STRUCTURAL CALCULATIONS FOR

Summit Point Apartments
504 NE Chipman Rd
Lee's Summit, MO 64063

Project # 21202
Date: February 07, 2022

Prepared by: Eric Swanson, PE

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8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project:	Summit Point Apartments
Project No:	21202
Engineer:	EJS
Date:	11/12/2021
Checked by:	CRG
Date:	12/15/2021

STRUCTURAL CODE REVIEW

Client: BCS Design
Project Address: 504 NE Chipman Rd

City Contact Info

City: Lee's Summit
State: MO
Website: https://cityofls.net/

Building Code

Code: IBC
Edition: 2018

Design Criteria

Roof:

Roof Live Load (psf): 20
Ground Snow (psf): 20

Wind:

Wind Speed (MPH): 109

Seismic:

0.2 sec Spectral Accel (Ss): 0.100
1.0 sec Spectral Accel (S1): 0.068

Frost Depth (in): 36

Additional Info

Are Calc Submittals Reqd?: Yes
Comments / Special items:

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Dead Loads

Typ Roof:

Component	Wt.[psf]
Roof Truss System[a]	30
Total:	30
Use:	30 for Roof

24" Truss Floor:

Component	Wt.[psf]
24" Floor Truss[a]	15
3/4" of Gypcrete	7.5
Total:	22.5
Use:	25 for Floors

Commodity Lumber Floor:

Component	Wt.[psf]
2x10[a]	10
3/4" of Gypcrete	7.5
Total:	17.5
Use:	20 for Floors

Typical Interior Wall:

Component	Wt.[psf]
2x6 Framing	6
(2) 5/8" Gyp Sheathing	5
Insulation	1
Total:	12
Use:	12 for 2x6 Single Wall

Cultured Stone Veneer Wall:

Component	Wt.[psf]
2x6 Framing	6
(2) 5/8" Gyp Sheathing	5.5
Insulation	1.5
Brick Veneer	12
Total:	25
Use:	25 for 2x6 Single Wall

a: Includes weight of MEP, ceiling, roofing, misc.

Live Loads

Roof:	**20 psf**
Residential:	**40 psf**
Ground Level Slab:	**100 psf**
Stairs:	**100 psf**
Lobbies:	**100 psf**
Mechanical Zone:	**25 psf**

SNOW LOADING

In accordance with ASCE7-16

Tedds calculation version 1.0.10

Building details

Roof type	Hip and gable
Width of roof (left on elevation)	b_1 = **37.00** ft
Width of roof (right on elevation)	b_2 = **37.00** ft
Slope of roof (left on elevation)	α_1 = **18.43** deg
Slope of roof (right on elevation)	α_2 = **18.43** deg

Ground snow load

Ground snow load (Figure 7.2-1)	p_g = **20.00** lb/ft^2
Density of snow	$\gamma = \min(0.13 \times p_g / 1\text{ft} + 14\text{lb/ft}^3, 30\text{lb/ft}^3)$ = **16.60** lb/ft^3
Terrain typeSect. 26.7	B
Exposure condition (Table 7.3-1)	Partially exposed
Exposure factor (Table 7.3-1)	C_e = **1.00**
Thermal condition (Table 7.3-2)	Structures kept just above freezing
Thermal factor (Table 7.3-2)	C_t = **1.10**
Importance category (Table 1.5-1)	II
Importance factor (Table 1.5-2)	I_s = **1.00**
Flat roof snow load (Sect 7.3)	$p_f = 0.7 \times C_e \times C_t \times I_s \times p_g$ = **15.40** lb/ft^2

Cold roof slope factor (C_t > 1.0)

Roof surface type	Non slippery
Ventilation	Ventilated
Thermal resistance (R-value)	R = **30.00** °F h ft^2 / Btu
Roof slope factor - left Fig 7.4-1b (solid line)	C_{s_l} = **1.00**
Roof slope factor - right Fig 7.4-1b (solid line)	C_{s_r} = **1.00**

Hip and gable roof loads

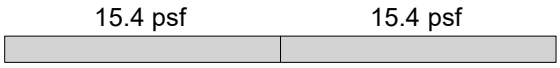
Balanced sloped snow load - left (Cl.7.4)	$p_{s\_l} = C_{s\_l} \times p_f$ = **15.40** lb/ft^2
Balanced sloped snow load - right (Cl.7.4)	$p_{s\_r} = C_{s\_r} \times p_f$ = **15.40** lb/ft^2
Slope of left roof	$S_l = 1 / \tan(\alpha_1)$ = **3.00**
Slope of right roof	$S_r = 1 / \tan(\alpha_2)$ = **3.00**
Unbalanced load - left roof windward	$p_{s\_lw} = 0.3 \times p_{s\_l}$ = **4.62** lb/ft^2
Unbalanced load - right roof leeward	$p_{s\_rl} = p_{s\_r}$ = **15.40** lb/ft^2
Length eaves to ridge for drift height	$l_{u\_ww\_l} = b_1$ = **37.00** ft
Drift height	$h_{dr\_r} = \sqrt{(l_s)} \times (0.43 \times (\max(l_{u\_ww\_l}, 20\text{ ft}) \times 1\text{ft}^2)^{1/3} \times (p_g / 1\text{ lb/ft}^2 + 10)^{1/4} - 1.5 \times 1\text{ft})$ = **1.85** ft
Rectangular surcharge to part leeward side	$p_{s\_rl\_sur} = h_{dr\_r} \times \gamma / \sqrt{(S_r)}$ = **17.76** lb/ft^2
Length of rectangular surcharge	$l_{u\_rl\_sur} = \min(8 / 3 \times h_{dr\_r} \times \sqrt{(S_r)}, b_2)$ = **8.56** ft
Unbalanced load - left roof leeward	$p_{s\_ll} = p_{s\_l}$ = **15.40** lb/ft^2
Unbalanced load - right roof windward	$p_{s\_rw} = 0.3 \times p_{s\_r}$ = **4.62** lb/ft^2
Length eaves to ridge for drift height	$l_{u\_ww\_r} = b_2$ = **37.00** ft

Drift height $h_{dr\_l} = \sqrt{(l_s)} \times (0.43 \times (\max(l_{u\_ww\_r}, 20\ ft) \times 1ft^2)^{1/3} \times (p_g / 1\ lb/ft^2 + 10)^{1/4} - 1.5 \times 1ft) = \mathbf{1.85}$ ft

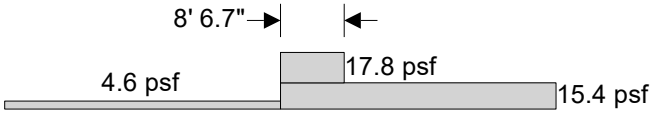
Rectangular surcharge to part leeward side $p_{s\_ll\_sur} = h_{dr\_l} \times \gamma / \sqrt{(S_l)} = \mathbf{17.76}$ lb/ft²

Length of rectangular surcharge $l_{u\_ll\_sur} = \min(8 / 3 \times h_{dr\_l} \times \sqrt{(S_l)}, b_1) = \mathbf{8.56}$ ft

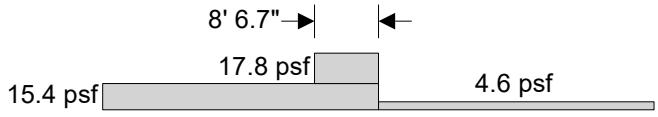
Balanced load

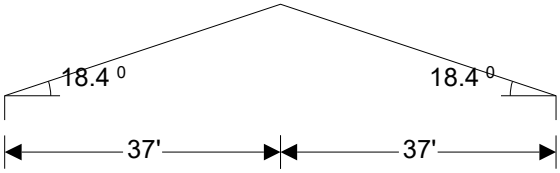


Unbalanced load



Unbalanced load





Roof elevation

Drift calculations

Balanced snow load height $h_b = \max(p_{s\_l}, p_{s\_r}) / \gamma = \mathbf{0.93}$ ft

Length of upper roof $l_u = \mathbf{89.00}$ ft

Length of lower roof $l_l = \mathbf{88.00}$ ft

Height diff between uppper and lower roofs $h_{diff} = \mathbf{4.00}$ ft

Height from balance load to top of upper roof $h_c = h_{diff} - h_b = \mathbf{3.07}$ ft

Drift height leeward drift $h_{d\_l} = \min(\sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_u) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft), 0.6 \times l_l) = \mathbf{2.99}$ ft

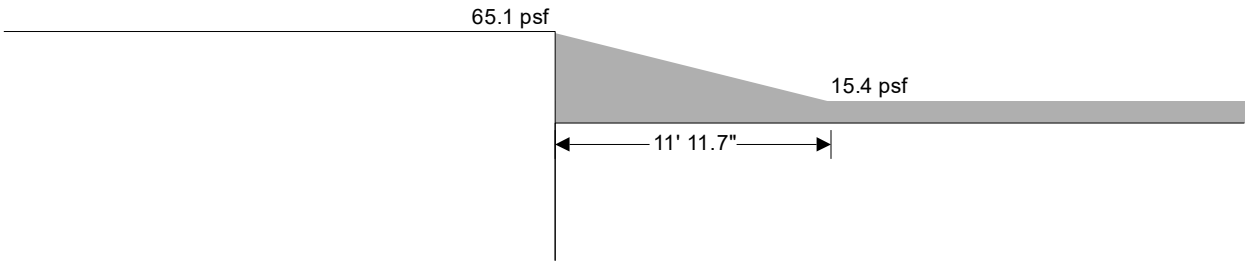
Drift height windward drift $h_{d\_w} = 0.75 \times \sqrt{(l_s)} \times (0.43 \times (\max(20\ ft, l_l) \times 1ft^2)^{1/3} \times (p_g / 1lb/ft^2 + 10)^{1/4} - 1.5ft) = \mathbf{2.23}$ ft

Maximum lw/ww drift height $h_{d\_max} = \max(h_{d\_w}, h_{d\_l}) = \mathbf{2.99}$ ft

Drift height $h_d = \min(h_{d\_max}, h_c) = \mathbf{2.99}$ ft

Drift width $W_d = \min(4 \times h_{d\_max}, 8 \times h_c) = \mathbf{11.97}$ ft

Drift surcharge load $p_d = h_d \times \gamma = \mathbf{49.69}$ lb/ft²



Elevation on snow drift

Hazards by Location

Search Information

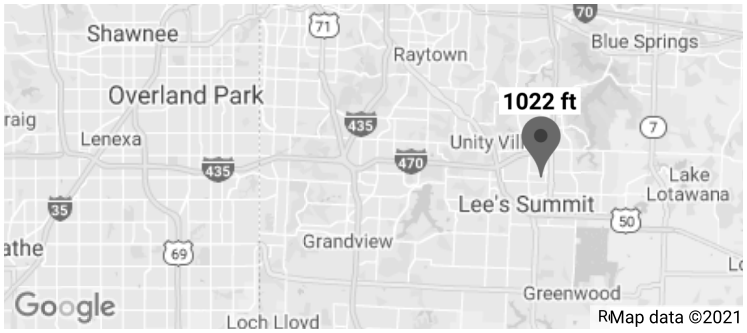
Address: 504 NE Chipman Rd, Lee's Summit, MO 64063, USA

Coordinates: 38.9253893, -94.3691862

Elevation: 1022 ft

Timestamp: 2021-10-14T14:03:51.718Z

Hazard Type: Wind



ASCE 7-16

MRI 10-Year	76 mph
MRI 25-Year	83 mph
MRI 50-Year	88 mph
MRI 100-Year	94 mph
Risk Category I	103 mph
Risk Category II	109 mph
Risk Category III	117 mph
Risk Category IV	122 mph

ASCE 7-10

MRI 10-Year	76 mph
MRI 25-Year	84 mph
MRI 50-Year	90 mph
MRI 100-Year	96 mph
Risk Category I	105 mph
Risk Category II	115 mph
Risk Category III-IV	120 mph

CONSERVATIVELY USE 115 MPH

ASCE 7-05

ASCE 7-05 Wind Speed	90 mph

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer. Per ASCE 7, islands and coastal areas outside the last contour should use the last wind speed contour of the coastal area – in some cases, this website will extrapolate past the last wind speed contour and therefore, provide a wind speed that is slightly higher. NOTE: For queries near wind-borne debris region boundaries, the resulting determination is sensitive to rounding which may affect whether or not it is considered to be within a wind-borne debris region.

Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.

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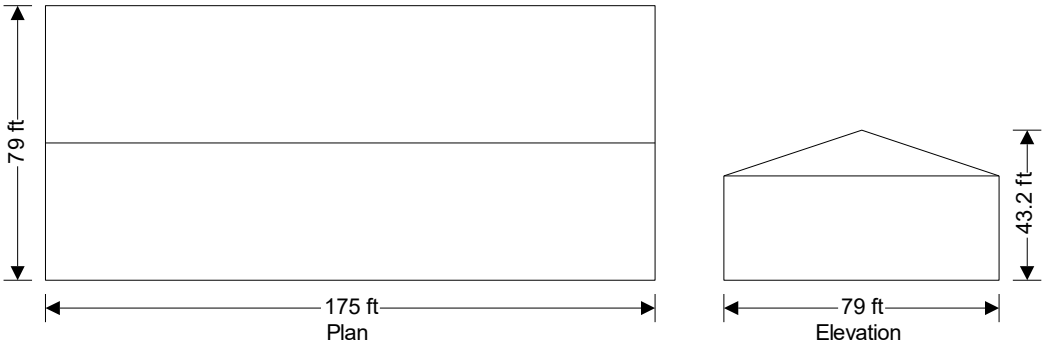
WIND LOAD - ASCE 7-16

In accordance with ASCE7-16

Using the directional design method

Tedds calculation version 2.1.09



Building data

Type of roof	Gable
Length of building	b = **175.00** ft
Width of building	d = **79.00** ft
Height to eaves	H = **30.00** ft
Pitch of roof	α_0 = **18.5** deg
Mean height	h = **36.61** ft

General wind load requirements

Basic wind speed	V = **115.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **900** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **0.97**
Exposure category (cl 26.7.3)	C
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Gust effect factor	G_f = **0.85**
Minimum design wind loading (cl.27.4.7)	p_{min_r} = **8** lb/ft^2

Topography

Topography factor not significant	K_{zt} = 1.0
Velocity pressure equation	$q = 0.00256 \times K_z \times K_{zt} \times K_d \times V^2 \times 1psf/mph^2$

Velocity pressures table

z (ft)	K_z (Table 26.10-1)	q_z (psf)
15.00	0.85	23.68
20.00	0.90	25.07
30.00	0.98	27.30
36.61	1.02	28.40

z (ft)	K_z (Table 26.10-1)	q_z (psf)
43.22	1.06	29.42

Peak velocity pressure for internal pressure

Peak velocity pressure – internal (as roof press.) q_i = **28.40** psf

Pressures and forces

Net pressure $p = q \times G_f \times C_{pe} - q_i \times GC_{pi}$

Net force $F_w = p \times A_{ref}$

Roof load case 1 - Wind 0, GC_{pi} 0.18, $-C_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	36.61	-0.47	28.40	-16.48	7289.18	-120.14
B (-ve)	36.61	-0.57	28.40	-18.87	7289.18	-137.57

Total vertical net force $F_{w,v}$ = **-244.40** kips

Total horizontal net force $F_{w,h}$ = **5.53** kips

Walls load case 1 - Wind 0, GC_{pi} 0.18, $-C_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	23.68	10.99	2625.00	28.84
A_2	20.00	0.80	25.07	11.93	875.00	10.44
A_3	30.00	0.80	27.30	13.45	1750.00	23.54
B	36.61	-0.50	28.40	-17.18	5250.00	-90.21
C	36.61	-0.70	28.40	-22.01	2892.05	-63.66
D	36.61	-0.70	28.40	-22.01	2892.05	-63.66

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_0} = b \times H$ = **5250.00** ft^2

Projected vertical area of roof $A_{vert\_r\_0} = b \times d/2 \times \tan(\alpha_0)$ = **2312.89** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0}$ = **102.50** kips

Leeward net force $F_l = F_{w,wB}$ = **-90.2** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wA\_3}$ = **62.8** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min})$ = **158.6** kips

Compare to Seismic

Roof load case 2 - Wind 0, GC_{pi} -0.18, $-0C_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	36.61	-0.03	28.40	4.49	7289.18	32.76
B (+ve)	36.61	-0.57	28.40	-8.65	7289.18	-63.04

Total vertical net force $F_{w,v}$ = **-28.71** kips

Total horizontal net force $F_{w,h}$ = **30.40** kips

Walls load case 2 - Wind 0, GC_{pi} -0.18, -0c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	23.68	21.21	2625.00	55.68
A_2	20.00	0.80	25.07	22.16	875.00	19.39
A_3	30.00	0.80	27.30	23.68	1750.00	41.43
B	36.61	-0.50	28.40	-6.96	5250.00	-36.53
C	36.61	-0.70	28.40	-11.79	2892.05	-34.09
D	36.61	-0.70	28.40	-11.79	2892.05	-34.09

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_0} = b \times H =$ **5250.00** ft^2

Projected vertical area of roof $A_{vert\_r\_0} = b \times d/2 \times \tan(\alpha_0) =$ **2312.89** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_0} + p_{min\_r} \times A_{vert\_r\_0} =$ **102.50** kips

Leeward net force $F_l = F_{w,wB} =$ **-36.5** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wA\_3} =$ **116.5** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) =$ **183.4** kips

Roof load case 3 - Wind 90, GC_{pi} 0.18, -c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (-ve)	36.61	-0.90	28.40	-26.84	1524.82	-40.93
B (-ve)	36.61	-0.90	28.40	-26.84	1524.82	-40.93
C (-ve)	36.61	-0.50	28.40	-17.18	3049.65	-52.40
D (-ve)	36.61	-0.30	28.40	-12.36	8479.06	-104.76

Total vertical net force $F_{w,v} =$ **-226.67** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 3 - Wind 90, GC_{pi} 0.18, -c_{pe}

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	23.68	10.99	1185.00	13.02
A_2	30.00	0.80	27.30	13.45	1185.00	15.94
A_3	43.22	0.80	29.42	14.89	522.19	7.78
B	36.61	-0.29	28.40	-12.10	2892.05	-34.98
C	36.61	-0.70	28.40	-22.01	5250.00	-115.56
D	36.61	-0.70	28.40	-22.01	5250.00	-115.56

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times H + d^2 \times \tan(\alpha_0) / 4 =$ **2892.05** ft^2

Projected vertical area of roof $A_{vert\_r\_90} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} =$ **46.27** kips

Leeward net force $F_l = F_{w,wB} =$ **-35.0** kips

Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wA\_3} =$ **36.7** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) =$ **71.7** kips

Roof load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A (+ve)	36.61	-0.18	28.40	0.77	1524.82	1.17
B (+ve)	36.61	-0.18	28.40	0.77	1524.82	1.17
C (+ve)	36.61	-0.18	28.40	0.77	3049.65	2.34
D (+ve)	36.61	-0.18	28.40	0.77	8479.06	6.50

Total vertical net force $F_{w,v} =$ **10.60** kips

Total horizontal net force $F_{w,h} =$ **0.00** kips

Walls load case 4 - Wind 90, GC_{pi} -0.18, $+c_{pe}$

Zone	Ref. height (ft)	Ext pressure coefficient c_{pe}	Peak velocity pressure q_p (psf)	Net pressure p (psf)	Area A_{ref} (ft^2)	Net force F_w (kips)
A_1	15.00	0.80	23.68	21.21	1185.00	25.14
A_2	30.00	0.80	27.30	23.68	1185.00	28.06
A_3	43.22	0.80	29.42	25.12	522.19	13.12
B	36.61	-0.29	28.40	-1.87	2892.05	-5.41
C	36.61	-0.70	28.40	-11.79	5250.00	-61.88
D	36.61	-0.70	28.40	-11.79	5250.00	-61.88

Max net pressure (Strength Level)

Overall loading

Projected vertical plan area of wall $A_{vert\_w\_90} = d \times H + d^2 \times \tan(\alpha_0) / 4 =$ **2892.05** ft^2

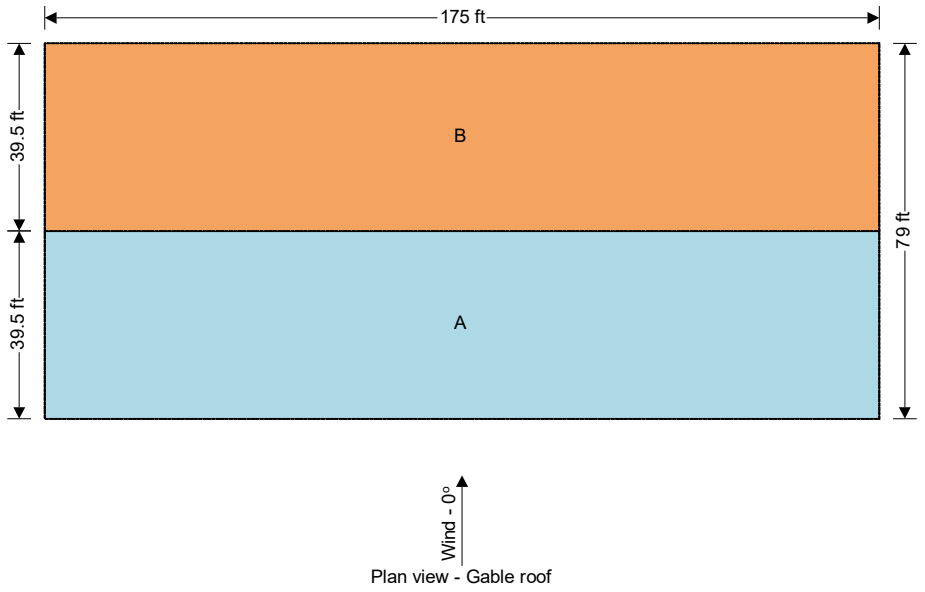
Projected vertical area of roof $A_{vert\_r\_90} =$ **0.00** ft^2

Minimum overall horizontal loading $F_{w,total\_min} = p_{min\_w} \times A_{vert\_w\_90} + p_{min\_r} \times A_{vert\_r\_90} =$ **46.27** kips

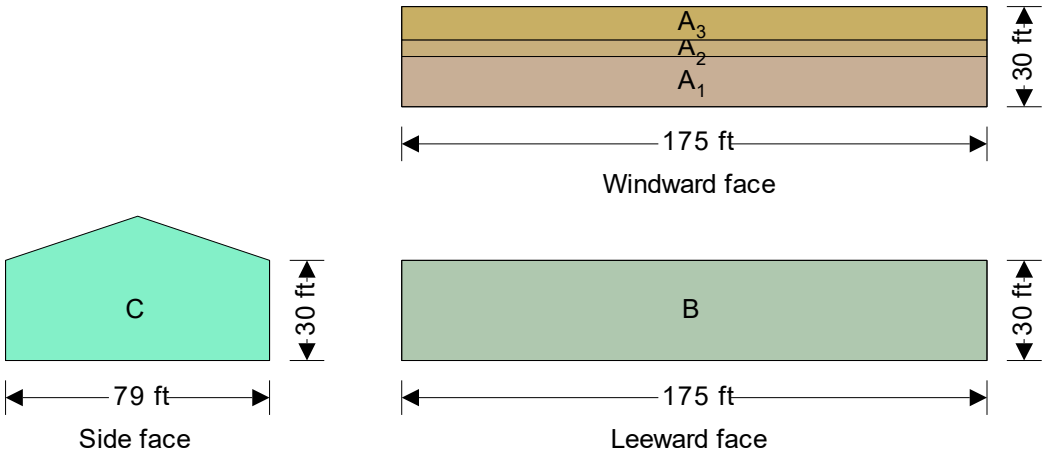
Leeward net force $F_l = F_{w,wB} =$ **-5.4** kips

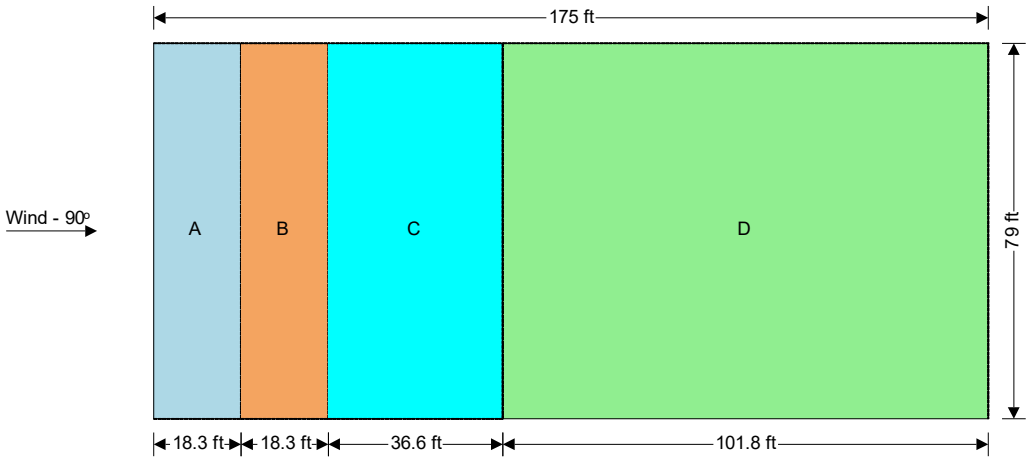
Windward net force $F_w = F_{w,wA\_1} + F_{w,wA\_2} + F_{w,wA\_3} =$ **66.3** kips

Overall horizontal loading $F_{w,total} = \max(F_w - F_l + F_{w,h}, F_{w,total\_min}) =$ **71.7** kips

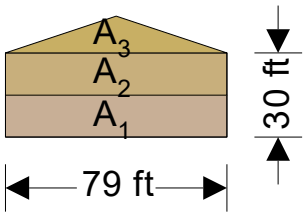


Plan view - Gable roof

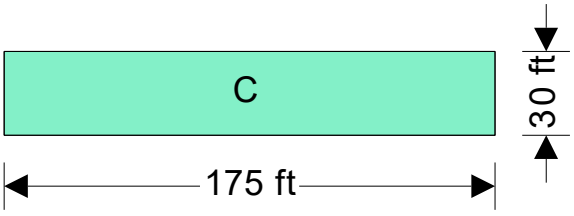




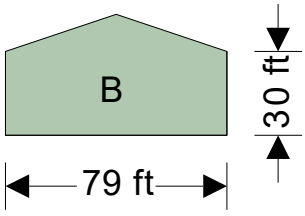
Plan view - Gable roof



Windward face



Side face



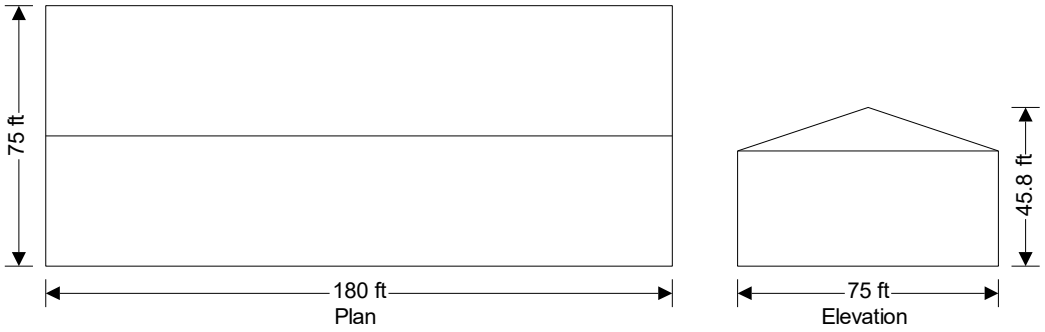
Leeward face

WIND LOADING - C&C (ASCE 7-16)

In accordance with ASCE7-16

Using the components and cladding design method

Tedds calculation version 2.1.09



Building data

Type of roof	Gable
Length of building	b = **180.00** ft
Width of building	d = **75.00** ft
Height to eaves	H = **33.25** ft
Pitch of roof	α_0 = **18.4** deg
Mean height	h = **39.50** ft

General wind load requirements

Basic wind speed	V = **115.0** mph
Risk category	II
Velocity pressure exponent coef (Table 26.6-1)	K_d = **0.85**
Ground elevation above sea level	z_{gl} = **0** ft
Ground elevation factor	$K_e = \exp(-0.0000362 \times z_{gl}/1ft)$ = **1.00**
Exposure category (cl 26.7.3)	B
Enclosure classification (cl.26.12)	Enclosed buildings
Internal pressure coef +ve (Table 26.13-1)	GC_{pi_p} = **0.18**
Internal pressure coef –ve (Table 26.13-1)	GC_{pi_n} = **-0.18**
Gust effect factor	G_f = **0.85**

Topography

Topography factor not significant	K_{zt} = 1.0

Velocity pressure

Velocity pressure coefficient (Table 26.10-1)	K_z = **0.76**
Velocity pressure	$q_h = 0.00256 \times K_z \times K_{zt} \times K_d \times K_e \times V^2 \times 1psf/mph^2$ = **21.8** psf

Peak velocity pressure for internal pressure

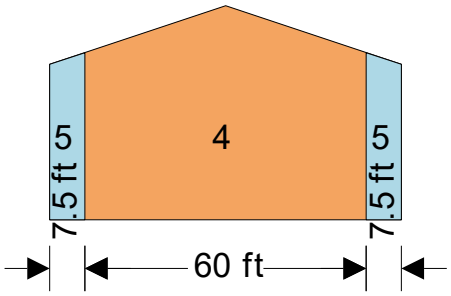
Peak velocity pressure – internal (as roof press.)	q_i = **21.78** psf

Equations used in tables

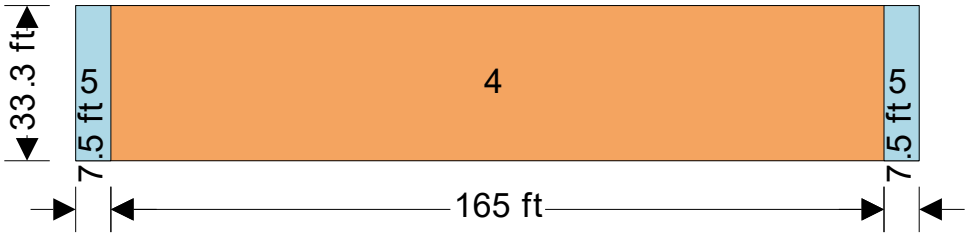
Net pressure	$p = q_h \times [GC_p - GC_{pi}]$

Components and cladding pressures - Wall (Table 30.3-1)

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
Girt	4	25.0	3.0	208.3	0.77	-0.87	20.6	-22.8
Girt	5	25.0	3.0	208.3	0.77	-0.93	20.6	-24.3
Wall panel	4	6.7	3.0	20.0	0.95	-1.05	24.5	-26.7
Wall panel	5	6.7	3.0	20.0	0.95	-1.29	24.5	-32.1
Fastner	4	6.7	1.0	14.8	0.97	-1.07	25.0	-27.2
Fastner	5	6.7	1.0	14.8	0.97	-1.34	25.0	-33.1
<10 sf	4	5.0	2.0	10.0	1.00	-1.10	25.7	-27.9
<10 sf	5	5.0	2.0	10.0	1.00	-1.40	25.7	-34.4
>500 sf	4	25.0	20.0	500.0	0.70	-0.80	19.2	-21.3
>500 sf	5	25.0	20.0	500.0	0.70	-0.80	19.2	-21.3



Elevation of gable wall



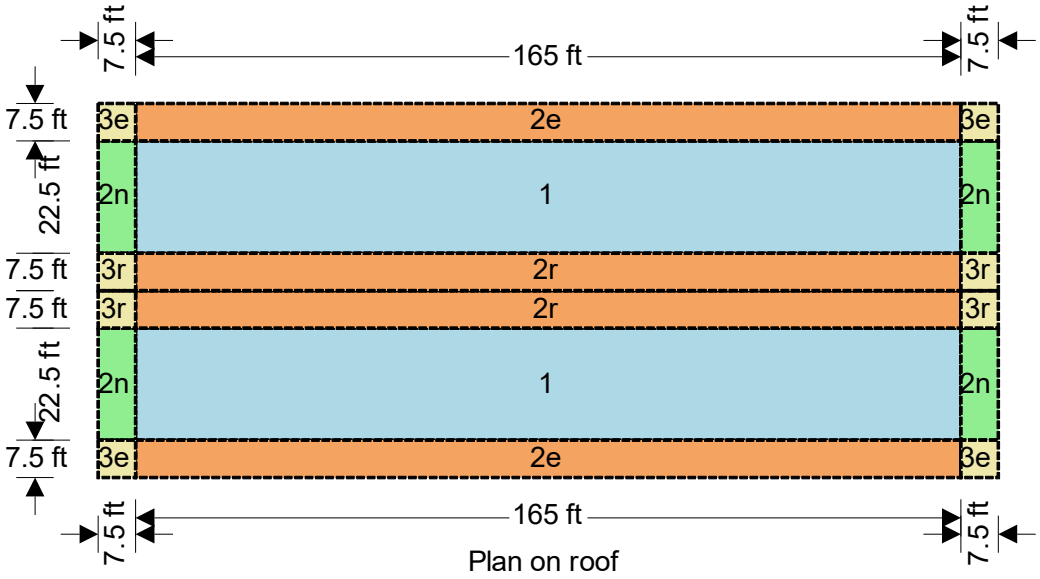
Elevation of side wall

Components and cladding pressures - Roof (Figure 30.3-2B)

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
<=2 sf	1	-	-	2.0	0.70	-2.00	19.2	-47.5
20 sf	1	-	-	20.0	0.46	-2.00	14.0 #	-47.5
50 sf	1	-	-	50.0	0.37	-1.15	12.0 #	-28.9
>100 sf	1	-	-	100.1	0.30	-0.50	10.5 #	-14.8 #
<=2 sf	2e	-	-	2.0	0.70	-2.00	19.2	-47.5
20 sf	2e	-	-	20.0	0.46	-2.00	14.0 #	-47.5

Component	Zone	Length (ft)	Width (ft)	Eff. area (ft^2)	$+GC_p$	$-GC_p$	Pres (+ve) (psf)	Pres (-ve) (psf)
50 sf	2e	-	-	50.0	0.37	-1.15	12.0 #	-28.9
>100 sf	2e	-	-	100.1	0.30	-0.50	10.5 #	-14.8 #
<=2 sf	2n	-	-	2.0	0.70	-3.00	19.2	-69.3
10 sf	2n	-	-	10.0	0.54	-3.00	15.6 #	-69.3
100 sf	2n	-	-	100.0	0.30	-1.57	10.5 #	-38.1
>250 sf	2n	-	-	250.1	0.30	-1.00	10.5 #	-25.7
<=2 sf	2r	-	-	2.0	0.70	-3.00	19.2	-69.3
10 sf	2r	-	-	10.0	0.54	-3.00	15.6 #	-69.3
100 sf	2r	-	-	100.0	0.30	-1.57	10.5 #	-38.1
>250 sf	2r	-	-	250.1	0.30	-1.00	10.5 #	-25.7
<=2 sf	3e	-	-	2.0	0.70	-3.00	19.2	-69.3
10 sf	3e	-	-	10.0	0.54	-3.00	15.6 #	-69.3
100 sf	3e	-	-	100.0	0.30	-1.57	10.5 #	-38.1
>250 sf	3e	-	-	250.1	0.30	-1.00	10.5 #	-25.7
<=2 sf	3r	-	-	2.0	0.70	-3.60	19.2	-82.3
10 sf	3r	-	-	10.0	0.54	-3.60	15.6 #	-82.3
50 sf	3r	-	-	50.0	0.37	-2.34	12.0 #	-54.9
>100 sf	3r	-	-	100.1	0.30	-1.80	10.5 #	-43.1

The final net design wind pressure, including all permitted reductions, used in the design shall not be less than 16psf acting in either direction

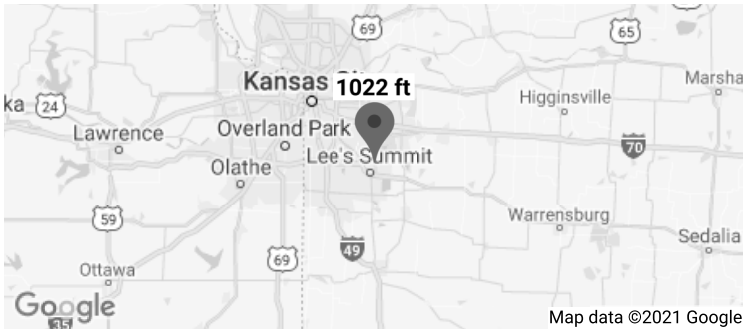


Plan on roof

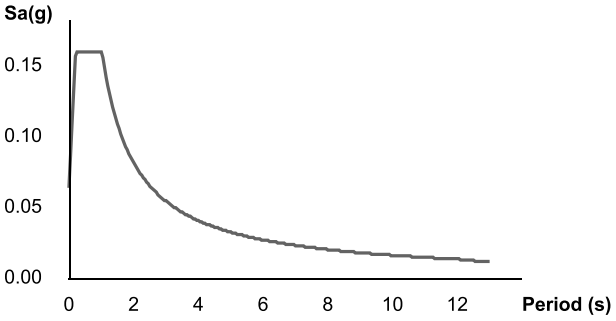
Hazards by Location

Search Information

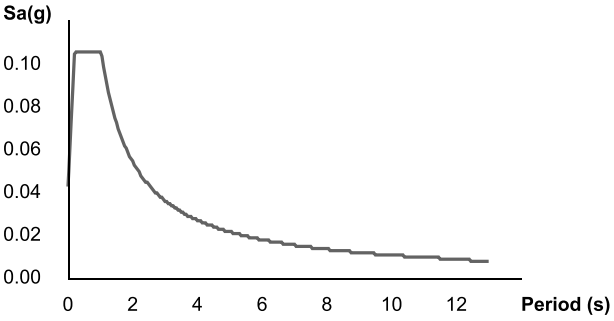
Address:	504 NE Chipman Rd, Lee's Summit, MO 64063, USA
Coordinates:	38.9253893, -94.3691862
Elevation:	1022 ft
Timestamp:	2021-10-14T14:06:41.633Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D



MCER Horizontal Response Spectrum



Design Horizontal Response Spectrum



Basic Parameters

Name	Value	Description
S_S	0.1	MCE_R ground motion (period=0.2s)
S_1	0.068	MCE_R ground motion (period=1.0s)
S_{MS}	0.16	Site-modified spectral acceleration value
S_{M1}	0.164	Site-modified spectral acceleration value
S_{DS}	0.106	Numeric seismic design value at 0.2s SA
S_{D1}	0.109	Numeric seismic design value at 1.0s SA

Additional Information

Name	Value	Description
SDC	B	Seismic design category
F_a	1.6	Site amplification factor at 0.2s
F_v	2.4	Site amplification factor at 1.0s
CR_S	0.927	Coefficient of risk (0.2s)
CR_1	0.876	Coefficient of risk (1.0s)
PGA	0.047	MCE_G peak ground acceleration
F_{PGA}	1.6	Site amplification factor at PGA
PGA_M	0.075	Site modified peak ground acceleration
T_L	12	Long-period transition period (s)
SsRT	0.1	Probabilistic risk-targeted ground motion (0.2s)

SsUH	0.108	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.068	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.078	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.6	Factored deterministic acceleration value (1.0s)
PGAd	0.5	Factored deterministic acceleration value (PGA)

The results indicated here DO NOT reflect any state or local amendments to the values or any delineation lines made during the building code adoption process. Users should confirm any output obtained from this tool with the local Authority Having Jurisdiction before proceeding with design.

Disclaimer

Hazard loads are provided by the U.S. Geological Survey Seismic Design Web Services.

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SUMMIT POINT APARTMENTS - SEISMIC LOADS

In accordance with ASCE 7-16

Tedds calculation version 3.1.03

Site parameters

Site class	D
Mapped acceleration parameters (Section 11.4.2)	
at short period	S_S = **0.1**
at 1 sec period	S_1 = **0.068**
Site coefficientat short period (Table 11.4-1)	F_a = **1.600**
at 1 sec period (Table 11.4-2)	F_v = **2.400**

Spectral response acceleration parameters

at short period (Eq. 11.4-1)	$S_{MS} = F_a \times S_S$ = **0.160**
at 1 sec period (Eq. 11.4-2)	$S_{M1} = F_v \times S_1$ = **0.163**

Design spectral acceleration parameters (Sect 11.4.4)

at short period (Eq. 11.4-3)	$S_{DS} = 2 / 3 \times S_{MS}$ = **0.107**
at 1 sec period (Eq. 11.4-4)	$S_{D1} = 2 / 3 \times S_{M1}$ = **0.109**

Seismic design category

Occupancy category (Table 1-1)	II
Seismic design category based on short period response acceleration (Table 11.6-1)	A
Seismic design category based on 1 sec period response acceleration (Table 11.6-2)	B
Seismic design category	B

Approximate fundamental period

Height above base to highest level of building	h_n = **31.25** ft
From Table 12.8-2:	
Structure type	All other systems
Building period parameter C_t	C_t = **0.02**
Building period parameter x	x = **0.75**
Approximate fundamental period (Eq 12.8-7)	$T_a = C_t \times (h_n)^x \times 1sec / (1ft)^x$= **0.264** sec
Building fundamental period (Sect 12.8.2)	$T = T_a$ = **0.264** sec
Long-period transition period	T_L = **12** sec

Seismic response coefficient

Seismic force-resisting system (Table 12.2-1)	A. Bearing_Wall_Systems 15. Light-frame (wood) walls sheathed with wood structural panels
Response modification factor (Table 12.2-1)	R = **6.5**
Seismic importance factor (Table 1.5-2)	I_e = **1.000**
Seismic response coefficient (Sect 12.8.1.1)	
Calculated (Eq 12.8-2)	$C_{s\_calc} = S_{DS} / (R / I_e)$ = **0.0164**
Maximum (Eq 12.8-3)	$C_{s\_max} = S_{D1} / ((T / 1\ sec) \times (R / I_e))$ = **0.0633**

Minimum (Eq.12.8-5)	$C_{s\_min} = \max(0.044 \times S_{DS} \times I_e, 0.01) =$ **0.0100**
Seismic response coefficient	$C_s =$ **0.0164**

Seismic base shear (Sect 12.8.1)

Effective seismic weight of the structure	W = **1900.0** kips
Seismic response coefficient	$C_s =$ **0.0164**
Seismic base shear (Eq 12.8-1)	$V = C_s \times W =$ **31.2** kips

Seismic Weight

Roof: 30 psf x 90’ x 75’ x 1.1 x 2 sides = 446 kips

Floors: 25 psf x 90’ x 75’ x 2 floors x 2 sides = 675 kips

Exterior Walls: (2 x 90’ + 75’) x 32’ x 25 psf x 2 sides = 408 kips

Interior Walls: (2 x 80’ + 2 x 50’ + 4 x 40’ + 6 x 25’) x 9’ x 3 levels x 12 psf x 2 sides = 370 kips

Total = 1900 kips

8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project:	Summit Point
Project No:	21202
Engineer:	EJS
Date:	10/26/2021
Checked by:	CRG
Date:	01/19/2022

Foundation Loads

Member Description: BW-1 (also applies to BW-3 at E-W Double Wall)

Input: Allowable Bearing 2500 psf

Level	Elev [ft]	Trib [ft]	DL [psf]	LL [psf]	RLL [psf]	SL [psf]	LLR Factor
Roof		19	30	0	20	20	1
3rd Wall	9	N/A	12	N/A	N/A	N/A	1
3rd		1	25	40	0	0	1
2nd Wall	9	N/A	12	N/A	N/A	N/A	1
2nd		1	25	40	0	0	1
1st Wall	9	N/A	20	N/A	N/A	N/A	1

Output:

Level	DL [klf]	LL [klf]	RLL [klf]	SL [klf]	ASD-1[a] [klf]	ASD-2[b] [klf]	ASD-3[c] [klf]	ASD-4[d] [klf]
Roof	0.57	0	0.38	0.38	0.57	0.57	0.95	0.86
3rd	0.13	0.04	0	0	0.13	0.17	0.13	0.16
2nd	0.13	0.04	0	0	0.13	0.17	0.13	0.16
Wall	0.18	0	0	0	0.18	0.18	0.18	0.18
				Total:	1.02	1.10	1.40	1.36
					Design Load [klf]:			1.40

a: ASD-1: 1.0DL
b: ASD-2: 1.0DL + 1.0LL
c: ASD-3: 1.0DL + (1.0RLL or 1.0SL)
d: ASD-4: 1.0DL + 0.75LL + 0.75(RLL or SL)

Min calc width 6.70 in
Width Used: 18 in

STAND STRUCTURAL ENGINEERING INC
8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point
Project No: 21202
Engineer: EJS
Date: 10/26/2021
Checked by: CRG
Date: 01/19/2022

Foundation Loads

Member Description: BW-2 (Interior Wall within Unit)

Input: 2500 psf

Level	Elev [ft]	Trib [ft]	DL [psf]	LL [psf]	RLL [psf]	SL [psf]	LLR Factor
Roof		0	30	0	20	20	1
3rd Wall	9	N/A	12	N/A	N/A	N/A	1
3rd		25	25	40	0	0	1
2nd Wall	9	N/A	12	N/A	N/A	N/A	1
2nd		25	25	40	0	0	1
1st Wall	9	N/A	20	N/A	N/A	N/A	1

Output:

Level	DL [klf]	LL [klf]	RLL [klf]	SL [klf]	ASD-1[a] [klf]	ASD-2[b] [klf]	ASD-3[c] [klf]	ASD-4[d] [klf]
Roof	0.00	0	0.00	0	0.00	0.00	0.00	0.00
3rd	0.73	1.00	0	0	0.73	1.73	0.73	1.48
2nd	0.73	1.00	0	0	0.73	1.73	0.73	1.48
FDN	0.18	0	0	0	0.18	0.18	0.18	0.18
				Total:	1.65	3.65	1.65	3.15
					Design Load [klf]:			3.65

a: ASD-1: 1.0DL
b: ASD-2: 1.0DL + 1.0LL
c: ASD-3: 1.0DL + (1.0RLL or 1.0SL)
d: ASD-4: 1.0DL + 0.75LL + 0.75(RLL or SL)

Min calc width 17.50 in
Width Used: 18 in

STAND STRUCTURAL ENGINEERING INC
8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point
Project No: 21202
Engineer: EJS
Date: 10/26/2021
Checked by: CRG
Date: 01/19/2022

Foundation Loads

Member Description: BW-3 @ N-S Double Wall (also applies to BW-2 at Exterior Wall

Input: 2500 psf

Level	Elev [ft]	Trib [ft]	DL [psf]	LL [psf]	RLL [psf]	SL [psf]	LLR Factor
Roof		0	30	0	20	20	1
3rd Wall	15	N/A	12	N/A	N/A	N/A	1
3rd		7	25	40	0	0	1
2nd Wall	9	N/A	12	N/A	N/A	N/A	1
2nd		7	25	40	0	0	1
1st Wall	9	N/A	20	N/A	N/A	N/A	1

Output:

Level	DL [klf]	LL [klf]	RLL [klf]	SL [klf]	ASD-1[a] [klf]	ASD-2[b] [klf]	ASD-3[c] [klf]	ASD-4[d] [klf]
Roof	0	0	0.00	0	0.00	0.00	0.00	0.00
3rd	0.355	0.28	0	0	0.36	0.64	0.36	0.57
2nd	0.283	0.28	0	0	0.28	0.56	0.28	0.49
FDN	0.18	0	0	0	0.18	0.18	0.18	0.18
				Total:	0.82	1.38	0.82	1.24
					Design Load [klf]:			1.38

a: ASD-1: 1.0DL
b: ASD-2: 1.0DL + 1.0LL
c: ASD-3: 1.0DL + (1.0RLL or 1.0SL)
d: ASD-4: 1.0DL + 0.75LL + 0.75(RLL or SL)

Min calc width 6.61 in
Width Used: 18 in

Multi-Family Stud Capacities					
Stud Size	Height	Blocked @ Midheight Capacity		Fully Sheathed Capacity	
		12" OC	16" OC	12" OC	16" OC
2x4	8'	1.9 klf (Compression)	1.4 klf (Compression)	2.7 klf (Plate Bearing)	2.0 klf (Plate Bearing)
2x4[1]	8'	3.4 klf	2.5 klf	3.8 klf	2.8 klf
(2) 2x4	8'	5.0 klf (Plate Bearing)	3.8 klf (Plate Bearing)	5.0 klf (Plate Bearing)	3.8 klf (Plate Bearing)
2x6	8'	3.1 klf (Compression)	2.3 klf (Compression)	4.3 klf (Plate Bearing)	3.2 klf (Compression)
2x6[1]	8'	5.4 klf	4.0 klf	6.0 klf	4.5 klf
(2) 2x6	8'	7.8 klf (Plate Bearing)	5.9 klf (Plate Bearing)	7.8 klf (Plate Bearing)	5.9 klf (Plate Bearing)
2x4	9'	1.6 klf (Compression)	1.2 klf (Compression)	2.2 klf (Compression)	1.7 klf (Compression)
2x4[1]	9'	3.0 klf	2.2 klf	3.3 klf	2.5 klf
(2) 2x4	9'	4.5 klf (Compression)	3.4 klf (Compression)	4.5 klf (Compression)	3.4 klf (Compression
2x6	9'	2.5 klf (Compression)	1.9 klf (Compression)	4.3 klf (Plate Bearing)	3.2 klf (Plate Bearing)
2x6[1]	9'	5.1 klf	3.8 klf	6.0 klf	4.5 klf
(2) 2x6	9'	7.8 klf (Plate Bearing)	5.9 klf (Plate Bearing)	7.8 klf (Plate Bearing)	5.9 klf (Plate Bearing)

**Sizes shown assume stud and plate are SPF*

[1]Double every other

SCHEDULE - BEARING WALL				
BRG MARK	3RD FLR STUDS	2ND FLR STUDS	1ST FLR STUDS	Comments
BW-1	2x6 @ 16" OC	2x6 @ 16" OC	2x6 @ 16" OC	
BW-2	2x6 @ 16" OC	2x6 @ 16" OC	2x6 @ 16" OC	
BW-3	2x4 @ 16" OC	2x4 @ 16" OC	2x4 @ 16" OC	DOUBLE DEMISING WALL
BW-4	-	-	2x4 @ 16" OC	
BW-5	-	-	2x6 @ 16" OC	

**PROVIDE 2x BLOCKING AT MIDHEIGHT (4'-6" MAX) AT ALL LOAD BEARING WALLS DURING CONSTRUCTION*

Wall Footing

LIC# : KW-06011423, Build:20.22.1.5 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: Typical Wall Footing

Code References

Calculations per ACI 318-14
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	4.0 ksi
fy : Rebar Yield	=	60.0 ksi
Ec : Concrete Elastic Modulus	=	3,122.0 ksi
Concrete Density	=	145.0 pcf
φ Values Flexure	=	0.90
Shear	=	0.750

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
AutoCalc Footing Weight as DL :		Yes

Soil Design Values

Allowable Soil Bearing	=	2.50 ksf
Increase Bearing By Footing Weight	=	No
Soil Passive Resistance (for Sliding)	=	250.0 pcf
Soil/Concrete Friction Coeff.	=	0.30

Increases based on footing Depth

Reference Depth below Surface	=	3.0 ft
Allow. Pressure Increase per foot of depth	=	ksf
when base footing is below	=	ft

Increases based on footing Width

Allow. Pressure Increase per foot of width	=	ksf
when footing is wider than	=	ft

Adjusted Allowable Bearing Pressure = 2.50 ksf

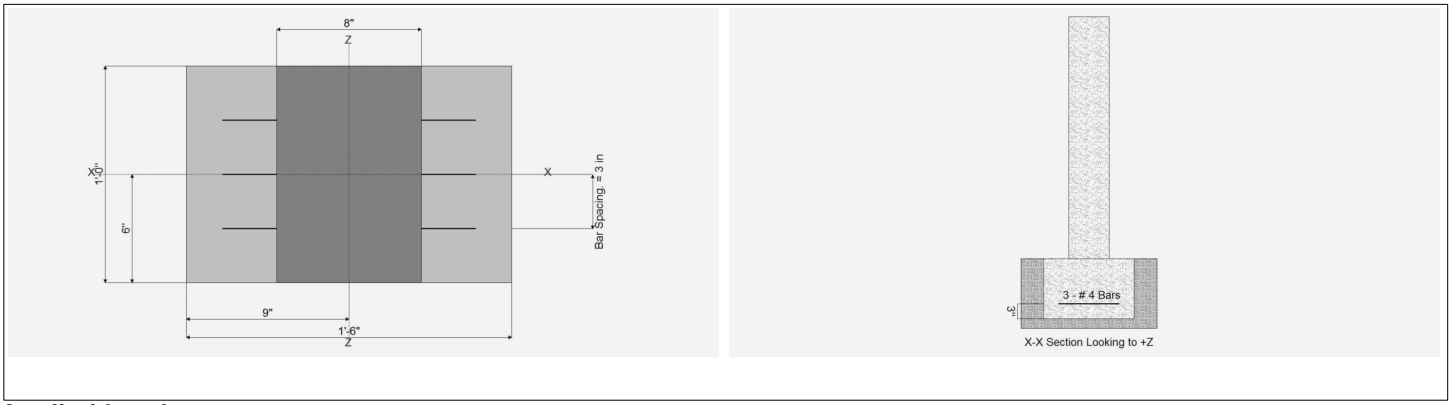
Dimensions

Footing Width	=	1.50 ft	Footing Thickness	=	12.0 in		
Wall Thickness	=	8.0 in	Rebar Centerline to Edge of Concrete...				
Wall center offset from center of footing	=	0 in	at Bottom of footing	=	3.0 in		

Reinforcing

Bars along X-X Axis

# of Bars in 12" Width	=		3
Reinforcing Bar Size	=	#	4



Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	1.450		1.680					k
OB : Overburden	=								ksf
V-x	=								k
M-zz	=								k-ft
Vx applied	=	in above top of footing							

Wall Footing

LIC# : KW-06011423, Build:20.22.1.5 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: Typical Wall Footing

DESIGN SUMMARY

Design OK

	Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift

	Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8927	Soil Bearing	2.232 ksf	2.50 ksf	+D+L
PASS	0.01174	Z Flexure (+X)	0.2713 k-ft	23.109 k-ft	+1.20D+1.60L
PASS	0.003758	Z Flexure (-X)	0.08684 k-ft	23.109 k-ft	+0.90D
PASS	n/a	1-way Shear (+X)	0.0 psi	94.868 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc	Actual Soil Bearing Stress -X	Actual Soil Bearing Stress +X	Actual / Allowable Ratio
, D Only	2.50 ksf	0.0 in	1.112 ksf	1.112 ksf	0.445
, +D+L	2.50 ksf	0.0 in	2.232 ksf	2.232 ksf	0.893
, +D+0.750L	2.50 ksf	0.0 in	1.952 ksf	1.952 ksf	0.781
, +0.60D	2.50 ksf	0.0 in	0.6670 ksf	0.6670 ksf	0.267

Overturning Stability Units : k-ft

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Sliding SafetyRatio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Which Side ?	Tension @ Bot. or Top ?	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
, +1.40D	0.1351	-X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.40D	0.1351	+X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D+1.60L	0.2713	-X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D+1.60L	0.2713	+X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D+L	0.213	-X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D+L	0.213	+X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D	0.1158	-X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +1.20D	0.1158	+X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +0.90D	0.08684	-X	Bottom	0.2592	Min Temp %	0.6	23.109	OK
, +0.90D	0.08684	+X	Bottom	0.2592	Min Temp %	0.6	23.109	OK

One Way Shear Units : k

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0 psi	0 psi	0 psi	94.868 psi	0	OK
+1.20D+1.60L	0 psi	0 psi	0 psi	94.868 psi	0	OK
+1.20D+L	0 psi	0 psi	0 psi	94.868 psi	0	OK
+1.20D	0 psi	0 psi	0 psi	94.868 psi	0	OK
+0.90D	0 psi	0 psi	0 psi	94.868 psi	0	OK

General Footing

LIC# : KW-06011423, Build:20.22.1.5 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: Club House Spread Footing

Code References

Calculations per ACI 318-14
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	4.0	ksi
fy : Rebar Yield	=	60.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	0.00180
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	2.50	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	3.0	ft
Allow press. increase per foot of depth	=		ksf
when footing base is below	=		ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=		ksf
when max. length or width is greater than	=		ft

Dimensions

Width parallel to X-X Axis	=	3.0	ft
Length parallel to Z-Z Axis	=	3.0	ft
Footing Thickness	=	28.0	in

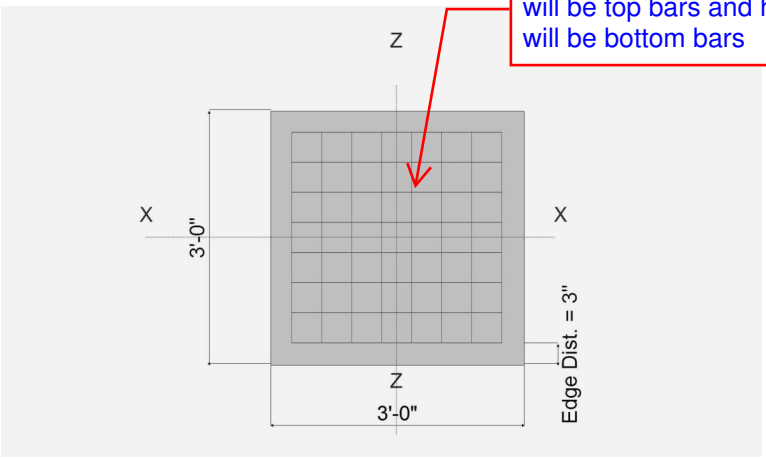
Pedestal dimensions...

px : parallel to X-X Axis	=		in
pz : parallel to Z-Z Axis	=		in
Height	=		in

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0	in

Note that half of the bars will be top bars and half will be bottom bars

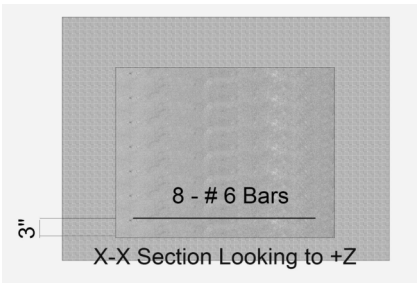


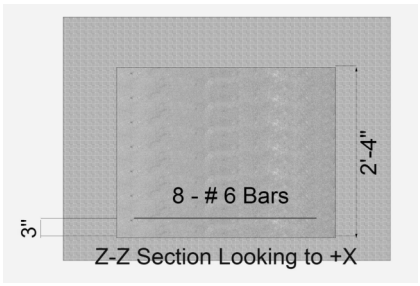
Reinforcing

Bars parallel to X-X Axis			
Number of Bars	=		8
Reinforcing Bar Size	=	#	6
Bars parallel to Z-Z Axis			
Number of Bars	=		8
Reinforcing Bar Size	=	#	6

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation n/a
Bars required within zone n/a
Bars required on each side of zone n/a





Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	2.0	2.0						k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=					4.0			k-ft
V-x	=								k
V-z	=								k

General Footing

LIC# : KW-06011423, Build:20.22.1.5 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: Club House Spread Footing

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.4788	Soil Bearing	1.197 ksf	2.50 ksf	+D+0.750Lr+0.450W about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	2.139	Overturning - Z-Z	2.40 k-ft	5.135 k-ft	+0.60D+0.60W
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.008566	Z Flexure (+X)	1.092 k-ft/ft	127.445 k-ft/ft	+1.20D+0.50Lr+W
PASS	0.005493	Z Flexure (-X)	0.70 k-ft/ft	127.445 k-ft/ft	+1.20D+1.60Lr
PASS	0.005493	X Flexure (+Z)	0.70 k-ft/ft	127.445 k-ft/ft	+1.20D+1.60Lr
PASS	0.005493	X Flexure (-Z)	0.70 k-ft/ft	127.445 k-ft/ft	+1.20D+1.60Lr
PASS	n/a	1-way Shear (+X)	0.0 psi	94.868 psi	n/a
PASS	0.0	1-way Shear (-X)	0.0 psi	0.0 psi	n/a
PASS	n/a	1-way Shear (+Z)	0.0 psi	94.868 psi	n/a
PASS	n/a	1-way Shear (-Z)	0.0 psi	94.868 psi	n/a
PASS	n/a	2-way Punching	1.142 psi	94.868 psi	+1.20D+1.60Lr

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location: Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	2.50	n/a	0.0	0.6339	0.6339	n/a	n/a	0.254
X-X, +D+Lr	2.50	n/a	0.0	0.8561	0.8561	n/a	n/a	0.342
X-X, +D+0.750Lr	2.50	n/a	0.0	0.8006	0.8006	n/a	n/a	0.320
X-X, +D+0.60W	2.50	n/a	0.0	0.6339	0.6339	n/a	n/a	0.254
X-X, +D+0.750Lr+0.450W	2.50	n/a	0.0	0.8006	0.8006	n/a	n/a	0.320
X-X, +D+0.450W	2.50	n/a	0.0	0.6339	0.6339	n/a	n/a	0.254
X-X, +0.60D+0.60W	2.50	n/a	0.0	0.3803	0.3803	n/a	n/a	0.152
X-X, +0.60D	2.50	n/a	0.0	0.3803	0.3803	n/a	n/a	0.152
Z-Z, D Only	2.50	0.0	n/a	n/a	n/a	0.6339	0.6339	0.254
Z-Z, +D+Lr	2.50	0.0	n/a	n/a	n/a	0.8561	0.8561	0.342
Z-Z, +D+0.750Lr	2.50	0.0	n/a	n/a	n/a	0.8006	0.8006	0.320
Z-Z, +D+0.60W	2.50	5.048	n/a	n/a	n/a	0.1059	1.162	0.465
Z-Z, +D+0.750Lr+0.450W	2.50	2.998	n/a	n/a	n/a	0.4046	1.197	0.479
Z-Z, +D+0.450W	2.50	3.786	n/a	n/a	n/a	0.2379	1.030	0.412
Z-Z, +0.60D+0.60W	2.50	8.414	n/a	n/a	n/a	0.0	0.9462	0.379
Z-Z, +0.60D	2.50	0.0	n/a	n/a	n/a	0.3803	0.3803	0.152

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
X-X, D Only	None	0.0 k-ft	Infinity	OK
X-X, +D+Lr	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr	None	0.0 k-ft	Infinity	OK
X-X, +D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.750Lr+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +D+0.450W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D+0.60W	None	0.0 k-ft	Infinity	OK
X-X, +0.60D	None	0.0 k-ft	Infinity	OK
Z-Z, D Only	None	0.0 k-ft	Infinity	OK
Z-Z, +D+Lr	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.750Lr	None	0.0 k-ft	Infinity	OK
Z-Z, +D+0.60W	2.40 k-ft	8.558 k-ft	3.566	OK
Z-Z, +D+0.750Lr+0.450W	1.80 k-ft	10.808 k-ft	6.004	OK
Z-Z, +D+0.450W	1.80 k-ft	8.558 k-ft	4.754	OK
Z-Z, +0.60D+0.60W	2.40 k-ft	5.135 k-ft	2.139	OK
Z-Z, +0.60D	None	0.0 k-ft	Infinity	OK

General Footing

LIC# : KW-06011423, Build:20.22.1.5 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: Club House Spread Footing

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.350	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.40D	0.350	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50Lr	0.4250	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50Lr	0.4250	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D	0.30	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D	0.30	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+1.60Lr	0.70	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+1.60Lr	0.70	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+1.60Lr+0.50W	0.70	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+1.60Lr+0.50W	0.70	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50W	0.30	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50W	0.30	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50Lr+W	0.4250	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+0.50Lr+W	0.4250	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+W	0.30	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +1.20D+W	0.30	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +0.90D+W	0.2250	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +0.90D+W	0.2250	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +0.90D	0.2250	+Z	Bottom	0.6048	AsMin	1.173	127.445	OK
X-X, +0.90D	0.2250	-Z	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.40D	0.350	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.40D	0.350	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50Lr	0.4250	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50Lr	0.4250	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D	0.30	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D	0.30	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+1.60Lr	0.70	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+1.60Lr	0.70	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+1.60Lr+0.50W	0.3667	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+1.60Lr+0.50W	1.033	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50W	0.03330	-X	Top	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50W	0.6333	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50Lr+W	0.2415	-X	Top	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+0.50Lr+W	1.092	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+W	0.3602	-X	Top	0.6048	AsMin	1.173	127.445	OK
Z-Z, +1.20D+W	0.9730	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +0.90D+W	0.3813	-X	Top	0.6048	AsMin	1.173	127.445	OK
Z-Z, +0.90D+W	0.9520	+X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +0.90D	0.2250	-X	Bottom	0.6048	AsMin	1.173	127.445	OK
Z-Z, +0.90D	0.2250	+X	Bottom	0.6048	AsMin	1.173	127.445	OK

One Way Shear

Load Combination...	Vu @ -X	Vu @ +X	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+0.50Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60Lr	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+1.60Lr+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+0.50W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+0.50Lr+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+1.20D+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+0.90D+W	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK
+0.90D	0.00 psi	0.00 psi	0.00 psi	0.00 psi	0.00 psi	94.87 psi	0.00	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	0.57 psi	189.74 psi	0.00301	OK

General Footing

DESCRIPTION: Club House Spread Footing

Two-Way "Punching" Shear All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.20D+0.50Lr	0.69 psi	189.74 psi	0.003656	OK
+1.20D	0.49 psi	189.74 psi	0.00258	OK
+1.20D+1.60Lr	1.14 psi	189.74 psi	0.006021	OK
+1.20D+1.60Lr+0.50W	1.14 psi	189.74 psi	0.006021	OK
+1.20D+0.50W	0.49 psi	189.74 psi	0.00258	OK
+1.20D+0.50Lr+W	0.69 psi	189.74 psi	0.003656	OK
+1.20D+W	0.50 psi	189.74 psi	0.00264	OK
+0.90D+W	0.47 psi	189.74 psi	0.002487	OK
+0.90D	0.37 psi	189.74 psi	0.001935	OK

Cantilevered Retaining Wall

DESCRIPTION: 4 ft Elev Difference

Code Reference

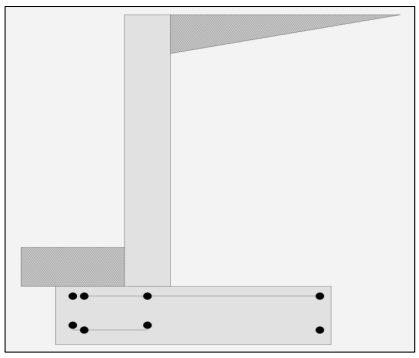
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	4.67 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	8.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	60.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	810.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Strength Level)	=	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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

LIC# : KW-06011423, Build:20.21.10.30 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: 4 ft Elev Difference

Design Summary

Wall Stability Ratios			
Overturning	=	3.48	OK
Sliding	=	1.54	OK
Global Stability	=	1.28	
Total Bearing Load	=	3,148 lbs	
...resultant ecc.	=	6.80 in	
Soil Pressure @ Toe	=	1,456 psf	OK
Soil Pressure @ Heel	=	118 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,038 psf	
ACI Factored @ Heel	=	166 psf	
Footing Shear @ Toe	=	4.8 psi	OK
Footing Shear @ Heel	=	1.7 psi	OK
Allowable	=	94.9 psi	
Sliding Calcs			
Lateral Sliding Force	=	963.4 lbs	
less 100% Passive Force	-	222.2 lbs	
less 100% Friction Force	-	1,259.2 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

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

Load Factors

Building Code	
Dead Load	0.000
Live Load	0.000
Earth, H	0.000
Wind, W	0.000
Seismic, E	0.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	12.00
Rebar Placed at	=	Center
Design Data		
fb/FB + fa/Fa	=	**0.694**
Total Force @ Section		
Service Level	lbs =	1,045.5
Strength Level	lbs =	1,045.5
Moment....Actual		
Service Level	ft-# =	1,626.4
Strength Level	ft-# =	1,626.4
Moment.....Allowable	=	2,341.0
Shear.....Actual		
Service Level	psi =	21.8
Strength Level	psi =	21.8
Shear.....Allowable	psi =	94.9
Anet (Masonry)	in2 =	
Rebar Depth 'd'	in =	4.00
Masonry Data		
f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Wall Weight	psf =	100.0
Short Term Factor	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	4,000.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: 4 ft Elev Difference

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1473 in2/ft		
(4/3) * As :	0.1964 in2/ft	Min Stem T&S Reinf Area 0.896 in2	
200bd/fy : 200(12)(4)/40000 :	0.24 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1964 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.2 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.3005 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Footing Data

Toe Width	=	1.00 ft
Heel Width	=	3.00
Total Footing Width	=	4.00
Footing Thickness	=	12.00 in
Key Width	=	12.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	2.00 ft

f'c = 4,000 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,038	166	psf
Mu' : Upward	=	941	1,442	ft-#
Mu' : Downward	=	134	2,167	ft-#
Mu: Design	=	807	725	ft-#
phiMin	=	6,705	7,491	ft-#
Actual 1-Way Shear	=	4.78	1.73	psi
Allow 1-Way Shear	=	94.87	94.87	psi

Toe Reinforcing = # 4 @ 9.26 in
Heel Reinforcing = # 4 @ 9.25 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, phi Tu = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe:
Heel:
Key:

Min footing T&S reinf Area 1.04 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

LIC# : KW-06011423, Build:20.21.10.30 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: 4 ft Elev Difference

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		963.4	1.89	1,820.0	Soil Over HL (ab. water tbl)	1,197.9	2.83	3,393.9
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.83	3,393.9
Hydrostatic Force					Watre Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	= 810.0	1.33	1,080.0
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	= 73.3	0.50	36.7
	=				Surcharge Over Toe	=		
					Stem Weight(s)	= 466.7	1.33	622.3
					Earth @ Stem Transitions	=		
					Footing Weight	= 600.0	2.00	1,200.0
					Key Weight	=	2.50	
					Vert. Component	=		
Total	=	963.4	**O.T.M.** =	1,820.0	**Total =**	3,147.9 lbs	**R.M.=**	6,332.9

Resisting/Overturning Ratio = **3.48**
Vertical Loads used for Soil Pressure = 3,147.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	150.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.079	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: 4 ft Elev Difference

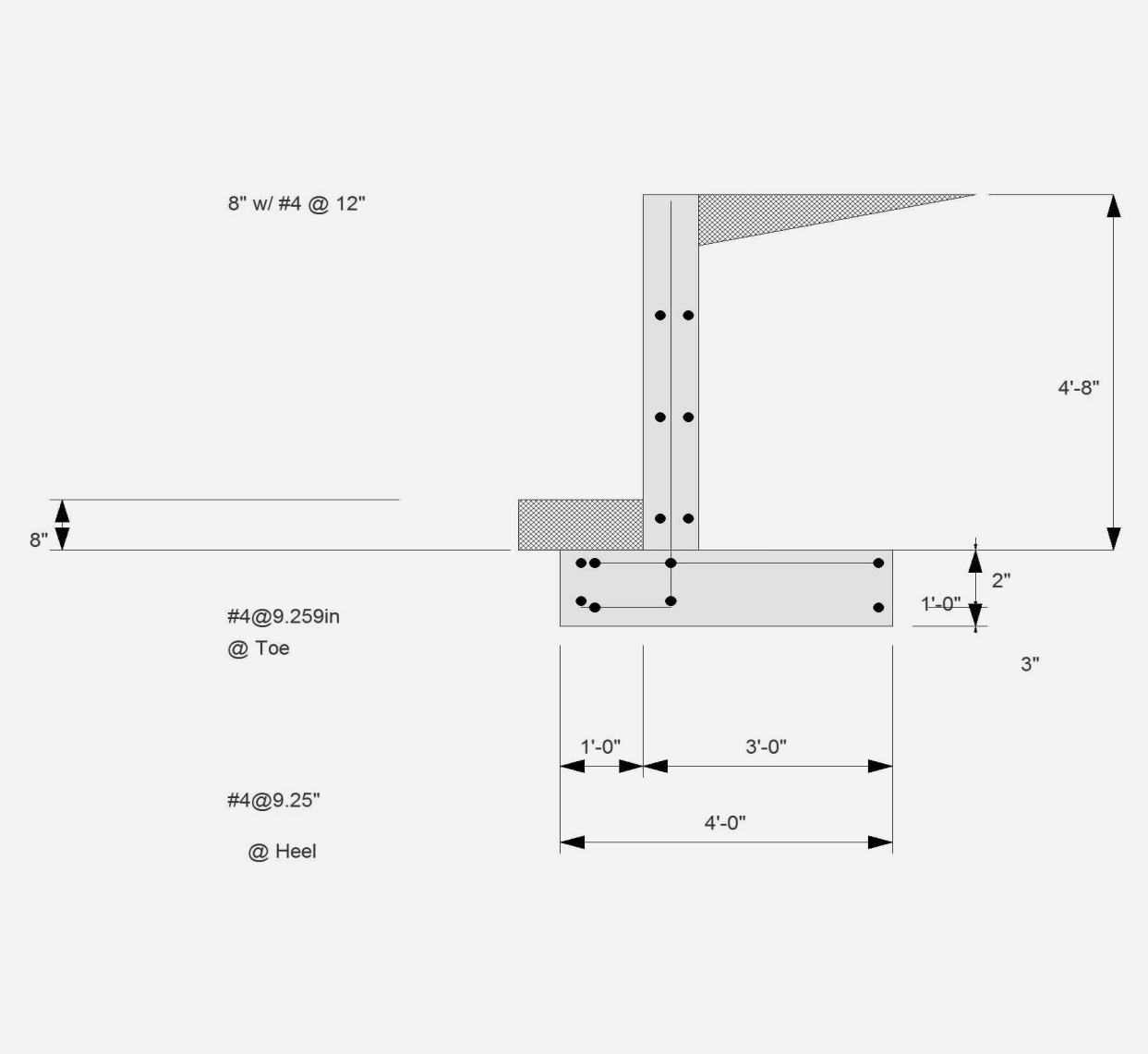
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2000 in2/ft
As Required =	0.1964 in2/ft

Cantilevered Retaining Wall

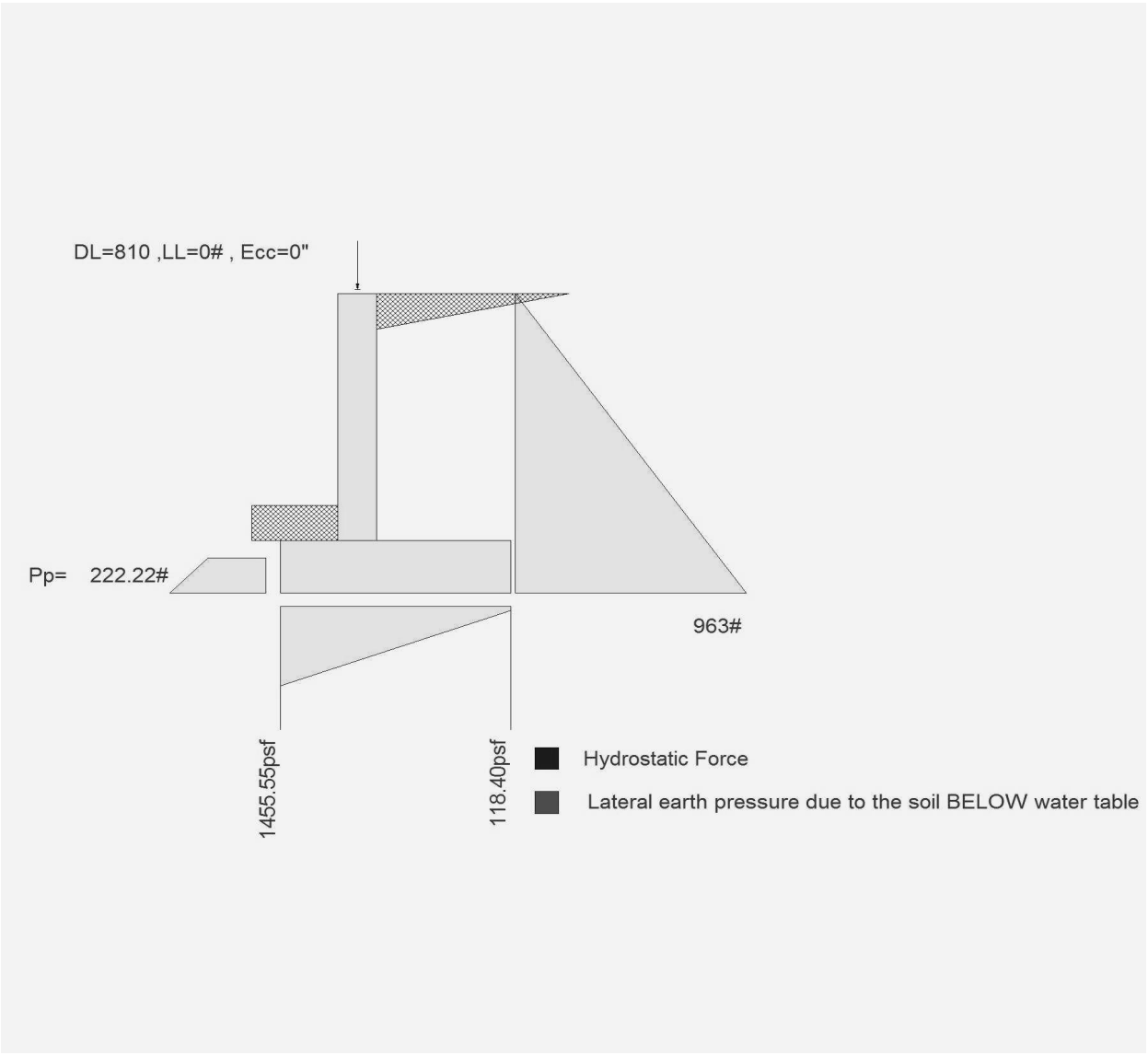
DESCRIPTION: 4 ft Elev Difference



Cantilevered Retaining Wall

LIC# : KW-06011423, Build:20.21.10.30 Stand Structural Engineering Inc. (c) ENERCALC INC 1983-2021

DESCRIPTION: 4 ft Elev Difference



8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point Apartments
Project No: 21202
Engineer: EJS
Date: 11/12/2021
Checked by: CRG
Date: 12/15/2021

Location: SW-A

General Input:

MWFRS WL: **25.1** psf
Parapet WL: **0** psf
Trib Width: **20** ft
Length: **48** ft
Truss Depth [ft]: **2**
Load Factor: **0.6** **<== Convert to ASD method forces**

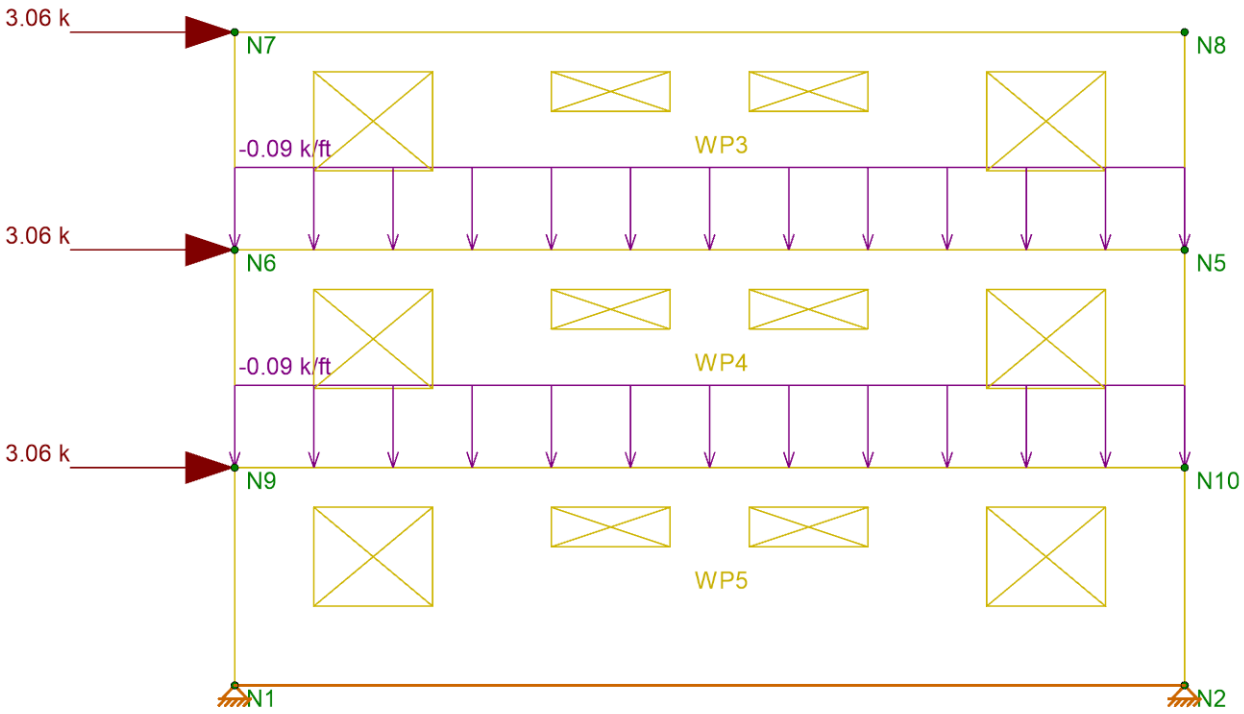
	Height [ft]	Stud Height [ft]	Trib Height [ft]	ASD Line Load [plf]	ASD Applied Point Load [k]	Level Shear ASD [k]	Wall Shear ASD [klf]	T / C per level [k]	Sheathing	Fasteners	Blocked
Parapet	44	n/a	0	0	0	n/a	n/a	n/a	-	-	-
Roof	44	9	11	165.66	3.31	3.31	0.069	0.76	15/32" OSB	10d @ 6"/12"	No
3rd	33	9	11	165.66	3.31	6.63	0.138	2.28	15/32" OSB	10d @ 6"/12"	No
2nd	22	9	11	165.66	3.31	9.94	0.207	4.56	15/32" OSB	10d @ 6"/12"	No
1st	11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

Overturning Moment Check

Wall Count: **1**
Length: **48** ft
Moment: **218.7** k-ft
Hold-Down **4.56** k

for RISA:

			Strap/Hold-down	
5.522	kip	3rd	0.76 kip	MSTC52
5.522	kip	2nd	1.52 kip	MSTC52
5.522	kip	1st	2.28 kip	HDU5-SDS2.5

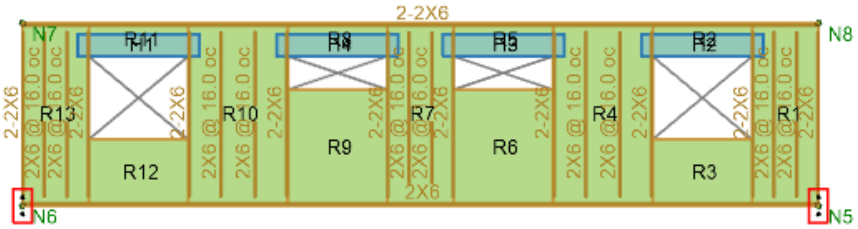


Loads: LC 4, IBC 16-15

Stand Structural Engineering	Summit Point Apartments	SK-3
EJS	0.6D + 0.6W	Jan 27, 2022
21202		SW-A.r3d

Detail Report: WP3

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	48
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.229
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	24
% Full Ht. Sheathed:	50
Wall Capacity Adj. Factor (2w/h):	0.727
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	1
Total Area of Openings (Ao):	84 ft²
Sheathing Area Ratio (r):	0.731

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	3.06 k			
Max Unit Shear	1 (W)	0.148 k/ft			
ShearPanel					
RS_15/32_8d@6	1 (W)	0.364 k/ft	0.26 k/ft	0.441	PASS

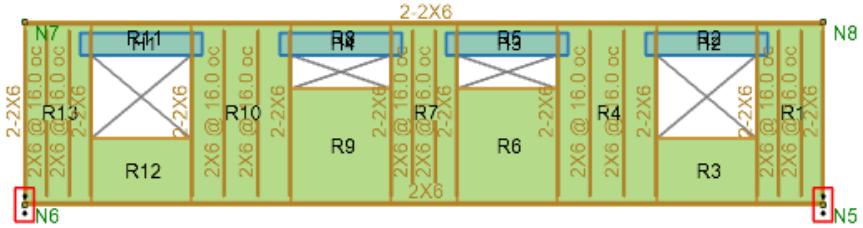
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson Chord Straps					
MSTC28_16_SPF/HF_Nail	4 (W)	1.159 k	1.33 k	0.872	PASS
Chords					
2-2X6 (Tension)	4 (W)	-1.159 k	15.444 k	0.075	PASS
2-2X6 (Compression)	1 (W)	1.666 k	11.657 k	0.143	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

Deflection Results

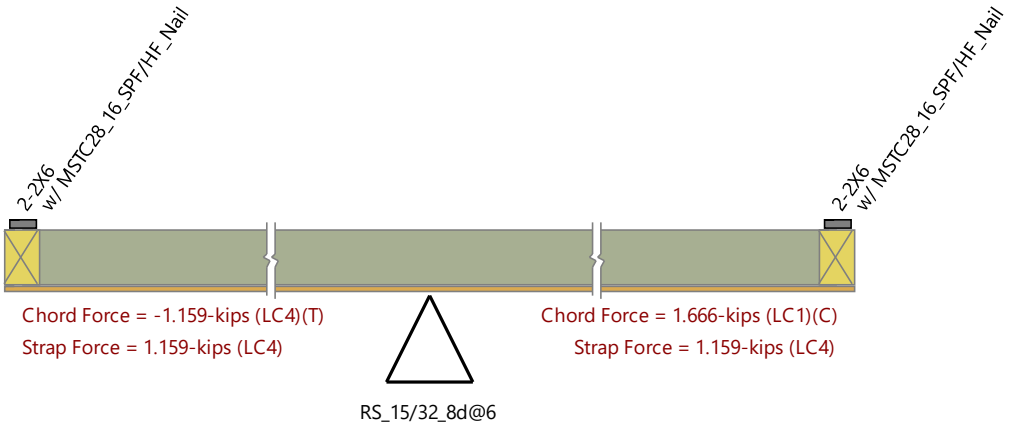
Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.128	1	0.003 in	0 in	0.125 in	1

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.148 k/ft**	**0.335 k/ft**	**0.441**	**PASS**
Shear Panel: RS_15/32_8d@6				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				8d
NOTE: AWC NDS-18 defines a 8d nail as being 2.5" x 0.131" common, or 2.5" x 0.113" galvanized box				
Required Penetration				1.375 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.26 k/ft
Reduced Shear Capacity (SGAF)				0.239 k/ft
Adjusted Capacity				0.335 k/ft
Chord Design	**1.666 k**	**11.657 k**	**0.143**	**PASS**
Gov Compression LC = 1				
Compression Analysis	**1.666 k**	**11.657 k**	0.143	PASS
Gov Tension LC = 4				
Tension Analysis	**1.159 k**	**15.444 k**	0.075	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Chord Strap Design	**1.159 k**	**1.33 k**	**0.872**	**PASS**
Selected Chord Strap / Hold Down:	MSTC28_16_SPF/HF_Nail			
Governing Load Combination = 4				
Clear Span				16 in
Fasteners				(16) 0.148 x 3 1/4 in
End Length				0 in
Req'd Chord Mat'l				SPF/HF
Base Cap (C_D=1)				0.831 k
C_D Factor				1.6
Adjusted Capacity				1.33 k



Cross Section Detailing



Opening Design H1

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

Opening Ht:	5 ft
Opening Width:	6 ft
h/w Ratio:	0.833

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2x10	Sill Size:	2X6

Opening Design H2

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

Opening Ht:	5 ft
Opening Width:	6 ft
h/w Ratio:	0.833

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2x10	Sill Size:	2X6

Opening Design H3

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

Opening Ht:	2 ft
Opening Width:	6 ft
h/w Ratio:	0.333

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2x10	Sill Size:	2X6

Opening Design H4

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

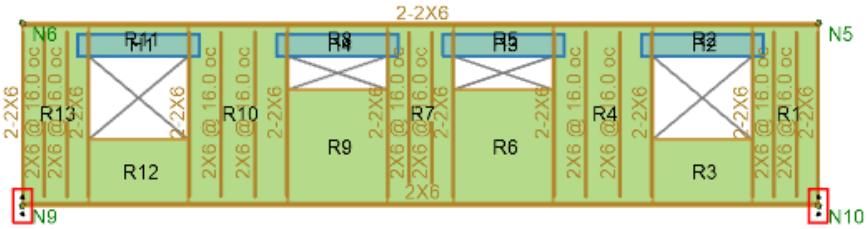
Opening Ht:	2 ft
Opening Width:	6 ft
h/w Ratio:	0.333

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2x10	Sill Size:	2X6

Detail Report: WP4

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	48
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.229
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	24
% Full Ht. Sheathed:	50
Wall Capacity Adj. Factor (2w/h):	0.727
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	1
Total Area of Openings (Ao):	84 ft²
Sheathing Area Ratio (r):	0.731

Material Properties:

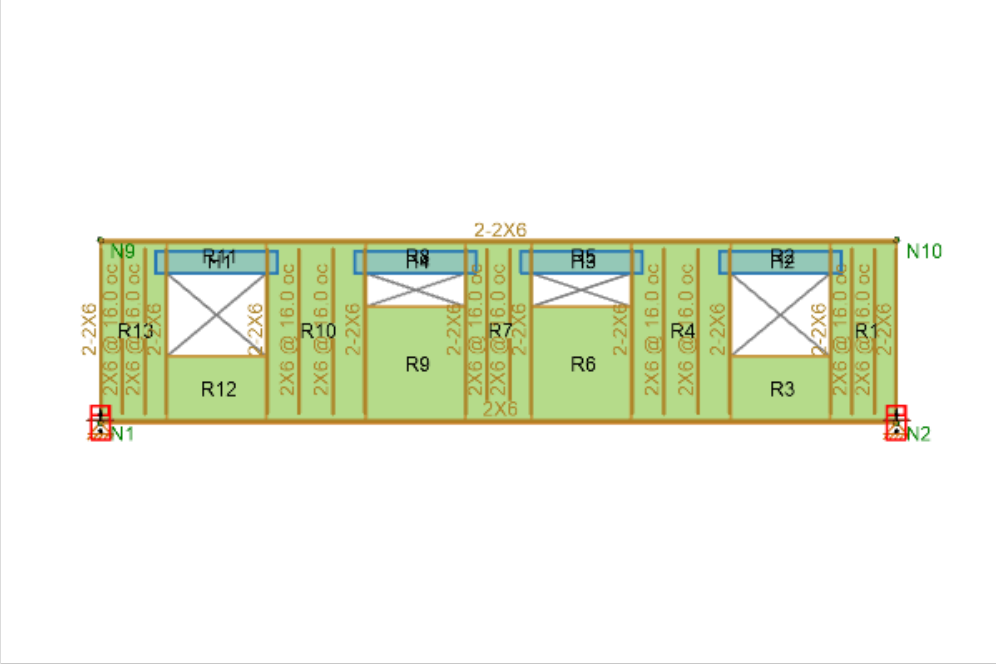
Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	6.12 k			
Max Unit Shear	1 (W)	0.295 k/ft			
ShearPanel					
RS_15/32_8d@6	1 (W)	0.364 k/ft	0.26 k/ft	0.882	PASS

Detail Report: WP5

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	48
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@4 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON
HD Eccentricity:	0

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.229
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	24
% Full Ht. Sheathed:	50
Wall Capacity Adj. Factor (2w/h):	0.727
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	1
Total Area of Openings (Ao):	84 ft²
Sheathing Area Ratio (r):	0.731

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	9.18 k			
Max Unit Shear	1 (W)	0.443 k/ft			
ShearPanel					
RS_15/32_8d@4	1 (W)	0.532 k/ft	0.38 k/ft	0.905	PASS

8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point Apartments
Project No: 21202
Engineer: EJS
Date: 11/12/2021
Checked by: CRG
Date: 12/15/2021

Location: SW-B

General Input:

MWFRS WL: **25.1** psf
Parapet WL: **0** psf
Trib Width: **25** ft
Length: **24** ft
Truss Depth [ft]: **2**
Load Factor: **0.6** **<== Convert to ASD method forces**

	Height [ft]	Stud Height [ft]	Trib Height [ft]	ASD Line Load [plf]	ASD Applied Point Load [k]	Level Shear ASD [k]	Wall Shear ASD [klf]	T / C per level [k]	Sheathing	Fasteners	Blocked
Parapet	44	n/a	0	0	0	n/a	n/a	n/a	-	-	-
Roof	44	9	11	165.66	4.14	4.14	0.173	1.90	15/32" OSB	10d @ 6"/12"	No
3rd	33	9	11	165.66	4.14	8.28	0.345	5.69	15/32" OSB	10d @ 6"/12"	No
2nd	22	9	11	165.66	4.14	12.42	0.518	11.39	15/32" OSB	10d @ 6"/12"	No
1st	11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

Overturning Moment Check

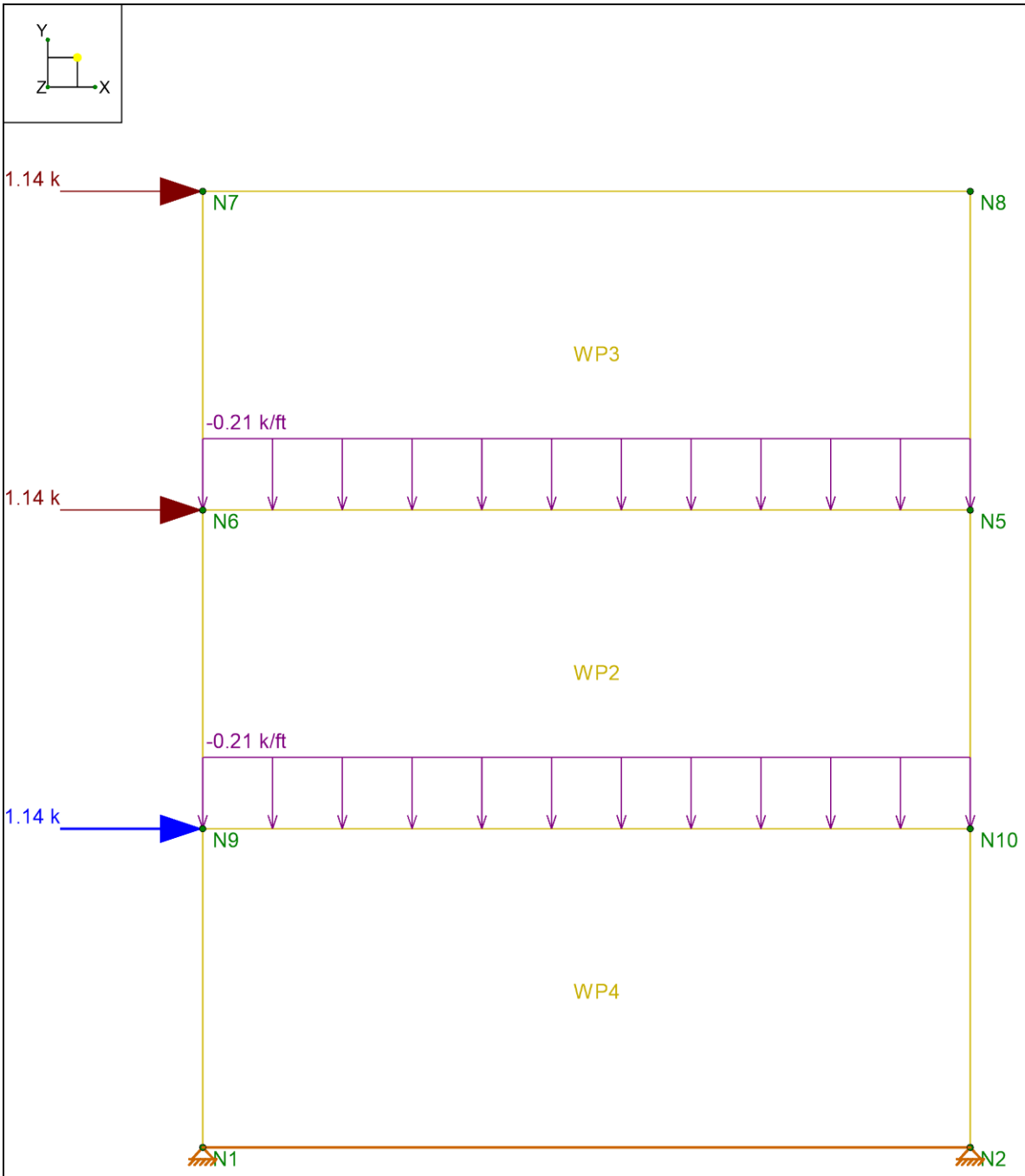
Wall Count: **2**
Length: **24** ft
Moment: **136.7** k-ft
Hold-Down **5.69** k

for RISA:

3.45125 kip	3rd	1.90 kip
3.45125 kip	2nd	3.80 kip
3.45125 kip	1st	5.69 kip

Strap/Hold-down

MSTC52
MSTC52
HDU5-SDS2.5

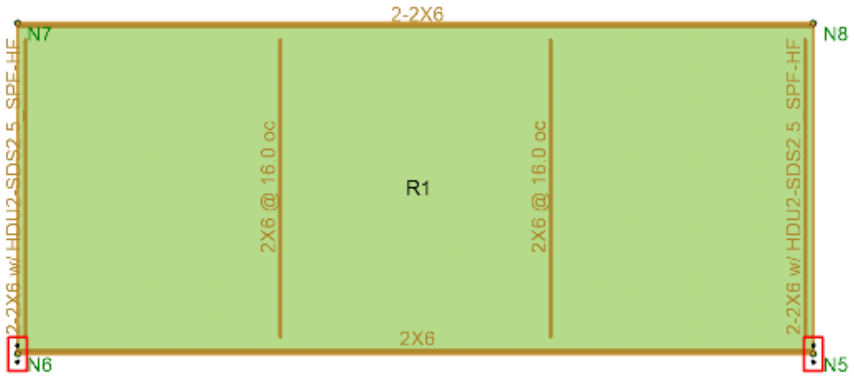


Loads: LC 4, IBC 16-15

Stand Structural Engineering	Summit Point Apartments	SK-2
EJS	0.6D + 0.6W	Jan 27, 2022
21202		SW-B.r3d

Detail Report: WP3

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	11
Length (ft):	26.5
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.42
K:	1

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
S1_15/32_10d@6	1 (W)	0.043 k/ft	0.045 k/ft	0.098	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HDU2-SDS2.5_SPF-HF	4 (W)	0.159 k	2.215 k	0.072	PASS
Chords					
2-2X6 (Tension)	4 (W)	0.159 k	15.444 k	0.010	PASS
2-2X6 (Compression)	1 (W)	0.523 k	11.657 k	0.045	PASS
Studs					
No gravity-only LC solved.					

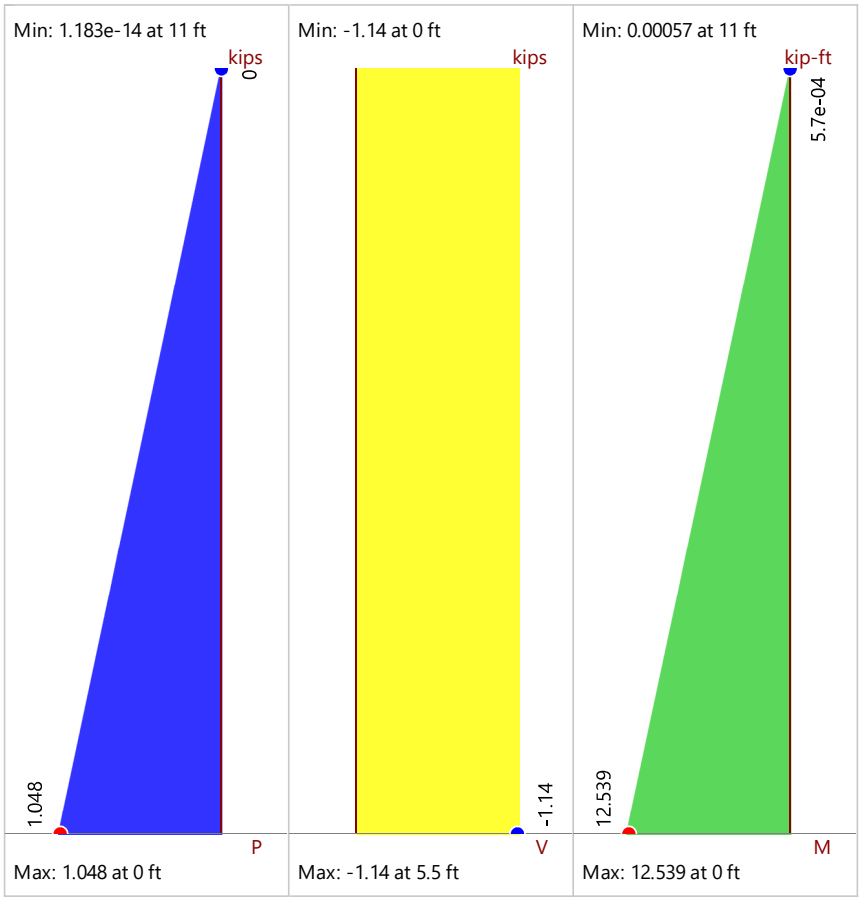
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.022(R1)	1 (W)	0.04	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	**0.098**	**0.072**	**0.045**	**N/C**	**PASS**

Envelope Diagrams



Axial Diagram **Shear Diagram** **Moment Diagram**

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SPF
Panel Schedule:	AWC 2015 OSB
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SPF
Stud Size:	2X6
Chord Material:	SPF
Chord Size:	2-2X6
Top Plate & Sill:	SPF
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	11
Total Length (ft):	26.5
Region H/W:	0.42
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.043 k/ft**	**0.313 k/ft**	**0.098**	**PASS**
Shear Panel: S1_15/32_10d@6				
Panel Grade				St-I
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				

Required Penetration	1.5 in
Required Spacing	6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]	0.92
Shear Capacity	0.34 k/ft
Reduced Shear Capacity (SGAF)	0.313 k/ft
Adjusted Capacity	0.438 k/ft

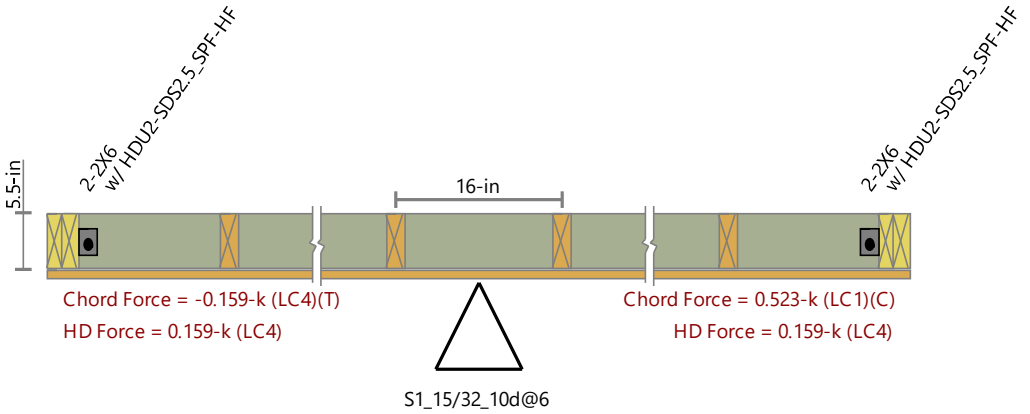
Chord Design	**0.523 k**	**11.657 k**	**0.045**	**PASS**
Gov Compression LC = 1				
Compression Analysis	0.523 k	11.657 k	0.045	PASS
Gov Tension LC = 4				
Tension Analysis	0.159 k	15.444 k	0.01	PASS

Stud Design	**No gravity-only LC solved.**

Hold Down Design	**0.159 k**	**2.215 k**	**0.072**	**PASS**
Selected Chord Strap / Hold Down:	HDU2-SDS2.5_SPF-HF			
Governing Load Combination = 4				
Clear Span				3
Fastener Size				0
Required chord Mat				Hem Fir
Base Cap (C_D=1)				1.384 k
C_D Factor				1.6
Adjusted Capacity				2.215 k

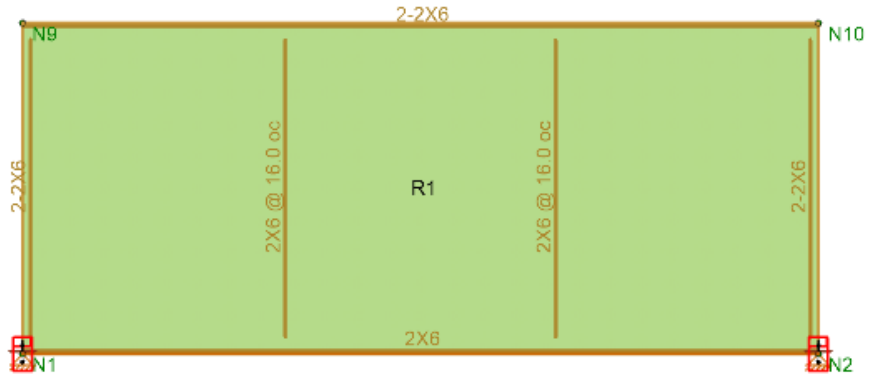
Deflection	
Flexure Compression	0.0007483 in
Shear Compression	0.022 in
HD Elongation	0 in
Total Deflection	0.022 in

Cross Section Detailing


2-2X6
w/ HDU2-SDS2.5_SPF-HF
5.5-in
16-in
2-2X6
w/ HDU2-SDS2.5_SPF-HF
Chord Force = -0.159-k (LC4)(T)
HD Force = 0.159-k (LC4)
Chord Force = 0.523-k (LC1)(C)
HD Force = 0.159-k (LC4)
S1_15/32_10d@6

Detail Report: WP4

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	11
Length (ft):	26.5
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.42
K:	1

Material Properties:

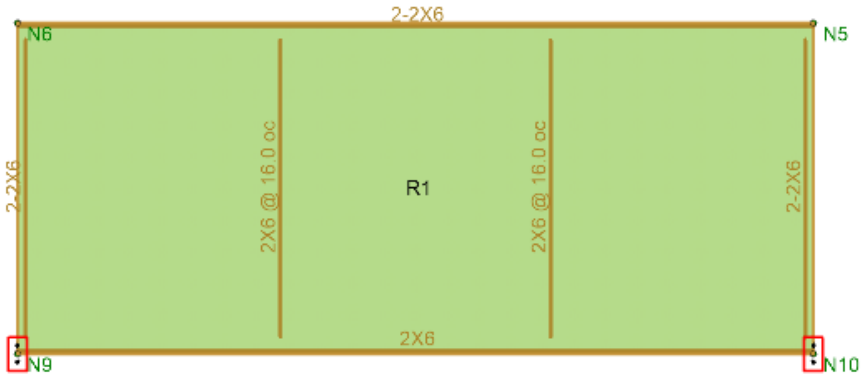
Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
S1_15/32_10d@6	1 (W)	0.129 k/ft	0.332 k/ft	0.295	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer :					
Not Req'd	NC			NC	
Chords					
2-2X6	4 (W)			0.000	PASS
2-2X6 (Compression)	1 (W)	3.872 k	11.657 k	0.332	PASS
Studs					
No gravity-only LC solved.					

Detail Report: WP2

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	11
Length (ft):	26.5
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.42
K:	1

Material Properties:

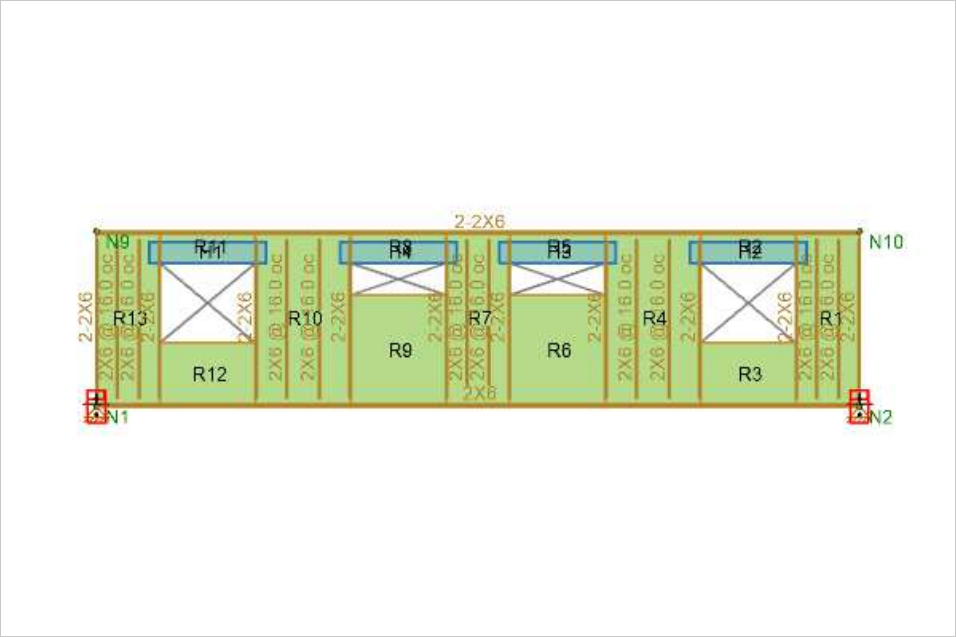
Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					**PASS**
Controlling region R1					
ShearPanel					
S1_15/32_10d@6	1 (W)	0.086 k/ft	0.168 k/ft	0.196	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer :					
Not Req'd	NC			NC	
Chords					
2-2X6	4 (W)			0.000	PASS
2-2X6 (Compression)	1 (W)	1.961 k	11.657 k	0.168	PASS
Studs					
No gravity-only LC solved.					

Detail Report: WP5

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	48
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@4 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON
HD Eccentricity:	0

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.229
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	24
% Full Ht. Sheathed:	50
Wall Capacity Adj. Factor (2w/h):	0.727
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	1
Total Area of Openings (Ao):	84 ft^2
Sheathing Area Ratio (r):	0.731

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					PASS
Whole Wall (Shear)					
Total Shear	1 (W)	9.18 k			
Max Unit Shear	1 (W)	0.443 k/ft			
ShearPanel					
RS_15/32_8d@4	1 (W)	0.532 k/ft	0.38 k/ft	0.905	PASS

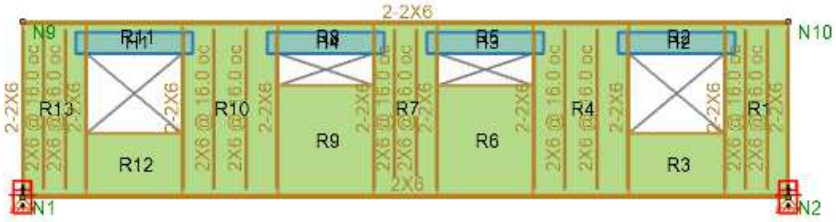
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HDU5-SDS2.5_SPF-HF	4 (W)	4.03 k	4.34 k	0.929	PASS
Chords					
2-2X6 (Tension)	4 (W)	-4.03 k	15.444 k	0.261	PASS
2-2X6 (Compression)	1 (W)	10.258 k	11.657 k	0.880	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

Deflection Results

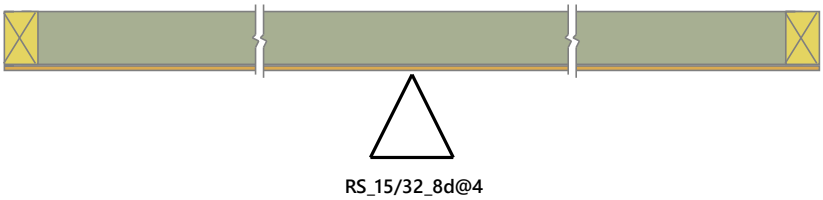
Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.316	1	0.009 in	0.051 in	0.256 in	1

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.443 k/ft**	**0.489 k/ft**	**0.905**	PASS
Shear Panel: RS_15/32_8d@4				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				8d
NOTE: AWC NDS-18 defines a 8d nail as being 2.5" x 0.131" common, or 2.5" x 0.113" galvanized box				
Required Penetration				1.375 in
Required Spacing				4 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.38 k/ft
Reduced Shear Capacity (SGAF)				0.35 k/ft
Adjusted Capacity				0.489 k/ft
Chord Design	**10.258 k**	**11.657 k**	**0.88**	PASS
Gov Compression LC = 1				
Compression Analysis	**10.258 k**	**11.657 k**	0.88	PASS
Gov Tension LC = 4				
Tension Analysis	**4.03 k**	**15.444 k**	0.261	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Hold Down Design	**4.03 k**	**4.34 k**	**0.929**	PASS
Selected Chord Strap / Hold Down:	HDU5-SDS2.5_SPF-HF			
Governing Load Combination = 4				
AB Diameter				0.5 in
Fastener Size				16d
Number of Fasteners				(8)
Raised?				No
Req'd Chord Mat'l				Hem Fir
Req'd Chord Thick				3 in
Base Cap (C_D=1)				2.712 k
C_D Factor				1.6
Adjusted Capacity				4.34 k



Cross Section Detailing



8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point Apartments
Project No: 21202
Engineer: EJS
Date: 11/12/2021
Checked by: CRG
Date: 12/15/2021

Location: SW-C

General Input:

MWFRS WL: **25.1** psf
Parapet WL: **0** psf
Trib Width: **5** ft
Length: **13** ft

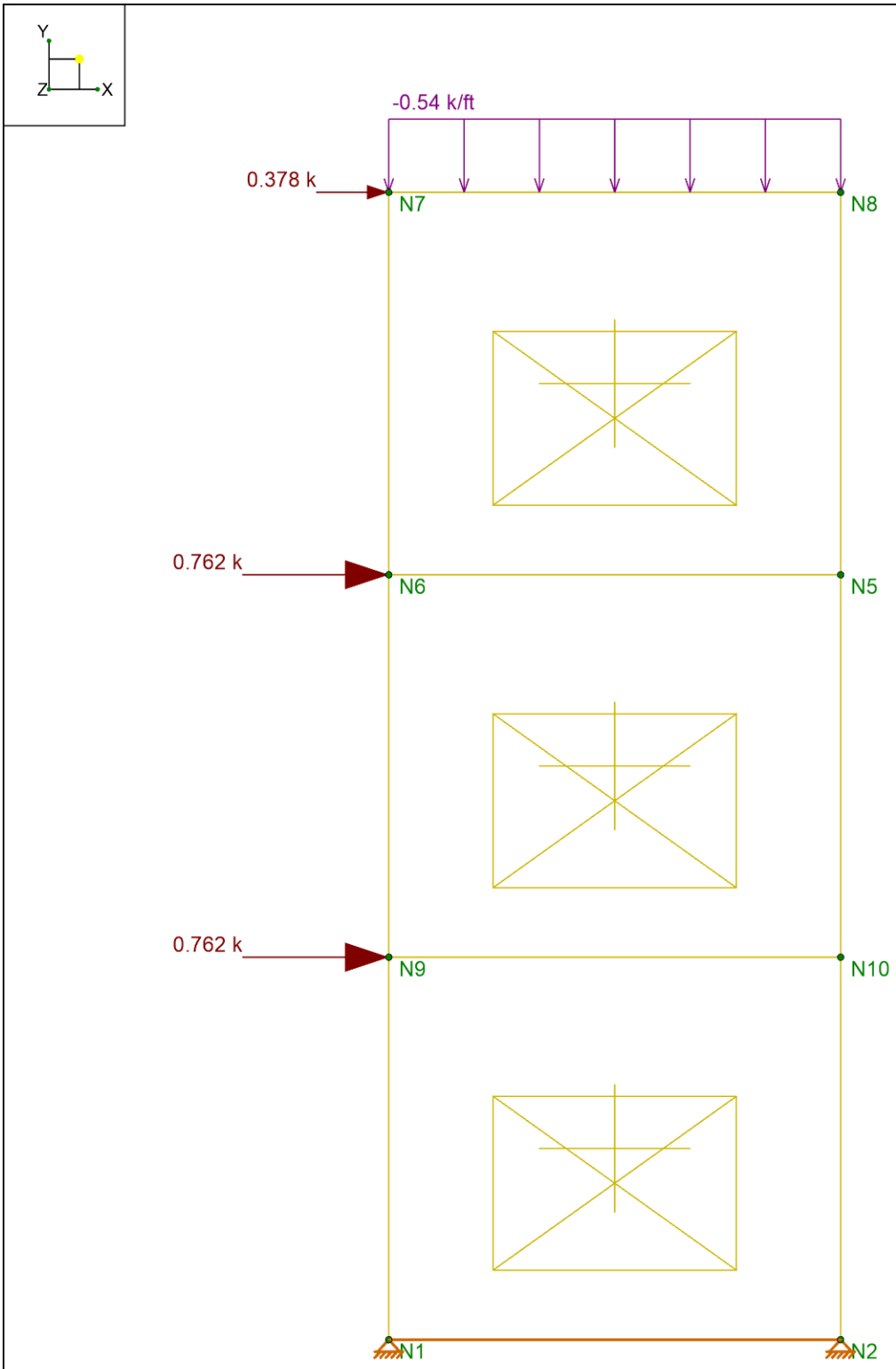
Truss Depth [ft]: **2**
Load Factor: **0.6** **<== Convert to ASD method forces**
<-- Actually 20 ft, but shared by four walls

	Height [ft]	Stud Height [ft]	Trib Height [ft]	ASD Line Load [plf]	ASD Applied Point Load [k]	Level Shear ASD [k]	Wall Shear ASD [klf]	T / C per level [k]	Sheathing	Fasteners	Blocked
Parapet	44	n/a	0	0	0	n/a	n/a	n/a	-	-	-
Roof	44	9	5.5	82.83	0.41	0.41	0.032	0.35	15/32" OSB	10d @ 6"/12"	No
3rd	33	9	11	165.66	0.83	1.24	0.096	1.40	15/32" OSB	10d @ 4"/12"	No
2nd	22	9	11	165.66	0.83	2.07	0.159	3.15	15/32" OSB	10d @ 4"/12"	No
1st	11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

Overturning Moment Check

Wall Count: **1**
Length: **13** ft
Moment: **41.0** k-ft
Hold-Down **3.15** k

for RISA:			Strap		
0.69	kip	3rd	0.35	kip	(2) MSTC28
1.3805	kip	2nd	1.05	kip	(2) MSTC28
1.3805	kip		1.75	kip	HDU7-SDS2.5

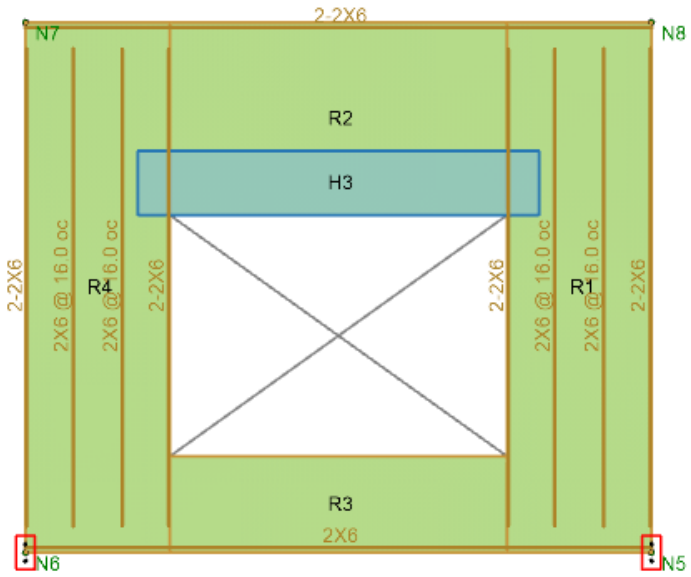


Loads: LC 1, IBC 16-12 (a)

Stand Structural Engineering	Summit Point Apartments	SK-4
EJS	0.6D + 0.6W	Jan 27, 2022
21202		SW-C.r3d

Detail Report: WP3

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	13
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.846
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	6
% Full Ht. Sheathed:	46.154
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.836
Total Area of Openings (Ao):	35 ft²
Sheathing Area Ratio (r):	0.653

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	0.378 k			
Max Unit Shear	1 (W)	0.075 k/ft			
ShearPanel					
S1_15/32_10d@6	1 (W)	0.476 k/ft	0.34 k/ft	0.172	PASS

Chord Straps / Hold Downs
Strap / Hold Down Manufacturer :

Straps Not Required.

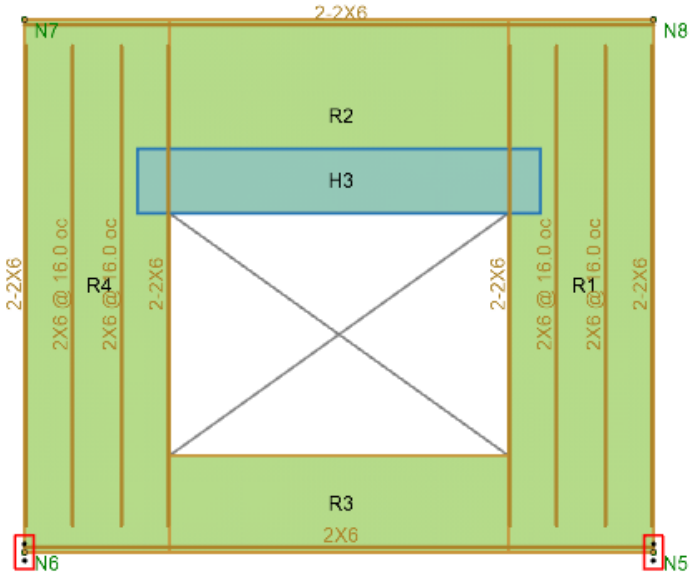
Chords					
2-2X6 (Compression)	2 (W)	0.638 k	11.657 k	0.000	PASS
2-2X6 (Compression)	1 (W)	1.505 k	11.657 k	0.129	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

Deflection Results

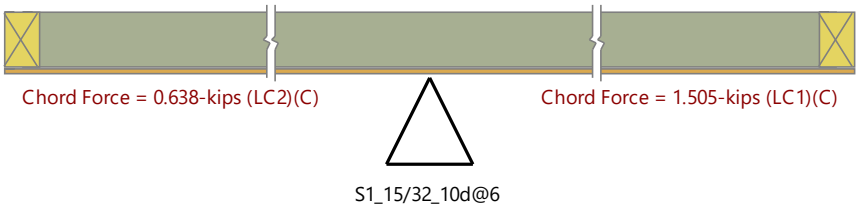
Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.043	1	0.006 in	0 in	0.038 in	1

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.075 k/ft**	**0.438 k/ft**	**0.172**	**PASS**
Shear Panel: S1_15/32_10d@6				
Panel Grade				St-I
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.34 k/ft
Reduced Shear Capacity (SGAF)				0.313 k/ft
Adjusted Capacity				0.438 k/ft
Chord Design	**1.505 k**	**11.657 k**	**0.129**	**PASS**
Gov Compression LC = 1				
Compression Analysis	**1.505 k**	**11.657 k**	0.129	PASS
Gov Tension LC = N/A				
Tension Analysis	**0 k**	**15.444 k**	0	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Chord Strap Design			**Straps are not required**	



Cross Section Detailing



Opening Design H3

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

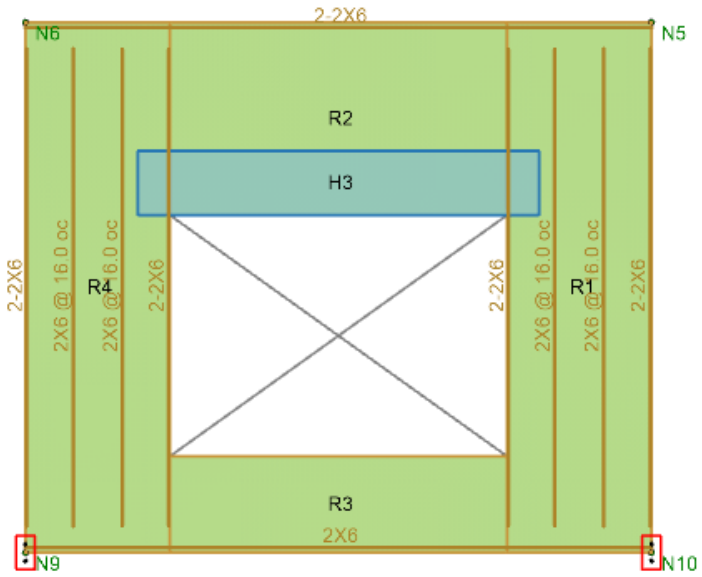
Opening Ht:	5 ft
Opening Width:	7 ft
h/w Ratio:	0.714

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2X8	Sill Size:	2X6

Detail Report: WP2

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	13
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.846
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	6
% Full Ht. Sheathed:	46.154
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.836
Total Area of Openings (Ao):	35 ft²
Sheathing Area Ratio (r):	0.653

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	1.14 k			
Max Unit Shear	1 (W)	0.227 k/ft			
ShearPanel					
S1_15/32_10d@6	1 (W)	0.476 k/ft	0.34 k/ft	0.519	PASS

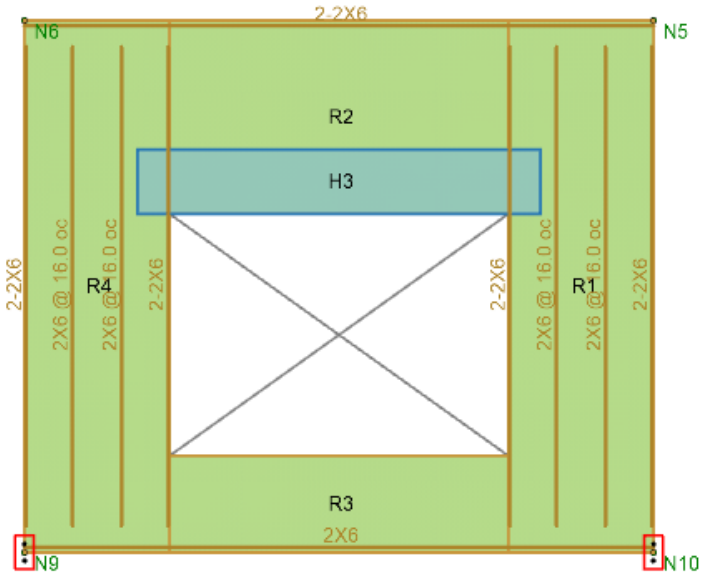
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson Chord Straps					
MSTC28_18_SPF/HF_Nail	4 (W)	0.972 k	0.995 k	0.977	PASS
Chords					
2-2X6 (Tension)	4 (W)	-0.972 k	15.444 k	0.063	PASS
2-2X6 (Compression)	1 (W)	4.042 k	11.657 k	0.347	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

Deflection Results

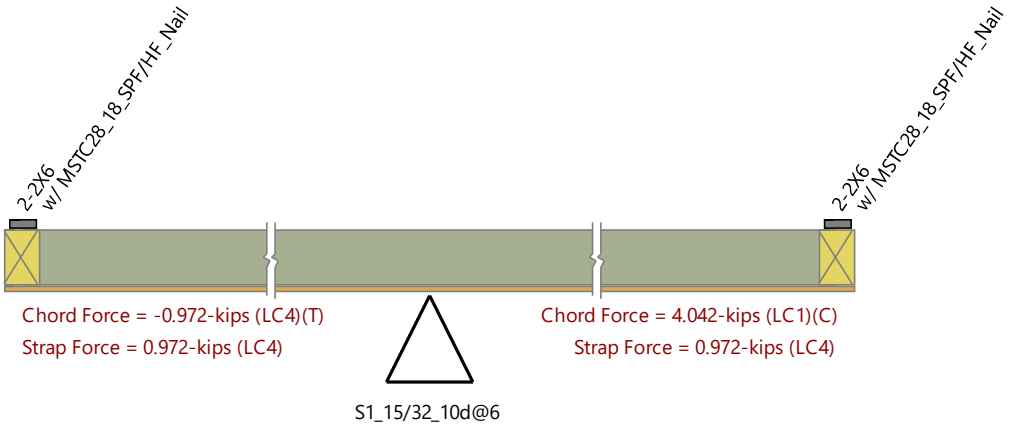
Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.131	1	0.017 in	0 in	0.114 in	1

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.227 k/ft**	**0.438 k/ft**	**0.519**	**PASS**
Shear Panel: S1_15/32_10d@6				
Panel Grade				St-I
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.34 k/ft
Reduced Shear Capacity (SGAF)				0.313 k/ft
Adjusted Capacity				0.438 k/ft
Chord Design	**4.042 k**	**11.657 k**	**0.347**	**PASS**
Gov Compression LC = 1				
Compression Analysis	**4.042 k**	**11.657 k**	0.347	PASS
Gov Tension LC = 4				
Tension Analysis	**0.972 k**	**15.444 k**	0.063	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Chord Strap Design	**0.972 k**	**0.995 k**	**0.977**	**PASS**
Selected Chord Strap / Hold Down:	MSTC28_18_SPF/HF_Nail			
Governing Load Combination = 4				
Clear Span				18 in
Fasteners				(12) 0.148 x 3 1/4 in
End Length				0 in
Req'd Chord Mat'l				SPF/HF
Base Cap (C_D=1)				0.622 k
C_D Factor				1.6
Adjusted Capacity				0.995 k



Cross Section Detailing



Opening Design H3

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

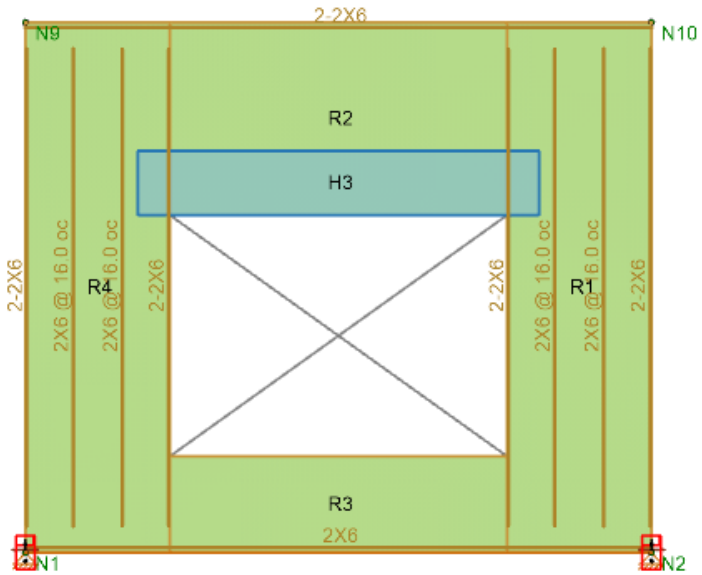
Opening Ht:	5 ft
Opening Width:	7 ft
h/w Ratio:	0.714

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2X8	Sill Size:	2X6

Detail Report: WP4

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	13
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON
HD Eccentricity:	0

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.846
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.455
Full Ht. Sheathed:	6
% Full Ht. Sheathed:	46.154
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.836
Total Area of Openings (Ao):	35 ft²
Sheathing Area Ratio (r):	0.653

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft³):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	1.902 k			
Max Unit Shear	1 (W)	0.379 k/ft			
ShearPanel					
S1_15/32_10d@6	1 (W)	0.476 k/ft	0.34 k/ft	0.866	PASS

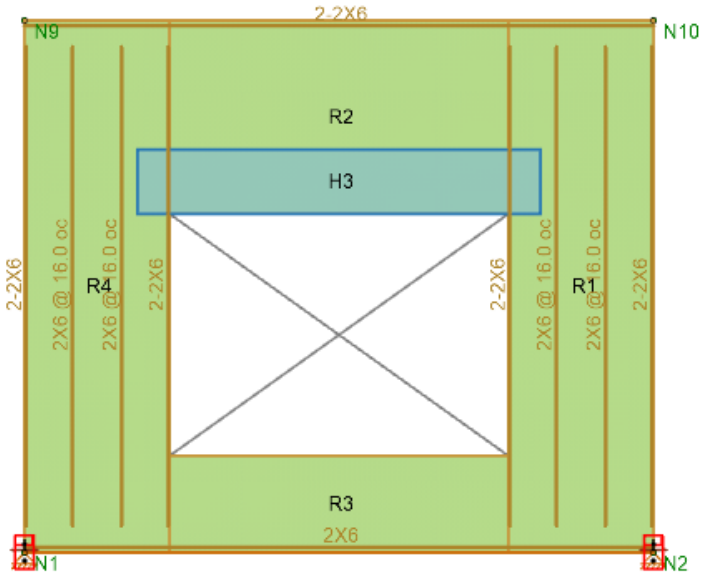
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HD7B_3_SPF-HF	4 (W)	5.017 k	5.65 k	0.888	PASS
Chords					
2-2X6 (Tension)	4 (W)	-5.017 k	15.444 k	0.325	PASS
2-2X6 (Compression)	1 (W)	8.249 k	11.657 k	0.708	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

Deflection Results

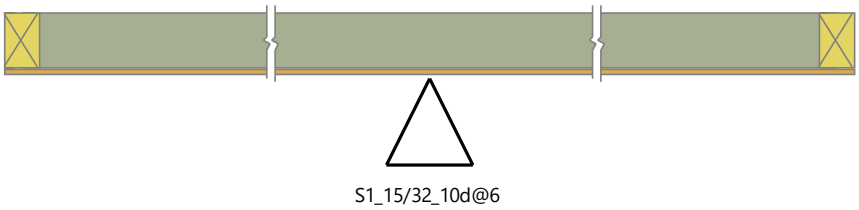
Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.46	1	0.029 in	0.242 in	0.19 in	1

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.379 k/ft**	**0.438 k/ft**	**0.866**	**PASS**
Shear Panel: S1_15/32_10d@6				
Panel Grade				St-I
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.34 k/ft
Reduced Shear Capacity (SGAF)				0.313 k/ft
Adjusted Capacity				0.438 k/ft
Chord Design	**8.249 k**	**11.657 k**	**0.708**	**PASS**
Gov Compression LC = 1				
Compression Analysis	**8.249 k**	**11.657 k**	0.708	PASS
Gov Tension LC = 4				
Tension Analysis	**5.017 k**	**15.444 k**	0.325	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Hold Down Design	**5.017 k**	**5.65 k**	**0.888**	**PASS**
Selected Chord Strap / Hold Down:	HD7B_3_SPF-HF			
Governing Load Combination = 4				
AB Diameter				0.5 in
Fastener Size				16d
Number of Fasteners				(8)
Raised?				No
Req'd Chord Mat'l				Hem Fir
Req'd Chord Thick				3 in
Base Cap (C_D=1)				3.531 k
C_D Factor				1.6
Adjusted Capacity				5.65 k



Cross Section Detailing



Opening Design H3

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

Opening Ht:	5 ft
Opening Width:	7 ft
h/w Ratio:	0.714

Material Properties:

Header Material:	SPF	Sill Material:	SPF
Header Size:	2-2X8	Sill Size:	2X6

8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point Apartments
Project No: 21202
Engineer: EJS
Date: 01/21/2022
Checked by: CRG
Date: 01/21/2022

Location: SW-D (3 Story Entry)

General Input:

MWFRS WL: **25.1** psf
Parapet WL: **0** psf
Trib Width: **2** ft
Length: **8** ft

Truss Depth [ft]: **2**
Load Factor: **0.6** **<== Convert to ASD method forces**

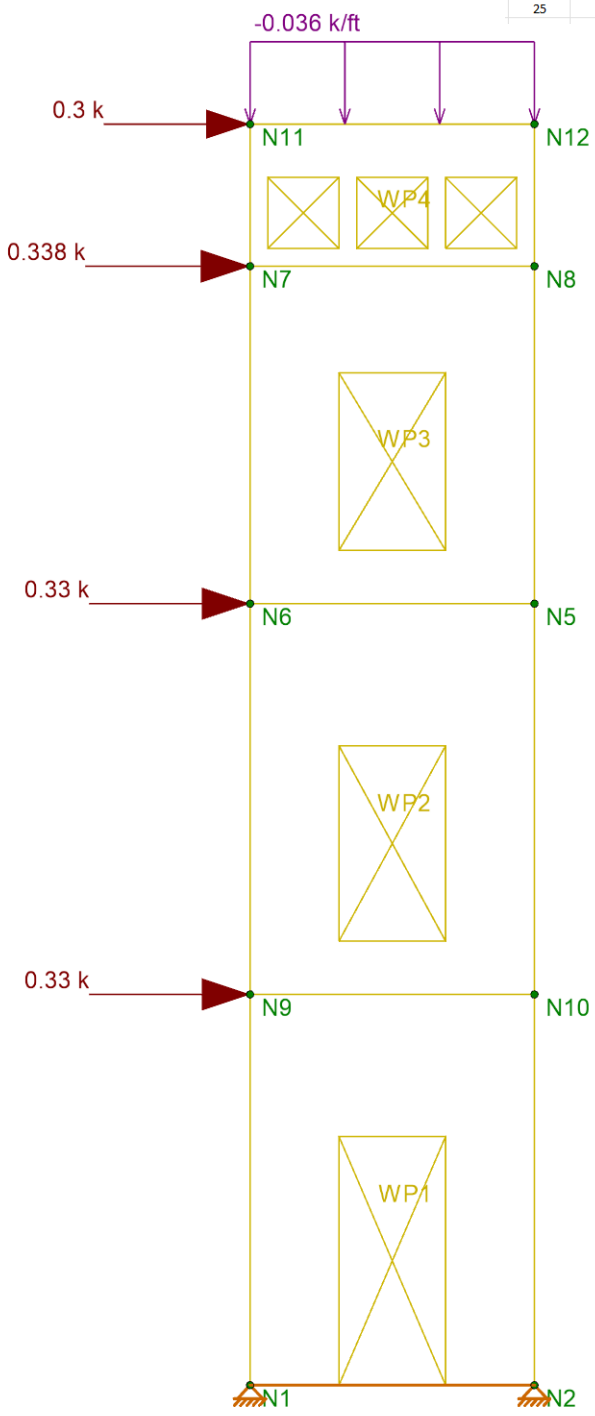
	Height [ft]	Stud Height [ft]	Trib Height [ft]	ASD Line Load [plf]	ASD Applied Point Load [k]	Level Shear ASD [k]	Wall Shear ASD [klf]	T / C per level [k]	Sheathing	Fasteners	Blocked
Parapet	44	n/a	0	0	0.5	0.50	n/a	n/a	-	-	-
Roof	44	9	9.5	143.07	0.66	1.16	0.145	1.60	15/32" OSB	10d @ 6"/12"	No
3rd	33	9	11	165.66	0.69	1.85	0.231	4.14	15/32" OSB	10d @ 6"/12"	No
2nd	22	9	11	165.66	0.69	2.54	0.318	7.63	15/32" OSB	10d @ 4"/12"	No
1st	11	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

Overturning Moment Check

Wall Count: **1**
Length: **8** ft
Moment: **63.1** k-ft
Hold-Down **7.88** k

MSTC40
MSTC60
HDU11-SDS2.5

Loads on SW-D (at Entry)						
Pw	Trib	Height	Load		0.6 (ASD)	
25	4	5	500	lbs	300	lbs
25	3	7.5	563	lbs	338	lbs
25	2	11	550	lbs	330	lbs
25	2	11	550	lbs	330	lbs

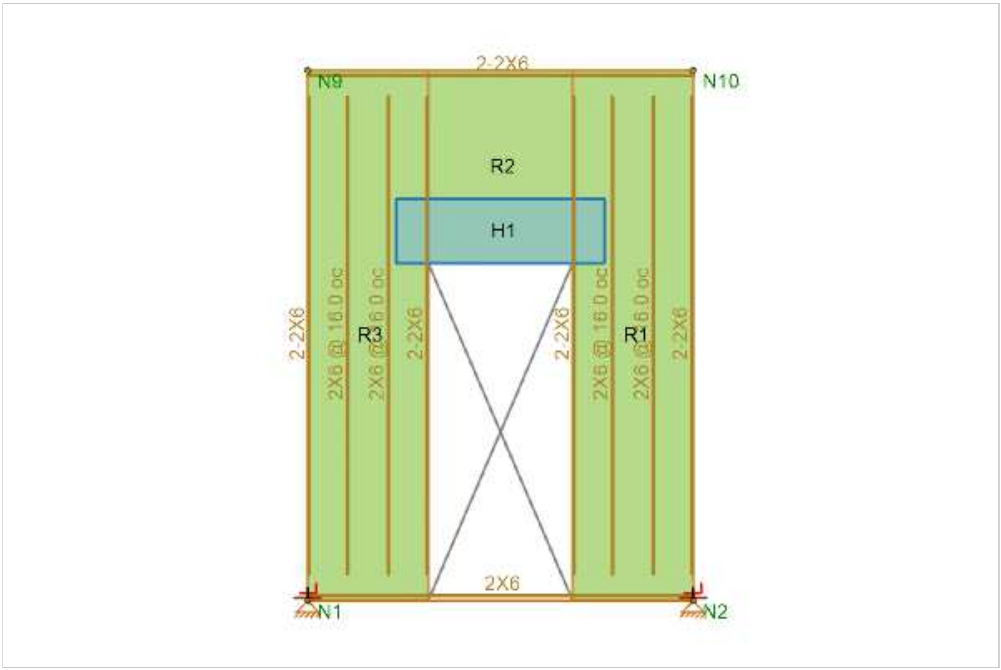


Loads: LC 4, IBC 16-15

Stand Structural Engineering	Summit Point Apartments	SK-2
EJS	0.6D + 0.6W	Feb 01, 2022
21202		SW-D (Entry).r3d

Detail Report: WP1

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	8
Wall Material:	Douglas Fir-Larch No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON
HD Eccentricity:	0

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	1.375
K:	1
Max Opening Ht:	7
Open/Wall Ht. Ratio:	0.636
Full Ht. Sheathed:	5
% Full Ht. Sheathed:	62.5
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.746
Total Area of Openings (Ao):	21 ft^2
Sheathing Area Ratio (r):	0.724

Material Properties:

Top Plate:	Douglas Fir-Larch No.2	Fb (ksi):	0.9	Ft (ksi):	0.575
Sill:	Douglas Fir-Larch No.2	Fv (ksi):	0.18	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Douglas Fir-Larch No.2	Fc (ksi):	1.35		
Chord:	Douglas Fir-Larch No.2	Specific Gravity:	0.5		
E:	1600	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	1.298 k			
Max Unit Shear	1 (W)	0.348 k/ft			

ShearPanel					
RS_15/32_8d@6	1 (W)	0.364 k/ft	0.26 k/ft	0.956	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HD9B_4.5_SPF-HF	4 (W)	8.21 k	8.43 k	0.974	PASS
Chords					
2-2X6 (Tension)	4 (W)	-8.21 k	16.37 k	0.502	PASS
2-2X6 (Compression)	1 (W)	8.83 k	11.09 k	0.796	PASS
Studs					
2X6	0 (W)	0 k	0 k	0.000	PASS

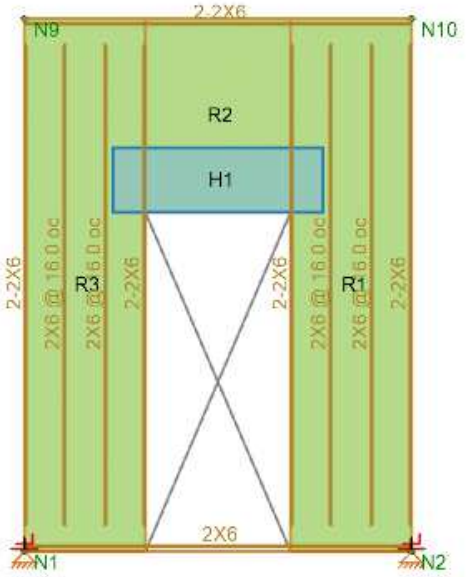
Deflection Results

Total (Max)	Gov. LC	Elastic	HD	Shear	Shear Stiffness Adjustment Factor (SSAF)
0.704	1	0.028 in	0.381 in	0.295 in	1

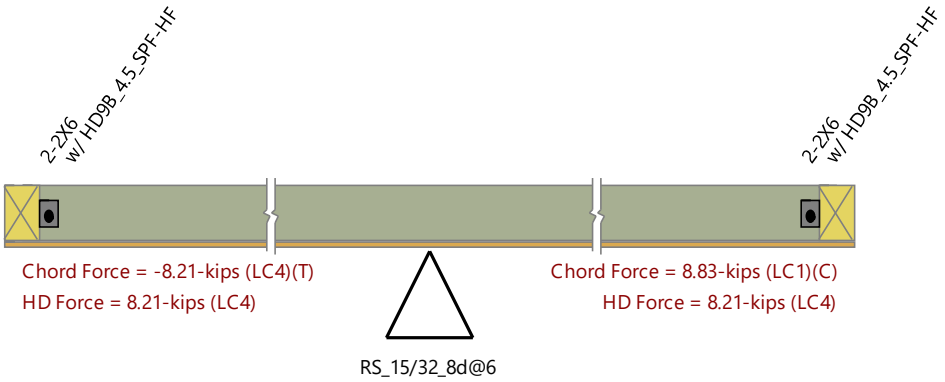
Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	**0.348 k/ft**	**0.364 k/ft**	**0.956**	**PASS**
Shear Panel: RS_15/32_8d@6				
Panel Grade				RS
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				8d
NOTE: AWC NDS-18 defines a 8d nail as being 2.5" x 0.131" common, or 2.5" x 0.113" galvanized box				
Required Penetration				1.375 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = 1.0				1
Shear Capacity				0.26 k/ft
Reduced Shear Capacity (SGAF)				0.26 k/ft
Adjusted Capacity				0.364 k/ft
Chord Design	**8.83 k**	**11.09 k**	**0.796**	**PASS**
Gov Compression LC = 1				
Compression Analysis	**8.83 k**	**11.09 k**	0.796	PASS
Gov Tension LC = 4				
Tension Analysis	**8.21 k**	**16.37 k**	0.502	PASS
Stud Design	**NOTE: Stud design performed only for load combinations which do not contain seismic or wind load**			
Hold Down Design	**8.21 k**	**8.43 k**	**0.974**	**PASS**
Selected Chord Strap / Hold Down:	HD9B_4.5_SPF-HF			
Governing Load Combination = 4				
AB Diameter				0.5 in
Fastener Size				16d
Number of Fasteners				(8)
Raised?				No
Req'd Chord Mat'l				Hem Fir
Req'd Chord Thick				4.5 in
Base Cap (C_D=1)				5.269 k
C_D Factor				1.6

Adjusted Capacity 8.43 k



Cross Section Detailing



Opening Design H1

Criteria:

Code:	AWC NDS-18:ASD
Design Method:	Perforated

Geometry:

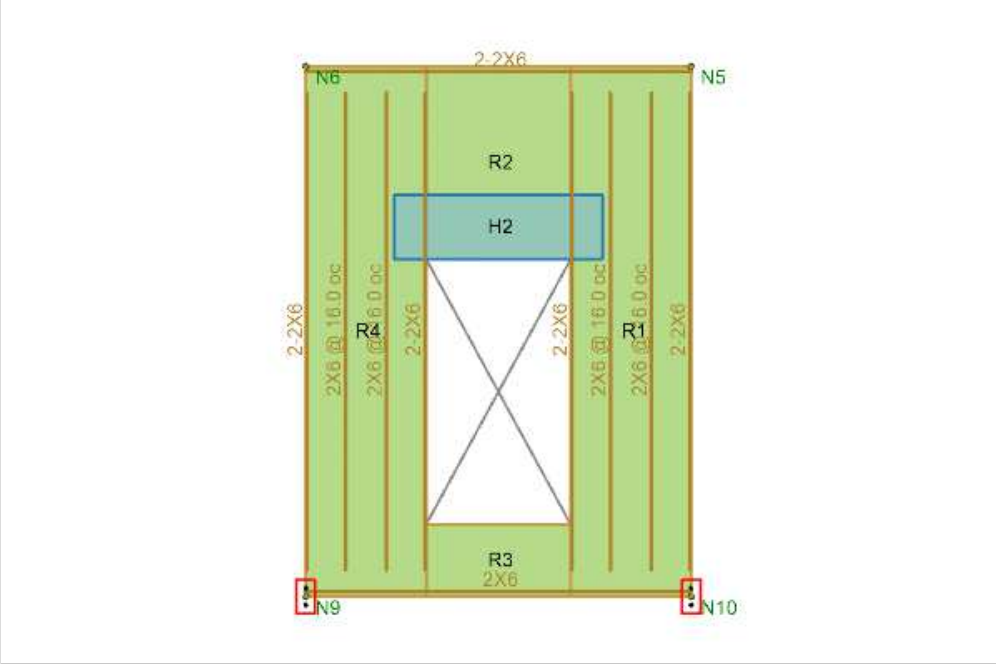
Opening Ht:	7 ft
Opening Width:	3 ft
h/w Ratio:	2.333

Material Properties:

Header Material:	DF	Sill Material:	DF
Header Size:	2-2X8	Sill Size:	2X6

Detail Report: WP2

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	11
Length (ft):	8
Wall Material:	Douglas Fir-Larch No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	1.375
K:	1
Max Opening Ht:	5.5
Open/Wall Ht. Ratio:	0.5
Full Ht. Sheathed:	5
% Full Ht. Sheathed:	62.5
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.842
Total Area of Openings (Ao):	16.5 ft^2
Sheathing Area Ratio (r):	0.769

Material Properties:

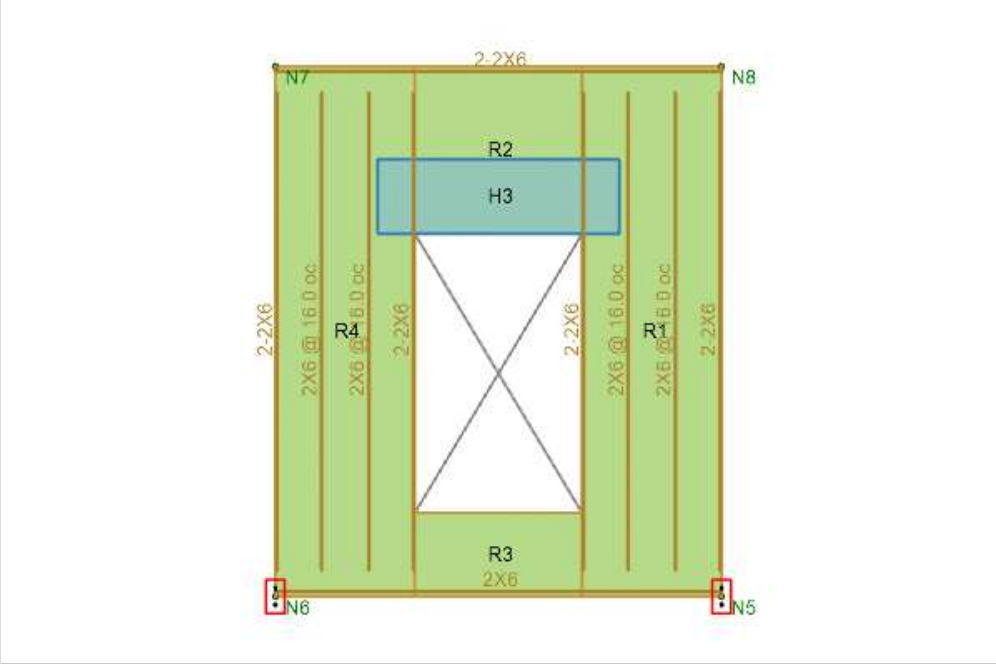
Top Plate:	Douglas Fir-Larch No.2	Fb (ksi):	0.9	Ft (ksi):	0.575
Sill:	Douglas Fir-Larch No.2	Fv (ksi):	0.18	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Douglas Fir-Larch No.2	Fc (ksi):	1.35		
Chord:	Douglas Fir-Larch No.2	Specific Gravity:	0.5		
E:	1600	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	0.968 k			
Max Unit Shear	1 (W)	0.23 k/ft			
ShearPanel					
RS_15/32_8d@6	1 (W)	0.364 k/ft	0.26 k/ft	0.631	PASS

Detail Report: WP3

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Perforated
Height (ft):	9.5
Length (ft):	8
Wall Material:	Douglas Fir-Larch No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	RS_15/32_8d@6 | 16
Optimize HD:	Yes
HD Manufacturer:	SIMPSON

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	1.188
K:	1
Max Opening Ht:	5
Open/Wall Ht. Ratio:	0.526
Full Ht. Sheathed:	5
% Full Ht. Sheathed:	62.5
Wall Capacity Adj. Factor (2w/h):	1
Aspect Ratio Factor:	1
Gov. H/W Ratio Factor:	1.4
Shear Cap. Adj Factor (Co):	0.822
Total Area of Openings (Ao):	15 ft^2
Sheathing Area Ratio (r):	0.76

Material Properties:

Top Plate:	Douglas Fir-Larch No.2	Fb (ksi):	0.9	Ft (ksi):	0.575
Sill:	Douglas Fir-Larch No.2	Fv (ksi):	0.18	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Douglas Fir-Larch No.2	Fc (ksi):	1.35		
Chord:	Douglas Fir-Larch No.2	Specific Gravity:	0.5		
E:	1600	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Wood Wall Summary					**PASS**
Whole Wall (Shear)					
Total Shear	1 (W)	0.638 k			
Max Unit Shear	1 (W)	0.155 k/ft			
ShearPanel					
RS_15/32_8d@6	1 (W)	0.364 k/ft	0.26 k/ft	0.427	PASS

8234 Robinson Street
Overland Park, KS 66204
913-214-2169
stand-sei.com

Project: Summit Point Apartments
Project No: 21202
Engineer: EJS
Date: 01/21/2022
Checked by: CRG
Date: 01/21/2022

Location: SW-E (Clubhouse)

General Input:

MWFRS WL: **25.1** psf
Parapet WL: **0** psf
Trib Width: **60** ft
Length: **10.5** ft
Truss Depth [ft]: **0**
Load Factor: **0.6** **<== Convert to ASD method forces**

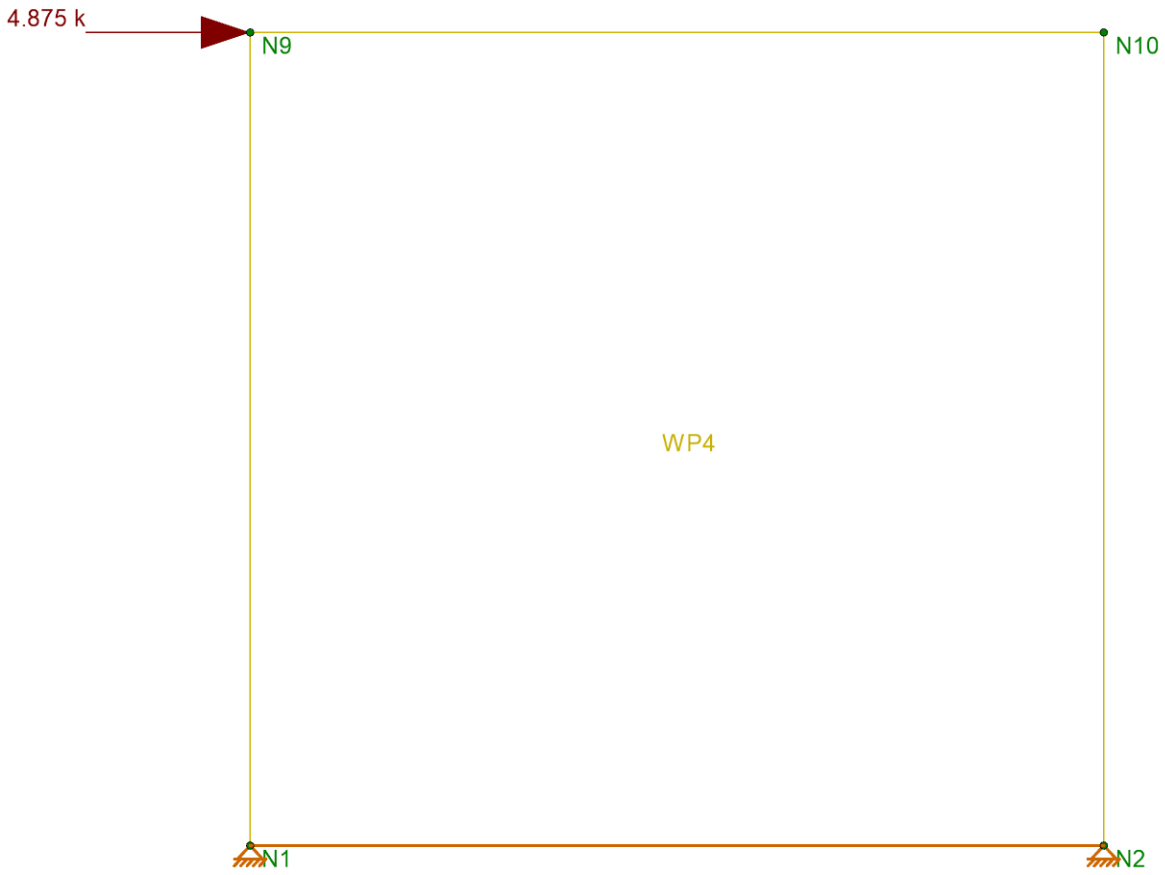
	Height [ft]	Stud Height [ft]	Trib Height [ft]	ASD Line Load [plf]	ASD Applied Point Load [k]	Level Shear ASD [k]	Wall Shear ASD [klf]	T / C per level [k]	Sheathing	Fasteners	Blocked
									-	-	-
Roof	10	0									
2nd	10	10	5		4.50	4.50	0.429	4.29	15/32" OSB	10d @ 6"/12"	No
1st	0	n/a	n/a	n/a	n/a	n/a	n/a	n/a	-	-	-

Overturning Moment Check

Wall Count: **1**
Length: **10.5** ft
Moment: **45.0** k-ft
Hold-Down **4.29** k

7.5 kip 1st 4.29 kip HDU5-SDS2.5

Loads on SW-E (at Clubhouse)			
Area	650	sf	total projected
Wind	25	psf	
Load	8125	lbs	(two SW)
0.6 (ASD)	4875	lbs	

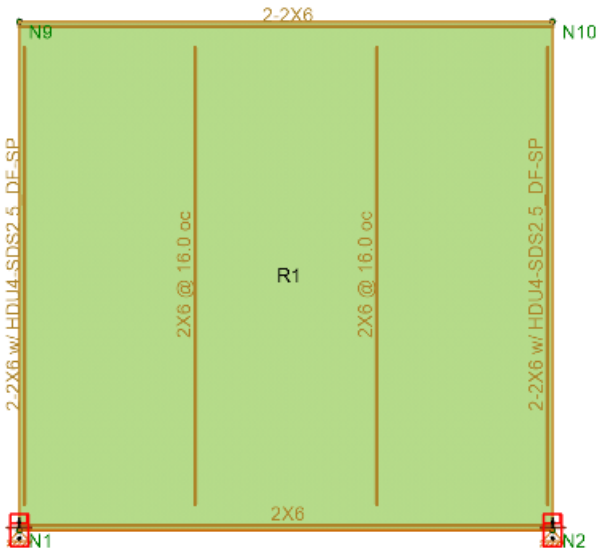


Loads: LC 1, IBC 16-12 (a)

Stand Structural Engineering	Summit Point Apartments	SK-4
EJS		Feb 01, 2022
21202		SW-E (Clubhouse).r3d

Detail Report: WP4

Enveloped Results



Input Data:

Code:	AWC NDS-18: ASD
Design Method:	Segmented
Height (ft):	10
Length (ft):	10.5
Wall Material:	Spruce-Pine-fir No.2
Panel Schedule:	AWC 2015 OSB
Sel. Shear Panel:	S1_15/32_10d@6

Wall Properties:

Top Plate:	2-2X6
Sill:	2X6
Wall Stud:	2X6
Chord:	2-2X6
Max H/W Ratio:	0.95
K:	1

Material Properties:

Top Plate:	Spruce-Pine-fir No.2	Fb (ksi):	0.875	Ft (ksi):	0.45
Sill:	Spruce-Pine-fir No.2	Fv (ksi):	0.135	* All values per 2015 NDS Supplement Table 4A (Reference Design Values for Visually Graded Dimension Lumber)	
Wall Stud:	Spruce-Pine-fir No.2	Fc (ksi):	1.15		
Chord:	Spruce-Pine-fir No.2	Specific Gravity:	0.42		
E:	1400	Density (k/ft^3):	0.035		

Design Summary: Enveloped Results

Limit State	Gov. LC	Required	Available	Unity Check	Result
Controlling region					PASS
Controlling region R1					
ShearPanel					
S1_15/32_10d@6	1 (W)	0.464 k/ft	0.296 k/ft	1.060	PASS
Chord Straps / Hold Downs					
Strap / Hold Down Manufacturer : Simpson HoldDowns					
HDU4-SDS2.5_DF-SP	4 (W)	4.517 k	4.565 k	0.989	PASS
Chords					
2-2X6 (Tension)	4 (W)	4.517 k	19.734 k	0.229	PASS
2-2X6 (Compression)	1 (W)	4.689 k	15.831 k	0.296	PASS
Studs					
No gravity-only LC solved.					

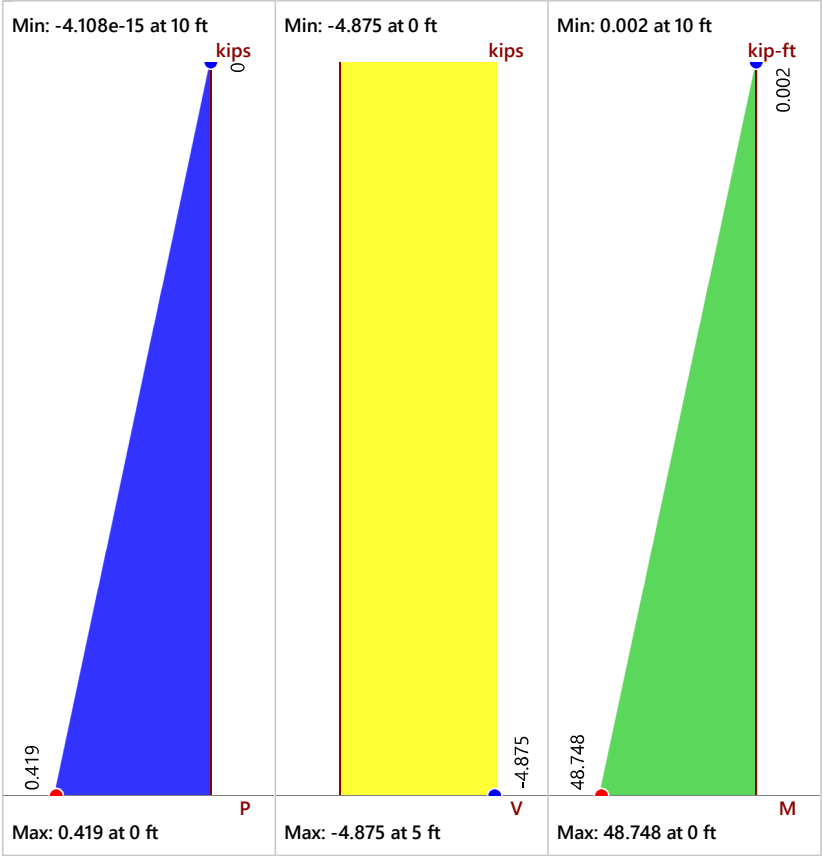
Deflection Results

Maximum Region Deflection (in)	Gov. LC	Finite element Deflection (in)	Shear Stiffness Adjustment Factor (SSAF)
0.33(R1)	1 (W)	0.267	1

Region Design

	Shear UC	Strap / Hold-Down UC	Chord UC	Stud UC	Result
R1 (In-Plane)	1.06	0.989	0.296	N/C	FAIL

Envelope Diagrams



Axial Diagram | Shear Diagram | Moment Diagram

Region Criteria

Code:	AWC NDS-18:ASD
Design Method:	Segmented
Wall Material:	SPF
Panel Schedule:	AWC 2015 OSB
Optimize Strap:	Yes
Strap Manuf:	SIMPSON

Region Materials

Wall Studs:	SPF
Stud Size:	2X6
Chord Material:	DF
Chord Size:	2-2X6
Top Plate & Sill:	SPF
Top Plate Size:	2-2X6
Sill Plate Size:	2X6

Region Geometry

Total Heigth (ft):	10
Total Length (ft):	10.5
Region H/W:	0.95
Wind ASIF:	1.4
Capacity Adj. (2w/h):	1.00
Aspect Ratio:	1.00
Gov. H/W Capacity:	1.40
Stud Spacing (in):	16
K:	1.0

Code Check:

Limit State	Required	Available	Unity Check	Result
Shear Panel Design	0.464 k/ft	0.313 k/ft	0.975	PASS
Shear Panel: S1_15/32_10d@6				
Panel Grade				St-I
Panel Thickness				0.469in
Number Sides				One
Over Gyp. Board				No
Nail Size				10d
NOTE: AWC NDS-18 defines a 10d nail as being 3" x 0.148" common, or 3" x 0.122" galvanized box				
Required Penetration				1.5 in
Required Spacing				6 in
Specific Gravity Adjustment Factor = [1-(0.5-G)]				0.92
Shear Capacity				0.34 k/ft
Reduced Shear Capacity (SGAF)				0.313 k/ft
Adjusted Capacity				0.438 k/ft

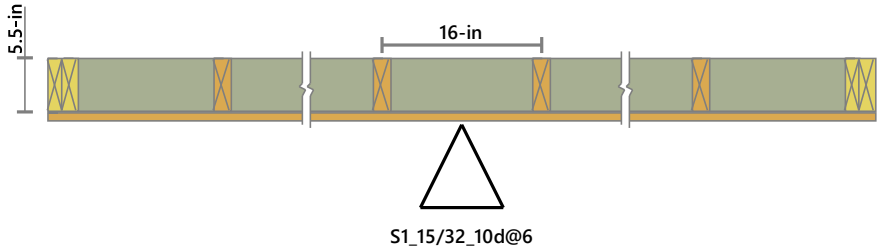
Chord Design	**4.689 k**	**15.831 k**	**0.296**	**PASS**
Gov Compression LC = 1				
Compression Analysis	4.689 k	15.831 k	0.296	PASS
Gov Tension LC = 4				
Tension Analysis	4.517 k	19.734 k	0.229	PASS

Stud Design				**No gravity-only LC solved.**
Hold Down Design	**4.517 k**	**4.565 k**	**0.989**	**PASS**
Selected Chord Strap / Hold Down:	HDU4-SDS2.5_DF-SP			
Governing Load Combination = 4				
Clear Span				3
Fastener Size				0
Required chord Mat				Douglas Fir
Base Cap (C_D=1)				2.853 k
C_D Factor				1.6
Adjusted Capacity				4.565 k

Conservatively use HDU5-SDS2.5

Deflection	
Flexure Compression	0.013 in
Shear Compression	0.211 in
HD Elongation	0.105 in
Total Deflection	0.33 in

Cross Section Detailing

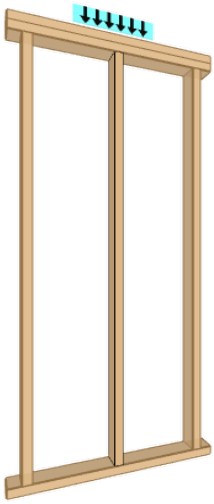


1st Floor			
Member Name	Results	Current Solution	Comments
W4-C	Passed	3 piece(s) 2 x 6 SP No.2 @ 32" OC	
W4	Passed	2 piece(s) 2 x 6 SP No.2 @ 16" OC	
Breezeway Joist - long	Passed	1 piece(s) 2 x 10 SPF No.1/No.2 @ 16" OC	
Breezeway Joist - short	Passed	1 piece(s) 2 x 10 SPF No.1/No.2 @ 16" OC	
Triple Plate @ 3 Story Entry	Passed	3 piece(s) 2 x 6 SPF No.1/No.2	
6' HDR at SW-A	Passed	2 piece(s) 2 x 10 DF No.2	
6' HDR at SW-A (B1-1)	Passed	2 piece(s) 2 x 12 DF No.2	
3rd Ceiling			
Member Name	Results	Current Solution	Comments
Breezeway HDR	Passed	2 piece(s) 1 3/4" x 9 1/2" 2.0E Microllam® LVL	
Breezeway HDR (center)	Passed	3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	
2nd/3rd Floor			
Member Name	Results	Current Solution	Comments
Balcony Beam	Passed	2 piece(s) 2 x 10 DF No.2	
Clubhouse			
Member Name	Results	Current Solution	Comments
Wall: Header	Passed	3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL	

1st Floor, W4-C

3 piece(s) 2 x 6 SP No.2 @ 32" OC

Wall Height: 9' Member Height: 8' 7 1/2" O. C. Spacing: 32.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	19	50	Passed (38%)	--	--
Compression (lbs)	6133	18504	Passed (33%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	6133	11395	Passed (54%)	--	1.0 D + 1.0 L
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/360)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.083333 has been applied to base plate bearing capacity.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
4' 3"	

Vertical Load	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Point (PLF)	32.00"	1450.0	850.0	Default Load

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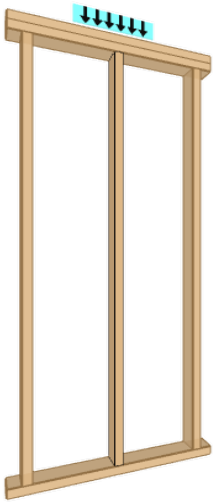
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

1st Floor, W4

2 piece(s) 2 x 6 SP No.2 @ 16" OC

Wall Height: 9' Member Height: 8' 7 1/2" O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	19	50	Passed (38%)	--	--
Compression (lbs)	4000	13707	Passed (29%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	4000	7889	Passed (51%)	--	1.0 D + 1.0 L
Lateral Reaction (lbs)	0	--	--	--	N/A
Lateral Shear (lbs)	0	N/A	Passed (N/A)	--	N/A
Lateral Moment (ft-lbs)	0 @ mid-span	N/A	Passed (N/A)	--	N/A
Total Deflection (in)	0.00 @ mid-span	N/A	Passed (N/A)	--	N/A
Bending/Compression	N/A	1	Passed (N/A)	--	N/A

- Lateral deflection criteria: Wind (L/360)
- Input axial load eccentricity for the design is zero
- Applicable calculations are based on NDS.
- A bearing area factor of 1.125 has been applied to base plate bearing capacity.
- The column stability factor (Kf = 0.6) applied to this design assumes nailed built-up columns per NDS section 15.3.3. For Weyerhaeuser ELP products refer to the U.S. Wall Guide for multiple-member connection requirements.
- A 15% increase in the moment capacity has been added to account for repetitive member usage.

Supports	Type	Material
Top	Dbl 2X	Spruce-Pine-Fir
Base	2X	Spruce-Pine-Fir

System : Wall
Member Type : Stud
Building Code : IBC 2018
Design Methodology : ASD

Max Unbraced Length	Comments
1'	

Vertical Load	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Point (PLF)	16.00"	1450.0	1550.0	Default Load

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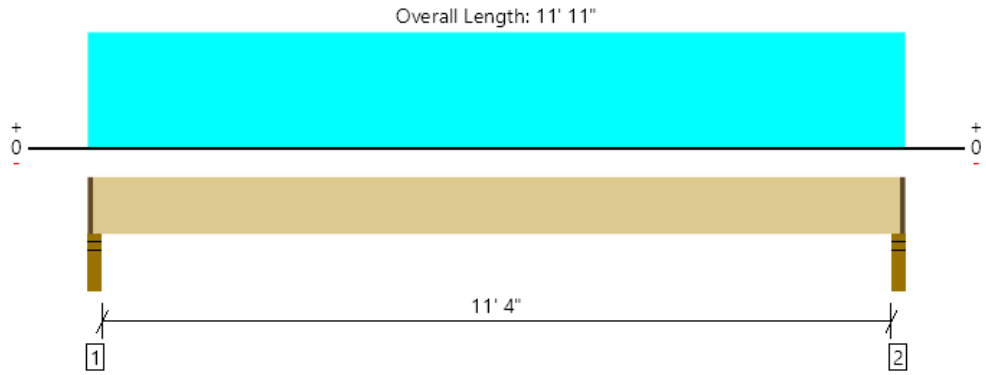
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

1st Floor, Breezeway Joist - long

1 piece(s) 2 x 10 SPF No.1/No.2 @ 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)	624 @ 2 1/2"	1434 (2.25")	Passed (44%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	522 @ 1' 3/4"	1249	Passed (42%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1763 @ 5' 11 1/2"	1973	Passed (89%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.152 @ 5' 11 1/2"	0.287	Passed (L/911)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.303 @ 5' 11 1/2"	0.575	Passed (L/455)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
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 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	318	318	636	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	318	318	636	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)	4' 3" o/c	
Bottom Edge (Lu)	11' 9" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 11' 11"	16"	40.0	40.0	Default Load

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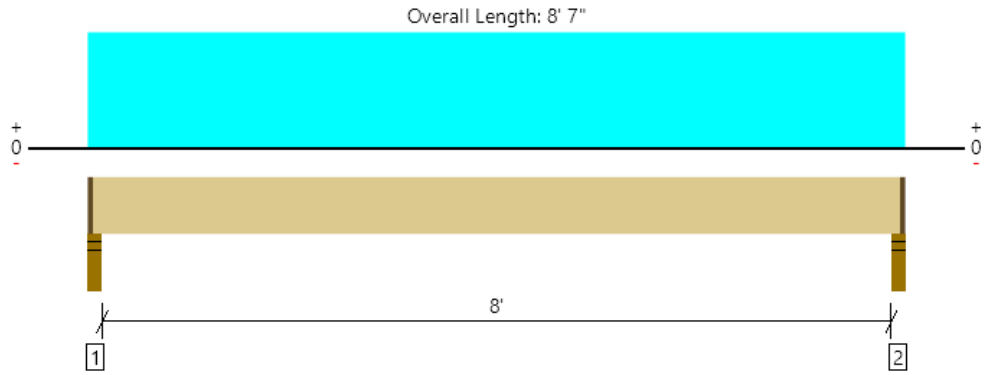
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

1st Floor, Breezeway Joist - short

1 piece(s) 2 x 10 SPF No.1/No.2 @ 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)	782 @ 2 1/2"	1434 (2.25")	Passed (54%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	603 @ 1' 3/4"	1249	Passed (48%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	1556 @ 4' 3 1/2"	1973	Passed (79%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.039 @ 4' 3 1/2"	0.204	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.135 @ 4' 3 1/2"	0.408	Passed (L/727)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	N/A	N/A	N/A	--	N/A

System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2018
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 15% increase in the moment capacity has been added to account for repetitive member usage.
- Applicable calculations are based on NDS.
- No composite action between deck and joist was considered in analysis.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Total	
1 - Stud wall - SPF	3.50"	2.25"	1.50"	572	229	801	1 1/4" Rim Board
2 - Stud wall - SPF	3.50"	2.25"	1.50"	572	229	801	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)	5' 11" o/c	
Bottom Edge (Lu)	8' 5" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location (Side)	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 8' 7"	16"	100.0	40.0	Default Load

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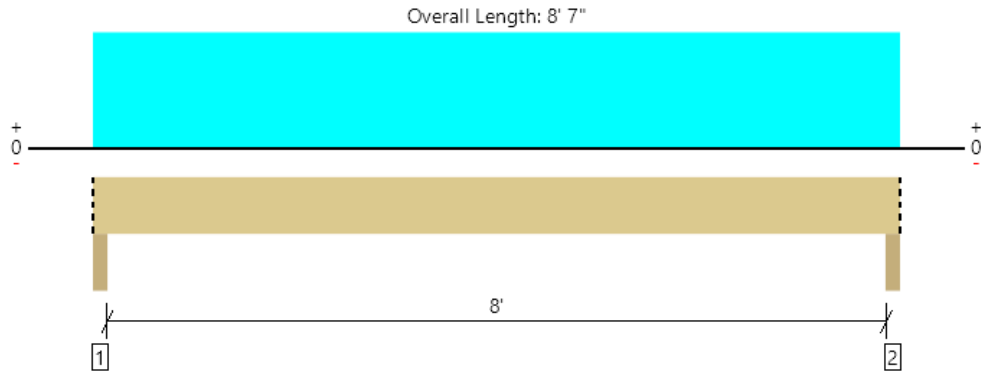
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

1st Floor, Triple Plate @ 3 Story Entry
3 piece(s) 2 x 6 SPF No.1/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)	703 @ 2"	6694 (3.50")	Passed (11%)	--	1.0 D + 0.6 W (All Spans)
Shear (lbs)	580 @ 9"	3564	Passed (16%)	1.60	1.0 D + 0.6 W (All Spans)
Moment (Ft-lbs)	1393 @ 4' 3 1/2"	3441	Passed (40%)	1.60	1.0 D + 0.6 W (All Spans)
Live Load Defl. (in)	0.188 @ 4' 3 1/2"	0.275	Passed (L/527)	--	1.0 D + 0.6 W (All Spans)
Total Load Defl. (in)	0.195 @ 4' 3 1/2"	0.412	Passed (L/507)	--	1.0 D + 0.6 W (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
Design Methodology : ASD

- Deflection criteria: LL (L/360) 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	Wind	Total	
1 - Column - DF	3.50"	3.50"	1.50"	27	1127	1154	Blocking
2 - Column - DF	3.50"	3.50"	1.50"	27	1127	1154	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)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Wind (1.60)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	6.3	--	
1 - Uniform (PSF)	0 to 8' 7" (Front)	10' 6"	-	25.0	

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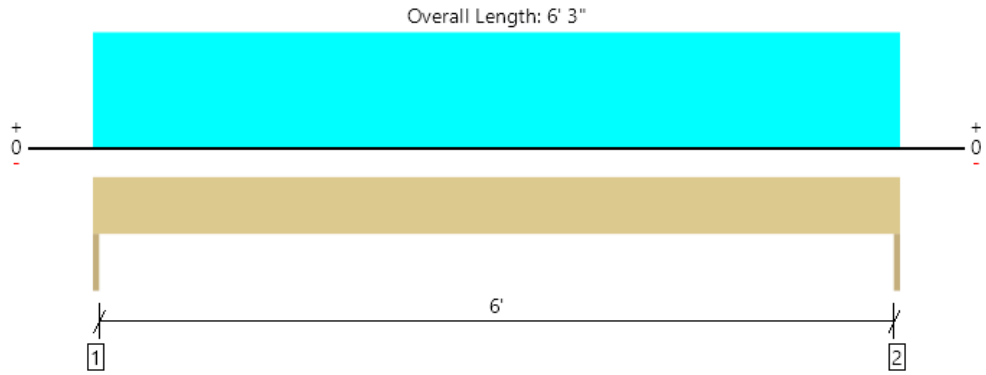
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

1st Floor, 6' HDR at SW-A
2 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)	1334 @ 0	2813 (1.50")	Passed (47%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	952 @ 10 3/4"	3330	Passed (29%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	2085 @ 3' 1 1/2"	3529	Passed (59%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.026 @ 3' 1 1/2"	0.156	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.046 @ 3' 1 1/2"	0.313	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
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 - Trimmer - SPF	1.50"	1.50"	1.50"	584	750	1334	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	584	750	1334	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 6' 3"	6'	30.0	40.0	Floor+Wall

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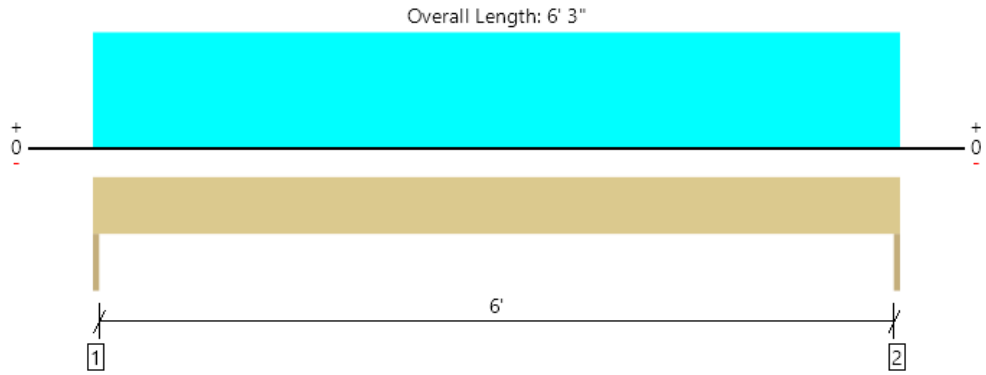
1st Floor, 6' HDR at SW-A (B1-1)
2 piece(s) 2 x 12 DF No.2



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)	2433 @ 0	2813 (1.50")	Passed (87%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1606 @ 1' 3/4"	4050	Passed (40%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3802 @ 3' 1 1/2"	4746	Passed (80%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.027 @ 3' 1 1/2"	0.156	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.047 @ 3' 1 1/2"	0.313	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
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 - Trimmer - SPF	1.50"	1.50"	1.50"	1058	1375	2433	None
2 - Trimmer - SPF	1.50"	1.50"	1.50"	1058	1375	2433	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	6' 3" o/c	
Bottom Edge (Lu)	6' 3" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	0 to 6' 3"	N/A	8.6	--	
1 - Uniform (PSF)	0 to 6' 3"	11'	30.0	40.0	Floor+Wall

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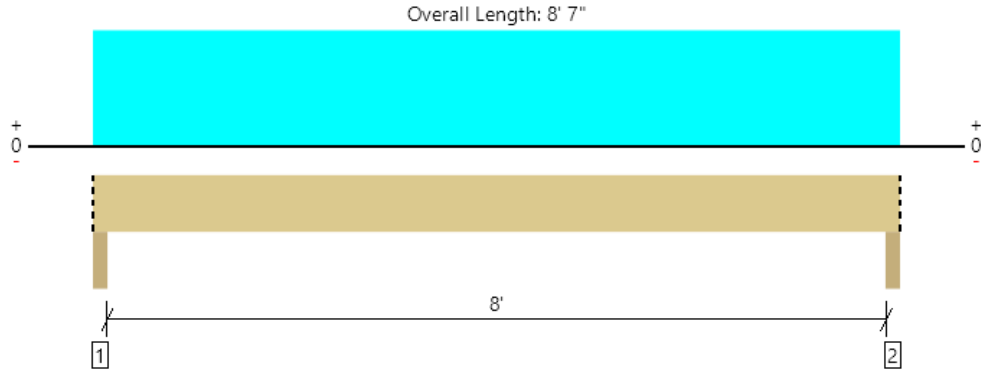
3rd Ceiling, Breezeway HDR

2 piece(s) 1 3/4" x 9 1/2" 2.0E Microllam® LVL



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)	3201 @ 2"	9188 (3.50")	Passed (35%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	2393 @ 1' 1"	7265	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	6345 @ 4' 3 1/2"	13541	Passed (47%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.077 @ 4' 3 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.177 @ 4' 3 1/2"	0.412	Passed (L/558)	--	1.0 D + 1.0 S (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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	Roof Live	Snow	Total	
1 - Column - DF	3.50"	3.50"	1.50"	1806	1116	1395	4317	Blocking
2 - Column - DF	3.50"	3.50"	1.50"	1806	1116	1395	4317	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)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	9.7	--	--	
1 - Uniform (PSF)	0 to 8' 7" (Top)	13'	31.6	20.0	25.0	Roof Trusses

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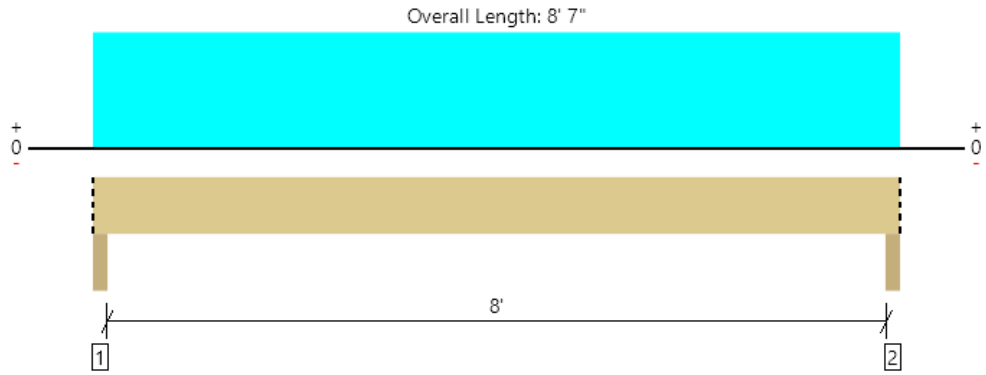
3rd Ceiling, Breezeway HDR (center)
3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL



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)	6396 @ 2"	13781 (3.50")	Passed (46%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	4487 @ 1' 3 3/8"	13622	Passed (33%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	12680 @ 4' 3 1/2"	30788	Passed (41%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.056 @ 4' 3 1/2"	0.206	Passed (L/999+)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.129 @ 4' 3 1/2"	0.412	Passed (L/765)	--	1.0 D + 1.0 S (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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	Roof Live	Snow	Total	
1 - Column - DF	3.50"	3.50"	1.62"	3607	2232	2790	8629	Blocking
2 - Column - DF	3.50"	3.50"	1.62"	3607	2232	2790	8629	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)	8' 7" o/c	
Bottom Edge (Lu)	8' 7" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 8' 7"	N/A	18.2	--	--	
1 - Uniform (PSF)	0 to 8' 7" (Top)	26'	31.6	20.0	25.0	Roof Trusses

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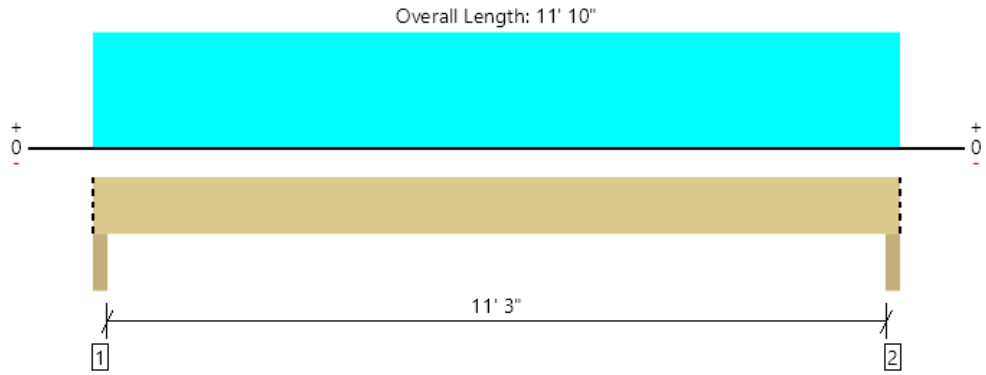
2nd/3rd Floor, Balcony Beam
2 piece(s) 2 x 10 DF No.2



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)	1213 @ 2"	6563 (3.50")	Passed (18%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	995 @ 1' 3/4"	3330	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3389 @ 5' 11"	3529	Passed (96%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.205 @ 5' 11"	0.287	Passed (L/673)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.255 @ 5' 11"	0.575	Passed (L/541)	--	1.0 D + 1.0 L (All Spans)

System : Floor
Member Type : Drop Beam
Building Use : Residential
Building Code : IBC 2018
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 - Column - DF	3.50"	3.50"	1.50"	237	976	1213	Blocking
2 - Column - DF	3.50"	3.50"	1.50"	237	976	1213	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)	5' 2" o/c	
Bottom Edge (Lu)	11' 10" 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)	0 to 11' 10"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 11' 10" (Front)	2' 9"	12.0	60.0	Balcony

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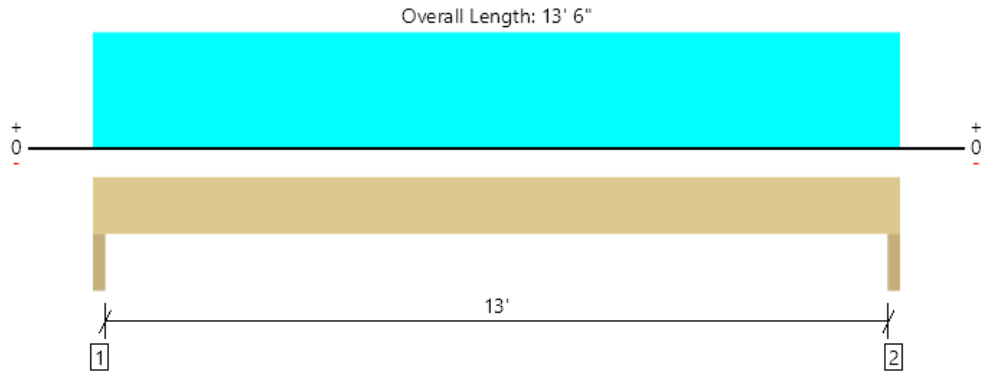
Clubhouse, Wall: Header

3 piece(s) 1 3/4" x 11 7/8" 2.0E Microllam® LVL



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)	8340 @ 1 1/2"	11813 (3.00")	Passed (71%)	--	1.0 D + 1.0 S (All Spans)
Shear (lbs)	6809 @ 1' 2 7/8"	13622	Passed (50%)	1.15	1.0 D + 1.0 S (All Spans)
Moment (Ft-lbs)	27115 @ 6' 9"	30788	Passed (88%)	1.15	1.0 D + 1.0 S (All Spans)
Live Load Defl. (in)	0.276 @ 6' 9"	0.331	Passed (L/576)	--	1.0 D + 1.0 S (All Spans)
Total Load Defl. (in)	0.635 @ 6' 9"	0.663	Passed (L/250)	--	1.0 D + 1.0 S (All Spans)

System : Wall
Member Type : Header
Building Use : Residential
Building Code : IBC 2018
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	Roof Live	Snow	Total	
1 - Trimmer - DF	3.00"	3.00"	2.12"	4712	2903	3628	11243	None
2 - Trimmer - DF	3.00"	3.00"	2.12"	4712	2903	3628	11243	None

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	7' 5" o/c	
Bottom Edge (Lu)	13' 6" o/c	

•Maximum allowable bracing intervals based on applied load.

Vertical Loads	Location	Tributary Width	Dead (0.90)	Roof Live (non-snow: 1.25)	Snow (1.15)	Comments
0 - Self Weight (PLF)	0 to 13' 6"	N/A	18.2	--	--	
1 - Uniform (PSF)	0 to 13' 6"	21' 6"	31.6	20.0	25.0	Roof

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Wood Shrinkage Calculator

The Wood Shrinkage Calculator is a quick and easy tool to estimate the amount of shrinkage the structure may experience as the wood member loses moisture content after it is framed and in service. The calculator estimates the shrinkage of each wood member in the wall and floor framing assembly and provides a graphical summary to help understand the global impact of shrinkage of individual elements in the wall system. The summary can then be used to determine the best approach to handle the shrinkage in the system. Each member of the wall and floor assembly is listed in the results table along with its calculated shrinkage amount which may be printed and maintained with the project.

Click on the help buttons (?) for information to guide you through the details. Or click here for a step-by-step tutorial that will run alongside the calculator. PDF and printable outputs are available on the Results page.

WOOD SHRINKAGE CALCULATOR VIDEO TUTORIAL

Summit Point Apartments

Holdown/Strap System Shrinkage Summary

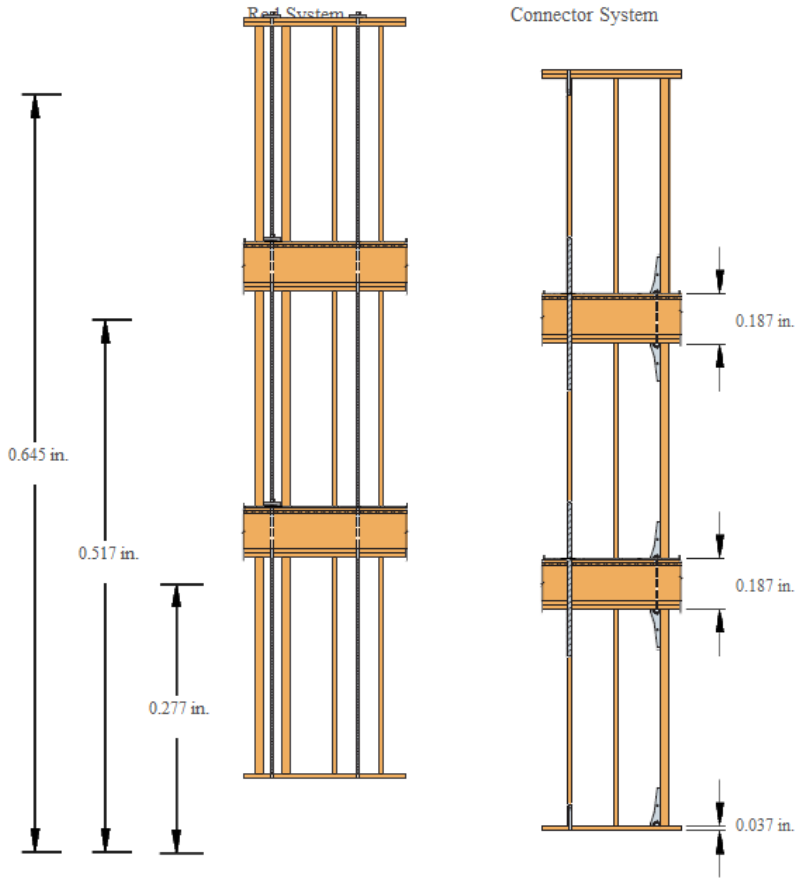
Location	Member	Depth	Shrinkage Coefficient	Moisture Change	Member Shrinkage	Incremental Shrinkage
3rd Story Sole Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	
3rd Floor System	Floor Truss	3 in.	0.0025	10%	0.075 in.	0.187 in.
2nd Story Top Plate	2-2x SPF	3 in.	0.0025	10%	0.075 in.	
2nd Story Sole Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	
2nd Floor System	Floor Truss	3 in.	0.0025	10%	0.075 in.	0.187 in.
1st Story Top Plate	2-2x SPF	3 in.	0.0025	10%	0.075 in.	
1st Story Sill Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	0.037 in.

Continuous Rod System Shrinkage Summary

Location	Member	Depth	Shrinkage Coefficient	Moisture Change	Member Shrinkage	Cumulative Shrinkage
3rd Story Top Plate	2-2x SPF	3 in.	0.0025	10%	0.075 in.	0.645 in.
3rd Story Stud	Stud	106.5 in.	0.00005	10%	0.053 in.	0.570 in.
3rd Story Sole Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	0.517 in.
3rd Floor System	Floor Truss	3 in.	0.0025	10%	0.075 in.	0.480 in.
2nd Story Top Plate	2-2x SPF	3 in.	0.0025	10%	0.075 in.	0.405 in.
2nd Story Stud	Stud	106.5 in.	0.00005	10%	0.053 in.	0.330 in.
2nd Story Sole Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	0.277 in.
2nd Floor System	Floor Truss	3 in.	0.0025	10%	0.075 in.	0.240 in.
1st Story Top Plate	2-2x SPF	3 in.	0.0025	10%	0.075 in.	0.165 in.
1st Story Stud	Stud	106.5 in.	0.00005	10%	0.053 in.	0.090 in.
1st Story Sill Plate	2x SPF	1.5 in.	0.0025	10%	0.037 in.	0.037 in.

Calculation Notes:

1. Calculation assumes that the sub-floor material is dimensionally stable and its shrinkage is negligible.
2. Calculation assumes that EWP members are dimensionally stable and its shrinkage is negligible. EWP members include I joists, LVL, LSL, and PSL.
3. Calculation assumes that floor trusses have a single top and bottom chord member whose shrinkage is equivalent to (2) SP 2x plates.
4. Calculator assumes that solid sawn members are between 2" – 4" nominal thickness. Heavy timbers that are 5" and thicker may be seasoned differently than smaller members and are therefore not considered in combination with other members in this calculator.


Roof System
Connector System
0.645 in.
0.517 in.
0.277 in.
0.187 in.
0.187 in.
0.037 in.

Stand
Structural
Engineering Inc

Overland Park, KS
(913) 214-2169
www.stand-sei.com

Project: Summit Point Apartments
Project No: 21202

Engineer: EJS
Date: 01/21/2022

Checker: CRG
Date: 01/21/2022

Diaphragm Design

Wind Load on Diaphragm

ASD Wind Pressure: 23 psf x 0.6 = 13.8 psf
Floor to Floor Height (trib): 11 ft
Line load on diaphragm: 11 ft x 13.8 psf = 152 plf
Max distance btwn shear wall lines: 40 ft
Force into shear wall: 152 plf x 40 ft / 2 = 3040 lbs
Length of shear wall (min): 25 ft
Line load from diaphragm on shear wall: 3040 lbs / 25 ft = 122 plf

Diaphragm Capacity

Assume Unblocked -> use NDS SDPWS Table 4.2C
Assume "Sheathing" Grade
Fastener Pattern: 10d @ 6" OC (General Notes)
Use values for 19/32 min sheathing thickness
Use 3" nominal minimum supported edges (truss chord width)
Wind Case 2 - trusses span perpendicular to wind primary direction
Nominal strength: 670 plf
ASD reduction factor: 2
Allowable diaphragm shear strength: 670 plf / 2 = 335 plf > 122 plf (OK)

Use 10d nails @ 6" OC max

SUMMIT POINT - TRASH ENCLOSURE

Tedds calculation version 2.2.08

Masonry wall panel details

Trash Enclosure - Reinforced single-wythe wall, the wall is free at the top and fixed at the bottom for out of plane loads

The wall is fixed at the bottom and free at the top for in plane loads

Panel length L = **30** ft

Panel height h = **10.5** ft

Seismic properties

Seismic design category B

Seismic importance factor (ASCE7 Table 1.5-2) I_e = **1**

Design spectral response acceleration parameter, short periods (IBC 1613.2.4 or ASCE7 11.4.5)

S_{DS} = **0.11**

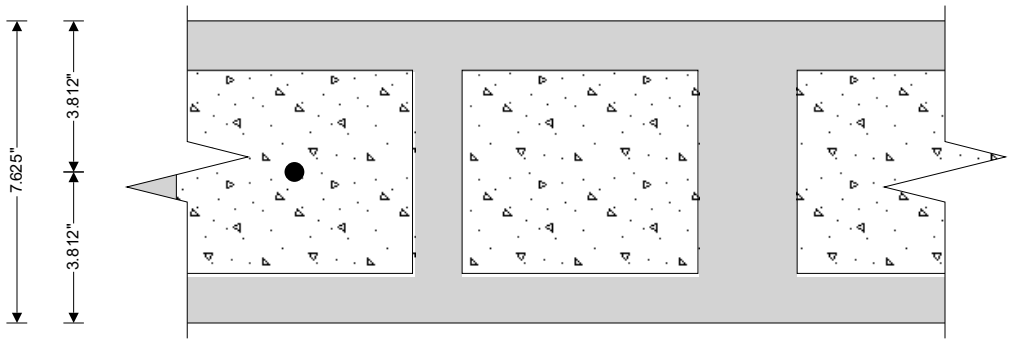
Seismic wall classification Nonparticipating

No prescriptive minimum seismic reinforcement

Redundancy factor, on out-of-plane load ρ_E = **1.0**

Construction details

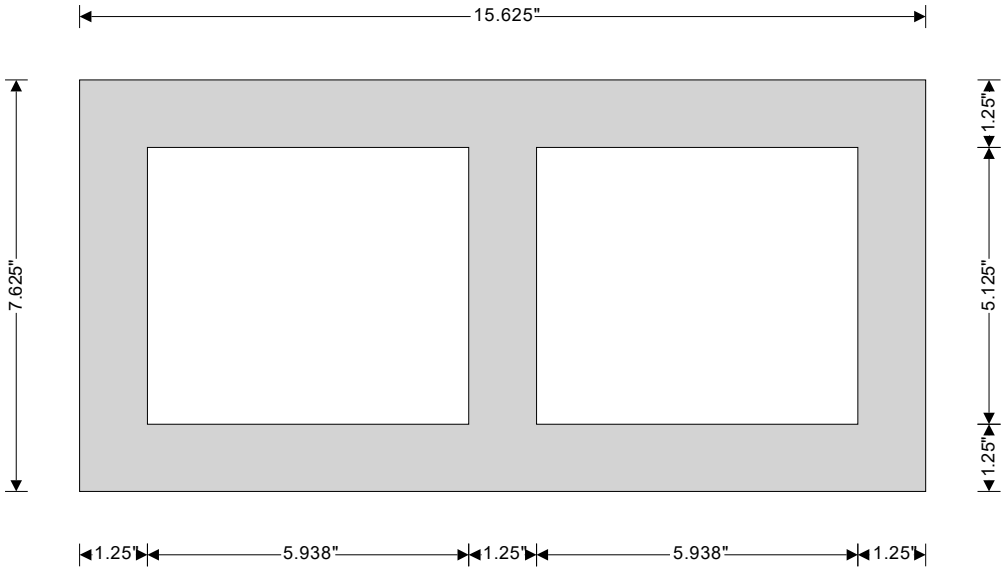
Wall thickness t = **7.625** in



Masonry details

Hollow concrete units fully grouted in running bond fully bedded with PCL class M mortar

Compressive strength of unit	f'_{cu} = **1900** psi
Density of masonry units	γ_{block} = **115** lb/ft^3
Height of masonry units	h_b = **7.625** in
Length of masonry units	l_b = **15.625** in
Number of internal webs	N_{web} = **1**
Number of end webs	N_{end} = **2**
Internal web thickness	t_{bw} = **1.25** in
Face shell thickness	t_{bf} = **1.25** in
End web thickness	t_{be} = **1.25** in
Area of block	$A_{block} = [t \times l_b - (l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b$ = **44.76** in^2/ft
Area of grout	$A_{grout} = [(l_b - N_{web} \times t_{bw} - N_{end} \times t_{be}) \times (t - 2 \times t_{bf})] / l_b$ = **46.74** in^2/ft
Density of grout	γ_{grout} = **140** lb/ft^3
Self weight of wall construction	$w_{SW\_w} = A_{block} \times \gamma_{block} + A_{grout} \times \gamma_{grout}$ = **81.19** psf
Self weight of bond beam	$w_{SW\_b} = 2 \times t_{bf} \times \gamma_{block} + (t - 2 \times t_{bf}) \times \gamma_{grout}$ = **83.75** psf
Self weight of wall	$w_{SW} = ((s_v - h_b) \times w_{SW\_w} + h_b \times w_{SW\_b}) / s_v$ = **81.39** psf



From TMS 602-13 Table 2 - Compressive strength of masonry

Net compressive strength of masonry	f'_m = **1900** psi
Modulus of elasticity for masonry	$E_m = 900 \times f'_m$ = **1710000** psi
Shear modulus of masonry	$G_v = 0.4 \times E_m$ = **684000** psi

From TMS 402 -13 Table 9.1.9.2 - Modulus of rupture

Modulus of rupture normal to bed	f_{r_norm} = **163** psi
Modulus of rupture parallel to bed	f_{r_para} = **267** psi

Reinforcement details

Yield strength of reinforcement	f_y = **60000** psi
Allowable tensile stress in reinforcement	F_s = **32000** psi
Modulus of elasticity for reinforcement	E_s = **29000000** psi

Vertical reinforcement provided	No.4 bars at 24 in centers
Area of vertical reinforcement	$A_s = \pi \times Dia^2 / (4 \times s)$ = **0.10** in²/ft
Yield strength of horizontal reinforcement	f_{yv} = **60000** psi
Allowable tensile stress in horizontal reinforcement	F_{sv} = **32000** psi
Horizontal reinforcement provided	(2) No. 4 bars at 96 in centers
Area of horizontal reinforcement	$A_v = 2 \times \pi \times HDia^2 / (4 \times s_v)$ = **0.05** in²/ft
Minimum area of vertical reinf. (cl. 9.3.6.2)	$A_{s\_min} = A_v / 3$ = **0.02** in²/ft
	PASS - Area of vertical reinforcement provided exceeds the minimum

Lateral out-of-plane loads

Wind load on panel	W = **25** psf
Wind load on parapet	W_p = **18** psf
Seismic load factor (ASCE7 12.11.1)	$F_p = 0.4 \times S_{DS} \times I_e$ = **0.044**
Seismic load from wall	$E_{wall} = \max(F_p, 0.1) \times w_{SW}$ = **8.1** psf
Additional seimic load	E_{add} = **0** psf
Seismic lateral load on panel	$E = E_{wall} + E_{add}$ = **8.1** psf

Lateral in-plane loads

Vertical loading details

Vertical seismic load factor applied to dead load	$F_{Ev} = 0.2 \times S_{DS}$ = **0.022**

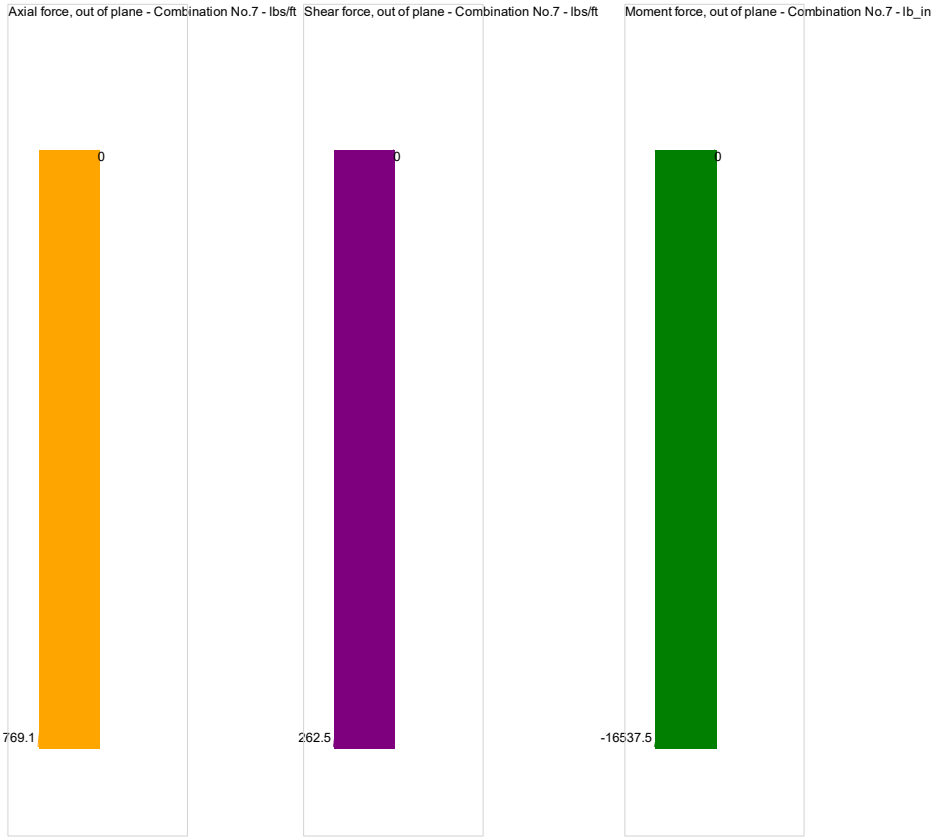
From IBC 2018 cl.1605.2 - Basic load combinations (Utilization)

Load combination no.7	$0.9 \times DL + W$ (0.756)
Load combination no.8	$0.9 \times DL + E_h - E_v$ (0.246)

Properties of masonry section

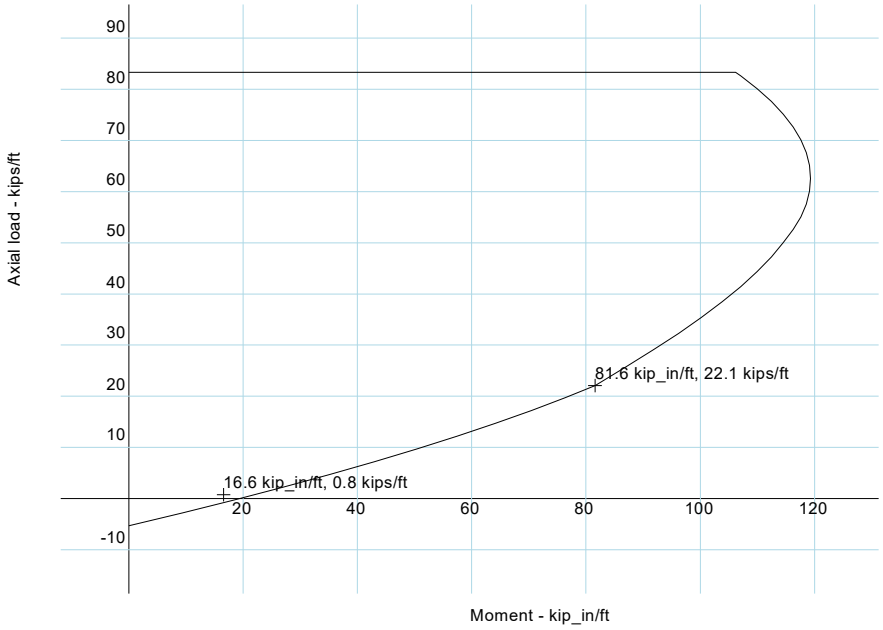
Cross-sectional area	A = t = **91.5** in²/ft
Properties for walls loaded out-of-plane:	
Moment of inertia	$I = t^3 / 12$ = **443.3** in⁴/ft
Section modulus	S = I / c = **116.3** in³/ft
Radius of gyration	$r = \sqrt{[I / A]}$ = **2.201** in
Effective height factor	K = **1**

Consider wall at bottom under load combination no.7



Axial load at bottom of panel	P = **769** lb/ft
Slenderness ratio	(K × h) / r = **57.243** < 99
Nominal axial strength	$P_n = 0.8 \times (0.8 \times f'_m \times (A - A_s) + A_s \times 0\ ksi) \times [1 - ((K \times h) / (140 \times r))^2]$ = **92563** lb/ft
Strength reduction factor	ϕ = **0.9**
Design axial strength	$\phi \times P_n$ = **83307** lb/ft
	$P / (\phi \times P_n)$ = **0.009**
	PASS - Nominal axial strength exceeds axial load
Factored axial stress	P / t = **8** psi
Factored axial stress limit	$0.2 \times f'_m$ = **380** psi
	PASS - Allowable stress under out of plane loads exceeds factored axial stress
Nominal cracking moment strength	$M_{cr} = S \times f_{r\_norm}$ = **18954** lb_in/ft
Modular ratio	$n = E_s / E_m$ = **16.959**
Distance to neutral axis	$c_{cr} = (A_s \times f_y + P) / (0.64 \times f'_m)$ = **0.456** in
Moment of inertia of cracked section	$I_{cr} = n \times (A_s + P \times t / (f_y \times 2 \times d)) \times (d - c_{cr})^2 + c_{cr}^3 / 3$ = **21.6** in^4/ft
By iteration	$M_{u0} = M$ = **16537** lb_in/ft
	$\delta_{u0} = M_{u0} \times h^2 / (4 \times E_m \times I)$ = **0.087** in
	$M_{u1} = M_{u0} + P \times \delta_{u0}$ = **16604** lb_in/ft
	$\delta_{u1} = M_{u1} \times h^2 / (4 \times E_m \times I)$ = **0.087** in
Bending moment at bottom of panel	$M = M_{u0} + P \times \delta_{u1}$ = **16604** lb_in/ft
Depth of reinforcement	d = **3.813** in

Effective width per bar	$b_{eff} = \min(s, 6 \times t_{nom}, 72\ in) =$ **24** in
Strength reduction factor	$\phi =$ **0.9**
Tensile strain in reinforcement	$\varepsilon_s = f_y / E_s =$ **0.0021**
Maximum usable compressive strain of masonry	$\varepsilon_{mu} =$ **0.0025**
Fiber of max.compressive strain to neutral axis	$c_{bal} = \varepsilon_{mu} \times d / (\varepsilon_{mu} + \varepsilon_s) =$ **2.086** in
Tensile force at balance point	$T_{bal} = A_s \times f_y =$ **5890** lb/ft
	$\beta_1 =$ **0.8**
Compressive force at balance point	$C_{bal} = 0.8 \times f'_m \times \beta_1 \times c_{bal} =$ **30440** lb/ft
Design axial force at balance point	$P_{bal} = \phi \times (C_{bal} - T_{bal}) =$ **22095** lb/ft
Design moment at balance point	$M_{bal} = \phi \times [T_{bal} \times (d - t / 2) + C_{bal} \times (t / 2 - \beta_1 \times c_{bal} / 2)] =$ **81588** lb_in/ft
Maximum design moment from integration diagram	$M_c =$ **21975** lb_in/ft
	$M / M_c =$ **0.756**
	PASS - Combination of applied axial load and flexure is acceptable
Maximum area of tensile reinforcement (9.3.3.5)	$A_{s\_max} = 0.64 \times f'_m \times [\varepsilon_{mu} / (\varepsilon_{mu} + 1.5 \times \varepsilon_s)] \times d / f_y =$ **0.414** in²/ft
	PASS - Area of reinforcement provided is less than maximum allowable



Strength interaction diagram

Consider wall at bottom under load combination no.7

Shear force	$V =$ **263** lb/ft
Compressive force	$N_u =$ **769** lb/ft
Net shear area	$A_{nv} = d =$ **45.750** in²/ft
Nominal shear strength	$V_n = \min([4 - 1.75 \times \min(M / (V \times d), 1)] \times A_{nv} \times \sqrt{(f'_m \times 1\ psi)} + 0.25 \times N_u, 4 \times A_{nv} \times \sqrt{(f'_m \times 1\ psi)}) =$ **4679** lb/ft
Strength reduction factor	$\phi_v =$ **0.8**
Design shear strength	$\phi_v \times V_n =$ **3743** lb/ft
	$V / (\phi_v \times V_n) =$ **0.070**

PASS - Design shear strength exceeds applied shear strength

RETAINING WALL ANALYSIS

In accordance with International Building Code 2018

Tedds calculation version 2.9.08

Analysis summary

Description	Unit	Capacity	Applied	F o S	Result
Sliding stability	plf	2726	479	5.691	PASS
Overturning stability	lb_ft/ft	4265	2406	1.772	PASS
Bearing pressure	psf	2500	1615	1.548	PASS

Design summary

Description	Unit	Provided	Required	Utilisation	Result
Stem p0 - moment limit	lb_in/ft	54229	38190	0.70	PASS
Stem p0 - Shear resistance	lb/ft	7652	580	0.08	PASS
Base top face - Flexural reinforcement	in^2/ft	0.295	0.259	0.88	PASS
Base bottom face - Flexural reinforcement	in^2/ft	0.295	0.259	0.88	PASS
Base - Shear resistance	lb/ft	9961	1875	0.19	PASS
Transverse base reinforcement	in^2/ft	0.589	0.259	0.44	PASS

Retaining wall details

Stem type	Cantilever
Stem height	h_{stem} = **12.5** ft
Stem thickness	t_{stem} = **6** in
Angle to rear face of stem	α = **90** deg
Stem density	γ_{stem} = **150** pcf
Toe length	l_{toe} = **1.5** ft
Heel length	l_{heel} = **1.5** ft
Base thickness	t_{base} = **12** in
Base density	γ_{base} = **150** pcf
Height of retained soil	h_{ret} = **0.083** ft
Angle of soil surface	β = **0** deg
Depth of cover	d_{cover} = **2** ft
Depth of excavation	d_{exc} = **0.667** ft

Retained soil properties

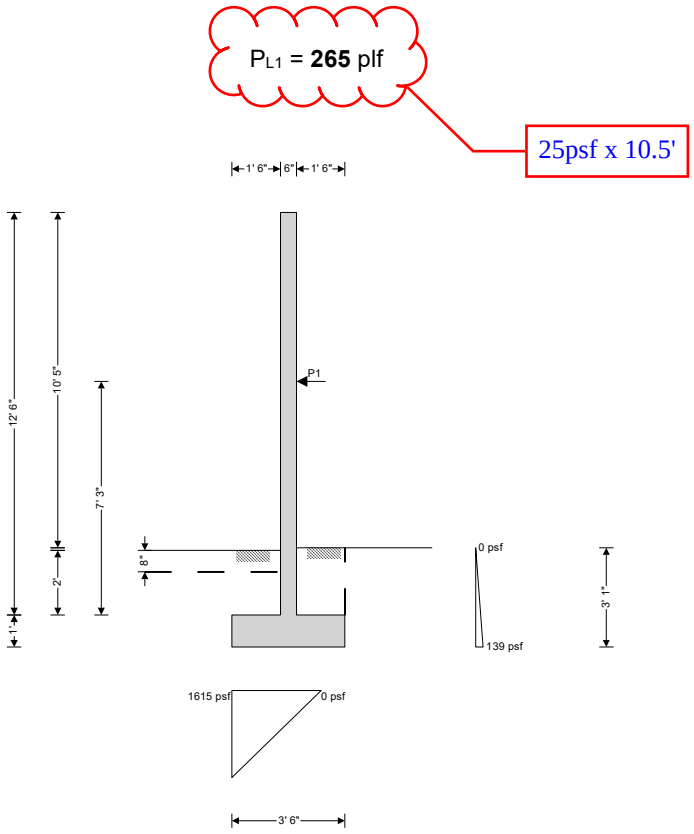
Soil type	Medium dense well graded sand
Moist density	γ_{mr} = **135** pcf
Saturated density	γ_{sr} = **145** pcf
Effective angle of internal resistance	ϕ_r = **30** deg
Effective wall friction angle	δ_r = **0** deg

Base soil properties

Soil type	Medium dense well graded sand
Soil density	γ_b = **115** pcf
Cohesion	c_b = **0** psf
Effective angle of internal resistance	ϕ_b = **30** deg
Effective wall friction angle	δ_b = **15** deg
Effective base friction angle	δ_{bb} = **30** deg
Allowable bearing pressure	$P_{bearing}$ = **2500** psf

Loading details

Horizontal line load at 7.25 ft



General arrangement

Calculate retaining wall geometry

Base length	$l_{base} = l_{toe} + t_{stem} + l_{heel}$ = **3.5** ft
Moist soil height	$h_{moist} = h_{soil}$ = **2.083** ft
Retained surface length	$l_{sur} = l_{heel}$ = **1.5** ft
Effective height of wall	$h_{eff} = h_{base} + d_{cover} + h_{ret}$ = **3.083** ft
Area of wall stem	$A_{stem} = h_{stem} \times t_{stem}$ = **6.25** ft^2
- Distance to vertical component	$x_{stem} = l_{toe} + t_{stem} / 2$ = **1.75** ft
Area of wall base	$A_{base} = l_{base} \times t_{base}$ = **3.5** ft^2
- Distance to vertical component	$x_{base} = l_{base} / 2$ = **1.75** ft
Area of moist soil	$A_{moist} = h_{moist} \times l_{heel}$ = **3.125** ft^2
- Distance to vertical component	$x_{moist\_v} = l_{base} - (h_{moist} \times l_{heel}^2 / 2) / A_{moist}$ = **2.75** ft
- Distance to horizontal component	$x_{moist\_h} = h_{eff} / 3$ = **1.028** ft
Area of base soil	$A_{pass} = d_{cover} \times l_{toe}$ = **3** ft^2
- Distance to vertical component	$x_{pass\_v} = l_{base} - (d_{cover} \times l_{toe} \times (l_{base} - l_{toe} / 2)) / A_{pass}$ = **0.75** ft
- Distance to horizontal component	$x_{pass\_h} = (d_{cover} + h_{base}) / 3$ = **1** ft
Area of excavated base soil	$A_{exc} = h_{pass} \times l_{toe}$ = **2** ft^2
- Distance to vertical component	$x_{exc\_v} = l_{base} - (h_{pass} \times l_{toe} \times (l_{base} - l_{toe} / 2)) / A_{exc}$ = **0.75** ft
- Distance to horizontal component	$x_{exc\_h} = (h_{pass} + h_{base}) / 3$ = **0.778** ft

Using Coulomb theory

Active pressure coefficient $K_A = \sin(\alpha + \phi_r)^2 / (\sin(\alpha)^2 \times \sin(\alpha - \delta_r) \times [1 + \sqrt{[\sin(\phi_r + \delta_r) \times \sin(\phi_r - \beta) / (\sin(\alpha - \delta_r) \times \sin(\alpha + \beta))]]^2}) = \mathbf{0.333}$

Passive pressure coefficient $K_P = \sin(90 - \phi_b)^2 / (\sin(90 + \delta_b) \times [1 - \sqrt{[\sin(\phi_b + \delta_b) \times \sin(\phi_b) / (\sin(90 + \delta_b))]]^2}) = \mathbf{4.977}$

From IBC 2018 cl.1807.2.3 Safety factor

Load combination 1 $1.0 \times \text{Dead} + 1.0 \times \text{Live} + 1.0 \times \text{Lateral earth}$

Sliding check

Vertical forces on wall

Wall stem $F_{stem} = A_{stem} \times \gamma_{stem} = \mathbf{937}$ plf

Wall base $F_{base} = A_{base} \times \gamma_{base} = \mathbf{525}$ plf

Moist retained soil $F_{moist\_v} = A_{moist} \times \gamma_{mr} = \mathbf{422}$ plf

Base soil $F_{exc\_v} = A_{exc} \times \gamma_b = \mathbf{230}$ plf

Total $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{exc\_v} = \mathbf{2114}$ plf

Horizontal forces on wall

Line loads $F_{P\_h} = P_{L1} = \mathbf{265}$ plf

Moist retained soil $F_{moist\_h} = K_A \times \gamma_{mr} \times h_{eff}^2 / 2 = \mathbf{214}$ plf

Total $F_{total\_h} = F_{P\_h} + F_{moist\_h} = \mathbf{479}$ plf

Check stability against sliding

Base soil resistance $F_{exc\_h} = K_P \times \cos(\delta_b) \times \gamma_b \times (h_{pass} + h_{base})^2 / 2 = \mathbf{1505}$ plf

Base friction $F_{friction} = F_{total\_v} \times \tan(\delta_{bb}) = \mathbf{1221}$ plf

Resistance to sliding $F_{rest} = F_{exc\_h} + F_{friction} = \mathbf{2726}$ plf

Factor of safety $FoS_{sl} = F_{rest} / F_{total\_h} = \mathbf{5.691} > 1.5$

PASS - Factor of safety against sliding is adequate

Overturning check

Vertical forces on wall

Wall stem $F_{stem} = A_{stem} \times \gamma_{stem} = \mathbf{937}$ plf

Wall base $F_{base} = A_{base} \times \gamma_{base} = \mathbf{525}$ plf

Moist retained soil $F_{moist\_v} = A_{moist} \times \gamma_{mr} = \mathbf{422}$ plf

Base soil $F_{exc\_v} = A_{exc} \times \gamma_b = \mathbf{230}$ plf

Total $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{exc\_v} = \mathbf{2114}$ plf

Horizontal forces on wall

Line loads $F_{P\_h} = P_{L1} = \mathbf{265}$ plf

Moist retained soil $F_{moist\_h} = K_A \times \gamma_{mr} \times h_{eff}^2 / 2 = \mathbf{214}$ plf

Base soil $F_{exc\_h} = \max(-K_P \times \cos(\delta_b) \times \gamma_b \times (h_{pass} + h_{base})^2 / 2, -(F_{moist\_h} + F_{P\_h})) = \mathbf{-479}$ plf

Total $F_{total\_h} = F_{P\_h} + F_{moist\_h} + F_{exc\_h} = \mathbf{0}$ plf

Overturning moments on wall

Line loads $M_{P\_OT} = \text{abs}(P_{L1}) \times (p_1 + t_{base}) = \mathbf{2186}$ lb_ft/ft

Moist retained soil $M_{moist\_OT} = F_{moist\_h} \times x_{moist\_h} = \mathbf{220}$ lb_ft/ft

Total $M_{total\_OT} = M_{P\_OT} + M_{moist\_OT} = \mathbf{2406}$ lb_ft/ft

Restoring moments on wall

Wall stem $M_{stem\_R} = F_{stem} \times x_{stem} = \mathbf{1641}$ lb_ft/ft

Wall base $M_{base\_R} = F_{base} \times x_{base} = \mathbf{919}$ lb_ft/ft

Moist retained soil $M_{moist\_R} = F_{moist\_v} \times x_{moist\_v} = \mathbf{1160}$ lb_ft/ft

Base soil $M_{exc\_R} = F_{exc\_v} \times x_{exc\_v} - F_{exc\_h} \times x_{exc\_h} = \mathbf{545}$ lb_ft/ft

Total $M_{total\_R} = M_{stem\_R} + M_{base\_R} + M_{moist\_R} + M_{exc\_R} = \mathbf{4265}$ lb_ft/ft

Check stability against overturning

Factor of safety $FoS_{ot} = M_{total\_R} / M_{total\_OT} = \mathbf{1.772} > 1.5$

PASS - Factor of safety against overturning is adequate

Bearing pressure check

Vertical forces on wall

Wall stem $F_{stem} = A_{stem} \times \gamma_{stem} = \mathbf{937}$ plf

Wall base $F_{base} = A_{base} \times \gamma_{base} = \mathbf{525}$ plf

Moist retained soil $F_{moist\_v} = A_{moist} \times \gamma_{mr} = \mathbf{422}$ plf

Base soil $F_{pass\_v} = A_{pass} \times \gamma_b = \mathbf{345}$ plf

Total $F_{total\_v} = F_{stem} + F_{base} + F_{moist\_v} + F_{pass\_v} = \mathbf{2229}$ plf

Horizontal forces on wall

Line loads $F_{P\_h} = P_{L1} = \mathbf{265}$ plf

Moist retained soil $F_{moist\_h} = K_A \times \gamma_{mr} \times h_{eff}^2 / 2 = \mathbf{214}$ plf

Base soil $F_{pass\_h} = \max(-K_P \times \cos(\delta_b) \times \gamma_b \times (d_{cover} + h_{base})^2 / 2, -(F_{moist\_h} + F_{P\_h})) = \mathbf{-479}$ plf

Total $F_{total\_h} = \max(F_{P\_h} + F_{moist\_h} + F_{pass\_h} - F_{total\_v} \times \tan(\delta_{bb}), 0 \text{ plf}) = \mathbf{0}$ plf

Moments on wall

Wall stem $M_{stem} = F_{stem} \times x_{stem} = \mathbf{1641}$ lb_ft/ft

Wall base $M_{base} = F_{base} \times x_{base} = \mathbf{919}$ lb_ft/ft

Line loads $M_P = -(P_{L1} \times (p_1 + t_{base})) = \mathbf{-2186}$ lb_ft/ft

Moist retained soil $M_{moist} = F_{moist\_v} \times x_{moist\_v} - F_{moist\_h} \times x_{moist\_h} = \mathbf{940}$ lb_ft/ft

Base soil $M_{pass} = F_{pass\_v} \times x_{pass\_v} - F_{pass\_h} \times x_{pass\_h} = \mathbf{738}$ lb_ft/ft

Total $M_{total} = M_{stem} + M_{base} + M_P + M_{moist} + M_{pass} = \mathbf{2051}$ lb_ft/ft

Check bearing pressure

Distance to reaction $\bar{x} = M_{total} / F_{total\_v} = \mathbf{0.92}$ ft

Eccentricity of reaction $e = \bar{x} - l_{base} / 2 = \mathbf{-0.83}$ ft

Loaded length of base $l_{load} = 3 \times \bar{x} = \mathbf{2.76}$ ft

Bearing pressure at toe $q_{toe} = 2 \times F_{total\_v} / l_{load} = \mathbf{1615}$ psf

Bearing pressure at heel $q_{heel} = \mathbf{0}$ psf

Factor of safety $FoS_{bp} = P_{bearing} / \max(q_{toe}, q_{heel}) = \mathbf{1.548}$

PASS - Allowable bearing pressure exceeds maximum applied bearing pressure

RETAINING WALL DESIGN

In accordance with ACI 318-14 and TMS 402/602-16 using the strength design method

see separate calculation for stem wall

Tedds calculation version 2.9.08

Concrete details

Compressive strength of concrete	f'_c = **4000** psi
Concrete type	Normal weight

Reinforcement details

Yield strength of reinforcement	f_y = **60000** psi
Modulus of elasticity or reinforcement	E_s = **29000000** psi
Compression-controlled strain limit	ε_{ty} = **0.002**

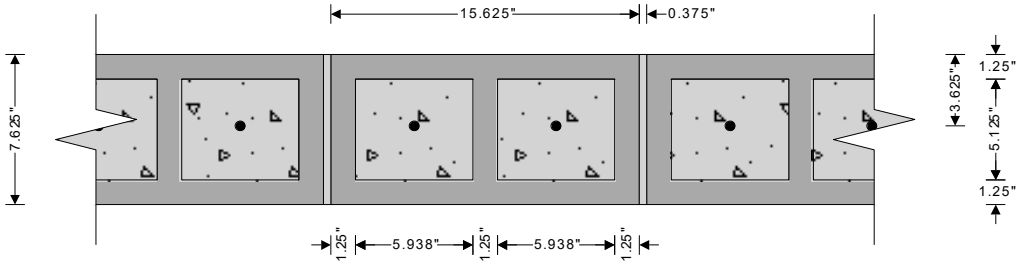
Cover to reinforcement

Top face of base	c_{bt} = **2** in
Bottom face of base	c_{bb} = **3** in

Masonry details

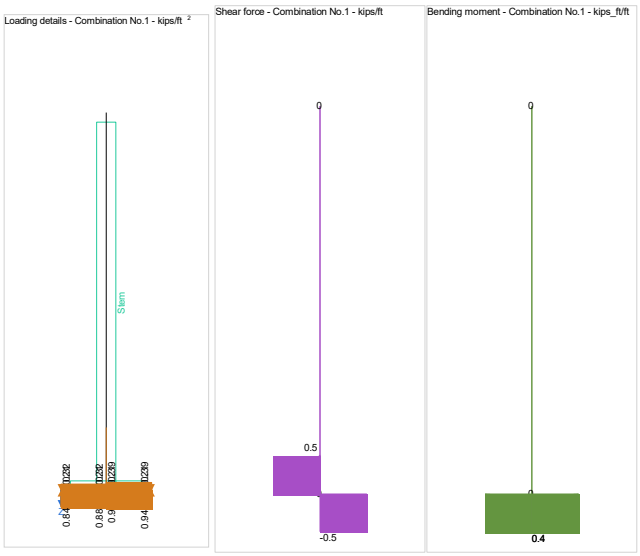
8" CMU in running bond, fully bedded with PCL class M mortar, fully grouted

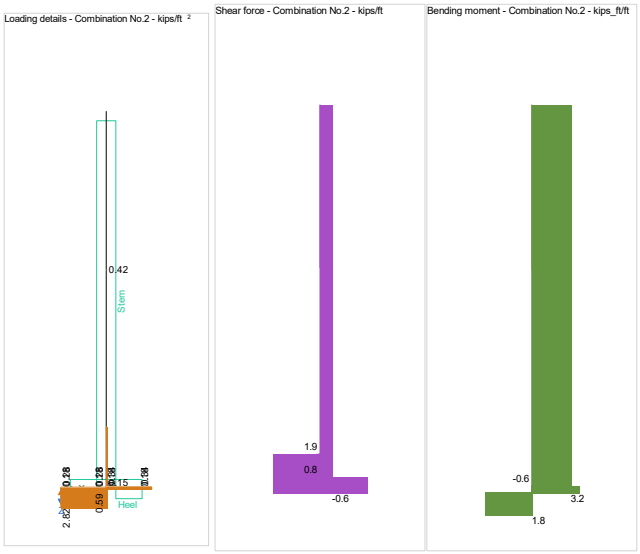
Compressive strength of unit	f_{cu} = **2000** psi
Net compressive strength - Table 2	f'_m = **2000** psi
Net modulus of elasticity - cl.Table 4.2.2	$E_m = 900 \times f'_m$ = **1800000** psi
Modulus of rupture - Table 9.1.9.2	f_r = **163** psi
Thickness of unit	t_b = **7.625** in
Length of unit	l_b = **15.625** in
Height of unit	h_b = **7.625** in
Thickness of joint	t_j = **0.375** in
Face shell thickness	t_{wf} = **1.25** in
End shell thickness	t_{we} = **1.25** in
Internal web thickness	t_{wi} = **1.25** in
Depth of cavity	$t_c = t_b - 2 \times t_{wf}$ = **5.125** in
Length of cavity	$l_c = (l_b - t_{wi} - 2 \times t_{we}) / 2$ = **5.938** in

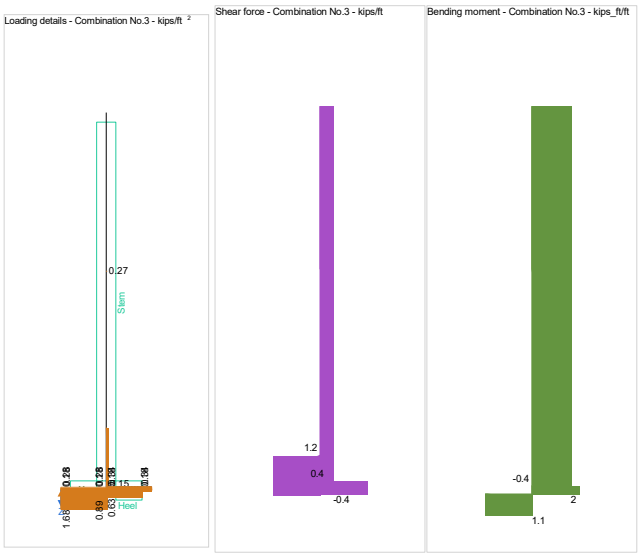


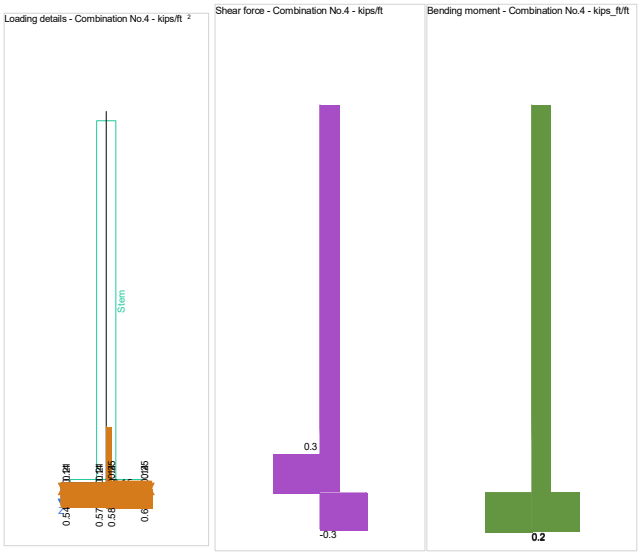
From IBC 2018 cl.1605.2 Basic load combinations

Load combination no.1	1.4 × Dead
Load combination no.2	1.2 × Dead + 1.6 × Live + 1.6 × Lateral earth
Load combination no.3	1.2 × Dead + 1.0 × Earthquake + 1.0 × Live + 1.6 × Lateral earth
Load combination no.4	0.9 × Dead + 1.0 × Earthquake + 1.6 × Lateral earth


Loading details - Combination No.1 - kips/ft ²
Stem
0.292
0.292
0.289
0.289
0.84
0.88
0.9
0.94
Shear force - Combination No.1 - kips/ft
0
0.5
-0.5
Bending moment - Combination No.1 - kips_ft/ft
0
0.4


Loading details - Combination No.2 - kips/ft ²
0.42
Stem
0.28
0.28
0.28
0.28
0.15
0.08
0.08
0.89
2.82
Heel
Shear force - Combination No.2 - kips/ft
1.9
0.8
-0.6
Bending moment - Combination No.2 - kips_ft/ft
-0.6
3.2
1.8





Check stem design at base of stem

Depth of section — t = **6** in

Masonry section properties

Gross cross-sectional area — $A = t_b$ = **91.5** in^2/ft

Gross moment of inertia — $I = t_b^3 / 12$ = **443.3** in^4/ft

Gross section modulus — $S = 2 \times I / t_b$ = **116.3** in^3/ft

Gross radius of gyration — $r = \sqrt{(I / A)}$ = **2.2** in

Reinforced masonry - Section 9.3

Design bending moment combination 2 — M = **38190** lb_in/ft

Axial load — $P = 1.2 \times \gamma_{stem} \times h_{stem} \times A$ = **1430** lb/ft

Effective height — $h = 2 \times h_{stem}$ = **25** ft

Slenderness ratio — h / r = **136.293**

Nominal axial strength - exp.9-16 — $P_n = 0.8 \times (0.8 \times (A - A_{sr.prov}) \times f'_m) \times (70 \times r / h)^2$ = **30795** lb/ft

Strength reduction factor - cl.9.1.4 — ϕ = **0.9**

Design axial strength — $\phi P_n = \phi \times P_n$ = **27716** lb/ft

$P / \phi P_n$ = **0.052**

PASS - Nominal axial strength exceeds axial load

Reinforcement provided — No.4 bars @ 8" c/c

Area of reinforcement provided — $A_{sr.prov} = \pi \times \phi_{sr}^2 / (4 \times s_{sr})$ = **0.295** in²/ft

Depth of reinforcement — d = **3.625** in

Maximum usable compressive strain of masonry - cl.9.3.2

ε_{mu} = **0.0025**

Tensile strain in reinforcement at balance point — $\varepsilon_s = f_y / E_s$ = **0.002069**

Tension reinforcement strain factor — α_s = **1.5**

Maximum area of reinforcement — $A_{sr.max} = 0.64 \times f'_m \times d \times [\varepsilon_{mu} / (\varepsilon_{mu} + \alpha_s \times \varepsilon_s)] / f_y$ = **0.414** in²/ft

PASS - Area of stem reinforcement provided is less than maximum allowable

Distance from fiber of maximum compressive strain to neutral axis

$c = d \times \varepsilon_{mu} / (\varepsilon_{mu} + \varepsilon_s)$ = **1.983** in

Tensile force at balance point — $T_b = A_{sr.prov} \times f_y$ = **17671** lb/ft

β_1 = **0.8**

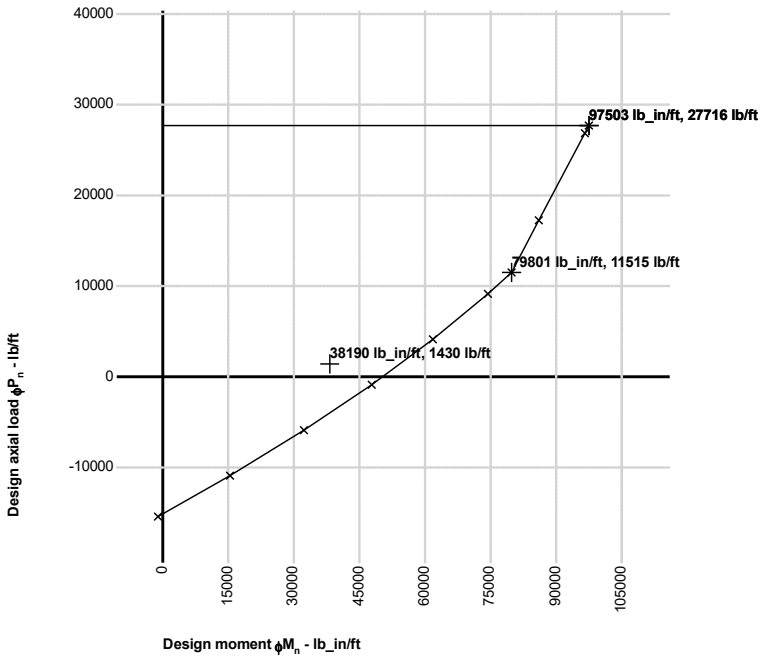
Compressive force at balance point — $C_b = 0.8 \times f'_m \times \beta_1 \times c$ = **30466** lb/ft

Design axial force at balance point — $P_b = \phi \times (C_b - T_b)$ = **11515** lb/ft

Design moment at balance point — $M_b = \phi \times (T_b \times (d - t_b / 2) + C_b \times (t_b / 2 - \beta_1 \times c / 2))$ = **79801** lb_in/ft

Strength interaction diagram

c / d	c (in)	C (lb/ft)	T (lb/ft)	f_s (psi)	M (lb_in/ft)	P (lb/ft)
0.01	0.036	557	17671	60000	-1079	-15403
0.1	0.363	5568	17671	60000	15397	-10893
0.2	0.725	11136	17671	60000	32322	-5882
0.3	1.088	16704	17671	60000	47794	-871
0.4	1.45	22272	17671	60000	61813	4140
0.5	1.813	27840	17671	60000	74378	9152
0.547	1.983	30466	17671	60000	79801	11515
0.6	2.175	33408	14235	48333	86071	17255
0.7	2.538	38976	9151	31071	96588	26842
0.8	2.9	44544	5338	18125	97503	27716



From strength interaction diagram...

Maximum moment — M_{max} = **105437** lb_in/ft

Limiting moment under applied axial load — M_{limit} = **54229** lb_in/ft

M / M_{limit} = **0.704**

PASS - Design flexural strength exceeds factored bending moment

Design shear force — V = **580** lb/ft

Nominal shear strength - cl.9.3.4.1.2 — $V_n = \min((4 - 1.75 \times \min(M / (V \times t_b), 1)) \times A \times \sqrt{(f'_m \times 1\ psi)} + 0.25 \times P, 4 \times A \times \sqrt{(f'_m \times 1\ psi)}) =$ **9564** lb/ft

Strength reduction factor - cl.9.1.4 — ϕ_v = **0.8**

Design shear strength — $\phi V_n = \phi_v \times V_n =$ **7652** lb/ft

$V / \phi V_n$ = **0.076**

PASS - Design shear strength exceeds applied shear force

Check base design at toe

Depth of section — h = **12** in

Rectangular section in flexure - Section 22.3

Design bending moment combination 2 — M = **1825** lb_ft/ft

Depth of tension reinforcement — $d = h - c_{bb} - \phi_{bb} / 2 =$ **8.75** in

Compression reinforcement provided — No.4 bars @ 8" c/c

Area of compression reinforcement provided — $A_{bt.prov} = \pi \times \phi_{bt}^2 / (4 \times s_{bt}) =$ **0.295** in^2/ft

Tension reinforcement provided — No.4 bars @ 8" c/c

Area of tension reinforcement provided — $A_{bb.prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb}) =$ **0.295** in^2/ft

Maximum reinforcement spacing - cl.7.7.2.3 — $s_{max} = \min(18\ in, 3 \times h) =$ **18** in

PASS - Reinforcement is adequately spaced

Depth of compression block	$a = A_{bb.prov} \times f_y / (0.85 \times f'_c)$ = **0.433** in
Neutral axis factor - cl.22.2.2.4.3	$\beta_1 = \min(\max(0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi, 0.65), 0.85)$ = **0.85**
Depth to neutral axis	$c = a / \beta_1$ = **0.51** in
Strain in reinforcement	$\varepsilon_t = 0.003 \times (d - c) / c$ = **0.048515**
	Section is in the tension controlled zone
Strength reduction factor	$\phi_f = \min(\max(0.65 + 0.25 \times (\varepsilon_t - \varepsilon_{ty}) / 0.003, 0.65), 0.9)$ = **0.9**
Nominal flexural strength	$M_n = A_{bb.prov} \times f_y \times (d - a / 2)$ = **12567** lb_ft/ft
Design flexural strength	$\phi M_n = \phi_f \times M_n$ = **11310** lb_ft/ft
	$M / \phi M_n$ = **0.161**
	PASS - Design flexural strength exceeds factored bending moment
By iteration, reinforcement required by analysis	$A_{bb.des}$ = **0.047** in²/ft
Minimum area of reinforcement - cl.7.6.1.1	$A_{bb.min} = 0.0018 \times h$ = **0.259** in²/ft
	PASS - Area of reinforcement provided is greater than minimum area of reinforcement required

Rectangular section in shear - Section 22.5

Design shear force	V = **1875** lb/ft
Concrete modification factor - cl.19.2.4	λ = **1**
Nominal concrete shear strength - eqn.22.5.5.1	$V_c = 2 \times \lambda \times \sqrt{(f'_c \times 1\ psi)} \times d$ = **13282** lb/ft
Strength reduction factor	ϕ_s = **0.75**
Design concrete shear strength - cl.7.6.3.1	$\phi V_c = \phi_s \times V_c$ = **9961** lb/ft
	$V / \phi V_c$ = **0.188**
	PASS - No shear reinforcement is required

Check base design at heel

Depth of section	h = **12** in

Rectangular section in flexure - Section 22.3

Design bending moment combination 2	M = **582** lb_ft/ft
Depth of tension reinforcement	$d = h - c_{bt} - \phi_{bt} / 2$ = **9.75** in
Compression reinforcement provided	No.4 bars @ 8" c/c
Area of compression reinforcement provided	$A_{bb.prov} = \pi \times \phi_{bb}^2 / (4 \times s_{bb})$ = **0.295** in²/ft
Tension reinforcement provided	No.4 bars @ 8" c/c
Area of tension reinforcement provided	$A_{bt.prov} = \pi \times \phi_{bt}^2 / (4 \times s_{bt})$ = **0.295** in²/ft
Maximum reinforcement spacing - cl.7.7.2.3	$s_{max} = \min(18\ in, 3 \times h)$ = **18** in
	PASS - Reinforcement is adequately spaced
Depth of compression block	$a = A_{bt.prov} \times f_y / (0.85 \times f'_c)$ = **0.433** in
Neutral axis factor - cl.22.2.2.4.3	$\beta_1 = \min(\max(0.85 - 0.05 \times (f'_c - 4\ ksi) / 1\ ksi, 0.65), 0.85)$ = **0.85**
Depth to neutral axis	$c = a / \beta_1$ = **0.51** in
Strain in reinforcement	$\varepsilon_t = 0.003 \times (d - c) / c$ = **0.054403**
	Section is in the tension controlled zone
Strength reduction factor	$\phi_f = \min(\max(0.65 + 0.25 \times (\varepsilon_t - \varepsilon_{ty}) / 0.003, 0.65), 0.9)$ = **0.9**
Nominal flexural strength	$M_n = A_{bt.prov} \times f_y \times (d - a / 2)$ = **14039** lb_ft/ft
Design flexural strength	$\phi M_n = \phi_f \times M_n$ = **12635** lb_ft/ft
	$M / \phi M_n$ = **0.046**
	PASS - Design flexural strength exceeds factored bending moment

By iteration, reinforcement required by analysis $A_{bt.des}$ = **0.013** in²/ft

Minimum area of reinforcement - cl.7.6.1.1 $A_{bt.min} = 0.0018 \times h$ = **0.259** in²/ft

PASS - Area of reinforcement provided is greater than minimum area of reinforcement required

Rectangular section in shear - Section 22.5

Design shear force V = **776** lb/ft

Concrete modification factor - cl.19.2.4 λ = **1**

Nominal concrete shear strength - eqn.22.5.5.1 $V_c = 2 \times \lambda \times \sqrt{(f'_c \times 1\ psi)} \times d$ = **14799** lb/ft

Strength reduction factor ϕ_s = **0.75**

Design concrete shear strength - cl.7.6.3.1 $\phi V_c = \phi_s \times V_c$ = **11100** lb/ft

$V / \phi V_c$ = **0.070**

PASS - No shear reinforcement is required

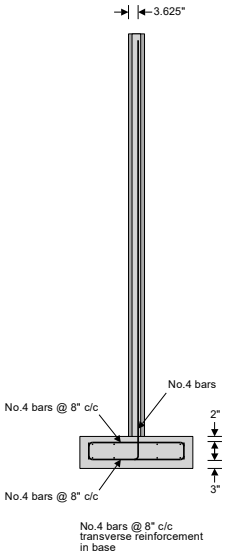
Transverse reinforcement parallel to base

Minimum area of reinforcement - cl.7.6.1.1 $A_{bx.req} = 0.0018 \times t_{base}$ = **0.259** in²/ft

Transverse reinforcement provided No.4 bars @ 8" c/c each face

Area of transverse reinforcement provided $A_{bx.prov} = 2 \times \pi \times \phi_{bx}^2 / (4 \times s_{bx})$ = **0.589** in²/ft

PASS - Area of reinforcement provided is greater than area of reinforcement required



Reinforcement details