Bellevue, WA 98005 | (425) 614-0949

Project:	Barnes & Noble Puyallup	Pg. No:	F - 7
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Company:	AUE	Page:	1
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

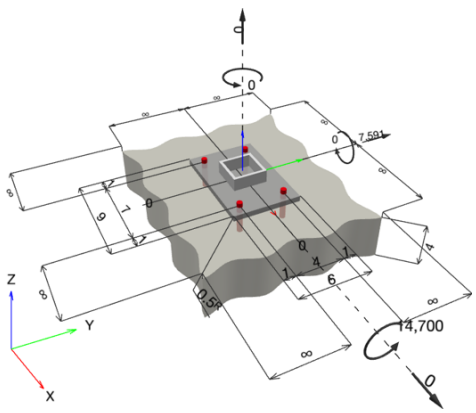
Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ2 - CS 1/2 (2) hnom2**
Item number:	2210254 KB-TZ2 1/2x3 3/4
Specification text:	Hilti ∅ 1/2 in Kwik Bolt TZ2 - CS with 2.5 in nominal embedment depth per ICC-ES ESR-4266 , Hammer drilled installation per MPII
Effective embedment depth:	$h_{ef,act}$ = 2.000 in., h_{nom} = 2.500 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
Shear edge breakout verification:	Row closest to edge (Case 3 only from ACI 318-19 Fig. R.17.7.2.1b)
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate[R] :	l_x x l_y x t = 9.000 in. x 6.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
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, 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
Seismic loads (cat. C, D, E, or F)	Tension load: yes (17.10.5.3 (d)) Shear load: yes (17.10.6.3 (c))

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

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



Company:	AUE	Page:	2
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

1.1 Design results

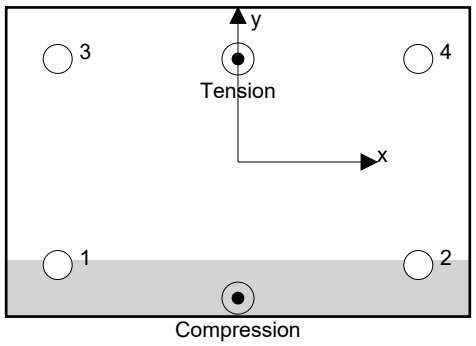
Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 0; V_x = 0; V_y = 7,591; M_x = 14,700; M_y = 0; M_z = 0;	yes	167

2 Load case/Resulting anchor forces

Anchor reactions [lb]

Tension force: (+Tension, -Compression)

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	1,898	0	1,898
2	0	1,898	0	1,898
3	1,583	1,898	0	1,898
4	1,583	1,898	0	1,898



Max. concrete compressive strain: 0.15 [‰]
Max. concrete compressive stress: 656 [psi]
Resulting tension force in (x/y)=(0.000/2.000): 3,167 [lb]
Resulting compression force in (x/y)=(0.000/-2.642): 3,167 [lb]

Anchor forces are calculated based on the assumption of a rigid anchor plate.

3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi$ N_n	Status
Steel Strength*	1,583	8,433	19	OK
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Failure**	3,167	3,172	100	OK

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

3.1 Steel Strength

N_{sa} [lb]	ϕ	ϕ N_{sa} [lb]	N_{ua} [lb]
11,244	0.750	8,433	1,583

Company:	AUE	Page:	3
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

3.2 Concrete Breakout Failure

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$c_{a,min}$ [in.]	c_{ac} [in.]	$\Psi_{c,N}$		
72.00	36.00	∞	5.500	1.000		

$e_{c1,N}$ [in.]	$\Psi_{ec1,N}$	$e_{c2,N}$ [in.]	$\Psi_{ec2,N}$	$\Psi_{ed,N}$	$\Psi_{cp,N}$	k_{cr}
0.000	1.000	0.000	1.000	1.000	1.000	21

λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕN_{cbg} [lb]	N_{ua} [lb]
1.000	3,253	0.650	0.750	3,172	3,167

Company:	AUE	Page:	4
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

4 Shear load

	Load V_{ua} [lb]	Capacity ϕ V_n [lb]	Utilization $\beta_V = V_{ua}/\phi$ V_n	Status
Steel Strength*	1,898	3,599	53	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	7,591	7,591	100	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* 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

4.1 Steel Strength

V_{sa} [lb]	$\alpha_{V,seis}$	ϕ	ϕ V_{sa} [lb]	V_{ua} [lb]
5,537	1.000	0.650	3,599	1,898

4.2 Pryout Strength

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$c_{a,min}$ [in.]	k_{cp}	c_{ac} [in.]	$\Psi_{c,N}$
120.00	36.00	∞	1	5.500	1.000

$e_{c1,V}$ [in.]	$\Psi_{ec1,V}$	$e_{c2,V}$ [in.]	$\Psi_{ec2,V}$	$\Psi_{ed,N}$	k_{cr}
0.000	1.000	0.000	1.000	1.000	21

λ_a	N_b [lb]	ϕ	$\phi_{seismic}$	ϕ V_{cpg} [lb]	V_{ua} [lb]
1.000	3,253	0.700	1.000	7,591	7,591

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

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.998	1.000	1.000	167	not recommended

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

Company:	AUE	Page:	5
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

6 Warnings

- The anchor design methods in PROFIS Engineering require rigid anchor plates per current regulations (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 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!
- 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.
- 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://submittals.us.hilti.com/PROFISAnchorDesignGuide/
- "An anchor design approach for structures assigned to Seismic Design Category C, D, E or F is given in ACI 318-19, Chapter 17, Section 17.10.5.3 (a) that requires the governing design strength of an anchor or group of anchors be limited by ductile steel failure. If this is NOT the case, the connection design (tension) shall satisfy the provisions of Section 17.10.5.3 (b), Section 17.10.5.3 (c), or Section 17.10.5.3 (d). The connection design (shear) shall satisfy the provisions of Section 17.10.6.3 (a), Section 17.10.6.3 (b), or Section 17.10.6.3 (c)."
- Section 17.10.5.3 (b) / Section 17.10.6.3 (a) require the attachment the anchors are connecting to the structure be designed to undergo ductile yielding at a load level corresponding to anchor forces no greater than the controlling design strength. Section 17.10.5.3 (c) / Section 17.10.6.3 (b) waive the ductility requirements and require the anchors to be designed for the maximum tension / shear that can be transmitted to the anchors by a non-yielding attachment. Section 17.10.5.3 (d) / Section 17.10.6.3 (c) waive the ductility requirements and require the design strength of the anchors to equal or exceed the maximum tension / shear obtained from design load combinations that include E, with E increased by ω_0.
- 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.

Analysis only used to determine capacity. Unity analysis is done in above calculations.

Company:	AUE	Page:	6
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
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Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

7 Installation data

Profile: Square HSS (AISC), HSS3X3X.250; (L x W x T) = 3.000 in. x 3.000 in. x 0.250 in.

Hole diameter in the fixture: d_f = 0.562 in.

Plate thickness (input): 0.500 in.

Recommended plate thickness: not calculated

Drilling method: Hammer drilled

Cleaning: Manual cleaning of the drilled hole according to instructions for use is required.

Anchor type and diameter: Kwik Bolt TZ2 - CS 1/2 (2) hnom2

Item number: 2210254 KB-TZ2 1/2x3 3/4

Maximum installation torque: 602 in.lb

Hole diameter in the base material: 0.500 in.

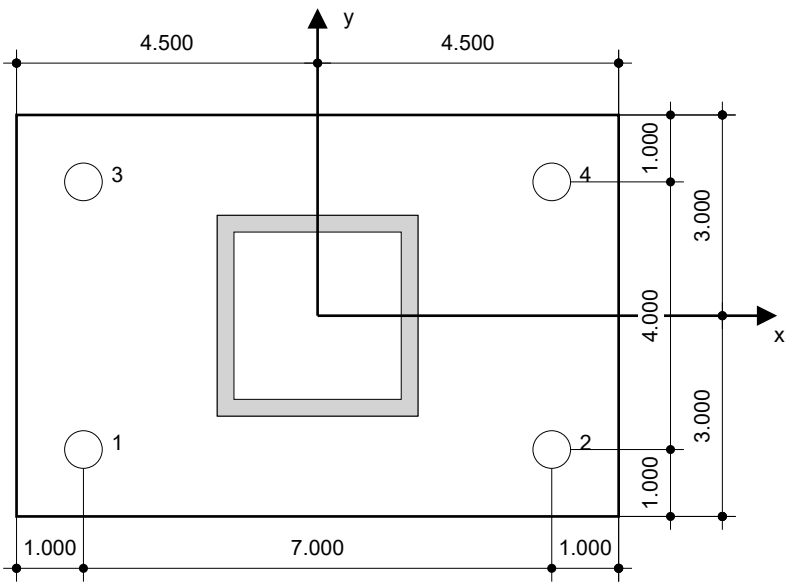
Hole depth in the base material: 2.750 in.

Minimum thickness of the base material: 4.000 in.

Hilti ∅ 1/2 in Kwik Bolt TZ2 - CS with 2.5 in nominal embedment depth per ICC-ES ESR-4266 , Hammer drilled installation per MPII

7.1 Recommended accessories

Drilling	Cleaning	Setting
• Suitable Rotary Hammer • Properly sized drill bit	• Manual blow-out pump	• Torque controlled cordless impact tool • Torque wrench • Hammer



Coordinates Anchor [in.]

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-3.500	-2.000	-	-	-	-
2	3.500	-2.000	-	-	-	-
3	-3.500	2.000	-	-	-	-
4	3.500	2.000	-	-	-	-

Company:	AUE	Page:	7
Address:	13228 NE 20th Street, Suite 100	Specifier:	Alex Habliston
Phone I Fax:	4256140949 |	E-Mail:	alexh@au-eng.com
Design:	Concrete - Dec 20, 2024	Date:	12/20/2024
Fastening point:			

8 Remarks; Your Cooperation Duties

- Any and all information and data contained in the Software concern solely the use of Hilti products and are based on the principles, formulas and security regulations in accordance with Hilti's technical directions and operating, mounting and assembly instructions, etc., that must be strictly complied with by the user. All figures contained therein are average figures, and therefore use-specific tests are to be conducted prior to using the relevant Hilti product. The results of the calculations carried out by means of the Software are based essentially on the data you put in. Therefore, you bear the sole responsibility for the absence of errors, the completeness and the relevance of the data to be put in by you. Moreover, you bear sole responsibility for having the results of the calculation checked and cleared by an expert, particularly with regard to compliance with applicable norms and permits, prior to using them for your specific facility. The Software serves only as an aid to interpret norms and permits without any guarantee as to the absence of errors, the correctness and the relevance of the results or suitability for a specific application.
- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

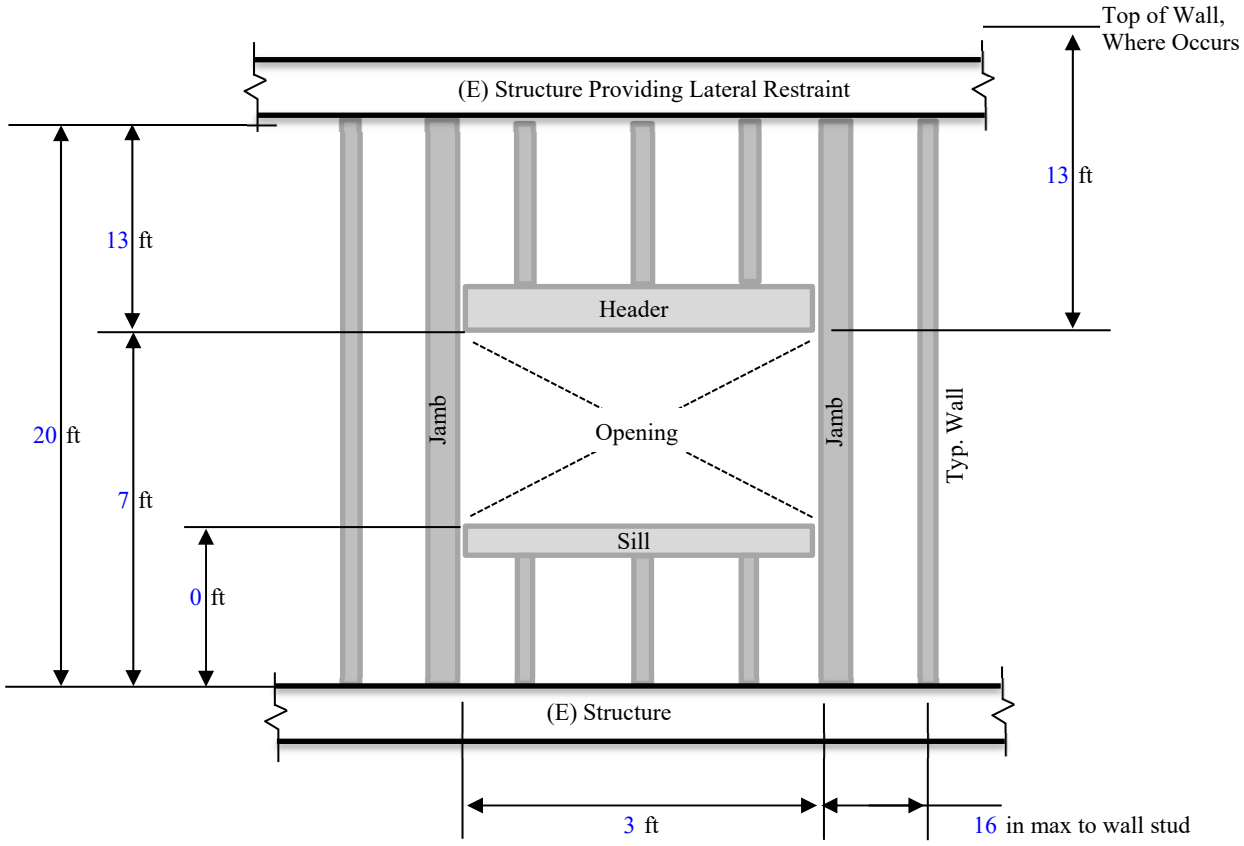
Partition Wall Opening(s)
Design & Analysis

Calculation: OPNG_1 {8-11}

Opening Dimension & Loading:

Loading				
Stud wall assembly weight:	10	psf	Wind Load Wall Zone:	-
Roof DL :	0	psf	Non-Seismic Pressure "w1":	5.00 psf [ASD]
Roof LL :	0	psf	Seismic Fp :	0.49 *W [LRFD]
Roof Trib. :	0	ft	Seismic Fp :	0.34 *W [ASD]
			Seismic Fp :	3.40 psf [ASD]
			Wind Deflection Reduction:	No

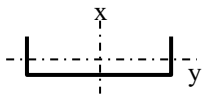
Opening and Framing Geometry



Calculation: OPNG_1 {8-11}

Header Member Design:

Flat Track Header Design:										
			Span :	3	ft.	Allow. Δ_{LL} : L/	240	Allow. Δ_{TL} : L/	240	
ASD Loading:			Track:	362T150-68 (50ksi)						
Vert	w_LL-vert.:	0 plf	Indivdual Track Properties:							
	w_TL-vert.:	130 plf	Ixe:	0.993	in^4	Iye:	0.100	in^4		
	Ma_vert.:	1.755 k-in.	Mn_x/Ω:	13.43	k-in.	Mn_y/Ω:	1.972	k-in.		
	Va_vert.:	0.195 k	Vn/Ω:	4.70	k					
Horiz.	w_horz.:	50 plf	Flexure:	0.94	OK					
	Ma_horz.:	0.675 k-in.	Shear:	0.044	OK					
	Va_horz.:	0.075 k	Flexural+Shear Unity:	0.941	OK					
Horizontal Deflection	$\Delta_{LL\text{-}Horz.}$:	0.00 in ->	L /	11572	OK	Vertical Deflection	$\Delta_{LL\text{-}Vert.}$:	0.00 in ->	L /	10000 OK
	$\Delta_{TL\text{-}Horz.}$:	0.00 in ->	L /	11572	OK		$\Delta_{TL\text{-}Vert.}$:	0.08 in ->	L /	446 OK



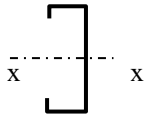
Jamb Member Design:

Built-Up Jamb Stud Design				Option:	3								
Loading at Jamb Stud:				Non-Seismic				Seismic					
	Mmax:	6.500	k-in.	Vbase:	0.108	kips		Vbase:	0.074	kips			
(at base)	Paxial:	0.262	kips	Vtop:	0.060	kips		Vtop:	0.040	kips			
	Δ_{LL}:	0.755	in.										

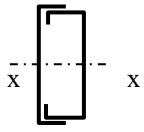
Member 1: (Stud)				Member 2: (Stud)				Member 3: (Track)				Member 4: (Track)			
362S162-43 (33ksi)				362S162-43 (33ksi)				362T125-33 (33ksi)				-			
Ixe	0.69	in^4		Ixe	0.69	in^4		Ixe	0.36	in^4		Ixe	0.00	in^4	
Area	0.34	in^2		Area	0.340	in^2		Area	0.21	in^2		Area	0.00	in^2	
$k_{horiz.}$:	39.66%			$k_{horiz.}$:	39.66%			$k_{horiz.}$:	20.69%			$k_{horiz.}$:	0.00%		
M_n/Ω:	7.00	k-in.	0.368 OK	M_n/Ω:	7.00	k-in.	0.368 OK	M_n/Ω:	3.44	k-in.	0.391 OK	M_n/W:	0.00	k-in.	- -
V_n/Ω:	0.68	k	0.064 OK	V_n/Ω:	0.68	k	0.064 OK	V_n/Ω:	1.02	k	0.022 OK	V_n/W:	0.00	k	- -
$k_{Axial.}$:	50.00%			$k_{Axial.}$:	50.00%										
P_n/Ω:	1.32	k	0.099 OK	P_n/Ω:	1.32	k	0.099 OK								
Flex + Axial Unity:	0.468		OK	Flex + Axial Unity:	0.468		OK								
Flex. + Shear Unity:	0.37		OK	Flex. + Shear Unity:	0.374		OK	Flex. + Shear Unity:	0.391		OK	Flex. + Shear Unity:	-		-

Deflection:	Comb. Ixe:	1.75	in^4	Max. Δ_{LL} :	0.76	in ->	L /	317.7	OK	Allow. Δ_{LL} : L/	240

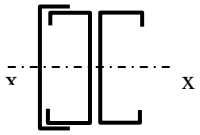
Jamb Stud Types:



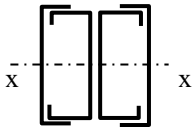
Option 1:



Option 2:



Option 3:



Option 4:

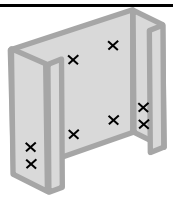
13228 NE 20th St., Suite 100, Bellevue, WA 98005 | (425) 614-0949

Calculation: OPNG_1 {8-11}

Header to Jamb Connection Design:

Induced Loading to Stud Clip:

Vert. Shear Load :	195 lb	Horz. Shear Load:	75 lb
Direct Tension:	0 lb	Ecc.$_{horz.}$:	1 in
Vert. Mu:	158.4 lb-in	Horz. Mu:	75 lb-in
Force Couple:	4.167 in		
Total Tension:	38.03 lb at top screw group *(Includes Direct Tension / # of screw rows)*		



Design of Stud Flanges for Strong-Axis Bending

Loading:

Ecc.$_x$ =	0.81 in.		
$M_{xreq.}$ =	0.158 k-in.		
Ecc.$_y$ =	0.81 in.		
$M_{yreq.}$ =	0.061 k-in.		

Stud Clip Dimension & Properties:

Try:	362S162-43 (33ksi)							
Clip Length 'b':	7	in.	F_y:	33	ksi.	I_{x-x}:	1.2891	in^4
Stud Thick:	43	mil	Ω_B =	1.67		S_x:	0.3683	in^3
Design Thick:	0.0451	in.	E:	29500	ksi.	M_{x_yield}:	12.1545	k-in.
Stud Depth:	3.625	in.	Z_{px}:	0.5525	in^3	M_{nx}:	18.2317	k-in.
			Z_{py}:	0.0036	in^3	I_{y-y}:	0.00005	in^4
			Design Mil:	0.0451	in.	S_y:	0.0024	in^3
			Corner Radii:	0.0712	in.	M_{y_yield}:	0.0783	k-in.
						M_{ny}:	0.1175	k-in.

Capacity Check:

Mnx/Ω_B:	21.83 k-in.	0.01 **OK**
Mny/Ω_B:	0.07 k-in.	0.866 **OK**
		0.87 **OK**

Track to Stud Connection: *Connection of Header to Stud Clip*

Max Reaction at Stud:	75 lb		
Track Condition:	Opening Condition		
Try:	362T150-68 (50ksi)	Stud Clip Size:	362S162-43 (33ksi)
Design Thickness:	0.0713 in.		
Fy:	50 ksi	Stud Properties:	
Fu:	65 ksi	Fy: 33 ksi	
Stud Bearing Length 'N':	1.5 in.		
Stud Web (Flat Portion) 'h':	3.3924	Stud Dimesions	
1/2*Pnst:	416 lbs	Member depth:	3.625 in.
Ω :	1.7	Design Mil:	0.0451 in.
Pallow:	245 lbs	Corner Radii:	0.0712 in.
Unity:	0.31 **OK**		

Screw & Light Gauge Steel Connection: *Connection of Header to Stud Clip (Vertical Loads*

Allowable Screw Capacities to CFS:

Shear Load :	195 lb	Shear of	#10 Screw	in 54 mils (50ksi) =	534	lbs
Tension Load :	0 lb	Tension of	#10 Screw	in 54 mils (50ksi) =	198	lbs

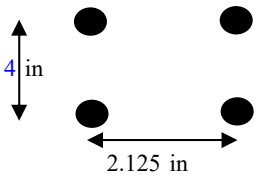
Effective Shear Fasteners #:	(4)	Effective Tension Fasteners #:	(1)
Shear Load :	48.75 lb per fastener	Tension Load :	0 lb per fastener
V_{ALLOW}:	534 lbs 0.091 **OK**	T_{ALLOW}:	198 lbs 0 **OK**

Unity Check: 0.091 + 0 = 0.091 **OK**

Screw & Light Gauge Steel Connection: *Connection of Stud Clip to Jamb Stud*

Vertical Load:	195 lb
Lateral Load:	75 lb
Ecc.$_{horz.}$:	3.0 in
Horz. Mu:	225 lb-in

Screw Group Analysis:



Σ d^2 :	20.52 in^2
h :	1.063 in
v :	2 in
H_{shear} :	40.68 lb
V_{shear} :	60.4 lb
R_{shear} :	72.83 lb

Allowable Screw Capacities to CFS:

Shear Load :	72.83 lb	Shear of	#10 Screw	in 54 mils (50ksi) =	534	lbs
Tension Load :	38.03 lb	Tension of	#10 Screw	in 54 mils (50ksi) =	198	lbs

Effective Shear Fasteners #:	(1)	Effective Tension Fasteners #:	(2) total
Shear Load :	72.83 lb per fastener	Tension Load :	19.01 lb per fastener
V_{ALLOW}:	534 lbs 0.136 **OK**	T_{ALLOW}:	198 lbs 0.096 **OK**

Unity Check: 0.136 + 0.096 = 0.232 **OK**

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Project:	Barnes & Noble Puyallup	Pg. No:	F - 10
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: OPNG_1 {8-11}

Jamb Base Connection to Structure Below:

Track to Stud Connection: *Bottom Track to Jamb Stud*

(AISI S211-07 Reaffirmed 2012)

Max Reaction at Stud:	108.3 lb				
Track Condition:	Opening Condition				
Try:	362T125-33 (33ksi)	Jamb Stud Size:	362S162-43 (33ksi)		
Design Thickness:	0.0346 in.				
Fy:	33 ksi	Stud Properties:			
Fu:	45 ksi	Fy:	33 ksi		
Stud Bearing Length 'N':	1.25 in.				
Stud Web (Flat Portion) 'h':	3.3924	Stud Dimesions			
1/2*Pnst:	387 lbs	Member depth:	3.625	in.	
Ω :	1.7	Design Mil:	0.0451	in.	
Pallow:	227 lbs	Corner Radii:	0.0712	in.	
Unity:	0.48 **OK**				

Design of Base Angle Clip *Angle Clip from Jamb to Structure Analysis (If Req'd)*

Loading:

$Ecc._x$:	0.75	in.	Clip Leg to Struct:	1.5	in	F_y:	50	ksi.	$I_{x\text{-}x}$:	0.0853	in^4
$M_{x\text{-}req.}$:	0.041	k-in.	Clip Leg to Jamb:	1.5	in	Ω_B :	1.67		S_x:	0.0650	in^3
Force Couple :	1.25	in	Clip Length 'b':	2.625	in.	E:	29500	ksi.	M_{x_yeild}:	3.2501	k-in.
Tens. / Comp. :	32.5	lb	Clip Thick:	54	mil	Z_{px}:	0.0975	in^3	M_{nx}:	4.8751	k-in.
$Ecc._y$:	0.75	in.	Design Thick:	0.0566	in.	Z_{py}:	0.0011	in^3			
$M_{y\text{-}req.}$:	0.02	k-in.							$I_{y\text{-}y}$:	0.00002	in^4
									S_y:	0.0007	in^3
									M_{y_yeild}:	0.0350	k-in.
									M_{ny}:	0.0526	k-in.

Capacity Check:

Mnx/Ω_B:	5.838 k-in.	0.01	**OK**
Mny/Ω_B:	0.031 k-in.	0.774	**OK**
		0.78	**OK**

Screw & Light Gauge Steel Connection: *Connection of Angle Clip to Jamb (If Req'd)*

Allowable Screw Capacities to CFS:

Shear Load :	108.3 lb	Shear of	#10 Screw	in 54 mils (50ksi) =	534	lbs
Tension Load :	32.5 lb	Tension of	#10 Screw	in 54 mils (50ksi) =	198	lbs

Effective Shear Fasteners #:	(1)			Effective Tension Fasteners #:	(1)		
Shear Load :	108.3	lb per fastener		Tension Load :	32.5	lb per fastener	
V_{ALLOW}:	534 lbs	0.203	**OK**	T_{ALLOW}:	198 lbs	0.164	**OK**

Unity Check: 0.203 + 0.164 = 0.367 **OK**

PAF & Light Gauge Steel Connection: *Bottom Track to Structure at Jamb / Jamb Base Clip to Structure*

Shear Load : 108.3 lb [ASD]
Use: 0.118" Dia. Hilti X-P G3 PAF w/ 3/4" Embed. into 2,500 psi Concrete
Tension Load : 0 lb [ASD]
Load Type: Non-Seismic

		Thickness:	33	mil	Fy:	33	ksi	Fu:	45	ksi	mf : 0.75
		Design Thick:	0.0346	in.	d:	0.118	dw:	0.268	d/t :	3.41	C : 3
Effective Shear		T_{allow}:	80	lbs				V_{allow}:	120	lbs	
Fasteners #:	(1)	$T_{allow\ (pullover)}$:	208.6	lbs				$V_{allow\ (bearing)}$:	165.4	lbs	
Shear Load :	108.3 lb per fastener							$V_{allow\ (bearing\text{-}deformation)}$:	139.9	lbs	
V_{ALLOW}:	120 lbs	0.903	**OK**								
Effective Tension								Min. Spacing =	4	in.	
Fasteners #:	(1)							Min. Edge. Dist. =	3	in.	
Tension Load :	0 lb per fastener							Min. Substrate Thickness =	2.25	in.	
T_{ALLOW}:	80 lbs	0	**OK**								

Unity Check: 0.903 + 0 = 0.903 **OK**

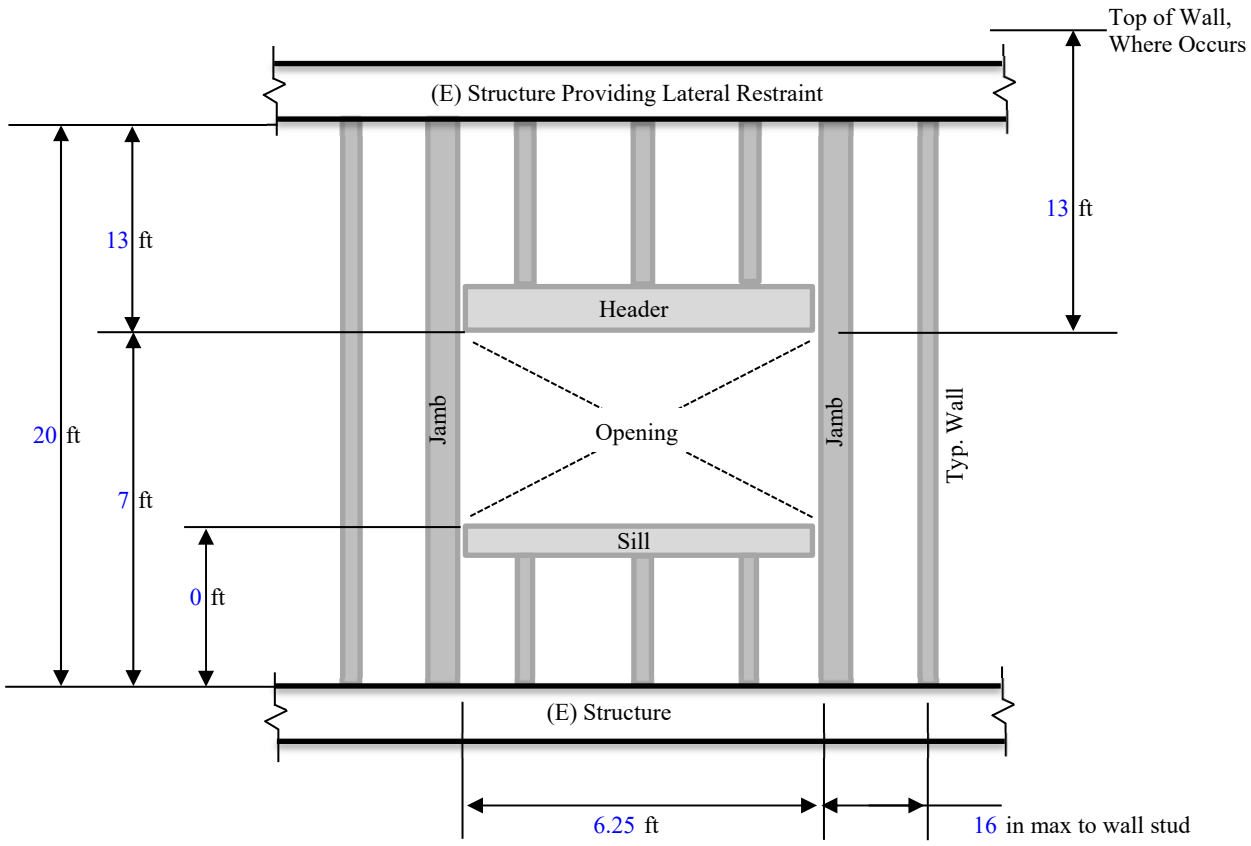
13228 NE 20th St., Suite 100, Bellevue, WA 98005 | (425) 614-0949

Calculation: OPNG_2 {12-16}

Opening Dimension & Loading:

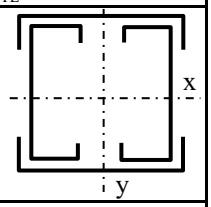
Loading	
Stud wall assembly weight: 10 psf	Wind Load Wall Zone: -
Roof DL : 0 psf	Non-Seismic Pressure "w1": 5.00 psf [ASD]
Roof LL : 0 psf	Seismic Fp : 0.49 *W [LRFD]
Roof Trib. : 0 ft	Seismic Fp : 0.34 *W [ASD]
	Seismic Fp : 3.40 psf [ASD]
	Wind Deflection Reduction: No

Opening and Framing Geometry



Calculation: OPNG_2 {12-16}

Header Member Design:

Box Beam Design:													
				Span : 6.25 ft.			Allow. Δ_{LL} : L/ 240			Allow. Δ_{TL} : L/ 240			
ASD Loading:				Stud: 362S137-43 (33ksi)			Track: 362T125-33 (33ksi)						
Vert	w_LL-vert.:	0	plf	Indivdual Stud Properties:			Indivdual Track Properties:						
	w_TL-vert.:	130	plf	I_{xe}:	0.600	in^4	I_{xe}:	0.362	in^4				
	Ma_vert.:	7.617	k-in.	M_{n_x}/Ω:	6.20	k-in.	M_{n_x}/Ω:	3.44	k-in.				
	Va_vert.:	0.406	k	V_{n_y}/Ω:	0.68	k	V_{n_x}/Ω:	1.02	k				
Horiz.	w_horz.:	50	plf										
	Ma_horz.:	2.93	k-in.	M_{n_x}/Ω:	12.4	k-in.	Flex:	0.61	OK				
	Va_horz.:	0.156	k	V_{n_x}/Ω:	1.4	k	Shear:	0.30	OK	Flexural+Shear Unity:		0.68	OK
				M_{n_x}/Ω:	6.9	k-in.	Flex:	0.43	OK				
Non-Comp. Member Properties:				V_{n_x}/Ω:	2.0	k	Shear:	0.08	OK	Flexural+Shear Unity:		0.43	OK
Tot. Stud I_{xe}:	1.200	in^4											
Tot. Track I_{xe}:	0.724	in^4		CFS Lu:	-	ft.	Unbraced:	OK					
Horizontal Deflection	$\Delta_{LL\text{-}Horz.}$:	0.08	in ->	L / 933	OK		Vertical Deflection	$\Delta_{LL\text{-}Vert.}$:	0.00	in ->	L / 10000	OK	
	$\Delta_{TL\text{-}Horz.}$:	0.08	in ->	L / 933	OK			$\Delta_{TL\text{-}Vert.}$:	0.13	in ->	L / 595	OK	

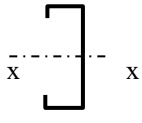
Jamb Member Design:

Built-Up Jamb Stud Design				Option: 3									
Loading at Jamb Stud:				Non-Seismic				Seismic					
	Mmax:	11.375	k-in.	Vbase:	0.190	kips		Vbase:	0.129	kips	Δ_{LL}:	0.940	in.
(at base)	Paxial:	0.473	kips	Vtop:	0.088	kips		Vtop:	0.060	kips			

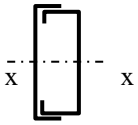
Member 1: (Stud) 362S162-68 (50ksi)				Member 2: (Stud) 362S162-68 (50ksi)				Member 3: (Track) 362T125-33 (33ksi)				Member 4: (Track) -			
Ixe	1.05	in^4		Ixe	1.05	in^4		Ixe	0.36	in^4		Ixe	0.00	in^4	
Area	0.52	in^2		Area	0.524	in^2		Area	0.21	in^2		Area	0.00	in^2	
$k_{horiz.}$:	42.64%			$k_{horiz.}$:	42.64%			$k_{horiz.}$:	14.72%			$k_{horiz.}$:	0.00%		
M_n/Ω:	18.24	k-in.	0.266 OK	M_n/Ω:	18.24	k-in.	0.266 OK	M_n/Ω:	3.44	k-in.	0.487 OK	M_n/W:	0.00	k-in.	- -
V_n/Ω:	1.00	k	0.081 OK	V_n/Ω:	1.00	k	0.081 OK	V_n/Ω:	1.02	k	0.027 OK	V_n/W:	0.00	k	- -
$k_{Axial.}$:	50.00%			$k_{Axial.}$:	50.00%										
P_n/Ω:	1.97	k	0.12 OK	P_n/Ω:	1.97	k	0.12 OK								
Flex + Axial Unity:	0.386	OK		Flex + Axial Unity:	0.386	OK									
Flex. + Shear Unity:	0.28	OK		Flex. + Shear Unity:	0.278	OK		Flex. + Shear Unity:	0.487	OK		Flex. + Shear Unity:	-	-	

Deflection:	Comb. Ixe: 2.46 in^4	Max. Δ_{LL} : 0.94 in ->	L / 255.2 OK	Allow. Δ_{LL} : L/ 240

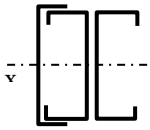
Jamb Stud Types:



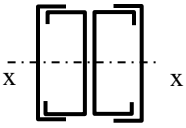
Option 1:



Option 2:



Option 3:



Option 4:

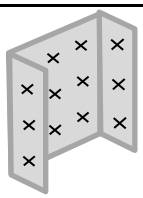
13228 NE 20th St., Suite 100, Bellevue, WA 98005 | (425) 614-0949

Calculation: OPNG_2 {12-16}

Header to Jamb Connection Design:

Induced Loading to Track Clip to Header & Jamb to Resist Gravity Loads

Vert. Shear Load : 406.3 lb
Direct Tension : 0 lb
Vert. Mu : 406.3 lb-in
Force Couple : 1.583 in
Total Tension : 256.6 lb at top screw group *(Includes Direct Tension / # of screw rows)*



Design of Track Legs for Strong-Axis Bending

Loading:
Ecc. : 1.00 in.
$M_{req.}$: 0.406 k-in.

Track Clip Dimension & Properties:
Try: 362T200-43 (33ksi)
Clip Length 'b': 3.125 in. F_y: 33 ksi. $I_{x\text{-}x}$: 0.1147 in^4
Track Thick: 43 mil Ω_B : 1.67 S_x: 0.0734 in^3
Design Thick: 0.0451 in. E: 29500 ksi. M_{x_yield}: 2.4224 k-in.
Z_p: 0.1101 in^3 M_n: 3.6335 k-in.

Capacity Check:
Mn/Ω_B: 4.352 k-in.
0.09 **OK**

Screw & Light Gauge Steel Connection: *Connection of Track Clip to Header*

Allowable Screw Capacities to CFS:

Shear Load : 406.3 lb — Shear of #10 Screw in 43 mils (33ksi) = 263 lbs
Tension Load : 0 lb — Tension of #10 Screw in 43 mils (33ksi) = 109 lbs

Effective Shear Fasteners #: (3) per side
Effective Shear Fasteners #: (6) total
Shear Load : 67.71 lb per fastener
V_{ALLOW}: 263 lbs 0.257 **OK**

Effective Tension Fasteners #: ( ) per row
Effective Tension Fasteners #: ( ) total
Tension Load : 0 lb per fastener
T_{ALLOW}: 109 lbs 0 **OK**

Unity Check: 0.257 + 0 = 0.257 **OK**

Screw & Light Gauge Steel Connection: *Connection of Track Clip to Jamb*

Allowable Screw Capacities to CFS:

Shear Load : 406.3 lb — Shear of #10 Screw in 43 mils (33ksi) = 263 lbs
Tension Load : 256.6 lb — Tension of #10 Screw in 68 mils (50ksi) = 249 lbs

# of Rows of Screws: 2 rows
Effective Shear Fasteners #: (3) per row
Effective Shear Fasteners #: (6) total
Shear Load : 67.71 lb per fastener
V_{ALLOW}: 263 lbs 0.257 **OK**

# of Rows of Screws: 2 rows
Effective Tension Fasteners #: (1) per row
Effective Tension Fasteners #: (2) total
Tension Load : 128.3 lb per fastener
T_{ALLOW}: 249 lbs 0.515 **OK**

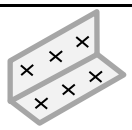
Unity Check: 0.257 + 0.515 = 0.773 **OK**

Calculation: OPNG_2 {12-16}

Header to Jamb Connection Design (Continued):

Induced Loading to Angle Clips to Header & Jamb to Resist Lateral Loads

Horz. Shear Load : 156.3 lb
Direct Tension Load : 0 lb
(#) of Clips: (2)



**Clip occurs on top+bottom of header, (2) clips total*

Design of Angle Clip

Loading:

$Ecc._x$:	0.75	in.
$M_{x\text{-}req.}$:	0.059	k-in.
Force Couple:	1.583	in
Tens. / Comp. :	37.01	lb
$Ecc._y$:	0.75	in.
$M_{y\text{-}req.}$:	0.028	k-in.

Clip Dimension & Properties:

Clip Leg to Header:	1.5	in
Clip Leg to Jamb:	1.5	in
Clip Length 'b':	3.125	in.
Clip Thick:	54	mil
Design Thick:	0.0566	in.

F_y:	50	ksi.
Ω_B :	1.67	
E:	29500	ksi.
Z_{px}:	0.1382	in^3
Z_{py}:	0.0013	in^3

$I_{x\text{-}x}$:	0.1439	in^4
S_x:	0.0921	in^3
M_{x_yeild}:	4.6061	k-in.
M_{nx}:	6.9092	k-in.
$I_{y\text{-}y}$:	0.00002	in^4
S_y:	0.0008	in^3
M_{y_yeild}:	0.0417	k-in.
M_{ny}:	0.0626	k-in.

Capacity Check:

Mnx/Ω_B:	8.274	k-in.	0.01 **OK**
Mny/Ω_B:	0.037	k-in.	0.741 **OK**
			0.75 **OK**

Screw & Light Gauge Steel Connection: *Connection of Track Clip to Header*

Allowable Screw Capacities to CFS:

Shear Load : 78.13 lb — Shear of #10 Screw — in 54 mils (33ksi) = 370 lbs
Tension Load : 0 lb — Tension of #10 Screw — in 54 mils (33ksi) = 137 lbs

Effective Shear Fasteners #: (3)
Shear Load : 26.04 lb per fastener
V_{ALLOW}: 370 lbs 0.07 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 0 lb per fastener
T_{ALLOW}: 137 lbs 0 **OK**

Unity Check: 0.07 + 0 = 0.07 **OK**

Screw & Light Gauge Steel Connection: *Connection of Angle Clip to Jamb*

Allowable Screw Capacities to CFS:

Shear Load : 78.13 lb — Shear of #10 Screw — in 54 mils (33ksi) = 370 lbs
Tension Load : 37.01 lb — Tension of #10 Screw — in 54 mils (33ksi) = 137 lbs

Effective Shear Fasteners #: (3)
Shear Load : 26.04 lb per fastener
V_{ALLOW}: 370 lbs 0.07 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 37.01 lb per fastener
T_{ALLOW}: 137 lbs 0.27 **OK**

Unity Check: 0.07 + 0.27 = 0.341 **OK**

Calculation: OPNG_2 {12-16}

Jamb Base Connection Design:

Track to Stud Connection:	*Bottom Track to Jamb Stud*				
(AISI S211-07 Reaffirmed 2012)					
Max Reaction at Stud:	189.6 lb				
Track Condition:	Opening Condition				
Try:	362T125-33 (33ksi)	Jamb Stud Size:	362S162-68 (50ksi)		
Design Thickness:	0.0346 in.				
Fy:	33 ksi	Stud Properties:			
Fu:	45 ksi	Fy:	50 ksi		
Stud Bearing Length 'N':	1.25 in.				
Stud Web (Flat Portion) 'h':	3.2686	Stud Dimesions			
1/2*Pnst:	585 lbs	Member depth:	3.625	in.	
Ω :	1.7	Design Mil:	0.0713	in.	
Pallow:	344 lbs	Corner Radii:	0.1069	in.	
Unity:	0.55 **OK**				

PAF & Light Gauge Steel Connection:	*Bottom Track to Structure at Jamb / Jamb Base Clip to Structure*								
Shear Load :	189.6 lb [ASD]	Use:	0.118" Dia. Hilti X-P G3 PAF w/ 3/4" Embed. into 2,500 psi Concrete						
Tension Load :	0 lb [ASD]								
Load Type:	Non-Seismic	Thickness:	33 mil	Fy:	33 ksi	Fu:	45 ksi	mf :	0.75
		Design Thick:	0.0346 in.	d:	0.118	dw:	0.268	d/t :	3.41
Effective Shear		T_{allow}:	80 lbs			V_{allow}:	120 lbs	C :	3
Fasteners #:	(2)	$T_{allow\ (pullover)}$:	208.6 lbs			$V_{allow\ (bearing)}$:	165.4 lbs		
Shear Load :	94.79 lb per fastener					$V_{allow\ (bearing\text{-}deformation)}$:	139.9 lbs		
V_{ALLOW}:	120 lbs 0.79 **OK**								
Effective Tension						Min. Spacing =	4 in.		
Fasteners #:	(1)					Min. Edge. Dist. =	3 in.		
Tension Load :	0 lb per fastener					Min. Substrate Thickness =	2.25 in.		
T_{ALLOW}:	80 lbs 0 **OK**								
Unity Check:	0.79 + 0 = 0.79 **OK**								

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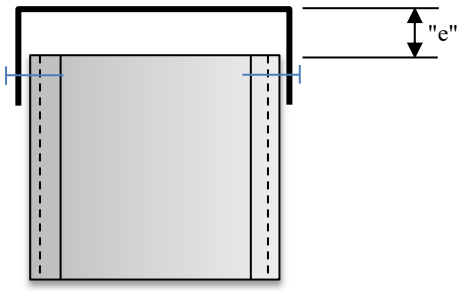
Project:	Barnes & Noble Puyallup	Pg. No:	F - 16
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: Top of Jamb {17-18}

Connection to Structure Above:

Deflection Track Design:	*Typcial Jamb Deflection Track Design*	
(AISI S211-07 Reaffirmed 2012)		
Load into Track:	88.02	lbs
Stud spacing:	16	in o.c.
Deflection Gap"e" :	1.00	in.
Thickness:	43	mil
Fy:	33	ksi
Design Thickness:	0.0451	in.
Effect. Track Length:	16.00	in.
Pn:	268	lbs
Ω :	2.8	
Pallow :	95.9	lbs
Unity:	0.92	**OK**



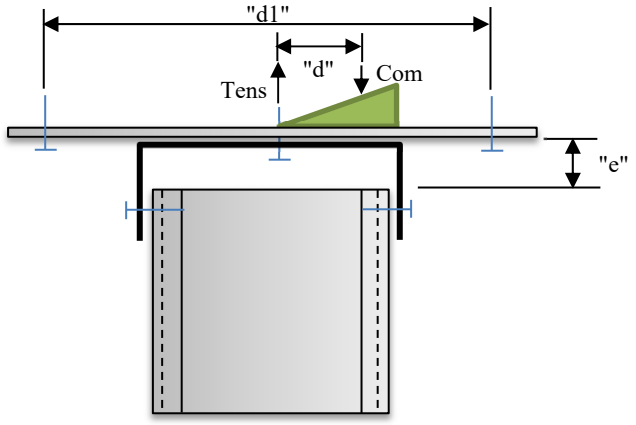
Calculation: Top of Jamb {17-18}

Connection to Structure Above cont.:

Deflection Track Connection Design — *Connection to Metal Deck Low Flute w/ Screws*

Load at Stud:	88.02	lb
Stud Spacing:	16	in o.c.
Conn. Spacing:	16	in o.c.
Load at Conn.:	88.02	lb
Eccentricity:	1	in
Moment:	88.02	lb-in
Force Couple at PL:	1.2	in
Tension Load:	72.84	lb at plate
Force Couple at Deck:	6	in
Tension Load:	14.67	lb at deck

Connection Diagrams



Light Gauge Plate Design - Flat Plate Bending — *Light Gauge Plate between Deck Low Flutes*

Loading: $M_{req.}$: 0.088 k-in.

Plate Dimension & Properties:

Plate Width 'b':	6	in.	F_y:	50	ksi.	$I_{x\text{-}x}$:	0.0001	in^4
Plate Thick:	54	mil	Ω_B:	1.67		S_x:	0.0032	in^3
Design Thick:	0.0566	in.	E:	29500	ksi.	M_{x_yeild}:	0.1602	k-in.
			Z_p:	0.0048	in^3	M_n:	0.2403	k-in.

Capacity Check:
Mn/Ω_B: 0.144 k-in.
0.61 **OK**

Screw & Light Gauge Steel Connection: — *Deflection Track to Light Gauge Plate*

Allowable Screw Capacities to CFS:

Shear Load : 88.02 lb — Shear of #8 Screw — in 43 mils (33ksi) = 244 lbs
Tension Load : 72.84 lb — Tension of #8 Screw — in 54 mils (50ksi) = 171 lbs
Pull-Over of #8 Screw — in 43 mils (33ksi) = 195 lbs

Effective Shear Fasteners #: (1)
Shear Load : 88.02 lb per fastener
V_{ALLOW}: 244 lbs 0.361 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 72.84 lb per fastener
T_{ALLOW}: 171 lbs 0.426 **OK**

Unity Check: 0.361 + 0.426 = 0.787 **OK**

Screw & Light Gauge Steel Connection: — *Light Gauge Plate Connection to Underside of Metal Deck*

Allowable Screw Capacities to CFS:

Shear Load : 88.02 lb — Shear of #8 Screw — in 33 mils (33ksi) = 164 lbs
Tension Load : 14.67 lb — Tension of #8 Screw — in 33 mils (33ksi) = 72 lbs
Pull-Over of #8 Screw — in 33 mils (33ksi) = 195 lbs

Effective Shear Fasteners #: (2)
Shear Load : 44.01 lb per fastener
V_{ALLOW}: 164 lbs 0.268 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 14.67 lb per fastener
T_{ALLOW}: 72 lbs 0.204 **OK**

Unity Check: 0.268 + 0.204 = 0.472 **OK**

Ceiling(s)
Design & Analysis

Calculation: GWB Ceiling {19-23}

Loading:		
Max Weight:	4	psf
Seismic Load:	0.485	*W [LRFD]
Seismic Load:	0.34	*W [ASD]
Seismic Load:	1.36	psf [ASD]
Vert. Seismic:	0.20	*W [LRFD]
Vert. Seismic:	0.14	*W [ASD]
SDC:	D->F	

Framing Geometry:			
Typ. Drop Wire Spacing:	4	ft o.c.	
Typ. Brace / Compression Strut Spacing:	12	ft x	12 ft
Ceiling Height AFF:	9.0	ft	
Structure Height AFF:	20.0	ft	

Cross-Tee Design:		
Spacing:	2	ft o.c.
Induced Load:	8	plf
Try:	Armstrong Drywall Grid: XL8945P	
Max Span:	4 ft	OK
Allowable Load:	22.5	plf
Unity:	0.356	OK

Main Beam Design:		
Spacing:	4	ft o.c.
Induced Load:	16	plf
Try:	Armstrong Drywall Grid: HD8906	
Max Span:	4 ft	OK
Allowable Load:	18.66	plf
Unity:	0.857	OK

Design & Analysis of Typ Drop Wire:		
Tributary Area:	16	ft^2
Tension Load:	90	lb
Support Wire, Try:	12	ga wire
Min. Tensile Strength, Fu:	70	ksi
Factor of Safety:	3.0	
Fallow:	24	ksi
Tallow:	211.8	lb
Unity:	0.425	OK
Try:	Min. (3) Twists	
Capacity:	270	lb
Unity:	0.33	OK

Design & Analysis of Typ Splay Wire:		
Tension Load:	276.6	lb
Conn. Tension Load:	276.6	lb
Support Wire, Try:	10	ga wire
Min. Tensile Strength, Fu:	70	ksi
Factor of Safety:	3.0	
Fallow:	24	ksi
Tallow:	343.5	lb
Unity:	0.805	OK
Try:	Min. (3) Twists w/in 1 in	
Capacity:	358	lb
Unity:	0.77	OK

Design Loading for Vert. Compression Post and Braces				
Vert. Tributary Area:	16	ft^2	Brace Angle:	1.0 H : 1.0 V
Tension Load:	90	lb	Brace Horz. Comp Load:	195.6 lb [ASD]
Seismic Tributary Area:	144	ft^2	Brace Vert. Comp Load:	195.6 lb [ASD]
Seismic Load:	195.6	lb [ASD]	Brace Axial Load:	276.6 lb [ASD]
Vert. Seismic Load:	9.05	lb [ASD]		
Compression Load:	150.6	lb		
Tension Load:	99.05	lb		

Calculation: GWB Ceiling {19-23}

Stud Compression Post:

Axial Load, P_u: 151 lb

Try: 250S125-33 (33ksi)

Member Properties:

Fy:	33 ksi	ß:	0.6040		
Fu:	45 ksi	x_o:	-0.8860	in	
E:	29500 ksi	r_o:	1.4090	in	
G:	11300 ksi	J:	0.000070	in^4	
µ:	0.3 ksi	C_w:	0.0400	in^6	
Ag:	0.176 in^2				
r_x:	1.007 in.				
r_y:	0.431 in.				
r_z:	in.				

Member Dimesions

Member depth:	2.500	in.
Member flange:	1.250	in.
Stiffiner Lip length:	0.188	in.
Member mil:	33	
Design Mil:	0.0346	in.
Corner Radii:	0.0764	in.
$h_{mid-line}$:	2.4654	in.
$b_{mid-line}$:	1.2154	in.
$d_{mid-line}$:	0.170	in.

Unbraced Lengths:

Lx:	11.00 ft.	Kx:	1.0
Ly:	11.00 ft.	Ky:	1.0
Lt:	11.00 ft.	Kt:	1.0

K_xL_x / r_x: 131.1

K_yL_y / r_y: 306.3

Punchouts:

Punchouts?:	Yes	
hole spacing:	24	in
hole depth:	1.25	in
hole length:	4.5	in
Min end length	12	in

Axial Capacity: 0.201 Kips OK

E2) Yielding & Global Buckling: P_{ne}/Ω_C= 0.266 kips P_{ne}= 0.479 kips λ_C: 3.261 Ω_C = 1.8 Fn: 2.722

E2.1) Check Flexural Buckling F_{cre}: 3.104 ksi

E2.2) Check Torsional & Flexural-Torsional Buckling F_{cre}: 3.104 ksi σ_t= 4.18 ksi σ_{ex}= 16.94 ksi

E3) Local Buckling Interacting with Yielding and Global Buckling P_{nl}/Ω_C= 0.201 kips P_{nl}= 0.361 kips Fn: 2.722 Ω_C = 1.8

E3.1) Effective Width Method

Effective $Area_{web}$: *Partially Effective* Eff. $length_{web}$: 1.028 in.

w_{web}:	2.278	in.	ρ_{web}:	-	λ_{web}:	-	f_{web}:	-	ksi	$F_{crl\ web}$:	-	ksi	k_{web}:	-
c_{pnch}:	0.514	in.	ρ_{pnch}:	1	λ_{pnch}:	0.228911308	f_{pnch}:	2.722	ksi	$F_{crl\ pnch}$:	51.95	ksi	k_{hole}:	0.43

Effective $Area_{flange}$: *Fully Effective* Eff. $length_{flg}$: 1.028 in.

w_{flg}:	1.028	in.	w/t:	29.71	S_{flg}:	133.25	$b_{1\ flg}$:	0.514	in.	$b_{2\ flg}$:	0.514	in.		
b_{flg}:	1.028	in.	ρ_{flg}:	1.000	λ_{flg}:	0.150	f_{flg}:	2.72	ksi	$F_{crl\ flg}$:	121	ksi	k_{flg}:	4
$I_{a\ stif}$:	0.00000	$in.^4$	$I_{s\ stif}$:	0.00000	$in.^4$	n_{flg}:	0.526	D/w:	0.182					
$d_{s\ stif}$:	0.077	in.	$d'_{s\ stif}$:	0.077	in.	$R_{I\ flg}$:	1							

Effective $Area_{stiffiner}$: *Fully Effective* Eff. $length_{stif}$: 0.077 in.

w_{stif}:	0.077	in.	ρ_{stif}:	1.000	λ_{stif}:	0.034	f_{stif}:	2.72	ksi	$F_{crl\ stif}$:	2345	ksi	k_{stif}:	0.43

Total Stud Effective Area: 0.1328 $in.^2$

E4) Distortional Buckling P_{nd}/Ω_C= 1.838 kips P_{nd}= 3.308 kips Ω_C = 1.8 λ_d: 1.366 P_{crd}: 3.113 kips P_y: 5.808 kips

F_{crd}:	17.69 ksi	$K_{\phi fe}$:	-	$K_{\phi we}$:	-	K_ϕ:	-	$K_{\phi fg}$:	-	$K_{\phi wg}$:	-				
L:	6.825	L_{crd}:	6.825	L_m:	132	A_f:	0.04794176	J_f:	1.91313E-05	I_{xf}:	5.58202E-05				
I_{yf}:	0.007084331	I_{xyf}:	0.000267138	C_{wf}:	0	X_{of}:	0.533053248	h_{xf}:	-0.68234675	h_{yf}/y_{of}:	-0.01045325				
t_{r_hole}:	0.02416 in.	$K_{\phi fe}$:	0.041654954	$K_{\phi we}$:	0.030492026	K_ϕ:	0	$K_{\phi fg}$:	0.00312475	$K_{\phi wg}$:	0.000953939				
L:	8.069	L_{crd}:	8.069	L_m:	132	A_f:	0.033481393	J_f:	6.51649E-06	I_{xf}:	3.74826E-05				
I_{yf}:	0.004947529	I_{xyf}:	0.000186563	C_{wf}:	0	X_{of}:	0.533053248	h_{xf}:	-0.68234675	h_{yf}/y_{of}:	-0.01045325				

Screw & Light Gauge Steel Connection: *Compression Post to Runner*

Allowable Screw Capacities to CFS:

Shear Load : 151 lb Shear of #8 Screw in 30 mils (33ksi) = 103 lbs

Tension Load : 0 lb Tension of #8 Screw in 30 mils (33ksi) = 48 lbs

Effective Shear Fasteners #: (2)

Shear Load : 75.3 lb per fastener

V_{ALLOW}: 103 lbs 0.731 OK

Effective Tension Fasteners #: (1)

Tension Load : 0 lb per fastener

T_{ALLOW}: 48 lbs 0 OK

Unity Check: 0.731 + 0 = 0.731 OK

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Calculation: GWB Ceiling {19-23}

Compression Post Connection to Structure:

Induced Loading	
Shear Load:	0 lb [ASD]
$Tension_{DL}$:	90 lb [ASD]
$Tension_{Seismic}$:	9.05 lb [ASD]
$Tension_{Total}$:	99.05 lb [ASD]

Light Gauge Clip - Flat Plate Bending — *Compression Post Clip to Structure*

Loading:

P_u:	0.099	k	
Ecc. :	0.75	in.	
$M_{req.}$:	0.074	k-in.	

Clip Dimension & Properties:

Clip Leg to Struct.:	1.5	in.	F_y:	33	ksi.	$I_{x\text{-}x}$:	0.0001	in^4
Clip Length 'b':	8	in.	Ω_B:	1.67		S_x:	0.0027	in^3
Clip Thick:	43	mil	E:	29500	ksi.	M_{x_yeild}:	0.0895	k-in.
Design Thick:	0.0451	in.	Z_p:	0.0041	in^3	M_n:	0.1342	k-in.

Capacity Check:
Mn/Ω_B: 0.08 k-in.
0.92 **OK**

Screw & Light Gauge Steel Connection: — *Compression Post Connection to Clip*

Allowable Screw Capacities to CFS:

Shear Load : 99 lb — Shear of #8 Screw — in 33 mils (33ksi) = 164 lbs
Tension Load : 0 lb — Tension of #8 Screw — in 33 mils (33ksi) = 72 lbs

Effective Shear Fasteners #: (3)
Shear Load : 33.02 lb per fastener
V_{ALLOW}: 164 lbs 0.201 **OK**

Effective Tension Fasteners #: (1)
Tension Load : 0 lb per fastener
T_{ALLOW}: 72 lbs 0 **OK**

Unity Check: 0.201 + 0 = 0.201 **OK**

Screw & Light Gauge Steel Connection: — *Clip Connection to Metal Deck*

Allowable Screw Capacities to CFS:

Shear Load : 0 lb — Shear of #8 Screw — in 33 mils (33ksi) = 164 lbs
Tension Load : 99 lb — Tension of #8 Screw — in 33 mils (33ksi) = 72 lbs

Effective Shear Fasteners #: (2)
Shear Load : 0 lb per fastener
V_{ALLOW}: 164 lbs 0 **OK**

Effective Tension Fasteners #: (2)
Tension Load : 49.52 lb per fastener
T_{ALLOW}: 72 lbs 0.688 **OK**

Unity Check: 0 + 0.688 = 0.688 **OK**

Calculation: GWB Ceiling {19-23}

Splay Wire Connection to Structure:

Load Bearing Clip Design per AISI D114-21 — *Splay Wire Clip Connection to Metal Deck*

Induced Loading & Design Check(s):

	Induced:	Strength:	Deflection:
F_1:	0 lbs	0.00 OK	
F_2:	196 lbs	0.35 OK	0.63 OK
F_3:	196 lbs	0.49 OK	
F_4:	196 lbs	0.04 OK	0.04 OK

Combined Strength:

Combined F_1 & F_4:	0.04 OK
Combined F_2 & F_4:	0.39 OK
Combined F_3 & F_4:	0.52 OK

Clip Properties & Fastening Geometry:

Clip Thick:	43 mil				
Design Thick, t:	0.0451 in	n_c:	(1)	S_a:	6.00 in
Clip Depth, 'B':	8.00 in	S_c:	1.00 in	D:	0.75 in
Clip Length:	1.50 in	n_h:	(1) in	d_{heel}:	1 in
F_y:	33 ksi	S_h:	1.00 in		
F_u:	45 ksi	L:	1.50 in		
E:	29500 ksi.	L / B:	0.19		
Deflection Limit, δ:	0.125 in	d_{leg}:	1 in		

Design Method: ASD

Clip Diagrams and Nomenclature:

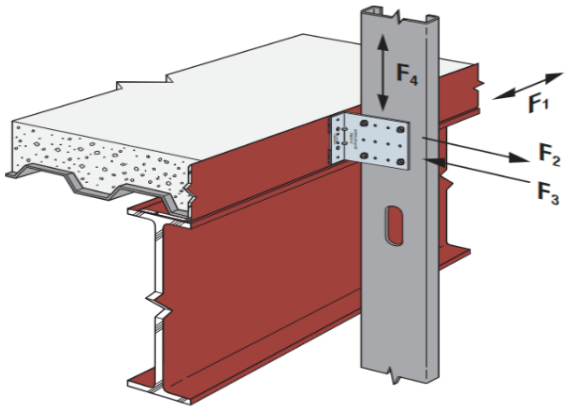

Figure 1: Clip Loading Direction(s) & Notation

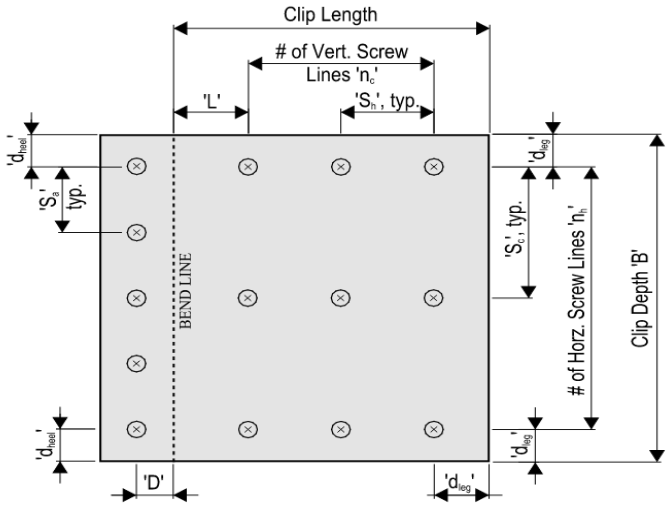

Figure 2: Clip & Fastening Dimensions

Tension Capacity (F_2):

Yielding of Gross Section [AISI S100 Ch. D]

A_g:	0.36 in^2
T_n:	11.91 k
Ω:	1.67
Tn/Ω :	7.13 k

Rupture of Net Section [AISI S100 Ch. D]

Screw Size in Cant. Leg:	#8 Screw
A_n:	0.35 in^2
T_n:	15.9 k
Ω:	2.00
Tn/Ω :	7.952 k

Pull-Over Strength of Anchored Leg [Sect. 2.4]

d'_w:	0.272 in
Single Fastener, P_{nov}:	0.414 k [Eq. 2.4-1]
(#) of Fasteners:	(4)
Total, P_{nov}:	1.656 k
Ω:	3.00
Pnov/Ω :	0.552 k

Strength: $F_{2,allow}$: 552 lb

Deflection Limit in Tension [Sect. 2.4]

ρ:	0.577 [Eq. 2.5-2]
I_y:	0.00006 in^4
P_d:	0.308 k [Eq. 2.5-1]

Deflection: $F_{2,allow}$: 308 lb

Shear Capacity (F_4):

Shear Strength of Cant. Leg [Sect. 2.1]

α:	0.13 [Eq. 2.1-5]
k:	102.47 [Eq. 2.1-7]
Poisson Ratio, μ:	0.30
F_{cr}:	86.83 ksi [Eq. 2.1-6]
λ:	0.62 [Eq. 2.1-4]
γ:	0.08 [Eq. 2.1-3]
n_c:	1.00
β:	0.12 [Eq. 2.1-2]
V_n:	3.983 k [Eq. 2.1-1]
Ω :	2.05
Vn/Ω :	1.94 k

Strength: $F_{4,allow}$: 1943 lb

Deflection Limit in Shear [Sect. 2.2]

ε:	1.00 lb/in
α:	0.13 [Eq. 2.2-2]
V_d:	4.99 k [Eq. 2.2-1]

Deflection: $F_{4,allow}$: 4990 lb

Compression Capacity (F_3):

Comp. Strength of Cant. Leg [Sect. 2.3]

B':	2.15 in
A_g:	0.10 in^2 [Eq. 2.3-2]
λ:	33.26 [Eq. 2.3-4]
k:	0.99
Poisson Ratio, μ:	0.30
F_{cr}:	23.83 ksi [Eq. 2.3-5]
F_n:	10.37 ksi [Eq. 2.3-3]
P_n:	1.01 k [Eq. 2.3-1]
Ω:	2.50
Pn/Ω :	0.403 k

Strength: $F_{3,allow}$: 403 lb

In-Plane Bending Capacity (F_1):

I_y:	0.0001 in^4	Yielding			
S_y:	0.0027 in^3	M_p:	0.134 k-in	Pn:	0.089 k
Z_y:	0.0041 in^3	$1.6M_y$:	0.143 k-in	Ω:	1.67
'e':	1.50 in	M_n:	0.134 k-in	Pn/Ω :	0.054 k

Strength: $F_{1,allow}$: 54 lb

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Project:	Barnes & Noble Puyallup	Pg. No:	F - 22
Address:	3500 S. Meridian St., Puyallup, WA 98373	Date:	12/20/24
Client:	WJCA	Job No.:	24438

Calculation: GWB Ceiling {19-23}

Hanger Wire Connection to Structure:

Load Bearing Clip Design per AISI D114-21 — *Hanger Wire Clip Connection to Metal Deck*

Induced Loading & Design Check(s):

	Induced:	Strength:	Deflection:
F_1:	0 lbs	0.00 OK	
F_2:	90 lbs	0.85 OK	0.92 OK
F_3:	0 lbs	0.00 OK	
F_4:	0 lbs	0.00 OK	0.00 OK

Combined Strength:

Combined F_1 & F_4: 0.00 OK

Combined F_2 & F_4: 0.85 OK

Combined F_3 & F_4: 0.00 OK

Clip Properties & Fastening Geometry:

Clip Thick:	33	mil			
Design Thick, t:	0.0346	in	n_c:	(1)	S_a: 1.00 in
Clip Depth, 'B':	2.00	in	S_c:	1.00 in	D: 0.75 in
Clip Length:	2.00	in	n_h:	(2)	d_{heel}: 1 in
F_y:	33	ksi	S_h:	1.00 in	
F_u:	45	ksi	L:	1.00 in	
E:	29500	ksi.	L / B:	0.50	
Deflection Limit, δ:	0.125	in	d_{leg}:	0.5 in	

Design Method: ASD

Clip Diagrams and Nomenclature:

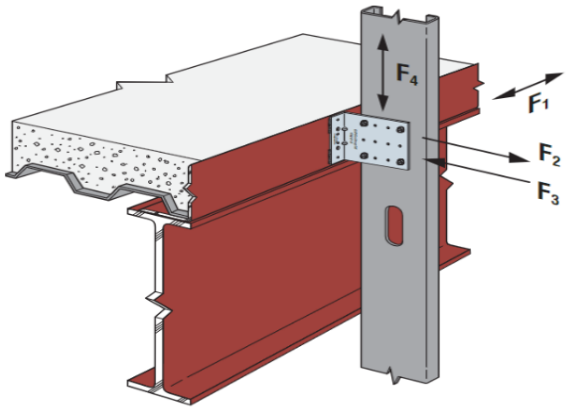

Figure 1: Clip Loading Direction(s) & Notation

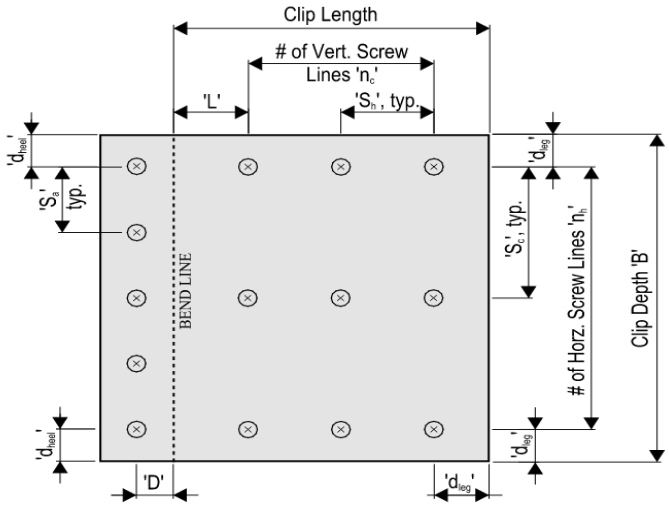

Figure 2: Clip & Fastening Dimensions

Tension Capacity (F_2):

Yielding of Gross Section [AISI S100 Ch. D]

A_g: 0.07 in^2

T_n: 2.284 k

Ω: 1.67

Tn/Ω : 1.367 k

Rupture of Net Section [AISI S100 Ch. D]

Screw Size in Cant. Leg: #8 Screw

A_n: 0.06 in^2

T_n: 2.603 k

Ω: 2.00

Tn/Ω : 1.302 k

Pull-Over Strength of Anchored Leg [Sect. 2.4]

d'w: 0.272 in

Single Fastener, P_{nov}: 0.318 k [Eq. 2.4-1]

(#) of Fasteners: (1)

Total, P_{nov}: 0.318 k

Ω: 3.00

Pnov/Ω : 0.106 k

Strength: $F_{2,allow}$: 106 lb

Deflection Limit in Tension [Sect. 2.4]

ρ: 1.613 [Eq. 2.5-2]

I_y: 0.00001 in^4

P_d: 0.097 k [Eq. 2.5-1]

Deflection: $F_{2,allow}$: 97 lb

Shear Capacity (F_4):

Shear Strength of Cant. Leg [Sect. 2.1]

α: 0.50 [Eq. 2.1-5]

k: 11.82 [Eq. 2.1-7]

Poisson Ratio, μ: 0.30

F_{cr}: 94.32 ksi [Eq. 2.1-6]

λ: 0.59 [Eq. 2.1-4]

γ: 0.30 [Eq. 2.1-3]

n_c: 1.00

β: 0.12 [Eq. 2.1-2]

V_n: 0.446 k [Eq. 2.1-1]

Ω : 2.05

Vn/Ω : 0.22 k

Strength: $F_{4,allow}$: 218 lb

Deflection Limit in Shear [Sect. 2.2]

ε: 1.00 lb/in

α: 0.50 [Eq. 2.2-2]

V_d: 0.805 k [Eq. 2.2-1]

Deflection: $F_{4,allow}$: 805 lb

Compression Capacity (F_3):

Comp. Strength of Cant. Leg [Sect. 2.3]

B': 2.00 in

A_g: 0.07 in^2 [Eq. 2.3-2]

λ: 28.90 [Eq. 2.3-4]

k: 0.97

Poisson Ratio, μ: 0.30

F_{cr}: 31.06 ksi [Eq. 2.3-5]

F_n: 11.04 ksi [Eq. 2.3-3]

P_n: 0.76 k [Eq. 2.3-1]

Ω: 2.50

Pn/Ω : 0.306 k

Strength: $F_{3,allow}$: 306 lb

In-Plane Bending Capacity (F_1):

I_y: 0.0000 in^4

S_y: 0.0004 in^3

Z_y: 0.0006 in^3

'e': 1.00 in

Yielding

M_p: 0.02 k-in

$1.6M_y$: 0.021 k-in

M_n: 0.02 k-in

Pn: 0.02 k

Ω: 1.67

Pn/Ω : 0.012 k

Strength: $F_{1,allow}$: 12 lb

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