STAND STRUCTURAL ENGINEERING INC

STRUCTURAL CALCULATIONS FOR

New Longview Townhomes
Lee's Summit, MO

Project # 22066

December 12, 2022

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STATE OF MISSOURI
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NUMBER
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REGISTERED PROFESSIONAL ENGINEER

12/12/22

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DESIGN CRITERIA AND LOADING

STRUCTURAL DESIGN CRITERIA (2018 IBC AND ASCE 7-16):

1. BUILDING OCCUPANCY RISK CATEGORY II.

2. LIVE LOADS [UNIFORM (PSF) / POINT LOADS (KIPS)]:
-- ROOF:…………………………………….............20 PSF / 300#
-- RESIDENTIAL CORRIDORS……………………….....40 PSF
-- GROUND LEVEL SLAB ....100 PSF / 2.0 K
-- STAIRS ....100 PSF / 300#
-- RESIDENTIAL…………………. ....40 PSF

3. ROOF SNOW LOAD:
-- GROUND SNOW LOAD (Pg):……………………....20 PSF
-- FLAT ROOF SNOW LOAD (Pf): ....15.4 PSF W/ DRIFT
-- MIN UNIFORM ROOF SNOW LOAD (Pm):…...….20 PSF (NO DRIFT OR RAIN)
-- RAIN ON SNOW SURCHARGE (Prs) ....5.0 PSF
-- SNOW EXPOSURE FACTOR (Ce):………………..1.0, EXPOSURE B & C
-- SNOW LOAD IMPORTANCE FACTOR (Is):….......1.0
-- THERMAL FACTOR (Ct):……………………........1.1 (just above freezing)
– SLOPE FACTOR (CS)..1.0 (for ¼ per foot roofs)

4. WIND DESIGN DATA:
-- BASIC WIND SPEED (3 SEC GUST):……….......115 MPH
-- WIND EXPOSURE:…………………………………..C
-- DIRECTIONALITY FACTOR (Kd) 0.85
-- INTERNAL PRESSURE COEFF:……….……….0.18
-- COMPONENTS AND CLADDING WIND (ULTIMATE 1.0*W) PRESSURES (BASED ON TRIB 10 S.F., EXP. B. MAY BE REDUCED FOR COMPONENTS WITH LARGER TRIB PER BLDG CODE):
WALLS AT CORNERS & EDGES:…………………+28 / -37 PSF
ALL OTHER MAIN WALL CONDITIONS:…………+28 / -31 PSF
ROOF CORNERS:…...................………………....+15 / -81 PSF
ROOF EDGES: ....+15 / -67 PSF
ALL OTHER MAIN ROOF CONDITIONS:…………+15 / -28 PSF

5. EARTHQUAKE DESIGN DATA:
-- SEISMIC IMPORTANCE FACTOR (Ie):……......1.0
-- MAPPED SPECTRAL RESP ACCEL (Ss / S1):…..0.10 / 0.068
-- SITE CLASS:…………………………………………D
-- SPECTRAL RESPONSE COEFF (Sds / Sd1):……0.107 / 0.109
-- SEISMIC DESIGN CATEGORY:……………………B
-- SEISMIC FORCE RESISTING SYSTEM:…………R=6.5, WOOD SHEAR WALLS
-- DESIGN BASE SHEAR:……………………………..4.72 K (ELF AND ASD)
-- SEISMIC RESPONSE COEFF (Cs):………………0.016
-- ANALYSIS PROCEDURE:…………………………..ELF

6. RAIN LOAD DATA:
– 15-MIN RAIN INTENSITY…………………………....7.49 IN/HR
– 60-MIN RAIN INTENSITY…………………………....3.51 IN/HR
DESIGN ASSUMES APPROPRIATE ROOF SLOPE AND DRAINAGE (INCLUDING OVERFLOWS) IS PROVIDED. ROOF IS DESIGNED FOR LIVE LOAD INDICATED ABOVE

7. GUARD RAILS:...50 PLF, AND/OR 200# CONCENTRATED LOAD APPLIED IN ANY DIRECTION.

SNOW LOADING ANALYSIS

Per ASCE 7 Code for Buildings with Flat or Low Slope Roofs (<= 5 deg. or 1 in./ft.)
for Balanced Snow, Drift, and Rain-on-Snow Surcharge Loadings

Job Name:	NLV Townhomes	Subject:	Snow Load Calculation		
Job No:	22066	Originator:	CRG	Checker:	JEF

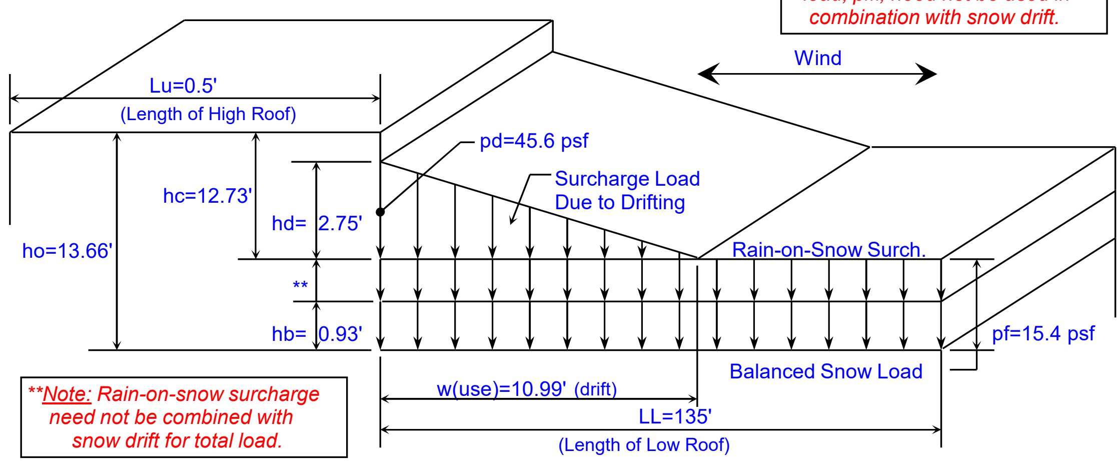
Input Data:

Building Risk Category =	II		Table 1.5-1, page 2
Ground Snow Load, p_g =	20.00	psf	Figure 7-1, pages 34-35 and Table 7-1, page 30
Length of High Roof, L_u =	0.50	ft.	Length of Roof Upwind of the Snow Drift
Length of Low Roof, L_L =	135.00	ft.	Length of Roof Downwind of the Snow Drift
. Dist. from Eave to Ridge, W =	13.66	ft.	Horizontal Distance from Eave to Ridge
Type of Roof =	Monoslope		Type of Roof = Monoslope, Gable, or Hip
Obstruction Height, h_o =	13.66	ft.	High Roof - Low Roof Elevations
Roof Slope, S =	1.05	in./ft.	S = Rise per foot of Run
Exposure Factor, C_e =	1.00		Table 7-2, page 30
Thermal Factor, C_t =	1.10		Table 7-3, page 30

Results:

Roof Angle, θ =	5.0006	deg.	θ = ATAN(S/12)
Importance Factor, I_s =	1.00		Table 1.5-2, page 5
Snow Density, γ =	16.60	pcf	γ = 0.13*p_g+14 <= 30 (Eqn. 7.7-1, page 33)
Flat Roof Snow Load, p_f =	15.40	psf	p_f = 0.7*C_e*C_t*I_s*p_g (Eqn. 7.3-1, page 29)
*Min. Roof Snow Load, p_m =	20.00	psf	p_m = p_g*I_s for p_g <= 20 , p_m = 20*I_s for p_g > 20
Balanced Snow Load Ht., h_b =	0.93	ft.	h_b = $p_{f(use)}$/γ (Section 7.1, page 29)
Clear Height, h_c =	12.73	ft.	h_c = h_o-h_b >= 0 (Section 7.1, page 29)
Leeward Drift Height, h_{dL} =	1.44	ft.	h_{dL} = 0.43*L_u^1/3*(p_g+10)^1/4-1.5, with L_u>=25' (Figure 7-9)
Windward Drift Height, h_{dw} =	2.75	ft.	h_{dw} = 0.75*(0.43*L_L^1/3*(p_g+10)^1/4-1.5), with L_L>=25'
Max. Drift Height, $h_{d(max)}$ =	2.75	ft.	$h_{d(max)}$ = maximum of: (h_{dL} or h_{dw})
Ratio, h_c/h_b =	13.72		If h_c/h_b >= 0.2 , then snow drifts are required to be applied
Drift Length, w =	10.99	ft.	If $h_{d(max)}$<=h_c: w = 4*$h_{d(max)}$, if $h_{d(max)}$>h_c: w = 4*$h_{d(max)}$^2/h_c
Design Drift Height, h_d =	2.75	ft.	If $h_{d(max)}$ <= h_c: h_d = $h_{d(max)}$, if $h_{d(max)}$ > h_c: h_d = h_c
Drift Length, $w_{(max)}$ =	101.86	ft.	$w_{(max)}$ <= 8*h_c
Drift Length, $w_{(use)}$ =	10.99	ft.	$w_{(use)}$ = minimum of: w or $w_{(max)}$
Wt. of Drift at High End, p_d =	45.60	psf	p_d =h_d*γ (maximum value)
Wt. of Drift at Low End, p_{de} =	0.00	psf	p_{de} = 0, as Low Roof Length (LL) >= w(max)
Rain-on-Snow Surch., p_{rs} =	0.00	psf	p_{rs} = 5.0 psf when 0 < p_g <=20 and θ < W/50) (Sect. 7.10)
Balanced Snow Load, $p_{f(bal)}$ =	15.40	psf	$p_{f(bal)}$ = p_f+p_{rs}
**Total Snow Load, $p_{(total)}$ =	61.00	psf	$p_{(total)}$ = $p_{f(bal)}$+p_d

**Note:* Minimum flat roof snow load, pm, need not be used in combination with snow drift.*



***Note:* Rain-on-snow surcharge need not be combined with snow drift for total load.*

Configuration of Snow Drift on Lower Roof

Hazards by Location

Search Information

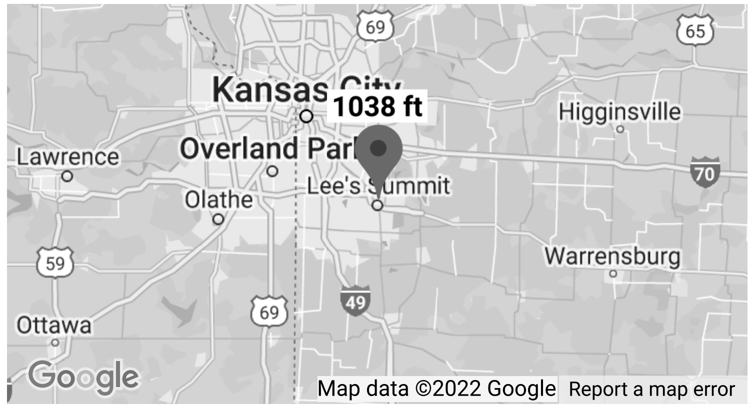
Address: Lee's Summit, MO, USA

Coordinates: 38.9108408, -94.3821724

Elevation: 1038 ft

Timestamp: 2022-08-05T13:54:26.237Z

Hazard Type: Snow



ASCE 7-16		ASCE 7-10		ASCE 7-05	
Ground Snow Load	20 lb/sqft	Ground Snow Load	20 lb/sqft	Ground Snow Load	20 lb/sqft

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.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

Disclaimer

Hazard loads are interpolated from data provided in ASCE 7 and rounded up to the nearest whole integer.

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WIND LOADING ANALYSIS - Main Wind-Force Resisting System

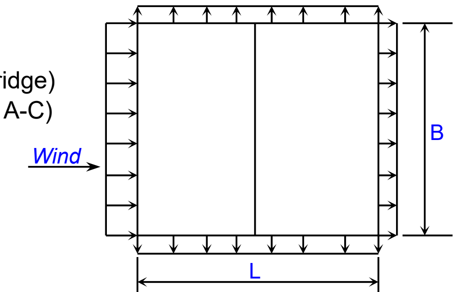
Per ASCE 7 Code for Enclosed or Partially Enclosed Buildings

Using Method 2: Analytical Procedure (Section 27) for Buildings of Any Height

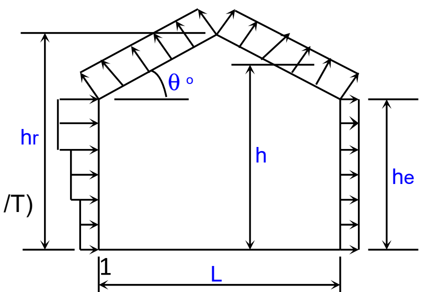
Job Name:	NLV Townhomes	Subject:	MWFRS		
Job Number:	22066	Originator:	CRG	Checker:	JEF

Input Data:

Wind Direction =	Parallel	(Normal or Parallel to building ridge)
Wind Speed, V =	115	mph (Wind Map, Figure 26.5-1A-C)
Bldg. Classification =	II	(Table 1.4-1 Risk Cat.)
Exposure Category =	C	(Sect. 26.7)
Ridge Height, hr =	35.00	ft. (hr >= he)
Eave Height, he =	22.00	ft. (he <= hr)
Building Width =	135.00	ft. (Normal to Building Ridge)
Building Length =	35.00	ft. (Parallel to Building Ridge)
Roof Type =	Gable	(Gable or Monoslope)
Topo. Factor, Kzt =	1.00	(Sect. 26.8 & Table 26.8-1)
Direct. Factor, Kd =	1.00	(Table 26.6-1)
Enclosed? (Y/N)	Y	(Sect. 6.2 & Figure 6-5)
Hurricane Region?	N	
Damping Ratio, β =	0.050	(Suggested Range = 0.010-0.070)
Period Coef., Ct =	0.0350	(Suggested Range = 0.020-0.035)
		(Assume: T = Ct*h^(3/4) , and f = 1/T)
G for Rigid Bldgs =	0.85	Calculated G = 0.85
WW Parapet h (ft) =	0.00	**Taller parapet should be WW
LW Parapet h (ft) =	0.00	**Parapet height measured from eave



Plan



Elevation

L = 35 ft.
B = 135 ft.

Resulting Parameters and Coefficients:

Roof Angle, θ =	10.90	deg.		
Mean Roof Ht., h =	28.50	ft. (h = (hr+he)/2, for roof angle >10 deg.)		
Windward Wall Cp =	0.80	(Fig. 27.4-1)		
Leeward Wall Cp =	-0.50	(Fig. 27.4-1)		
Side Walls Cp =	-0.70	(Fig. 27-4.1)		
Roof Cp (zone #1) =	-0.99	-0.18	(Fig. 27-4.1)	(zone #1 for 0 to h/2)
Roof Cp (zone #2) =	-0.77	-0.18	(Fig. 27-4.1)	(zone #2 for h/2 to h)
Roof Cp (zone #3) =	-0.63	-0.18	(Fig. 27-4.1)	(zone #3 for h to 2*h)
Roof Cp (zone #4) =	N.A.	N.A.	(Fig. 27-4.1)	(zone #4 for > 2*h)
+GCpi Coef. =	0.18	(Table 26.11- (positive internal pressure)		
-GCpi Coef. =	-0.18	(Table 26.11- (negative internal pressure)		

If z <= 15 then: Kz = 2.01*(15/zg)^(2/α) , If z > 15 then: Kz = 2.01*(z/zg)^(2/α) (Table 27.3-1)

α =	9.50	zg =	900	(Table 26.9-1)
Kh =	0.97	(Kh = Kz evaluated at z = h)	hz.	(f >= 1, Rigid structure)

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2*I (Eq. 27.3-1)

qh =	32.90	psf	qh = 0.00256*Kh*Kzt*Kd*V^2 (qz evaluated at z = h)	
Ratio h/B =	0.814	freq., f =	2.316	
Gust Factor, G =	0.850	(Sect. 26.9)		

Design Net External Wind Pressures (Sect. 27.4):

p = qz*G*Cp - qi*(+/-GCpi) for windward wall (psf), where: qi =qh (Eq. 27.4-1)

p = qh*G*Cp - qi*(+/-GCpi) for leeward wall, sidewalls, and roof (psf), where: qi = qh (Eq. 27.4-1)

Parallel to Ridge Wind Load Tabulation for MWFRS - Buildings of Any Height						
Surface	z (ft.)	Kz	qz (psf)	Cp	p = Net Design Press. (psf)	
					Windward	WW + LW
Windward Wall	0	0.85	28.74	0.80	19.54	33.52
	15.00	0.85	28.74	0.80	19.54	33.52
	20.00	0.90	30.53	0.80	20.76	34.74
	25.00	0.95	32.00	0.80	21.76	35.74
	23.40	0.93	31.56	0.80	21.46	35.44
For z = hr:	35.00	1.01	34.35	0.80	23.36	37.34
For z = he:	22.00	0.92	31.15	0.80	21.18	35.17
For z = h:	28.50	0.97	32.90	0.80	22.37	36.35
Leeward Wall	All	-	-	-0.50	-13.98	
Side Walls	All	-	-	-0.70	-19.57	
Roof (w/ GCpi)				Cp	+Gcpi	-Gcpi
Roof (zone #1) cond. 1	-	-	-	-0.99	-33.55	-21.71
Roof (zone #1) cond. 2	-	-	-	-0.18	-10.96	0.89
Roof (zone #2) cond. 1	-	-	-	-0.77	-27.57	-15.73
Roof (zone #2) cond. 2	-	-	-	-0.18	-10.96	0.89
Roof (zone #3) cond. 1	-	-	-	-0.63	-23.42	-11.58
Roof (zone #3) cond. 2	-	-	-	-0.18	-10.96	0.89
Parapets	hp	Kz	qp (psf)	GCp	Pp (psf)	P = Pp * h (plf)
Windward Parapet	22.00	0.92	31.15	1.50	46.73	0.00
Leeward Parapet	22.00	0.92	31.15	-1.00	-31.15	0.00
Total Parapet					77.88	0.00

Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Per Code Section 27.4.7, the minimum wind load for MWFRS shall not be less than 16 psf.

4. Roof zone #1 is applied for horizontal distance of 0 to h/2 from windward edge.
5. Roof zone #2 is applied for horizontal distance of h/2 to h from windward edge.
6. Roof zone #3 is applied for horizontal distance of h to 2*h from windward edge.

Determination of Gust Effect Factor, G:

Is Building Flexible? | No | f >=1 Hz.

1: Simplified Method for Rigid Building

G =	0.850	

Parameters Used in Both Item #2 and Item #3 Calculations (from Table 26.9-1):

α^ =	0.105	
b^ =	1.00	
α(bar) =	0.154	
b(bar) =	0.65	
c =	0.20	
l =	500	ft.
ε(bar) =	0.200	
z(min) =	15	ft.

Calculated Parameters Used in Both Rigid and/or Flexible Building Calculations:

z(bar) =	17.10	= 0.6*h , but not < z(min) , ft. Table 26.9-1
Iz(bar) =	0.223	= c*(33/z(bar))^(1/6) , Eq. 26.9-7
Lz(bar) =	438.40	= l*(z(bar)/33)^(ε(bar)) , Eq. 26.9-9
gq =	3.4	(3.4, per Sect. 26.9.4)
gv =	3.4	(3.4, per Sect. 26.9.4)
gr =	4.385	= (2*(LN(3600*f)))^(1/2)+0.577/(2*LN(3600*f))^(1/2) , Eq. 26.9-11
Q =	0.864	= (1/(1+0.63*((B+h)/Lz(bar))^0.63))^(1/2) , Eq. 26.9-8

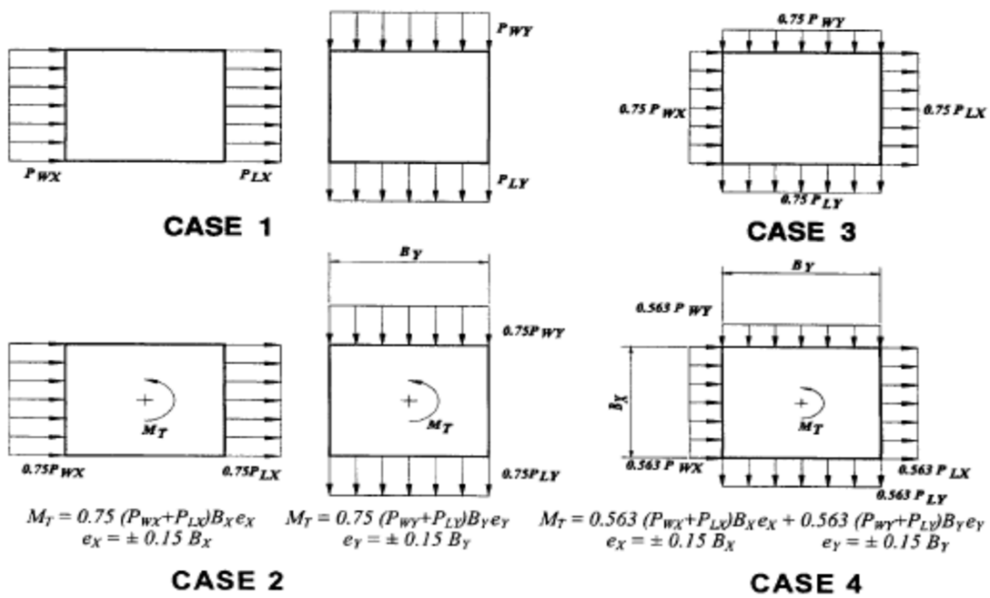
2: Calculation of G for Rigid Building

G =	0.854	= 0.925*((1+1.7*gq*Iz(bar)*Q)/(1+1.7*gv*Iz(bar))) , Eq. 26.9-6

3: Calculation of Gf for Flexible Building

β =	0.050	Damping Ratio
Ct =	0.035	Period Coefficient
T =	0.432	= Ct*h^(3/4) , sec. (Approximate fundamental period)
f =	2.316	= 1/T , Hz. (Natural Frequency)
V(fps) =	N.A.	= V(mph)*(88/60) , ft./sec.
V(bar,zbar) =	N.A.	= b(bar)*(z(bar)/33)^(α(bar))*V*(88/60) , ft./sec. , Eq. 26.9-16
N1 =	N.A.	= f*Lz(bar)/(V(bar,zbar)) , Eq. 26.9-14
Rn =	N.A.	= 7.47*N1/(1+10.3*N1)^(5/3) , Eq. 26.9-13
ηh =	N.A.	= 4.6*f*h/(V(bar,zbar))
Rh =	N.A.	= (1/ηh)-1/(2*ηh^2)*(1-e^(-2*ηh)) for ηh>0, or = 1 for ηh=0 ,Eq. 26.9-15a, b
ηb =	N.A.	= 4.6*f*B/(V(bar,zbar))
RB =	N.A.	= (1/ηb)-1/(2*ηb^2)*(1-e^(-2*ηb)) for ηb>0, or = 1 for ηb=0,Eq. 26.9-15a, b
ηd =	N.A.	= 15.4*f*L/(V(bar,zbar))
RL =	N.A.	= (1/ηd)-1/(2*ηd^2)*(1-e^(-2*ηd)) for ηd>0, or = 1 for ηd=0 ,Eq. 26.9-15a, b
R =	N.A.	= ((1/β)*Rn*Rh*RB*(0.53+0.47*RL))^(1/2) , Eq. 26.9-12
Gf =	N.A.	= 0.925*(1+1.7*Iz(bar)*(gq^2*Q^2+gr^2*R^2)^(1/2))/(1+1.7*gv*Iz(bar)) , Eq. 26.9-10
Use: G =	0.850	

Figure 27.4-1 - Design Wind Load Cases of MWFRS for Buildings of All Heights



Case 1: Full design wind pressure acting on the projected area perpendicular to each principal axis of the structure, considered separately along each principal axis.

Case 2: Three quarters of the design wind pressure acting on the projected area perpendicular to each principal axis of the structure in conjunction with a torsional moment as shown, considered separately for each principal axis.

Case 3: Wind pressure as defined in Case 1, but considered to act simultaneously at 75% of the specified value.

Case 4: Wind pressure as defined in Case 2, but considered to act simultaneously at 75% of the specified value.

Notes:
1. Design wind pressures for windward (Pw) and leeward (PL) faces shall be determined in accordance with the provisions of Section 27.4.1 and 27.4.2 as applicable for buildings of all heights.
2. Above diagrams show plan views of building.
3. Notation:
   - P_{wx}, P_{wy} = Windward face pressure acting in the X, Y principal axis, respectively.
   - P_{Lx}, P_{Ly} = Leeward face pressure acting in the X, Y principal axis, respectively.
   - e (e_x, e_y) = Eccentricity for the X, Y principal axis of the structure, respectively.
   - M_T = Torsional moment per unit height acting about a vertical axis of the building.

WIND LOADING ANALYSIS - Wall Components and Cladding

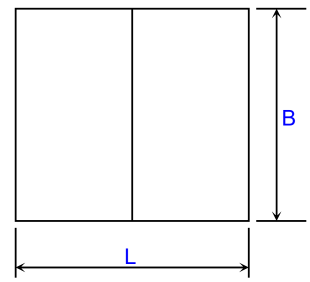
Per ASCE 7 Code for Buildings of Any Height

Using Part 1 & 3: Analytical Procedure (Section 30.4 & 30.6)

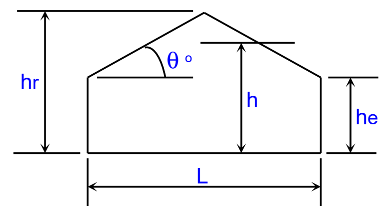
Job Name:	NLV Townhomes	Subject:	Wall C&C		
Job Number:	22066	Originator:	CRG	Checker:	JEF

Input Data:

Wind Speed, V =	115	mph (Wind Map, Figure 26.5-1A-C)
Bldg. Classification =	II	(Table 1.5-1 Risk Category)
Exposure Category =	C	(Sect. 26.7)
Ridge Height, hr =	35.00	ft. (hr >= he)
Eave Height, he =	22.00	ft. (he <= hr)
Building Width =	135.00	ft. (Normal to Building Ridge)
Building Length =	35.00	ft. (Parallel to Building Ridge)
Roof Type =	Monoslope	(Gable or Monoslope)
Topo. Factor, Kzt =	1.00	(Sect. 26.8 & Figure 26.8-1)
Direct. Factor, Kd =	0.85	(Table 26.6)
Enclosed? (Y/N)	Y	(Sect. 28.6-1 & Figure 26.11-1)
Hurricane Region?	N	
Component Name =	Wall	(Girt, Siding, Wall, or Fastener)
Effective Area, Ae =	13.3	ft.^2 (Area Tributary to C&C)



Plan



Elevation

Resulting Parameters and Coefficients:

Roof Angle, θ =	5.50	deg.
Mean Roof Ht., h =	22.00	ft. (h = he, for roof angle <=10 deg.)

Wall External Pressure Coefficients, GCp:

GCp Zone 4 Pos. =	0.88	(Fig. 30.4-1, GCp is reduced by 10% for roof angle <=10 deg.)
GCp Zone 5 Pos. =	0.88	(Fig. 30.4-1, GCp is reduced by 10% for roof angle <=10 deg.)
GCp Zone 4 Neg. =	-0.97	(Fig. 30.4-1, GCp is reduced by 10% for roof angle <=10 deg.)
GCp Zone 5 Neg. =	-1.22	(Fig. 30.4-1, GCp is reduced by 10% for roof angle <=10 deg.)

Positive & Negative Internal Pressure Coefficients, GCpi (Figure 26.11-1):

+GCpi Coef. =	0.18	(positive internal pressure)
-GCpi Coef. =	-0.18	(negative internal pressure)

If z <= 15 then: Kz = 2.01*(15/zg)^(2/α) , If z > 15 then: Kz = 2.01*(z/zg)^(2/α) (Table 30.3-1)

α =	9.50	(Table 26.9-1)
zg =	900	(Table 26.9-1)
Kh =	0.92	(Kh = Kz evaluated at z = h)

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2 (Sect. 30.3.2, Eq. 30.3-1)

qh = 26.48 psf   qh = 0.00256*Kh*Kzt*Kd*V^2 (qz evaluated at z = h)

Design Net External Wind Pressures (Sect. 30.4 & 30.6):

For h <= 60 ft.: p = qh*((GCp) - (+/-GCpi)) (psf)

For h > 60 ft.: p = q*(GCp) - qi*(+/-GCpi) (psf)

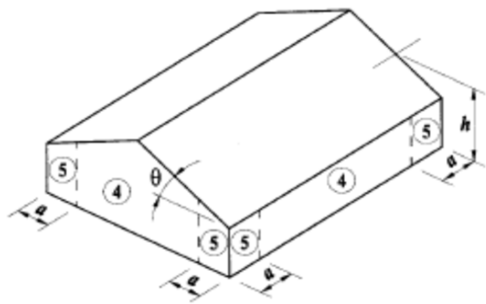
where: q = qz for windward walls, q = qh for leeward walls and side walls

qi = qh for all walls (conservatively assumed per Sect. 30.6)

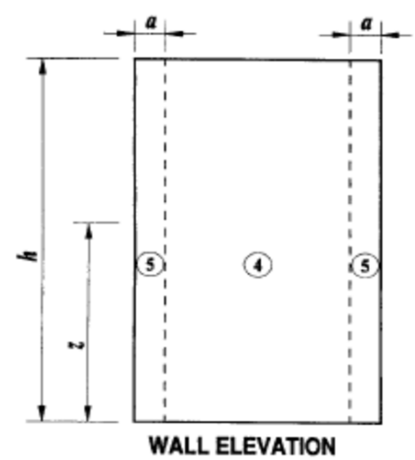
Wind Load Tabulation for Wall Components & Cladding							
Component	z	Kh	qh	p = Net Design Pressures (psf)			
	(ft.)		(psf)	Zone 4 (+)	Zone 4 (-)	Zone 5 (+)	Zone 5 (-)
Wall	0	0.92	26.48	28.08	-30.46	28.08	-37.09
	15.00	0.92	26.48	28.08	-30.46	28.08	-37.09
	20.00	0.92	26.48	28.08	-30.46	28.08	-37.09
	25.00	0.92	26.48	28.08	-30.46	28.08	-37.09
	30.00	0.92	26.48	28.08	-30.46	28.08	-37.09
For z = hr:	35.00	0.92	26.48	28.08	-30.46	28.08	-37.09
For z = he:	22.00	0.92	26.48	28.08	-30.46	28.08	-37.09
For z = h:	22.00	0.92	26.48	28.08	-30.46	28.08	-37.09

Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Width of Zone 5 (end zones), 'a' = 3.50 ft.
3. Per Code Section 30.2.2, the minimum wind load for C&C shall not be less than 16 psf.
4. References : a. ASCE 7-10, "Minimum Design Loads for Buildings and Other Structures".
b. "Guide to the Use of the Wind Load Provisions of ASCE 7-02"
by: Kishor C. Mehta and James M. Delahay (2004).

Wall Components and Cladding:



Wall Zones for Buildings with h <= 60 ft.



Wall Zones for Buildings with h > 60 ft.

WIND LOADING ANALYSIS - Roof Components and Cladding

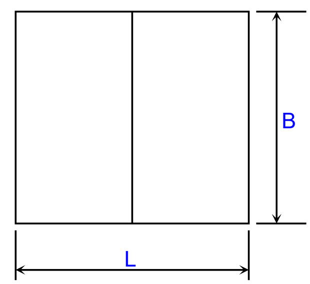
Per ASCE 7 Code for Bldgs. of Any Height with Gable Roof θ <= 45° or Monoslope Roof θ <= 3°

Using Part 1 & 3: Analytical Procedure (Section 30.4 & 30.6)

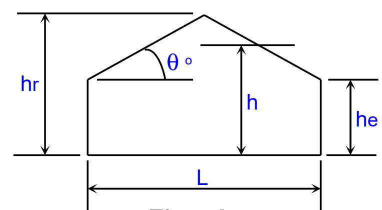
Job Name:	NLV Townhomes	Subject:	Roof C&C		
Job Number:	22066	Originator:	CRG	Checker:	JEF

Input Data:

Wind Speed, V =	115	mph (Wind Map, Figure 26.5-1A-C)
Bldg. Classification =	II	(Table 1.5-1 Risk Category)
Exposure Category =	C	(Sect. 26.7)
Ridge Height, hr =	35.00	ft. (hr >= he)
Eave Height, he =	22.00	ft. (he <= hr)
Building Width =	135.00	ft. (Normal to Building Ridge)
Building Length =	35.00	ft. (Parallel to Building Ridge)
Roof Type =	Gable	(Gable or Monoslope)
Topo. Factor, Kzt =	1.00	(Sect. 26.8 & Figure 26.8-1)
Direct. Factor, Kd =	0.85	(Table 26.6)
Enclosed? (Y/N)	Y	(Sect. 28.6-1 & Figure 26.11-1)
Hurricane Region?	N	
Component Name =	Joist	(Purlin, Joist, Decking, or Fastener)
Effective Area, Ae =	70	ft.^2 (Area Tributary to C&C)
Overhangs? (Y/N)	Y	(if used, overhangs on all sides)



Plan



Elevation

Resulting Parameters and Coefficients:

Roof Angle, θ =	10.90	deg.
Mean Roof Ht., h =	28.50	ft. (h = (hr+he)/2, for roof angle >10 deg.)

Roof External Pressure Coefficients, GCp:

GCp Zone 1-3 Pos. =	0.33	(Fig. 30.4-2A, 30.4-2B, and 30.4-2C)
GCp Zone 1 Neg. =	-0.82	(Fig. 30.4-2A, 30.4-2B, and 30.4-2C)
GCp Zone 2 Neg. =	-2.20	(Fig. 30.4-2A, 30.4-2B, and 30.4-2C)
GCp Zone 3 Neg. =	-2.69	(Fig. 30.4-2A, 30.4-2B, and 30.4-2C)

Positive & Negative Internal Pressure Coefficients, GCpi (Figure 26.11-1):

+GCpi Coef. =	0.18	(positive internal pressure)
-GCpi Coef. =	-0.18	(negative internal pressure)

If z <= 15 then: Kz = 2.01*(15/zg)^(2/α) , If z > 15 then: Kz = 2.01*(z/zg)^(2/α) (Table 30.3-1)

α =	9.50	(Table 26.9-1)
zg =	900	(Table 26.9-1)
Kh =	0.97	(Kh = Kz evaluated at z = h)

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2 (Sect. 30.3.2, Eq. 30.3-1)

qh = 27.96 psf qh = 0.00256*Kh*Kzt*Kd*V^2 (qz evaluated at z = h)

Design Net External Wind Pressures (Sect. 30.4 & 30.6):

For h <= 60 ft.: p = qh*((GCp) - (+/-GCpi)) (psf)

For h > 60 ft.: p = q*(GCp) - qi*(+/-GCpi) (psf)

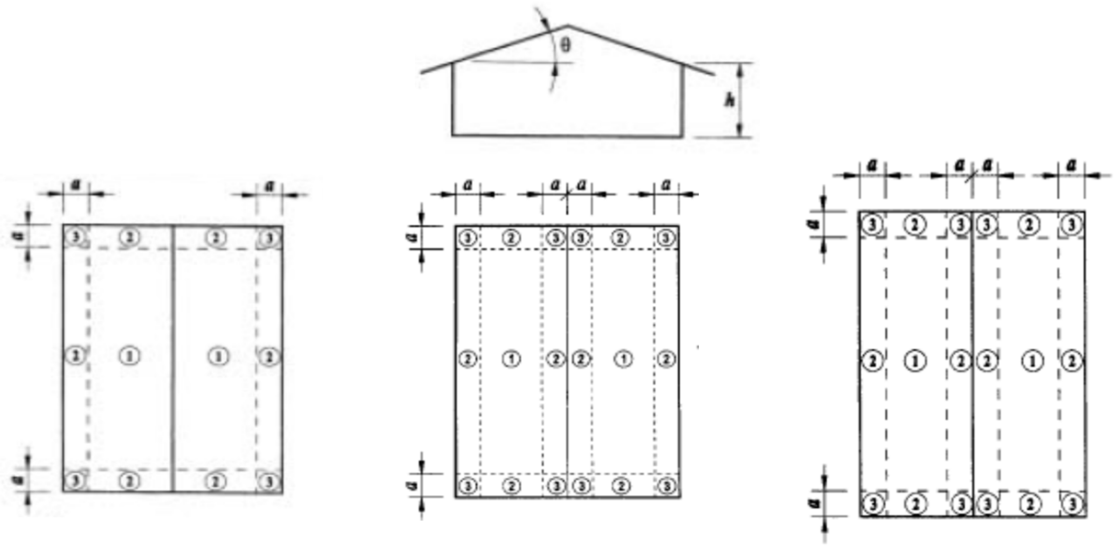
where: q = qh for roof

qi = qh for roof (conservatively assumed per Sect. 30.6)

Wind Load Tabulation for Roof Components & Cladding							
Component	z (ft.)	Kh	qh (psf)	p = Net Design Pressures (psf)			
				Zone 1,2,3 (+)	Zone 1 (-)	Zone 2 (-)	Zone 3 (-)
Joist	0	0.97	27.96	14.29	-27.84	-66.55	-80.14
	15.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
	20.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
	25.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
	30.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
For z = hr:	35.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
For z = he:	22.00	0.97	27.96	14.29	-27.84	-66.55	-80.14
For z = h:	28.50	0.97	27.96	14.29	-27.84	-66.55	-80.14

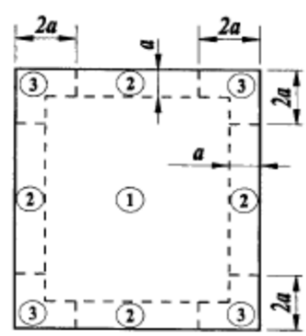
Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Width of Zone 2 (edge), 'a' = 3.50 ft.
3. Width of Zone 3 (corner), 'a' = 3.50 ft.
4. For monoslope roofs with θ <= 3 degrees, use Fig. 30.4-2A for 'GCp' values with 'qh'.
5. For buildings with h > 60' and θ > 10 degrees, use Fig. 30.6-1 for 'GCpi' values with 'qh'.
6. For all buildings with overhangs, use Fig. 30.4-2B for 'GCp' values per Sect. 30.10.
7. If a parapet >= 3' in height is provided around perimeter of roof with θ <= 10 degrees, Zone 3 shall be treated as Zone 2.
8. Per Code Section 30.2.2, the minimum wind load for C&C shall not be less than 16 psf.
9. References : a. ASCE 7-02, "Minimum Design Loads for Buildings and Other Structures".
b. "Guide to the Use of the Wind Load Provisions of ASCE 7-02" by: Kishor C. Mehta and James M. Delahay (2004).

Roof Components and Cladding:



θ <= 7 deg. 7 deg. < θ <= 27 deg. 27 deg. < θ <= 45 deg.

Roof Zones for Buildings with h <= 60 ft.
(for Gable Roofs <= 45° and Monoslope Roofs <= 3°)



ROOF PLAN

Roof Zones for Buildings with h > 60 ft.
(for Gable Roofs <= 10° and Monoslope Roofs <= 3°)

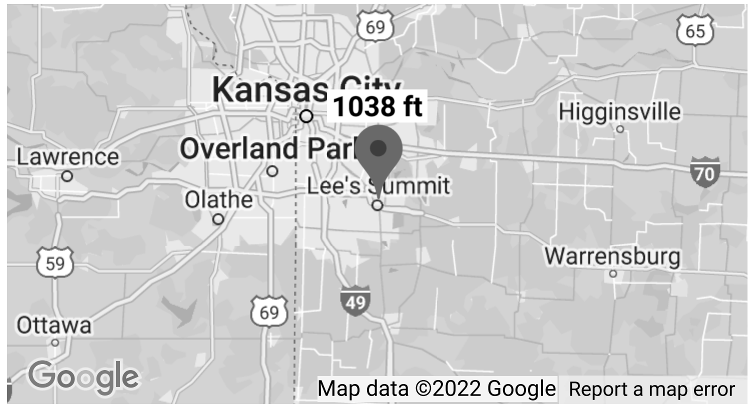
This is a beta release of the new ATC Hazards by Location website. Please contact us with feedback.

The ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

ATC Hazards by Location

Search Information

Address:	Lee's Summit, MO, USA
Coordinates:	38.9108408, -94.3821724
Elevation:	1038 ft
Timestamp:	2022-08-05T13:52:20.611Z
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

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.

Please note that the ATC Hazards by Location website will not be updated to support ASCE 7-22. Find out why.

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.

While the information presented on this website is believed to be correct, ATC and its sponsors and contributors assume no responsibility

SEISMIC BASE SHEAR AND VERTICAL SHEAR DISTRIBUTION

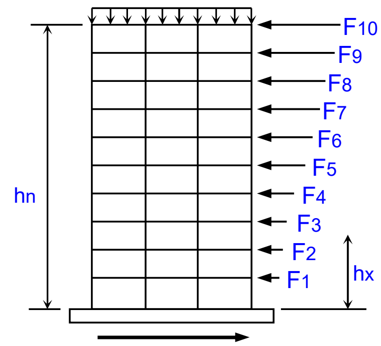
Per IBC and ASCE 7 Specifications

Using Equivalent Lateral Force Procedure for Regular Multi-Level Building/Structural Systems

Job Name:	NLV Townhomes	Subject:	Seismic Calcs		
Job Number:	22066	Originator:	CRG	Checker:	JEF

Input Data:

Risk Category =	II	IBC, Table 1604.5, page 336
Importance Factor, I =	1.00	ASCE 7 Table 1.5-2, page 5
Soil Site Class =	D	ASCE 7 Table 20.3-1, page 204
Location Zip Code =		(not required)
Spectral Accel., S_S =	0.100	ASCE 7 Figures 22-1 to 22-11
Spectral Accel., S_1 =	0.068	ASCE 7 Figures 22-1 to 22-11
Long. Trans. Period, T_L =	12.000	sec. ASCE 7 Fig's. 22-12 to 22-18
Structure Height, h_n =	41.000	ft.
Actual Calc. Period, T_c =		sec. from independent analysis
Seismic Resist. System =	A15	Light-framed walls sheathed with wood structural panels rated for shear or steel sheets (ASCE 7 Table 12.2-1)



V = Cs*W = Σ(Fi) = 4.72 kips

Seismic Base Shear

(Regular Bldg. Configurations Only)

Structure Weight Distribution:

No. of Seismic Levels = 3

Seismic Level x	Height, hx (ft.)	Weight, Wx (kips)
3	34.000	95.80
2	24.000	95.80
1	11.500	95.80

Total Weight, W = ΣW_x = 287.40 kips (ASCE 7 Section 12.7.2)

Results:

Site Coefficients:

F_a =	1.600	ASCE 7 Table 11.4-1, page 66
F_v =	2.400	ASCE Table 11.4-2, page 66

Maximum Spectral Response Accelerations for Short and 1-Second Periods:

S_{MS} =	0.160	$S_{MS} = F_a*S_S$, ASCE Eqn. 11.4-1, page 65
S_{M1} =	0.163	$S_{M1} = F_v*S_1$, ASCE Eqn. 11.4-2, page 65

Design Spectral Response Accelerations for Short and 1-Second Periods :

S_{DS} =	0.107	$S_{DS} = 2*S_{MS}/3$, ASCE 7 Eqn. 11.4-3, page 65
S_{D1} =	0.109	$S_{D1} = 2*S_{M1}/3$, ASCE Eqn. 11.4-4, page 65

(continued:)

Seismic Design Category:

Category(for S_{DS}) =	A	ASCE 7 Table 11.6-1, page 67
Category(for S_{D1}) =	B	ASCE 7 Table 11.6-2, page 67
Use Category =	B	Most critical of either category case above controls

Fundamental Period:

Period Coefficient, C_T =	0.020	ASCE 7 Table 12.8-2, page 90
Period Exponent, x =	0.75	ASCE 7 Table 12.8-2, page 90
Approx. Period, T_a =	0.324	sec., $T_a = C_T*h_n$^(x), ASCE 7 Section 12.8.2.1, Eqn. 12.8-7
Upper Limit Coef., C_u =	1.682	ASCE 7 Table 12.8-1, page 90
Period max., $T_{(max)}$ =	0.545	sec., $T_{(max)} = C_u*T_a$, ASCE 7 Section 12.8.2, page 90
Fundamental Period, T =	0.324	sec., T = Ta <= Cu*Ta, ASCE 7 Section 12.8.2, page 90

Seismic Design Coefficients and Factors:

Response Mod. Coef., R =	6.5	ASCE 7 Table 12.2-1, pages 73-75
Overstrength Factor, Ω_o =	3	ASCE 7 Table 12.2-1, pages 73-75
Defl. Amplif. Factor, C_d =	4	ASCE 7 Table 12.2-1, pages 73-75
C_S =	0.016	$C_S = S_{DS}/(R/I)$, ASCE 7 Section 12.8.1.1, Eqn. 12.8-2
$C_{S(max)}$ =	0.052	For T<=TL, CS(max) = SD1/(T*(R/I)), ASCE 7 Eqn. 12.8-3
$C_{S(min)}$ =	0.010	CS(min) = 0.044*SDS*I >= 0.01, ASCE 7 Eqn. 12.8-5
Use: C_S =	0.016	$C_{S(min)} <= C_S <= C_{S(max)}$

Seismic Base Shear:

V = 4.72 kips, V = C_S*W, ASCE 7 Section 12.8.1, Eqn. 12.8-1

Seismic Shear Vertical Distribution:

Distribution Exponent, k = 1.00 k = 1 for T<=0.5 sec., k = 2 for T>=2.5 sec.
k = (2-1)*(T-0.5)/(2.5-0.5)+1, for 0.5 sec. < T < 2.5 sec.

Lateral Force at Any Level: $F_x = C_{vx}$*V, ASCE 7 Section 12.8.3, Eqn. 12.8-11, page 91

Vertical Distribution Factor: $C_{vx} = W_x*h_x$^k/(ΣW_i*h_i^k), ASCE 7 Eqn. 12.8-12, page 91

Seismic Level x	Weight, Wx (kips)	h_x^k (ft.)	W_x*h^k (ft-kips)	C_{vx} (%)	Shear, F_x (kips)	Σ Story Shears
3	95.80	34.000	3257.2	0.489	2.31	2.31
2	95.80	24.000	2299.2	0.345	1.63	3.94
1	95.80	11.500	1101.7	0.165	0.78	4.72
Σ =	287.40		6658.1	1.000	4.72	

Comments:

ATC Hazards by Location

Search Information

Address: Lee's Summit, MO, USA

Coordinates: 38.9108408, -94.3821724

Elevation: 1038 ft

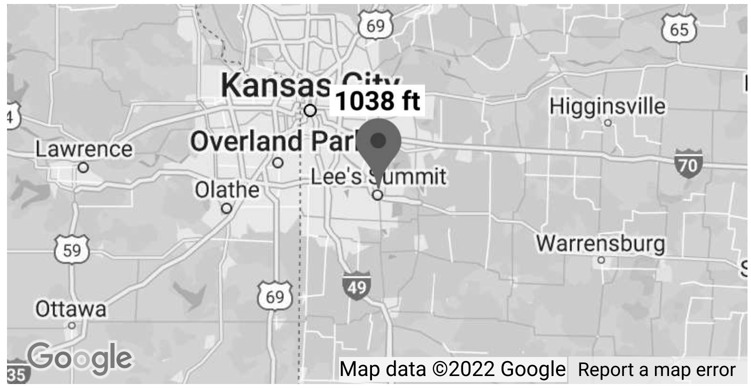
Timestamp: 2022-08-05T13:55:10.500Z

Hazard Type: Seismic

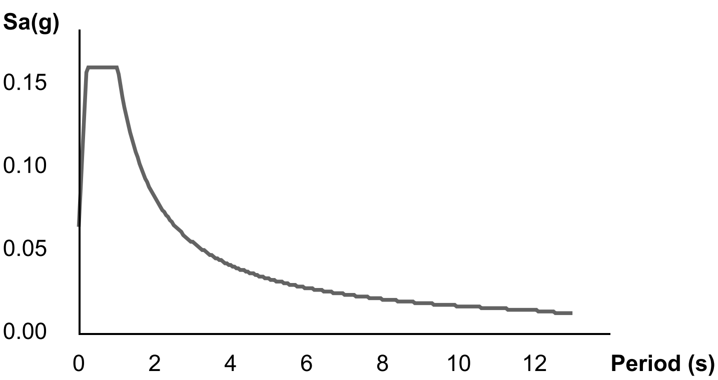
Reference Document: ASCE7-16

Risk Category: II

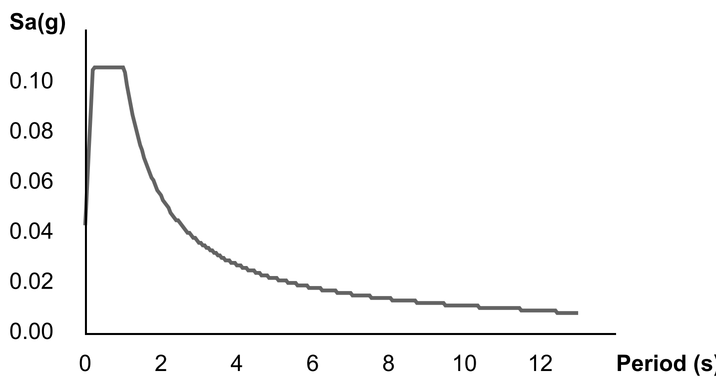
Site Class: D-default



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)

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Disclaimer

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

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REPRESENTATIVE FOUNDATION DESIGN

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

Project: NLV Townhomes
Project No: 22066

Engineer: CRG
Date: 12/12/2022

Checked by: JEF
Date: 12/12/2022

Square Spread Footing Design

f'c: 4 ksi
fy: 60 ksi

wcol: 30 in
Rebar Clr: 3 in

LRFD Factor: 1.6
Allowable Bearing, qa: 2.5 ksf
Ultimate Bearing, qu: 4 ksf

Bar Areas

3	0.11
4	0.2
5	0.31
6	0.44
7	0.6
8	0.79
9	1

ϕ-v: 0.75
ϕ-f: 0.9

Footings in Lower Section Are Deepened For Uplift
Footings in Lower Section assume reinforcement in top and bottom, so the min temp and shrinkage reinforcement on one side meets .0009

v-beam: 94.9 psi <<Allowable Beam Shear Stress
v-punch: 189.7 psi <<Allowable Punching Shear Stress

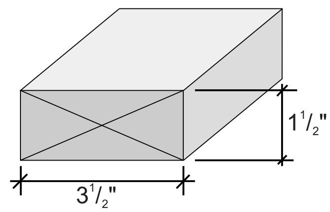
Width	Thickness	Depth	Reaction	BEAM SHEAR		PUNCHING SHEAR		LRFD Moment	Beam Min	Temp. & Shrinkage	Rebar Size 4	5	Footing Weight
											0.20	0.31	
b (ft):	h (in):	d (in):	**P-allow:**	σact	Unity	σact	Unity	Mu (kft)	As reqd	As reqd	num reqd		kips
12.5	36	33	**390.63**	22.7	0.24	61.9	0.33	625.000	5.655	9.720	49	32	70.31
3	10	7	**22.50**	0.0	0.00	0.0	0.00	0.375	0.016	0.648	4	3	1.13
3.5	10	7	**30.63**	0.0	0.00	10.6	0.06	1.750	0.074	0.756	4	3	1.53
4	12	9	**40.00**	0.0	0.00	15.5	0.08	4.500	0.148	1.037	6	4	2.40
4.5	12	9	**50.63**	9.3	0.10	27.6	0.15	9.000	0.298	1.166	6	4	3.04
5	12	9	**62.50**	18.5	0.20	41.1	0.22	15.625	0.518	1.296	7	5	3.75
6	14	11	**90.00**	25.3	0.27	53.9	0.28	36.750	0.998	1.814	10	6	6.30
7	16	13	**122.50**	29.9	0.32	64.7	0.34	70.875	1.632	2.419	13	8	9.80

2.5	30	27	**15.63**	0.0	0.00	0.0	0.00	0.000	0.000	0.810	5	3	2.34
3	30	27	**22.50**	0.0	0.00	0.0	0.00	0.375	0.004	0.972	5	4	3.38
3.5	30	27	**30.63**	0.0	0.00	0.0	0.00	1.750	0.019	1.134	6	4	4.59
4	30	27	**40.00**	0.0	0.00	0.0	0.00	4.500	0.049	1.296	7	5	6.00
4.5	30	27	**50.63**	0.0	0.00	0.0	0.00	9.000	0.099	1.458	8	5	7.59
5	30	27	**62.50**	0.0	0.00	1.6	0.01	15.625	0.172	1.620	9	6	9.38
6	30	27	**90.00**	0.0	0.00	8.7	0.05	36.750	0.404	1.944	10	7	13.50
7	30	27	**122.50**	0.0	0.00	17.2	0.09	70.875	0.780	2.268	12	8	18.38

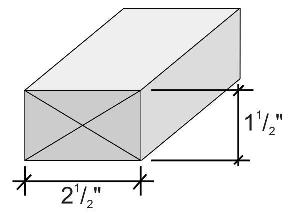
GENERAL FRAMING

These allowable spans are based on NDS 91. Maximum deflection is limited by L/360 or L/480[1] under live load. Basic Lumber Design Values are $F_{(b)}$=2000 psi $F_{(t)}$=1100 psi $F_{(c)}$=2000 psi E=1,800,000 psi Duration Of Load = 1.00. Spacing of trusses are center to center (in inches). Top Chord Dead Load = 10 psf. Bottom Chord Dead Load = 5 psf. Center Line Chase = 24" max. Trusses must be designed for any special loading, such as concentrated loads. Other floor and roof loading conditions, a variety of species and other lumber grades are available.

4x2 Lumber



3x2 Lumber



40 PSF Live Load / 55 PSF Total Load

Center Spacing	Deflection Limit	4x2 Truss Depth 12"	14"	16"	18"	20"	22"	3x2 Truss Depth 12"	14"	16"	18"	20"	22"
16" o.c.	L/360	22'2"	24'11"	26'10"	28'8"	30'4"	31'11"	19'0"	20'9"	22'4"	23'10"	25'3"	26'7"
	L/480	20'2"	22'7"	24'11"	27'2"	29'4"	31'5"	18'0"	20'2"	22"4'	23'10"	25'3"	26'7"
19.2" o.c.	L/360	20'9"	22'8"	24'4"	26'0"	27'6"	29'0"	17'3"	18'9"	20'3"	21'7"	22'10"	24'1"
	L/480	18'11"	21'3"	23'6"	25'7"	27'6"	29'0"	16'11"	18'9"	20'3"	21'7"	22'10"	24'1"
24" o.c.	L/360	18'5"	20'1"	21'7"	23'1"	24'5"	25'9"	15'2"	16'7"	17'10"	19'1"	20'2"	21'3"
	L/480	17'7"	19'9"	21'7"	23'1"	24'5"	25'9"	15'2"	16'7"	17'10"	19'1"	20'2"	21'3"

60 PSF Live Load / 75 PSF Total Load

Center Spacing	Deflection Limit	4x2 12"	14"	16"	18"	20"	22"	3x2 12"	14"	16"	18"	20"	22"
16" o.c.	L/360	19'4"	21'4"	23'0"	24'6"	26'0"	27'4"	16'3"	17'9"	19'2"	20'5"	21'8"	22'9"
	L/480	17'7"	19'9"	21'10"	23'9"	25'8"	27'4"	15'9"	17'8"	19'2"	20'5"	21'8"	22'9"
19.2" o.c.	L/360	17'9"	19'4"	20'10"	22'3"	23'7"	24'10"	14'9"	16'1"	17'4"	18'6"	19'7"	20'7"
	L/480	16'7"	18'7"	20'6"	22'3"	23'7"	24'10"	14'9"	16'1"	17'4"	18'6"	19'7"	20'7"
24" o.c.	L/360	15'9"	17'2"	18'6"	19'9"	20'11"	22'0"	13'0"	14'2"	15'3"	16'4"	17'3"	18'2"
	L/480	15'4"	17'2"	18'6"	19'9"	20'11"	22'0"	13'0"	14'2"	15'3"	16'4"	17'3"	18'2"

85 PSF Live Load / 100 PSF Total Load

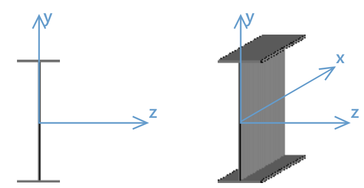
Center Spacing	Deflection Limit	4x2 12"	14"	16"	18"	20"	22"	3x2 12"	14"	16"	18"	20"	22"
16" o.c.	L/360	16'11"	18'6"	19'11"	21'3"	22'6"	23'8"	14'1"	15'5"	16'7"	17'8"	18'9"	19'9"
	L/480	15'8"	17'7"	19'5"	21'2"	22'6"	23'8"	14'0"	15'5"	16'7"	17'8"	18'9"	19'9"
19.2" o.c.	L/360	15'4"	16'9"	18'1"	19'3"	20'5"	21'6"	12'9"	13'11"	15'0"	16'0"	16'11"	17'10"
	L/480	14'9"	16'6"	18'1"	19'3"	20'5"	21'6"	12'9"	13'11"	15'0"	16'0"	16'11"	17'10"
24" o.c.	L/360	13'8"	14'10"	16'0"	17'1"	18'1"	19'1"	11'3"	12'3"	13'3"	14'1"	14'11"	15'9"
	L/480	13'8"	14'10"	16'0"	17'1"	18'1"	19'1"	11'3"	12'3"	13'3"	14'1"	14'11"	15'9"

(1) Vibration Control -- Research by Virginia Tech indicates that L/480 live load deflection criteria provides a high degree of resistance to floor vibration (bounce). The building designer desiring this benefit may choose to specify an L/480 live load deflection criteria to be used for the floor trusses.

REPRESENTATIVE STEEL BEAM DESIGN

Detail Report: M1

Load Combination: Envelope **Code check:** 0.269 (LC 3)



Input Data

Shape:	W16X26	**I Node:**	N3
Member Type:	Beam	**J Node:**	N4
Length (ft):	23	**I Release:**	BenPIN
Material Type:	Hot Rolled Steel	**J Release:**	BenPIN
Design Rule:	Typical	**I Offset:**	N/A
Internal Sections:	97	**J Offset:**	N/A
Design Code:	AISC 15th (360-16): ASD	**T/C Only:**	Both Way

Material Properties

Material:	A992	**Therm. Coeff. (/1E5 F):**	0.65	**F_u (ksi):**	65
E (ksi):	29000	**Density (k/ft^3):**	0.49	**R_t:**	1.1
G (ksi):	11154	**F_y (ksi):**	50		
Nu:	0.3	**R_y:**	1.1		

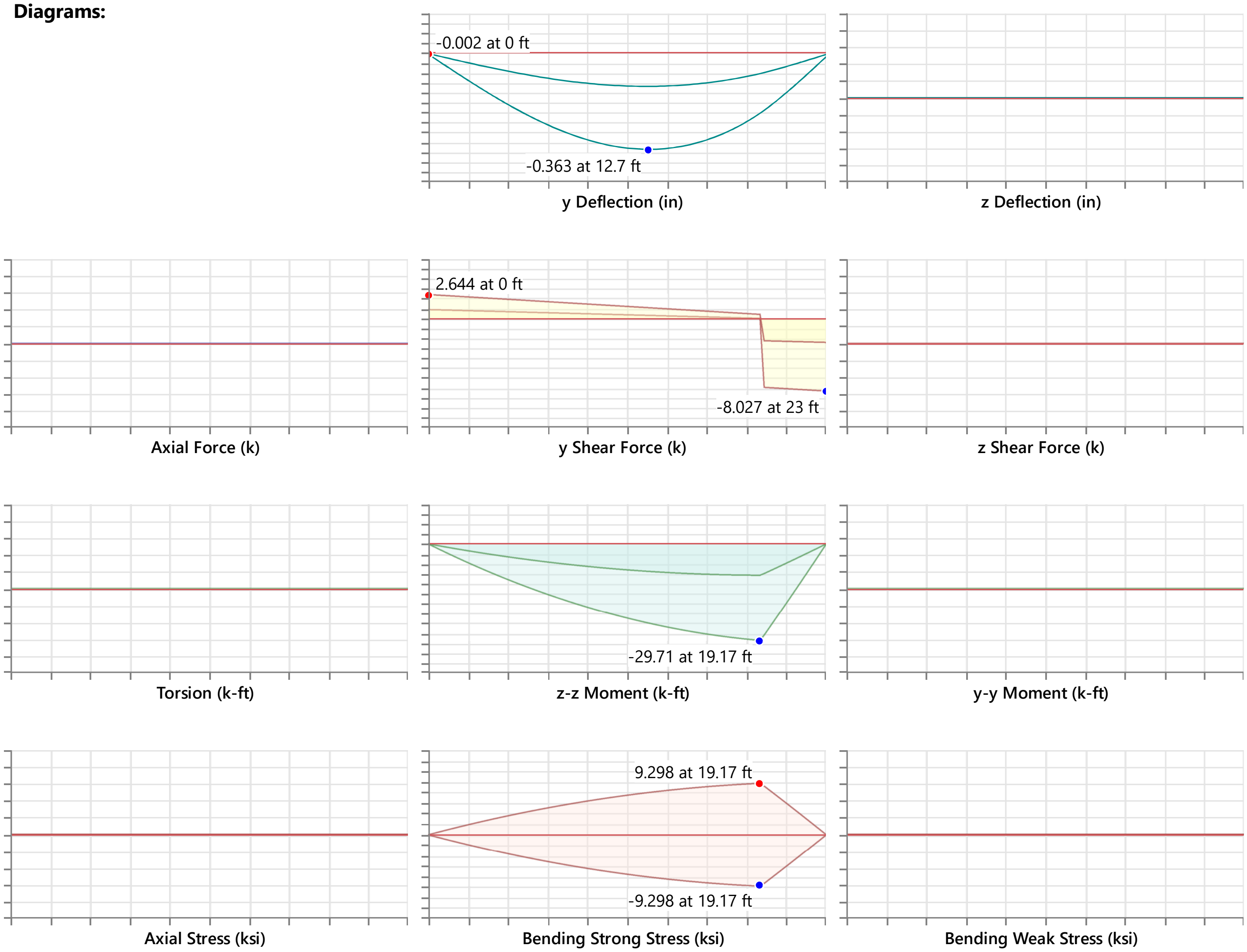
Shape Properties

d (in):	15.7	**Area (in^2):**	7.68	**r_T (in):**	1.36
b_f (in):	5.5	**Z_{yy} (in^3):**	5.48	**J (in^4):**	0.262
t_f (in):	0.345	**Z_{zz} (in^3):**	44.2	**k_{det} (in):**	1.062
t_w (in):	0.25	**C_w (in^6):**	565	**k_{des} (in):**	0.747
I_{yy} (in^4):	9.59	**W_{no} (in^2):**	21.1		
I_{zz} (in^4):	301	**S_w (in^4):**	10		

Design Properties

$L_{b\ y\text{-}y}$ (ft):	2	**$K_{y\text{-}y}$:**	1	**Seismic DR:**	None
$L_{b\ z\text{-}z}$ (ft):	23	**$K_{z\text{-}z}$:**	1	**Max Defl Ratio:**	L/1032
$L_{comp\ top}$:	Lbyy	**y sway:**	No	**Max Defl Location:**	10.781
$L_{comp\ bot}$ (ft):	23	**z sway:**	No	**Span:**	1
L_{torque} (ft):	23	**Function:**	Lateral	**τ_b:**	1

Diagrams:



AISC 15th (360-16): ASD Code Check

Limit State	Gov. LC	Required	Available	Unity Check	Result
Applied Loading - Bending/Axial	3	-	-	**-**	**-**
Applied Loading - Shear + Torsion	3	-	-	**-**	**-**
Axial Tension Analysis	3	0 k	229.94 k	**-**	**-**
Axial Compression Analysis	3	0 k	65.515 k	**-**	**-**
Flexural Analysis (Strong Axis)	3	29.71 k-ft	110.279 k-ft	**-**	**-**
Flexural Analysis (Weak Axis)	3	0 k-ft	13.673 k-ft	**-**	**-**
Shear Analysis (Major Axis y)	3	8.027 k	70.509 k	**0.114**	**PASS**
Shear Analysis (Minor Axis z)	3	0 k	68.174 k	**0**	**PASS**
Bending & Axial Interaction Check (UC Bending Max)	3	-	-	**0.269**	**PASS**

WOOD DESIGN

BLDG 1 - 2nd Flr			
Member Name	Results	Current Solution	Comments
Deck Beam Cant	Passed	2 piece(s) 2 x 12 SPF No.1/No.2	
Deck Beam End	Passed	3 piece(s) 2 x 12 SPF No.1/No.2	
Porch Beam	Passed	2 piece(s) 2 x 8 SPF No.1/No.2	
Wall: Stud	Passed	1 piece(s) 2 x 6 SPF No.1/No.2 @ 16" OC	
B3			
Member Name	Results	Current Solution	Comments
GARAGE BREEZEWAY	Passed	2 piece(s) 2 x 10 SPF No.1/No.2	
BLDG 1 - 3rd Flr			
Member Name	Results	Current Solution	Comments
Stair Beam 1	Passed	2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL	
Stair North Bm	Passed	2 piece(s) 1 3/4" x 18" 2.0E Microllam® LVL	

ForteWEB Software Operator	Job Notes
Cody Gibbens Stand Structural Engineering (785) 534-0641 cgibbens@stand-sei.com	

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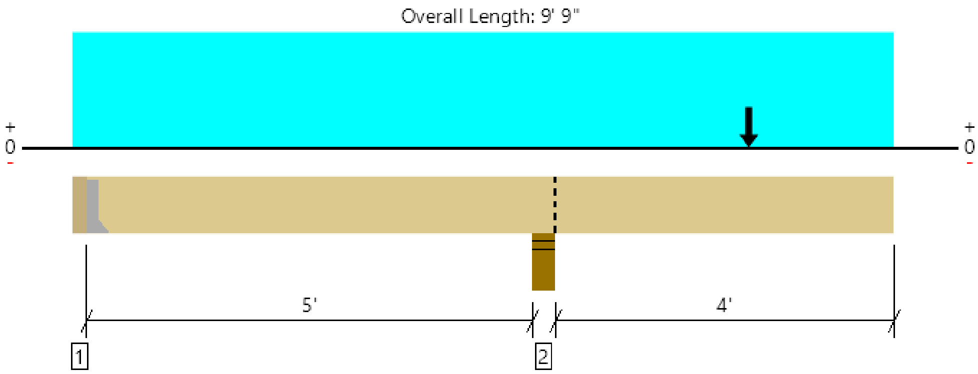
12/12/2022 1:56:58 PM UTC
ForteWEB v3.4
File Name: 22066 NLV Townhomes

BLDG 1 - 2nd Flr, Deck Beam Cant
2 piece(s) 2 x 12 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)	2826 @ 5' 6 1/4"	7013 (5.50")	Passed (40%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1688 @ 6' 8 1/4"	3038	Passed (56%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	-4297 @ 5' 6 1/4"	4614	Passed (93%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.127 @ 9' 9"	0.282	Passed (2L/798)	--	1.0 D + 1.0 L (Alt Spans)
Total Load Defl. (in)	0.171 @ 9' 9"	0.423	Passed (2L/592)	--	1.0 D + 1.0 L (Alt 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/240).
- Right cantilever length exceeds 1/3 member length or 1/2 back span length. Additional bracing should be considered.
- Allowed moment does not reflect the adjustment for the beam stability factor.
- -738 lbs uplift at support located at 3 1/2". Strapping or other restraint may be required.
- Applicable calculations are based on NDS.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Hanger on 11 1/4" DF beam	3.50"	Hanger[1]	1.50"	-153	174/-585	21/-738	See note [1]
2 - Stud wall - DF	5.50"	5.50"	2.22"	757	2068	2826	Blocking

- Blocking Panels are assumed to carry no loads applied directly above them and the full load is applied to the member being designed.
- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 6" o/c	
Bottom Edge (Lu)	5' 9" o/c	

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie

Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS28-2	2.00"	N/A	6-16d	4-16d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Floor Live (1.00)	Comments
0 - Self Weight (PLF)	3 1/2" to 9' 9"	N/A	8.6	--	
1 - Uniform (PSF)	0 to 9' 9" (Front)	1'	15.0	60.0	Default Load
2 - Point (lb)	8' (Front)	N/A	377	1055	Linked from: Deck Beam End, Support 1

ForteWEB Software Operator	Job Notes
Cody Gibbens Stand Structural Engineering (785) 534-0641 cgibbens@stand-sei.com	

New Longview Townhomes

Structural Calcs by Stand-SEI
Proj. #22066

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DEC. 2022

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ForteWEB v3.4, Engine: V8.2.2.122, Data: V8.1.3.0
File Name: 22066 NLV Townhomes

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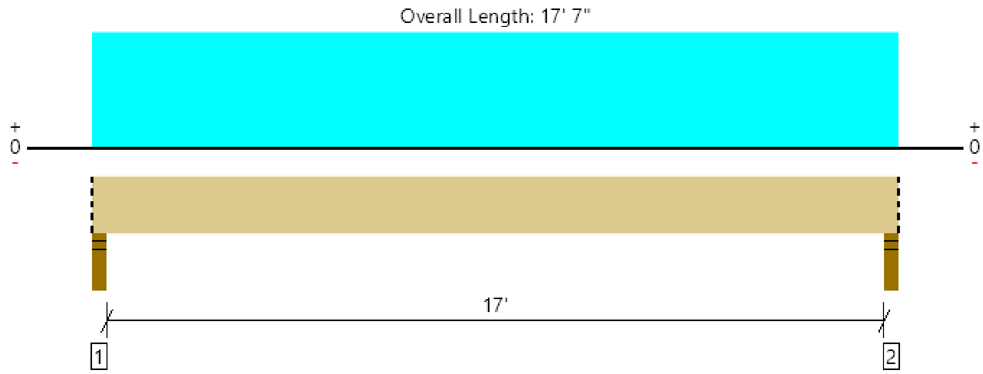
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

BLDG 1 - 2nd Flr, Deck Beam End

3 piece(s) 2 x 12 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)	1432 @ 2"	6694 (3.50")	Passed (21%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1231 @ 1' 2 3/4"	4556	Passed (27%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	6056 @ 8' 9 1/2"	6921	Passed (88%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.320 @ 8' 9 1/2"	0.575	Passed (L/647)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.434 @ 8' 9 1/2"	0.863	Passed (L/477)	--	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/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	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	377	1055	1432	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	377	1055	1432	Blocking

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

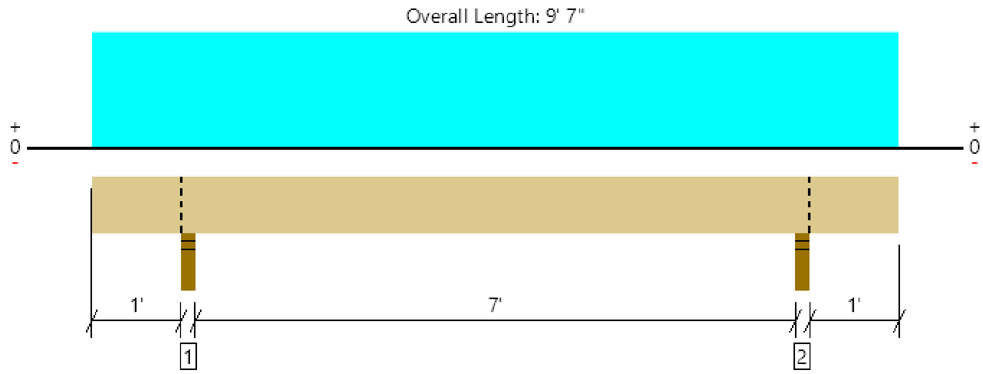
Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	10' 10" o/c	
Bottom Edge (Lu)	17' 7" o/c	

- 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 17' 7"	N/A	12.8	--	
1 - Uniform (PSF)	0 to 17' 7" (Front)	2'	15.0	60.0	Default Load

Weyerhaeuser Notes

BLDG 1 - 2nd Flr, Porch Beam
2 piece(s) 2 x 8 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)	539 @ 1' 1 3/4"	4463 (3.50")	Passed (12%)	--	1.0 D + 1.0 Lr (Adj Spans)
Shear (lbs)	327 @ 1' 10 3/4"	2447	Passed (13%)	1.25	1.0 D + 1.0 Lr (Adj Spans)
Moment (Ft-lbs)	690 @ 4' 9 1/2"	2875	Passed (24%)	1.25	1.0 D + 1.0 Lr (Alt Spans)
Live Load Defl. (in)	0.027 @ 4' 9 1/2"	0.243	Passed (L/999+)	--	1.0 D + 1.0 Lr (Alt Spans)
Total Load Defl. (in)	0.049 @ 4' 9 1/2"	0.365	Passed (L/999+)	--	1.0 D + 1.0 Lr (Alt 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).
- Overhang deflection criteria: LL (2L/360) and TL (2L/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	Roof Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	249	290	539	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	249	290	539	Blocking

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

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	9' 7" o/c	
Bottom Edge (Lu)	9' 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)	Comments
0 - Self Weight (PLF)	0 to 9' 7"	N/A	5.5	--	
1 - Uniform (PSF)	0 to 9' 7" (Front)	3'	15.5	20.0	Default Load

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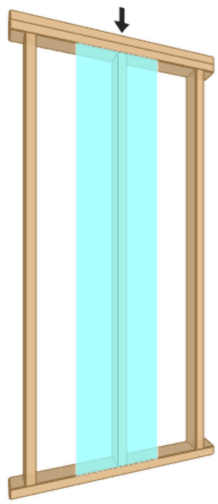
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Cody Gibbens Stand Structural Engineering (785) 534-0641 cgibbens@stand-sei.com	

BLDG 1 - 2nd Flr, Wall: Stud
1 piece(s) 2 x 6 SPF No.1/No.2 @ 16" OC

Wall Height: 14' 6" | Member Height: 14' 1 1/2" | O. C. Spacing: 16.00"



Drawing is Conceptual

Design Results	Actual	Allowed	Result	LDF	Load: Combination
Slenderness	31	50	Passed (62%)	--	--
Compression (lbs)	1440	3330	Passed (43%)	1.00	1.0 D + 1.0 L
Plate Bearing (lbs)	1440	4383	Passed (33%)	--	1.0 D + 1.0 L
Lateral Reaction (lbs)	133	--	--	1.60	1.0 D + 0.6 W
Lateral Shear (lbs)	124	1188	Passed (10%)	1.60	1.0 D + 0.6 W
Lateral Moment (ft-lbs)	469 @ mid-span	1302	Passed (36%)	1.60	1.0 D + 0.6 W
Total Deflection (in)	0.43 @ mid-span	1.41	Passed (L/392)	--	1.0 D + 0.6 W
Bending/Compression	0.64	1	Passed (64%)	1.60	1.0 D + 0.45 W + 0.75 L + 0.75 Lr

- Lateral deflection criteria: Wind (L/120)
- Input axial load eccentricity for this design is 16.67% of applicable member side dimension.
- Applicable calculations are based on NDS.
- A bearing area factor of 1.25 has been applied to base plate bearing capacity.
- 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'	

Lateral Connections				
Supports	Connector	Type/Model	Quantity	Connector Nailing
Top	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A
Base	Nails	8d (0.113" x 2 1/2") (Toe)	2	N/A

- Nailed connection at the top of the member is assumed to be nailed through the bottom 2x plate prior to placement of the top 2x of the double top plate assembly.

Vertical Load	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Point (lb)	N/A	480	960	Default Load

Lateral Load	Location	Spacing	Wind (1.60)	Comments
1 - Uniform (PSF)	Full Length	16.00"	23.5	

- ASCE/SEI 7 Sec. 30.4: Exposure Category (B), Mean Roof Height (33'), Topographic Factor (1.0), Wind Directionality Factor (0.85), Basic Wind Speed (115), Risk Category(II), Effective Wind Area determined using full member span and trib. width.
- IBC Table 1604.3, footnote f: Deflection checks are performed using 42% of this lateral wind load.

Weyerhaeuser Notes

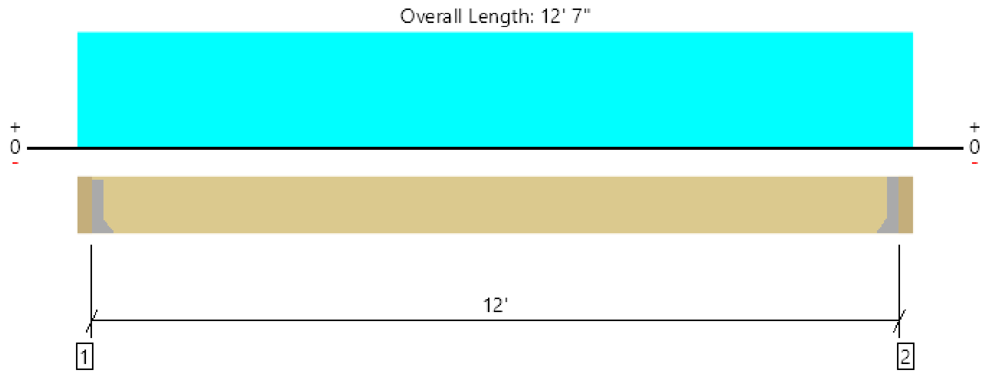
FORTEWEB

MEMBER REPORT

PASSED

B3, GARAGE BREEZEWAY

2 piece(s) 2 x 10 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)	602 @ 3 1/2"	1913 (1.50")	Passed (31%)	--	1.0 D + 1.0 Lr (All Spans)
Shear (lbs)	525 @ 1' 3/4"	3122	Passed (17%)	1.25	1.0 D + 1.0 Lr (All Spans)
Moment (Ft-lbs)	1807 @ 6' 3 1/2"	4289	Passed (42%)	1.25	1.0 D + 1.0 Lr (All Spans)
Live Load Defl. (in)	0.090 @ 6' 3 1/2"	0.400	Passed (L/999+)	--	1.0 D + 1.0 Lr (All Spans)
Total Load Defl. (in)	0.169 @ 6' 3 1/2"	0.600	Passed (L/852)	--	1.0 D + 1.0 Lr (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	Roof Live	Factored	
1 - Hanger on 9 1/4" SPF beam	3.50"	Hanger[1]	1.50"	294	336	629	See note [1]
2 - Hanger on 9 1/4" SPF beam	3.50"	Hanger[1]	1.50"	294	336	629	See note [1]

- At hanger supports, the Total Bearing dimension is equal to the width of the material that is supporting the hanger
- [1] See Connector grid below for additional information and/or requirements.

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

- Maximum allowable bracing intervals based on applied load.

Connector: Simpson Strong-Tie						
Support	Model	Seat Length	Top Fasteners	Face Fasteners	Member Fasteners	Accessories
1 - Face Mount Hanger	LUS28-2	2.00"	N/A	6-10dx1.5	3-10d	
2 - Face Mount Hanger	LUS28-2	2.00"	N/A	6-10dx1.5	3-10d	

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

Vertical Loads	Location (Side)	Tributary Width	Dead (0.90)	Roof Live (non-snow: 1.25)	Comments
0 - Self Weight (PLF)	3 1/2" to 12' 3 1/2"	N/A	7.0	--	
1 - Uniform (PSF)	0 to 12' 7" (Front)	2' 8"	15.0	20.0	Default Load

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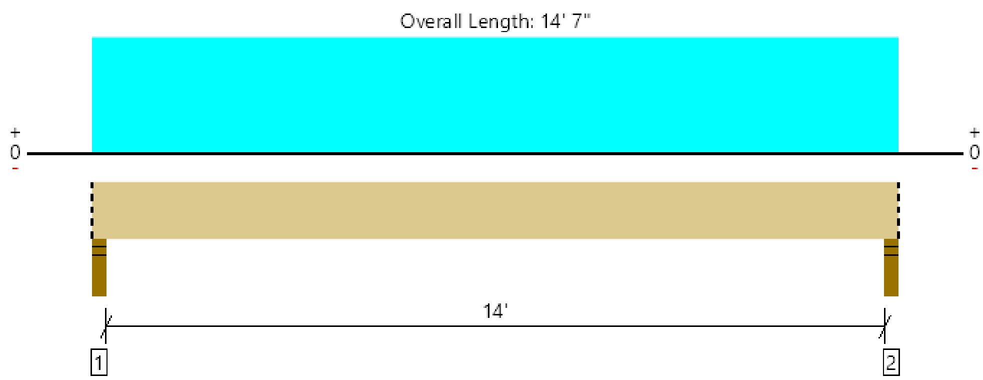
The product application, input design loads, dimensions and support information have been provided by ForteWEB Software Operator

ForteWEB Software Operator	Job Notes
Cody Gibbens Stand Structural Engineering (785) 534-0641 cgibbens@stand-sei.com	

BLDG 1 - 3rd Flr, Stair Beam 1

2 piece(s) 1 3/4" x 18" 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)	2540 @ 2"	5206 (3.50")	Passed (49%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	1916 @ 1' 9 1/2"	11970	Passed (16%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	8843 @ 7' 3 1/2"	38753	Passed (23%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.077 @ 7' 3 1/2"	0.475	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.111 @ 7' 3 1/2"	0.712	Passed (L/999+)	--	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/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.71"	790	1750	2540	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.71"	790	1750	2540	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)	14' 7" o/c	
Bottom Edge (Lu)	14' 7" 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 14' 7"	N/A	18.4	--	
1 - Uniform (PSF)	0 to 14' 7" (Front)	6'	15.0	40.0	Default Load

Weyerhaeuser Notes

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

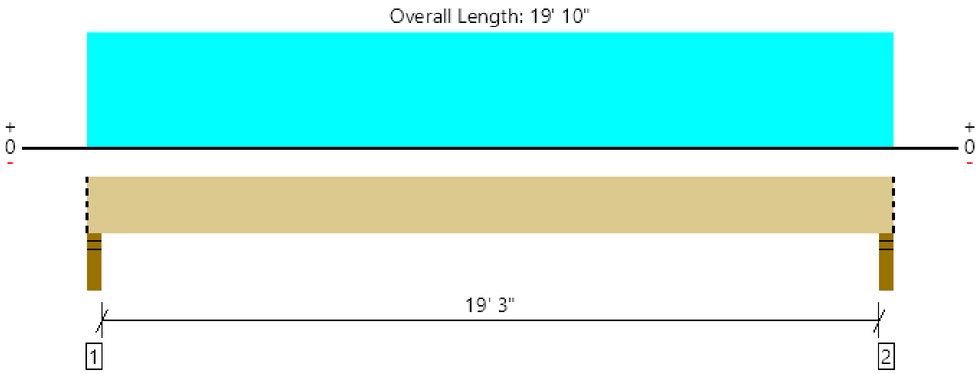
FORTEWEB

MEMBER REPORT

PASSED

BLDG 1 - 3rd Flr, Stair North Bm

2 piece(s) 1 3/4" x 18" 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)	1055 @ 2"	5206 (3.50")	Passed (20%)	--	1.0 D + 1.0 L (All Spans)
Shear (lbs)	864 @ 1' 9 1/2"	11970	Passed (7%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	5056 @ 9' 11"	38753	Passed (13%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.067 @ 9' 11"	0.650	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.111 @ 9' 11"	0.975	Passed (L/999+)	--	1.0 D + 1.0 L (All Spans)

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

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

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - SPF	3.50"	3.50"	1.50"	420	635	1055	Blocking
2 - Stud wall - SPF	3.50"	3.50"	1.50"	420	635	1055	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)	19' 10" o/c	
Bottom Edge (Lu)	19' 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 19' 10"	N/A	18.4	--	
1 - Uniform (PSF)	0 to 19' 10" (Front)	1' 7 3/16"	15.0	40.0	Default Load

Weyerhaeuser Notes

ForteWEB Software Operator	Job Notes
Cody Gibbens Stand Structural Engineering (785) 534-0641 cgibbens@stand-sei.com	