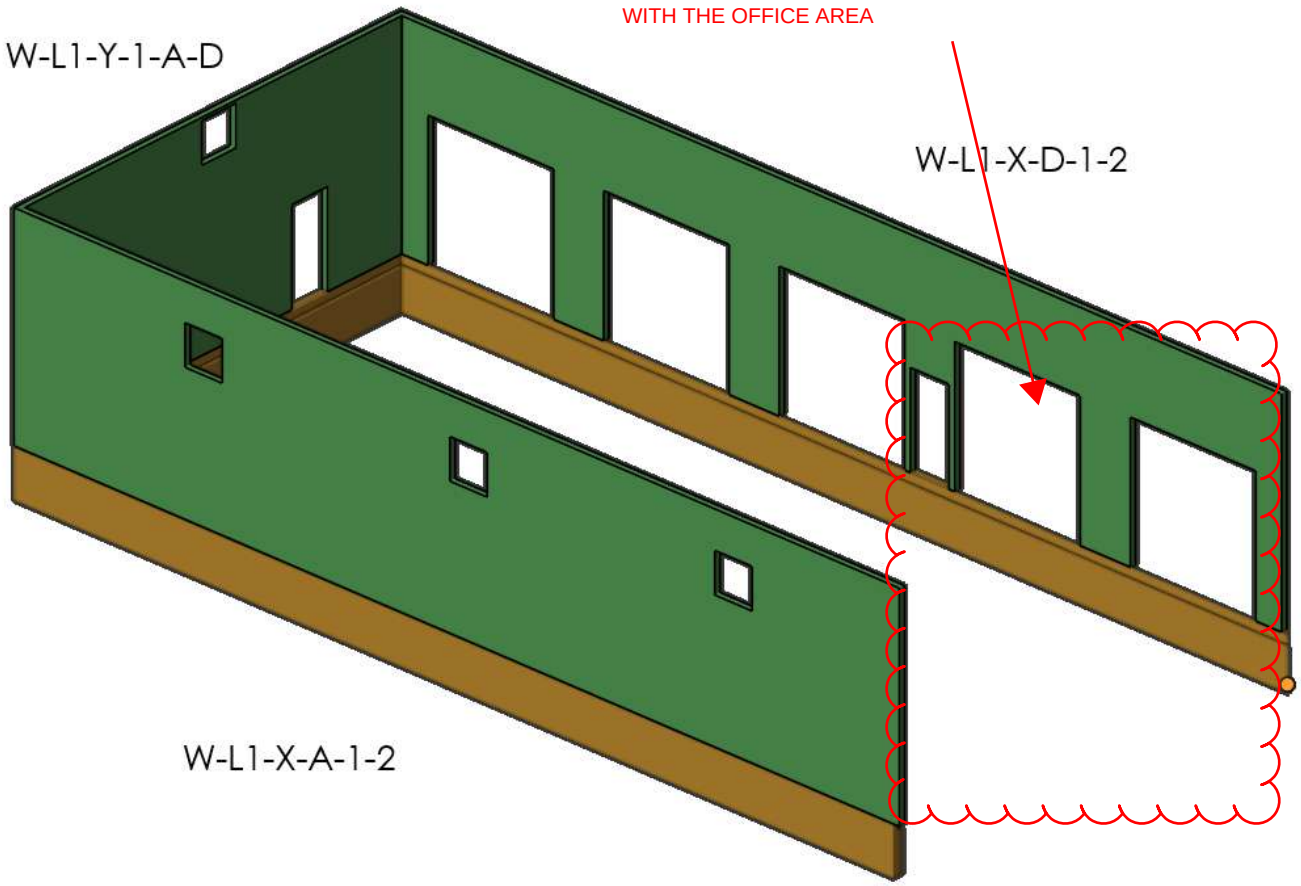
Wall Framing Design - Service Area

First Storey Walls:

- Wall Framing Design: W-L1-X-A-1-2
- Wall Framing Design: W-L1-X-D-1-2
- Wall Framing Design: W-L1-Y-1-A-D

YOUR DESIGN OF THE ROOF FRAMING NEEDS TO TAKE INTO ACCOUNT SNOW DRIFTING ALONG THE SERVICE INTERFACE WITH THE OFFICE AREA



TYPICAL WOOD TO USE IN THIS AREA IS SPRUCE PINE FIR (SPF). I WOULD USE EITHER STUD GRADE OF NO. 1/ NO. 2. SOUTHERN PINE IS A DIFFICULT WOOD TO WORK WITH. IT HAS GREAT STRENGTH BUT TENDS TO TWIST ALOT

Wall Framing Design: W-L1-X-A-1-2

Components

Wall - Dimensions (L x H): 71.6 ft x 16 ft

Window Opening - Dimensions (L x H_{top}): 3 ft x 13.2 ft

Component	Section	Product / Species	Grade
Studs	2x6 @ 16 in O.C.	Southern Pine	No.2
Top plate	(2) 2x6	Southern Pine	No.2
Sill plate	2x6 Pressure Treated	Southern Pine	No.2

Component	Section	Product / Species	Grade
Window Opening - Posts	(1) 2x6	Southern Pine	No.2
Window Opening - Lintel	(3) 2x6	Southern Pine	No.2

Loads

Source	Dead	Live	Snow	Wind	Width
Self-weight and wind	10 psf	-	-	16.4 psf	-
Roof - Service area	13 psf	-	23.4 psf	-	20.1 ft

THIS SHOULD BE A MINIMUM OF 15 PSF, BUT YOU MAY WANT TO USE 20 PSF TO ACCOUNT FOR FUTURE CONSIDERATION OF PHOTO VOTAIC PANELS ADDED TO THE ROOF

I WOULD SUGGEST USING A ROOF SNOW LOAD OF 30 PSF FOR DESIGN, THAT IS MY PERSONAL PREFERENCE

Analysis and Design Result

Studs

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 1.08 kip , f_c: 131.2 psi	F_c: 322 psi , C_P: 0.2	0.41	✔
D + 0.6 W	Buckling + Bending	P: 0.46 kip , f_c: 55.2 psi M: 0.42 kip-ft , f_b: 666.2 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.39	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 0.93 kip , f_c: 112.2 psi M: 0.31 kip-ft , f_b: 499.6 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.45	✔
D + 0.6 W	Shear	V: 0.1 kip , f_v: 19.1 psi	F_v: 280 psi	0.07	✔
D + 0.75 S + 0.45 W	Shear	V: 0.079 kip , f_v: 14.3 psi	F_v: 280 psi	0.05	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.35 in	d_U: 0.53 in (L / 360)	0.65	✔

Top plate

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.18 kip-ft , f_b: 524.7 psi	F_b: 1322.5 psi	0.40	✔
D + S	Shear	V: 0.54 kip , f_v: 49.2 psi	F_v: 201.2 psi	0.24	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.009 in	d_U: 0.044 in (L / 360)	0.20	✔
1.5 D + S	Deflection	d: 0.018 in	d_U: 0.067 in (L / 240)	0.27	✔

Window Opening - Posts

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 1.22 kip , f_c: 147.6 psi	F_c: 322 psi , C_P: 0.2	0.46	✔
D + 0.6 W	Buckling + Bending	P: 0.51 kip , f_c: 62.1 psi M: 0.47 kip-ft , f_b: 749.5 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.46	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 1.04 kip , f_c: 126.2 psi M: 0.35 kip-ft , f_b: 562.1 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.56	✔
D + 0.6 W	Shear	V: 0.12 kip , f_v: 21.5 psi	F_v: 280 psi	0.08	✔
D + 0.75 S + 0.45 W	Shear	V: 0.089 kip , f_v: 16.1 psi	F_v: 280 psi	0.06	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.39 in	d_U: 0.53 in (L / 360)	0.74	✔

Window Opening - Lintel

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.91 kip-ft , f_b: 483 psi	F_b: 1150 psi	0.42	✔
D + S	Shear	V: 1.22 kip , f_v: 73.8 psi	F_v: 201.2 psi	0.37	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.013 in	d_U: 0.1 in (L / 360)	0.13	✔
1.5 D + S	Deflection	d: 0.028 in	d_U: 0.15 in (L / 240)	0.19	✔

Wall Framing Design: W-L1-X-D-1-2

Components

Wall - Dimensions (L x H): 71.6 ft x 16 ft

Garage Door - Dimensions (L x H_{top}): 10.2 ft x 10.1 ft

Main Door - Dimensions (L x H_{top}): 3.2 ft x 7.1 ft

USE SPRUCE PINE FIR

Component	Section	Product / Species	Grade
Studs	2x6 @ 16 in O.C.	Southern Pine	No.2

Component	Section	Product / Species	Grade
Top plate	(2) 2x6	Southern Pine	No.2
Sill plate	2x6 Pressure Treated	Southern Pine	No.2
Garage Door - Posts	(3) 2x6	Southern Pine	No.2
Garage Door - Lintel	(3) 2x12	Southern Pine	Select Structural
Main Door - Posts	(1) 2x6	Southern Pine	No.2
Main Door - Lintel	(3) 2x6	Southern Pine	No.2

Loads

Source	Dead	Live	Snow	Wind	Width
Self-weight and wind	10 psf	-	-	16.4 psf	-
Roof - Service area	13 psf	-	23.4 psf	-	20.1 ft

Analysis and Design Results

Studs

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 1.08 kip , f_c: 131.2 psi	F_c: 322 psi , C_P: 0.2	0.41	✔
D + 0.6 W	Buckling + Bending	P: 0.46 kip , f_c: 55.2 psi M: 0.42 kip-ft , f_b: 666.2 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.39	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 0.93 kip , f_c: 112.2 psi M: 0.31 kip-ft , f_b: 499.6 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.45	✔
D + 0.6 W	Shear	V: 0.1 kip , f_v: 19.1 psi	F_v: 280 psi	0.07	✔
D + 0.75 S + 0.45 W	Shear	V: 0.079 kip , f_v: 14.3 psi	F_v: 280 psi	0.05	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.35 in	d_U: 0.53 in (L / 360)	0.65	✔

Top plate

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.18 kip-ft , f_b: 524.7 psi	F_b: 1322.5 psi	0.40	✔
D + S	Shear	V: 0.54 kip , f_v: 49.2 psi	F_v: 201.2 psi	0.24	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.009 in	d_U: 0.044 in (L / 360)	0.20	✔
1.5 D + S	Deflection	d: 0.018 in	d_U: 0.067 in (L / 240)	0.27	✔

Garage Door - Posts

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 4.14 kip , f_c: 167.2 psi	F_c: 322 psi , C_P: 0.2	0.52	✔
D + 0.6 W	Buckling + Bending	P: 1.74 kip , f_c: 70.3 psi M: 1.61 kip-ft , f_b: 849.4 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.53	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 3.54 kip , f_c: 143 psi M: 1.2 kip-ft , f_b: 637 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.68	✔
D + 0.6 W	Shear	V: 0.4 kip , f_v: 24.3 psi	F_v: 280 psi	0.09	✔
D + 0.75 S + 0.45 W	Shear	V: 0.3 kip , f_v: 18.2 psi	F_v: 280 psi	0.07	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.44 in	d_U: 0.53 in (L / 360)	0.83	✔

Garage Door - Lintel

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 10.6 kip-ft , f_b: 1334.4 psi	F_b: 1840 psi	0.73	✔
D + S	Shear	V: 4.14 kip , f_v: 122.6 psi	F_v: 201.2 psi	0.61	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.13 in	d_U: 0.34 in (L / 360)	0.40	✔
1.5 D + S	Deflection	d: 0.28 in	d_U: 0.51 in (L / 240)	0.55	✔

Main Door - Posts

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 1.3 kip , f_c: 157.4 psi	F_c: 322 psi , C_P: 0.2	0.49	✔

Combination	Check Type	Action	Resistance	Ratio	Check
D + 0.6 W	Buckling + Bending	P: 0.55 kip , f_c: 66.2 psi M: 0.5 kip-ft , f_b: 799.4 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.50	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 1.11 kip , f_c: 134.6 psi M: 0.38 kip-ft , f_b: 599.6 psi	F_c: 336 psi , C_P: 0.15 F_b: 2160 psi	0.62	✔
D + 0.6 W	Shear	V: 0.13 kip , f_v: 22.9 psi	F_v: 280 psi	0.08	✔
D + 0.75 S + 0.45 W	Shear	V: 0.094 kip , f_v: 17.2 psi	F_v: 280 psi	0.06	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.42 in	d_U: 0.53 in (L / 360)	0.79	✔

Main Door - Lintel

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 1.04 kip-ft , f_b: 549.5 psi	F_b: 1150 psi	0.48	✔
D + S	Shear	V: 1.3 kip , f_v: 78.7 psi	F_v: 201.2 psi	0.39	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.017 in	d_U: 0.11 in (L / 360)	0.16	✔
1.5 D + S	Deflection	d: 0.035 in	d_U: 0.16 in (L / 240)	0.22	✔

Wall Framing Design: W-L1-Y-1-A-D

Components

USE SPRUCE PINE FIR

Wall - Dimensions (L x H): 33.1 ft x 16 ft

Main Door - Dimensions (L x H_{top}): 3.2 ft x 7.1 ft

Window Opening - Dimensions (L x H_{top}): 3 ft x 15.8 ft

Component	Section	Product / Species	Grade
Studs	2x6 @ 16 in O.C.	Southern Pine	Stud
Top plate	(2) 2x6	Southern Pine	No.2
Sill plate	2x6 Pressure Treated	Southern Pine	No.2
Main Door - Posts	(1) 2x6	Southern Pine	Stud
Main Door - Lintel	(3) 2x4	Southern Pine	No.2

Component	Section	Product / Species	Grade
Window Opening - Posts	(1) 2x6	Southern Pine	Stud
Window Opening - Lintel	(1) 2x4	Southern Pine	No.2

Loads

Source	Dead	Live	Snow	Wind	Width
Self-weight and wind	10 psf	-	-	16.4 psf	-
Roof - Service area	13 psf	-	23.4 psf	-	2.3 ft

Analysis and Design Results

Studs

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 0.22 kip , f_c: 26.5 psi	F_c: 294.4 psi , C_P: 0.32	0.09	✔
D + 0.6 W	Buckling + Bending	P: 0.15 kip , f_c: 17.8 psi M: 0.42 kip-ft , f_b: 666.2 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.58	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 0.2 kip , f_c: 24.3 psi M: 0.31 kip-ft , f_b: 499.6 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.44	✔
D + 0.6 W	Shear	V: 0.1 kip , f_v: 19.1 psi	F_v: 280 psi	0.07	✔
D + 0.75 S + 0.45 W	Shear	V: 0.079 kip , f_v: 14.3 psi	F_v: 280 psi	0.05	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.38 in	d_U: 0.53 in (L / 360)	0.70	✔

Top plate

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.036 kip-ft , f_b: 105.8 psi	F_b: 1322.5 psi	0.08	✔
D + S	Shear	V: 0.11 kip , f_v: 9.92 psi	F_v: 201.2 psi	0.05	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.001 in	d_U: 0.044 in (L / 360)	0.02	✔
1.5 D + S	Deflection	d: 0.004 in	d_U: 0.067 in (L / 240)	0.06	✔

Main Door - Posts

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 0.26 kip , f_c: 31.8 psi	F_c: 294.4 psi , C_P: 0.32	0.11	✔
D + 0.6 W	Buckling + Bending	P: 0.18 kip , f_c: 21.3 psi M: 0.5 kip-ft , f_b: 799.4 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.69	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 0.24 kip , f_c: 29.1 psi M: 0.38 kip-ft , f_b: 599.6 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.54	✔
D + 0.6 W	Shear	V: 0.13 kip , f_v: 22.9 psi	F_v: 280 psi	0.08	✔
D + 0.75 S + 0.45 W	Shear	V: 0.094 kip , f_v: 17.2 psi	F_v: 280 psi	0.06	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.45 in	d_U: 0.53 in (L / 360)	0.85	✔

Main Door - Lintel

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.21 kip-ft , f_b: 273.7 psi	F_b: 1265 psi	0.22	✔
D + S	Shear	V: 0.26 kip , f_v: 24.9 psi	F_V: 201.2 psi	0.12	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.006 in	d_U: 0.11 in (L / 360)	0.06	✔
1.5 D + S	Deflection	d: 0.026 in	d_U: 0.16 in (L / 240)	0.16	✔

Window Opening - Posts

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Buckling	P: 0.25 kip , f_c: 29.8 psi	F_c: 294.4 psi , C_P: 0.32	0.10	✔
D + 0.6 W	Buckling + Bending	P: 0.16 kip , f_c: 20 psi M: 0.47 kip-ft , f_b: 749.5 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.65	✔
D + 0.75 S + 0.45 W	Buckling + Bending	P: 0.23 kip , f_c: 27.3 psi M: 0.35 kip-ft , f_b: 562.1 psi	F_c: 294.4 psi , C_P: 0.23 F_b: 1242 psi	0.50	✔
D + 0.6 W	Shear	V: 0.12 kip , f_v: 21.5 psi	F_v: 280 psi	0.08	✔
D + 0.75 S + 0.45 W	Shear	V: 0.089 kip , f_v: 16.1 psi	F_v: 280 psi	0.06	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
0.42 W	Deflection	d: 0.42 in	d_U: 0.53 in (L / 360)	0.79	✔

Window Opening - Lintel

Strength Checks (ASD)

Combination	Check Type	Action	Resistance	Ratio	Check
D + S	Bending	M: 0.18 kip-ft , f_b: 721.7 psi	F_b: 1265 psi	0.57	✔
D + S	Shear	V: 0.25 kip , f_v: 70.2 psi	F_v: 201.2 psi	0.35	✔

Serviceability Checks

Combination	Check Type	Action	Limit	Ratio	Check
S	Deflection	d: 0.015 in	d_U: 0.1 in (L / 360)	0.15	✔
1.5 D + S	Deflection	d: 0.061 in	d_U: 0.15 in (L / 240)	0.41	✔