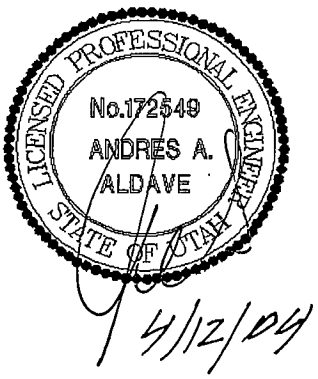


4/12/24

Aldave & Associates, LC

1486 E. Barton Creek Lane, Bountiful, UT 84010
Phone: 801-557-5524

JOB: Dr. Sorensen Fairview Office Addition, 229 S. State, Fairview, UT
CLIENT: Think Architecture
DATE: APR 2024
BY: AAA

DESIGN CRITERIA

1. GOVERNING CODE ..... 2021 IBC
2. SEISMIC DESIGN CATEGORY ..... "D"
   MCE parameters (Earthquake Spectral Acceleration Maps): $S_S = 0.573g$
   $S_1 = 0.192g$
   $I_E = 1.0$
   $R = 6.5$
3. BASIC WIND SPEED (3-second gust) ..... 110 MPH
   EXPOSURE "C"
   $I_W = 1.0$
4. ROOF ... DEAD LOAD ..... 18 PSF
   SNOW LOAD ..... 35 PSF

MATERIAL STRESSES

1. SOIL BEARING PRESSURE ..... 1500 PSF
2. CONCRETE ..... f'c = 2500 PSI
3. CONCRETE REINFORCING ..... ASTM A615 grade 60
4. DIMENSIONAL LUMBER ....joists..DOUG-FIR #2 BTR
   studs ..... DOUG-FIR #2 BTR
5. GLU-LAM ..... simple span..24F-V4 DF/DF
   continuous spans & cantilever...24F-V8 DF/DF
6. STEEL ..... ASTM A36
7. BOLTS ..... wood connections...ASTM A307

PROJECT NAME: Fairview Office

Roof Loads:

DL= 18 psf

Ground snow load :

p_g = 44.0 psf

Flat roof snow load: (ASCE Eq. 7-1*)

$p_f = 0.7 C_e C_t I p_g$ = 30.8 psf

C_e (exposure): 1.0

C_t (thermal): 1.0

I (importance): 1.0

Sloped roof snow load : (ASCE Eq. 7-2)

$p_s = C_s p_f$ = 30.8 psf

Roof slope: 4//12

C_s (warm roof): 1.00

(ASCE Fig. 7-2)

Snow Drifts on lower roofs:(ASCE 7.7.1)

Density, γ = $0.13 p_g + 14$ = 19.7 pcf ($\leq$ 30 pcf max)

h_r= 8.0 ft h_b= 1.6 ft

h_c= $h_r - h_b$= 6.4 ft

h_c/h_b = 4.12 > 0.2 ==> Drift loads need be considered

Leeward drift , high roof: lu = 41 ft. > 20 = 41 ft

h_d = 2.52 ft. (ASCE Fig. 7-9)

Windward drift , lower roo lu = 10 ft. > 20 = 20 ft (min)

$0.75 h_d$ = 1.25 ft. (ASCE Fig. 7-9)

max h_d = 2.52 ft < h_c = 6.4 ft

Drift widtl $w = 4h_d$ = 10.08 ft., or width of lower roof

Maximum intensity of drift surcharge:

$p_d = h_d \gamma$ = 49.68 psf (ASCE 7.7.1)

*All references are made to Section 7 of ASCE/SEI standard 7-16

PROJECT NAME: Fairview Office

ROOF FRAMING

RB-1: window header

SPAN =	4.5	ft	TRB AR=	4	ft	F'b =	1020 psi
						F'v =	180 psi
DL =	18	psf				E =	1600000 psi
LL =	35	psf	W(LL) =	140	plf	LDF =	1
TL =	53	psf	W(TL) =	212	plf		

MOMENT =	536.63	lb-ft	Req. S =	6.31	in3
SHEAR =	477	lb	Req. A =	3.57	in2
			Req. I(TL)=	5.43	in4 (L/240)
			Req. I(LL) =	5.38	in4 (L/360)

d= 5.5
b= 4.5

USE (3)2x6		A =	24.75 in2
		S =	22.6875 in3
		I =	62.390625 in4

RB-2: window header

SPAN =	4.5	ft	TRB AR=	16	ft	F'b =	1020 psi
						F'v =	180 psi
DL =	18	psf				E =	1600000 psi
LL =	35	psf	W(LL) =	560	plf	LDF =	1.15
TL =	53	psf	W(TL) =	848	plf		

MOMENT =	2146.5	lb-ft	Req. S =	22	in3
SHEAR =	1908	lb	Req. A =	12	in2
			Req. I(TL)=	54.3	in4 (L/600)
			Req. I(LL) =	21.5	in4 (L/360)

d= 7.25
b= 4.5

USE (3)2x8		A =	32.625 in2
		S =	39.421875 in3
		I =	142.9042969 in4

PROJECT NAME: Fairview Office

ROOF FRAMING

RB-3: window header

SPAN =	4.5	ft	TRB AR=	7	ft	F'b =	1020 psi
						F'v =	180 psi
DL =	18	psf				E =	1600000 psi
LL =	55	psf	W(LL) =	385	plf	LDF =	1.15
TL =	73	psf	W(TL) =	511	plf		

MOMENT =	1293	lb-ft	Req. S =	13.232	in3
SHEAR =	1150	lb	Req. A =	7.2129	in2
			Req. I(TL)=	13.096	in4 (L/240)
			Req. I(LL) =	14.801	in4 (L/360)

d= 7.25
b= 4.5

USE (3)2x8		A =	32.625 in2
		S =	39.421875 in3
		I =	142.9042969 in4

RB-4: interior beam

SPAN =	5	ft	TRB AR=	17	ft	F'b =	935 psi
						F'v =	180 psi
DL =	18	psf				E =	1600000 psi
LL =	38	psf	W(LL) =	646	plf	LDF =	1.15
TL =	56	psf	W(TL) =	952	plf		

MOMENT =	2975	lb-ft	Req. S =	33.202	in3
SHEAR =	2380	lb	Req. A =	14.588	in2
			Req. I(TL)=	83.672	in4 (L/600)
			Req. I(LL) =	34.066	in4 (L/360)

d= 9.25
b= 3

USE (2)2x10		A =	27.75 in2
		S =	42.78125 in3
		I =	197.8632813 in4

PROJECT NAME: Fairview Office

ROOF FRAMING

RB-5: interior beam

SPAN =	9.5	ft	TRB AR=	28	ft	F'b =	2900 psi
						F'v =	285 psi
DL =	18	psf				E =	2000000 psi
LL =	38	psf	W(LL) =	1064	plf	LDF =	1.15
TL =	56	psf	W(TL) =	1568	plf		

MOMENT =	17689	lb-ft	Req. S =	63.65	in3
SHEAR =	7448	lb	Req. A =	31.25	in2
			Req. I(TL)=	302.5	in4 (L/240)
			Req. I(LL) =	307.9	in4 (L/360)

d= 9.5
b= 5.25

USE 5-1/4 x 9-1/2 Parallam	A =	49.875	in2
	S =	78.96875	in3
	I =	375.1015625	in4

RB-6: exterior beam

SPAN =	9.5	ft	TRB AR=	7	ft	F'b =	2400 psi
						F'v =	245 psi
DL =	18	psf				E =	1800000 psi
LL =	65	psf	W(LL) =	455	plf	LDF =	1.15
TL =	83	psf	W(TL) =	581	plf		

MOMENT =	6554.4	lb-ft	Req. S =	28.5	in3
SHEAR =	2759.8	lb	Req. A =	13.53	in2
			Req. I(TL)=	311.3	in4 (L/600)
			Req. I(LL) =	146.3	in4 (L/360)

d= 9
b= 5.125

USE 5-1/8 x 9 GLB	A =	46.125	in2
	S =	69.1875	in3
	I =	311.34375	in4

PROJECT NAME: Fairview Office

ROOF FRAMING

Rafters at exterior porch

SPAN =	9	ft	TRB AR=	1.33	ft	F'b =	935 psi
						F'v =	180 psi
DL =	18	psf				E =	1600000 psi
LL =	70	psf	W(LL)	93.1	plf	LDF =	1.15
TL =	88	psf	W(TL)	117	plf		

MOMENT =	1185	lb-ft	Req. S =	13.2	in3
SHEAR =	526.7	lb	Req. A =	3.49	in2
			Req. I(TL)=	24	in4 (L/240)
			Req. I(LL) =	28.6	in4 (L/360)
d=	9.25				
b=	1.5				

USE 2x10 @ 16" o.c.

A =	13.875	in2
S =	21.390625	in3
I =	98.93164063	in4

PROJECT NAME: Fairview Office

SEISMIC ANALYSIS

From Earthquake Spectral Acceleration Maps "CD":
MCE Parameters - Conterminous 48 States
lat: 39.624 Long: -111.439

S_s = 0.573 g < 1.5 g ==: Use Ss = 0.573 g
S_1 = 0.192 g

Occupancy Category: I
Site Class: "D"

F_a = 1.34
F_v = 2.22

S_{MS} = F_aS_s = 0.768 g
S_{M1} = F_vS_1 = 0.425 g

S_{DS} = $(2/3)S_{MS}$ = 0.512 g
S_{D1} = $(2/3)S_{M1}$ = 0.284 g

==> Seismic Design Category: "D"

Seismic Base Shear (Equivalent lateral force procedure- ASCE 12.8):

V_{MAX}= $[S_{D1}/((R/I)T)]$ W = 0.43638 W
V= $[S_{DS}/(R/I)]$ W = 0.07881 <== Cs**
V_{MIN}= $[0.5S_1/(R/I)]$ W = 0.01477

N= 1
R = 6.5
I = 1.0
C_T = 0.020
h_n = 21.5
T = 0.100
T_L = 6 > 0.1

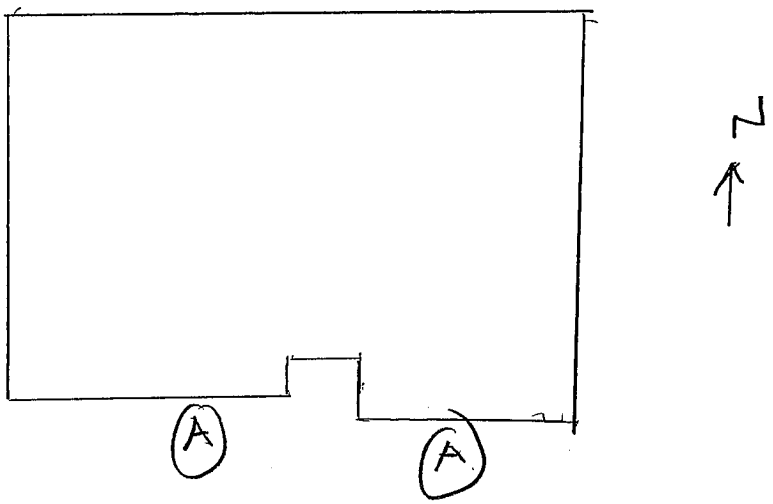
*All section references are made to the 2021 International Building Code & the ASCE/SEI 7-16
** Indicates Seismic response coefficient to be used

PROJECT NAME: Fairview Office

SEISMIC ANALYSIS (cont'd)

	WT(psf)	Width (ft)	Length (ft)		Width (ft)	Length (ft)	Tot (lbs)	Cumul. Total (lbs)
W(roof) =	18	50	55	+			49500	
W(wall) =	35	4	105	+			14700	
							64200	

V(roof) = V* (Tot) = 5059.57 *0.7 = 3541.7 lbs 3541.7



PROJECT NAME: Fairview Office

WIND ANALYSIS

End Zone Width

Min[horiz length], ft = 49

$h_{eave, ft}$ = 8

Edge Strip= a = Min{0.10*Min[horiz. length],0.40h $_{eave}$} ≥ Max{0.04*Min[horiz.length],3}

= Min{0.10*49,0.40*8} Max{0.04*49,3}

= 3.2 ft ≥ 3 ft

End Zone = 2*a = 6.4 ft

Design Wind Pressures:

Basic Wind Speed = 110 mph (3 -second gust) Roof Angle : 18.43

Exposure: "C"

TRANSVERSE MWFRS DIRECTION:

Type	Zone	Surface	Base press. psf	Height & Exp.Factor	Iw	Design Press, psf
Horiz	End	Wall	25.000	1.21	1.0	30.250
		Roof	-7.500	1.21	1.0	0.000
	Interior	Wall	17.000	1.21	1.0	20.570
		Roof	-4.200	1.21	1.0	0.000
Vert	End	Wind	-23.000	1.21	1.0	-27.830
		Lee	-15.500	1.21	1.0	-18.755
	Interior	Wind	-16.000	1.21	1.0	-19.360
		Lee	-11.800	1.21	1.0	-14.278

LONGITUDINAL MWFRS DIRECTION:

Type	Zone	Surface	Base press. psf	Height & Exp.Factor	Iw	Design Press, psf
Horiz	End	Wall	25.000	1.21	1.0	30.250
		Roof	-7.500	1.21	1.0	0.000
	Interior	Wall	17.000	1.21	1.0	20.570
		Roof	-4.200	1.21	1.0	0.000
Vert	End	Wind	-23.000	1.21	1.0	-27.830
		Lee	-15.500	1.21	1.0	-18.755
	Interior	Wind	-16.000	1.21	1.0	-19.360
		Lee	-11.800	1.21	1.0	-14.278

* Upward vertical loads are counteracted by roof DL

PROJECT NAME: Fairview Office

Total Wind Loads:

NORTH-SOUTH DIRECTION:

	Wind (psf)	Width (ft)	Height (ft)		Width (ft)	Height (ft)	Sub-Tt(lb)	0.6 xTotal*(lbs)
V(roof-end-transv)=	0.000	0	0	+			0.00	
	30.250	13	4	+			1573.00	943.80
V(roof-int-transv)=	0.000	0	0	+			0.00	
	20.570	40	4	+	52	4.5	8104.58	4862.75
				+			0.00	
V(flr-end-transv)=								
V(flr-int-transv)=								
				+			0.00	
				+			0.00	0.00
							TOTAL =	5806.55

EAST-WEST DIRECTION:

	Wind (psf)	Width (ft)	Height (ft)		Width (ft)	Height (ft)	Sub-Tt(lb)	0.6 xTotal*(lbs)
V(roof-end-transv)=	0.000	0	0	+			0.00	
	30.250	13	4	+			1573.00	943.80
V(roof-int-transv)=	0.000	0	0	+			0.00	
	20.570	34	4	+	31	2.5	4391.70	2635.02
				+			0.00	
V(flr-end-transv)=								
V(flr-int-transv)=								
				+			0.00	
				+			0.00	0.00
							TOTAL =	3578.82

PROJECT NAME: Fairview Office

SHEAR WALLS DESIGN

	SEISMIC**	WIND		SEISMIC	WIND			
Wall	Trib. load (lbs.)	Trib. load (lbs.)	Length (ft)	Shear (lb/ft)	Shear (lb/ft)	Shear* adj.(lb/ft)	Shear wall type	
"A"	1771.0	1624.0	29	61.07	56.00	40.00	SW-1	main flr

*as per IBC 2306.3.2 unit shears due to wind have been reduced by 28.6%
(equivalent to a 40% increase in the allowable shear capacity)

SHEAR WALLS SHEATHING DESIGN:

7/16" OSB nailed:
SW-1 8d at 6"o.c. at edges & 8d at 12" o.c. at field GF: 260 plf
With 5/8" diam. anchor bolts at 32" o.c. GF: 444 plf

PROJECT NAME: Fairview Office

OVERTURNING FACTORS:

Sds= 0.512

8. (0.9 - 0.14Sds/1.4)D 0.84877

Wind = 0.67

OVERTURNING ANALYSIS

Shear Wall	Panel #	Length (ft)	O.M. (lb-ft)	R.M. (lb-ft)	T = C (lbs)	DL React.* (lbs)	Connector to use**:	G.F.**: (lbs)
"A" (main flr)	1	9	4259.6	4721.5	0.0	0/0	none	
	2	11	5374.1	13115.3	0.0	0/0	none	

PROJECT NAME: Fairview Office
Allowable Soils Bearing Pressure: 1500 psf

LOCATION	Roof	Trib.	2nd floor	Trib.	1st floo	Trib.	Stud wal	Trib	Conc. Wa	Trib	TOTAL
typical exterior walls	58	17					18	10	100	4	1566
	W=	1.04	ft								

Use 2'-0" CONT.