STRUCTURAL CALCULATIONS

Project

A NEW STORAGE POLE BUILDING
AT
BENTON COUNTY FAIRGROUNDS
110 SW 53rd ST
CORVALLIS, OR 97333

Client

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*

*

by

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January 17, 2024

Digitally signed by
William E. Barlow, P.E.
Date: 2024.01.17
15:21:53 -08'00'

Table of Contents

A NEW STORAGE POLE BUILDING
AT
BENTON COUNTY FAIR GROUNDS
110 SW 53rd ST
CORVALLIS, OR 97333

LATERAL FORCE RESISTING SYSTEM
DESIGN NOTES

2022 EDITION OF THE OREGON STRUCTURAL SPECIALTY CODE & ASCE 7-16

SEISMIC

EARTHQUAKE DESIGN DATA:

RISK CATEGORY	II
SEISMIC IMPORTANCE FACTOR, Ie:	1.0
MAPPED SPECTRAL RESPONSE ACCELERATIONS:	
Ss:	0.904 g
S1:	0.478 g
SITE CLASS:	D
DESIGN SPECTRAL RESPONSE COEFFICIENTS:	
SDS:	0.686 g
SD1:	0.860 g
SEISMIC DESIGN CATEGORY:	D
SEISMIC FORCE RESISTING SYSTEM:	CANTILEVERED COLUMN SYSTEMS TIMBER FRAMES
DESIGN BASE SHEAR, V (SEISMIC):	20.13 KIPS, N/S; 18.56 KIPS, E/W
SEISMIC RESPONSE COEFF. Cs:	0.4572
RESPONSE MODIFICATION FACTOR, R:	1 1/2
ANALYSIS PROCEDURE:	EQUIVALENT LATERAL FORCE (ELF)

WIND

WIND DESIGN DATA:

ULTIMATE DESIGN WIND SPEED, Vult:	96 M.P.H. (3-SEC GUST)
NOMINAL DESIGN WIND SPEED, Vasd:	74 M.P.H
RISK CATEGORY (2022 OSSC, 1604.5):	II
WIND EXPOSURE:	C
APPLICABLE INTERNAL PRESS. COEFF.:	0.18± PSF
DESIGN WIND PRESS. FOR C&C:	18 PSF

SNOW

ROOF SLOPE:	18.45 DEG. (4:12)
IMPORTANCE FACTOR, Ig=	1.0
GROUND SNOW LOAD, Pg= http://snowload.seao.org/lookup.html	9 P.S.F.
MIN. SNOW LOAD, Pm:	20 P.S.F.
RAIN ON SNOW:	0 P.S.F.
EXPOSURE:	C
Ce:	1.0
ROOFING MATERIAL:	UNOBSTRUCTED SLIPPERY
Ct:	1.0
Cs:	1.0
FLAT ROOF SLOW LOAD: Pf=0.7*Ce*Ct*Ig*Pg=	CONSTANT: 0.7 6.30 P.S.F.
MIN. SNOW LOAD, Pm=	20 P.S.F. USE: 25 P.S.F. (CONSERVATIVE)
SLOPED ROOF, Ps: Ps=Cs*Pf=	6.30 P.S.F.
GROUND SNOW LOAD, g= g=0.13*Pg+14=	CONSTANTS: 0.13 14 15.17 P.S.F.
DEPTH GROUND SNOW LOAD, hg= hg=Pg/g=	CONSTANTS: 0.60 FT 25.28 P.S.F. FOR DECKS, BALCONIES, ETC. WHOSE HT ABOVE GROUND SURFACE IS LESS THAN hg USE Pm

ABBREVIATIONS

(N)	NEW	UNO	UNLESS NOTED OTHERWISE
(E)	EXISTING	PT	PRESSURE TREATED
DO	DITTO (SAME)	CONC.	CONCRETE
TPI	TRUSS PLATE INSTITUTE (tpinst.org)	TYP.	TYPICAL
OH	OVER HANG (EAVE)		

REVISIONS	BY

A NEW STORAGE POLE BUILDING
23100 SW 82nd AVE.
TUALATIN, OR
LATERAL FORCE RESISTING SYSTEM DESIGN NOTES

CIVIL ENGINEERING DESIGN
Design for the Human Environment
WILLIAM E. BARLOW, P.E.
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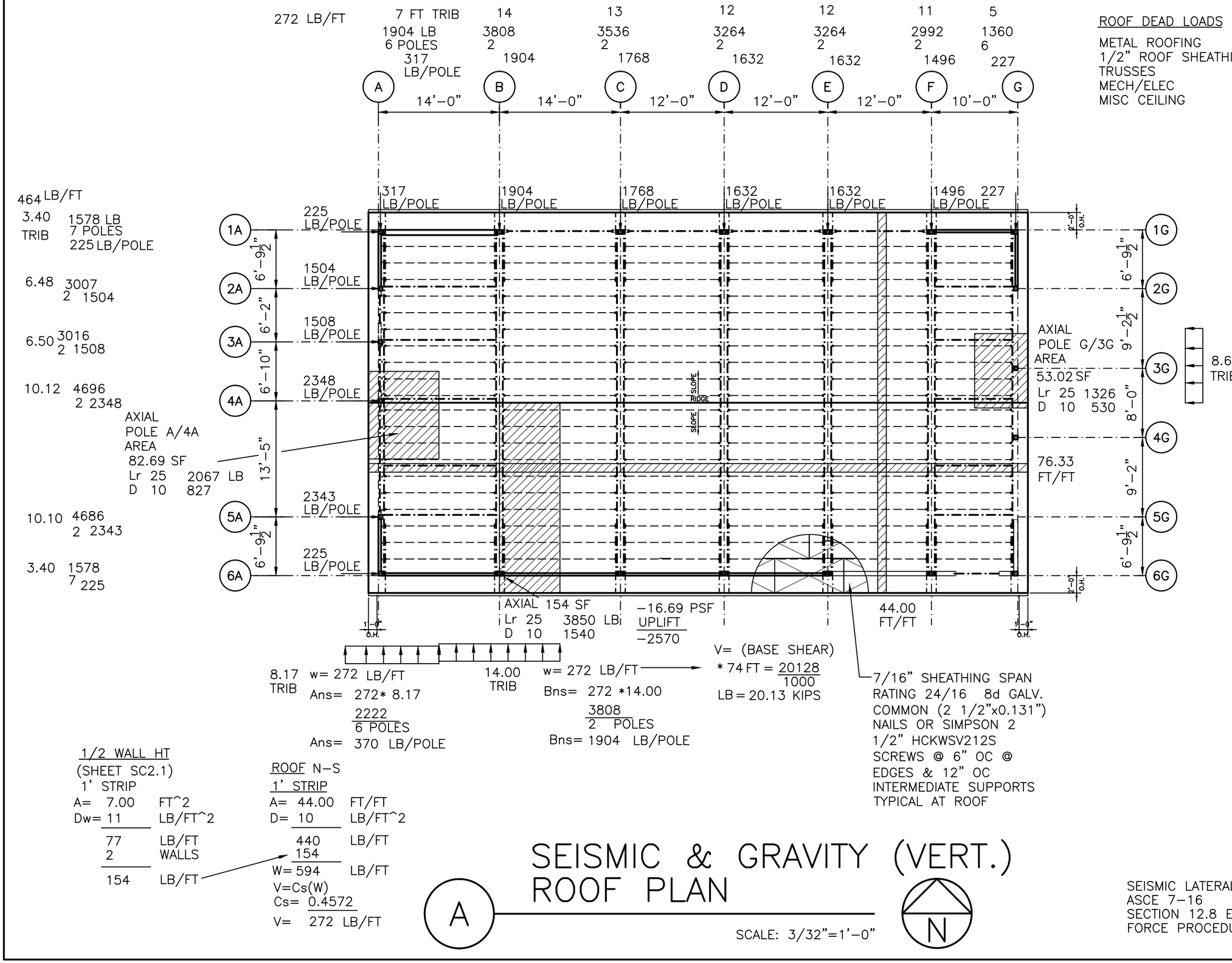
CORVALLIS, OR 97339
541-929-8111
www.civilengineeringdesign.com

DATE	11.20.2023
SCALE	AS SHOWN
DRAWN	WEB
SHEET	SC1.0



ROOF DEAD LOADS

METAL ROOFING	1	LB/FT^2
1/2" ROOF SHEATHING	2	
TRUSSES	2	
MECH/ELEC	3	
MISC CEILING	2	
	10	LB/FT^2

1/2 WALL HT
(SHEET SC2.1)
1' STRIP

A=	7.00	FT^2
Dw=	11	LB/FT^2
	77	LB/FT
	2	WALLS
	154	LB/FT

ROOF N–S
1' STRIP

A=	44.00	FT/FT
D=	10	LB/FT^2
	440	LB/FT
	154	
W=	594	LB/FT

V=Cs(W)
Cs= 0.4572
V= 272 LB/FT

1/2 WALL HT
(SHEET SC2.2)
1' STRIP

A=	11.47	FT^2
Dw=	11	LB/FT^2
	126	LB/FT
	2	WALLS
	252	LB/FT

ROOF E–W
1' STRIP

A=	76.33	FT/FT
W=	10	LB/FT^2
	763	LB/FT
	252	
W=	1015	LB/FT

V=Cs(W)
Cs= 0.4572
V= 464 LB/FT

7/16" SHEATHING SPAN RATING 24/16 8d GALV. COMMON (2 1/2"x0.131") NAILS OR SIMPSON 2 1/2" HCKWSV212S SCREWS @ 6" OC @ EDGES & 12" OC INTERMEDIATE SUPPORTS TYPICAL AT ROOF

SEISMIC LATERAL CALCULATIONS
ASCE 7–16
SECTION 12.8 EQUIVALENT LATERAL FORCE PROCEDURE (ELF), p. 101

SEISMIC & GRAVITY (VERT.) ROOF PLAN

A

SCALE: 3/32"=1'–0"

N

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SEISMIC & GRAVITY (VERT.) ROOF PLAN

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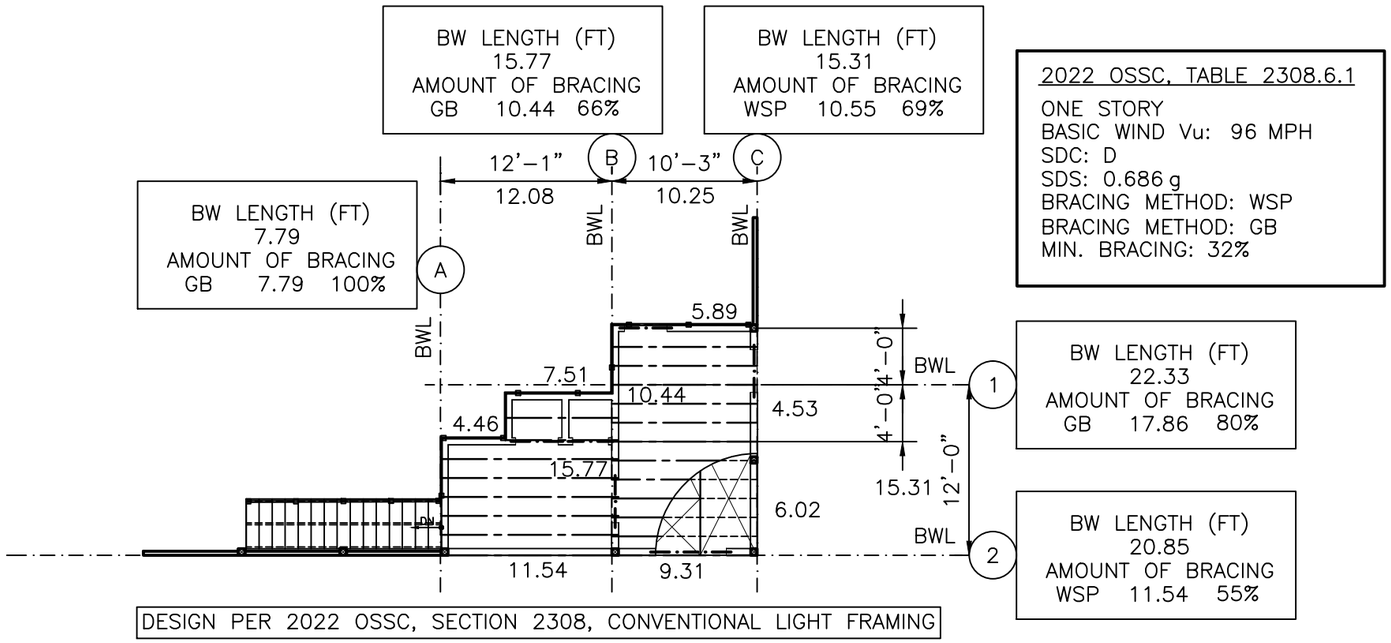
DATE	11.20.2023
SCALE	AS SHOWN
DRAWN	WEB
SHEET	SC2.0



2022 OSSC, TABLE 2308.6.1

ONE STORY
BASIC WIND Vu: 96 MPH
SDC: D
SDS: 0.686 g
BRACING METHOD: WSP
BRACING METHOD: GB
MIN. BRACING: 32%

DESIGN PER 2022 OSSC, SECTION 2308, CONVENTIONAL LIGHT FRAMING

B OFFICE LATERAL DESIGN

SCALE: 3/32"=1'–0"

WIND PRESSURES

NORMAL TO RIDGE

WINDWARD WALL

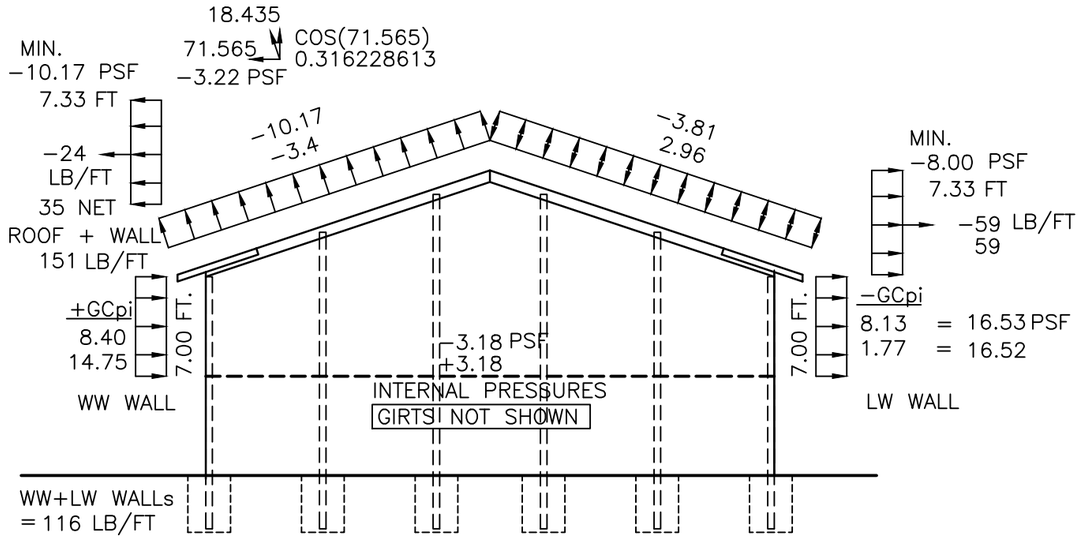
h= (FT)	+GCpi	–GCpi
0.00	8.40	14.75
15.00	8.40	14.75
20.00	9.12	15.48
21.69	9.33	15.69
he: 14	8.40	14.75
h: 17.79	8.83	15.19

MIN. 16 PSF * WALL AREA
& 8 PSF * ROOF AREA PROJECTED
ONTO A VERTICAL PLANE NORMAL
TO THE ASSUMED WIND DIRECTION

LEEWARD	+GCpi	–GCpi
	–10.86	–4.33

SIDE WALLS	+GCpi	–GCpi
	–13.68	–7.33

ROOF	+GCpi	–GCpi
ROOF (WINDWARD), 1	–10.17	–3.81
ROOF (WINDWARD), 2	–3.4	2.96
ROOF (LEEWARD)	–11.71	–5.36



NORMAL TO RIDGE

A EAST ELEV

SCALE: 3/32"=1'–0"

SEISMIC CONTROLS!

WIND LATERAL: ASCE–7–16, CH. 27, DIRECTIONAL PROCEDURE, PART 1, p. 273

2022 OSSC
TABLE 1609.3
RISK CATEGORY: II
BENTON COUNTY
BASIC DESIGN WIND SPEED: 96 MPH

PRELIMINARY
NOT FOR CONSTRUCTION

NOTE: ENCLOSURE CLASSIFICATION:
PARTIALLY OPEN
SAME INTERNAL PRESSURE
COEFFICIENTS AS ENCLOSED.

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A NEW STORAGE POLE BUILDING
23100 SW 82nd AVE.
TUALATIN, OR
WIND EAST ELEVATION

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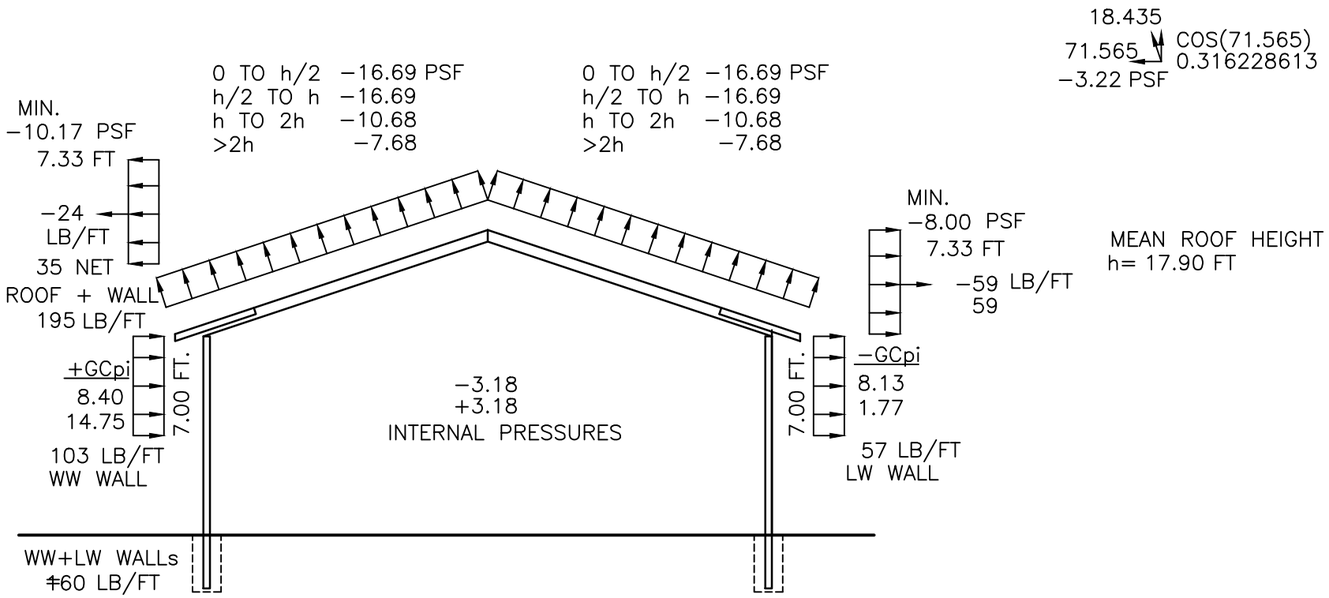
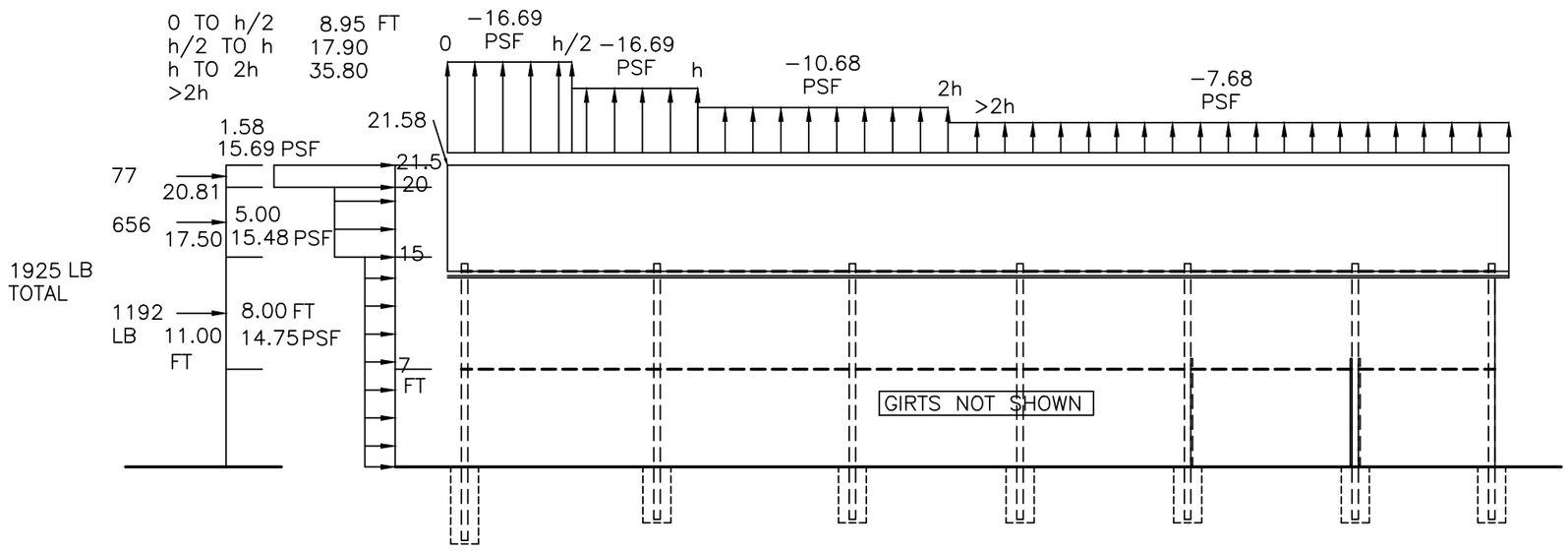
DATE	11.20.2023
SCALE	AS SHOWN
DRAWN	WEB
SHEET	SC3.0



PARALLEL TO RIDGE

B TRANSVERSE SECT.

SCALE: 3/32"=1'−0"



PARALLEL TO RIDGE

A SOUTH ELEV

SCALE: 3/32"=1'−0"

18.435
71.565
COS(71.565)
0.316228613
−3.22 PSF

MEAN ROOF HEIGHT
h= 17.90 FT

WIND PRESSURES

PARALLEL TO RIDGE

WINDWARD WALL

h= (FT)	+GCpi	−GCpi
0.00	8.40	14.75
15.00	8.40	14.75
20.00	9.12	15.48
21.69	9.33	15.69
he: 14	8.40	14.75
h: 17.79	8.83	15.19

MIN. 16 PSF * WALL AREA
& 8 PSF * ROOF AREA PROJECTED
ONTO A VERTICAL PLANE NORMAL
TO THE ASSUMED WIND DIRECTION

		+GCpi	−GCpi
LEEWARD		−8.13	−1.77
SIDE WALLS		+GCpi	−GCpi
< NORMAL TO RIDGE		−13.68	−7.33
ROOF		+GCpi	−GCpi
0 TO h/2	ROOF (ZONE 1), 1	−16.69	−10.33
	ROOF (ZONE 1), 2	−5.88	0.48
h/2 TO h	ROOF (ZONE 2), 1	−16.69	−10.33
	ROOF (ZONE 2), 2	−5.88	0.48
h TO 2h	ROOF (ZONE 3), 1	−10.68	−4.33
	ROOF (ZONE 3), 2	−5.88	0.48
>2h	ROOF (ZONE 4), 1	−7.68	−1.32
	ROOF (ZONE 4), 2	−5.88	0.48

SEISMIC CONTROLS!

WIND LATERAL: ASCE−7−16, CH. 27, DIRECTIONAL PROCEDURE, PART 1. p. 273

2022 OSSC
TABLE 1609.3
RISK CATEGORY: II
BENTON COUNTY
BASIC DESIGN WIND SPEED: 96 MPH

NOTE: ENCLOSURE CLASSIFICATION: PARTIALLY OPEN
SAME INTERNAL PRESSURE COEFFICIENTS AS ENCLOSED.

REVISIONS	BY

A NEW STORAGE POLE BUILDING
23100 SW 82nd AVE.
TUALATIN, OR
WIND SOUTH ELEV. & TRANSVERSE SECT.

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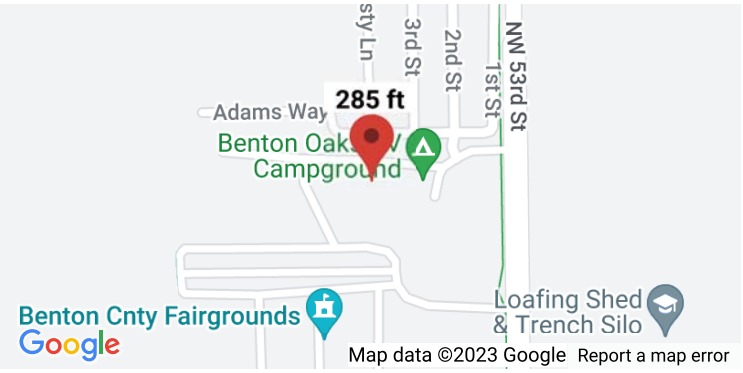
DATE	11.20.2023
SCALE	AS SHOWN
DRAWN	WEB
SHEET	SC3.1

Hazards by Location

Search Information

Coordinates:	44.56822, -123.313783
Elevation:	285 ft
Timestamp:	2023-11-15T16:32:05.343Z
Hazard Type:	Seismic
Reference Document:	ASCE7-16
Risk Category:	II
Site Class:	D



Basic Parameters

Name	Value	Description
S_S	0.904	MCE_R ground motion (period=0.2s)
S_1	0.478	MCE_R ground motion (period=1.0s)
S_{MS}	1.029	Site-modified spectral acceleration value
S_{M1}	* null	Site-modified spectral acceleration value
S_{DS}	0.686	Numeric seismic design value at 0.2s SA
S_{D1}	* null	Numeric seismic design value at 1.0s SA

* See Section 11.4.8

Additional Information

Name	Value	Description
SDC	* null	Seismic design category
F_a	1.138	Site amplification factor at 0.2s
F_v	* null	Site amplification factor at 1.0s
CR_S	0.868	Coefficient of risk (0.2s)
CR_1	0.861	Coefficient of risk (1.0s)
PGA	0.43	MCE_G peak ground acceleration
F_{PGA}	1.17	Site amplification factor at PGA
PGA_M	0.503	Site modified peak ground acceleration
T_L	16	Long-period transition period (s)

SsRT	0.904	Probabilistic risk-targeted ground motion (0.2s)
SsUH	1.041	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
SsD	1.5	Factored deterministic acceleration value (0.2s)
S1RT	0.478	Probabilistic risk-targeted ground motion (1.0s)
S1UH	0.555	Factored uniform-hazard spectral acceleration (2% probability of exceedance in 50 years)
S1D	0.787	Factored deterministic acceleration value (1.0s)
PGAd	0.676	Factored deterministic acceleration value (PGA)

* See Section 11.4.8

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

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2022 OSSC & ASCE 7-16								Project:	Storage Building							
EQUIVALENT LATERAL FORCE PROCEDURE (12.8.1), p. 71								Date:	11.15.2023							
													Input	Results		
Code:	OSSC	<= Pull Down														
Occupancy Category	II	<= Pull Down, (OSSC Table 1604.5), p. 350: I, II, III OR IV														
$T_a=C_t(h_n)^x$	Equation (12.8-7)							**Table 11.4-1 Short-Period Site Coefficient, Fa**								
Structure Type	All other Structures								Ss<=	Ss=	Ss=	Ss=	Ss=	Ss>=		
C_t =	0.020	(Table 12.8-2), p. 102						Site Class	0;.25	0.5	0.75	1	1.25	1.5		
x =	0.75	(Table 12.8-2), p. 102						A	0.8	0.8	0.8	0.8	0.8	0.8		
h_n =	18.0	ft						B	0.9	0.9	0.9	0.9	0.9	0.9		
T_a =	0.17	sec						C	1.3	1.3	1.2	1.2	1.2	1.2		
								D	1.6	1.4	1.2	1.1	1	1		
ASCE 7-16, 20.3 SITE CLASS DEFINITIONS, 20.3.1, Exception								E				See 11.4.8	See 11.4.8	See 11.4.8		
Site Class =	D							F	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8		
S_s =	0.904	From ATC Basic Parameters						Find: Fa=	Linear Interpolation							
S_1=	0.478	From ATC Basic Parameters	S1>0.2, SITE SPECIFIC REQ'D; Use Expection					Ssa=	0.750	Fa1=	1.2					
					S_s=	0.904		S_s=	0.904		**Fa=**	**1.2**				
F_a=	1.138	From ATC Additional Information						Ssb=	1.000	Fa2=	1.2					
F_v=	1.800	From Table 11.4.2 See right=>														
								Table 11.4-2 Long-Period Site Coefficient, Fv								
$S_{MS}=F_a*S_s$	1.029	(11.4-1)							S_1<=	S_1=	S_1=	S_1=	S_1=	$S_{1>}$=		
$S_{M1}=F_v*S_1$	1.291	(11.4-2)	Increased 50%, Supplement 3, Chapter 11					Site Class	0.1	0.2	0.3	0.4	0.5	0.6		
								A	0.8	0.8	0.8	0.8	0.8	0.8		
S_{DS}= 2/3*S_{MS}	0.686	(11.4-3)						B	0.8	0.8	0.8	0.8	0.8	0.8		
S_{D1}=2/3*S_{M1}	0.860	(11.4-4)						C	1.5	1.5	1.5	1.5	1.5	1.4		
								D	2.4	2.2	2	1.9	1.8	1.7		
ASCE 7-16, 20.1 [p. 203],	Where the soil properties are not known in sufficient detail							E	4.2	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8		
	to determine the site class, Site Class D, subject to the							F	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8	See 11.4.8		
	requirements of Section 11.4.4, shall be used unless the															
	Authority Having Jurisdiction or geotechnical data determine							Find: Fv=	Linear Interpolation							
	that Site Class E or F soils are present at the site.							S1a=	0.400	Fv1=	1.9					
					S_1=	0.478		S_1=	0.478		**Fv=**	**1.8**				
								S1b=	0.500	Fv2=	1.8					
S_1 =	0.478	S1>0.2, OKAY!														
T_a =	0.175	s														
$T_s = S_{D1}/S_{DS}$ =	1.255															
Ta/Ts =	0.139	<=1.5 OKAY!	IF Ta/Ts<=1.5, THEN USE Cs Equation 12.8-2, p. 101													
T_L > (T >= 1.5 Ts)	T_L=16s															
1.5 T_s =	1.882		ASCE 7-16, 11.4.4 [p. 84] Site Coefficients and Risk-Targeted Maximum													
V=Cs(W) (12.8-1)			Considered Earthquake (MCER) Spectral Response													
Calculation of Seismic Response Coefficient (12.8.1.1), p. 101			Acceleration Parameters. The MCER spectral response													
S_{DS} =	0.686	g, EXCEPTION 2. ABOVE	acceleration parameters for short periods (S_{MS}) and at 1 s													
S_{D1} =	0.860	g, EXCEPTION 2. ABOVE	(SM1), adjusted for site class effects, shall be determined by													
R =	1.5	(Table 12.2-1), p. 92	Eqs. (11.4-1) and (11.4-2), respectively.													
I =	1.00	(Table 1.5.-2), p. 4	S_{MS} = FaS_S (11.4-1)													
			S_{M1} = FvS_1 (11.4-2) Increased 50% per Exception Supplement 3, Chapter 11													
Cs =	0.4572	(12.8-2), p. 101	where													
T_L =	16	sec (Figure 22-14), p. 225	S_S = the mapped MCER spectral response acceleration parameter													
Cs |> =	3.2819	for T<T_L (12.8-3), p. 101	at short periods as determined in accordance with													
or			Section 11.4.2, and													
Cs |> =	300.44	for T>T_L (12.8-4), p. 101	S_1 = the mapped MCER spectral response acceleration parameter													
Cs |< =	0.0302	(12.8-5), p. 101	at a period of 1 s as determined in accordance with													
Cs |< =	0.3155	(12.8-6), p. 101	Section 11.4.2													
			where site coefficients Fa and Fv are defined in Tables 11.4-1 and													
			11.4-2, respectively. Where Site Class D is selected as the default													
Seismic Design Category			site class per Section 11.4.3, the value of Fa shall not be less than													
SDC DS:	D		1.2.													
SDC D1:	D															
Note:																
C_t =	(Table 12.8-2), p. 102		Steel frame: 0.028, Concrete frame: 0.016, Steel ecc. braced frame: Table 12.2.1, Steel buckling-restrained braced frame: 0.03, All others: 0.02													
x =	(Table 12.8-2), p. 102		Steel frame: 0.8, Concrete frame: 0.9, Steel ecc. braced frame: Table 12.8.2, Steel buckling-restrained braced frame: 0.75, All others: 0.75													

S_S = mapped MCE, 5 percent damped, spectral response acceleration parameter at short periods as defined in Section 11.4.1

S_1 = mapped MCE, 5 percent damped, spectral response acceleration parameter at a period of 1 s as defined in Section 11.4.1

S_{sM} = the site-specific MCE spectral response acceleration at any period

S_{DS} = design, 5 percent damped, spectral response acceleration parameter at short periods as defined in Section 11.4.4

S_{D1} = design, 5 percent damped, spectral response acceleration parameter at a period of 1 s as defined in Section 11.4.4

S_{MS} = the MCE, 5 percent damped, spectral response acceleration at short periods adjusted for site class effects as defined in Section 11.4.3

Exposure Classification

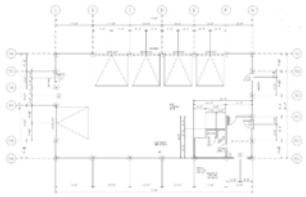
ASCE 7-16, 26.12, p. 270

Input
Result

Project: 110 SW 53rd ST
Date: 11.14.2023

Buliding Dimensions

Length, L= 74.00 ft
Width, W= 40.00 ft
Average Roof Height, H= 18.00 ft



Wall 1:

Length 1= 74.00 ft
Height 1= 14.00 ft
Wall 1 Area= 1036.00 ft²

Opening 1: width = 12.00 ft, height = 12.00 ft, Area 1 = 144.00 ft²
Opening 2: width = 12.00 ft, height = 10.00 ft, Area 2 = 120.00 ft²
Opening 3: width = 12.00 ft, height = 10.00 ft, Area 3 = 120.00 ft²
Opening 4: width = 12.00 ft, height = 10.00 ft, Area 4 = 120.00 ft²
Opening 5: width = ft, height = ft, Area 5 = 0.00 ft²
Opening 6: width = ft, height = ft, Area 6 = 0.00 ft²

A_o=	504.00	ft²	A_o=Total area of openings in a wall that receives positive external pressure, in ft²
A_g=	1036.00	ft²	A_g=gross area of that wall which Ao is identified, in ft²
$A_{o/Ag}$=	0.49	ft²	If > 0.8, then OPEN
0.01A_g=	10.36	ft²	
	4.00	ft²	4.00 ft² Is lesser
A_{oi}=	219.00	ft²	Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft²
A_{gi}=	2156.00	ft²	Sum of the gross surface areas of the building envelope (walls and roof) not including Ag, in ft²
A_{oi}/A_{og}=	0.1	<=0.2?	YES
1.1*A_{oi}=	240.9		1.1 * Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft2

Wall 1:

Wall 2:

Length 2= 40.00 ft
Height 2= 14.00 ft
Wall 2 Area= 560.00 ft²

Opening 1: width = 3.00 ft, height = 6.67 ft, Area 1 = 20.00 ft²
Opening 2: width = 12.00 ft, height = 12.00 ft, Area 2 = 144.00 ft²
Opening 3: width = ft, height = ft, Area 3 = 0.00 ft²
Opening 4: width = ft, height = ft, Area 4 = 0.00 ft²
Opening 5: width = ft, height = ft, Area 5 = 0.00 ft²
Opening 6: width = ft, height = ft, Area 6 = 0.00 ft²

A_o=	164.00	ft²	A_o=Total area of openings in a wall that receives positive external pressure, in ft²
A_g=	560.00	ft²	A_g=gross area of that wall which Ao is identified, in ft²
$A_{o/Ag}$=	0.29	ft²	If > 0.8, then OPEN
0.01A_g=	5.60	ft²	
	4.00	ft²	4.00 ft² Is lesser
A_{oi}=	763.01	ft²	Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft²
A_{gi}=	2632.00	ft²	Sum of the gross surface areas of the building envelope (walls and roof) not including Ag, in ft²
A_{oi}/A_{og}=	0.3	<=0.2?	NO
1.1*A_{oi}=	839.3		1.1 * Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft2

Exposure Classification

ASCE 7-16, 26.12, p. 270

Input
Result

Project: 110 SW 53rd ST
Date: 11.14.2023

Wall 3:

Length 3= 74.00 ft
Height 3= 14.00 ft
Wall 3 Area= 1036.00 ft²

Opening 1:		Opening 2:		Opening 3:	
width =	5.00 ft	width =	ft	width =	ft
height =	3.00 ft	height =	ft	height =	ft
Area 1 =	15.00 ft²	Area 2 =	0.00 ft²	Area 3 =	0.00 ft²

Opening 4:		Opening 5:		Opening 6:	
width =	ft	width =	ft	width =	ft
height =	ft	height =	ft	height =	ft
Area 4 =	0.00 ft²	Area 5 =	0.00 ft²	Area 6 =	0.00 ft²

A_o=	15.00	ft²	A_o=Total area of openings in a wall that receives positive external pressure, in ft²
A_g=	1036.00	ft²	A_g=gross area of that wall which Ao is identified, in ft²
A_o/A_g=	0.01	ft²	If > 0.8, then OPEN
$0.01A_g$=	10.36	ft²	
	4.00	ft²	4.00 ft² Is lesser
A_{oi}=	708.00	ft²	Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft²
A_{gi}=	2156.00	ft²	Sum of the gross surface areas of the building envelope (walls and roof) not including Ag, in ft²
A_{oi}/A_{og}=	0.3	<=0.2?	NO
$1.1*A_{oi}$=	778.8		1.1 * Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft2

Wall 4:

Length 4= 40.00 ft
Height 4= 14.00 ft
Wall 4 Area= 560.00 ft²

Opening 1:		Opening 2:		Opening 3:	
width =	3.00 ft	width =	3.00 ft	width =	ft
height =	6.67 ft	height =	6.67 ft	height =	ft
Area 1 =	20.00 ft²	Area 2 =	20.00 ft²	Area 3 =	0.00 ft²

Opening 4:		Opening 5:		Opening 6:	
width =	ft	width =	ft	width =	ft
height =	ft	height =	ft	height =	ft
Area 4 =	0.00 ft²	Area 5 =	0.00 ft²	Area 6 =	0.00 ft²

A_o=	40.00	ft²	A_o=Total area of openings in a wall that receives positive external pressure, in ft²
A_g=	560.00	ft²	A_g=gross area of that wall which Ao is identified, in ft²
A_o/A_g=	0.07	ft²	If > 0.8, then OPEN
$0.01A_g$=	5.60	ft²	
	4.00	ft²	4.00 ft² Is lesser
A_{oi}=	683.00	ft²	Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft²
A_{gi}=	2632.00	ft²	Sum of the gross surface areas of the building envelope (walls and roof) not including Ag, in ft²
A_{oi}/A_{og}=	0.26	<=0.2?	NO
$1.1*A_{oi}$=	751.3		1.1 * Sum of the areas of openings in the building envelope (walls and roof) not including Ao, in ft2

Wall 4:

Roof Openings 0.00 ft²

Summary

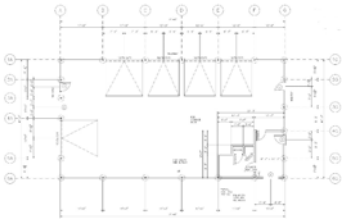
	Side 1	Side 2	Side 3	Side 4	
A_o=	504.00	164.00	15.00	40.00	ft²
Smaller of 4 ft² or $0.01A_g$=	4.00	4.00	4.00	4.00	ft²
A_g=	1036.00	560.00	1036.00	560.00	ft²
$0.8A_g$=	828.80	448.00	828.80	448.00	ft²
A_o/A_g=	0.49	0.29	0.01	0.07	ft²
A_{oi}=	219.00	763.01	708.00	683.00	ft²
A_{gi}=	2156.00	2632.00	2156.00	2632.00	ft²
A_o/A_{og}=	0.10	0.29	0.33	0.26	ft²
A_{oi}/A_{og}<0.2?=	NO	NO	NO	NO	
$1.10A_{oi}$=	240.90	839.31	778.80	751.30	ft²

Building Enclosure Classification:

(1) ENCLOSED:	NO	NO	NO	NO	For each wall, if Ao<(smaller of 0.01Ag or 4 ft2) & Aoi/Aog<= 0.2 then Enclosed
(2) OPEN:	NO	NO	NO	NO	For each wall, if Ao>=0.8Ag then Open
(3) PARTIALLY ENCLOSED:	NO	NO	NO	NO	In a wall, if Ao>= (smaller of 1.10Aoi or 4 ft2) & Aoi/Aog<= 0.2 then Partially Enclosed
(4) PARTIALLY OPEN:	YES	YES	YES	YES	A building that does not comply with the requirements for open, partially enclosed, or enclosed buildings.

	GCpi	GCpi	GCpi	GCpi
(1) ENCLOSED:	NA	NA	NA	NA
(2) OPEN:	NA	NA	NA	NA
(3) PARTIALLY ENCLOSED:	NA	NA	NA	NA
(4) PARTIALLY OPEN:	+/- 0.18	+/- 0.18	+/- 0.18	+/- 0.18

Use:	PARTIALLY OPEN	GCpi +/- 0.18



WIND LOADING ANALYSIS - Main Wind-Force Resisting System

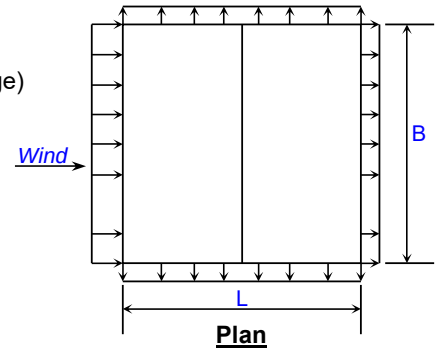
Per ASCE 7-16 Code for Enclosed or Partially Enclosed Buildings

Using Direction Procedure (Ch. 27, Part 1) for Buildings of Any Height

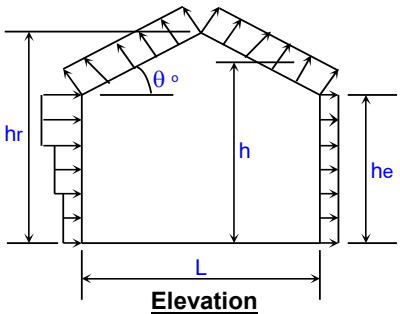
Job Name:	110 SW 53rd St	Subject:	MWFRS	Date:	11,14,2023
Job Number:	23024	Originator:	WEB	Checker:	WEB

Input Data:

Wind Direction =	Normal	(Normal or Parallel to building ridge)
Wind Speed, V =	96	mph (2022 OSSC)
Risk Category =	II	(2022 OSSC)
Exposure Category =	C	(Sect. 26.7)
Roof Pitch =	4	:12
Ridge Height, hr =	21.69	ft. (hr >= he)
Eave Height, he =	14.00	ft. (he <= hr)
Building Width, L =	40.00	ft. (Normal to Building Ridge)
Building Length, B =	74.00	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 =	0.85	(Table 26.6-1)
Enclosure Classification =	Partially Open	(Table 26.13-1)
Hurricane Region?	N	
Damping Ratio, β =	0.050	(Suggested Range = 0.010-0.070)
Period Coef., Ct =	0.0200	(Suggested Range = 0.020-0.035)
		(Assume: T = Ct*h^(3/4) , and f = 1/T)



Plan



Elevation

Resulting Parameters and Coefficients:

Roof Angle, θ =	18.43	deg.		
Mean Roof Ht., h =	17.85	ft. (h = (hr+he)/2, for roof angle >10 deg.)		
Windward Wall Cp =	0.80	(Fig. 27.3-1)		
Leeward Wall Cp =	-0.50	(Fig. 27.3-1)		
Side Walls Cp =	-0.70	(Fig. 27.3-1)		
Windward Roof Cp =	-0.47		(Fig. 27.3-1)	(Condition #1)
Windward Roof Cp =	-0.01		(Fig. 27.3-1)	(Condition #2)
Leeward Roof Cp =	-0.57		(Fig. 27.3-1)	
			(Fig. 27.3-1)	
+GCpi Coef. =	0.18	(Table 26.13-1)	(positive internal pressure)	Internal Press. = qh*+/-GCpi
-GCpi Coef. =	-0.18	(Table 26.13-1)	(negative internal pressure)	3.18 -3.18

L = 40 ft.
B = 74 ft.

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 =	0.88	(Kh = Kz evaluated at z = h)	

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2*I (Eq. 26.10-1)

qh =	17.66 psf	qh = 0.00256*Kh*Kzt*Kd*V^2 (qz evaluated at z = h)	
Ratio h/L =	0.446	freq., f = 5.759 hz.	(f >= 1, Rigid structure)
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. 27.3-1)

p = qh*G*Cp - qi*(+/-GCpi) for leeward wall, sidewalls, and roof (psf), where: qi = qh (Eq. 27.3-1)

Normal to Ridge Wind Load Tabulation for MWFRS - Buildings of Any Height						
Surface	z (ft.)	Kz	qz (psf)	Cp	p = Net Design Press. (psf) (w/ +GCpi)	p = Net Design Press. (psf) (w/ -GCpi)
Windward Wall	0	0.85	17.02	0.80	8.40	14.75
	15.00	0.85	17.02	0.80	8.40	14.75
	20.00	0.90	18.09	0.80	9.12	15.48
For z = hr:	21.69	0.92	18.40	0.80	9.33	15.69
For z = he:	14.00	0.85	17.02	0.80	8.40	14.75
For z = h:	17.85	0.88	17.66	0.80	8.83	15.19
Leeward Wall	All	-	-	-0.50	-10.68	-4.33
Side Walls	All	-	-	-0.70	-13.68	-7.33
Roof (windward) cond. 1	-	-	-	-0.47	-10.17	-3.81
Roof (windward) cond. 2	-	-	-	-0.01	-3.40	2.96
	-	-	-			
Roof (leeward)	-	-	-	-0.57	-11.71	-5.36
	-	-	-			

Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Section 27.1.5, the min. wind load for MWFRS shall not be less than 16 psf; 8 psf roof-proj. onto vert. plane

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) =	15.00	= 0.6*h , but not < z(min) , ft. Table 26.9-1
Iz(bar) =	0.228	= c*(33/z(bar))^(1/6) , Eq. 26.9-7
Lz(bar) =	427.06	= 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 =	4.588	= (2*(LN(3600*f)))^(1/2)+0.577/(2*LN(3600*f))^(1/2) , Eq. 26.9-11
Q =	0.898	= (1/(1+0.63*((B+h)/Lz(bar))^0.63))^(1/2) , Eq. 26.9-8

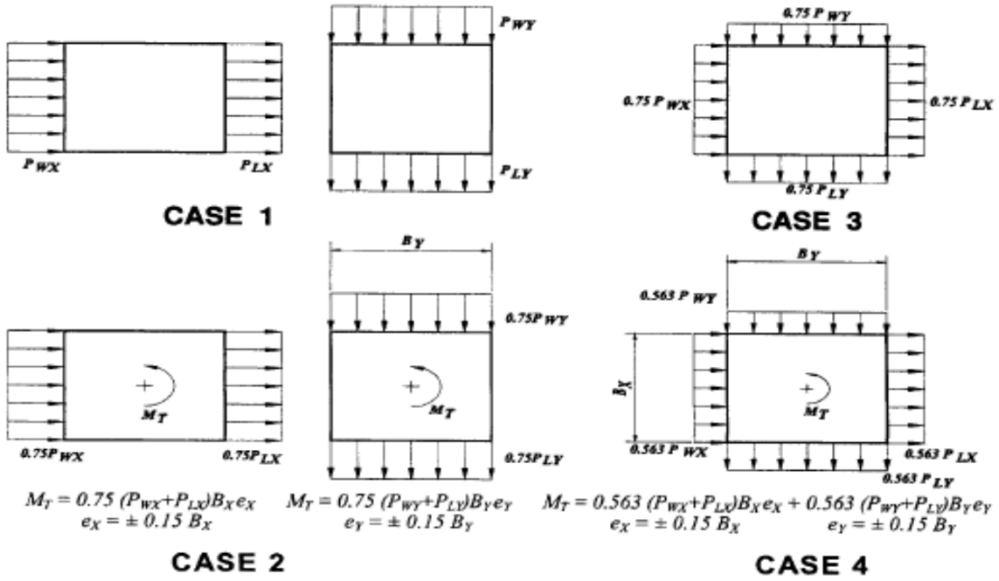
2: Calculation of G for Rigid Building

G =	0.872	= 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 =	0.020	Period Coefficient
T =	0.174	= Ct*h^(3/4) , sec. (Approximate fundamental period)
f =	5.759	= 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)) ,
Use: G =	0.850	Eq. 26.9-10

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 - Main Wind-Force Resisting System

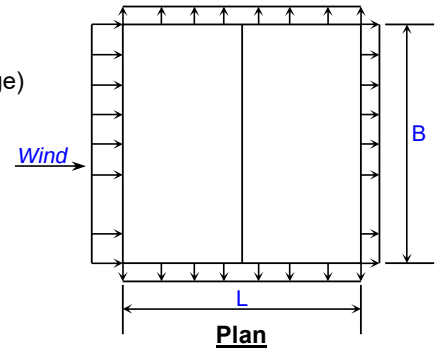
Per ASCE 7-16 Code for Enclosed or Partially Enclosed Buildings

Using Direction Procedure (Ch. 27, Part 1) for Buildings of Any Height

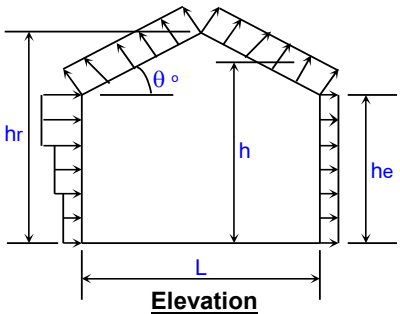
Job Name:	110 SW 53rd St	Subject:	MWFRS	Date:	11,14,2023
Job Number:	23024	Originator:	WEB	Checker:	WEB

Input Data:

Wind Direction =	Parallel	(Normal or Parallel to building ridge)
Wind Speed, V =	96	mph (2022 OSSC)
Risk Category =	II	(2022 OSSC)
Exposure Category =	C	(Sect. 26.7)
Roof Pitch =	4	:12
Ridge Height, hr =	21.69	ft. (hr >= he)
Eave Height, he =	14.00	ft. (he <= hr)
Building Width, L =	40.00	ft. (Normal to Building Ridge)
Building Length, B =	74.00	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 =	0.85	(Table 26.6-1)
Enclosure Classification =	Partially Open	(Table 26.13-1)
Hurricane Region?	N	
Damping Ratio, β =	0.050	(Suggested Range = 0.010-0.070)
Period Coef., Ct =	0.0200	(Suggested Range = 0.020-0.035)
		(Assume: T = Ct*h^(3/4) , and f = 1/T)



Plan



Elevation

Resulting Parameters and Coefficients:

Roof Angle, θ =	18.43	deg.		
Mean Roof Ht., h =	17.85	ft. (h = (hr+he)/2, for roof angle >10 deg.)		
Windward Wall Cp =	0.80	(Fig. 27.3-1)		
Leeward Wall Cp =	-0.33	(Fig. 27.3-1)		
Side Walls Cp =	-0.70	(Fig. 27.3-1)		
Roof Cp (zone #1) =	-0.90	-0.18	(Fig. 27.3-1)	(zone #1 for 0 to h/2)
Roof Cp (zone #2) =	-0.90	-0.18	(Fig. 27.3-1)	(zone #2 for h/2 to h)
Roof Cp (zone #3) =	-0.50	-0.18	(Fig. 27.3-1)	(zone #3 for h to 2*h)
Roof Cp (zone #4) =	-0.30	-0.18	(Fig. 27.3-1)	(zone #4 for > 2*h)
+GCpi Coef. =	0.18	(Table 26.13-1)	(positive internal pressure)	Internal Press. = qh*+/-GCpi
-GCpi Coef. =	-0.18	(Table 26.13-1)	(negative internal pressure)	3.18 -3.18

L = 74 ft.
B = 40 ft.

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 =	0.88	(Kh = Kz evaluated at z = h)	

Velocity Pressure: qz = 0.00256*Kz*Kzt*Kd*V^2*I (Eq. 26.10-1)

qh =	17.66 psf	qh = 0.00256*Kh*Kzt*Kd*V^2 (qz evaluated at z = h)	
Ratio h/L =	0.241	freq., f = 5.759 hz.	(f >= 1, Rigid structure)
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. 27.3-1)

p = qh*G*Cp - qi*(+/-GCpi) for leeward wall, sidewalls, and roof (psf), where: qi = qh (Eq. 27.3-1)

Parallel to Ridge Wind Load Tabulation for MWFRS - Buildings of Any Height						
Surface	z (ft.)	Kz	qz (psf)	Cp	p = Net Design Press. (psf) (w/ +GCpi)	p = Net Design Press. (psf) (w/ -GCpi)
Windward Wall	0	0.85	17.02	0.80	8.40	14.75
	15.00	0.85	17.02	0.80	8.40	14.75
	20.00	0.90	18.09	0.80	9.12	15.48
For z = hr:	21.69	0.92	18.40	0.80	9.33	15.69
For z = he:	14.00	0.85	17.02	0.80	8.40	14.75
For z = h:	17.85	0.88	17.66	0.80	8.83	15.19
Leeward Wall	All	-	-	-0.33	-8.13	-1.77
Side Walls	All	-	-	-0.70	-13.68	-7.33
Roof (zone #1) cond. 1	-	-	-	-0.90	-16.69	-10.33
Roof (zone #1) cond. 2	-	-	-	-0.18	-5.88	0.48
Roof (zone #2) cond. 1	-	-	-	-0.90	-16.69	-10.33
Roof (zone #2) cond. 2	-	-	-	-0.18	-5.88	0.48
Roof (zone #3) cond. 1	-	-	-	-0.50	-10.68	-4.33
Roof (zone #3) cond. 2	-	-	-	-0.18	-5.88	0.48
Roof (zone #4) cond. 1	-	-	-	-0.30	-7.68	-1.32
Roof (zone #4) cond. 2	-	-	-	-0.18	-5.88	0.48

Notes: 1. (+) and (-) signs signify wind pressures acting toward & away from respective surfaces.
2. Section 27.1.5, the min. wind load for MWFRS shall not be less than 16 psf; 8 psf roof-proj. onto vert. plane

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.
7. Roof zone #4 is applied for horizontal distance of > 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) =	15.00	= 0.6*h , but not < z(min) , ft. Table 26.9-1
Iz(bar) =	0.228	= c*(33/z(bar))^(1/6) , Eq. 26.9-7
Lz(bar) =	427.06	= 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 =	4.588	= (2*(LN(3600*f)))^(1/2)+0.577/(2*LN(3600*f))^(1/2) , Eq. 26.9-11
Q =	0.921	= (1/(1+0.63*((B+h)/Lz(bar))^0.63))^(1/2) , Eq. 26.9-8

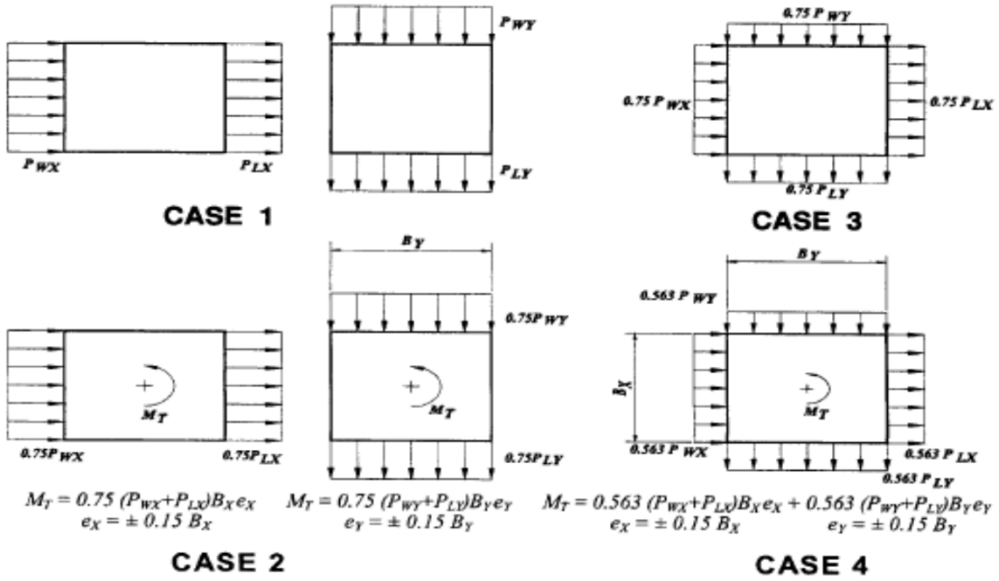
2: Calculation of G for Rigid Building

G =	0.883	= 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 =	0.020	Period Coefficient
T =	0.174	= Ct*h^(3/4) , sec. (Approximate fundamental period)
f =	5.759	= 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)) ,
Use: G =	0.850	Eq. 26.9-10

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.

Net Design Wind Pressure, p_{net30}, in lb/ft^2, for Exposure B at h = 30 ft, V= 95–130 mph

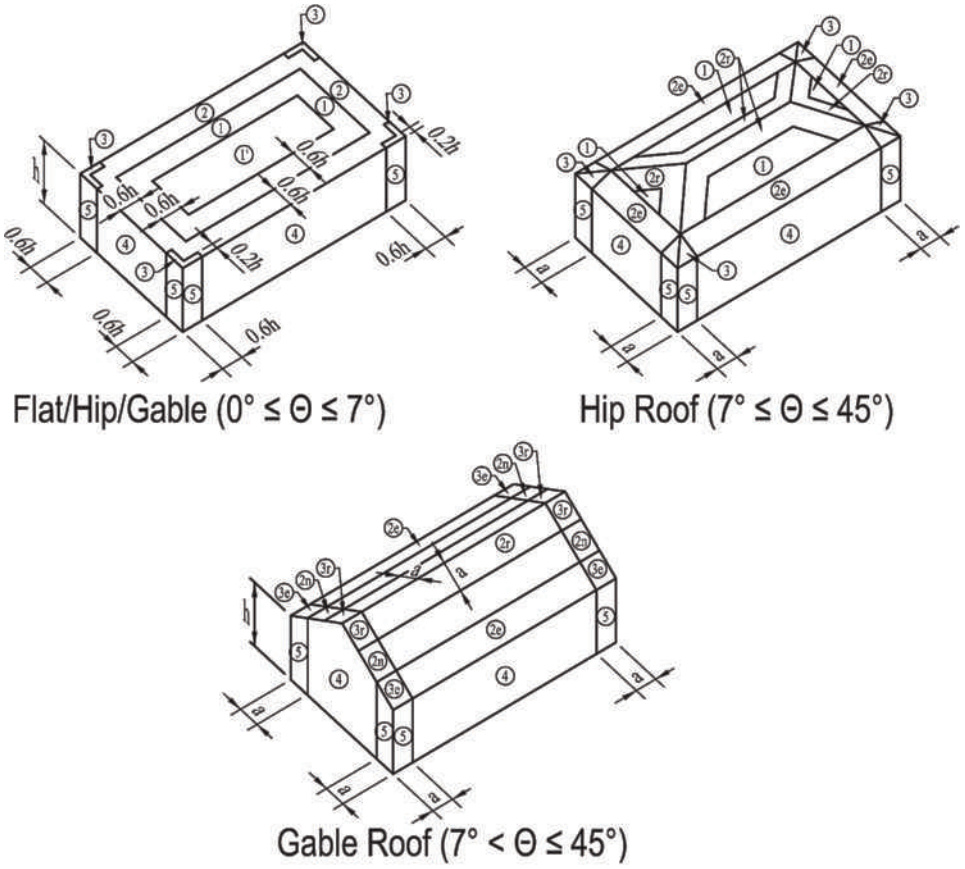
	Zone	Effective Wind Area (ft^2)	Basic Wind Speed (mph)													
			95		100		105		110		115		120		130	
Walls	4	10	16.2	–17.6	18.0	–19.5	19.8	–21.5	21.8	–23.6	23.8	–25.8	25.9	–28.1	30.4	–33.0
	4	20	15.5	–16.9	17.2	–18.7	18.9	–20.6	20.8	–22.6	22.7	–24.7	24.7	–26.9	29.0	–31.6
	4	50	14.5	–15.9	16.1	–17.6	17.8	–19.4	19.5	–21.3	21.3	–23.3	23.2	–25.4	27.2	–29.8
	4	100	13.8	–15.2	15.3	–16.8	16.9	–18.5	18.5	–20.4	20.2	–22.2	22.0	–24.2	25.9	–28.4
	5	10	16.2	–21.7	18.0	–24.1	19.8	–26.6	21.8	–29.1	23.8	–31.9	25.9	–34.7	30.4	–40.7
	5	20	15.5	–20.3	17.2	–22.5	18.9	–24.8	20.8	–27.2	22.7	–29.7	24.7	–32.4	29.0	–38.0
	5	50	14.5	–18.3	16.1	–20.3	17.8	–22.4	19.5	–24.6	21.3	–26.9	23.2	–29.3	27.2	–34.3
	5	100	13.8	–16.9	15.3	–18.7	16.9	–20.6	18.5	–22.6	20.2	–24.7	22.0	–26.9	25.9	–31.6
Flat/Hip/Gable Roof 0 to 7 Degrees	1	10	6.6	–25.9	7.3	–28.7	8.1	–31.6	8.9	–34.7	9.7	–37.9	10.5	–41.3	12.4	–48.4
	1	20	6.2	–24.2	6.9	–26.8	7.6	–29.5	8.3	–32.4	9.1	–35.4	9.9	–38.5	11.6	–45.2
	1	50	5.6	–21.9	6.3	–24.3	6.9	–26.8	7.6	–29.4	8.3	–32.1	9.0	–34.9	10.6	–41.0
	1	100	5.2	–20.2	5.8	–22.4	6.4	–24.7	7.0	–27.1	7.7	–29.6	8.3	–32.2	9.8	–37.8
	1′	10	6.6	–14.9	7.3	–16.5	8.1	–18.2	8.9	–19.9	9.7	–21.8	10.5	–23.7	12.4	–27.8
	1′	20	6.2	–14.9	6.9	–16.5	7.6	–18.2	8.3	–19.9	9.1	–21.8	9.9	–23.7	11.6	–27.8
	1′	50	5.6	–14.9	6.3	–16.5	6.9	–18.2	7.6	–19.9	8.3	–21.8	9.0	–23.7	10.6	–27.8
	1′	100	5.2	–14.9	5.8	–16.5	6.4	–18.2	7.0	–19.9	7.7	–21.8	8.3	–23.7	9.8	–27.8
	2	10	6.6	–34.1	7.3	–37.8	8.1	–41.7	8.9	–45.7	9.7	–50.0	10.5	–54.4	12.4	–63.9
	2	20	6.2	–31.9	6.9	–35.4	7.6	–39.0	8.3	–42.8	9.1	–46.8	9.9	–50.9	11.6	–59.8
	2	50	5.6	–29.0	6.3	–32.2	6.9	–35.5	7.6	–38.9	8.3	–42.5	9.0	–46.3	10.6	–54.4
	2	100	5.2	–26.8	5.8	–29.7	6.4	–32.8	7.0	–36.0	7.7	–39.3	8.3	–42.8	9.8	–50.2
	3	10	6.6	–46.5	7.3	–51.5	8.1	–56.8	8.9	–62.3	9.7	–68.1	10.5	–74.2	12.4	–87.1
	3	20	6.2	–42.1	6.9	–46.7	7.6	–51.4	8.3	–56.5	9.1	–61.7	9.9	–67.2	11.6	–78.9
	3	50	5.6	–36.3	6.3	–40.2	6.9	–44.4	7.6	–48.7	8.3	–53.2	9.0	–57.9	10.6	–68.0
	3	100	5.2	–31.9	5.8	–35.4	6.4	–39.0	7.0	–42.8	7.7	–46.8	8.3	–50.9	9.8	–59.8
Gable Roof > 7 to 20 Degrees	1	10	9.8	–30.0	10.9	–33.2	12.0	–36.6	13.2	–40.2	14.4	–44.0	15.7	–47.9	18.4	–56.2
	1	20	8.9	–30.0	9.8	–33.2	10.8	–36.6	11.9	–40.2	13.0	–44.0	14.1	–47.9	16.6	–56.2
	1	50	7.6	–18.2	8.4	–20.2	9.3	–22.3	10.2	–24.5	11.1	–26.7	12.1	–29.1	14.2	–34.2
	1	100	6.6	–9.4	7.3	–10.4	8.1	–11.4	8.9	–12.5	9.7	–13.7	10.5	–14.9	12.4	–17.5
	2e	10	9.8	–30.0	10.9	–33.2	12.0	–36.6	13.2	–40.2	14.4	–44.0	15.7	–47.9	18.4	–56.2
	2e	20	8.9	–30.0	9.8	–33.2	10.8	–36.6	11.9	–40.2	13.0	–44.0	14.1	–47.9	16.6	–56.2
	2e	50	7.6	–18.2	8.4	–20.2	9.3	–22.3	10.2	–24.5	11.1	–26.7	12.1	–29.1	14.2	–34.2
	2e	100	6.6	–9.4	7.3	–10.4	8.1	–11.4	8.9	–12.5	9.7	–13.7	10.5	–14.9	12.4	–17.5
	2n	10	9.8	–43.8	10.9	–48.5	12.0	–53.4	13.2	–58.7	14.4	–64.1	15.7	–69.8	18.4	–81.9
	2n	20	8.9	–37.8	9.8	–41.9	10.8	–46.2	11.9	–50.7	13.0	–55.4	14.1	–60.4	16.6	–70.8
	2n	50	7.6	–30.0	8.4	–33.2	9.3	–36.6	10.2	–40.2	11.1	–44.0	12.1	–47.9	14.2	–56.2
	2n	100	6.6	–24.1	7.3	–26.7	8.1	–29.4	8.9	–32.3	9.7	–35.3	10.5	–38.4	12.4	–45.1
	2r	10	9.8	–43.8	10.9	–48.5	12.0	–53.4	13.2	–58.7	14.4	–64.1	15.7	–69.8	18.4	–81.9
	2r	20	8.9	–37.8	9.8	–41.9	10.8	–46.2	11.9	–50.7	13.0	–55.4	14.1	–60.4	16.6	–70.8
	2r	50	7.6	–30.0	8.4	–33.2	9.3	–36.6	10.2	–40.2	11.1	–44.0	12.1	–47.9	14.2	–56.2
	2r	100	6.6	–24.1	7.3	–26.7	8.1	–29.4	8.9	–32.3	9.7	–35.3	10.5	–38.4	12.4	–45.1
	3e	10	9.8	–43.8	10.9	–48.5	12.0	–53.4	13.2	–58.7	14.4	–64.1	15.7	–69.8	18.4	–81.9
	3e	20	8.9	–37.8	9.8	–41.9	10.8	–46.2	11.9	–50.7	13.0	–55.4	14.1	–60.4	16.6	–70.8
	3e	50	7.6	–30.0	8.4	–33.2	9.3	–36.6	10.2	–40.2	11.1	–44.0	12.1	–47.9	14.2	–56.2
	3e	100	6.6	–24.1	7.3	–26.7	8.1	–29.4	8.9	–32.3	9.7	–35.3	10.5	–38.4	12.4	–45.1
	3r	10	9.8	–52.0	10.9	–57.6	12.0	–63.5	13.2	–69.7	14.4	–76.2	15.7	–83.0	18.4	–97.4
	3r	20	8.9	–44.6	9.8	–49.4	10.8	–54.4	11.9	–59.7	13.0	–65.3	14.1	–71.1	16.6	–83.4
	3r	50	7.6	–34.7	8.4	–38.4	9.3	–42.4	10.2	–46.5	11.1	–50.8	12.1	–55.4	14.2	–65.0
	3r	100	6.6	–27.2	7.3	–30.2	8.1	–33.3	8.9	–36.5	9.7	–39.9	10.5	–43.5	12.4	–51.0

Notes: Plus and minus signs signify pressures acting toward and away from the surfaces, respectively. For effective wind areas between those given above, the load may be interpolated; otherwise, use the load associated with the lower effective area. Gray shading indicates that the final value, including all permitted reductions, used in the design shall not be less than that required by Section 30.2.2.
Metric conversions: 1.0 ft = 0.3048 m; 1.0 ft^2 = 0.0929 m^2; 1.0 lb/ft^2 = 0.0479 kN/m^2.

FIGURE 30.4-1 (*Continued*). Components and Cladding, Part 2 [$h \leq 60$ ft ($h \leq 18.3$ m)]: Design Wind Pressures for Enclosed Buildings—Walls and Roofs

continues

Diagrams



Notation

a = 10% of least horizontal dimension or 0.4h, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).

Exception: For buildings with θ = 0° to 7° and a least horizontal dimension greater than 300 ft (90 m), dimension a shall be limited to a maximum of 0.8 h.

h = Mean roof height, in ft (m), except that eave height shall be used for roof angles <10°.

θ = Angle of plane of roof from horizontal, in degrees.

Notes

1. Pressures shown are applied normal to the surface, for Exposure B, at h = 30 ft (9.1 m). Adjust to other conditions using Eq. (30.4-1).
2. Plus and minus signs signify pressures acting toward and away from the surfaces, respectively.
3. For hip roofs with θ ≤ 25°, Zone 3 shall be treated as Zone 2e and 2r.
4. For effective wind areas between those given, values may be in terpolated; otherwise use the value associated with the lower effective wind area.
5. If overhangs exist, the lesser horizontal dimension of the building shall not include any overhang dimension, but the edge distance, a, shall be measured from the outside edge of the overhang.

FIGURE 30.4-1 Components and Cladding, Part 2 [$h \leq 60$ ft ($h \leq 18.3$ m)]: Design Wind Pressures for Enclosed Buildings—Walls and Roofs

continues

GIRT WIND LOAD

ASCE 7-16, PART 1: LOW-RISE BUILDINGS, CHAPTER 30, WIND LOADS: COMPONENTS AND CLADDING

Project: Storage Building
Date: 11.18.2023

ASCE 7-16
Table C30.3-1 Walls for Building…, p. 783

Girt Area, A =	65.38	10<A<500 ft^2	Building Dimensons		
			L=	74 ft	
Positive	Cpi		W=	40 ft	
Zones 4 and 5	0.86		h=	17.9 ft	
Negative			**a=**		
Zone 4	-0.96		10% least	4.00 ft	**<-- Contols!**
			0.4h	7.16	
Negative			4% W	1.6	
Zone 5	-1.11			3	

qh=	14.75	lb/ft^2
Cpi = +0.18	0.18	
Cpi = -0.18	-0.18	

qh = qh(Gcpi-Cp+/-0.18 Part 1: Low Rise Buildings, EQ (30.3-1)

	Cpi = +0.18	Cpi = -0.18
Zone 4 pos.	9.97	**15.28**
Zone 4 neg.	**-16.76**	-11.45
Zone 5 pos.	9.97	**15.28**
Zone 5 neg.	**-19.06**	-13.75

30.2.2 Minimum Design Wind Pressure

Not less than a net pressure of **16 lb/ft^2** acting in either direction normal to the surface

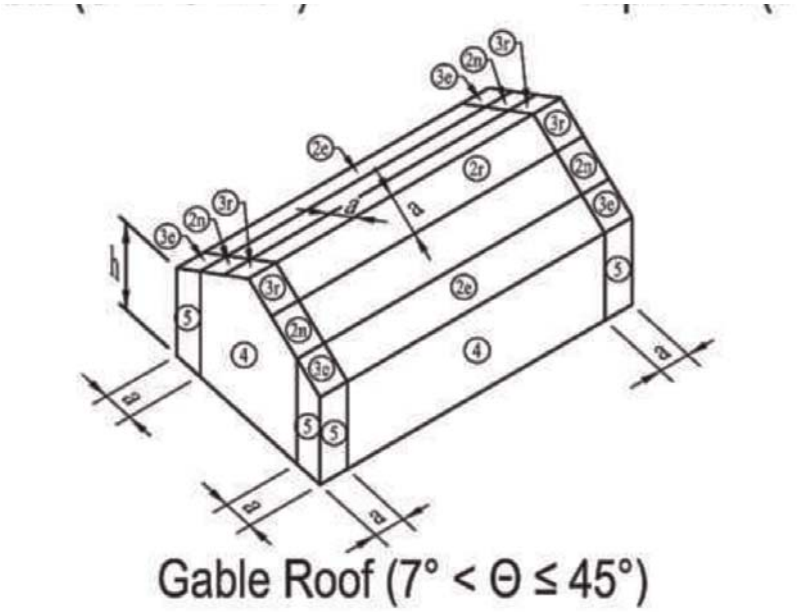
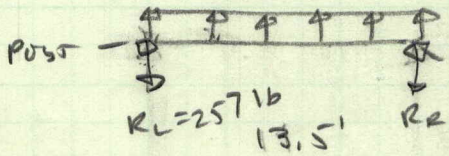


FIGURE 30.4-1, P 351

WALL GIRTS (C & C)



$w = -19.06\ lb/ft^2$ (2' ft TRIB)
$= -38.12\ lb/ft$

$$M = \frac{wl^2}{8} = \frac{38.12\ (13.5')^2}{8}$$

$= 868.47\ ft\text{-}lb\ (12\ in/ft)$
$= 10421\ in\text{-}lb$

$$S = \frac{M}{F_b} = \frac{10421\ in\text{-}lb}{900\ \frac{lb}{in^2}\ (1.6\ C_{b\ WIND})}$$ NDS TABLE 4A, p. 34

$= 7.24\ in^3$

2x6 $S = 7.56\ in^2$

∴ **USE: 2x6 #2 D.F @ 24" OC GIRTS**

USE: SIMPSON A35 EACH END 2x6 GIRT W/ (12) 0.131 x 1½ SIMPSON NAILS OR (12) SIMPSON (SDH2) #9 x 1½" SCREWS

Location: FJ1
Floor Joist
Floor Joist [2021 International Building Code(2018 NDS)
10.25 FT @ 16 O.C.
TJI 110 / 16 - iLevel Trus Joist
Section Adequate By: 43.7%
Controlling Factor: End Reaction

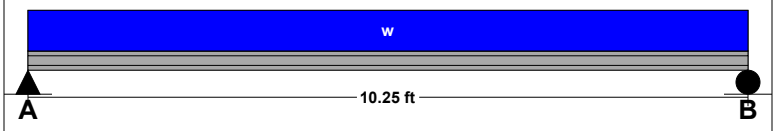
DEFLECTIONS	Center	
Live Load	0.11	IN L/1154
Dead Load	0.01	in
Total Load	0.12	IN L/1030

Live Load Deflection Criteria: L/480 Total Load Deflection Criteria: L/360

REACTIONS	A		B	
Live Load	854	lb	854	lb
Dead Load	103	lb	103	lb
Total Load	957	lb	957	lb
Bearing Length	3.50	in	3.50	in
Web Stiffeners	No		No	

SUPPORT LOADS	A		B	
Live Load	641	plf	641	plf
Dead Load	77	plf	77	plf
Total Load	718	plf	718	plf

LOADING DIAGRAM



I-JOIST PROPERTIES

TJI 110 / 16 - iLevel Trus Joist

		Base Values			Adjusted	
Moment Cap:	Mcap =	4280	ft-lb	Mcap' =	4280	ft-lb
	Cd = 1.00					
Shear Stress:	Vcap =	2145	lb	Vcap' =	2145	lb
	Cd = 1.00					
Reaction A:	Rcap =	1375	lb	Rcap' =	1375	lb
Reaction B:	Rcap =	1375	lb	Rcap' =	1375	lb
E.I.:	EI =	535	lb-in2	EI' =	535	lb-in2

Controlling Moment: 2451 ft-lb
5.12 Ft from left support of span 3 (Right Span)
Created by combining all dead and live loads.
Controlling Shear: -957 lb
10.0 Ft from left support of span 2 (Center Span)
Created by combining all dead and live loads.

JOIST DATA	Center	
Span Length	10.25	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	0	ft

Floor sheathing applied to top of joists-top of joists fully braced.
Floor Duration Factor 1.00

JOIST LOADING			
Uniform Floor Loading		Center	
Live Load	LL =	125	psf
Dead Load	DL =	15	psf
Total Load	TL =	140	psf
TL Adj. For Joist Spacing	wT =	186.7	plf

Comparisons with required sections:	Req'd		Provided	
E.I.:	223	in2-lb E6	535	in2-lb xE6
Moment:	2451	ft-lb	4280	ft-lb
Shear:	-957	lb	2145	lb

Location: FTG_B/6A
Footing
Footing [2021 International Building Code(ACI 318-14)
Footing Size: 3.0 FT Round Diameter X 36.00 IN Deep
Reinforcement: #4 Bars @ 2.54 IN. O.C. E/W / (11) min.
Section Footing Design Adequate

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs = 1500	psf
Concrete Compressive Strength:	F'c = 3000	psi
Reinforcing Steel Yield Strength:	Fy = 60000	psi
Concrete Reinforcement Cover:	c = 3	in

FOOTING SIZE

Diameter:	Dia. = 3	ft
Effective Depth to Top Layer of Steel:	d = 32.25	in

COLUMN AND BASEPLATE SIZE

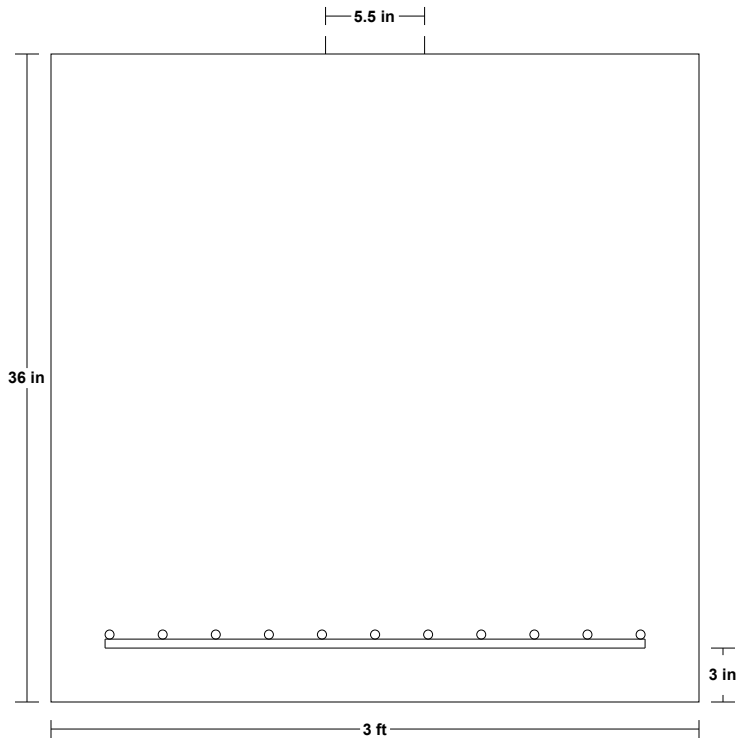
Column Type:	Wood	
Column Width:	m = 5.5	in
Column Depth:	n = 5.5	in

FOOTING CALCULATIONS

Bearing Calculations:			
Ultimate Bearing Pressure:	Qu =	763	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1050	psf
Required Footing Area:	Areq =	5.13	sf
Area Provided:	A =	7.07	sf
Baseplate Bearing:			
Bearing Required:	Bear =	8008	lb
Allowable Bearing:	Bear-A =	100279	lb
Beam Shear Calculations (One Way Shear):			
Beam Shear:	Vu1 =	0	lb
Allowable Beam Shear:	Vc1 =	84534	lb
Punching Shear Calculations (Two Way Shear):			
Critical Perimeter:	Bo =	0	in
Punching Shear:	Vu2 =	0	lb
Allowable Punching Shear (ACI 11-35):	vc2-a =	0	lb
Allowable Punching Shear (ACI 11-36):	vc2-b =	0	lb
Allowable Punching Shear (ACI 11-37):	vc2-c =	0	lb
Controlling Allowable Punching Shear:	vc2 =	0	lb
Bending Calculations:			
Factored Moment:	Mu =	31936	in-lb
Nominal Moment Strength:	Mn =	3668480	in-lb
Reinforcement Calculations:			
Concrete Compressive Block Depth:	a =	1.59	in
Steel Required Based on Moment:	As(1) =	0.02	in2
Min. Code Req'd Reinf. Flex. Members (ACI-150.1):	As(2) =	2.07	in2
Controlling Reinforcing Steel:	As-reqd =	2.07	in2
Selected Reinforcement:	#4's @ 2.5 in. o.c. e/w (11) Min.		
Reinforcement Area Provided:	As =	2.16	in2
Development Length Calculations:			
Development Length Required:	Ld =	15	in
Development Length Supplied:	Ld-sup =	12.95	in

Note: Plain concrete adequate for bending,
therefore adequate development length not required.

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL = 3850	lb
Dead Load:	PD = 1540	lb
Total Load:	PT = 5390	lb
Ultimate Factored Load:	Pu = 8008	lb
Footing plus soil above footing weight:	Wt = 2050	lb

Location: FTG_G/3G
Footing
Footing [2021 International Building Code(ACI 318-14)
Footing Size: 3.0 FT Round Diameter X 36.00 IN Deep
Reinforcement: #4 Bars @ 2.54 IN. O.C. E/W / (11) min.
Section Footing Design Adequate

FOOTING PROPERTIES

Allowable Soil Bearing Pressure:	Qs =	1500 psf
Concrete Compressive Strength:	F'c =	3000 psi
Reinforcing Steel Yield Strength:	Fy =	60000 psi
Concrete Reinforcement Cover:	c =	3 in

FOOTING SIZE

Diameter:	Dia. =	3 ft
Effective Depth to Top Layer of Steel:	d =	32.25 in

COLUMN AND BASEPLATE SIZE

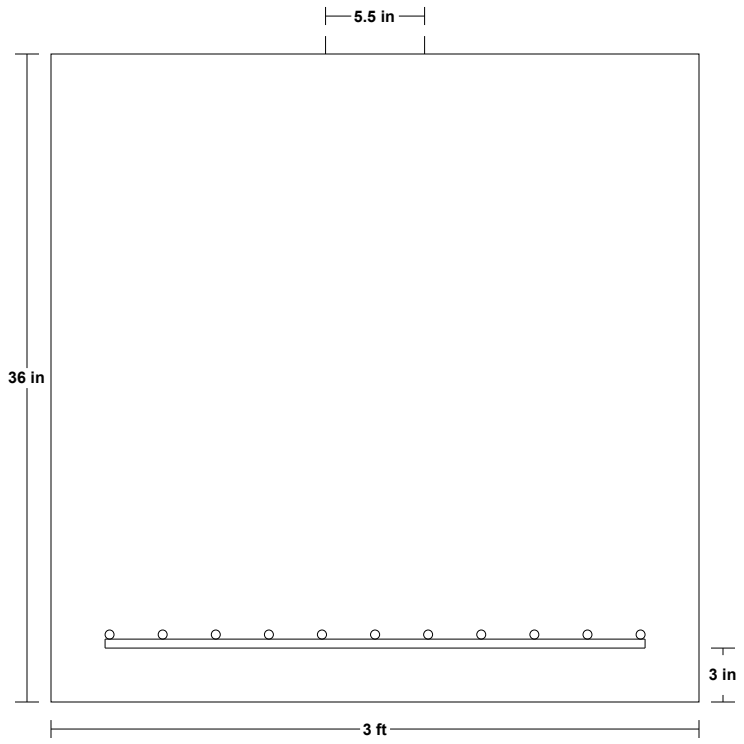
Column Type:	Wood
Column Width:	m = 5.5 in
Column Depth:	n = 5.5 in

FOOTING CALCULATIONS

Bearing Calculations:			
Ultimate Bearing Pressure:	Qu =	263	psf
Effective Allowable Soil Bearing Pressure:	Qe =	1050	psf
Required Footing Area:	Areq =	1.77	sf
Area Provided:	A =	7.07	sf
Baseplate Bearing:			
Bearing Required:	Bear =	2758	lb
Allowable Bearing:	Bear-A =	100279	lb
Beam Shear Calculations (One Way Shear):			
Beam Shear:	Vu1 =	0	lb
Allowable Beam Shear:	Vc1 =	84534	lb
Punching Shear Calculations (Two Way Shear):			
Critical Perimeter:	Bo =	0	in
Punching Shear:	Vu2 =	0	lb
Allowable Punching Shear (ACI 11-35):	vc2-a =	0	lb
Allowable Punching Shear (ACI 11-36):	vc2-b =	0	lb
Allowable Punching Shear (ACI 11-37):	vc2-c =	0	lb
Controlling Allowable Punching Shear:	vc2 =	0	lb
Bending Calculations:			
Factored Moment:	Mu =	10997	in-lb
Nominal Moment Strength:	Mn =	3668480	in-lb
Reinforcement Calculations:			
Concrete Compressive Block Depth:	a =	1.59	in
Steel Required Based on Moment:	As(1) =	0.01	in2
Min. Code Req'd Reinf. Flex. Members (ACI-150.1):	As(2) =	2.07	in2
Controlling Reinforcing Steel:	As-reqd =	2.07	in2
Selected Reinforcement:	#4's @ 2.5 in. o.c. e/w (11) Min.		
Reinforcement Area Provided:	As =	2.16	in2
Development Length Calculations:			
Development Length Required:	Ld =	15	in
Development Length Supplied:	Ld-sup =	12.95	in

Note: Plain concrete adequate for bending,
therefore adequate development length not required.

LOADING DIAGRAM



FOOTING LOADING

Live Load:	PL =	1326 lb
Dead Load:	PD =	530 lb
Total Load:	PT =	1856 lb
Ultimate Factored Load:	Pu =	2758 lb
Footing plus soil above footing weight:	Wt =	2050 lb

Location: H1
Multi-Loaded Multi-Span Beam
Multi-Loaded Multi-Span Beam [2021 International Building Code(2018 NDS)
3.5 IN x 7.25 IN x 3.67 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 130.0%
Controlling Factor: Shear

DEFLECTIONS	Center	
Live Load	0.01	IN L/3003
Dead Load	0.00	in
Total Load	0.02	IN L/2660

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	1173	lb	1173	lb
Dead Load	151	lb	151	lb
Total Load	1324	lb	1324	lb
Bearing Length	0.61	in	0.61	in

BEAM DATA	Center	
Span Length	3.67	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	3.67	ft
Live Load Duration Factor	1.00	
Notch Depth	0.00	

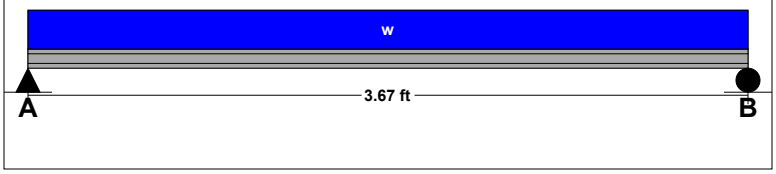
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 1170	psi
	Cd=1.00 CF=1.30			
Shear Stress:	Fv = 180	psi	Fv' = 180	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1215 ft-lb
1.84 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: -1324 lb
4.0 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	12.46	in3	30.66	in3
Area (Shear):	11.03	in2	25.38	in2
Moment of Inertia (deflection):	13.32	in4	111.15	in4
Moment:	1215	ft-lb	2989	ft-lb
Shear:	-1324	lb	3045	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	639	plf
Uniform Dead Load	77	plf
Beam Self Weight	6	plf
Total Uniform Load	722	plf

Location: H2
Multi-Loaded Multi-Span Beam
Multi-Loaded Multi-Span Beam [2021 International Building Code(2018 NDS)
3.5 IN x 7.25 IN x 3.67 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 8.2%
Controlling Factor: Shear

DEFLECTIONS	Center	
Live Load	0.03	IN L/1407
Dead Load	0.00	in
Total Load	0.04	IN L/1251

Live Load Deflection Criteria: L/360 Total Load Deflection Criteria: L/240

REACTIONS	A		B	
Live Load	2503	lb	2503	lb
Dead Load	311	lb	311	lb
Total Load	2814	lb	2814	lb
Bearing Length	1.29	in	1.29	in

BEAM DATA	Center	
Span Length	3.67	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	3.67	ft
Live Load Duration Factor	1.00	
Notch Depth	0.00	

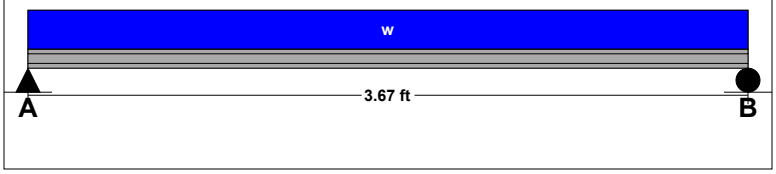
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values			Adjusted		
Bending Stress:	Fb =	900	psi	Fb' =	1170	psi
	Cd=1.00 CF=1.30					
Shear Stress:	Fv =	180	psi	Fv' =	180	psi
	Cd=1.00					
Modulus of Elasticity:	E =	1600	ksi	E' =	1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ =	625	psi	Fc - ⊥' =	625	psi

Controlling Moment: 2582 ft-lb
1.84 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 2814 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	26.48	in3	30.66	in3
Area (Shear):	23.45	in2	25.38	in2
Moment of Inertia (deflection):	28.44	in4	111.15	in4
Moment:	2582	ft-lb	2989	ft-lb
Shear:	2814	lb	3045	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	1364	plf
Uniform Dead Load	164	plf
Beam Self Weight	6	plf
Total Uniform Load	1534	plf

Location: H3
Multi-Loaded Multi-Span Beam
Multi-Loaded Multi-Span Beam [2021 International Building Code(2018 NDS)
5.5 IN x 11.5 IN x 13.54 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 229.3%
Controlling Factor: Moment

DEFLECTIONS	Center	
Live Load	0.06	IN L/2562
Dead Load	0.05	in
Total Load	0.11	IN L/1446

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	515	lb	515	lb
Dead Load	397	lb	397	lb
Total Load	912	lb	912	lb
Bearing Length	0.27	in	0.27	in

BEAM DATA	Center	
Span Length	13.54	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	13.54	ft
Live Load Duration Factor	1.15	
Notch Depth	0.00	

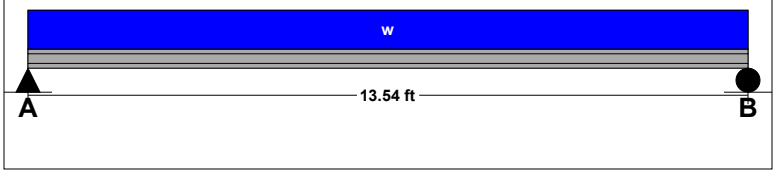
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 875	psi	Fb' = 1006	psi
	Cd=1.15 CF=1.00			
Shear Stress:	Fv = 170	psi	Fv' = 196	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1300	ksi	E' = 1300	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 3087 ft-lb
6.77 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 912 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	36.82	in3	121.23	in3
Area (Shear):	7	in2	63.25	in2
Moment of Inertia (deflection):	86.8	in4	697.07	in4
Moment:	3087	ft-lb	10166	ft-lb
Shear:	912	lb	8244	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	76	plf
Uniform Dead Load	45	plf
Beam Self Weight	14	plf
Total Uniform Load	135	plf

Wood Material Properties

	Label	Species	Grade	Cm	Emod	Nu	Therm (\1E...	Dens[lb/ft^3]
1	DF-#2	Douglas Fir-Larch	No.2		1	.3	.3	35

Wood Section Sets

	Label	Shape	Type	Design List	Material	Design Rules	A [in2]	Iyy [in4]	Izz [in4]	J [in4]
1	POLE	6X6	Column	Posts	DF-#2	Typical	30.25	76.255	76.255	128.871
2	BRACE	2-2X6B	VBrace	Rectangular Double	DF-#2	Typical	16.5	12.375	41.594	32.615

Design Size and Code Check Parameters

	Label	Max Depth[in]	Min Depth[in]	Max Width[in]	Min Width[in]	Max Bending Chk	Max Shear Chk
1	Typical					1	1

Wood Design Parameters

	Label	Shape	Length[...	le2[ft]	le1[ft]	le-bend to...	le-bend bo...	Kyy	Kzz	CV	Cr	y sway	z sway
1	M1	POLE	14.43										
2	M2	POLE	7.38										
3	M3	BRACE	10.437										

Member Point Loads (BLC 3 : SEISMIC)

	Member Label	Direction	Magnitude[lb,lb-ft]	Location[ft,%]
1	M2	X	2000	1.5

Joint Reactions (By Combination)

	LC	Joint Label	X [lb]	Y [lb]	Z [lb]	MX [lb-ft]	MY [lb-ft]	MZ [lb-ft]
1	1	N1	60.305	4630.952	0	NC	NC	NC
2	1	N3	-258.257	0	0	0	0	0
3	1	N4	-1802.048	-1736.952	0	0	0	0
4	1	Totals:	-2000	2894	0			
5	1	COG (ft):	X: 0	Y: 21.81	Z: 0			

Basic Load Cases

	BLC Description	Category	X Gravity	Y Gravity	Z Gravity	Joint	Point	Distribut...	Area(Memb...	Surface...
1	AXIAL Lr	LL				1				
2	AXIAL D	DL				1				
3	SEISMIC	ELX+Y					1			

Load Combinations

	Description	Solve	PD...	SR...	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor	BLC	Factor
1	Lr+D+S	Yes	Y	+	1	1	2	1	3	1										

Joint Deflections

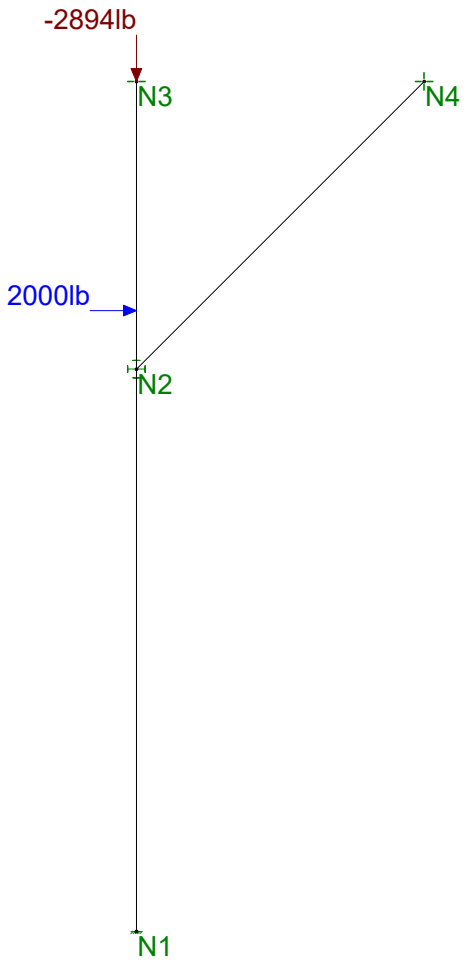
	LC	Joint Label	X [in]	Y [in]	Z [in]	X Rotation [rad]	Y Rotation [rad]	Z Rotation [rad]
1	1	N1	0	0	0	0	0	0
2	1	N2	.037	-.02	0	0	0	-3.399e-3
3	1	N3	0	-.027	0	0	0	3.626e-3
4	1	N4	0	0	0	0	0	2.179e-3

Member Section Stresses

	LC	Member Label	Sec	Axial[psi]	y Shear[psi]	z Shear[psi]	y top Bendin...	y bot Bendin...	z top Bendin...	z bot Bendin...
1	1	M1	1	153.089	-2.912	0	113.173	-113.173	0	0
2			2	153.089	-2.912	0	21.502	-21.502	0	0
3			3	153.089	-2.912	0	-70.168	70.168	0	0
4			4	153.089	-2.912	0	-161.839	161.839	0	0
5			5	153.089	-2.912	0	-253.509	253.509	0	0
6	1	M2	1	95.669	86.271	0	-467.266	467.266	0	0
7			2	95.669	-12.902	0	623.255	-623.255	0	0
8			3	95.669	-12.902	0	415.503	-415.503	0	0
9			4	95.669	-12.902	0	207.752	-207.752	0	0
10			5	95.669	-12.902	0	0	0	0	0
11	1	M3	1	151.664	-4.302	0	391.887	-391.887	0	0
12			2	151.664	-4.302	0	293.915	-293.915	0	0
13			3	151.664	-4.302	0	195.944	-195.944	0	0
14			4	151.664	-4.302	0	97.972	-97.972	0	0
15			5	151.664	-4.302	0	0	0	0	0

Member Wood Code Checks

	LC	Member	Shape	UC Max	Loc[ft]	Shear ...	Loc[ft]	Dir	Fc'[psi]	Ft'[psi]	Fb1'[psi]	Fb2'[psi]	Fv'[psi]	RB	CL	CP	Eqn
1	1	M1	6X6	.764	14.43	.017	0	y	333.26	475	750	750	170	5.611	1	.476	3.9-3
2	1	M2	6X6	.961	1.537	.507	0	y	615.05	475	750	750	170	4.013	1	.879	3.9-3
3	1	M3	2-2X6B	.989	0	.024	0	y	198.174	747.5	1161.57	1345.5	180	8.749	.993	.133	3.9-3



Loads: LC 1, Lr+D+S

William E. Barlow, P.E.	Storage Bldg, Pole A-4A	1
WEB		Nov 19, 2023 at 3:33 PM
23024		Benton-Co.r3d

William E. Barlow. P.E.

P.O. Box 43
Philomath, OR 97370
541-609-8777

Pole Footing Embedded in Soil

Project File: Benton-Co.ec6

DESCRIPTION: POLE FOOTING A/4A

Code References

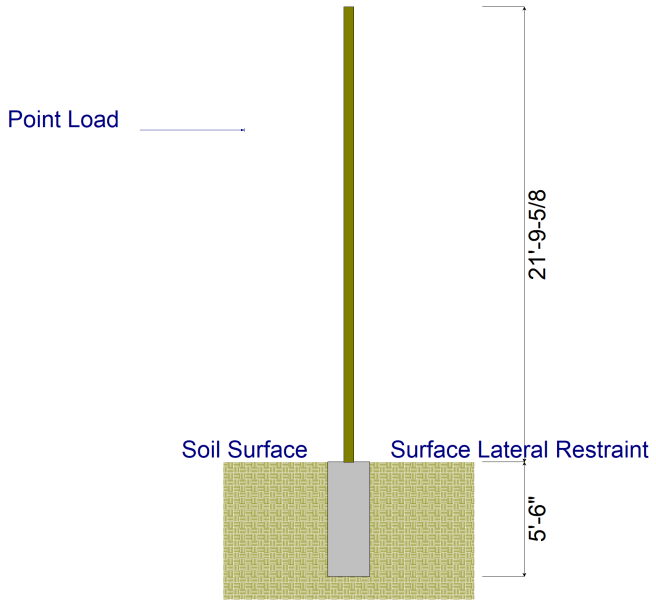
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16
Load Combinations Used : IBC 2021

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	24.0 in
Calculate Min. Depth for Allowable Pressures	
Lateral Restraint at Ground Surface	
Allow Passive	250.0 pcf
Max Passive	1,500.0 psf

Controlling Values

Governing Load Combination	D+0.60W
Lateral Load	1.155 k
Moment	18.376 k-ft
Restraint @ Ground Surface	
Pressure at Depth	
Actual	**1,290.88** psf
Allowable	**1,375.0** psf
Surface Retraint Force	8,254.84 lbs
Minimum Required Depth	**5.50 ft**
Footing Base Area	3.142 ft^2
Maximum Soil Pressure	0.9212 ksf



Applied Loads

	Lateral Concentrated Load (k)	Lateral Distributed Loads (k		Applied Moment (kft)	Vertical Load (k)
D : Dead Load	k		k/ft	k-ft	0.8270 k
Lr : Roof Live	k		k/ft	k-ft	2.067 k
L : Live	k		k/ft	k-ft	k
S : Snow	k		k/ft	k-ft	k
W : Wind	1.925 k		k/ft	k-ft	k
E : Earthquake	0.0 k		k/ft	k-ft	k
H : Lateral Earth	k		k/ft	k-ft	k
Load distance above ground surface	15.910 ft	TOP of Load above ground surface 21.80	ft		
		BOTTOM of Load above ground surface	ft		

Load Combination Results

	Forces @ Ground Surface		Required	Pressure at Depth		Soil Increase
Load Combination	Loads - (k)	Moments - (ft-k)	Depth - (ft)	Actual - (psf)	Allow - (psf)	Factor
D Only	0.000	0.000	0.13	0.0	31.3	1.000
+D+Lr	0.000	0.000	0.13	0.0	31.3	1.000
+D+0.750Lr	0.000	0.000	0.13	0.0	31.3	1.000
+D+0.60W	1.155	18.376	5.50	1,290.9	1,375.0	1.000
+D+0.750Lr+0.450W	0.866	13.782	5.00	1,171.5	1,250.0	1.000
+D+0.450W	0.866	13.782	5.00	1,171.5	1,250.0	1.000
+0.60D+0.60W	1.155	18.376	5.50	1,290.9	1,375.0	1.000
+0.60D	0.000	0.000	0.13	0.0	31.3	1.000

Location: PURLIN
Multi-Loaded Multi-Span Beam
Multi-Loaded Multi-Span Beam [2021 International Building Code(2018 NDS)
1.5 IN x 9.25 IN x 13.54 FT
#2 - Douglas-Fir-Larch - Dry Use
Section Adequate By: 6.7%
Controlling Factor: Moment

DEFLECTIONS	Center	
Live Load	0.24	IN L/680
Dead Load	0.16	in
Total Load	0.40	IN L/410

Live Load Deflection Criteria: L/240 Total Load Deflection Criteria: L/180

REACTIONS	A		B	
Live Load	339	lb	339	lb
Dead Load	223	lb	223	lb
Total Load	562	lb	562	lb
Bearing Length	0.60	in	0.60	in

BEAM DATA	Center	
Span Length	13.54	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	13.54	ft
Live Load Duration Factor	1.15	
Notch Depth	0.00	

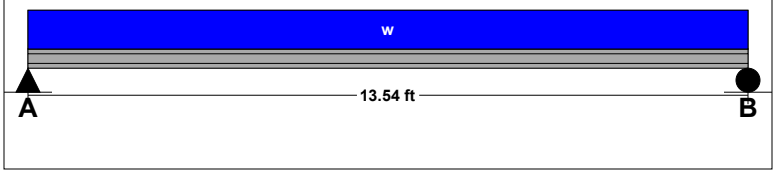
MATERIAL PROPERTIES
#2 - Douglas-Fir-Larch

	Base Values		Adjusted	
Bending Stress:	Fb = 900	psi	Fb' = 1139	psi
	Cd=1.15 CF=1.10			
Shear Stress:	Fv = 180	psi	Fv' = 207	psi
	Cd=1.15			
Modulus of Elasticity:	E = 1600	ksi	E' = 1600	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 625	psi	Fc - ⊥' = 625	psi

Controlling Moment: 1902 ft-lb
6.77 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2
Controlling Shear: 562 lb
At left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	20.05	in3	21.39	in3
Area (Shear):	4.07	in2	13.88	in2
Moment of Inertia (deflection):	43.46	in4	98.93	in4
Moment:	1902	ft-lb	2029	ft-lb
Shear:	562	lb	1915	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	50	plf
Uniform Dead Load	30	plf
Beam Self Weight	3	plf
Total Uniform Load	83	plf

Location: STAIR STRINGER
Multi-Loaded Multi-Span Beam
Multi-Loaded Multi-Span Beam [2021 International Building Code(2018 NDS)
1.75 IN x 14.0 IN x 13.75 FT (Actual 16.4 FT)
1.55E Timberstrand LSL - iLevel Trus Joist
Section Adequate By: 2.9%
Controlling Factor: Deflection

DEFLECTIONS	Center	
Live Load	0.40	IN L/494
Dead Load	0.07	in
Total Load	0.47	IN L/417

Live Load Deflection Criteria: L/480 Total Load Deflection Criteria: L/360

REACTIONS	A		B	
Live Load	1487	lb	1487	lb
Dead Load	275	lb	275	lb
Total Load	1762	lb	1762	lb
Bearing Length	1.12	in	1.12	in

BEAM DATA	Center	
Span Length	13.75	ft
Unbraced Length-Top	0	ft
Unbraced Length-Bottom	13.75	ft
Beam End Elevation Difference	8.9	ft
Live Load Duration Factor	1.00	
Notch Depth	0.00	

MATERIAL PROPERTIES

1.55E Timberstrand LSL - iLevel Trus Joist

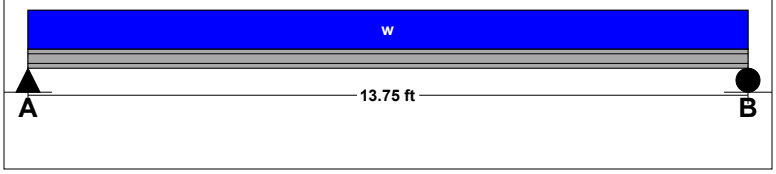
	Base Values		Adjusted	
Bending Stress:	Fb = 2325	psi	Fb' = 2292	psi
	Cd=1.00 CF=0.99			
Shear Stress:	Fv = 525	psi	Fv' = 525	psi
	Cd=1.00			
Modulus of Elasticity:	E = 1550	ksi	E' = 1550	ksi
Comp. ⊥ to Grain:	Fc - ⊥ = 900	psi	Fc - ⊥' = 900	psi

Controlling Moment: 6057 ft-lb
6.875 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Controlling Shear: -1479 lb
13.432 Ft from left support of span 2 (Center Span)
Created by combining all dead loads and live loads on span(s) 2

Comparisons with required sections:	Req'd		Provided	
Section Modulus:	31.71	in3	57.17	in3
Area (Shear):	4.23	in2	24.5	in2
Moment of Inertia (deflection):	388.77	in4	400.17	in4
Moment:	6057	ft-lb	10920	ft-lb
Shear:	-1479	lb	8575	lb

LOADING DIAGRAM



UNIFORM LOADS	Center	
Uniform Live Load	216	plf
Uniform Dead Load	26	plf
Beam Self Weight	8	plf
Total Uniform Load	250	plf