PCS Structural Solutions

Seattle | 1011 Western Avenue, Suite 810 | Seattle, WA 98104 | 206.292.5076
Tacoma | 1250 Pacific Avenue, Suite 701 | Tacoma, WA 98402 | 253.383.2797
Portland | 101 SW Main Street, Suite 280 | Portland, OR 97204 | 503.232.3746

www.pcs-structural.com

SUPPLEMENTAL STRUCTURAL CALCULATIONS

BUILDING PERMIT CORRECTIONS #3

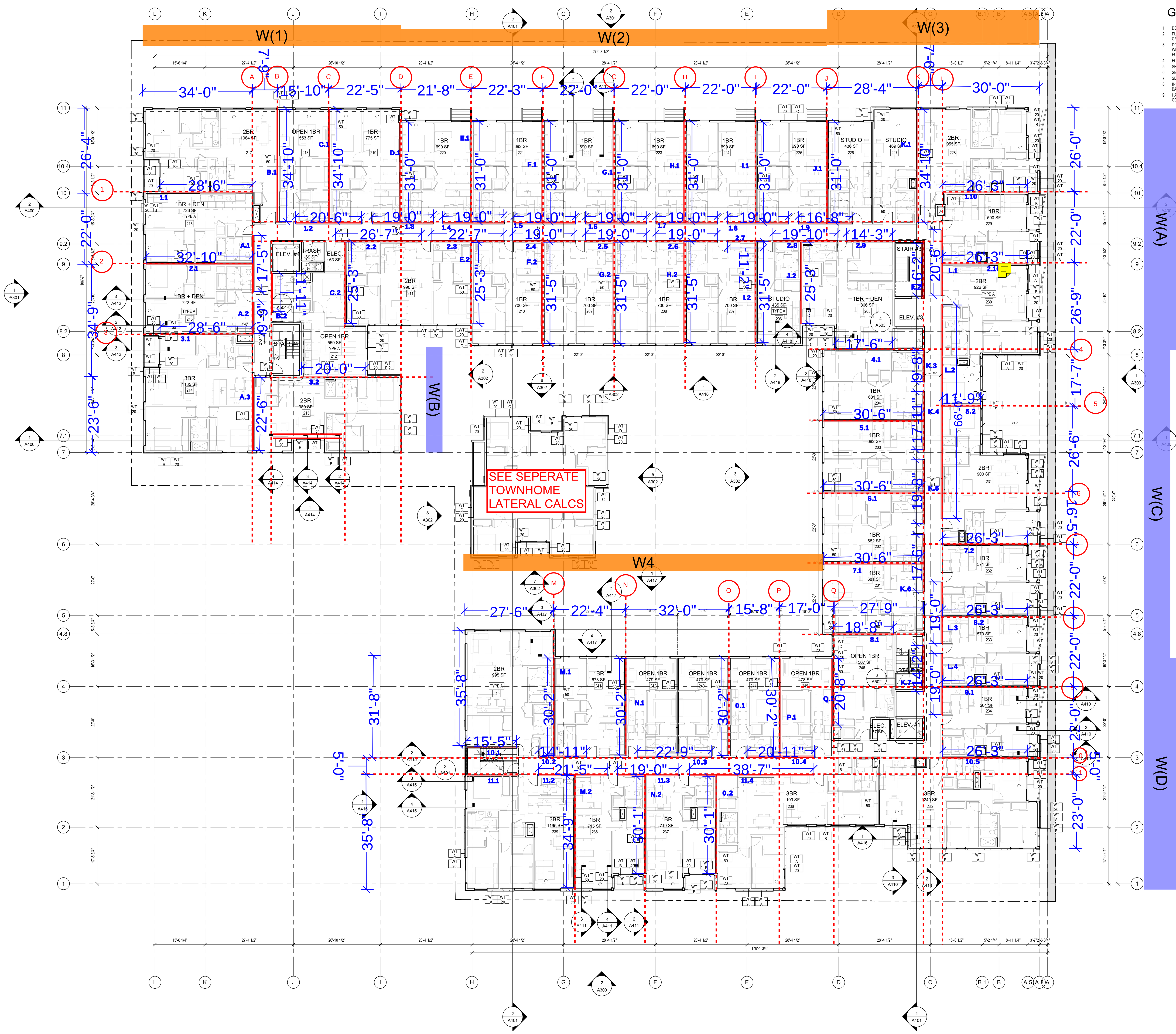
FOR

MERCER ISLAND MIXED USED
2885 78TH AVE SE
MERCER ISLAND, WA 98040

PREPARED BY
PCS STRUCTURAL *SOLUTIONS*

DECEMBER 13, 2022
19-028

S001 – GENERAL NOTES



1 LEVEL 2
1" = 10'-0"

GENERAL - FLOOR PLAN NOTES

1. DO NOT SCALE DRAWINGS.
2. PLAN DIMENSIONS ARE TO FACE OF STUD, FACE OF CONCRETE WALL, CENTERLINE OF COLUMN, OR CENTERLINE OF ROUGH OPENINGS, UON. CONTACT ARCHITECT FOR CLARIFICATIONS.
3. DOORS AND CASED OPENINGS INDICATED ADJACENT TO WALL INTERSECTIONS SHALL BE LOCATED WITH THE EDGE OF FINISH OPENING SIX INCHES FROM THE ADJACENT WALL AT THE EXTERIOR AND FOUR INCHES FROM THE ADJACENT WALL.
4. FOR KITCHEN / BATH / WASHER-DRYER FAN LOCATIONS, SEE MECHANICAL DWGS.
5. SEE SHEET A-XXX & A-XXX FOR WINDOW SCHEDULE AND DETAILS.
6 SEE SHEET A-XXX & A-XXX FOR DOOR SCHEDULE AND DETAILS.
7 SEE SHEET A-XXX & A-XXX FOR WALL ASSEMBLIES.
8 INSTALL BLOCKING FOR GRAB BARS IN ALL BATHROOM WALLS SURROUNDING WATER CLOSET, BATHTUB AND SHOWER. REF. A-XXX.
9 HANDRAILS SHALL RETURN TO A WALL, GUARD OR THE WALKING SURFACE OR SHALL BE CONTINUOUS TO THE HANDRAIL OF AN ADJACENT STAIR FLIGHT OR RAMP RUN - PER IBC 1012.5

JA

Johnston Architects, LLC
100 NE Northlake Way,
Suite 200
Seattle, WA 98105
t 206.523.6150
f 206.523.9382

4039 REGISTERED ARCHITECT
RAYMOND S. JOHNSTON
State of Washington

MERCER ISLAND MIXED USE

2885 78TH AVE SE
MERCER ISLAND, WA 98040

DRAWING ISSUE

Date	Description
12/24/2019	LAND USE SET
03/31/2020	50% CD
06/26/2020	LAND USE SET REV #1
10/01/2020	BUILDING PERMIT / 75% CD

SHEET TITLE
LEVEL 2 FLOOR PLAN

SHEET NO.
A202

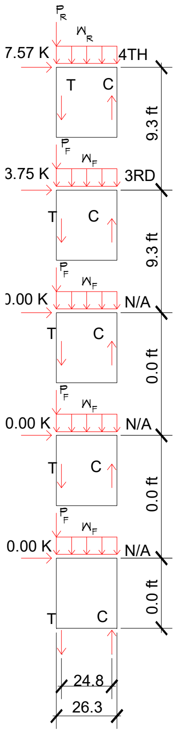
Drawn
Checked

Project: Mercer Island Mixed Use Job Number: 19028

Multiplier:

Sheet: of Name: AED

Originating Office: Seattle Date: 09/27/21



STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W1.10

C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	1	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	0.67	ft	1+ 0.14Sds =	1.13	
Trib Area =	0.00	ft^2	*Resists uplift only (due to near walls)*		
L =	26.3 ft		*Total Wall Length*		
L_{HD} =	24.8 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	213	A	0.46	0.5	0.44	(4)	2x4	0.714	0.012	OK
4TH	DF	419	A	0.91	0.75	0.51	(4)	2x4	0.633	0.014	OK
3RD	DF	521	B	0.87	0.875	0.69	(5)	2x4	0.858	0.014	OK
N/A	DF	521	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	521	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	521	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	v_u plf	Add Load lbs	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	299	0	7.84 K	7.84	0.00	0.13	14.5 ft	14.5	113.7	45.2	1.9
4TH	288	0	7.57 K	15.41	0.00	0.10	9.3 ft	23.8	257.0	79.8	4.9
3RD	143	0	3.75 K	19.16	0.00	0.10	9.3 ft	33.1	435.1	114.3	9.0
N/A	0	0	0.00 K	19.16	0.00	0.02	0.0 ft	33.1	435.1	120.0	0.0
N/A	0	0	0.00 K	19.16	0.00	0.02	0.0 ft	33.1	435.1	125.8	0.0
N/A	0	0	0.00 K	19.16	0.00	0.02	0.0 ft	33.1	435.1	131.5	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	299	15	0.180	21	1.50E+06	13.5	0.276	0.935	0.105	30.1	0.362	1.298	0.180
4TH	587	15	0.180	21	1.50E+06	8.3	0.328	0.659	0.068	16.6	0.128	0.787	0.180
3RD	730	19	0.180	26	1.50E+06	8.3	0.331	0.331	0.068	8.3	0.068	0.398	0.180
N/A	730	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	730	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	730	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	4.3	3.093	13.5	0.087	147	625	206	0.236	0.714	0.714
4TH	0.00	0.00	0.00	9.8	6.992	8.3	0.221	333	625	526	0.533	0.633	0.633
3RD	0.00	0.00	0.00	16.6	11.841	8.3	0.221	451	625	526	0.722	0.858	0.858
N/A	0.00	0.00	0.00	16.6	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.6	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.6	0.000	0.0	0.000	0	625	0			0.000

PCS Structural Solutions

Project: Mercer Island Mixed Use Job Number: 19028

Sheet: ____ of ____ Name: AED

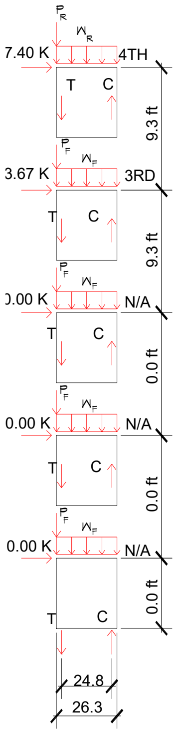
Originating Office: Seattle Date: 09/27/21

Multiplier:

STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W2.10



C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	1	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	19.50	ft	1+ 0.14Sds =	1.13	
Trib Area =	0.00	ft^2	*Resists uplift only (due to near walls)*		
L =	26.3 ft		*Total Wall Length*		
L_{HD} =	24.8 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	209	A	0.45	HDU-02	0.52	(4)	2x4	0.699	0.012	OK
4TH	DF	410	A	0.89	NONE	0.00	(4)	2x4	0.619	0.014	OK
3RD	DF	510	B	0.85	NONE	0.00	(4)	2x4	1.049	0.014	OK
N/A	DF	510	B	0.00	NONE	0.00	(2)	2x4	0.000	0.000	OK
N/A	DF	510	B	0.00	NONE	0.00	(2)	2x4	0.000	0.000	OK
N/A	DF	510	B	0.00	NONE	0.00	(2)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load lbs	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	292	0	7.67 K	7.67	0.00	0.15	14.5 ft	14.5	111.1	51.7	1.6
4TH	282	0	7.40 K	15.07	0.00	0.57	9.3 ft	23.8	251.3	248.5	0.0
3RD	140	0	3.67 K	18.74	0.00	0.57	9.3 ft	33.1	425.5	445.3	0.0
N/A	0	0	0.00 K	18.74	0.00	0.49	0.0 ft	33.1	425.5	613.2	0.0
N/A	0	0	0.00 K	18.74	0.00	0.49	0.0 ft	33.1	425.5	781.2	0.0
N/A	0	0	0.00 K	18.74	0.00	0.49	0.0 ft	33.1	425.5	949.1	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	292	15	0.180	21	1.50E+06	13.5	0.270	0.916	0.105	30.1	0.362	1.278	0.180
4TH	574	15	0.180	21	1.50E+06	8.3	0.321	0.645	0.068	16.6	0.128	0.773	0.180
3RD	714	19	0.180	21	1.50E+06	8.3	0.324	0.324	0.068	8.3	0.068	0.392	0.180
N/A	714	19	0.000	11	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	714	19	0.000	11	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	714	19	0.000	11	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	4.2	3.024	13.5	0.087	144	625	206	0.230	0.699	0.699
4TH	0.00	0.00	0.00	9.6	6.838	8.3	0.221	326	625	526	0.521	0.619	0.619
3RD	0.00	0.00	0.00	16.2	11.579	8.3	0.221	551	625	526	0.882	1.049	1.049
N/A	0.00	0.00	0.00	16.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.2	0.000	0.0	0.000	0	625	0			0.000

Project: Mercer Island Mixed Use   Job Number: 19028

Sheet: ______ of ______   Name: AED

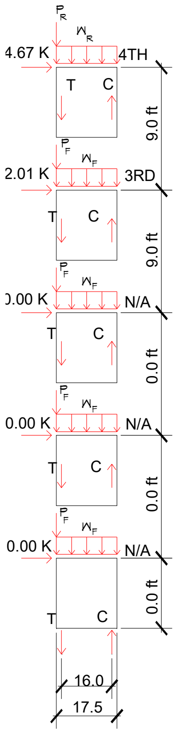
Originating Office: Seattle   Date: 09/27/21

Multiplier:

STATUS: NO GOOD!

MULTI-STORY SHEARWALL DESIGN:

WALL W4.1



C_s =	0.142		Wall Weight =	9	psf	
S_{DS} =	0.92	sec	Roof Dead =	18	psf	
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf	
Trib Width =	10.63	ft	1+ 0.14Sds =	1.13		
Trib Area =	5.00	ft²	*Resists uplift only (due to near walls)*			
L =	17.5 ft		*Total Wall Length*			
L_{HD} =	16.0 ft		*Distance from Holdown to comp post*			

THIS CALCULATION ASSUMES WALL STUDS UNBRACED FOR FULL SHEAR WALL HEIGHT. STUDS ARE BRACED BY LANDING AT MID-HEIGHT - COMPR. STUDS OK BY INSPECTION

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	171	A	0.37	0.5	0.42	(4)	2x4	1.626	0.014	NO GOOD!
4TH	DF	337	A	0.73	0.5	0.75	(4)	2x4	0.664	0.013	OK
3RD	DF	419	A	0.91	0.625	0.81	(5)	2x4	0.832	0.015	OK
N/A	DF	419	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	419	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	419	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load k	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	240	1.24	5.43 K	5.43	0.09	0.36	18.7 ft	18.7	101.5	56.6	1.8
4TH	232	0.62	4.67 K	10.11	0.13	0.35	9.0 ft	27.7	192.5	111.9	3.2
3RD	115	0	2.01 K	12.12	0.13	0.35	9.0 ft	36.7	301.5	167.1	5.4
N/A	0	0	0.00 K	12.12	0.13	0.27	0.0 ft	36.7	301.5	210.0	0.0
N/A	0	0	0.00 K	12.12	0.13	0.27	0.0 ft	36.7	301.5	252.8	0.0
N/A	0	0	0.00 K	12.12	0.13	0.27	0.0 ft	36.7	301.5	295.7	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	240	15	0.180	21	1.50E+06	17.7	0.303	0.875	0.210	33.7	0.698	1.573	0.180
4TH	472	15	0.180	21	1.50E+06	8.0	0.255	0.572	0.101	16.0	0.191	0.763	0.180
3RD	586	15	0.180	26	1.50E+06	8.0	0.316	0.316	0.101	8.0	0.101	0.418	0.180
N/A	586	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	586	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	586	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	5.8	4.142	17.7	0.051	197	625	121	0.316	1.626	1.626
4TH	0.00	0.00	0.00	11.0	7.855	8.0	0.237	374	625	563	0.599	0.664	0.664
3RD	0.00	0.00	0.00	17.2	12.306	8.0	0.237	469	625	563	0.750	0.832	0.832
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000

PCS Structural Solutions

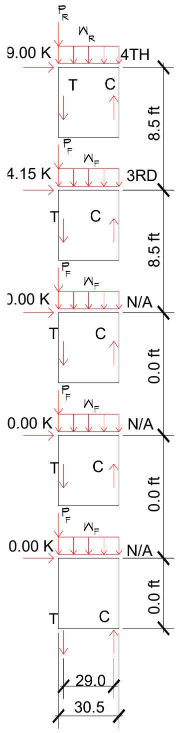
Project: Mercer Island Mixed Use   Job Number: 19028

Sheet: ____ of ____   Name: AED

Originating Office: Seattle   Date: 09/27/21

Multiplier:

STATUS: NO GOOD!



MULTI-STORY SHEARWALL DESIGN:

WALL W5.1

C_s = 0.142

S_{DS} = 0.92 sec

0.9- 0.14Sds = 0.77

Trib Width = 10.63 ft

Trib Area = 5.00 ft² *Resists uplift only (due to near walls)*

L = 30.5 ft *Total Wall Length*

L_{HD} = 29.0 ft *Distance from Holdown to comp post*

Wall Weight = 9 psf

Roof Dead = 18 psf

Floor Dead = 25 psf

1+ 0.14Sds = 1.13

THIS CALCULATION ASSUMES WALL STUDS UNBRACED FOR FULL SHEAR WALL HEIGHT. STUDS ARE BRACED BY LANDING AT MID-HEIGHT - COMPR. STUDS OK BY INSPECTION

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	203	A	0.44	NONE	0.07	(4)	2x4	1.701	0.011	NO GOOD!
4TH	DF	399	A	0.87	NONE	0.00	(4)	2x4	0.617	0.013	OK
3RD	DF	496	B	0.83	NONE	0.28	(5)	2x4	0.773	0.013	OK
N/A	DF	496	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	496	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	496	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load k	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	284	1.24	9.91 K	9.91	0.09	0.36	18.7 ft	18.7	185.0	169.9	0.0
4TH	275	0.62	9.00 K	18.91	0.13	0.34	8.5 ft	27.2	345.8	332.8	0.0
3RD	136	0	4.15 K	23.06	0.13	0.34	8.5 ft	35.7	541.8	495.7	0.2
N/A	0	0	0.00 K	23.06	0.13	0.27	0.0 ft	35.7	541.8	623.1	0.0
N/A	0	0	0.00 K	23.06	0.13	0.27	0.0 ft	35.7	541.8	750.5	0.0
N/A	0	0	0.00 K	23.06	0.13	0.27	0.0 ft	35.7	541.8	877.8	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	284	15	0.180	21	1.50E+06	17.7	0.349	0.914	0.116	32.7	0.382	1.296	0.180
4TH	559	15	0.180	21	1.50E+06	7.5	0.282	0.565	0.053	15.0	0.099	0.665	0.180
3RD	695	19	0.180	26	1.50E+06	7.5	0.284	0.284	0.053	7.5	0.053	0.337	0.180
N/A	695	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	695	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	695	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	6.1	4.334	17.7	0.051	206	625	121	0.330	1.701	1.701
4TH	0.00	0.00	0.00	11.3	8.098	7.5	0.267	386	625	634	0.617	0.608	0.617
3RD	0.00	0.00	0.00	17.8	12.687	7.5	0.267	483	625	634	0.773	0.762	0.773
N/A	0.00	0.00	0.00	17.8	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.8	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.8	0.000	0.0	0.000	0	625	0			0.000

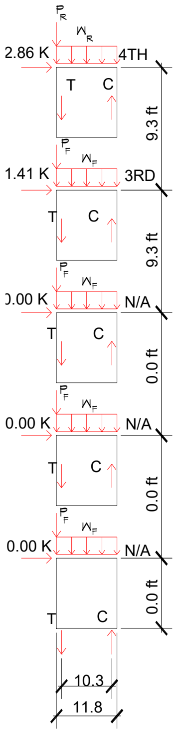
Structural Solutions

Project: Mercer Island Mixed Use   Job Number: 19028

Sheet: ____ of ____   Name: AED

Originating Office: Seattle   Date: 09/27/21

Multiplier:



STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W5.2

C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	18	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	2.00	ft	1+ 0.14Sds =	1.13	
Trib Area =	5.00	ft^2	*Resists uplift only (due to near walls)*		
L =	11.8 ft		*Total Wall Length*		
L_{HD} =	10.3 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	180	A	0.39	0.5	0.48	(4)	2x4	0.602	0.019	OK
4TH	DF	353	A	0.77	0.625	0.75	(4)	2x4	0.534	0.015	OK
3RD	DF	439	A	0.95	0.75	0.92	(4)	2x4	0.904	0.018	OK
N/A	DF	439	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	439	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	439	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load lbs	V k	ΣV k	P' k	W' klf	h ft	Σh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	252	0	2.96 K	2.96	0.09	0.17	14.5 ft	14.5	42.9	12.6	2.0
4TH	243	0	2.86 K	5.81	0.13	0.13	9.3 ft	23.8	96.9	23.2	5.0
3RD	120	0	1.41 K	7.23	0.13	0.13	9.3 ft	33.1	164.1	33.9	8.9
N/A	0	0	0.00 K	7.23	0.13	0.05	0.0 ft	33.1	164.1	38.9	0.0
N/A	0	0	0.00 K	7.23	0.13	0.05	0.0 ft	33.1	164.1	43.8	0.0
N/A	0	0	0.00 K	7.23	0.13	0.05	0.0 ft	33.1	164.1	48.7	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	252	15	0.180	21	1.50E+06	13.5	0.242	0.872	0.255	30.1	0.875	1.746	0.180
4TH	495	15	0.180	21	1.50E+06	8.3	0.281	0.630	0.163	16.6	0.309	0.939	0.180
3RD	615	15	0.180	21	1.50E+06	8.3	0.349	0.349	0.163	8.3	0.163	0.512	0.180
N/A	615	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	615	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	615	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

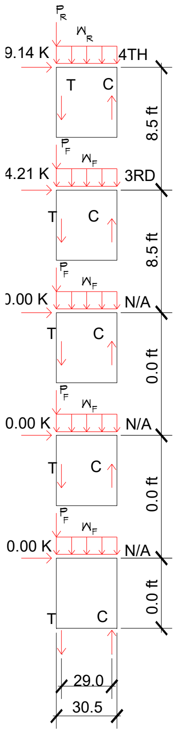
Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	3.6	2.606	13.5	0.087	124	625	206	0.199	0.602	0.602
4TH	0.00	0.00	0.00	8.2	5.892	8.3	0.221	281	625	526	0.449	0.534	0.534
3RD	0.00	0.00	0.00	14.0	9.977	8.3	0.221	475	625	526	0.760	0.904	0.904
N/A	0.00	0.00	0.00	14.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	14.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	14.0	0.000	0.0	0.000	0	625	0			0.000

Project: Mercer Island Mixed Use Job Number: 19028

Multiplier:

Sheet: of Name: AED

Originating Office: Seattle Date: 09/27/21



STATUS: NO GOOD!

MULTI-STORY SHEARWALL DESIGN:

WALL W6.1

C_s = 0.142
S_{DS} = 0.92 sec
0.9- 0.14Sds = 0.77
Trib Width = 10.63 ft
Trib Area = 5.00 ft^2
L = 30.5 ft *Total Wall Length*
L_{HD} = 29.0 ft *Distance from Holdown to comp post*

Wall Weight = 9 psf
Roof Dead = 18 psf
Floor Dead = 25 psf
1+ 0.14Sds = 1.13
Resists uplift only (due to near walls)

THIS CALCULATION ASSUMES WALL STUDS UNBRACED FOR FULL SHEAR WALL HEIGHT. STUDS ARE BRACED BY LANDING AT MID-HEIGHT - COMPR. STUDS OK BY INSPECTION

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	206	A	0.45	NONE	0.00	(2)	2x4	2.927	0.011	NO GOOD!
4TH	DF	406	A	0.88	NONE	0.00	(3)	2x4	0.811	0.013	OK
3RD	DF	505	B	0.84	NONE	0.38	(5)	2x4	0.771	0.013	OK
N/A	DF	505	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	505	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	505	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load k	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	289	1.24	10.05 K	10.05	0.09	0.35	17.7 ft	17.7	178.0	165.8	0.0
4TH	279	0.62	9.14 K	19.19	0.13	0.34	8.5 ft	26.2	341.1	328.7	0.0
3RD	138	0	4.21 K	23.40	0.13	0.34	8.5 ft	34.7	540.0	491.7	0.2
N/A	0	0	0.00 K	23.40	0.13	0.27	0.0 ft	34.7	540.0	619.0	0.0
N/A	0	0	0.00 K	23.40	0.13	0.27	0.0 ft	34.7	540.0	746.4	0.0
N/A	0	0	0.00 K	23.40	0.13	0.27	0.0 ft	34.7	540.0	873.8	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	289	15	0.180	11	1.50E+06	16.7	0.345	0.921	0.110	31.7	0.364	1.284	0.180
4TH	568	15	0.180	16	1.50E+06	7.5	0.287	0.575	0.053	15.0	0.099	0.675	0.180
3RD	706	19	0.180	26	1.50E+06	7.5	0.288	0.288	0.053	7.5	0.053	0.341	0.180
N/A	706	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	706	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	706	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	5.8	4.168	16.7	0.057	397	625	136	0.635	2.927	2.927
4TH	0.00	0.00	0.00	11.2	7.987	7.5	0.267	507	625	634	0.811	0.799	0.811
3RD	0.00	0.00	0.00	17.7	12.646	7.5	0.267	482	625	634	0.771	0.759	0.771
N/A	0.00	0.00	0.00	17.7	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.7	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.7	0.000	0.0	0.000	0	625	0			0.000

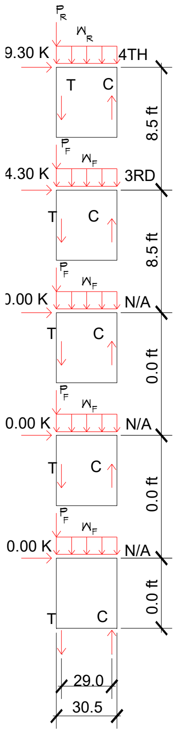
Project:	Mercer Island Mixed Use	Job Number:	19028
Sheet:	of	Name:	AED
Originating Office:	Seattle	Date:	09/27/21

Multiplier:

STATUS: NO GOOD!

MULTI-STORY SHEARWALL DESIGN:

WALL W7.1



C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	18	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	10.63	ft	1+ 0.14Sds =	1.13	
Trib Area =	5.00	ft²	*Resists uplift only (due to near walls)*		
L =	30.5 ft		*Total Wall Length*		
L_{HD} =	29.0 ft		*Distance from Holdown to comp post*		

THIS CALCULATION ASSUMES WALL STUDS UNBRACED FOR FULL SHEAR WALL HEIGHT. STUDS ARE BRACED BY LANDING AT MID-HEIGHT - COMPR. STUDS OK BY INSPECTION

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	211	A	0.46	NONE	0.08	(4)	2x4	1.481	0.011	NO GOOD!
4TH	DF	414	A	0.90	NONE	0.00	(4)	2x4	0.619	0.013	OK
3RD	DF	515	B	0.86	NONE	0.74	(5)	2x4	0.784	0.014	OK
N/A	DF	515	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	515	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK
N/A	DF	515	B	0.00	NONE	0.00	(5)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u	Add Load	V	SV	P'	W'	h	Sh	M_{OT}	M_R	T_{ASD}
	plf	k	k	k	k	klf	ft	ft	kft	kft	k
ROOF	295	1.24	10.23 K	10.23	0.09	0.35	17.7 ft	17.7	180.8	165.7	0.1
4TH	285	0.62	9.30 K	19.53	0.13	0.34	8.5 ft	26.2	346.8	328.6	0.0
3RD	141	0	4.30 K	23.84	0.13	0.34	8.5 ft	34.7	549.4	491.6	0.5
N/A	0	0	0.00 K	23.84	0.13	0.27	0.0 ft	34.7	549.4	618.9	0.0
N/A	0	0	0.00 K	23.84	0.13	0.27	0.0 ft	34.7	549.4	746.3	0.0
N/A	0	0	0.00 K	23.84	0.13	0.27	0.0 ft	34.7	549.4	873.6	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u	G_a	D_s	A_{chord}	E	h	d_{WALL}	Sd_{WALL}	d_{HD}	Sh	Sd_{HD}	d_{TOT}	Stretch
	plf	k-in	in	in2	psi	ft	in	in	in	ft	in	in	in
ROOF	295	15	0.180	21	1.50E+06	16.7	0.340	0.926	0.110	31.7	0.363	1.289	0.180
4TH	580	15	0.180	21	1.50E+06	7.5	0.292	0.586	0.053	15.0	0.099	0.685	0.180
3RD	721	19	0.180	26	1.50E+06	7.5	0.294	0.294	0.053	7.5	0.053	0.347	0.180
N/A	721	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	721	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	721	19	0.000	26	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D	L	S	E	C_{ASD}	h	C_p	f_c	F_{cp}	F_c'	f_c/F_{cp}	f_c/F_c'	MAX
	k	k	k	k	k	ft		psi	psi	psi			
ROOF	0.00	0.00	0.00	5.9	4.233	16.7	0.057	202	625	136	0.323	1.481	1.481
4TH	0.00	0.00	0.00	11.4	8.122	7.5	0.267	387	625	634	0.619	0.610	0.619
3RD	0.00	0.00	0.00	18.0	12.867	7.5	0.267	490	625	634	0.784	0.773	0.784
N/A	0.00	0.00	0.00	18.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	18.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	18.0	0.000	0.0	0.000	0	625	0			0.000

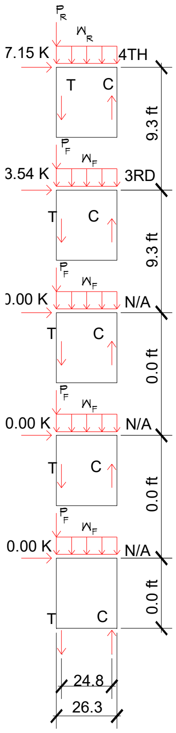
Structural Solutions

Project: Mercer Island Mixed Use Job Number: 19028

Sheet: of Name: AED

Originating Office: Seattle Date: 09/27/21

Multiplier:



STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W7.2

C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	1	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	10.63	ft	1+ 0.14Sds =	1.13	
Trib Area =	5.00	ft^2	*Resists uplift only (due to near walls)*		
L =	26.3 ft		*Total Wall Length*		
L_{HD} =	24.8 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	201	A	0.44	0.5	0.37	(4)	2x4	0.674	0.011	OK
4TH	DF	396	A	0.86	0.5	0.38	(4)	2x4	0.598	0.013	OK
3RD	DF	492	B	0.82	0.5	0.62	(4)	2x4	1.012	0.014	OK
N/A	DF	492	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	492	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	492	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load lbs	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	282	0	7.40 K	7.40	0.01	0.14	14.5 ft	14.5	107.3	48.8	1.6
4TH	272	0	7.15 K	14.54	0.13	0.35	9.3 ft	23.8	242.5	172.4	1.6
3RD	135	0	3.54 K	18.08	0.13	0.35	9.3 ft	33.1	410.7	296.0	2.6
N/A	0	0	0.00 K	18.08	0.13	0.27	0.0 ft	33.1	410.7	390.8	0.0
N/A	0	0	0.00 K	18.08	0.13	0.27	0.0 ft	33.1	410.7	485.6	0.0
N/A	0	0	0.00 K	18.08	0.13	0.27	0.0 ft	33.1	410.7	580.4	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	282	15	0.180	21	1.50E+06	13.5	0.261	0.884	0.105	30.1	0.362	1.246	0.180
4TH	554	15	0.180	21	1.50E+06	8.3	0.310	0.623	0.068	16.6	0.128	0.751	0.180
3RD	689	19	0.180	21	1.50E+06	8.3	0.313	0.313	0.068	8.3	0.068	0.381	0.180
N/A	689	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	689	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	689	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	4.1	2.918	13.5	0.087	139	625	206	0.222	0.674	0.674
4TH	0.00	0.00	0.00	9.2	6.599	8.3	0.221	314	625	526	0.503	0.598	0.598
3RD	0.00	0.00	0.00	15.6	11.174	8.3	0.221	532	625	526	0.851	1.012	1.012
N/A	0.00	0.00	0.00	15.6	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	15.6	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	15.6	0.000	0.0	0.000	0	625	0			0.000

PCS Structural Solutions

Project: Mercer Island Mixed Use Job Number: 19028

Sheet: of Name: AED

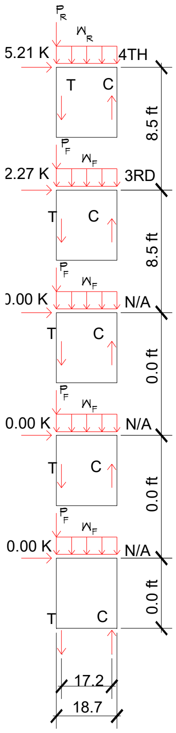
Originating Office: Seattle Date: 09/27/21

Multiplier:

STATUS: NO GOOD!

MULTI-STORY SHEARWALL DESIGN:

WALL W8.1



C_s =	0.142		Wall Weight =	9	psf	
S_{DS} =	0.92	sec	Roof Dead =	18	psf	
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf	
Trib Width =	11.00	ft	1+ 0.14Sds =	1.13		
Trib Area =	5.00	ft^2	*Resists uplift only (due to near walls)*			
L =	18.7 ft		*Total Wall Length*			
L_{HD} =	17.2 ft		*Distance from Holdown to comp post*			

THIS CALCULATION ASSUMES WALL STUDS UNBRACED FOR FULL SHEAR WALL HEIGHT. STUDS ARE BRACED BY LANDING AT MID-HEIGHT - COMPR. STUDS OK BY INSPECTION

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	182	A	0.40	0.5	0.40	(4)	2x4	1.680	0.014	NO GOOD!
4TH	DF	357	A	0.78	0.5	0.66	(4)	2x4	0.604	0.013	OK
3RD	DF	444	A	0.97	0.625	0.71	(5)	2x4	0.750	0.016	OK
N/A	DF	444	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	444	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	444	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u	Add Load	V	SV	P'	W'	h	Sh	M_{OT}	M_R	T_{ASD}
	plf	k	k	k	k	klf	ft	ft	kft	kft	k
ROOF	254	1.24	5.99 K	5.99	0.09	0.37	18.7 ft	18.7	111.9	65.5	1.7
4TH	246	0.62	5.21 K	11.20	0.13	0.35	8.5 ft	27.2	207.1	129.1	2.8
3RD	122	0	2.27 K	13.47	0.13	0.35	8.5 ft	35.7	321.6	192.7	4.7
N/A	0	0	0.00 K	13.47	0.13	0.28	0.0 ft	35.7	321.6	242.9	0.0
N/A	0	0	0.00 K	13.47	0.13	0.28	0.0 ft	35.7	321.6	293.2	0.0
N/A	0	0	0.00 K	13.47	0.13	0.28	0.0 ft	35.7	321.6	343.4	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u	G_a	D_s	A_{chord}	E	h	d_{WALL}	Sd_{WALL}	d_{HD}	Sh	Sd_{HD}	d_{TOT}	Stretch
	plf	k-in	in	in2	psi	ft	in	in	in	ft	in	in	in
ROOF	255	15	0.180	21	1.50E+06	17.7	0.321	0.888	0.196	32.7	0.645	1.533	0.180
4TH	500	15	0.180	21	1.50E+06	7.5	0.253	0.568	0.089	15.0	0.168	0.735	0.180
3RD	622	15	0.180	26	1.50E+06	7.5	0.314	0.314	0.089	7.5	0.089	0.403	0.180
N/A	622	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	622	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	622	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

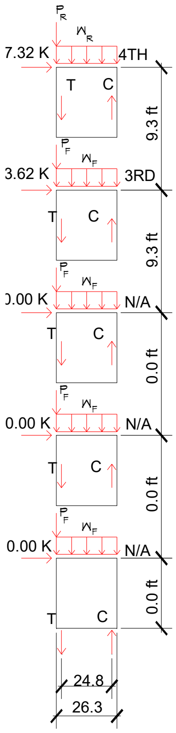
Level	D	L	S	E	C_{ASD}	h	C_p	f_c	F_{cp}	F_c'	f_c/F_{cp}	f_c/F_c'	MAX
	k	k	k	k	k	ft		psi	psi	psi			
ROOF	0.00	0.00	0.00	6.0	4.280	17.7	0.051	204	625	121	0.326	1.680	1.680
4TH	0.00	0.00	0.00	11.1	7.922	7.5	0.267	377	625	634	0.604	0.595	0.604
3RD	0.00	0.00	0.00	17.2	12.304	7.5	0.267	469	625	634	0.750	0.739	0.750
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000

Project: Mercer Island Mixed Use   Job Number: 19028

Sheet: ____ of ____   Name: AED

Originating Office: Seattle   Date: 09/27/21

Multiplier:



STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W8.2

C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	1	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	10.75	ft	1+ 0.14Sds =	1.13	
Trib Area =	5.00	ft^2	*Resists uplift only (due to near walls)*		
L =	26.3 ft		*Total Wall Length*		
L_{HD} =	24.8 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	206	A	0.45	0.5	0.39	(4)	2x4	0.691	0.012	OK
4TH	DF	405	A	0.88	0.5	0.41	(4)	2x4	0.612	0.014	OK
3RD	DF	504	B	0.84	0.5	0.67	(4)	2x4	1.037	0.014	OK
N/A	DF	504	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	504	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	504	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	v_u	Add Load	V	SV	P'	W'	h	Sh	M_{OT}	M_R	T_{ASD}
	plf	lbs	k	k	k	klf	ft	ft	kft	kft	k
ROOF	289	0	7.58 K	7.58	0.01	0.14	14.5 ft	14.5	109.9	48.8	1.7
4TH	279	0	7.32 K	14.90	0.13	0.35	9.3 ft	23.8	248.4	173.5	1.8
3RD	138	0	3.62 K	18.52	0.13	0.35	9.3 ft	33.1	420.7	298.2	2.9
N/A	0	0	0.00 K	18.52	0.13	0.27	0.0 ft	33.1	420.7	394.1	0.0
N/A	0	0	0.00 K	18.52	0.13	0.27	0.0 ft	33.1	420.7	490.0	0.0
N/A	0	0	0.00 K	18.52	0.13	0.27	0.0 ft	33.1	420.7	585.8	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u	G_a	D_s	A_{chord}	E	h	d_{WALL}	Sd_{WALL}	d_{HD}	Sh	Sd_{HD}	d_{TOT}	Stretch
	plf	k-in	in	in2	psi	ft	in	in	in	ft	in	in	in
ROOF	289	15	0.180	21	1.50E+06	13.5	0.267	0.905	0.105	30.1	0.362	1.267	0.180
4TH	568	15	0.180	21	1.50E+06	8.3	0.317	0.638	0.068	16.6	0.128	0.766	0.180
3RD	706	19	0.180	21	1.50E+06	8.3	0.321	0.321	0.068	8.3	0.068	0.388	0.180
N/A	706	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	706	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	706	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D	L	S	E	C_{ASD}	h	C_p	f_c	F_{cp}	F_c'	f_c/F_{cp}	f_c/F_c'	MAX
	k	k	k	k	k	ft		psi	psi	psi			
ROOF	0.00	0.00	0.00	4.2	2.990	13.5	0.087	142	625	206	0.228	0.691	0.691
4TH	0.00	0.00	0.00	9.5	6.759	8.3	0.221	322	625	526	0.515	0.612	0.612
3RD	0.00	0.00	0.00	16.0	11.446	8.3	0.221	545	625	526	0.872	1.037	1.037
N/A	0.00	0.00	0.00	16.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.0	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.0	0.000	0.0	0.000	0	625	0			0.000

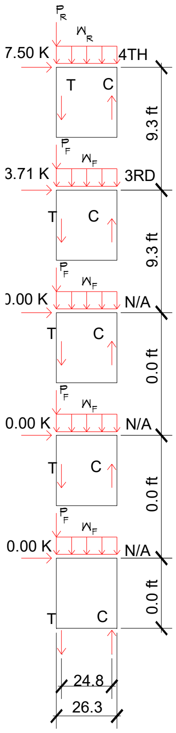
PCS Structural Solutions

Project: Mercer Island Mixed Use Job Number: 19028

Sheet: of Name: AED

Originating Office: Seattle Date: 09/27/21

Multiplier:



STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W9.1

C_s = 0.142 Wall Weight = 9 psf

S_{DS} = 0.92 sec Roof Dead = 1 psf

0.9- 0.14Sds = 0.77 Floor Dead = 25 psf

Trib Width = 10.75 ft 1+ 0.14Sds = 1.13

Trib Area = 5.00 ft² *Resists uplift only (due to near walls)*

L = 26.3 ft *Total Wall Length*

L_{HD} = 24.8 ft *Distance from Holdown to comp post*

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	211	A	0.46	0.5	0.40	(4)	2x4	0.707	0.012	OK
4TH	DF	415	A	0.90	0.5	0.46	(4)	2x4	0.627	0.014	OK
3RD	DF	516	B	0.86	0.5	0.74	(5)	2x4	0.849	0.014	OK
N/A	DF	516	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	516	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	516	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load lbs	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	296	0	7.76 K	7.76	0.01	0.14	14.5 ft	14.5	112.5	48.8	1.7
4TH	286	0	7.50 K	15.26	0.13	0.35	9.3 ft	23.8	254.4	173.5	1.9
3RD	141	0	3.71 K	18.97	0.13	0.35	9.3 ft	33.1	430.8	298.2	3.2
N/A	0	0	0.00 K	18.97	0.13	0.27	0.0 ft	33.1	430.8	394.1	0.0
N/A	0	0	0.00 K	18.97	0.13	0.27	0.0 ft	33.1	430.8	490.0	0.0
N/A	0	0	0.00 K	18.97	0.13	0.27	0.0 ft	33.1	430.8	585.8	0.0

DEFLECTION - PER SDPWS 4.3.2

Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	296	15	0.180	21	1.50E+06	13.5	0.273	0.926	0.105	30.1	0.362	1.288	0.180
4TH	581	15	0.180	21	1.50E+06	8.3	0.325	0.653	0.068	16.6	0.128	0.781	0.180
3RD	722	19	0.180	26	1.50E+06	8.3	0.328	0.328	0.068	8.3	0.068	0.395	0.180
N/A	722	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	722	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	722	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	4.3	3.061	13.5	0.087	146	625	206	0.233	0.707	0.707
4TH	0.00	0.00	0.00	9.7	6.922	8.3	0.221	330	625	526	0.527	0.627	0.627
3RD	0.00	0.00	0.00	16.4	11.721	8.3	0.221	447	625	526	0.714	0.849	0.849
N/A	0.00	0.00	0.00	16.4	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.4	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	16.4	0.000	0.0	0.000	0	625	0			0.000

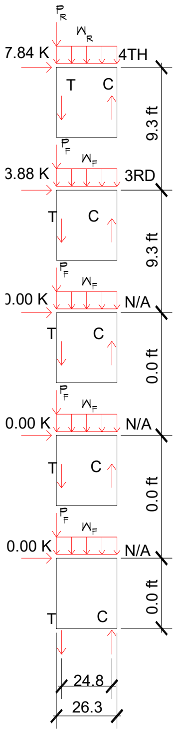
Project:	Mercer Island Mixed Use	Job Number:	19028
Sheet:	of	Name:	AED
Originating Office:	Seattle	Date:	09/27/21

Multiplier:

STATUS: OK

MULTI-STORY SHEARWALL DESIGN:

WALL W10.5



C_s =	0.142		Wall Weight =	9	psf
S_{DS} =	0.92	sec	Roof Dead =	1	psf
0.9- 0.14Sds =	0.77		Floor Dead =	25	psf
Trib Width =	10.75	ft	1+ 0.14Sds =	1.13	
Trib Area =	5.00	ft²	*Resists uplift only (due to near walls)*		
L =	26.3 ft		*Total Wall Length*		
L_{HD} =	24.8 ft		*Distance from Holdown to comp post*		

WALL SUMMARY

Level	DF?	Sv	WALL	%	HOLDOWN	%	Post		%	Drift	CHECKS
ROOF	DF	221	A	0.48	0.5	0.44	(4)	2x4	0.740	0.012	OK
4TH	DF	434	A	0.94	0.5	0.53	(4)	2x4	0.656	0.014	OK
3RD	DF	540	B	0.90	0.5	0.87	(5)	2x4	0.888	0.015	OK
N/A	DF	540	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	540	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK
N/A	DF	540	B	0.00	NONE	0.00	(4)	2x4	0.000	0.000	OK

HOLDOWN

Level	V_u plf	Add Load lbs	V k	SV k	P' k	W' klf	h ft	Sh ft	M_{OT} kft	M_R kft	T_{ASD} k
ROOF	309	0	8.11 K	8.11	0.01	0.14	14.5 ft	14.5	117.7	48.8	1.9
4TH	299	0	7.84 K	15.95	0.13	0.35	9.3 ft	23.8	266.0	173.5	2.3
3RD	148	0	3.88 K	19.83	0.13	0.35	9.3 ft	33.1	450.5	298.2	3.7
N/A	0	0	0.00 K	19.83	0.13	0.27	0.0 ft	33.1	450.5	394.1	0.0
N/A	0	0	0.00 K	19.83	0.13	0.27	0.0 ft	33.1	450.5	490.0	0.0
N/A	0	0	0.00 K	19.83	0.13	0.27	0.0 ft	33.1	450.5	585.8	0.0

DEFLECTION - PER SDPWS 4.3.2

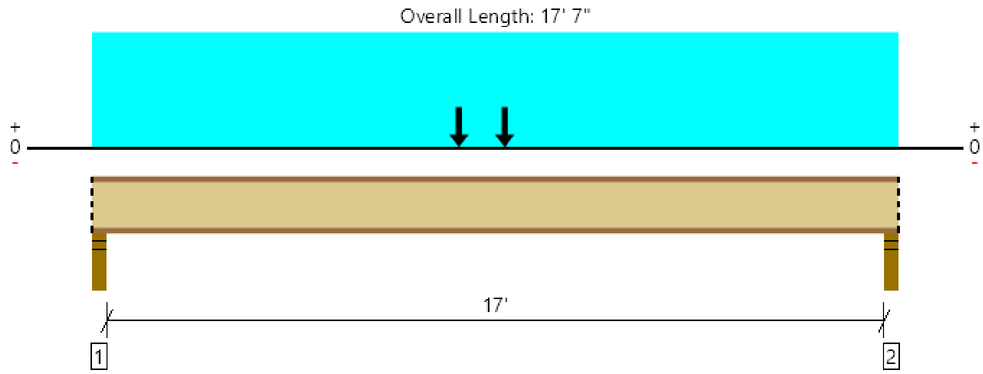
Level	v_u plf	G_a k-in	D_s in	A_{chord} in2	E psi	h ft	d_{WALL} in	Sd_{WALL} in	d_{HD} in	Sh ft	Sd_{HD} in	d_{TOT} in	Stretch in
ROOF	309	15	0.180	21	1.50E+06	13.5	0.286	0.968	0.105	30.1	0.362	1.331	0.180
4TH	608	15	0.180	21	1.50E+06	8.3	0.340	0.682	0.068	16.6	0.128	0.810	0.180
3RD	756	19	0.180	26	1.50E+06	8.3	0.343	0.343	0.068	8.3	0.068	0.410	0.180
N/A	756	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	756	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000
N/A	756	19	0.000	21	1.50E+06	0.0	0.000	0.000	0.000	0.0	0.000	0.000	0.000

CHORDS - COMPRESSION CONTROLS

Level	D k	L k	S k	E k	C_{ASD} k	h ft	C_p	f_c psi	F_{cp} psi	F_c' psi	f_c/F_{cp}	f_c/F_c'	MAX
ROOF	0.00	0.00	0.00	4.5	3.201	13.5	0.087	152	625	206	0.244	0.740	0.740
4TH	0.00	0.00	0.00	10.1	7.239	8.3	0.221	345	625	526	0.552	0.656	0.656
3RD	0.00	0.00	0.00	17.2	12.258	8.3	0.221	467	625	526	0.747	0.888	0.888
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000
N/A	0.00	0.00	0.00	17.2	0.000	0.0	0.000	0	625	0			0.000

Level, RF J1

1 piece(s) 11 7/8" TJI® 110 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	714 @ 2 1/2"	1581 (3.50")	Passed (45%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	694 @ 3 1/2"	1794	Passed (39%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	3331 @ 8' 10"	3634	Passed (92%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.319 @ 8' 9 1/2"	0.572	Passed (L/645)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.699 @ 8' 9 1/4"	0.858	Passed (L/295)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	3.50"	3.50"	1.75"	363	352	715	Blocking
2 - Stud wall - DF	3.50"	3.50"	1.75"	357	352	709	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	3' o/c	
Bottom Edge (Lu)	17' 7" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 17' 7"	16"	23.0	30.0	Default Load
2 - Point (lb)	8'	N/A	90	-	
3 - Point (lb)	9'	N/A	90	-	

Member Notes

16.75' SPAN

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

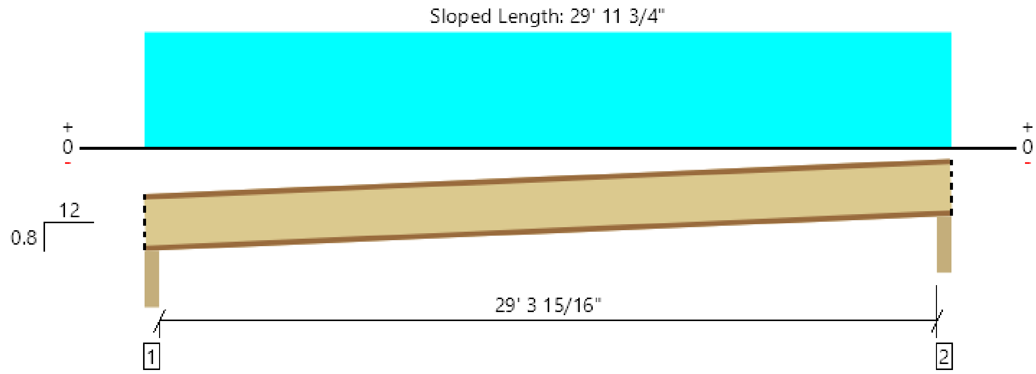
FORTE WEB

MEMBER REPORT

PASSED

Level, RF J2 SLOPED

1 piece(s) 11 7/8" TJI® 560 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Member Length : 30' 9/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.8/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	958 @ 2 1/2"	1984 (3.50")	Passed (48%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	940 @ 3 1/2"	2358	Passed (40%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6968 @ 14' 11 1/2"	10925	Passed (64%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.952 @ 14' 11 1/2"	1.478	Passed (L/372)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.831 @ 14' 11 1/2"	1.971	Passed (L/194)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/240) and TL (L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beveled Plate - DF	3.50"	3.50"	1.75"	460	499	959	Blocking
2 - Beveled Plate - DF	3.50"	3.50"	1.75"	460	499	959	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 7" o/c	
Bottom Edge (Lu)	30' o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 29' 10 15/16"	16"	23.0	25.0	Default Load

Member Notes
29.33' SPAN

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

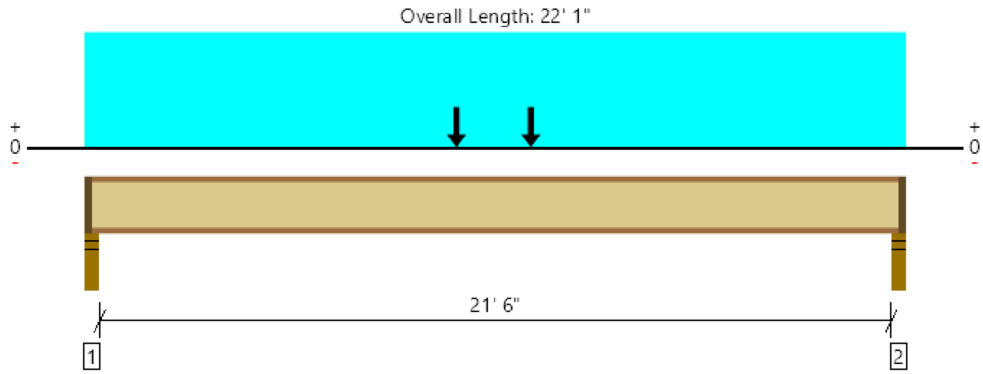
ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

3/25/2022 12:49:24 AM UTC
ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16
File Name: Gravity Updates

Level, RF J3

1 piece(s) 11 7/8" TJI® 560 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1245 @ 2 1/2"	1455 (1.75")	Passed (86%)	1.15	1.0 D + 1.0 S (All Spans)
Shear (lbs)	1230 @ 3 1/2"	2358	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	7105 @ 11' 9/16"	10925	Passed (65%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.522 @ 11' 1/2"	0.722	Passed (L/498)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	1.038 @ 11' 1/2"	1.083	Passed (L/250)	--	1.0 D + 1.0 S (All Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	3.50"	1.75"	1.75"	598	663	1261	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.75"	598	663	1261	1 3/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 6" o/c	
Bottom Edge (Lu)	21' 10" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 22' 1"	24"	23.0	30.0	Default Load
2 - Point (lb)	10'	N/A	90	-	
3 - Point (lb)	12'	N/A	90	-	

Member Notes
16.75' SPAN

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

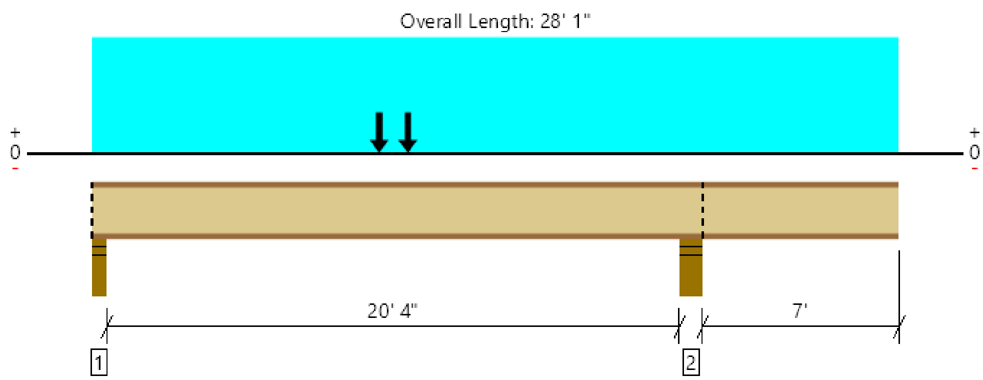
FORTE WEB

MEMBER REPORT

PASSED

Level, RF J4

1 piece(s) 11 7/8" TJI® 560 @ 24" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1110 @ 2 1/2"	1984 (3.50")	Passed (56%)	1.15	1.0 D + 1.0 S (Alt Spans)
Shear (lbs)	1227 @ 20' 7 1/2"	2358	Passed (52%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	5575 @ 10'	10925	Passed (51%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.378 @ 10' 3 1/2"	0.688	Passed (L/655)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.728 @ 10' 2 11/16"	1.032	Passed (L/340)	--	1.0 D + 1.0 S (Alt Spans)

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0/12

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Upward deflection on right cantilever exceeds 0.4".

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	3.50"	3.50"	1.75"	516	594	1110	Blocking
2 - Stud wall - DF	5.50"	5.50"	3.50"	955	1129	2084	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 5" o/c	
Bottom Edge (Lu)	10' 9" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	0 to 28' 1"	24"	23.0	30.0	Default Load
2 - Point (lb)	10'	N/A	90	-	
3 - Point (lb)	11'	N/A	90	-	

Member Notes

7' cantilever

Weyerhaeuser Notes

Weyerhaeuser warrants that the sizing of its products will be in accordance with Weyerhaeuser product design criteria and published design values. Weyerhaeuser expressly disclaims any other warranties related to the software. Use of this software is not intended to circumvent the need for a design professional as determined by the authority having jurisdiction. The designer of record, builder or framer is responsible to assure that this calculation is compatible with the overall project. Accessories (Rim Board, Blocking Panels and Squash Blocks) are not designed by this software. Products manufactured at Weyerhaeuser facilities are third-party certified to sustainable forestry standards. Weyerhaeuser Engineered Lumber Products have been evaluated by ICC-ES under evaluation reports ESR-1153 and ESR-1387 and/or tested in accordance with applicable ASTM standards. For current code evaluation reports, Weyerhaeuser product literature and installation details refer to www.weyerhaeuser.com/woodproducts/document-library.

The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

S003 - GENERAL NOTES

PCS Structural Solutions

Project: MIMU | Job No: 19028
Subject: Rim Nailing | Sheet | Name: AED
Originating Office: [X] Seattle [ ] Tacoma [ ] Portland | Date: 3/24/22

Check nailing into 1-3/4" SCL Rim:

16d Sole Nailing → 3.5" Max. Spacing w/ 1.25" max penetration

(2) Rows OK w/ 1/2" Stagger
Per TrusJoist Tech. Bulletin

16d length = 3.5"

Penetration = 3.5" − 1.5" (PL) − 0.75" (SHT'G)
= 1.25" ✓ OK

SEE 1/S500

SDS Sole Screws: → 6" Max. Spacing
Per TrusJoist Tech. Bulletin

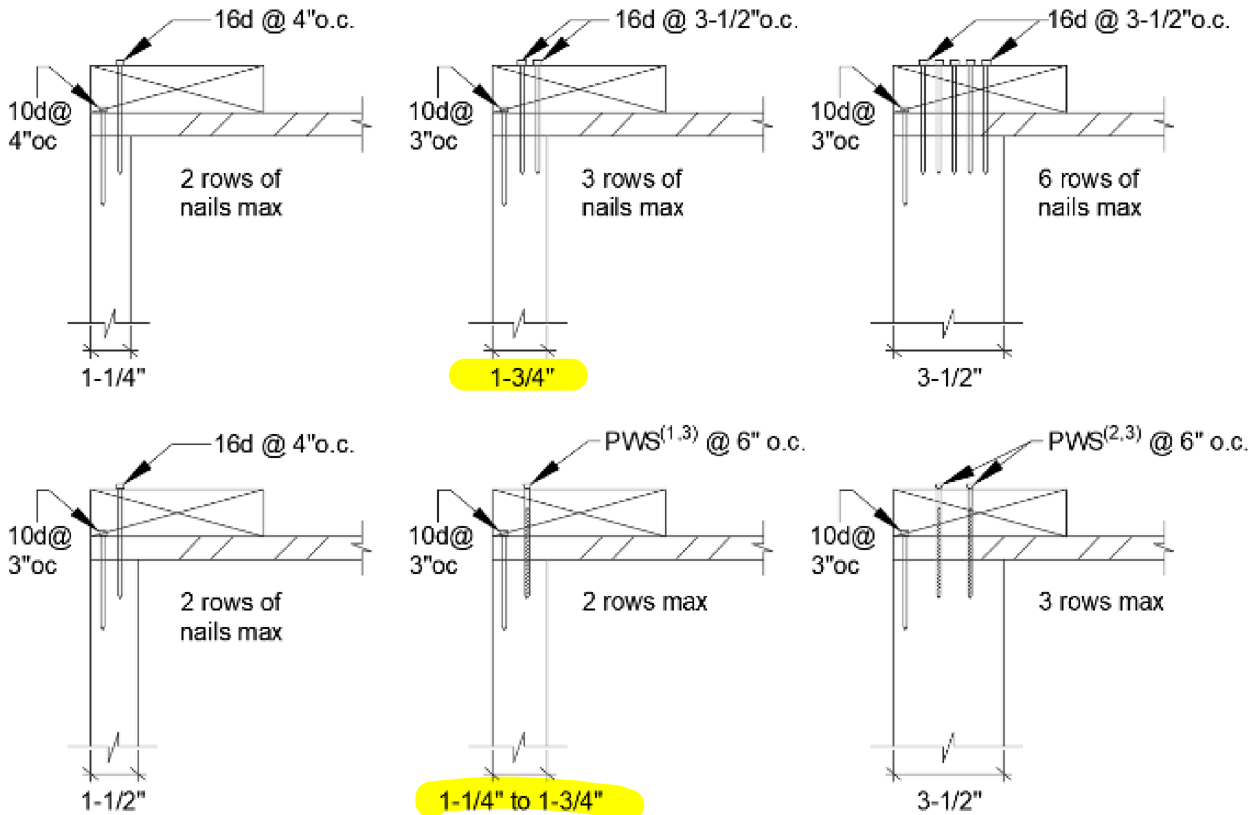
Screw spacing OK ✓
SEE 1/S500

Nailing Criteria Includes Allowance For Diaphragm Nails

Weyerhaeuser publishes two documents to help an engineer of record to correctly specify TimberStrand® LSL to avoid potential splitting and achieve lateral shear transfer.

- ICC-ES ESR-1387
- Technical Bulletin TB-206

Section details below summarize the fastener minimum spacings, maximum number of rows and width requirements:
(**Note**: PWS = Proprietary Wood Screws; 1.25" & 1.5" widths are 1.3E grade, while 1.75" & 3.5" are 1.55E grade. Minimum edge distances and spacing between rows per TB-206).



(1) For 1-3/4" TimberStrand® LSL, a single row of Strong-Tie® SDWS Timber screws or SDWH Hex screws may be installed at 4" o.c. to attach the wall plate to rim board.
(2) For 3-1/2" TimberStrand® LSL, two rows of Strong-Tie® SDWS Timber screws or SDWH Hex screws may be installed at 4" o.c. to attach the wall plate to rim board.
(3) For additional information, reference Simpson Strong-Tie® engineering letter, *Sole or Top Plate to Rim/Blocking using SDWS and SDWH Screw (L-F-PLTRMBLK21)*.

Expires January 2023

S200.1 LEVEL P2 FOUNDATION PLAN

RetainPro (c) 1987-2018, Build 11.18.12.04
License : KW-06057733
License To : PCS STRUCTURAL SOLUTIONS

Restrained Retaining Wall

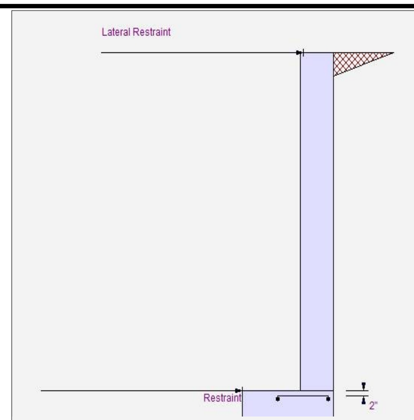
Code: IBC 2015,ACI 318-14,ACI 530-13

Criteria

Retained Height	=	9.67 ft
Wall height above soil	=	0.00 ft
Total Wall Height	=	9.67 ft
Top Support Height	=	9.67 ft
Slope Behind Wal	=	0.00
Height of Soil over Toe	=	0.00 in

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	55.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density	=	110.00 pcf
Footing||Soil Frictior	=	0.350
Soil height to ignore for passive pressure	=	12.00 in



Thumbnail

Surcharge Loads

Surcharge Over Heel = 250.0 psf
>>>NOT Used To Resist Sliding & Overturn
Surcharge Over Toe = 125.0 psf
NOT Used for Sliding & Overturning

Uniform Lateral Load Applied to Stem

Lateral Load	=	250.0 #/ft
...Height to Top	=	9.67 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Earth (H) (Strength Level)
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	145.0 lbs
Axial Live Load	=	225.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

K_h Soil Density Multiplier = 0.020 g Added seismic per unit area = 14.9 psf

Design Summary

Total Bearing Load	=	2,746 lbs	
...resultant ecc.	=	6.32 in	
Soil Pressure @ Toe	=	0 psf	OK
Soil Pressure @ Heel	=	1,880 psf	OK
Allowable	=	3,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	0 psf	
ACI Factored @ Heel	=	2,318 psf	
Footing Shear @ Toe	=	1.0 psi	OK
Footing Shear @ Heel	=	0.0 psi	OK
Allowable	=	94.9 psi	
Reaction at Top	=	2,740.7 lbs	
Reaction at Bottom	=	4,646.6 lbs	

Sliding Calcs
Lateral Sliding Force = 4,646.6 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing

Load Factors

Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Concrete Stem Construction

Thickness = 12.00 in   Fy = 60,000 psi
Wall Weight = 150.0 psf   f'c = 5,000 psi
Stem is FREE to rotate at top of footing

		@ Top Support	Mmax Between Top & Base	@ Base of Wall
		Stem OK	Stem OK	Stem OK
Design Height Above Ftg	=	9.67 ft	4.54 ft	0.00 ft
Rebar Size	=	# 7	# 7	# 7
Rebar Spacing	=	12.00 in	12.00 in	12.00 in
Rebar Placed at	=	Edge	Edge	Edge
Rebar Depth 'd'	=	9.50 in	10.00 in	9.50 in
Design Data				
fb/FB + fa/Fa	=	0.000	0.468	0.000
Mu....Actual	=	0.0 ft-#	12,186.3 ft-#	0.0 ft-#
Mn * Phi.....Allowable	=	24,694.2 ft-#	26,044.2 ft-#	24,694.2 ft-#
Shear Force @ this height	=	4,398.6 lbs		5,746.8 lbs
Shear.....Actual	=	38.58 psi		50.41 psi
Shear.....Allowable	=	106.07 psi		106.07 psi

Other Acceptable Sizes & Spacings:
Toe: # 6 @ 18.00 in -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Heel: # 6 @ 16.00 in -or- Not req'd: Mu < phi*5*lambda*sqrt(f'c)*Sm
Key: No key defined -or- No key defined

Concrete Stem Rebar Area Details

Top Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 2.785 in2	
3sqrt(f'c)bd/fy : 3sqrt(5000)(12)(9.5)/60000 :	0.4031 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	============	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.6 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	2.4225 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Mmax Between Ends	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2792 in2/ft		
(4/3) * As :	0.3722 in2/ft	Min Stem T&S Reinf Area 1.476 in2	
3sqrt(f'c)bd/fy : 3sqrt(5000)(12)(10)/60000 :	0.4243 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	============	One layer of :	Two layers of :
Required Area :	0.3722 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.6 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	2.55 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Base Support	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 1.309 in2	
3sqrt(f'c)bd/fy : 3sqrt(5000)(12)(9.5)/60000 :	0.4031 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	============	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.6 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	2.4225 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Footing Strengths & Dimensions

Toe Width	=	2.00	ft
Heel Width	=	1.00	
Total Footing Width	=	3.00	
Footing Thickness	=	18.00	in
Key Width	=	0.00	in
Key Depth	=	0.00	in
Key Distance from Toe	=	0.00	ft

f'c = 4,000 psi   Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top = 2.00 in   @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	0	2,318	psf
Mu' : Upward	=	937	0	ft-#
Mu' : Downward	=	940	0	ft-#
Mu: Design	=	-3	0	ft-#
Actual 1-Way Shear	=	0.98	0.00	psi
Allow 1-Way Shear	=	94.87	0.00	psi

Min footing T&S reinf Area 1.17 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

Restrained Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Summary of Forces on Footing : Slab RESISTS sliding, stem is PINNED at footing

Forces acting on footing soil pressure

(taking moments about front of footing to find eccentricity)

Surcharge Over Heel	=		lbs		ft		ft-#
Axial Dead Load on Stem	=	370.0	lbs	2.50	ft	925.0	ft-#
Soil Over Toe	=		lbs		ft		ft-#
Adjacent Footing Load	=		lbs		ft		ft-#
Surcharge Over Toe	=		lbs		ft		ft-#
Stem Weight	=	1,450.5	lbs	2.50	ft	3,626.3	ft-#
Soil Over Heel	=		lbs	3.00	ft		ft-#
Footing Weight	=	675.0	lbs	1.50	ft	1,012.5	ft-#
Total Vertical Force	=	2,745.5	lbs	Moment =		5,563.8	ft-#

Net Mom. at Stem/Ftg Interface = -1,445.5 ft-#

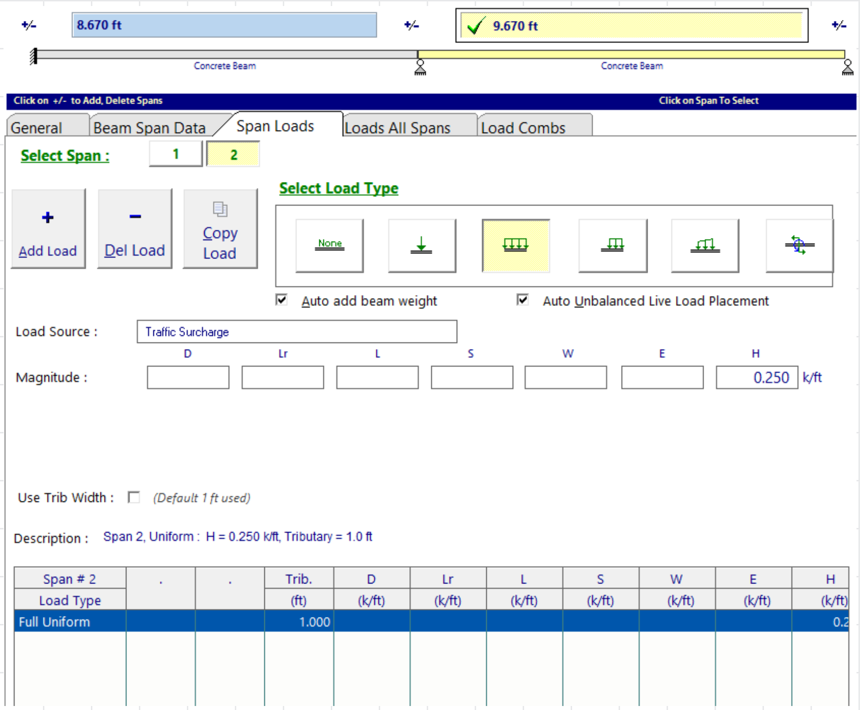
Allow. Mom. @ Stem/Ftg Interface = 15,433.9 ft-#

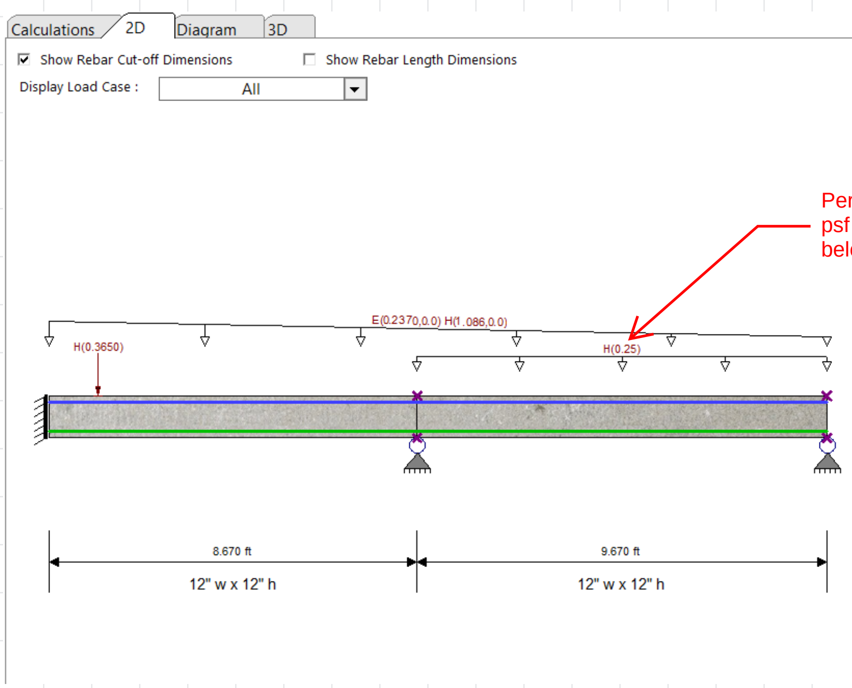
Allow. Mom. Exceeds Applied Mom.? Yes

Therefore Uniform Soil Pressure = 915.2 psf

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

BASEMENT WALL SURCHARGE





Per City of Mercer Island, 250 psf traffic surcharge for first 10' below grade

BASEMENT WALL SURCHARGE

Calculations | 2D | Diagram | 3D

Summary Results | Max. Combinations | M-V-D Summary | Support Reactions — Design OK

✔ **Maximum Bending Stress Ratio** = 0.592 : 1

Section used for this span: Typical Section

Mu-x : Applied: -12.733 k-ft

Mn * Phi : Allowable: 21.522 k-ft

Load Combination: +1.20D+L+0.20S+E+1.60H, LL Comb Run (*L)

Location of maximum on span: 0.000 ft

Span # where maximum occurs: Span # 2

✔ **Deflection Ratios**

Transient Load Deflection

Max Downward 0.010 in — Ratio = 11623 >=360
Span: 2 : H Only

Max Upward 0.000 in — Ratio = 0 >=360
Span: 2 : E Only

Total Deflection

Max Downward 0.000 in — Ratio = 8783 >=180
Span: 2 : +D+0.750L+0.750S+0.5250E+H, LL

Max Upward 0.013 in — Ratio = 0 >=180
Span: 2 : +D+0.750L+0.750S+0.5250E+H, LL

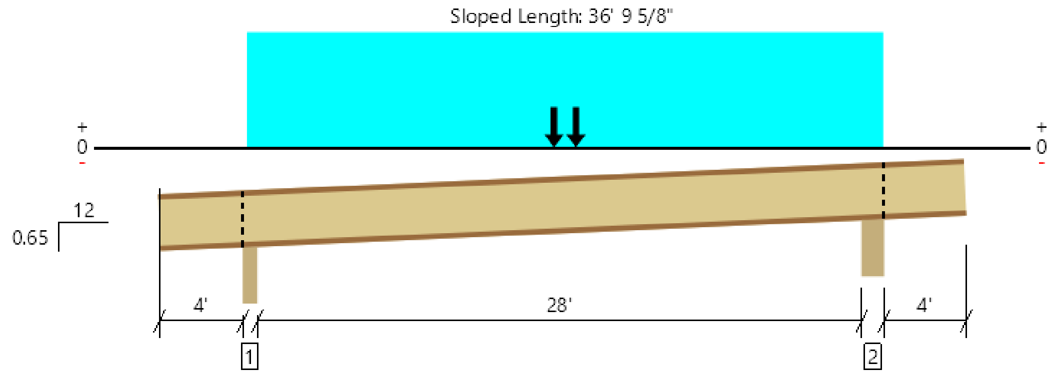
Extreme Reactions (kips)

	D	Lr	L	S	W	E	H
Support #1	0.55					0.91	4.22
Support #2	1.55					1.25	7.44
Support #3	0.56					0.17	1.79
Support #4							
Support #5							
Support #6							
Support #7							
Support #8							
Support #9							

S201 – LEVEL 1 FRAMING PLAN

Level, Townhome RF J4

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Member Length : 36' 10 5/16"

System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD
Member Pitch : 0.65/12

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1007 @ 4' 1 3/4"	6910 (3.50")	Passed (15%)	1.15	1.0 D + 1.0 S (Adj Spans)
Shear (lbs)	964 @ 4' 3 1/2"	4715	Passed (20%)	1.15	1.0 D + 1.0 S (Adj Spans)
Moment (Ft-lbs)	7675 @ 18' 3 3/4"	21850	Passed (35%)	1.15	1.0 D + 1.0 S (Alt Spans)
Live Load Defl. (in)	0.409 @ 18' 4"	0.947	Passed (L/834)	--	1.0 D + 1.0 S (Alt Spans)
Total Load Defl. (in)	0.912 @ 18' 4 1/16"	1.421	Passed (L/374)	--	1.0 D + 1.0 S (Alt Spans)

- Deflection criteria: LL (L/360) and TL (L/240).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Upward deflection on right cantilever exceeds 0.4".

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Beveled Plate - DF	3.50"	3.50"	3.50"	529	478	1007	Blocking
2 - Beveled Plate - DF	5.50"	5.50"	3.50"	542	489	1031	Blocking

• Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 1" o/c	
Bottom Edge (Lu)	14' 7" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Snow (1.15)	Comments
1 - Uniform (PSF)	4' to 33'	16"	23.0	25.0	Default Load
2 - Point (lb)	18'	N/A	90	-	
3 - Point (lb)	19'	N/A	90	-	

Member Notes

7' cantilever

Weyerhaeuser Notes

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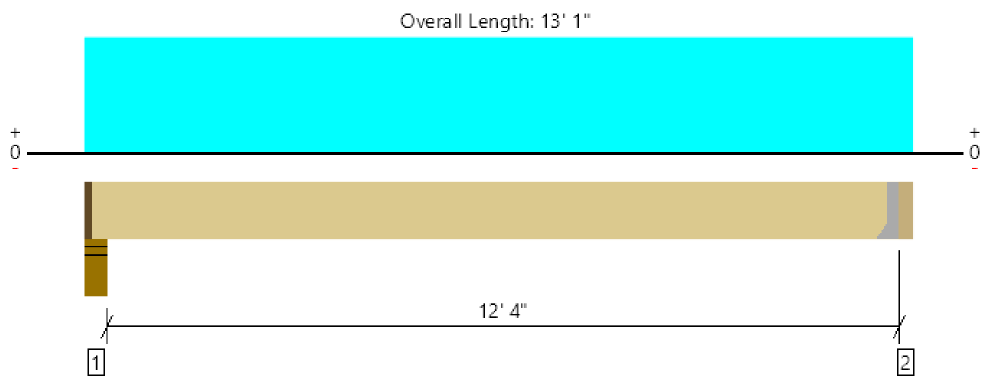
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Level, B7 - Townhome Roof

1 piece(s) 5 1/8" x 12" 24F-V4 DF Glulam



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	4204 @ 12' 9 1/2"	4997 (1.50")	Passed (84%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	3529 @ 11' 9 1/2"	12495	Passed (28%)	1.15	1.0 D + 1.0 S (All Spans)
Pos Moment (Ft-lbs)	13095 @ 6' 6 3/4"	28290	Passed (46%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.140 @ 6' 6 3/4"	0.311	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.275 @ 6' 6 3/4"	0.623	Passed (L/543)	--	1.0 D + 1.0 S (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Critical positive moment adjusted by a volume factor of 1.00 that was calculated using length L = 12' 5 1/2".
- The effects of positive or negative camber have not been accounted for when calculating deflection.
- The specified glulam is assumed to have its strong laminations at the bottom of the beam. Install with proper side up as indicated by the manufacturer.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Total	
1 - Stud wall - DF	5.50"	3.75"	1.50"	2171	2256	4427	1 3/4" Rim Board
2 - Hanger on 12" DF beam	3.50"	Hanger[1]	1.50"	2155	2242	4397	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 8" o/c	
Bottom Edge (Lu)	12' 8" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	HUCQ5.25/9-SDS	3.00"	N/A	12-SDS25212	6-SDS25212	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 3/4" to 12' 9 1/2"	N/A	14.9	--	
1 - Uniform (PSF)	0 to 13' 1" (Front)	13' 9"	23.0	25.0	Default Load

Weyerhaeuser Notes

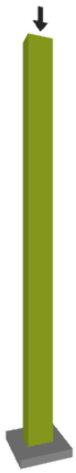
ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

MEMBER REPORT

PASSED

Level, Townhome 6x6 Post
1 piece(s) 6 x 6 DF No.1

Post Height: 8' 9"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	19	50	Passed (38%)	--	--
Compression (lbs)	4427	25519	Passed (17%)	1.15	1.0 D + 1.0 S
Base Bearing (lbs)	4427	18906	Passed (23%)	--	1.0 D + 1.0 S
Bending/Compression	0.15	1	Passed (15%)	1.15	1.0 D + 1.0 S

- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.

Supports	Type	Material
Base	Plate	Douglas Fir-Larch

Member Type : Free Standing Post
Building Code : IBC 2015
Design Methodology : ASD

Max Unbraced Length	Comments
Full Member Length	No bracing assumed.

Vertical Load	Dead (0.90)	Snow (1.15)	Comments
1 - Point (lb)	2171	2256	From B7

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

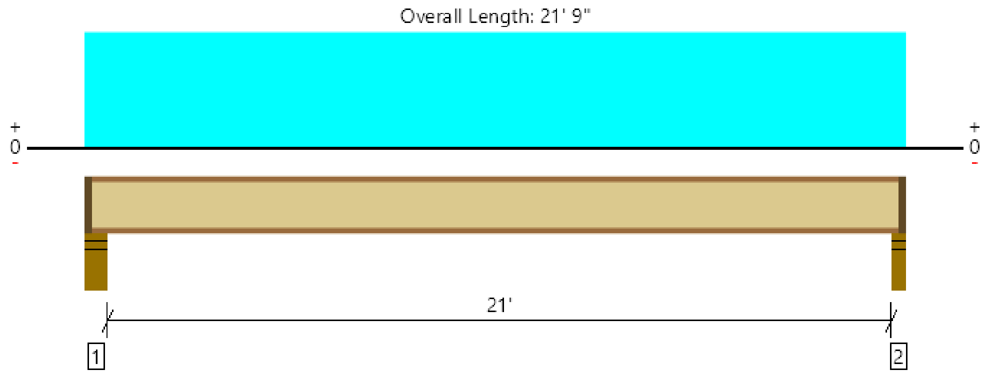
FORTE WEB

MEMBER REPORT

PASSED

Level, J4 @ Townhome Floor

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1774 @ 21' 6 1/2"	2530 (1.75")	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1750 @ 5 1/2"	4100	Passed (43%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	9334 @ 10' 11 1/2"	19000	Passed (49%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.299 @ 10' 11 1/2"	0.529	Passed (L/850)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.623 @ 10' 11 1/2"	1.058	Passed (L/408)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling, Pour Flooring Overlay.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	3.75"	1.75"	950	877	1827	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.75"	935	863	1798	1 3/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	8' 2" o/c	
Bottom Edge (Lu)	21' 6" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 9"	16"	65.0	60.0	Default Load

Member Notes

Worst Case Loading Occurs at Roof Deck

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

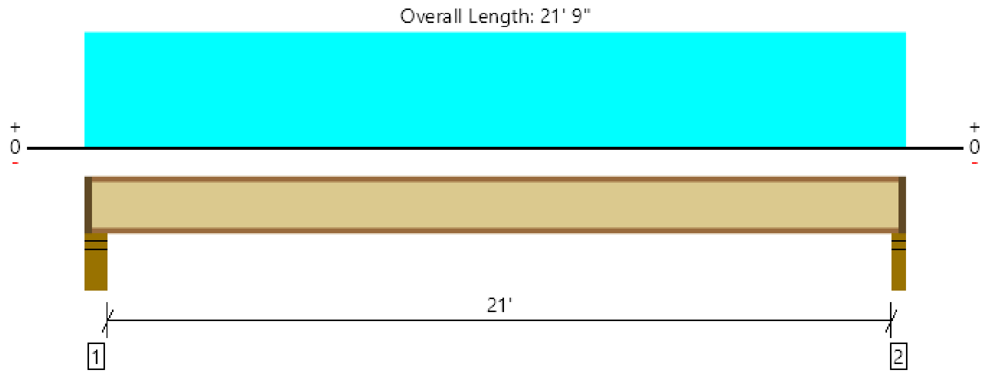
Weyerhaeuser

MEMBER REPORT

PASSED

Level, J4 @ Townhome Floor

2 piece(s) 11 7/8" TJI® 560 @ 16" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	923 @ 21' 6 1/2"	2530 (1.75")	Passed (36%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	910 @ 5 1/2"	4100	Passed (22%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	4854 @ 10' 11 1/2"	19000	Passed (26%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.199 @ 10' 11 1/2"	0.529	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.324 @ 10' 11 1/2"	1.058	Passed (L/785)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	51	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling, Pour Flooring Overlay.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	3.75"	1.75"	365	584	949	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.75"	360	576	936	1 3/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	11' 6" o/c	
Bottom Edge (Lu)	21' 6" o/c	

- TJI joists are only analyzed using Maximum Allowable bracing solutions.
- Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 21' 9"	16"	25.0	40.0	Default Load

Member Notes
Typical Floor Joist

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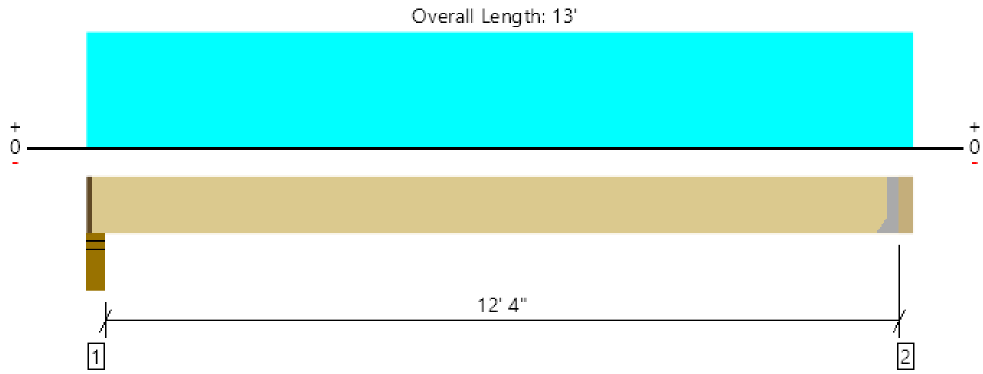
ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Level, Townhome B4

1 piece(s) 3 1/2" x 11 7/8" 2.0E Parallam® PSL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2713 @ 12' 8 1/2"	3281 (1.50")	Passed (83%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	2282 @ 11' 8 5/8"	8035	Passed (28%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	8449 @ 6' 5 3/4"	19902	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.158 @ 6' 5 3/4"	0.311	Passed (L/945)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.265 @ 6' 5 3/4"	0.623	Passed (L/564)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	4.50"	3.25"	1.50"	1136	1685	2821	1 1/4" Rim Board
2 - Hanger on 11 7/8" DF beam	3.50"	Hanger[1]	1.50"	1140	1695	2835	See note [1]

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	12' 7" o/c	
Bottom Edge (Lu)	12' 7" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
2 - Face Mount Hanger	HHUS48	3.00"	N/A	22-10d	8-10d	

- Refer to manufacturer notes and instructions for proper installation and use of all connectors.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 1/4" to 12' 8 1/2"	N/A	13.0	--	
1 - Uniform (PSF)	0 to 13' (Front)	6' 6"	25.0	40.0	Default Load

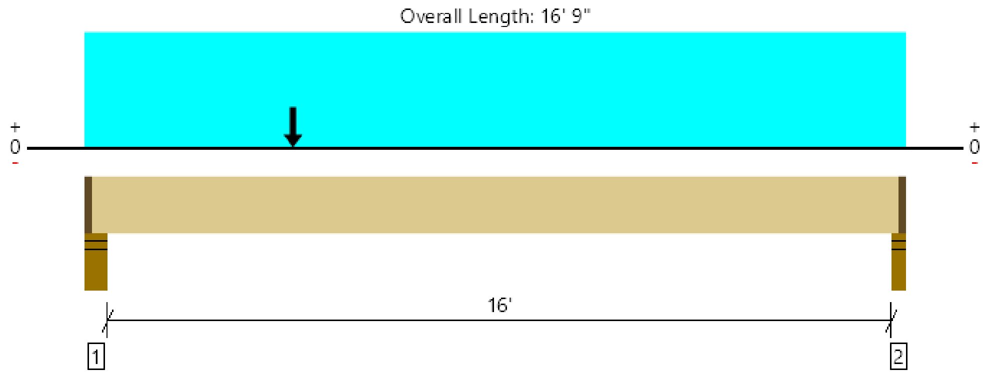
Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

Level, Townhome B6

1 piece(s) 5 1/4" x 11 7/8" 2.0E Parallam® PSL



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	2960 @ 16' 7"	5742 (1.75")	Passed (52%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	4111 @ 1' 5 3/8"	12053	Passed (34%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	15613 @ 6' 3/16"	29854	Passed (52%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.307 @ 8' 7/8"	0.406	Passed (L/634)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.528 @ 8' 1"	0.813	Passed (L/370)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	3.75"	1.50"	1873	2640	4513	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.50"	1263	1735	2998	1 3/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	16' 6" o/c	
Bottom Edge (Lu)	16' 6" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 3/4" to 16' 7 1/4"	N/A	19.5	--	
1 - Uniform (PSF)	0 to 16' 9" (Front)	4'	25.0	40.0	Default Load
2 - Point (lb)	4' 3" (Front)	N/A	1140	1695	

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Project: Mercer Island | Job Number: 19-028
Sheet: 1 of | Name: AED
Originating Office: Seattle | Date: 03/25/22

PCS Structural Solutions

STUD WALL DESIGN - Townhome 2x4

2018 NDS/2018 IBC

WALL DATA

LUMBER TYPE: DF#2

F_b =	900 PSI		
F_c =	1350 PSI		
$F_{c\perp}$ =	625 PSI		
E =	1.60E+06 PSI		

APPLIED LOADS:

W_{WIND} =	8.0 PSF	P_{DEAD} =	1124 LBS
$W_{SEISMIC}$ =	5.0 PSF	P_{LIVE} =	1152 LBS
		P_{SNOW} =	360 LBS
		P_{WIND} =	0 LBS
		$P_{SEISMIC}$ =	0 LBS

STUD SIZE: (2) 2x4

A_X =	10.50 IN^2
S_X =	6.13 IN^3
I_X =	10.72 IN^4
$C_{F(BENDING)}$ =	1.5 (NDS 4.3.6)
F_{cE} =	469.1 PSI
C_b =	1.13 (NDS 3.10.4)

MISCELLANEOUS:

HEIGHT =	9.33 FT		
SPACING =	16 IN		
ECCENTRICITY =	0.1 IN		
$C_{F(COMPRESSION)}$ =	1.15 (NDS 4.3.6)		
		APPLY?	
$C_{SYS(BENDING)}$ =	1.50	YES	(SDPWS T3.1.1.1)
$C_{r(BENDING)}$ =	1.15	YES	(NDS 4.3.9)

LOAD CASES - IBC 1605.3.1

CASE 1	DEAD + LIVE + 5 PSF LAT.	CASE 4	DEAD + 0.45WIND + 0.75LIVE + 0.75SNOW
CASE 2	DEAD + SNOW + 5 PSF LAT.	CASE 5	DEAD + 0.60WIND
CASE 3	DEAD + 0.75LIVE + 0.75SNOW + 5 PSF LAT.	CASE 6	DEAD + 0.75EISMIC
		CASE 7	DEAD + 0.53SEISMIC + 0.75LIVE + 0.75SNOW

ALLOWABLE STRESSES - Cd PER NDS T2.3.2, Cp PER NDS 3.7.1, ASSUME Cm, Ct, Ci, CL = 1.0

CASE	C_D	F_c*	F_{cE}/F_c*	C_P	F_c'	F_b'	$F_{c\perp}$
1	1.00	1553	0.30	0.280	435	1553	703
2 & 3	1.15	1785	0.26	0.247	440	1785	703
4 & 5	1.60	2484	0.19	0.181	449	3240	703
6 & 7	1.60	2484	0.19	0.181	449	2484	703

APPLIED STRESSES - NDS CHAPTER 3 DESIGN EQUATIONS

CASE	$P_{APPLIED}$	f_c	$M_{LAT. LOAD}$	$M_{ECC.}$	M_{TOTAL}	f_b
1	2276	217	73	19	84	165
2	1484	141	73	12	80	157
3	2258	215	73	19	84	165
4	2258	215	52	19	64	125
5	1124	107	70	9	75	148
6	1124	107	51	9	57	111
7	2258	215	38	19	50	98

DESIGN CHECKS - COMBINED STRESS CHECK PER NDS EQN 3.9-3

CASE	f_c/F_c'	f_b/F_b'	$f_c/F_{c\perp}$	Combined	f_c/F_{cE}	Deflection	L/?
1	0.50	0.11	0.31	0.45	0.46	0.08	L/1452
2	0.32	0.09	0.20	0.23	0.30	0.07	L/1527
3	0.49	0.09	0.31	0.41	0.46	0.08	L/1454
4*	0.48	0.04	0.31	0.30	0.46	0.03	L/4104
5*	0.24	0.05	0.15	0.12	0.23	0.03	L/3478
6	0.24	0.04	0.15	0.11	0.23	0.05	L/2164
7	0.48	0.04	0.31	0.30	0.46	0.05	L/2441
MAX. --->	0.50	0.11	0.31	0.45	0.46	0.08	L/1452
	O.K.	O.K.	O.K.	O.K.	O.K.		

* Deflections reduced by 0.42 per IBC Table 1604.3 footnote f. Increase deflection by 1.4 for jambs supporting glass.

PLATE BENDING - *ALIGN STUDS WITH JOISTS WHERE POSSIBLE*

MISCELLANEOUS:

C_{Fu} =	1.1 (NDS 4.3.7)
F_V =	150 PSI

ALLOWABLE STRESSES:

F_V' =	173 PSI
F_b' =	1708 PSI

STUD REACTIONS (OUT - OF - PLANE): 50 LB

DBL TOP PLATE PROPERTIES:

A_X =	10.50 IN^2
S_X =	2.63 IN^3
I_X =	1.97 IN^4

APPLIED STRESSES:

f_v =	141 PSI	<--- O.K.
f_b =	2261 PSI	<--- N.G.
Δ_{MAX} =	0.040 IN	

OK - NO PL BENDING WHEN STUDS STACK

PCS Structural Solutions

Project: Mercer Island | Job Number: 19-028

Sheet: 1 of | Name: AED

Originating Office: Seattle | Date: 03/25/22

STUD WALL DESIGN - Townhome 2x6

2018 NDS/2018 IBC

WALL DATA

LUMBER TYPE:	DF#2		APPLIED LOADS:		P_{DEAD} =	1124 LBS
F_b =	900 PSI		W_{WIND} =	8.0 PSF	P_{LIVE} =	1152 LBS
F_c =	1350 PSI		$W_{SEISMIC}$ =	5.0 PSF	P_{SNOW} =	360 LBS
$F_{c\perp}$ =	625 PSI				P_{WIND} =	0 LBS
E =	1.60E+06 PSI				$P_{SEISMIC}$ =	0 LBS

STUD SIZE:	(1) 2x6	MISCELLANEOUS:	HEIGHT =	9.33 FT	
A_X =	8.25 IN^2		SPACING =	16 IN	
S_X =	7.56 IN^3		ECCENTRICITY =	0.1 IN	
I_X =	20.80 IN^4		$C_{F(COMPRESSION)}$ =	1.10 (NDS 4.3.6)	
$C_{F(BENDING)}$ =	1.3 (NDS 4.3.6)			APPLY?	
F_{cE} =	1158.4 PSI		$C_{SYS(BENDING)}$ = 1.35	YES	(SDPWS T3.1.1.1)
C_b =	1.25 (NDS 3.10.4)		$C_{r(BENDING)}$ = 1.15	YES	(NDS 4.3.9)

LOAD CASES - IBC 1605.3.1

CASE 1	DEAD + LIVE + 5 PSF LAT.	CASE 4	DEAD + 0.45WIND + 0.75LIVE + 0.75SNOW
CASE 2	DEAD + SNOW + 5 PSF LAT.	CASE 5	DEAD + 0.60WIND
CASE 3	DEAD + 0.75LIVE + 0.75SNOW + 5 PSF LAT.	CASE 6	DEAD + 0.75SEISMIC
		CASE 7	DEAD + 0.53SEISMIC + 0.75LIVE + 0.75SNOW

ALLOWABLE STRESSES - Cd PER NDS T2.3.2, Cp PER NDS 3.7.1, ASSUME Cm, Ct, Ci, CL = 1.0

CASE	C_D	F_c*	F_{cE}/F_c*	C_P	F_c'	F_b'	$F_{c\perp}$
1	1.00	1485	0.78	0.600	891	1346	781
2 & 3	1.15	1708	0.68	0.547	933	1547	781
4 & 5	1.60	2376	0.49	0.425	1009	2527	781
6 & 7	1.60	2376	0.49	0.425	1009	2153	781

APPLIED STRESSES - NDS CHAPTER 3 DESIGN EQUATIONS

CASE	$P_{APPLIED}$	f_c	$M_{LAT. LOAD}$	$M_{ECC.}$	M_{TOTAL}	f_b
1	2276	276	73	19	84	134
2	1484	180	73	12	80	127
3	2258	274	73	19	84	134
4	2258	274	52	19	64	102
5	1124	136	70	9	75	120
6	1124	136	51	9	57	90
7	2258	274	38	19	50	80

DESIGN CHECKS - COMBINED STRESS CHECK PER NDS EQN 3.9-3

CASE	f_c/F_c'	f_b/F_b'	$f_c/F_{c\perp}$	Combined	f_c/F_{cE}	Deflection	L/?
1	0.31	0.10	0.35	0.23	0.24	0.04	L/2817
2	0.19	0.08	0.23	0.13	0.16	0.04	L/2962
3	0.29	0.09	0.35	0.20	0.24	0.04	L/2820
4*	0.27	0.04	0.35	0.13	0.24	0.02	L/7166
5*	0.13	0.05	0.17	0.07	0.12	0.02	L/6074
6	0.13	0.04	0.17	0.07	0.12	0.03	L/4199
7	0.27	0.04	0.35	0.12	0.24	0.02	L/4736
MAX. --->	0.31	0.10	0.35	0.23	0.24	0.04	L/2817
	O.K.	O.K.	O.K.	O.K.	O.K.		

* Deflections reduced by 0.42 per IBC Table 1604.3 footnote f. Increase deflection by 1.4 for jambs supporting glass.

PLATE BENDING - *ALIGN STUDS WITH JOISTS WHERE POSSIBLE*

MISCELLANEOUS:		ALLOWABLE STRESSES:		STUD REACTIONS (OUT - OF - PLANE)
C_{fu} =	1.15 (NDS 4.3.7)	F_V' =	173 PSI	
F_V =	150 PSI	F_b' =	1547 PSI	50 LB

DBL TOP PLATE PROPERTIES:		APPLIED STRESSES:		
A_X =	16.50 IN^2	f_v =	90 PSI	<--- O.K.
S_X =	4.13 IN^3	f_b =	1439 PSI	<--- O.K.
I_X =	3.09 IN^4	Δ_{MAX} =	0.026 IN	

Lateral - Townhomes:

$R = 6.5$ (Wood Framed Shear Walls)

$I_e = 1.0$, $S_{DS} = 0.931$, $C_s = 0.142$ (Ult.)

(See Design Criteria)

Seismic Weight:

LVL	DESC.	DL (PSF)	AREA (SF)	W (LBS)	
L4 (RF)	Typ. RF	20 PSF	1768	35,360	50,660
	Walls BLW	9 PSF	1700	15,300	
L3	Floor	25 PSF	1574	39,350	106,356
	Walls	9 PSF	1700	15,300	
	w/ veneer	48 PSF	1897	91,056	
L2	Floor	25 PSF	1574	39,350	200,822
	Walls (typ)	—	—	—	
	Walls w/ veneer	48 PSF	3364	161,472	

Convert to ASD

Σ: 357.8 K

$V = C_s W = (0.7)(0.142)(357.8\ K) = \underline{\underline{35.57\ K}}$

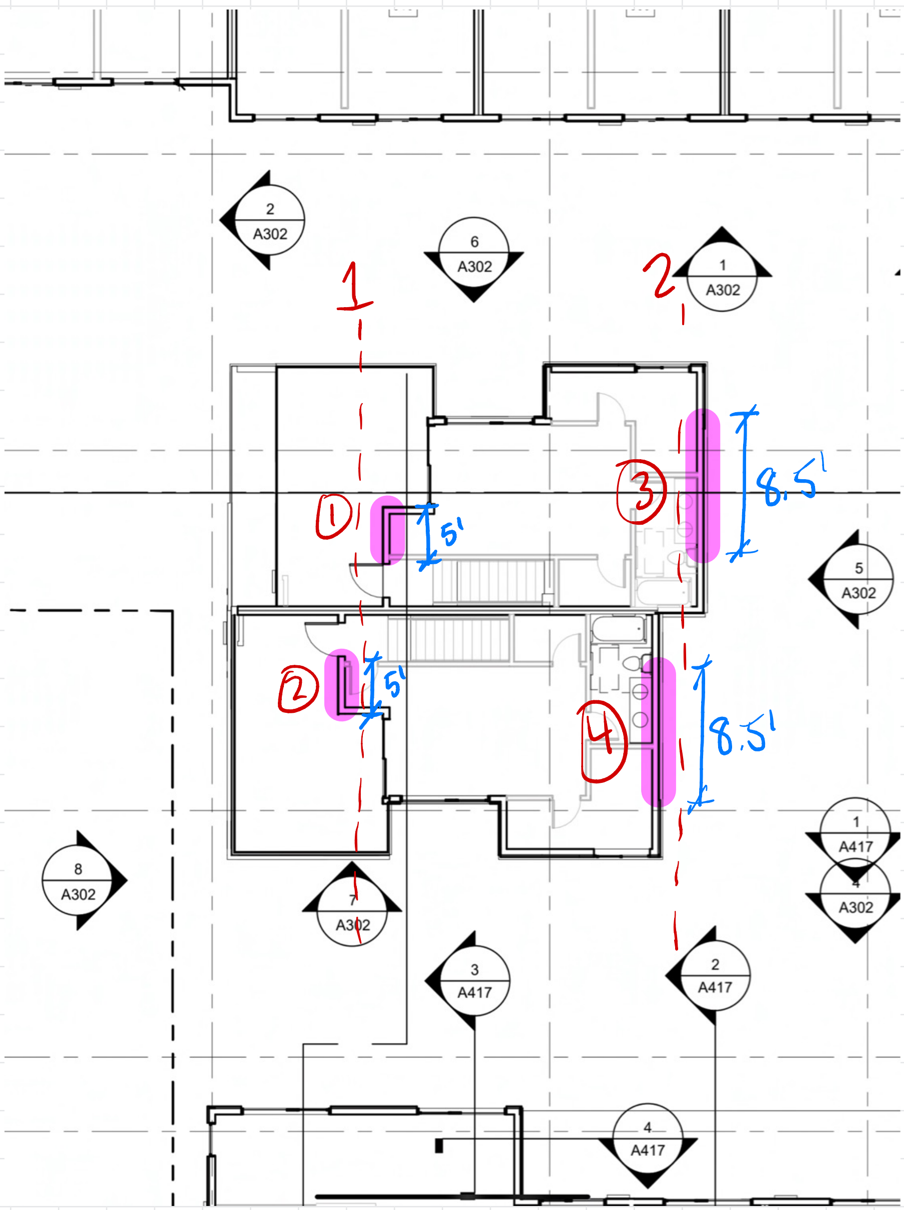
Vertical Distribution:

LVL	h (ft)	W_x (k)	$W_x h_x^k$	$\frac{W_x h_x^k}{\Sigma W_i h_i^k}$	(ASD) F_x (k)
4 (RF)	11'	50.66	551.3	0.152	5.41
3	9.5'	106.4	1010.8	0.275	9.78
2	10.5'	200.8	2108.4	0.574	20.42

Σ: 3676.5 35.61 K ✓

Project: MIMU | Job No: 19028
Subject: Townhome - Lat. | Sheet | Name: AED
Originating Office: [X] Seattle [ ] Tacoma [ ] Portland | Date: 7/26/21

N-S Direction:



Level 3

Wall Line 1:

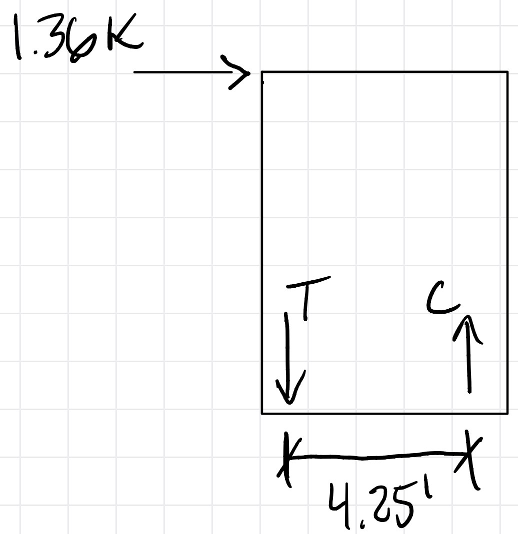
1/2 Roof Trib. goes to this wall line

$V = (0.5)(5.41\,k) = 2.71\,k / 10' = 271\ PLF$

Wall ① + ② :

V = 271 PLF → Wall Type ⟨A⟩

Cap. = 460 plf



$M_{OT} = (1.36K)(11') = 15$ K-FT (11' = h)

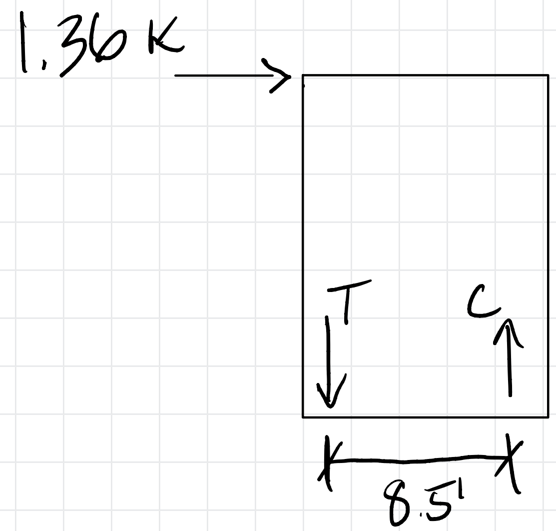
$T = \frac{15}{4.25'} = 3.53$ K (ASD)

Wall ③,④ :

V = 0.5(5.41 K) = 2.71 K

$v = \frac{2.71K}{17'} = 160$ PLF → Wall Type ⟨A⟩

Cap. = 460 plf



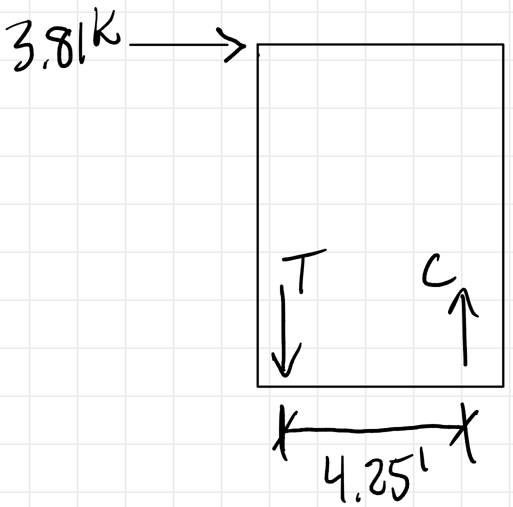
$M_{OT} = (1.36^k)(11') = 15$ KFT

$T = \frac{15}{8.5'} = 1.77K$

LEVEL 2:

Wall ① + ②:

V = 489 PLF
+271 PLF } 760 PLF → Wall Type ⟨C⟩
Cap. = 920 plf



$M_{OT} = (3.81k)(11') = 41.9$ K-FT (h = 11')

$T = \frac{41.9}{4.25'} = 9.86$ K (ASD)

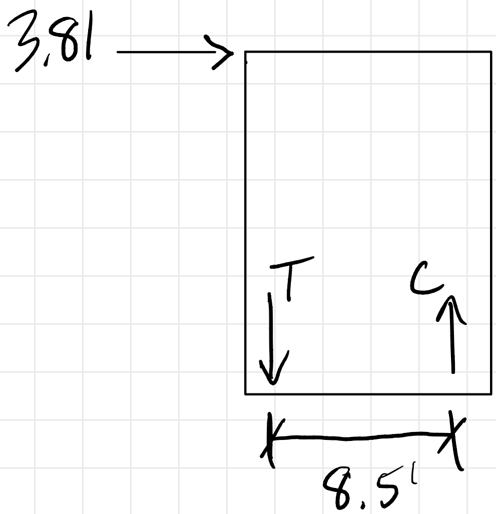
Wall (3), (4):

$V = 0.5(9.78\ k) = 4.89\ k$

$v = \frac{4.89\ k}{17'} = 288$ PLF

$+ 160$ PLF

448 PLF → Cap. = 460 plf — Wall Type (A)



$M_{OT} = (3.81\ k)(11') = 41.9$ kFT

$T = \frac{41.9}{8.5'} = 4.93\ K$ (ASD)

PCS Structural Solutions

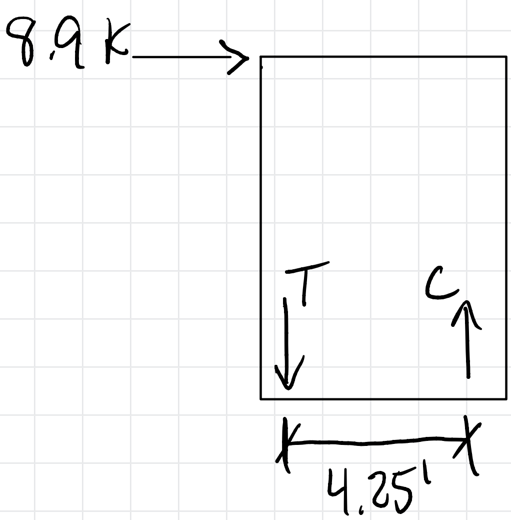
Project: MIMU | Job No: 19028
Subject: Townhome - Lat. | Sheet:
Name: AED
Originating Office: [X] Seattle [ ] Tacoma [ ] Portland | Date: 7/26/21

LEVEL 1:

Wall (1) + (2):

V = 1781 plf

Wall Type (D)
Cap. = 1740 plf
(DCR = 1.02 ✓OK)



$M_{OT} = (8.9\text{ k})(10.5') = 93.45\text{ k-ft}$ (h = 10.5')

$T = \dfrac{93.45}{4.25'} = 21.99\text{ k (ASD)}$

Net Tension = $21,990 - (0.6)(20\text{ PSF})\left(\frac{31'}{2}\right)(5') - (0.6)(10\text{ PSF})(5')(30')$

$= 20,160\ \#$

Use Type 4 Holdown

PCS Structural Solutions

Project: MIMU | Job No: 19028
Subject: Townhome - Lat. | Sheet | Name: AED
Originating Office: [X] Seattle [ ] Tacoma [ ] Portland | Date: 7/26/21

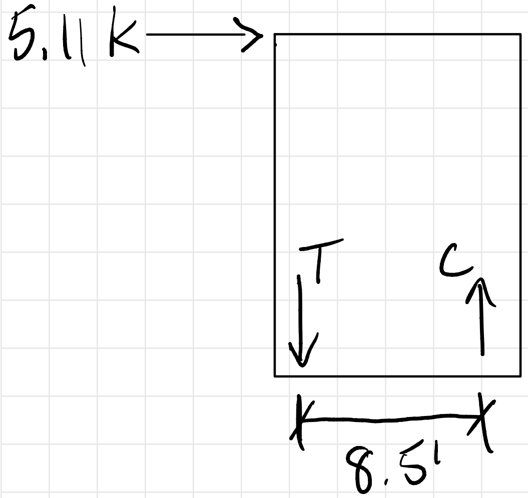
Wall (3),(4):

$$v = \frac{10.21\,k}{17'} = 601\ \text{PLF} + 448$$

$$= 1049\ \text{PLF} \rightarrow \langle D \rangle$$

Wall Type

Cap. = 1740 plf



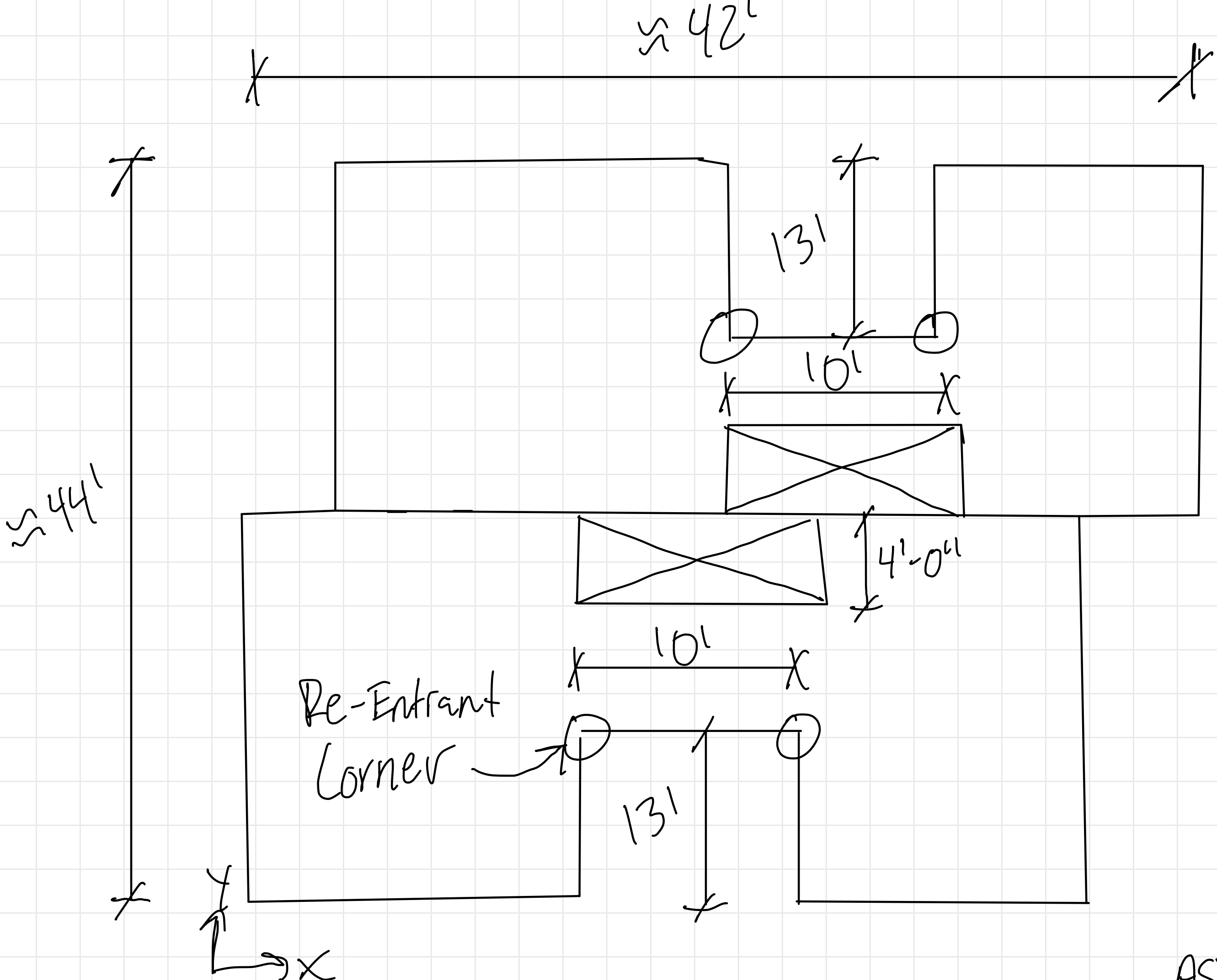
$$M_{OT} = (5.11\,k)(11') = 56.2\ \text{kFT}$$

$$T = \frac{56.2}{8.5'} = 6.61\,K \quad (ASD)$$

Use Holdown Type 2

Project: MIMU Job No: 19028
Subject: Sheet Name: AED
Originating Office: [x] Seattle [ ] Tacoma [ ] Portland Date: 12/6/22

Townhome L2 Re-Entrant Corner:



F_{px} (MAX.) = $0.4 S_{DS} I W_{px} = 0.4(0.92)(1)(201k) = 74K$ (53k ASD)

F_{px} (MIN) = $0.2 S_{DS} I W_{px} = 0.2(0.92)(1)(201k) = 37K$ (27k ASD)

$F_{px} = W_{px} \frac{\Sigma F_x}{\Sigma W_{px}} = (201)\frac{35.6k}{357.9k} = 20K$ (ASD)

F_{px} (MIN) Controls → **27K**

$$W_x = \frac{F_{px}}{L} = \frac{27K}{44'} = 0.61 \text{ KLF}$$

$$W_y = \frac{27K}{42'} = 0.64 \text{ KLF}$$

X-Direction:

Diaphragm Shear @ Strap $= \left(\frac{27K}{2}\right) - 0.64(8) = 8.4K$

Dist. Shear $= \frac{8.4K}{44'} = 191$ plf × 1.25 (Discontinuity)

$= 239$ plf

Re-Entrant Corner Force $= (239 \text{ plf})(10/2) = 1195\#$ (1.2K)

8'-0" long CS14 Strap OK

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Project: MIMU | Job No: 19028
Subject: | Sheet | Name: AED
Originating Office: [X] Seattle [ ] Tacoma [ ] Portland | Date: 12/6/22

Y-Direction:

(Discontinuity)

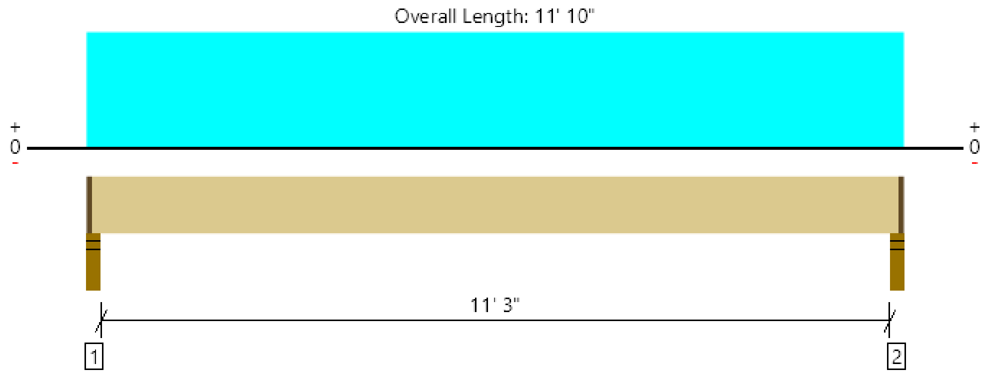
Diaphragm Shear @ Strap $= \left(\frac{27K}{4}\right) - 0.61(7') = 2.5K \times 1.25$
$= 3.1K$

22' I-JST w/ Diaphragm Nails $= 22' \cdot 1.6 \cdot 105 = 3.7K$

✓ OK

Level, Townhome Garage Louver

1 piece(s) 2 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	544 @ 2"	2109 (2.25")	Passed (26%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	454 @ 1' 3/4"	1915	Passed (24%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	1546 @ 5' 11"	2029	Passed (76%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.149 @ 5' 11"	0.287	Passed (L/925)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.232 @ 5' 11"	0.575	Passed (L/594)	--	1.0 D + 1.0 S (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Snow	Factored	
1 - Stud wall - DF	3.50"	2.25"	1.50"	198	355	553	1 1/4" Rim Board
2 - Stud wall - DF	3.50"	2.25"	1.50"	198	355	553	1 1/4" Rim Board

- Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 2" o/c	
Bottom Edge (Lu)	11' 8" o/c	

- Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Snow (1.15)	Comments
0 - Self Weight (PLF)	1 1/4" to 11' 8 3/4"	N/A	3.5	--	
1 - Uniform (PSF)	0 to 11' 10" (Front)	2'	15.0	30.0	Default Load

Member Notes

Rim Spanning Over Louver

Weyerhaeuser Notes

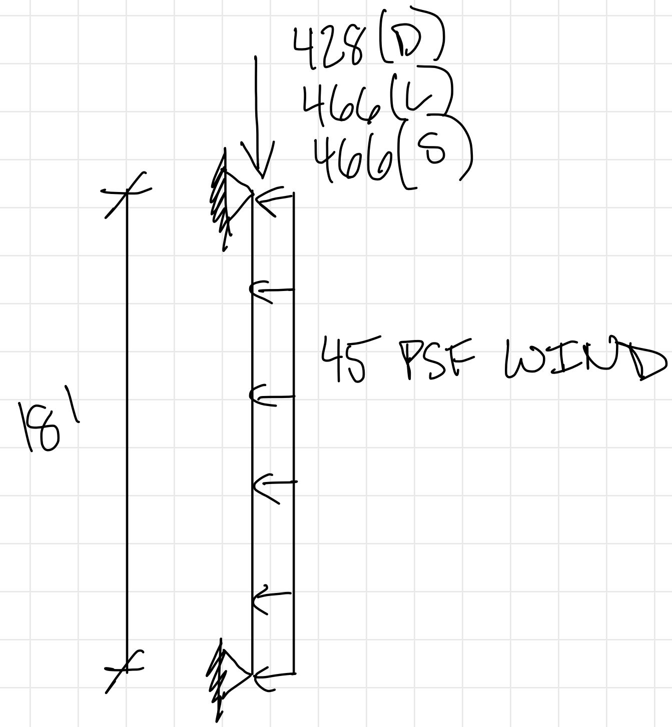
ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

PCS Structural Solutions

Project: MIMU
Job No: 19028
Subject:
Sheet
Name: AED
Originating Office: ☒ Seattle ☐ Tacoma ☐ Portland
Date: 12/7/22

Check Studs Out-Of-Plane:

GEOMETRY AND LOADING REPRESENTS WORST CASE STUD LOADING AND HEIGHT - WALL TYPE 7



Wall Type 7 OK ✓

Reaction at Top/Base = 540 lbs / 2 studs
= 270 lbs per stud

IBC Min. Nailing = (2) 16d (0.162") END NAIL

(2) 16d Cap. = $(1.6)(141)(2)$ = 451 lbs > 270 lbs ✓ (C_D = 1.6)

Reaction @ Top/Base OK

Project: Mercer Island	Job Number: 19-028
Sheet: 1 of	Name: AK
Originating Office: Seattle	Date: 12/07/22

PCS Structural Solutions

STUD WALL DESIGN - C.2

2018 NDS/2018 IBC

WALL DATA

LUMBER TYPE: DF#2

F_b =	900	PSI
F_c =	1350	PSI
$F_{c\perp}$ =	625	PSI
E =	1.60E+06	PSI

APPLIED LOADS:

W_{WIND} = 45.0 PSF

$W_{SEISMIC}$ = 5.0 PSF

P_{DEAD} =	428	LBS
P_{LIVE} =	466	LBS
P_{SNOW} =	466	LBS
P_{WIND} =	0	LBS
$P_{SEISMIC}$ =	0	LBS

STUD SIZE: (2) 2x6

A_X =	16.50	IN^2
S_X =	15.13	IN^3
I_X =	41.59	IN^4
$C_{F(BENDING)}$ =	1.3	(NDS 4.3.6)
F_{cE} =	311.2	PSI
C_b =	1.13	(NDS 3.10.4)

MISCELLANEOUS:

HEIGHT =	18	FT	
SPACING =	16	IN	
ECCENTRICITY =	0.1	IN	
$C_{F(COMPRESSION)}$ =	1.10	(NDS 4.3.6)	
		APPLY?	
$C_{SYS(BENDING)}$ =	1.35	YES	(SDPWS T3.1.1.1)
$C_{r(BENDING)}$ =	1.15	YES	(NDS 4.3.9)

LOAD CASES - IBC 1605.3.1

CASE 1	DEAD + LIVE + 5 PSF LAT.
CASE 2	DEAD + SNOW + 5 PSF LAT.
CASE 3	DEAD + 0.75LIVE + 0.75SNOW + 5 PSF LAT.
CASE 4	DEAD + 0.45WIND + 0.75LIVE + 0.75SNOW
CASE 5	DEAD + 0.60WIND
CASE 6	DEAD + 0.7SEISMIC
CASE 7	DEAD + 0.53SEISMIC + 0.75LIVE + 0.75SNOW

ALLOWABLE STRESSES - Cd PER NDS T2.3.2, Cp PER NDS 3.7.1, ASSUME Cm, Ct, Ci, CL = 1.0

CASE	C_D	F_c*	F_{cE}/F_c*	C_P	F_c'	F_b'	$F_{c\perp}$
1	1.00	1485	0.21	0.200	296	1346	703
2 & 3	1.15	1708	0.18	0.175	299	1547	703
4 & 5	1.60	2376	0.13	0.127	302	2527	703
6 & 7	1.60	2376	0.13	0.127	302	2153	703

APPLIED STRESSES - NDS CHAPTER 3 DESIGN EQUATIONS

CASE	$P_{APPLIED}$	f_c	$M_{LAT. LOAD}$	$M_{ECC.}$	M_{TOTAL}	f_b
1	894	54	270	7	275	218
2	894	54	270	7	275	218
3	1127	68	270	9	276	219
4	1127	68	1094	9	1099	872
5	428	26	1458	4	1460	1159
6	428	26	189	4	191	152
7	1127	68	143	9	149	118

DESIGN CHECKS - COMBINED STRESS CHECK PER NDS EQN 3.9-3

CASE	f_c/F_c'	f_b/F_b'	$f_c/F_{c\perp}$	Combined	f_c/F_{cE}	Deflection	L/?
1	0.18	0.16	0.08	0.23	0.17	0.24	L/897
2	0.18	0.14	0.08	0.20	0.17	0.24	L/897
3	0.23	0.14	0.10	0.23	0.22	0.24	L/893
4*	0.23	0.35	0.10	0.49	0.22	0.50	L/432
5*	0.09	0.46	0.04	0.51	0.08	0.66	L/326
6	0.09	0.07	0.04	0.08	0.08	0.17	L/1289
7	0.23	0.05	0.10	0.12	0.22	0.13	L/1655
MAX. --->	0.23	0.46	0.10	0.51	0.22	0.66	L/326
	O.K.	O.K.	O.K.	O.K.	O.K.		

* Deflections reduced by 0.42 per IBC Table 1604.3 footnote f. Increase deflection by 1.4 for jambs supporting glass.

PLATE BENDING - *ALIGN STUDS WITH JOISTS WHERE POSSIBLE*

MISCELLANEOUS:

C_{fu} =	1.15	(NDS 4.3.7)
F_v =	150	PSI

ALLOWABLE STRESSES:

F_v' =	173	PSI
F_b' =	1547	PSI

STUD REACTIONS (OUT - OF - PLANE)
540 LB

DBL TOP PLATE PROPERTIES:

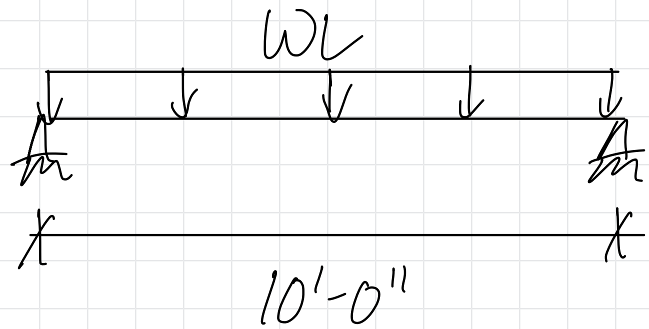
A_X =	16.50	IN^2
S_X =	4.13	IN^3
I_X =	3.09	IN^4

APPLIED STRESSES:

f_v =	54	PSI	<--- O.K.
f_b =	867	PSI	<--- O.K.
Δ_{MAX} =	0.015	IN	

Check Worst Case BM Out-of-Plane:

Trib. $= \frac{18'}{2} = 9'$ Wind Area = 90 sf $\xrightarrow{\text{use}}$ 50sf Pressures (Conservative)



WL = (9')(31 PSF) = 279 PLF

See Enercalc Report

6x10 or 5-1/4x9 1/2 SCL OK

Seattle | 1011 Western Avenue, Suite 810 | Seattle, WA 98104 | 206.292.5076
Tacoma | 1250 Pacific Avenue, Suite 701 | Tacoma, WA 98402 | 253.383.2797
Portland | 101 SW Main Street, Suite 280 | Portland, OR 97204 | 503.232.3746
www.pcs-structural.com

Wood Beam

Project File: Out of Plane Beam Calc.ec6

LIC# : KW-06014122, Build:20.22.10.25 PCS STRUCTURAL SOLUTIONS

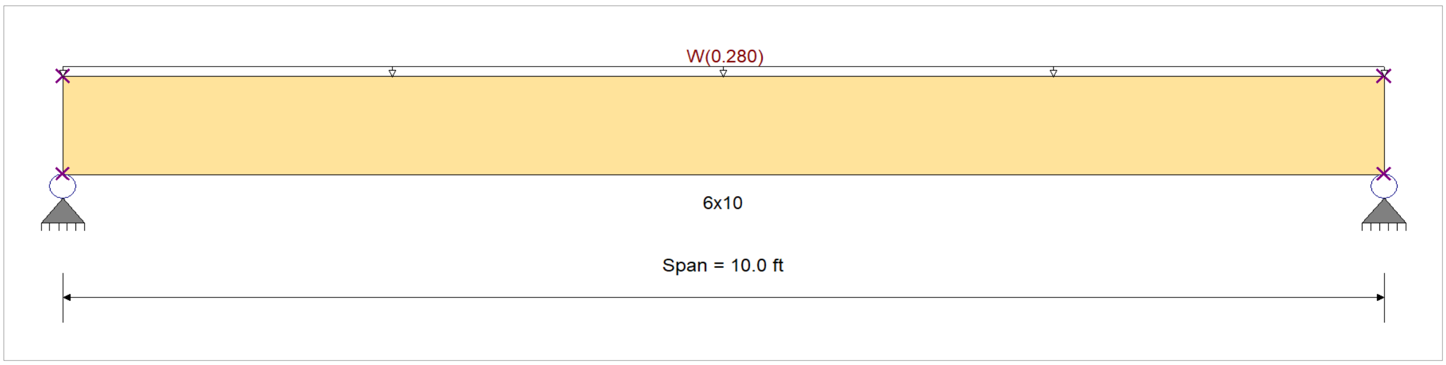
DESCRIPTION: Solid Sawn BM

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2015

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	1,350.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2015	Fb -	1,350.0 psi	Ebend- xx	1,600.0 ksi
		Fc - Prll	925.0 psi	Eminbend - xx	580.0 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625.0 psi		
Wood Grade :	No.1	Fv	170.0 psi		
		Ft	675.0 psi	Density	31.210 pcf
Beam Bracing :	Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : W = 0.280 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.143** : 1	Maximum Shear Stress Ratio	=	**0.075** : 1
Section used for this span		**6x10**	Section used for this span		**6x10**
fb: Actual	=	304.61 psi	fv: Actual	=	20.42 psi
F'b	=	2,130.74 psi	F'v	=	272.00 psi
Load Combination		+0.60W	Load Combination		+0.60W
Location of maximum on span	=	5.000 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.101 in	Ratio =	1190 >=360	Span: 1 : W Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.060 in	Ratio =	1984 >=180	Span: 1 : +0.60W
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
														0.0	0.00	0.0	0.0
Length = 10.0 ft	1			0.90	1.00	1.00	0.99	1.000	1.00	1.00	1.00			1,206.6	0.00	0.0	153.0
+0.60W					1.00	1.00	0.99	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.143	0.075	1.60	1.00	1.00	0.99	1.000	1.00	1.00	1.00	2.10	304.6	2,130.7	0.71	20.4	272.0
+0.450W					1.00	1.00	0.99	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.107	0.056	1.60	1.00	1.00	0.99	1.000	1.00	1.00	1.00	1.58	228.5	2,130.7	0.53	15.3	272.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.1008	5.036		0.0000	0.000

Wood Beam

DESCRIPTION: Solid Sawn BM

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.400	1.400
Max Upward from Load Combinations	0.840	0.840
Max Upward from Load Cases	1.400	1.400
+0.60W	0.840	0.840
+0.450W	0.630	0.630
W Only	1.400	1.400

Project Title: Mercer Island Mixed Use
Engineer: AED
Project ID: 19028
Project Descr:

Wood Beam

Project File: Out of Plane Beam Calc.ec6

LIC# : KW-06014122, Build:20.22.10.25 PCS STRUCTURAL SOLUTIONS (c) ENERCALC INC 1983-2022

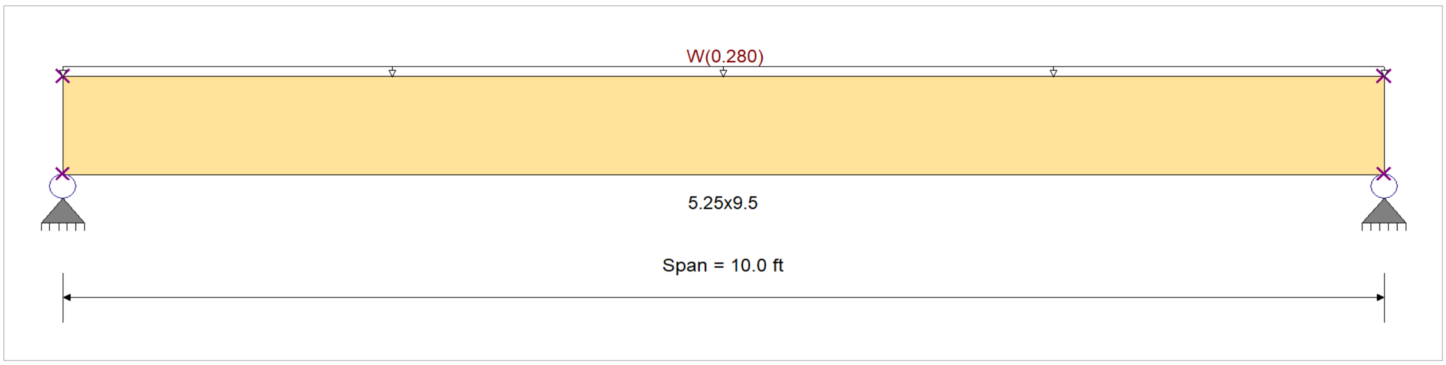
DESCRIPTION: SCL BM

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2015

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2,400.0 psi	*E : Modulus of Elasticity*	
Load Combination :	IBC 2015	Fb -	2,400.0 psi	Ebend- xx	1,800.0 ksi
		Fc - Prll	2,500.0 psi	Eminbend - xx	914.88 ksi
Wood Species :	iLevel Truss Joist	Fc - Perp	425.0 psi		
Wood Grade :	Parallam PSL 1.8E	Fv	190.0 psi		
		Ft	1,755.0 psi	Density	45.070 pcf
Beam Bracing :	Completely Unbraced				



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Loads on all spans...
Uniform Load on ALL spans : W = 0.280 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.085** : 1	Maximum Shear Stress Ratio	=	**0.070** : 1
Section used for this span		**5.25x9.5**	Section used for this span		**5.25x9.5**
fb: Actual	=	319.11 psi	fv: Actual	=	21.39 psi
F'b	=	3,771.87 psi	F'v	=	304.00 psi
Load Combination		+0.60W	Load Combination		+0.60W
Location of maximum on span	=	5.000 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.094 in	Ratio =	1278 >=360	Span: 1 : W Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.056 in	Ratio =	2130 >=180	Span: 1 : +0.60W
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
														0.0	0.00	0.0	0.0
Length = 10.0 ft	1			0.90	1.00	1.00	0.99	1.000	1.00	1.00	1.00			2,141.0	0.00	0.0	171.0
+0.60W					1.00	1.00	0.99	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.085	0.070	1.60	1.00	1.00	0.98	1.000	1.00	1.00	1.00	2.10	319.1	3,771.9	0.71	21.4	304.0
+0.450W					1.00	1.00	0.98	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.063	0.053	1.60	1.00	1.00	0.98	1.000	1.00	1.00	1.00	1.58	239.3	3,771.9	0.53	16.0	304.0

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
W Only	1	0.0939	5.036		0.0000	0.000

Wood Beam

DESCRIPTION: SCL BM

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.400	1.400
Max Upward from Load Combinations	0.840	0.840
Max Upward from Load Cases	1.400	1.400
+0.60W	0.840	0.840
+0.450W	0.630	0.630
W Only	1.400	1.400

S201.1 LEVEL 1M
FLOOR FRAMING PLAN

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	8	0	
2	N2	8.5	8	0	
3	N3	0	0	0	
4	N4	8.5	0	0	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N3	Reaction	Reaction	Reaction
2	N4	Reaction	Reaction	Reaction

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e⁵°F⁻¹]	Density [k/ft³]	Yield [ksi]	Ry	Fu [ksi]	Rt
1	A36_L	29000	11154	0.3	0.65	0.49	36	1.5	58	1.2
2	A572Grade50_CT	29000	11154	0.3	0.65	0.49	50	1.1	58	1.2
3	A992_W	29000	11154	0.3	0.65	0.49	50	1.1	58	1.2
4	A500_42	29000	11154	0.3	0.65	0.49	42	1.3	58	1.1
5	A500_46_TS	29000	11154	0.3	0.65	0.49	46	1.2	58	1.1

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	W12X22	Beam	Wide Flange	A992_W	Typical
2	M2	N1	N3	HSS5X5X6	Column	Tube	A500_46_TS	Typical
3	M3	N2	N4	HSS5X5X6	Column	Tube	A500_46_TS	Typical

Node Loads and Enforced Displacements (BLC 5 : EQ)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	X	2.65

Member Distributed Loads (BLC 1 : Dead)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-0.05	-0.05	0	%100

Member Distributed Loads (BLC 2 : Live)

	Member Label	Direction	Start Magnitude [k/ft, F, ksf, k-ft/ft]	End Magnitude [k/ft, F, ksf, k-ft/ft]	Start Location [(ft, %)]	End Location [(ft, %)]
1	M1	Y	-0.025	-0.025	0	%100

Basic Load Cases

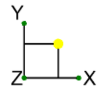
	BLC Description	Category	Y Gravity	Nodal	Distributed
1	Dead	None	-1		1
2	Live	None			1
3	Wind	None			
4	Snow	None			
5	EQ	None		1	
6	Live Rf	None			
7	Wind Pos	None			

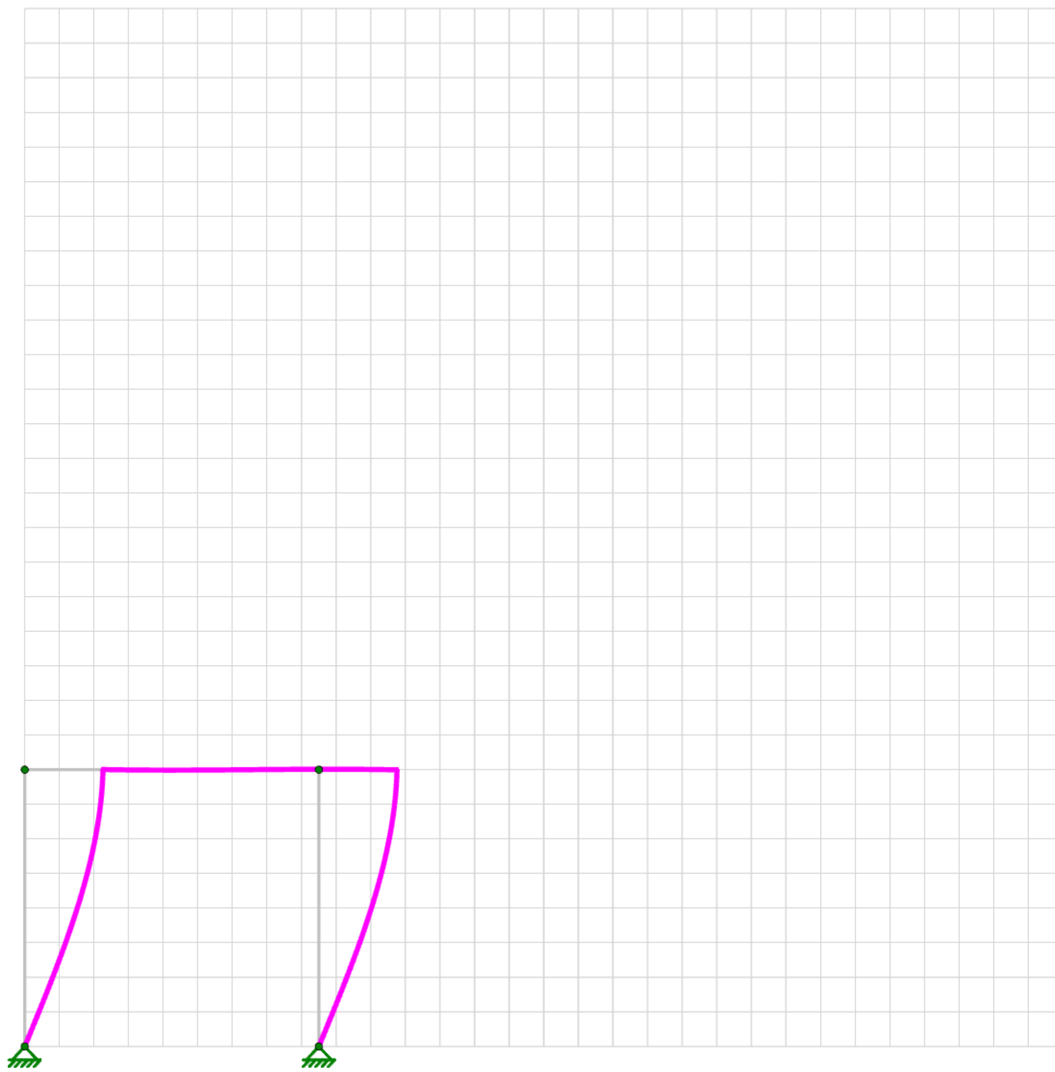
Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Dead	Yes	Y	1	1						
2	Live	Yes	Y	2	1						
3	Service		Y	1	1	2	1				
4	EQ	Yes	Y	5	1						
5	Live Rf	Yes	Y	6	1						
6	Wind Pos	Yes	Y	7	1						
7	1.4D	Yes	Y	1	1.4						
8	1.2D+1.6L+.5Lr	Yes	Y	1	1.2	2	1.6	6	0.5		
9	1.2D+1.6L+.5S	Yes	Y	1	1.2	2	1.6	4	0.5		
10	1.2D+1.6Lr+.5L	Yes	Y	1	1.2	6	1.6	2	0.5		
11	1.2D+1.6Lr+.8W	Yes	Y	1	1.2	6	1.6	3	0.8		
12	1.2D+1.6S+.5L	Yes	Y	1	1.2	4	1.6	2	0.5		
13	1.2D+1.6S+.8W	Yes	Y	1	1.2	4	1.6	3	0.8		
14	1.2D+1.6W+.5L+.5Lr	Yes	Y	1	1.2	3	1.6	2	0.5	6	0.5
15	1.2D+1.6W+.5L+.5S	Yes	Y	1	1.2	3	1.6	2	0.5	4	0.5
16	1.2D+1E+.5L+.2S	Yes	Y	1	1.2	5	1	2	0.5	4	0.2
17	.9D-1.6W	Yes	Y	1	0.9	3	-1.6				
18	.9D-1E	Yes	Y	1	0.9	5	-1				
19	(.9+.2Sds)D+pQE+.5L+0.2S	Yes	Y	1	0.9	5	1	2	0.5	4	0.2
20	(.9-.2Sds)D-pQE	Yes	Y	1	0.9	5	-1				

Envelope AISC 14TH (360-10): LRFD Member Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-y [k-ft]	phi*Mn z-z [k-ft]	Cb	Eqn
1	M1	W12X22	0.101	8.5	16	0.03	8.5	y	16	182.372	291.6	13.725	109.875	2.168	H1-1b
2	M2	HSS5X5X6	0.299	0	20	0.02	8	y	20	214.443	255.852	36.57	36.57	1.667	H1-1b
3	M3	HSS5X5X6	0.3	0	16	0.02	8	y	16	214.443	255.852	36.57	36.57	1.667	H1-1b

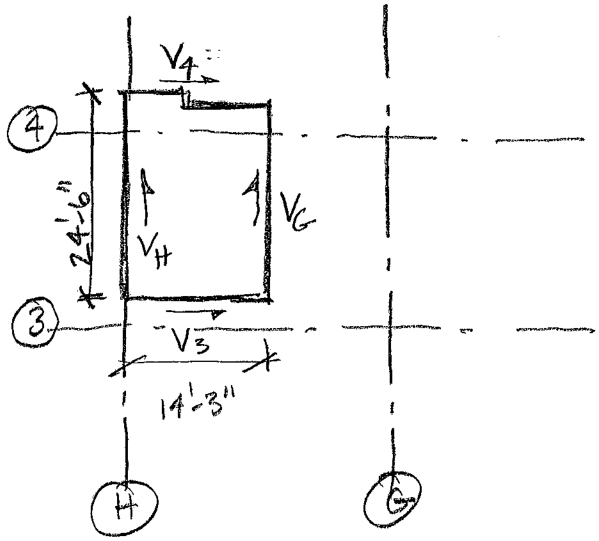




Results for LC 4, EQ

PCS Structural Solutions	Mezz Frame Grid 4	SK-1
KAR		Mar 28, 2022
		RISA-Steel-Template_v5.8.r3d

MEZZANINE LATERAL CALCS



3½ ON W2 / STEEL FRMG / MISC

D = 55psf + 15psf + 5psf

L = 40psf

$W = 75psf(14.25)(24.5) = 26.2^k$

R = 3½ (OMF) Cd = 3 Ω = 3

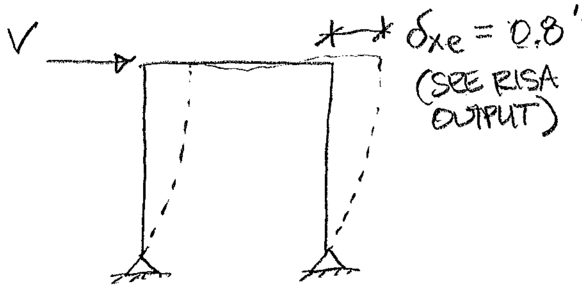
$V = C_s W$

$C_{s\,SW} = .184$ $R_{IMF} = 4.5$ $R_{SW} = 5$

$C_s = .184\left(\frac{5}{3.5}\right) = .204$

$V = .204(26.2) = 5.3\,k$

$V_4 = V_3 = V_H = V_G = \frac{5.3}{2} = \underline{2.65\,k}$



CHECK DRIFT :

$\Delta_1 = \frac{Cd\,\delta xe}{Ie} = \frac{3(0.8)}{1.0} = 2.4"$

$\Delta_{allow} = \frac{.025 h_x}{\rho} = \frac{.025(8.17)(12)}{1.0} = 2.5"$

$\Delta_1 < \Delta_{allow}$ ∴ OK

CHECK COLS

$P_D = .5k$
$P_L = 0.1k$
$P_E = 2.5k$ (SEE RISA)

$P_u = (1.2 + .2S_{DS})D + E + .5L$ $S_{DS} = .92$
$= [1.2 + .2(.92)].5 + 2.5 + .5(.1)$
$= 3.2k$

CHECK HSS5x5x1/2 $K = 1.0$ $L = 8.17ft$ $r = 1.82 in$

$\frac{KL}{r} = \frac{1.0(8.17)(12)}{1.82} = 53.7 < 4.71\sqrt{\frac{E}{F_y}} = 4.71\sqrt{\frac{29000}{46}} = 118.3$

$F_{cr} = [.658^{(\frac{F_y}{F_e})}]F_y$ $F_y = 46ksi$

$F_e = \frac{\pi^2 E}{(\frac{KL}{r})^2} = 99.2 ksi$

$= [.658^{\frac{46}{99.2}}](46) = 38.0 ksi$

$\phi P_n = \phi F_{cr} A_g$ $A_g = 7.88 in^2$

$= .9(38)(7.88) = 269 k > P_u$

MF AT MEZZANINE

BEAMS

GRID (4)

$M_D = 0.6\,k\text{-}ft$
$M_L = 0.2\,k\text{-}ft$
$M_E = 10.6\,k\text{-}ft$

$M_u = (1.2 + .2S_{DS})D + E + .5L$
$= [1.2 + 2(.92)].6 + 10.6 + .5(.2)$
$= 11.5\,k\text{-}ft$

$\phi M_n < \phi F_y Z$

$F_y = 50\,ksi \quad F_u = 65\,ksi$

CHECK W14x30

$L_p = 5.26 \quad L_r = 14.9$
$r_x = 5.73 \quad r_y = 1.49$
$S_x = 42$

$L_b = 8.5 \rightarrow L_p < L_b < L_r$

$\phi M_n = \phi C_b\left[M_p - (M_p - .7F_yS_x)\left(\frac{L_b - L_p}{L_r - L_p}\right)\right] \leq \phi M_p$

$M_p = 168\,k\text{-}ft$
$C_b = 1.0$ (CONSERV.)

$= .9(1.0)\left[168 - \left(168 - .7(50)(42)\left[\frac{8.5 - 5.26}{14.9 - 5.26}\right]\right)\right]$

$= 450 > \phi M_p \quad \therefore$ USE $\phi M_n = 450\,k\text{-}ft$

$\phi M_n < M_u \quad \therefore$ OK

Project: MIMU Job No: 19028

Subject: Sheet Name:

Originating Office: ☐ Seattle ☐ Tacoma ☐ Portland Date: 3/13/22

MF AT MEZZANINE

CHECK WELDS:

WELD SIZE, $t = 0.25$ in

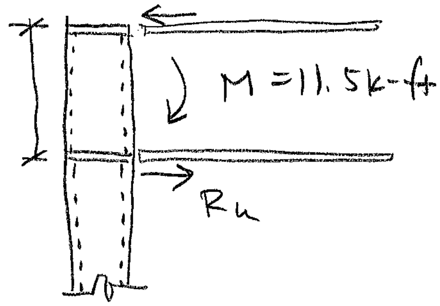
$F_{nw} = 0.6F_{EXX}(1+.5\sin^{1.5}\theta)$ $\phi = .75$

$F_{EXX} = 70$ ksi

$= .6(70)(1+.5) = 63$ ksi

$\phi F_{uw} = \phi(.6)70$

$= .75(.6)(70) = 31.5$ ksi $\ell_t = 5''$



$\frac{R_u}{t} = 9.6$ k/in

$R_u = \frac{11.5(12)}{14} = 9.6$ k

$a = .707t = .707(.25) = .177$ in

$R_u = \left(\frac{R_u}{t}\right)a = 9.6(.177) = 1.7$ k

$\phi R_n = \phi F_{uw} A_{nw} = .75(31.5)(.177)(5) = 20.9$ k $> R_u$

∴ OK

MEZZANINES

CHECK DIAPHRAGM :

$F_p = .4 S_{DS} I_e W_{px}$ (MAX)

$= .4(.92)(1.0)(26.2^k) = 9.6k$

GRID (4) : $v_4 = \frac{9.6}{2(14.25')} = 338^{\#/\prime}$

22 Ga $v_{allow} = 2255^{\#/\prime} > v_4$ ∴ OK

S202s LEVEL 2
CONCRETE FRAMING PLAN

Node Coordinates

	Label	X [ft]	Y [ft]	Z [ft]	Detach From Diaphragm
1	N1	0	0	0	
2	N2	5	0	0	
3	N3	10	0	0	
4	N4	15	0	0	
5	N5	20	0	0	
6	N6	25	0	0	
7	N7	0	11	0	
8	N8	5	11	0	
9	N9	10	11	0	
10	N10	15	11	0	
11	N11	20	11	0	
12	N12	25	11	0	
13	N13	0	0	-1.5	
14	N14	25	0	-1.5	

Node Boundary Conditions

	Node Label	X [k/in]	Y [k/in]	Z [k/in]
1	N7	Reaction	Reaction	Reaction
2	N8	Reaction	Reaction	Reaction
3	N9	Reaction	Reaction	Reaction
4	N10	Reaction	Reaction	Reaction
5	N11	Reaction	Reaction	Reaction
6	N12	Reaction	Reaction	Reaction
7	N13	Reaction	Reaction	Reaction
8	N14	Reaction	Reaction	Reaction

Hot Rolled Steel Properties

	Label	E [ksi]	G [ksi]	Nu	Therm. Coeff. [1e^5°F^{-1}]	Density [k/ft^3]	Yield [ksi]	Ry	Fu [ksi]	Rt
1	A36_L	29000	11154	0.3	0.65	0.49	36	1.5	58	1.2
2	A572Grade50_CT	29000	11154	0.3	0.65	0.49	50	1.1	58	1.2
3	A992_W	29000	11154	0.3	0.65	0.49	50	1.1	58	1.2
4	A500_42	29000	11154	0.3	0.65	0.49	42	1.3	58	1.1
5	A500_46_TS	29000	11154	0.3	0.65	0.49	46	1.2	58	1.1

Member Primary Data

	Label	I Node	J Node	Section/Shape	Type	Design List	Material	Design Rule
1	M1	N1	N2	HSS7X5X4	Column	Tube	A500_46_TS	Typical
2	M2	N2	N3	HSS7X5X4	Column	Tube	A500_46_TS	Typical
3	M3	N3	N4	HSS7X5X4	Column	Tube	A500_46_TS	Typical
4	M4	N4	N5	HSS7X5X4	Column	Tube	A500_46_TS	Typical
5	M5	N5	N6	HSS7X5X4	Column	Tube	A500_46_TS	Typical
6	M6	N1	N7	HSS4X4X4	Column	Tube	A500_46_TS	Typical
7	M7	N2	N8	HSS4X4X4	Column	Tube	A500_46_TS	Typical
8	M8	N3	N9	HSS4X4X4	Column	Tube	A500_46_TS	Typical
9	M9	N4	N10	HSS4X4X4	Column	Tube	A500_46_TS	Typical
10	M10	N5	N11	HSS4X4X4	Column	Tube	A500_46_TS	Typical
11	M11	N6	N12	HSS4X4X4	Column	Tube	A500_46_TS	Typical
12	M12	N1	N13	HSS5X5X4	Column	Tube	A500_46_TS	Typical
13	M13	N6	N14	HSS5X5X4	Column	Tube	A500_46_TS	Typical

Node Loads and Enforced Displacements (BLC 5 : EQ)

	Node Label	L, D, M	Direction	Magnitude [(k, k-ft), (in, rad), (k*s²/ft, k*s²*ft)]
1	N1	L	X	250

Member Distributed Loads

No Data to Print...

Basic Load Cases

	BLC Description	Category	Y Gravity	Nodal	Surface(Plate/Wall)
1	Dead	None	-1		
2	Live	None			
3	Wind	None			1
4	Snow	None			
5	EQ	None		1	
6	Live Rf	None			
7	Wind Pos	None			

Load Combinations

	Description	Solve	P-Delta	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Dead	Yes	Y	1	1						
2	Live	Yes	Y	2	1						
3	Service		Y	1	1	2	1				
4	EQ	Yes	Y	5	1						
5	Live Rf	Yes	Y	6	1						
6	Wind Pos	Yes	Y	7	1						
7	1.4D	Yes	Y	1	1.4						
8	1.2D+1.6L+.5Lr	Yes	Y	1	1.2	2	1.6	6	0.5		
9	1.2D+1.6L+.5S	Yes	Y	1	1.2	2	1.6	4	0.5		
10	1.2D+1.6Lr+.5L	Yes	Y	1	1.2	6	1.6	2	0.5		
11	1.2D+1.6Lr+.8W	Yes	Y	1	1.2	6	1.6	3	0.8		
12	1.2D+1.6S+.5L	Yes	Y	1	1.2	4	1.6	2	0.5		
13	1.2D+1.6S+.8W	Yes	Y	1	1.2	4	1.6	3	0.8		
14	1.2D+1.6W+.5L+.5Lr	Yes	Y	1	1.2	3	1.6	2	0.5	6	0.5
15	1.2D+1.6W+.5L+.5S	Yes	Y	1	1.2	3	1.6	2	0.5	4	0.5
16	1.2D+1E+.5L+.2S	Yes	Y	1	1.2	5	1	2	0.5	4	0.2
17	.9D-1.6W	Yes	Y	1	0.9	3	-1.6				
18	.9D-1E	Yes	Y	1	0.9	5	-1				
19	(.9+.2Sds)D+pQE+.5L+0.2S	Yes	Y	1	0.9	5	1	2	0.5	4	0.2
20	(.9-.2Sds)D-pQE	Yes	Y	1	0.9	5	-1				

Envelope AISC 14TH (360-10): LRFD Member Steel Code Checks

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-y [k-ft]	phi*Mn z-z [k-ft]	Cb	Eqn
1	M1	HSS7X5X4	0.155	5	16	0.006	0	y	20	204.39	216.936	33.914	42.78	1.696	H1-1b*
2	M2	HSS7X5X4	0.155	5	16	0.005	5	y	20	204.39	216.936	33.914	42.78	2.246	H1-1b*
3	M3	HSS7X5X4	0.155	5	16	0.005	5	y	16	204.39	216.936	33.914	42.78	1.588	H1-1b*
4	M4	HSS7X5X4	0.155	5	16	0.012	0	y	16	204.39	216.936	33.914	42.78	1.92	H1-1b*
5	M5	HSS7X5X4	0.155	5	16	0.018	5	y	16	204.39	216.936	33.914	42.78	1.425	H1-1b*
6	M6	HSS4X4X4	0.154	0	20	0.001	11	y	16	84.082	139.518	16.181	16.181	1.668	H1-1b*
7	M7	HSS4X4X4	0.014	0	20	0	11	y	20	84.082	139.518	16.181	16.181	1.667	H1-1b
8	M8	HSS4X4X4	0.019	0	4	0	11	y	16	84.082	139.518	16.181	16.181	1.667	H1-1b
9	M9	HSS4X4X4	0.02	0	16	0	11	z	4	84.082	139.518	16.181	16.181	1.667	H1-1b
10	M10	HSS4X4X4	0.016	0	4	0	11	z	4	84.082	139.518	16.181	16.181	1.667	H1-1b

Envelope AISC 14TH (360-10): LRFD Member Steel Code Checks (Continued)

	Member	Shape	Code Check	Loc[ft]	LC	Shear Check	Loc[ft]	Dir	LC	phi*Pnc [k]	phi*Pnt [k]	phi*Mn y-y [k-ft]	phi*Mn z-z [k-ft]	Cb	Eqn
11	M11	HSS4X4X4	0.087	0	16	0	11	y	16	84.082	139.518	16.181	16.181	1.666	H1-1b*
12	M12	HSS5X5X4	0.599	0	20	0.201	1.5	z	20	176.98	178.02	26.255	26.255	1.678	H1-1b
13	M13	HSS5X5X4	0.555	0	4	0.184	1.5	z	4	176.98	178.02	26.255	26.255	1.667	H1-1b

S203 – LEVEL 3 FRAMING PLAN

PCS Structural Solutions

Project: MIMU　　Job No: 19028
Subject: ____　　Sheet ____　　Name: AED
Originating Office: ☒ Seattle ☐ Tacoma ☐ Portland　　Date: 3/25/22

Check Diaphragm w/ Re-Entrant Straps:

Highest Strap Shear = 7.72K ← Re-entrant Corner @ Grid D/4.5+

Diaphragm Capacity = 240 plf (ASD)

$$\frac{7.72K \cdot 1000}{240 \text{ plf}} = \underline{\underline{32'}} \text{ Strap End Length}$$

Re-entrant Corner @ Grid D/8.2, I/3.2
= 4.31 K

$$\frac{4.31 \cdot 1000}{240 \text{ plf}} = \underline{\underline{18'}} \text{ Strap End Length}$$

S204 - LEVEL 4 FRAMING PLAN

Level 4 Loft Lateral Design: $S_{DS} = 0.92$

Loft Area = 238 sf

Weight = (238 sf)(25 PSF + 10 PSF)
(25 PSF = Floor, 10 PSF = Walls)

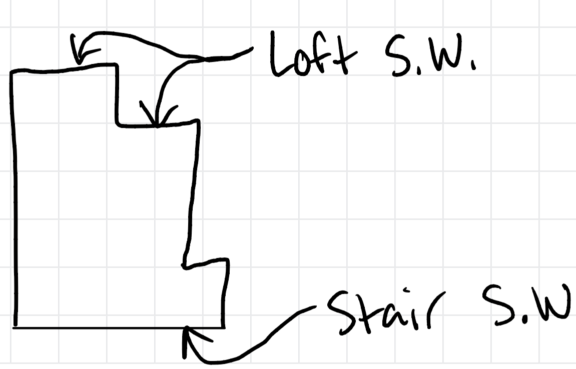
$W_p = 8330$ lbs

$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)}\left(1 + 2\frac{z}{h}\right) \quad \text{ASCE 13.3-1}$$

$a_p = 2.5$, $R_p = 3.5$, $I_p = 1.0$, $z = 18.5'$, $h = 28.5'$

$$F_p = \frac{0.4(2.5)(0.92)(8330)}{\left(\frac{3.5}{1}\right)}\left(1 + 2\left(\frac{18.5}{28.5}\right)\right)$$

$F_p = 5032$ lbs OR ≈ 60% · W_p (Very Conservative)



$V_{stair\ S.W.} = \frac{5032}{2} = 2516 \times 0.7$ (ASD)

$v_{stair\ S.W.} = \frac{1761}{14.5'} = 121.5$ plf

Add to L4 in excel

$\checkmark_{Loft\ S.W.} = \frac{1761}{7.5' + 4.67'} = 145$ plf ✓ Wall Type A OK

Add to L3 Excel ↑

Diaphragm positively attached at 2 sides to additionally brace loft - See 18+19 on S510

Level 4M Loft Design:

Loft Area = 167 sf

Weight = (167 sf)(25 PSF + 10 PSF)
(25 PSF = Floor, 10 PSF = Walls)

$W_p = 5845$ lbs

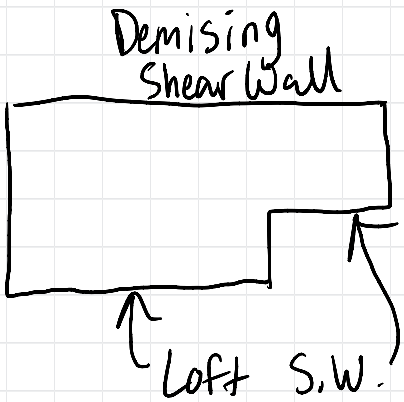
$$F_p = \frac{0.4 a_p S_{DS} W_p}{\left(\frac{R_p}{I_p}\right)} \left(1 + 2\frac{z}{h}\right)$$ ASCE 13.3-1

$a_p = 2.5$, $R_p = 3.5$, $I_p = 1.0$, $z = 18.5'$, $h = 28.5'$

$$F_p = \frac{0.4(2.5)(0.92)(5845)}{\left(\frac{3.5}{1}\right)}\left(1 + 2\left(\frac{18.5}{28.5}\right)\right)$$

Very Conservative

$F_p = 3531$ lbs OR $\approx 60\% \cdot W_p$



$V_{Demising\ S.W.} = \frac{3531}{2} \times 0.7 = 1236\#$ (0.7: ASD)

$v_{Demising\ S.W.} = \frac{1236}{30.5'} = 41$ plf ← Add to Excel Calc

$v_{Loft\ S.W.} = \frac{1236}{9.5' + 14.5'} = 52$ plf ✓

Wall Type A OK

Add to L3 Excel Calc

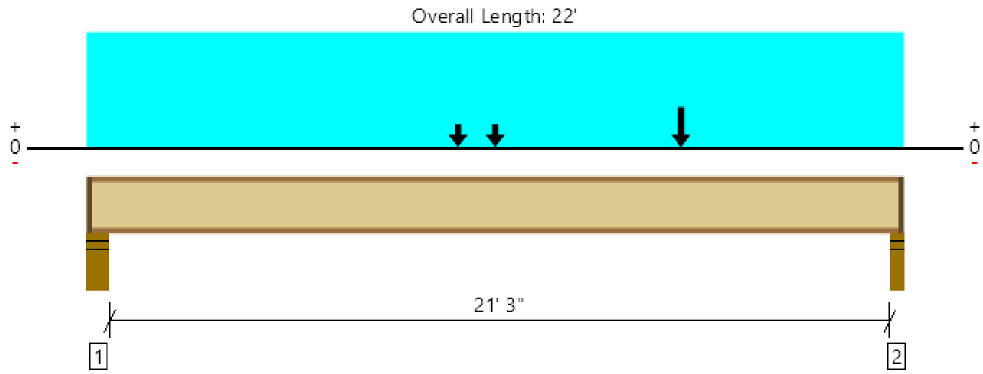
Diaphragm Positively Attached - see 16+18 on S510

MEMBER REPORT

PASSED

Level, J2 @ Lofts

1 piece(s) 11 7/8" TJI® 560 @ 12" OC



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	978 @ 21' 9 1/2"	1396 (2.25")	Passed (70%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	965 @ 21' 8 1/2"	2050	Passed (47%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5392 @ 11'	9500	Passed (57%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.350 @ 11' 2 13/16"	0.535	Passed (L/734)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.706 @ 11' 2 3/4"	1.071	Passed (L/364)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	45	45	Passed	--	--

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: 5/8" Gypsum ceiling, Pour Flooring Overlay.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	5.50"	4.25"	1.75"	413	473	886	1 1/4" Rim Board
2 - Stud wall - DF	3.50"	2.25"	1.75"	467	517	984	1 1/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 6" o/c	
Bottom Edge (Lu)	21' 10" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 22'	12"	25.0	40.0	Default Load
2 - Point (PLF)	16'	12"	150.0	110.0	
3 - Point (lb)	10'	N/A	90	-	
4 - Point (lb)	11'	N/A	90	-	

Weyerhaeuser Notes

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The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

3/28/2022 6:06:15 PM UTC

ForteWEB v3.2, Engine: V8.2.0.17, Data: V8.1.0.16

File Name: Gravity Updates

S250 – DETENTION VAULT DETAILS

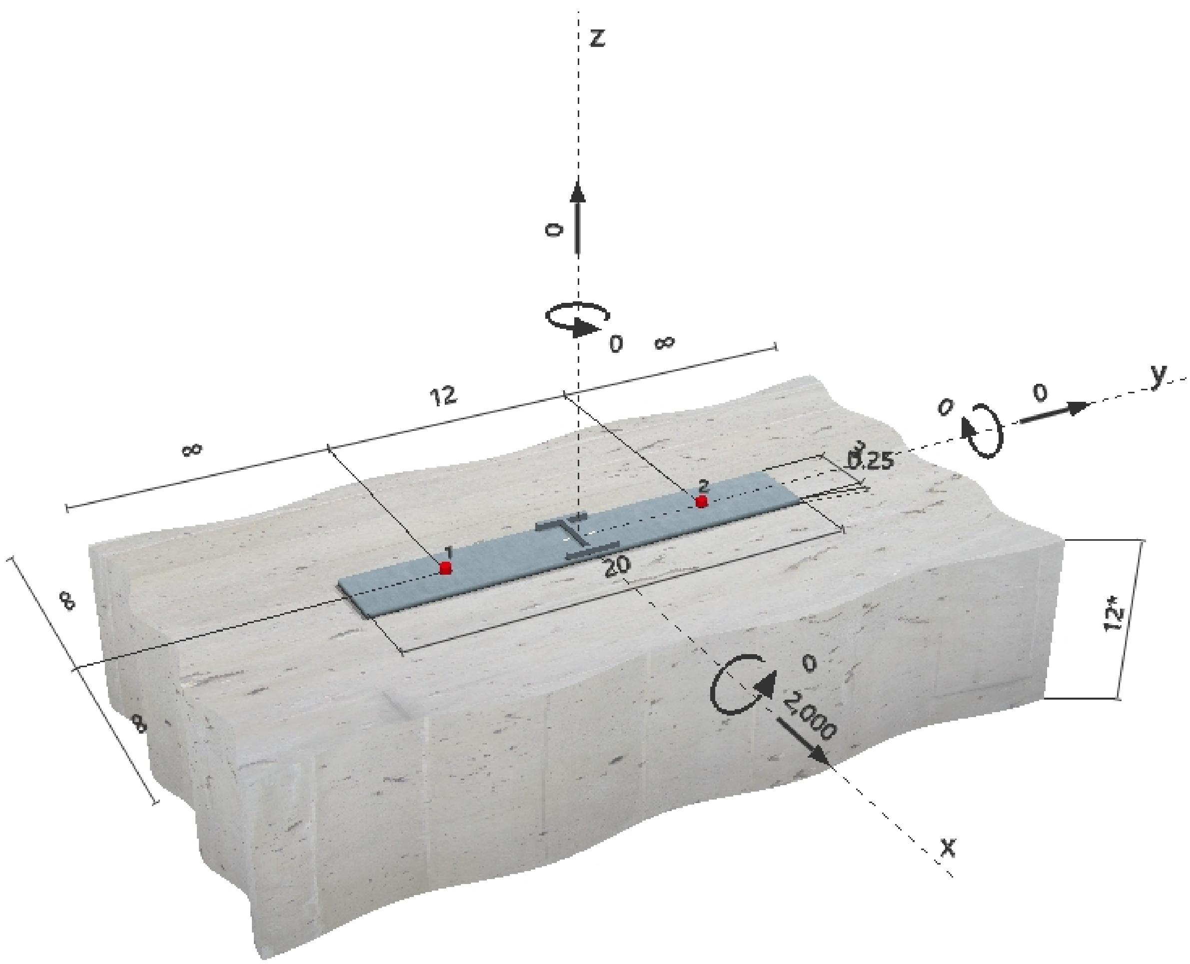
Company:		Page:	1
Specifier:		Project:	Mercer Island Apts
Address:		Sub-Project I Pos. No.:	Sump Grate Conn
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Kwik Bolt TZ - SS 316 1/2 (3 1/4)**
Effective embedment depth:	$h_{ef,act}$ = 3.250 in., h_{nom} = 3.625 in.
Material:	AISI 316
Evaluation Service Report:	ESR-1917
Issued I Valid:	5/1/2017 | 5/1/2019
Proof:	Design method ACI 318-14 / Mech.
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.250 in.
Anchor plate:	l_x x l_y x t = 3.000 in. x 20.000 in. x 0.250 in.; (Recommended plate thickness: not calculated
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 4000, f_c' = 4000 psi; h = 12.000 in.
Installation:	**hammer drilled hole, Installation condition: Dry**
Reinforcement:	tension: condition B, shear: condition B; no supplemental splitting reinforcement present edge reinforcement: none or < No. 4 bar

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



Company:		Page:	2
Specifier:		Project:	Mercer Island Apts
Address:		Sub-Project I Pos. No.:	Sump Grate Conn
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

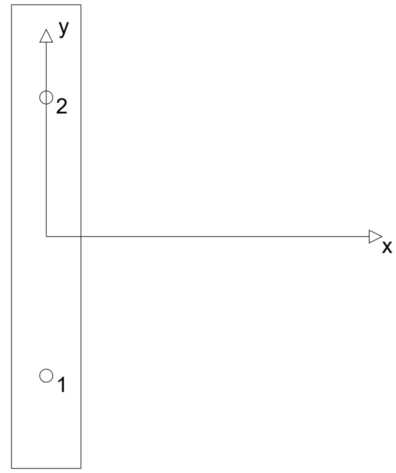
2 Load case/Resulting anchor forces

Load case: Design loads

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

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	0	1000	1000	0
2	0	1000	1000	0

max. concrete compressive strain: - [‰]
max. concrete compressive stress: - [psi]
resulting tension force in (x/y)=(0.000/0.000): 0 [lb]
resulting compression force in (x/y)=(0.000/0.000): 0 [lb]



3 Tension load

	Load N_{ua} [lb]	Capacity ϕ N_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	N/A	N/A	N/A	N/A
Pullout Strength*	N/A	N/A	N/A	N/A
Concrete Breakout Strength**	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (anchors in tension)

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	1000	4472	23	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	2000	17639	12	OK
Concrete edge failure in direction **	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (relevant anchors)

4.1 Steel Strength

V_{sa} = ESR value refer to ICC-ES ESR-1917

$\phi\ V_{steel} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.10	115000

Calculations

V_{sa} [lb]
6880

Results

V_{sa} [lb]	ϕ_{steel}	$\phi\ V_{sa}$ [lb]	V_{ua} [lb]
6880	0.650	4472	1000

4.2 Pryout Strength

$V_{cpg} = k_{cp}\left[\left(\frac{A_{Nc}}{A_{Nc0}}\right)\psi_{ec,N}\ \psi_{ed,N}\ \psi_{c,N}\ \psi_{cp,N}\ N_b\right]$ ACI 318-14 Eq. (17.5.3.1b)

$\phi\ V_{cpg} \geq V_{ua}$ ACI 318-14 Table 17.3.1.1

A_{Nc} see ACI 318-14, Section 17.4.2.1, Fig. R 17.4.2.1(b)

$A_{Nc0} = 9\ h_{ef}^2$ ACI 318-14 Eq. (17.4.2.1c)

$\psi_{ec,N} = \left(\frac{1}{1+\frac{2\ e_N'}{3\ h_{ef}}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.4)

$\psi_{ed,N} = 0.7 + 0.3\left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.5b)

$\psi_{cp,N} = \mathrm{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-14 Eq. (17.4.2.7b)

$N_b = k_c\ \lambda_a \sqrt{f_c'}\ h_{ef}^{1.5}$ ACI 318-14 Eq. (17.4.2.2a)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	3.250	0.000	0.000	∞

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ_a	f_c' [psi]
1.000	6.000	17	1.000	4000

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
190.13	95.06	1.000	1.000	1.000	1.000	6299

Results

V_{cpg} [lb]	$\phi_{concrete}$	$\phi\ V_{cpg}$ [lb]	V_{ua} [lb]
25198	0.700	17639	2000

Company:		Page:	4
Specifier:		Project:	Mercer Island Apts
Address:		Sub-Project I Pos. No.:	Sump Grate Conn
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

5 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (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 Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Refer to the manufacturer's product literature for cleaning and installation instructions.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!
- Hilti post-installed anchors shall be installed in accordance with the Hilti Manufacturer's Printed Installation Instructions (MPII). Reference ACI 318-14, Section 17.8.1.

Fastening meets the design criteria!

Company:		Page:	5
Specifier:		Project:	Mercer Island Apts
Address:		Sub-Project I Pos. No.:	Sump Grate Conn
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

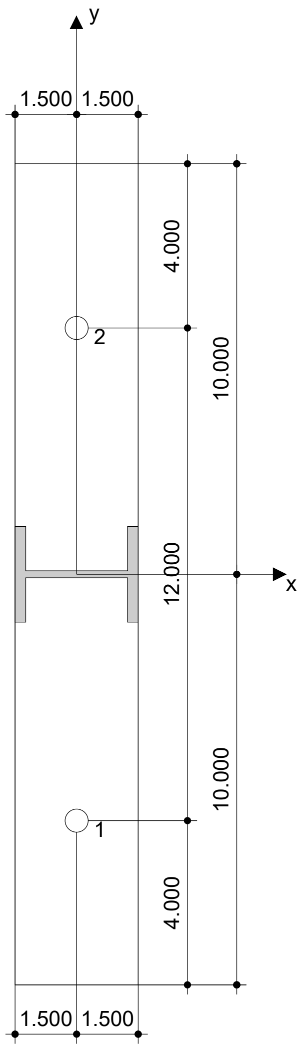
6 Installation data

Anchor plate, steel: -
Profile: S shape (AISC); 3.000 x 2.330 x 0.170 x 0.260 in.
Hole diameter in the fixture: d_f = 0.563 in.
Plate thickness (input): 0.250 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 TZ - SS 316 1/2 (3 1/4)
Installation torque: 480.001 in.lb
Hole diameter in the base material: 0.500 in.
Hole depth in the base material: 4.000 in.
Minimum thickness of the base material: 8.000 in.

6.1 Recommended accessories

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



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	0.000	-6.000	-	-	-	-
2	0.000	6.000	-	-	-	-

Company:		Page:	6
Specifier:		Project:	Mercer Island Apts
Address:		Sub-Project I Pos. No.:	Sump Grate Conn
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

7 Remarks; Your Cooperation Duties

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S420 TYPICAL POST-TENSION SLAB DETAILS

Structural Solutions

Project: MIMU
Job No:
Subject:
Sheet
Name:
Originating Office: ☐ Seattle ☐ Tacoma ☐ Portland
Date: 3/21/22

Both ASTM E119 Table X3.1 and ANSI / UL 263 Appendix C define all Concrete cast-in-place slab bays as "restrained".

See specific text noted below:

ASTM E119:

TABLE X3.1 Construction Classification, Restrained and Unrestrained

I. Wall bearing:	
Single span and simply supported end spans of multiple bays:[A]	
(1) Open-web steel joists or steel beams, supporting concrete slab, precast units, or metal decking	unrestrained
(2) Concrete slabs, precast units, or metal decking	unrestrained
Interior spans of multiple bays:	
(1) Open-web steel joists, steel beams or metal decking, supporting continuous concrete slab	restrained
(2) Open-web steel joists or steel beams, supporting precast units or metal decking	unrestrained
(3) Cast-in-place concrete slab systems	restrained
(4) Precast concrete where the potential thermal expansion is resisted by adjacent construction[B]	restrained
II. Steel framing:	
(1) Steel beams welded, riveted, or bolted to the framing members	restrained
(2) All types of cast-in-place floor and roof systems (such as beam-and-slabs, flat slabs, pan joists, and waffle slabs) where the floor or roof system is secured to the framing members	restrained
(3) All types of prefabricated floor or roof systems where the structural members are secured to the framing members and the potential thermal expansion of the floor or roof system is resisted by the framing system or the adjoining floor or roof construction[B]	restrained
III. Concrete framing:	
(1) Beams securely fastened to the framing members	restrained
(2) All types of cast-in-place floor or roof systems (such as beam-and-slabs, flat slabs, pan joists, and waffle slabs) where the floor system is cast with the framing members	restrained
(3) Interior and exterior spans of precast systems with cast-in-place joints resulting in restraint equivalent to that which would exist in condition III (1)	restrained
(4) All types of prefabricated floor or roof systems where the structural members are secured to such systems and the potential thermal expansion of the floor or roof systems is resisted by the framing system or the adjoining floor or roof construction[B]	restrained
IV. Wood construction:	
All types	unrestrained

APPENDIX C

Nonmandatory Guide for Determining Conditions of Restraint for Floor and Roof Assemblies and for Individual Beams

C1.1 Revisions adopted in 1970 introduced the concept of fire endurance classifications based on two conditions of support: restrained and unrestrained. As a result, specimens are fire tested to derive these two classifications.

C1.2 In fire tests, a restrained condition, as used in this standard, is one in which expansion at the supports of a load-carrying element resulting from the effects of the fire is resisted by forces external to the element. An unrestrained condition is one in which the load-carrying element is free to expand and rotate at its supports.

C1.3 This guide is based on knowledge currently available and classifies all constructions as either restrained or unrestrained. This classification will enable the architect, engineer, or building official to correlate the fire endurance classification, based on conditions of restraint, with the construction type under consideration. While it has been shown that certain conditions of restraint will improve fire endurance, methodologies for establishing the presence of sufficient restraint in actual constructions have not been standardized.

C1.4 For the purpose of this Guide, restraint in buildings is defined as follows:

> Floor and roof assemblies and individual beams in buildings shall be considered restrained when the surrounding or supporting structure is capable of resisting substantial thermal expansion throughout the range of anticipated elevated temperatures. Constructions not complying with this definition are assumed to be free to rotate and expand and shall therefore be considered as unrestrained.

C1.5 The definition in C1.4 requires the exercise of engineering judgment to determine what constitutes restraint to ″substantial thermal expansion.″ Restraint may be provided by the lateral stiffness of supports for floor and roof assemblies and intermediate beams forming part of the assembly. In order to develop restraint, connections must adequately transfer thermal thrusts to such supports. The rigidity of adjoining panels or structures should be considered in assessing the capability of a structure to resist thermal expansion. Continuity, such as that occurring in beams acting continuously over more than two supports, will induce rotational restraint which will usually add to the fire resistance of structural members. In Table C1.1 only the common types of constructions are listed. Having these examples in mind, as well as the philosophy expressed in the preamble, the user should be able to rationalize the less common types of construction.

C1.6 The foregoing methods of determining the presence or absence of restraint, according to the type and detail of construction, represent only one procedure for establishing dual fire endurance classifications. This procedure alone does not represent all restrained and unrestrained construction conditions.

Table C1.1
Considerations of restraint for common construction

I. Wall Bearing:

- A. Single span and simply supported end spans of multiple bays.[a]
  - 1. Open-web steel joists or steel beams supporting concrete slab, precast units, or metal decking. . . . . Unrestrained
  - 2. Concrete slabs, precast units, or metal decking. . . . . Unrestrained
- B. Interior spans of multiple bays.
  - 1. Open-web steel joists, steel beams, or metal decking supporting continuous concrete slab. . . . . . Restrained
  - 2. Open-web steel joists or steel beams, supporting precast units or metal decking. . . . . Unrestrained
  - 3. Cast-in-place concrete slab systems . . . . Restrained
  - 4. Precast concrete where the potential thermal expansion is resisted by adjacent construction[b]. . . . Restrained

II. Steel Framing:

- A. Steel beams welded, riveted, or bolted to the framing members . . . . Restrained
- B. All types of cast-in-place floor and roof systems (such as beam-and-slabs, flat slabs, pan joists, and waffle slabs) where the floor or roof system is secured to the framing members . . . . Restrained
- C. All types of prefabricated floor or roof systems where the structural members are secured to the framing members and the potential thermal expansion of the floor or roof system is resisted by the framing system or the adjoining floor or roof construction[b]. . . . . Restrained

III. Concrete Framing:

- A. Beams securely fastened to the framing members. . . . . Restrained
- B. All types of cast-in-place floor or roof systems, such as beam-and-slabs, flat slabs, pan joists, and waffle slabs, where the floor system is cast with the framing members. . . . . Restrained
- C. Interior and exterior spans of precast systems with cast-in-place joints resulting in restraint equivalent to that which would exist in Condition III, item A . . . . Restrained
- D. All types of prefabricated floor or roof systems where the structural members are secured to such systems and the potential thermal expansion of the floor or roof system is resisted by the framing system or the adjoining floor or roof construction[b]. . . . . Restrained

IV. Wood Construction:

- A. All types. . . . . Unrestrained

[a] Floor and roof systems can be considered restrained if they are tied into walls with or without tie beams, and the walls are designed and detailed to resist thermal thrust from the floor or roof system.

[b] For example, resistance to potential thermal expansion is considered to be achieved if:

1. Continuous structural concrete topping is used.
2. The space between the ends of precast units or between the ends of units and the vertical face of supports is filled with concrete or mortar.
3. The space between the ends of precast units and the vertical faces of supports or between the ends of solid or hollow core slab units does not exceed 0.25 percent of the length for normal-weight concrete members or 0.1 percent of the length for structural light-weight concrete members.

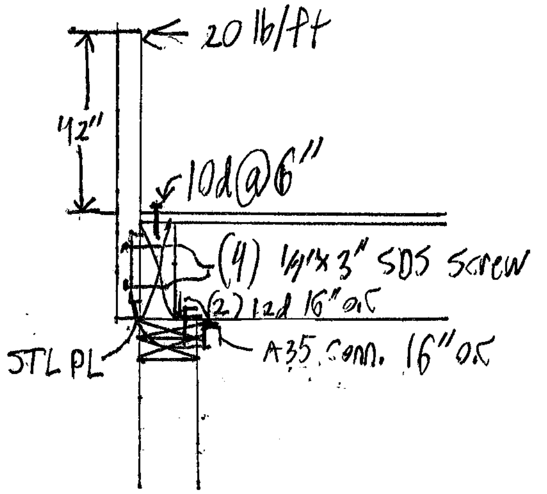
S510 – WOOD I-JOIST FLOOR

PCS Structural Solutions

Project: Mercer Island Apartments — Job No: 14028

Subject: Guard rail — Sheet 1 — Name: MES

Originating Office: [X] Seattle [ ] Tacoma [ ] Portland — Date: 3/25/2022

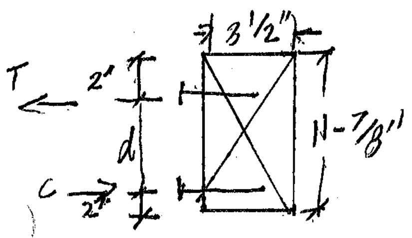


* 20 lb/ft from IBC 1607.8.1
  Area Is not accessible to public ⇒ guard rail load can be reduced

48" Tributary to each guard post

$20 \frac{lb}{ft} \cdot 48 \cdot \frac{1'}{12''} = 80\ lb$

$M = 80\ lb \cdot 42'' = 3360\ lb \cdot in$ at STL PL



$T = \frac{M}{d} = \frac{3360\ lb \cdot in}{7.875} = 427\ lb$

$d = 11\tfrac{7}{8}'' - 4'' = 7.875''$

From SST wood connections manual SDS25300 1/4x3" screws
W = 345 lb (2" threaded length) (DF formember)

$W' = W \cdot C_D \cdot C_M \cdot C_t \cdot C_{eg} \cdot C_{tn} = 345\ lb/screw$

w/ $C_D = 1.0$ (Live load, TA 2.3.2 NDS) $C_M = 1.0$ (Assume service cond. dry, NDS 11.3.3)

$C_t = 1.0$ (Not exposed to sustained high temp. Assumed NDS 11.3.4) $C_{eg} = 1.0$ (Not loaded in end grain)

$C_{tn} = 1.0$ (Not a toenail conn.)

W, 2 screws $= 345\ lb/screw \cdot 2 = 690\ lb > 427\ lb$ demand ✓

Check shear in diaphram nailing

48" Tributary to each guard post

10d @ 6" spacing $\frac{48"}{6"} = 8$ nails 3/4" thick Diaphram SHT'G

10d common nails (D=0.148")

Z = 105 lb (TA 12N NDS)

$Z' = Z \cdot C_D \cdot C_M \cdot C_t \cdot C_g \cdot C_\Delta \cdot C_{eg} \cdot C_{di} \cdot C_{tn} = 105$ lb

$C_D, C_M, C_t, C_{eg}, C_{tn} = 1.0$ (see prev. calc)

$C_g = 1.0$ (D < 1/4", 11.3.6 NDS) $C_\Delta = 1.0$ (D < 1/4", NDS 12.5.1

$C_{di} = 1.0$ (Dont use diaphram factor)

Total capacity = 8 nails · 105 lb = 840 lb > 427 lb demand ✓

Z (12d common nail, D = 0.148") side member I-Joist flange = 1-1/2"

Z = 118 (DF, TA 12N) Z' = Z = 118 lb 48" Trib, (2) 12d nails spaced at 16" O.C for each Joist

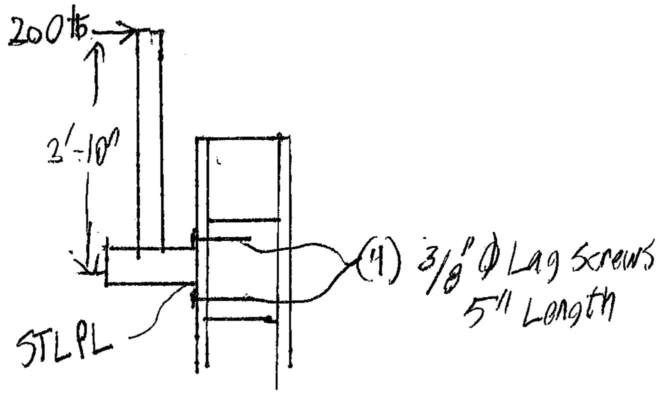
$\frac{48"}{16"} = 3$ 3 · 2 nails perjoist = 6 nails

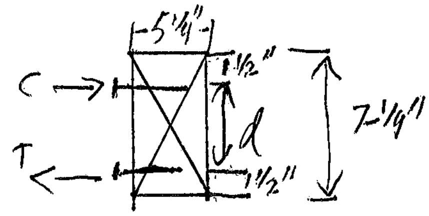
12d nail cap = 6 · 118 lb = 708 lb

A35 connector case 4 loading spaced at 16" O.C ⇒ 6 A35 connections

From SST conn. Table A35 Cap. = 590 lb (Top is restrained to protect against loads in both directions)

6 · 590 lb = 3540 lb > 427 lb





$d = 7\,1/4" - 3" = 4.25"$

$T = \frac{M}{d}$ $M = 200\,lb \cdot 2.83' = 566.7\,lb\,ft = 6800\,lb \cdot in$

$T = \frac{6800\,lb \cdot in}{4.25"} = 1600\,lb$

For W = 305 lb (TA 12.2A, DF, G=0.5)

$W' = W \cdot C_D \cdot C_M \cdot C_t \cdot C_{eg} \cdot C_{tn} = 305\,lb/in$

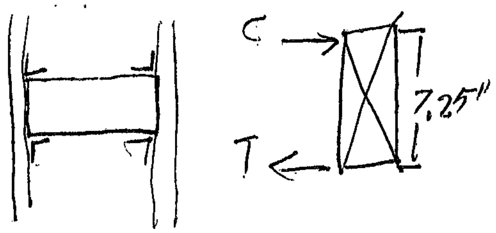
$C_D = 1.0$ (Live, TA 2.3.2 NDS) $C_M = 1.0$ (Sealed Inside wall, assume dry cond.)

$C_t = 1.0$ (Assume no sustained high temps) $C_{eg}, C_{tn} = 1.0$ (Not applicable)

3/8" x 5" Lag Screws, Threaded length, T-E = 2-25/32"

$305\,lb/in \cdot 2 \cdot 25/32" = 848\,lb$ $848\,lb \cdot 2\,screws = 1697\,lb$ = Total cap for 2 lag screws

$1697\,lb > 1600\,lb$ ✓



$M = 6800\ \text{lb}\cdot\text{in}$

$T = \dfrac{6800\ \text{lb}\cdot\text{in}}{7.25''} = 938\ \text{lb}$

HGA10 using (4) 1/4" x 1 1/2" SDS Screws Cap = 500 lb F_1 loading

2 connectors = 500 lb x 2 = 1000 lb > 938 lb ✓

S520 – WOOD I-JOIST ROOF

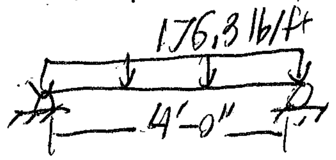
$q_p = 32psf + 15psf = 47psf$

$GC_{pn} = +1.5$ windward

$P_p = q_p (GC_{pn}) = 47psf \cdot 1.5 = 70.5 psf$

5' parapet wall height ⇒ 2.5' Trib to parapet wall header

$70.5psf \cdot 2.5' = 176.3 plf$



$M_u = 353 lb \cdot ft$ $V_u = 353 lb$

(2) 2x6 $F_b = 700psi$ (DF-L TA 4A NDS Supp.)

$C_D = 1.6$ (TA 2.3.2, wind) $C_M = 1.0$ (sealed inside wall, dry)

$C_t = 1.0$ (No sustained high temps) $C_L = 1.0$ (fully laterally supported w/ sheathing)

$C_F = 1.0$ (TA 4A NDS Supp.) $C_{fu} = 1.0$ (loaded short face)

$C_i = 1.0$ (Not incised $C_r = 1.0$ (stud header)

$F_b' = F_b \cdot C_D \cdot C_M \cdot C_t \cdot C_L \cdot C_{fu} \cdot C_i \cdot C_r = 700 \cdot 1.6 = 1120 psi$

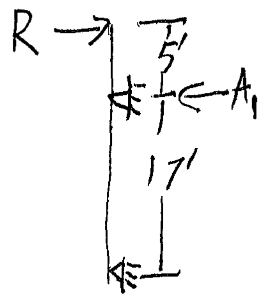
x2 studs = 2240 psi

$f_b = \frac{353 \cdot 12 lb \cdot in}{2 \cdot 7.56 in^3} = 280 psi < 2240 psi$ ✓

S_{xx} strong axis bending

Case 4 A35 F_1 loading From SST manual = 650 lb > 353 lb ✓

Check SCL col.



$R = 353\,lb$ $M_{max} = 353 \cdot 5 = 1765\,lb \cdot ft = 21{,}180\,lb \cdot in$

$\frac{21180\,lb \cdot in}{2 \cdot 7.56\,in^3} = 1400\,psi < 2720\,psi$ ✓

$F_b = 1700\,psi$ for 2x SCL

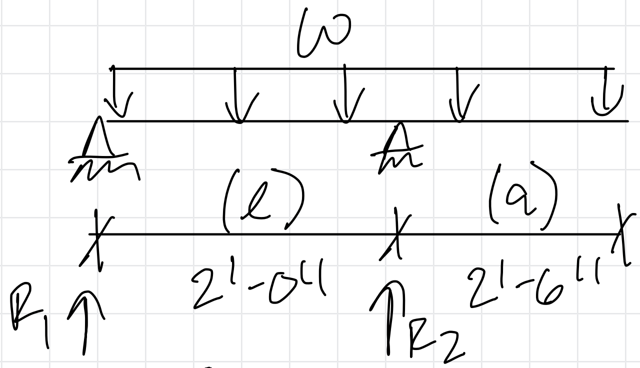
$F_b' = 1.6 \cdot 1700\,psi = 2720\,psi$

$A_1 = \frac{R}{17'}(17+5') = 457\,lb$

A35 cap. F1 Case 4 loading = 650 lb 2 connectors => 1300 lb cap > 457 lb demand ✓

Check Outrigger Hanger:

Trib. = 2' O.C.



$$w = (23\ PSF)\,DL + \underbrace{(30\ PSF)}_{\text{Rain + Snow}} = 53\ PSF$$

$$R_1 = \frac{w}{2l}(l^2 - a^2) = \frac{53}{2 \cdot 2'}(2^2 - 2.5^2)$$

$$R_1 = -30\# \times \underset{\text{Trib.}}{2'} = -60\#$$

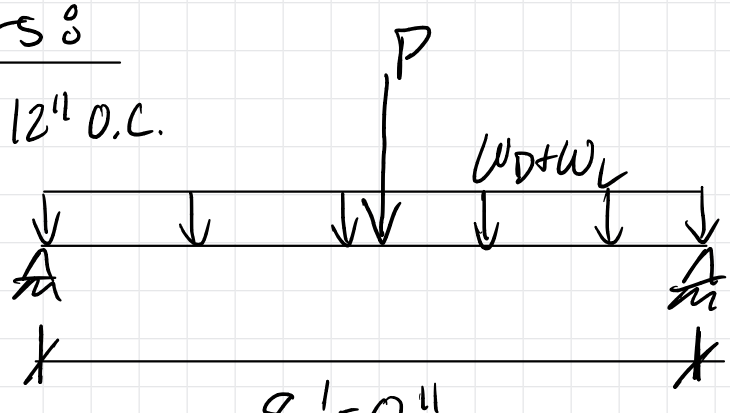
Simpson LB uplift capacity = 380# ✓ LB HGR OK

S600 – WOOD STAIR DETAILS

Stair Details:

Stringers:

Spaced @ 12" O.C.



Case 1:

$W_D = 25$ PSF $\times (1') = 25$ PLF

$W_L = 100$ PSF $\times (1') = 100$ PLF

$M_{max} = \frac{wl^2}{8} = 1000$ FT-lbs $= 12{,}000$ in-lbs

$V_{max} = \frac{wl}{2} = 500$ lbs

Case 2:

$P = 300\#$

$M_{max} = \frac{Pl}{4} = 600$ ft-lbs

$V_{max} = 150$ lbs

∴ Case 1 Controls

PCS Structural Solutions

Project: MIMU | Job No: 19028
Subject: Stair Details | Sheet:
Name: AED
Originating Office: ☒ Seattle ☐ Tacoma ☐ Portland | Date: 3/25/22

2x12 SCL Stringer w/ 2x6 strongback

$f_b = 1700$ PSI

All adjustment factors = 1.0

2x12 SCL Stringer is notched, so analyze as (2) 2x6 SCL Members

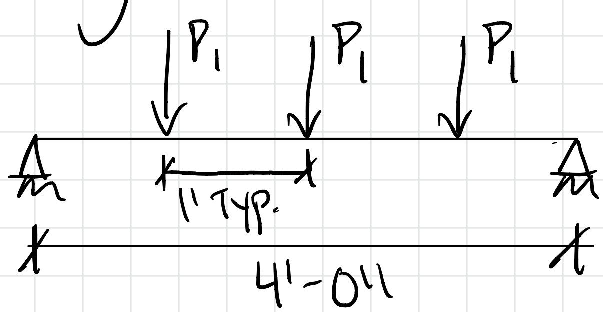
$S = 2 \times 7.56 = 15.12 \text{ in}^3$

$F_b = \frac{12{,}000}{15.12} = 794 \text{ PSI} < 1700 \text{ PSI}$ ✓ OK

Check Simpson Hanger:

HUC26-2 Capacity = 1,190# > 500# ✓ OK

Check Landing BM:



$P_1 = 500\#$

✓ OK

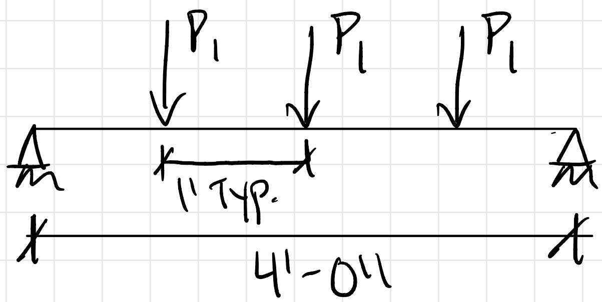
SEE FORTE

PCS Structural Solutions

Project: MIMU | Job No: 19028
Subject: Stair Details | Sheet: | Name: AED
Originating Office: ☒ Seattle ☐ Tacoma ☐ Portland | Date: 3/25/22

Check Center BM:

$P_1 = 1000\#$



✓ OK – SEE FORTE

Check Conc. Ledger:

(4) 5/8" ∅ A.B.'s

500 # Shear to bolt
2000 # Tension to bolt
} 5/8" ∅ A.B. OK Per Hilti ✓

Stairs

Level			
Member Name	Results	Current Solution	Comments
Typ. Landing BM	Passed	1 piece(s) 4 x 10 DF No.2	
Typ Center BM	Passed	1 piece(s) 4 x 10 DF No.2	

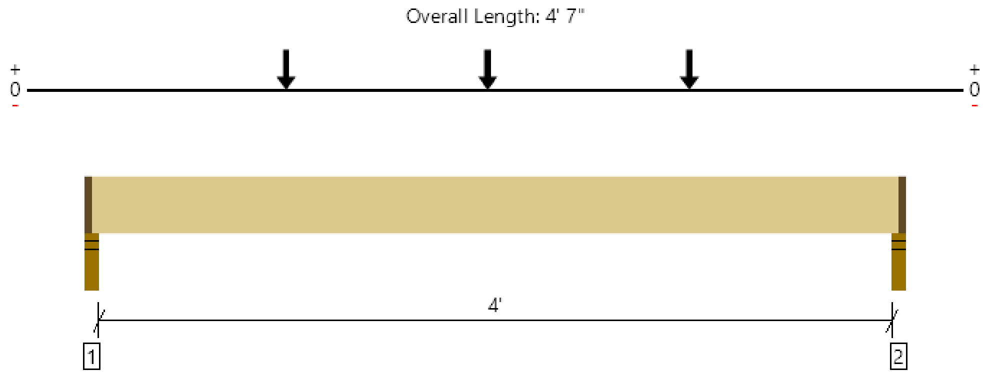
ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

FORTE WEB

MEMBER REPORT

PASSED

Level, Typ. Landing BM
1 piece(s) 4 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	782 @ 2"	3828 (1.75")	Passed (20%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	775 @ 1' 3/4"	3885	Passed (20%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1049 @ 2' 3"	4492	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.007 @ 2' 3 1/2"	0.106	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.009 @ 2' 3 1/2"	0.213	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	3.50"	1.75"	1.50"	171	612	783	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.50"	165	588	753	1 3/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 4" o/c	
Bottom Edge (Lu)	4' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 3/4" to 4' 5 1/4"	N/A	8.2	--	
1 - Point (lb)	1' 1 1/2" (Front)	N/A	100	400	Default Load
2 - Point (lb)	2' 3" (Front)	N/A	100	400	Default Load
3 - Point (lb)	3' 4 1/2" (Front)	N/A	100	400	Default Load

Weyerhaeuser Notes

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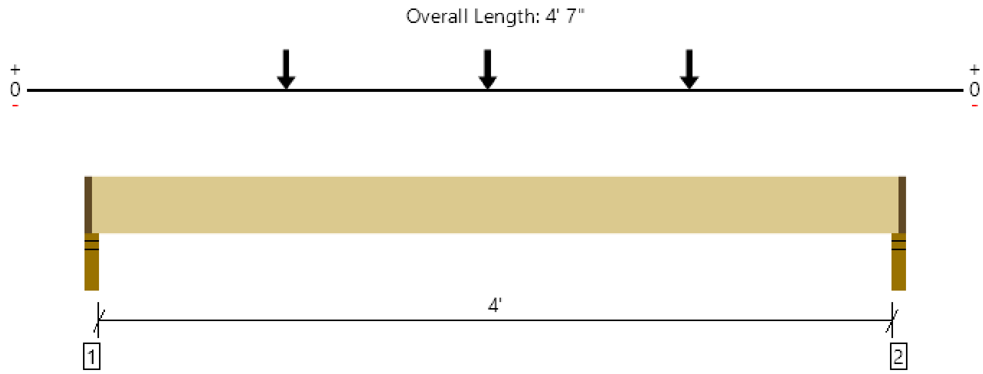
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

Level, Typ Center BM
1 piece(s) 4 x 10 DF No.2



All locations are measured from the outside face of left support (or left cantilever end). All dimensions are horizontal.

Design Results	Actual @ Location	Allowed	Result	LDF	Load: Combination (Pattern)
Member Reaction (lbs)	1547 @ 2"	3828 (1.75")	Passed (40%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1539 @ 1' 3/4"	3885	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2080 @ 2' 3"	4492	Passed (46%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.014 @ 2' 3 1/2"	0.106	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.017 @ 2' 3 1/2"	0.213	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

- Deflection criteria: LL (L/480) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Applicable calculations are based on NDS.

System : Floor
Member Type : Flush Beam
Building Use : Residential
Building Code : IBC 2015
Design Methodology : ASD

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - DF	3.50"	1.75"	1.50"	323	1224	1547	1 3/4" Rim Board
2 - Stud wall - DF	3.50"	1.75"	1.50"	312	1176	1488	1 3/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 4" o/c	
Bottom Edge (Lu)	4' 4" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	1 3/4" to 4' 5 1/4"	N/A	8.2	--	
1 - Point (lb)	1' 1 1/2" (Top)	N/A	200	800	Default Load
2 - Point (lb)	2' 3" (Top)	N/A	200	800	Default Load
3 - Point (lb)	3' 4 1/2" (Top)	N/A	200	800	Default Load

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Alex Davis PCS Structural Solutions (206) 292-5076 adavis@pcs-structural.com	

Weyerhaeuser

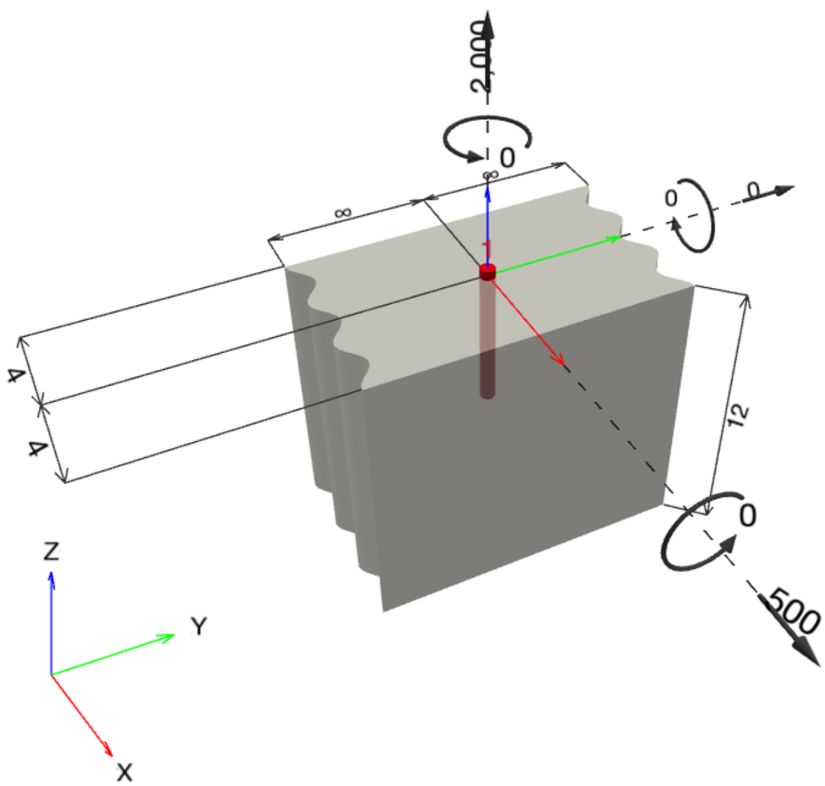
Company:		Page:	1
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - May 17, 2021	Date:	5/17/2021
Fastening point:			

Specifier's comments:

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 5/8**
Item number:	not available
Effective embedment depth:	h_{ef} = 6.000 in.
Material:	ASTM F 1554
Evaluation Service Report:	Hilti Technical Data
Issued I Valid:	- | -
Proof:	Design Method ACI 318-14 / CIP
Stand-off installation:	
Profile:	
Base material:	cracked concrete, 4000, f_c' = 4,000 psi; h = 12.000 in.
Reinforcement:	tension: condition B, shear: condition B;
	edge reinforcement: none or < No. 4 bar

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



Company:		Page:	2
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - May 17, 2021	Date:	5/17/2021
Fastening point:			

1.1 Design results

Case	Description	Forces [lb] / Moments [in.lb]	Seismic	Max. Util. Anchor [%]
1	Combination 1	N = 2,000; V_x = 500; V_y = 0; M_x = 0; M_y = 0; M_z = 0;	no	35

Company:		Page:	3
Address:		Specifier:	
Phone I Fax:	|	E-Mail:	
Design:	Concrete - May 17, 2021	Date:	5/17/2021
Fastening point:			

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Failure	2,000	5,784	35 / -	OK
Shear	Concrete edge failure in direction x+	500	2,971	- / 17	OK

Loading	β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
Combined tension and shear loads	0.346	0.168	5/3	23	OK

3 Warnings

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

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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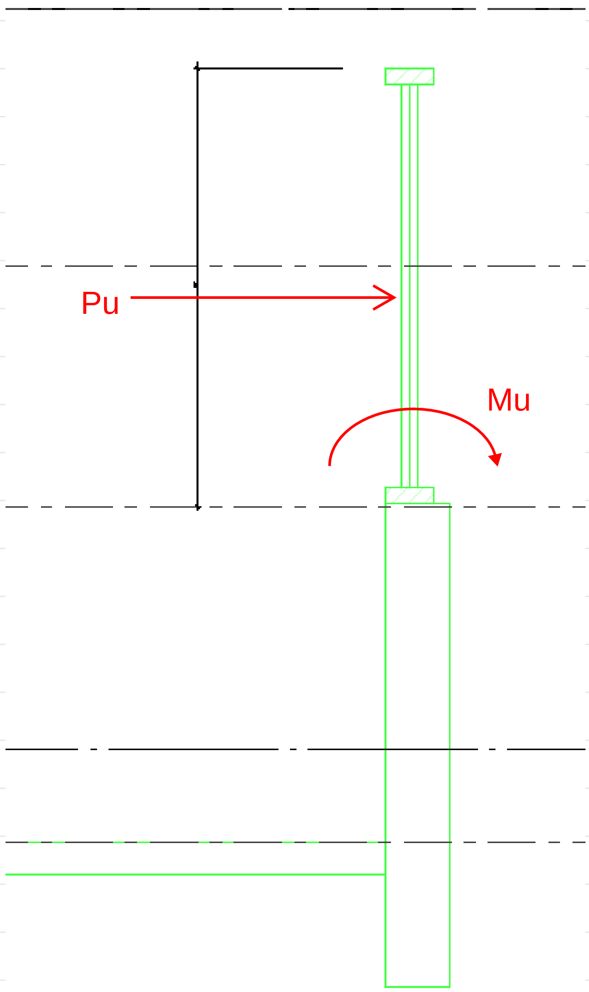
MISC



Pu = 1.7(25 psf)(5'/2)(8') = 850 lbs

Mu = 850 lbs(2.5') = 2125 lbs

LOADING DOCK FENCE

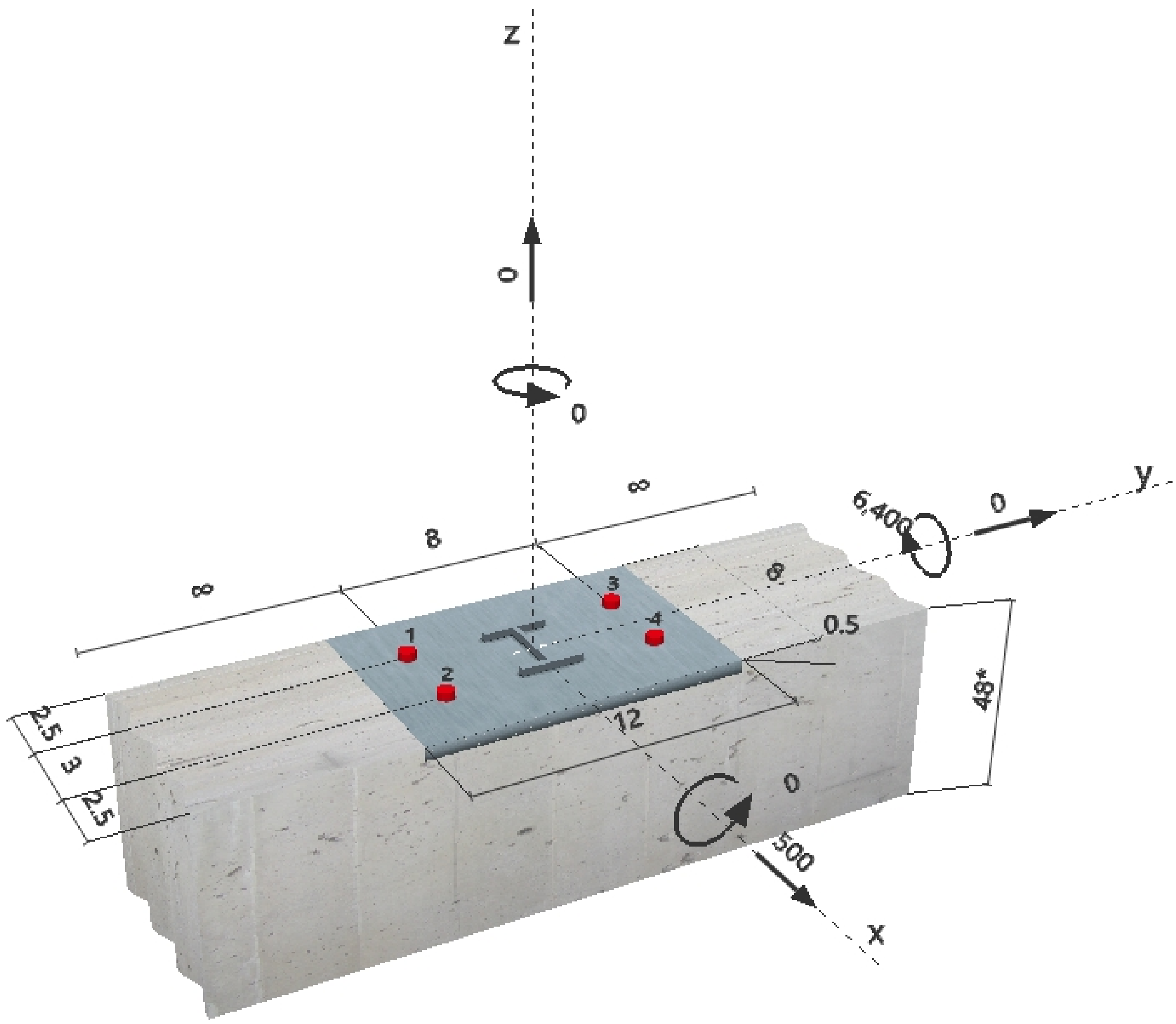
Company:		Page:	1
Specifier:		Project:	MI Apts - LD Fence
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

Specifier's comments: Loading Dock Fence

1 Input data

Anchor type and diameter:	**AWS D1.1 GR. B 5/8**
Effective embedment depth:	h_{ef} = 4.724 in.
Material:	
Proof:	Design method ACI 318-08 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 8.000 in. x 12.000 in. x 0.500 in.; (Recommended plate thickness: not calculated
Profile:	S shape (AISC); (L x W x T x FT) = 3.000 in. x 2.330 in. x 0.170 in. x 0.260 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 48.000 in.
Reinforcement:	tension: condition B, shear: condition B;
	edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

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



Company:		Page:	2
Specifier:		Project:	MI Apts - LD Fence
Address:		Sub-Project I Pos. No.:	
Phone I Fax:	|	Date:	12/12/2022
E-Mail:			

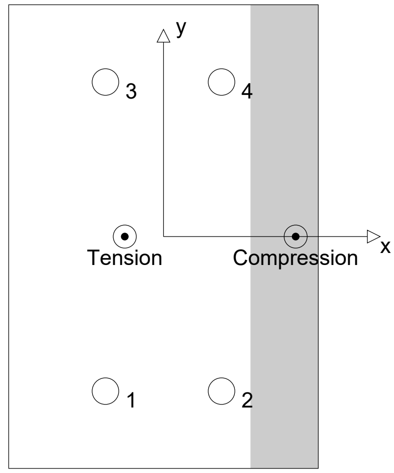
2 Load case/Resulting anchor forces

Load case: Design loads

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

Anchor	Tension force	Shear force	Shear force x	Shear force y
1	604	125	125	0
2	121	125	125	0
3	604	125	125	0
4	121	125	125	0

max. concrete compressive strain: 0.03 [‰]
max. concrete compressive stress: 138 [psi]
resulting tension force in (x/y)=(-1.001/0.000): 1449 [lb]
resulting compression force in (x/y)=(3.416/0.000): 1449 [lb]



3 Tension load

	Load N_{ua} [lb]	Capacity ϕN_n [lb]	Utilization $\beta_N = N_{ua}/\phi N_n$	Status
Steel Strength*	604	14966	5	OK
Pullout Strength*	604	12880	5	OK
Concrete Breakout Strength**	1449	5379	27	OK
Concrete Side-Face Blowout, direction **	N/A	N/A	N/A	N/A

* anchor having the highest loading **anchor group (anchors in tension)

3.1 Steel Strength

$N_{sa} = A_{se,N} f_{uta}$ ACI 318-08 Eq. (D-3)
$\phi N_{sa} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

$A_{se,N}$ [in.^{2}]	f_{uta} [psi]
0.31	65000

Calculations

N_{sa} [lb]
19955

Results

N_{sa} [lb]	ϕ_{steel}	ϕN_{sa} [lb]	N_{ua} [lb]
19955	0.750	14966	604

3.2 Pullout Strength

$N_{pN} = \psi_{c,p} N_p$ ACI 318-08 Eq. (D-14)
$N_p = 8 A_{brg} f'_c$ ACI 318-08 Eq. (D-15)
$\phi N_{pN} \geq N_{ua}$ ACI 318-08 Eq. (D-1)

Variables

$\psi_{c,p}$	A_{brg} [in.^{2}]	f'_c [psi]
1.000	0.92	2500

Calculations

N_p [lb]
18400

Results

N_{pn} [lb]	$\phi_{concrete}$	ϕN_{pn} [lb]	N_{ua} [lb]
18400	0.700	12880	604

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

Page: 3
Project: MI Apts - LD Fence
Sub-Project I Pos. No.:
Date: 12/12/2022

3.3 Concrete Breakout Strength

$N_{cbg} = \left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N} \psi_{ed,N} \psi_{c,N} \psi_{cp,N} N_b$	ACI 318-08 Eq. (D-5)
$\phi N_{cbg} \geq N_{ua}$	ACI 318-08 Eq. (D-1)
A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)	
$A_{Nc0} = 9 h_{ef}^2$	ACI 318-08 Eq. (D-6)
$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2 e'_N}{3 h_{ef}}}\right) \leq 1.0$	ACI 318-08 Eq. (D-9)
$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5h_{ef}}\right) \leq 1.0$	ACI 318-08 Eq. (D-11)
$\psi_{cp,N} = MAX\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5h_{ef}}{c_{ac}}\right) \leq 1.0$	ACI 318-08 Eq. (D-13)
$N_b = k_c \lambda \sqrt{f'_c} h_{ef}^{1.5}$	ACI 318-08 Eq. (D-7)

Variables

h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]	$\psi_{c,N}$
4.724	1.001	0.000	2.500	1.000

c_{ac} [in.]	k_c	λ	f'_c [psi]
0.000	24	1	2500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
177.39	200.88	0.876	1.000	0.806	1.000	12323

Results

N_{cbg} [lb]	$\phi_{concrete}$	ϕN_{cbg} [lb]	N_{ua} [lb]
7684	0.700	5379	1449

4 Shear load

	Load V_{ua} [lb]	Capacity ϕV_n [lb]	Utilization $\beta_V = V_{ua}/\phi V_n$	Status
Steel Strength*	125	12971	1	OK
Steel failure (with lever arm)*	N/A	N/A	N/A	N/A
Pryout Strength**	500	12276	5	OK
Concrete edge failure in direction x+**	500	6354	8	OK

* anchor having the highest loading   **anchor group (relevant anchors)

4.1 Steel Strength

$V_{sa} = A_{se,V} f_{uta}$ ACI 318-08 Eq. (D-19)
$\phi V_{steel} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

Variables

$A_{se,V}$ [in.^{2}]	f_{uta} [psi]
0.31	65000

Calculations

V_{sa} [lb]
19955

Results

V_{sa} [lb]	ϕ_{steel}	ϕV_{sa} [lb]	V_{ua} [lb]
19955	0.650	12971	125

4.2 Pryout Strength

$V_{cpg} = k_{cp} \left[\left(\frac{A_{Nc}}{A_{Nc0}}\right) \psi_{ec,N}\, \psi_{ed,N}\, \psi_{c,N}\, \psi_{cp,N}\, N_b\right]$ ACI 318-08 Eq. (D-31)
$\phi V_{cpg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)
A_{Nc} see ACI 318-08, Part D.5.2.1, Fig. RD.5.2.1(b)
$A_{Nc0} = 9\, h_{ef}^2$ ACI 318-08 Eq. (D-6)
$\psi_{ec,N} = \left(\frac{1}{1 + \frac{2\, e_N'}{3\, h_{ef}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-9)
$\psi_{ed,N} = 0.7 + 0.3 \left(\frac{c_{a,min}}{1.5 h_{ef}}\right) \leq 1.0$ ACI 318-08 Eq. (D-11)
$\psi_{cp,N} = \text{MAX}\left(\frac{c_{a,min}}{c_{ac}}, \frac{1.5 h_{ef}}{c_{ac}}\right) \leq 1.0$ ACI 318-08 Eq. (D-13)
$N_b = k_c\, \lambda\, \sqrt{f_c'}\, h_{ef}^{1.5}$ ACI 318-08 Eq. (D-7)

Variables

k_{cp}	h_{ef} [in.]	$e_{c1,N}$ [in.]	$e_{c2,N}$ [in.]	$c_{a,min}$ [in.]
2	4.724	0.000	0.000	2.500

$\psi_{c,N}$	c_{ac} [in.]	k_c	λ	f_c' [psi]
1.000	-	24	1	2500

Calculations

A_{Nc} [in.^{2}]	A_{Nc0} [in.^{2}]	$\psi_{ec1,N}$	$\psi_{ec2,N}$	$\psi_{ed,N}$	$\psi_{cp,N}$	N_b [lb]
177.39	200.88	1.000	1.000	0.806	1.000	12323

Results

V_{cpg} [lb]	$\phi_{concrete}$	ϕV_{cpg} [lb]	V_{ua} [lb]
17537	0.700	12276	500

4.3 Concrete edge failure in direction x+

$V_{cbg} = \left(\frac{A_{Vc}}{A_{Vc0}}\right) \psi_{ec,V}\ \psi_{ed,V}\ \psi_{c,V}\ \psi_{h,V}\ \psi_{parallel,V}\ V_b$ ACI 318-08 Eq. (D-22)

$\phi\ V_{cbg} \geq V_{ua}$ ACI 318-08 Eq. (D-2)

A_{Vc} see ACI 318-08, Part D.6.2.1, Fig. RD.6.2.1(b)

$A_{Vc0} = 4.5\ c_{a1}^2$ ACI 318-08 Eq. (D-23)

$\psi_{ec,V} = \left(\frac{1}{1 + \frac{2e_V'}{3c_{a1}}}\right) \leq 1.0$ ACI 318-08 Eq. (D-26)

$\psi_{ed,V} = 0.7 + 0.3\left(\frac{c_{a2}}{1.5c_{a1}}\right) \leq 1.0$ ACI 318-08 Eq. (D-28)

$\psi_{h,V} = \sqrt{\frac{1.5c_{a1}}{h_a}} \geq 1.0$ ACI 318-08 Eq. (D-29)

$V_b = \left(8\left(\frac{l_e}{d_a}\right)^{0.2}\sqrt{d_a}\right)\lambda\ \sqrt{f_c'}\ c_{a1}^{1.5}$ ACI 318-08 Eq. (D-25)

Variables

c_{a1} [in.]	c_{a2} [in.]	e_{cV} [in.]	$\psi_{c,V}$	h_a [in.]
5.500	-	0.000	1.000	48.000

l_e [in.]	λ	d_a [in.]	f_c' [psi]	$\psi_{parallel,V}$
4.724	1.000	0.625	2500	1.000

Calculations

A_{Vc} [in.^{2}]	A_{Vc0} [in.^{2}]	$\psi_{ec,V}$	$\psi_{ed,V}$	$\psi_{h,V}$	V_b [lb]
202.13	136.13	1.000	1.000	1.000	6113

Results

V_{cbg} [lb]	$\phi_{concrete}$	$\phi\ V_{cbg}$ [lb]	V_{ua} [lb]
9077	0.700	6354	500

5 Combined tension and shear loads

β_N	β_V	ζ	Utilization $\beta_{N,V}$ [%]	Status
0.269	0.079	5/3	13	OK

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

6 Warnings

- The anchor design methods in PROFIS Anchor require rigid anchor plates per current regulations (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 Anchor calculates the minimum required anchor plate thickness with FEM to limit the stress of the anchor plate based on the assumptions explained above. The proof if the rigid base plate assumption is valid is not carried out by PROFIS Anchor. Input data and results must be checked for agreement with the existing conditions and for plausibility!
- Condition A applies when supplementary reinforcement is used. The Φ factor is increased for non-steel Design Strengths except Pullout Strength and Pryout strength. Condition B applies when supplementary reinforcement is not used and for Pullout Strength and Pryout Strength. Refer to your local standard.
- Checking the transfer of loads into the base material and the shear resistance are required in accordance with ACI 318 or the relevant standard!

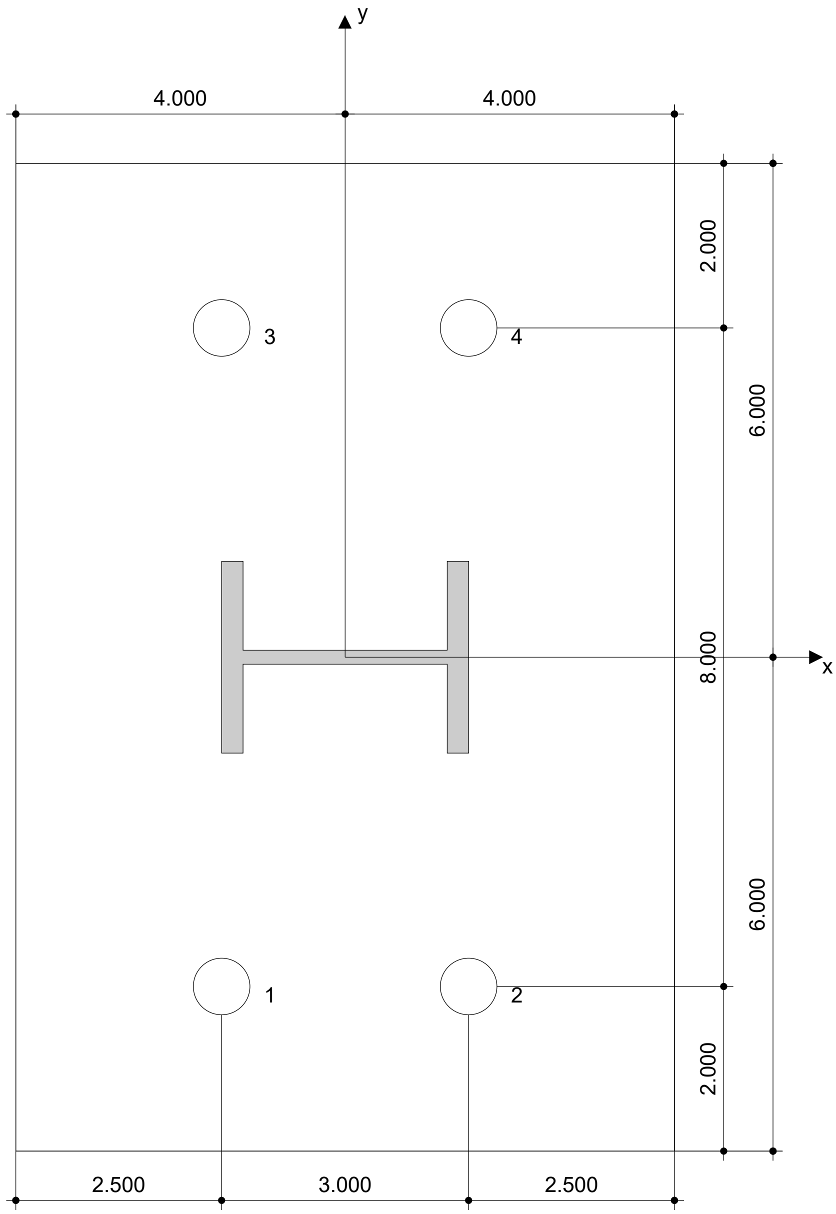
Fastening meets the design criteria!

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

7 Installation data

Anchor plate, steel: -
Profile: S shape (AISC); 3.000 x 2.330 x 0.170 x 0.260 in.
Hole diameter in the fixture: d_f = 0.688 in.
Plate thickness (input): 0.500 in.
Recommended plate thickness: not calculated
Drilling method: -
Cleaning: No cleaning of the drilled hole is required

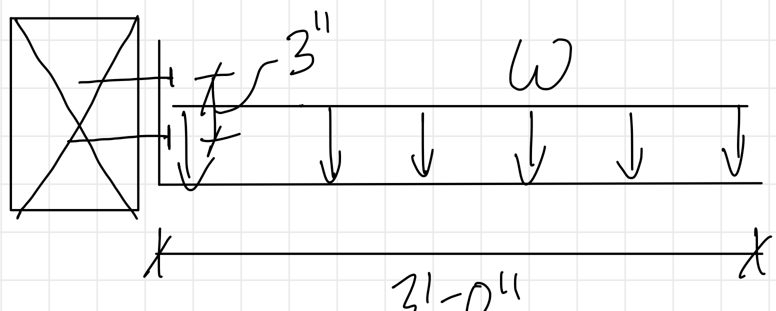
Anchor type and diameter: AWS D1.1 GR. B 5/8
Installation torque: -
Hole diameter in the base material: - in.
Hole depth in the base material: 4.724 in.
Minimum thickness of the base material: 5.537 in.



Coordinates Anchor in.

Anchor	x	y	c_{-x}	c_{+x}	c_{-y}	c_{+y}
1	-1.500	-4.000	2.500	5.500	-	-
2	1.500	-4.000	5.500	2.500	-	-
3	-1.500	4.000	2.500	5.500	-	-
4	1.500	4.000	5.500	2.500	-	-

Check Bent PL Canopy:



Try 1/4" STL PL:

$W = 1.2D + 1.6S + 0.5W$

$W = 1.2(10.5\text{ PSF}) + 1.6(25\text{ PSF}) + 0.5(19\text{ PSF})$

$W = 62\text{ PSF}$

$$M_{max} = \frac{w\ell^2}{2} = \frac{(62)(3^2)}{2} = 279\text{ FT\#}$$

$$= 3.4\text{ k-in}$$

$$S_{req.} = \frac{3.4\text{ k-in}}{(0.9)(36)} = 0.105\text{ in}^3$$

$$S_{provided} = \frac{(12")(0.25^2)}{6} = 0.125\text{ in}^3 \checkmark$$

1/4" STL PL OK

Check 1/2" ∅ Lag Screw:

$V_{APP} = 186$ PLF

$V_{CAP} = 2 \times 1.6 \times 320\# = 1024\#$ ✓ OK

(2 = # of screws; 1.6 = C_D)

$T_{APP} = \frac{M}{d} = \frac{3.4}{3''} = 1.13\ K$

$T_{CAP} = 378\#/in \times 1.6 \times (2.19'') = 1.3\ K$ ✓ OK

(1.6 = C_D; 2.19" = T-E (Thread Length))

1/2" ∅ x 4" Long Lag Screws OK ✓