TUFF SHED
Storage Buildings & Garages

17777 South Harrison Street, Suite 600 • Denver, CO 80210
office: 303-753-8833 • facsimile: 303-782-5027

Structural Calculations

for

Owner: Anne & John Vernon
21981 Timber Cove Rd
Jenner, CA 95450

Project: 20.0' x 28.0'
Building
SO# 2060259
EP- 20597

Store: 180 Santa Rosa
5925 Redwood Dr. Ste A
Rohnert Park, CA 94928

Engineer: Timothy Cahalan, P.E.
Tuff Shed Inc.
1777 South Harrison St., Ste. 600
Denver, CO 80210
(303) 753-8833
TCahalan@tuffshed.com

3/14/2025

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DESIGN CRITERIA

Building Code:	2022 CBC
Occupancy Category:	II-Regular
Seismic Design Category:	E
Wind Speed, v_{ult}:	95 mph
Wind Exposure:	C

Building Specifications

Width:	20.0 ft.
Length:	28.0 ft.
First Floor Wall Height:	8.51 ft.
Second Floor Wall Height:	11.69 ft.
Stud Size:	2x6
Stud Spacing:	16 in. o.c.
Floor Depth:	16.75 in.
Wall Sheathing:	7/16" Smartside Panel
Roof Sheathing:	7/16" OSB
Wall Wood Species & Grade:	HF Stud
Wall "A" Overhang:	12.0 in.
Wall "B" Overhang:	24.0 in.
Wall "C" Overhang:	12.0 in.
Wall "D" Overhang:	24.0 in.
Foundation:	Concrete - Monolithic Foundation
Anchor:	J-Bolts
Anchor Bolt Diameter:	.63 in.

Roof Support

Span:	20.0 ft.
Left Overhang:	24.0 in.
Right Overhang:	24.0 in.
Spacing:	24 in. o.c.
Pitch:	3./12
Lumber:	HF #2
Roofing:	Composition Shingles
Top Chord Live/Snow Load:	20 psf
Top Chord Dead Load:	10 psf
Bottom Chord Live Load:	0 psf
Bottom Chord Dead Load:	0 psf
Floor Dead Load:	10 psf
Floor Live Load:	40 psf

Ground Snow Load, p_g:	0 psf

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2nd Floor Header: Wall A, Hdr 1

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	2.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	3.0 ft.
Floor Dead Load:	0 psf	Moment=	2,438 in.-lbs.
Floor Live Load:	0 psf	Reaction=	191 lbs.

Header Size:	2x4			
Number of Headers:	3			
Header depth=	3.50 in.		**Lumber**	
Total header width=	4.50 in.		*HF #2*	
Header span=	4.25 ft.	F_b=	850 psi	
		F_t=	525 psi	
Bending		F_v=	150 psi	
S_x=	9.19 cu.in.	F_{cP}=	405 psi	
F'_b=	1590 psi	F_c=	1300 psi	
f_b=	265 psi	E=	1,300,000 psi	
		E_{min}=	470,000 psi	
Good/No Good?	**O.K.**		*Lumber Factors*	
		C_D=	1.25	Duration
Shear		C_M=	1.00	Wet Service
F'_v=	188 psi	C_t=	1.00	Temperature
f_v=	18 psi	C_L=	1.00	Beam Stability
Good/No Good?	**O.K.**	C_F=	1.50	Size
		C_{fu}=	1.00	Flat Use
Deflection		C_i=	1.00	Incising
E'=	1,300,000 psi	C_r=	1.00	Repetitive Member
I=	16.078	C_f=	1.00	Form
Deflection Ratio=	L/180	TL (L/x)	L/240	LL(L/x)
Allowable Deflection=	.28 in.		.21 in.	
Δ=	.03 in.		.02 in.	
Good/No Good?	**O.K.**		**O.K.**	

2nd Floor Header: Wall B, Hdr 1-2

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	12.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	6.0 ft.
Floor Dead Load:	0 psf	Moment=	11,379 in.-lbs.
Floor Live Load:	0 psf	Reaction=	893 lbs.

Header Size:	2x4			
Number of Headers:	3			
Header depth=	3.50 in.		**Lumber**	
Total header width=	4.50 in.		*HF #2*	
Header span=	4.25 ft.	F_b=	850 psi	
		F_t=	525 psi	
Bending		F_v=	150 psi	
S_x=	9.19 cu.in.	F_{cP}=	405 psi	
F'_b=	1590 psi	F_c=	1300 psi	
f_b=	1239 psi	E=	1,300,000 psi	
		E_{min}=	470,000 psi	
Good/No Good?	**O.K.**		*Lumber Factors*	
		C_D=	1.25	Duration
Shear		C_M=	1.00	Wet Service
F'_v=	188 psi	C_t=	1.00	Temperature
f_v=	85 psi	C_L=	1.00	Beam Stability
Good/No Good?	**O.K.**	C_F=	1.50	Size
		C_{fu}=	1.00	Flat Use
Deflection		C_i=	1.00	Incising
E'=	1,300,000 psi	C_r=	1.00	Repetitive Member
I=	16.078125	C_f=	1.00	Form
Deflection Ratio=	L/180	TL (L/x)	L/240	LL(L/x)
Allowable Deflection=	.28 in.		.21 in.	
Δ=	.15 in.		.11 in.	
Good/No Good?	**O.K.**		**O.K.**	

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2nd Floor Header: Wall C, Hdr 1-2

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	2.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	4.50 ft.
Floor Dead Load:	0 psf	Moment=	2,845 in.-lbs.
Floor Live Load:	0 psf	Reaction=	223 lbs.

Header Size:	2x4			
Number of Headers:	3			
Header depth=	3.50 in.		**Lumber**	
Total header width=	4.50 in.		*HF #2*	
Header span=	4.25 ft.	F_b=	850 psi	
		F_t=	525 psi	
Bending		F_v=	150 psi	
S_x=	9.19 cu.in.	F_{cP}=	405 psi	
F'_b=	1590 psi	F_c=	1300 psi	
f_b=	310 psi	E=	1,300,000 psi	
		E_{min}=	470,000 psi	
Good/No Good?	**O.K.**		*Lumber Factors*	
		C_D=	1.25	Duration
Shear		C_M=	1.00	Wet Service
F'_v=	188 psi	C_t=	1.00	Temperature
f_v=	21 psi	C_L=	1.00	Beam Stability
Good/No Good?	**O.K.**	C_F=	1.50	Size
		C_{fu}=	1.00	Flat Use
Deflection		C_i=	1.00	Incising
E'=	1,300,000 psi	C_r=	1.00	Repetitive Member
I=	16.078125	C_f=	1.00	Form
Deflection Ratio=	L/180	TL (L/x)	L/240	LL(L/x)
Allowable Deflection=	.28 in.		.21 in.	
Δ=	.04 in.		.03 in.	
Good/No Good?	**O.K.**		**O.K.**	

1st Floor Header: Wall A & C, Hdr 1

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	3.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	12.50 ft.
Floor Dead Load:	10 psf	Moment=	6,391 in.-lbs.
Floor Live Load:	40 psf	Reaction=	624 lbs.

Header Size:	2x4			
Number of Headers:	3			
Header depth=	3.50 in.		**Lumber**	
Total header width=	4.50 in.		*HF #2*	
Header span=	3.42 ft.	F_b=	850 psi	
		F_t=	525 psi	
Bending		F_v=	150 psi	
S_x=	9.19 cu.in.	F_{cP}=	405 psi	
F'_b=	1591 psi	F_c=	1300 psi	
f_b=	696 psi	E=	1,300,000 psi	
		E_{min}=	470,000 psi	
Good/No Good?	**O.K.**		*Lumber Factors*	
		C_D=	1.25	Duration
Shear		C_M=	1.00	Wet Service
F'_v=	188 psi	C_t=	1.00	Temperature
f_v=	59 psi	C_L=	1.00	Beam Stability
Good/No Good?	**O.K.**	C_F=	1.50	Size
		C_{fu}=	1.00	Flat Use
Deflection		C_i=	1.00	Incising
E'=	1,300,000 psi	C_r=	1.00	Repetitive Member
I=	16.078125	C_f=	1.00	Form
Deflection Ratio=	L/180	TL (L/x)	L/240	LL(L/x)
Allowable Deflection=	.23 in.		.17 in.	
Δ=	.05 in.		.03 in.	
Good/No Good?	**O.K.**		**O.K.**	

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1st Floor Header: Wall B, Hdr 1

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	12.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	15.0 ft.
Floor Dead Load:	10 psf	Moment=	30,074 in.-lbs.
Floor Live Load:	40 psf	Reaction=	2,359 lbs.

Header Size:	2x6				
Number of Headers:	3				
Header depth=	5.50 in.		**Lumber**		
Total header width=	4.50 in.		*HF #2*		
Header span=	4.25 ft.	F_b=	850 psi		
		F_t=	525 psi		
Bending		F_v=	150 psi		
S_x=	22.69 cu.in.	F_{cP}=	405 psi		
F'_b=	1376 psi	F_c=	1300 psi		
f_b=	1326 psi	E=	1,300,000 psi		
		E_{min}=	470,000 psi		
Good/No Good?	**O.K.**		*Lumber Factors*		
		C_D=	1.25	Duration	
Shear		C_M=	1.00	Wet Service	
F'_v=	188 psi	C_t=	1.00	Temperature	
f_v=	143 psi	C_L=	1.00	Beam Stability	
Good/No Good?	**O.K.**	C_F=	1.30	Size	
		C_{fu}=	1.00	Flat Use	
Deflection		C_i=	1.00	Incising	
E'=	1,300,000 psi	C_r=	1.00	Repetitive Member	
I=	62.391	C_f=	1.00	Form	
Deflection Ratio=	L/180	TL (L/x)	L/240	LL(L/x)	
Allowable Deflection=	.28 in.		.21 in.		
Δ=	.10 in.		.04 in.		
Good/No Good?	**O.K.**		**O.K.**		

1st Floor Header: Wall D, Hdr 1

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	11.0 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	10.50 ft.
Floor Dead Load:	10 psf	Moment=	402,249 in.-lbs.
Floor Live Load:	40 psf	Reaction=	8,126 lbs.

Header Size:	1¾x14 LVL				
Number of Headers:	3				
Header depth=	14.0 in.		**Lumber**		
Total header width=	5.25 in.		*LVL 2600Fb*		
Header span=	16.50 ft.	F_b=	2600 psi		
		F_t=	1555 psi		
Bending		F_v=	285 psi		
S_x=	171.50 cu.in.	F_{cP}=	750 psi		
F'_b=	3098 psi	F_c=	2510 psi		
f_b=	2345 psi	E=	1,900,000 psi		
		E_{min}=	965,710 psi		
Good/No Good?	**O.K.**		*Lumber Factors*		
		C_D=	1.25	Duration	
Shear		C_M=	1.00	Wet Service	
F'_v=	356 psi	C_t=	1.00	Temperature	
f_v=	166 psi	C_L=	0.95	Beam Stability	
Good/No Good?	**O.K.**	C_F=	1.00	Size	
		C_{fu}=	1.00	Flat Use	
Deflection		C_i=	1.00	Incising	
E'=	1,900,000 psi	C_r=	1.00	Repetitive Member	
I=	1200.5	C_f=	1.00	Form	
Deflection Ratio=	L/180	TL(L/x)	L/240	LL(L/x)	
Allowable Deflection=	1.10 in.		1.10 in.		
Δ=	.72 in.		.24 in.		
Good/No Good?	**O.K.**		**O.K.**		

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Loft Header: Stair Beam

Top Chord Live/Snow Load:	0 psf		
Top Chord Dead Load:	0 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	9.50 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	1.33 ft.
Floor Dead Load:	10 psf	Moment=	13,733 in.-lbs.
Floor Live Load:	40 psf	Reaction=	1,057 lbs.

Header Size: 1¾x16 LVL
Number of Headers: 2
Header depth= 16.0 in.
Total header width= 3.50 in.
Header span= 4.33 ft.

Bending
S_x= 149.33 cu.in.
F'_b= 2544 psi
f_b= 92 psi
Good/No Good? **O.K.**

Shear
F'_v= 285 psi
f_v= 28 psi
Good/No Good? **O.K.**

Deflection
E'= 1,900,000 psi
I= 1194.666667
Deflection Ratio= L/180 TL(L/x) L/240 LL(L/x)
Allowable Deflection= .29 in. .29 in.
Δ= .0 in. .0 in.
Good/No Good? **O.K.** **O.K.**

Lumber
LVL 2600Fb
F_b= 2600 psi
F_t= 1555 psi
F_v= 285 psi
F_{cP}= 750 psi
F_c= 2510 psi
E= 1,900,000 psi
E_{min}= 965,710 psi

Lumber Factors

C_D=	1.00	Duration
C_M=	1.00	Wet Service
C_t=	1.00	Temperature
C_L=	0.98	Beam Stability
C_F=	1.00	Size
C_{fu}=	1.00	Flat Use
C_i=	1.00	Incising
C_r=	1.00	Repetitive Member
C_f=	1.00	Form

Loft Header: Transfer Beam

Top Chord Live/Snow Load:	0 psf		
Top Chord Dead Load:	0 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	1.33 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	1.50 ft.
Floor Dead Load:	10 psf	Moment=	77,736 in.-lbs.
Floor Live Load:	40 psf	Reaction=	1,335 lbs.

Header Size: 1¾x16 LVL
Number of Headers: 2
Header depth= 16.0 in.
Total header width= 3.50 in.
Header span= 16.0 ft.

Bending
S_x= 149.33 cu.in.
F'_b= 2062 psi
f_b= 521 psi
Good/No Good? **O.K.**

Shear
F'_v= 285 psi
f_v= 36 psi
Good/No Good? **O.K.**

Deflection
E'= 1,900,000 psi
I= 1194.666667
Deflection Ratio= L/180 TL(L/x) L/240 LL(L/x)
Allowable Deflection= 1.07 in. 1.07 in.
Δ= .13 in. .03 in.
Good/No Good? **O.K.** **O.K.**

Lumber
LVL 2600Fb
F_b= 2600 psi
F_t= 1555 psi
F_v= 285 psi
F_{cP}= 750 psi
F_c= 2510 psi
E= 1,900,000 psi
E_{min}= 965,710 psi

Lumber Factors

C_D=	1.00	Duration
C_M=	1.00	Wet Service
C_t=	1.00	Temperature
C_L=	0.79	Beam Stability
C_F=	1.00	Size
C_{fu}=	1.00	Flat Use
C_i=	1.00	Incising
C_r=	1.00	Repetitive Member
C_f=	1.00	Form

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ROOF: CANTILEVER

Top Chord Live/Snow Load:	20 psf		
Top Chord Dead Load:	10 psf		
Bottom Chord Live Load:	0 psf	Tributary Width=	1.67 ft.
Bottom Chord Dead Load:	0 psf	Height of wall above Header=	.0 ft.
Floor Dead Load:	0 psf	Moment=	29,970 in.-lbs.
Floor Live Load:	0 psf	Reaction=	500 lbs.

Header Size: 1¾x11-7/8 LVL
Number of Headers: 2
Header depth= 11.88 in.
Total header width= 3.50 in.
Header span= 20.0 ft.

Bending
S_x= 82.26 cu.in.
F'_b= 2436 psi
f_b= 364 psi
Good/No Good? **O.K.**

Shear
F'_v= 356 psi
f_v= 18 psi
Good/No Good? **O.K.**

Deflection
E'= 1,900,000 psi
I= 488.413
Deflection Ratio= L/180 TL(L/x) L/240 LL(L/x)
Allowable Deflection= 1.33 in. 1.33 in.
Δ= .19 in. .13 in.
Good/No Good? **O.K.** **O.K.**

Lumber
LVL 2600Fb
F_b= 2600 psi
F_t= 1555 psi
F_v= 285 psi
F_{cP}= 750 psi
F_c= 2510 psi
E= 1,900,000 psi
E_{min}= 965,710 psi

Lumber Factors

C_D=	1.25	Duration
C_M=	1.00	Wet Service
C_t=	1.00	Temperature
C_L=	0.75	Beam Stability
C_F=	1.00	Size
C_{fu}=	1.00	Flat Use
C_i=	1.00	Incising
C_r=	1.00	Repetitive Member
C_f=	1.00	Form

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Trimmer for: 2nd Floor Header: Wall A, Hdr 1

		HF Stud	
		F_b= 675 psi	
Load=	191 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	115.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	20.91	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	827.34
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	0.90
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.19
C_P=	0.99	C_P=	0.65
F'_c=	912.33	F'_c=	600.95
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	4,958 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: 2nd Floor Header: Wall B, Hdr 1-2

		HF Stud	
		F_b= 675 psi	
Load=	893 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	115.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	20.91	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	827.28
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	0.90
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.19
C_P=	0.99	C_P=	0.65
F'_c=	912.33	F'_c=	600.93
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	4,958 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: 2nd Floor Header: Wall C, Hdr 1-2

		HF Stud	
		F_b= 675 psi	
Load=	223 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	90.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	16.36	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	1350.72
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	1.47
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.54
C_P=	0.99	C_P=	0.80
F'_c=	912.33	F'_c=	740.38
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	6,108 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: 1st Floor Header: Wall A & C, Hdr 1

		HF Stud	
		F_b= 675 psi	
Load=	624 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	90.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	16.36	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	1350.72
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	1.47
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.54
C_P=	0.99	C_P=	0.80
F'_c=	912.33	F'_c=	740.38
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	6,108 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

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Trimmer for: 1st Floor Header: Wall B, Hdr 1

		HF Stud	
		F_b= 675 psi	
Load=	2,359 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	90.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	16.36	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	1350.72
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	1.47
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.54
C_P=	0.99	C_P=	0.80
F'_c=	912.33	F'_c=	740.38
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	6,108 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: 1st Floor Header: Wall D, Hdr 1

		HF Stud	
		F_b= 675 psi	
Load=	8,126 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	2	F_c= 800 psi	
Unbraced Length(x)(width)=	90.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	16.50 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	16.36	C_F= 1.00	Size
$(l/d)_y$=	2.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	90420.00	F_{cE}=	1350.72
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	98.28	F_{cE}/F^*_c=	1.47
$1+F_{cE}/F^*_c/2c$=	62.05	$1+F_{cE}/F^*_c/2c$=	1.54
C_P=	1.00	C_P=	0.80
F'_c=	918.12	F'_c=	740.38
$P_{allowable}$=	15,149 lbs.	$P_{allowable}$=	12,216 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: Loft Header: Stair Beam

		HF Stud	
		F_b= 675 psi	
Load=	1,057 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	102.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	18.55	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	1051.60
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	1.14
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.34
C_P=	0.99	C_P=	0.74
F'_c=	912.33	F'_c=	676.28
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	5,579 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

Trimmer for: Loft Header: Transfer Beam

		HF Stud	
		F_b= 675 psi	
Load=	1,335 lbs.	F_t= 400 psi	
width=	5.50 in.	F_v= 150 psi	
thickness=	1.50 in.	F_{cP}= 405 psi	
No. of members=	1	F_c= 800 psi	
Unbraced Length(x)(width)=	102.0 in.	E_{min}= 440,000 psi	
Unbraced Length(y)(thickness)=	6.0 in.		
Effective Length factor, $K_{e(x)}$=	1	*Lumber Factors*	
Effective Length factor, $K_{e(y)}$=	1	C_D= 1.15	Duration
		C_M= 1.00	Wet Service
c=	0.8	C_t= 1.00	Temperature
A=	8.25 sq.in.	C_L= 1.00	Beam Stability
$(l/d)_x$=	18.55	C_F= 1.00	Size
$(l/d)_y$=	4.00	C_{fu}= 1.00	Flat Use
E'_{min}=	440,000 psi	C_i= 1.00	Incising
		C_r= 1.00	Repetitive Member
		C_f= 1.00	Form
		C_T= 1.00	Buckling Stiffness

Weak Axis Calculations(y)		*Strong Axis Calculations (x)*	
F_{cE}=	22605.00	F_{cE}=	1051.60
F^*_c=	920.00	F^*_c=	920.00
F_{cE}/F^*_c=	24.57	F_{cE}/F^*_c=	1.14
$1+F_{cE}/F^*_c/2c$=	15.98	$1+F_{cE}/F^*_c/2c$=	1.34
C_P=	0.99	C_P=	0.74
F'_c=	912.33	F'_c=	676.28
$P_{allowable}$=	7,527 lbs.	$P_{allowable}$=	5,579 lbs.
Good/No Good?	**O.K.**	*Good/No Good?*	**O.K.**

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SEISMIC CALCULATIONS

Building Code: 2022 CBC
Seismic Design Classification: E
Site Class: D

S_s= 2.355	Figure 22-1
F= 1	Section 12.14.8.1
F_a= 1.2	Table 11.4-1
R= 6.5	Table 12.14-1
I= 1	Table 11.5-1
ρ= 1.30	
S= lbs.	20% of Snow (if applicable)
S_{DS}= 1.88	Eq. 12.14-11

F_x Story (Shearwall) Force Table

Story	Height (h_x)	Weight (w_x)	w_xh_x	Story Force	F_x Coef.	Story Shear (V_x)	
R	21.59 ft.	12,650 lbs.	273,161 ft.-lbs.	F_r= 5,973 lbs.	0.4722	5,973 lbs.	
2	8.51 ft.	22,235 lbs.	189,229 ft.-lbs.	F_2= 4,138 lbs.	0.1861	10,111 lbs.	
1	.0 ft.						
		34,885 lbs.	462,390 ft.-lbs.	V= 10,111 lbs.			

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Wind Calculations (C&C)

Alternate all-heights method

Wind Speed, v_{ASD}:	74 mph	
Wind Exposure:	C	
Risk Category:	II-Regular	
Roof Angle=	14.04°	
Gable Wall Span=	20.0 ft.	
Longitude Wall Span=	28.0 ft.	
Enclosure Classification:	Enclosed	Section 26.10
K_{zt}=	1	Section 26.8.2
K_z=	0.85	Table 27.3-1
K_d=	0.85	Table 26.6-1
Mean Roof Height=	11.01 ft.	

LOW RISE BUILDINGS (ASCE 7-16 Chapt. 30)

GC_{pi}=	0.18					
q_h=	10.02 psf					
	Zone 1	Zone 2	Zone 3	Zone 4	Zone 5	
GC_p=	-2.0	-3.0	-3.6	-1.1	-1.4	(ASCE 7-16 Figures 30.3-1,30.3-2A-C)
GC_p=	0.7	0.7	0.7	1.0	1.0	(ASCE 7-16 Figures 30.3-1,30.3-2A-C)
p=	-21.83 psf	-31.85 psf	-37.86 psf	-12.82 psf	-15.82 psf	
p=	8.81 psf	8.81 psf	8.81 psf	11.82 psf	11.82 psf	
p=	-21.83 psf	-31.85 psf	-37.86 psf	-12.82 psf	-15.82 psf	
p=	8.81 psf	8.81 psf	8.81 psf	11.82 psf	11.82 psf	
p_{max}=	**22 psf**	**32 psf**	**38 psf**	**15 psf**	**16 psf**	

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Wind Calculations (MWFRS)

ASCE 7-16 Chapt. 28 Part 1

Wind Speed, v_{ult}: 95 mph
Wind Speed, v_{ASD}: 74 mph
Wind Exposure: C
Risk Category: II-Regular
Roof Angle= 14.04
Gable Wall Span= 20.0 ft.
Longitude Wall Span= 28.0 ft.
nclosure Classification: Enclosed — Section 26.10
K_{zt}= 1 — Section 26.8.2
K_z= 0.9 — K_z= 0.85 — Table 27.3-1
K_d= 0.85 — Table 26.6-1
K_e= 1 — Table 26.9-1
Mean Height= 23.26 ft. (roof) — 15.75 ft. (wall)
GC_{pi}= ±0.18 — Table 26.13-1
q_h= 10.60 psf — Eq. 26.10-1

GC_{pf}	1	2	3	4	5	6	1E	2E	3E	4E	5E	6E
Load Case A	0.48	-0.69	-0.44	-0.37	N/A	N/A	0.72	-1.07	-0.63	-0.56	N/A	N/A
Load Case B	-0.45	-0.69	-0.37	-0.45	0.40	-0.29	-0.48	-1.07	-0.53	-0.48	0.61	-0.43

p												
Load Case A (-GC_{pi})	3.16 psf	-9.23 psf	-6.54 psf	-5.88 psf	N/A	N/A	5.77 psf	-13.26 psf	-8.55 psf	-7.81 psf	N/A	N/A
Load Case A (+GC_{pi})	6.98 psf	-5.41 psf	-2.72 psf	-2.06 psf	N/A	N/A	9.59 psf	-9.44 psf	-4.73 psf	-3.99 psf	N/A	N/A
Load Case B (-GC_{pi})	-6.68 psf	-9.23 psf	-5.83 psf	-6.68 psf	2.33 psf	-4.98 psf	-7.0 psf	-13.26 psf	-7.53 psf	-7.0 psf	4.56 psf	-6.47 psf
Load Case B (+GC_{pi})	-2.86 psf	-5.41 psf	-2.01 psf	-2.86 psf	6.15 psf	-1.17 psf	-3.18 psf	-9.44 psf	-3.71 psf	-3.18 psf	8.38 psf	-2.65 psf

max. p_L= 16.0 psf — Side Wall, maximum wind pressure
max. p_T= 16.0 psf — Gable End Wall, maximum wind pressure

max. p_{roof}= -13.26 psf

V_i= 2,212 lbs.
V_{L2}= 2,360 lbs. — V_{L1}= 3,041 lbs. — Max. Longitudinal Shear
V_{T2}= 3,304 lbs. — V_{T1}= 4,257 lbs. — Max. Transversial Shear
Max. uplift pressure= -9,544 lbs. — Max. uplift pressure on the building due to wind on roof

Diaphragm Calculations

Length (for shear)

1st floor			2nd floor	
Wall A1:	15.0 ft.	Sheathe Both Faces of Wall	Wall A2:	16.0 ft.
Wall B1:	24.0 ft.		Wall B2:	18.67 ft.
Wall C1:	15.0 ft.	Sheathe Both Faces of Wall	Wall C2:	13.0 ft.
Wall D1:	12.0 ft.	Sheathe Both Faces of Wall	Wall D2:	28.0 ft.

	Sheathing*	Nail Size	Edge Nailing	Boundary Nailing		v_{allow}	HF/SPF Factor
Roof	7/16" OSB	8d	6 in. o.c.	12 in. o.c.	v= 180.0 plf	167.4 plf	0.93
Wall	7/16" Smartside Pane	8d	6 in. o.c.	12 in. o.c.	v= 185.0 plf	151.7 plf	0.82
Wall	7/16" Smartside Pane	8d	4 in. o.c.	12 in. o.c.	v= 265.0 plf	217.3 plf	0.82
Wall	7/16" Smartside Pane	8d	3 in. o.c.	12 in. o.c.	v= 345.0 plf	282.9 plf	0.82
Wall	7/16" OSB	8d	6 in. o.c.	12 in. o.c.	v= 185.0 plf	172.1 plf	0.93
Wall	7/16" OSB	8d	4 in. o.c.	12 in. o.c.	v= 265.0 plf	246.5 plf	0.93

*Must be Rated sheathing

	Wind	*Seismic*	v_{allow}	C_a	$2b_s/h$	Nail Size	Edge Nailing	*Sheathing*	*Notes*
Wall A1:	283.8 plf	306.7 plf	323.8 plf	1.00	1.00	8d	6" o.c.	7/16" Smartside Panel & 7/16" OSB	Sheathe Both Faces of Wall
Wall B1:	126.7 plf	191.7 plf	215.6 plf	0.99	1.00	8d	4" o.c.	7/16" Smartside Panel	
Wall C1:	283.8 plf	306.7 plf	323.8 plf	1.00	1.00	8d	6" o.c.	7/16" Smartside Panel & 7/16" OSB	Sheathe Both Faces of Wall
Wall D1:	253.4 plf	383.4 plf	463.8 plf	1.00	1.00	8d	4" o.c.	7/16" Smartside Panel & 7/16" OSB	Sheathe Both Faces of Wall
Wall A2:	206.5 plf	169.9 plf	217.3 plf	1.00	1.00	8d	4" o.c.	7/16" Smartside Panel	
Wall B2:	126.4 plf	145.6 plf	204.3 plf	1.00	0.94	8d	4" o.c.	7/16" Smartside Panel	
Wall C2:	254.2 plf	209.1 plf	282.9 plf	1.00	1.00	8d	3" o.c.	7/16" Smartside Panel	
Wall D2:	84.3 plf	97.1 plf	151.7 plf	1.00	1.00	8d	6" o.c.	7/16" Smartside Panel	
Roof=	73.7 plf		167.4 plf			8d		7/16" OSB	

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Foundation Calculations

F_b=	1500 psf	Min. allowable bearing pressure
Foundation Stem above grade=	8.0 in.	Height of foundation from the top of the grade to the top of the foundation/stemwall
Foundation Depth=	24.0 in.	Depth of the foundation from the top of the grade to the bottom of the footing
P_{max}=	1162.0 plf	Max. load per foot of wall
b_{ftg}=	9.3 in.	min. required footing width
PL_{max}=	8,126 lbs.	Maximum point load
b_{ftg}=	780.12 sq.in.	Min. required footing area
Rectangular pad=	19.50 in.	min. required footing width

2ND STORY Overturning Calculations

Type of Nails:	16d Common	Nails used to resist uplifts
Lumber:	HF Stud	
Lumber Specific Gravity:	0.43	
Allowable Withdrawal/Inch:	27 lbs.	Allowable force per pounds per inch of embedment
Minimum Embedment of Nails:	1.25 in.	Min. embedment of nails into lower wall

Wall A

Min. Number of Nails=	8	
Width=	16.0 ft.	
Height=	11.69 ft.	
Overturning Length=	15.08 ft.	
P_{wind}=	3,304 lbs.	
$P_{seismic}$=	3,883 lbs.	
Wall Weight=	1,134.0 lbs.	
$Uplift_{wind}$=	1,993.20 lbs.	CMSTC16 STRAP W/ 24-0.148X2.5" NAILS END LENGTH 17"
$Uplift_{seismic}$=	1,538.97 lbs.	
Allowable Withdrawal, wind:	406 lbs.	**N.G. Add straps.**
Allowable Withdrawal, seismic:	406 lbs.	**N.G. Add Straps.**

Wall B

Min. Number of Nails=	11	
Width=	18.67 ft.	
Height=	11.69 ft.	
Overturning Length=	17.75 ft.	
P_{wind}=	2,360 lbs.	
$P_{seismic}$=	3,883 lbs.	
Wall Weight=	1,381.23 lbs.	
$Uplift_{wind}$=	863.07 lbs.	CMSTC16 STRAP W/ 16-0.148X2.5" NAILS END LENGTH 11"
$Uplift_{seismic}$=	1,098.63 lbs.	
Allowable Withdrawal, wind:	568 lbs.	**N.G. Add straps.**
Allowable Withdrawal, seismic:	568 lbs.	**N.G. Add Straps.**

Wall C

Min. Number of Nails=	8	
Width=	13.0 ft.	
Height=	11.69 ft.	
Overturning Length=	8.0 ft.	
P_{wind}=	3,304 lbs.	
$P_{seismic}$=	3,883 lbs.	
Wall Weight=	923.63 lbs.	
$Uplift_{wind}$=	4,365.23 lbs.	CMSTC16 STRAP W/ 48-0.148X2.5" NAILS END LENGTH 35"
$Uplift_{seismic}$=	3,508.82 lbs.	
Allowable Withdrawal, wind:	406 lbs.	**N.G. Add straps.**
Allowable Withdrawal, seismic:	406 lbs.	**N.G. Add Straps.**

Wall D

Min. Number of Nails=	11	
Width=	28.0 ft.	
Height=	11.69 ft.	
Overturning Length=	27.08 ft.	
P_{wind}=	2,360 lbs.	
$P_{seismic}$=	3,883 lbs.	
Wall Weight=	2,035.50 lbs.	
$Uplift_{wind}$=	.70 lbs.	
$Uplift_{seismic}$=	155.11 lbs.	
Allowable Withdrawal, wind:	594 lbs.	**ok. No additional holddowns required.**
Allowable Withdrawal, seismic:	594 lbs.	**ok. No additional holddowns required.**

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Overturning Calculations-First Story

Wall A			Wall B		
No. anchor bolts=	4		No. anchor bolts=	5	
Width=	15.0 ft.		Width=	24.0 ft.	
Height=	8.51 ft.		Height=	8.51 ft.	
Overturning Length=	14.08 ft.		Overturning Length=	23.08 ft.	
P_{wind}=	4,257 lbs.		P_{wind}=	3,041 lbs.	
$P_{seismic}$=	6,572 lbs.		$P_{seismic}$=	6,572 lbs.	
Wall Weight=	777.94 lbs.		Wall Weight=	1,297.35 lbs.	
$Uplift_{wind}$=	4,176.84 lbs.	Use SSTB28 anchor bolts and HDU8 hold-c	$Uplift_{wind}$=	1,335.66 lbs.	
$Uplift_{seismic}$=	3,930.12 lbs.		$Uplift_{seismic}$=	2,146.35 lbs.	Use SSTB16 anchor bolts and HDU2 hold-downs
Allowable Service, wind:	2.88	**N.G. Holddowns required.**	Allowable Service, wind:	0.68	**ok. No additional holddowns required.**
Allowable Service, seismic:	3.81	**N.G. Holddowns required.**	Allowable Service, seismic:	2.09	**N.G. Holddowns required.**

Wall C			Wall D		
No. anchor bolts=	4		No. anchor bolts=	4	
Width=	15.0 ft.		Width=	12.0 ft.	
Height=	8.51 ft.		Height=	8.51 ft.	
Overturning Length=	14.08 ft.		Overturning Length=	11.08 ft.	
P_{wind}=	4,257 lbs.		P_{wind}=	3,041 lbs.	
$P_{seismic}$=	6,572 lbs.		$P_{seismic}$=	6,572 lbs.	
Wall Weight=	777.94 lbs.		Wall Weight=	684.75 lbs.	
$Uplift_{wind}$=	6,548.87 lbs.	Use SSTB28 anchor bolts and HDU8 hold-c	$Uplift_{wind}$=	1,993.30 lbs.	
$Uplift_{seismic}$=	5,899.97 lbs.		$Uplift_{seismic}$=	3,345.37 lbs.	Use SSTB28 anchor bolts and HDU8 hold-downs
Allowable Service, wind:	4.93	**N.G. Holddowns required.**	Allowable Service, wind:	1.13	**N.G. Holddowns required.**
Allowable Service, seismic:	5.41	**N.G. Holddowns required.**	Allowable Service, seismic:	3.42	**N.G. Holddowns required.**

Building Uplift

Wind uplift=	-9,544.26 lbs.	
Min. building weight=	.0 lbs.	
Additional min. dead load=	.0 lbs.	additional dead load due to steel floor, wood base, or other permanent loads,if any, (not including foundation)
Net uplift=	-9,544.26 lbs.	(positive number = no uplift)
Total no. of anchor bolts (min.)=	17	(Does not include additional holddowns for overturning of the walls.)
Anchor bolt uplift=	49,306.64 lbs.	

OK. No additional anchors needed

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Storage Buildings & Garages

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Bearing Wall Calculations

Axial Load

Stud Spacing=	16 in. o.c.	
Max. Load on wall=	1045.1 plf	
depth=	5.50 in.	
width=	1.50 in.	
No. of members=	1	
Length (depth)=	97.63 in.	unbraced length (depth)(x)(in.)
Length (width)=	12.0 in.	unbraced length (width)(y)(in.)
$K_{e(x)}$=	1	effective length factor (x)
$K_{e(y)}$=	1	effective length factor (y)
K_{cE}=	0.3	
c=	0.8	
Load=	1,393 lbs.	Load per stud
A=	8.25 sq.in.	
$(l/d)_x$=	17.75	
$(l/d)_y$=	8.00	
E'_{min}=	440,000 psi	

Lumber

HF Stud

F_b=	675 psi	
F_t=	400 psi	
F_v=	150 psi	
F_{cP}=	405 psi	
F_c=	800 psi	
E_{min}=	440,000 psi	
E=	1,200,000 psi	

Lumber Factors

C_D=	1.25	Duration for gravity load
C_M=	1.00	Wet Service
C_t=	1.00	Temperature
C_L=	1.00	Beam Stability
C_F=	1.05	Size for F_c
C_{fu}=	1.00	Flat Use
C_i=	1.00	Incising
C_r=	1.15	Repetitive Member
C_f=	1.00	Form
C_T=	1.00	Buckling Stiffness (2005 NDS 4.4.2)
C_F=	1.10	Size for F_b
C_D=	1.60	Duration for lateral load
C_r=	1.50	Repetitive Member (wind)

Weak Axis Calculations(y)

F_{cE}=	5651.25
F^*_c=	1050.00
F_{cE}/F^*_c=	5.38
$1+F_{cE}/F^*_c/2c$=	3.99
C_P=	0.96
F'_c=	1006.39
$P_{allowable}$=	8,303 lbs.
Good/No Good?	**O.K.**

Strong Axis Calculations (x)

F_{cE}=	1147.96
F^*_c=	1050.00
F_{cE}/F^*_c=	1.09
$1+F_{cE}/F^*_c/2c$=	1.31
C_P=	0.72
F'_c=	756.94
$P_{allowable}$=	6,245 lbs.
Good/No Good?	**O.K.**

Wind Load

Wind load per stud=	21.3 plf
Moment=	2,118 in.-lbs.
Reaction=	87 lbs.
Header depth=	3.50 in.
Total header width=	1.50 in.
Header span=	8.0 ft.

Bending

S_x=	7.56 cu.in.
F'_b=	1782 psi
f_b=	280 psi
Good/No Good?	**O.K.**

Shear

F'_v=	240 psi
f_v=	16 psi
Good/No Good?	**O.K.**

Combined Bending and Axial Loading

F'_c=	968.89	combine allowable compressive stress
f_c=	56 psi	combine compressive stress
Combined stress index=	0.17	
Good/No Good?	**O.K.**	

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Bearing Wall Calculations

Axial Load

Second floor

Stud Spacing=	16 in. o.c.	
Max. Load on wall=	1045.1 plf	
depth=	5.50 in.	
width=	1.50 in.	
No. of members=	1	
Length (depth)=	135.75 in.	unbraced length (depth)(x)(in.)
Length (width)=	12.0 in.	unbraced length (width)(y)(in.)
$K_{e(x)}$=	1	effective length factor (x)
$K_{e(y)}$=	1	effective length factor (y)
K_{cE}=	0.3	
c=	0.8	
Load=	1,393 lbs.	Load per stud
A=	8.25 sq.in.	
$(l/d)_x$=	24.68	
$(l/d)_y$=	8.00	
E'_{min}=	440,000 psi	

Lumber

HF Stud

F_b=	675 psi	
F_t=	400 psi	
F_v=	150 psi	
F_{cP}=	405 psi	
F_c=	800 psi	
E_{min}=	440,000 psi	
E=	1,200,000 psi	

Lumber Factors

C_D=	1.25	Duration for gravity load
C_M=	1.00	Wet Service
C_t=	1.00	Temperature
C_L=	1.00	Beam Stability
C_F=	1.05	Size for F_c
C_{fu}=	1.00	Flat Use
C_i=	1.00	Incising
C_r=	1.15	Repetitive Member
C_f=	1.00	Form
C_T=	1.00	Buckling Stiffness (2005 NDS 4.4.2)
C_F=	1.10	Size for F_b
C_D=	1.60	Duration for lateral load
C_r=	1.50	Repetitive Member (wind)

Weak Axis Calculations(y)

F_{cE}=	5651.25
F^*_c=	1050.00
F_{cE}/F^*_c=	5.38
$1+F_{cE}/F^*_c/2c$=	3.99
C_P=	0.96
F'_c=	1006.39
$P_{allowable}$=	8,303 lbs.
Good/No Good?	**O.K.**

Strong Axis Calculations (x)

F_{cE}=	593.70
F^*_c=	1050.00
F_{cE}/F^*_c=	0.57
$1+F_{cE}/F^*_c/2c$=	0.98
C_P=	0.48
F'_c=	501.83
$P_{allowable}$=	4,140 lbs.
Good/No Good?	**O.K.**

Wind Load

Wind load per stud=	21.3 plf
Moment=	4,095 in.-lbs.
Reaction=	121 lbs.
Header depth=	3.50 in.
Total header width=	1.50 in.
Header span=	8.0 ft.

Bending

S_x=	7.56 cu.in.
F'_b=	1782 psi
f_b=	542 psi
Good/No Good?	**O.K.**

Shear

F'_v=	240 psi
f_v=	22 psi
Good/No Good?	**O.K.**

Combined Bending and Axial Loading

F'_c=	642.34	combine allowable compressive stress
f_c=	56 psi	combine compressive stress
Combined stress index=	0.34	
Good/No Good?	**O.K.**	

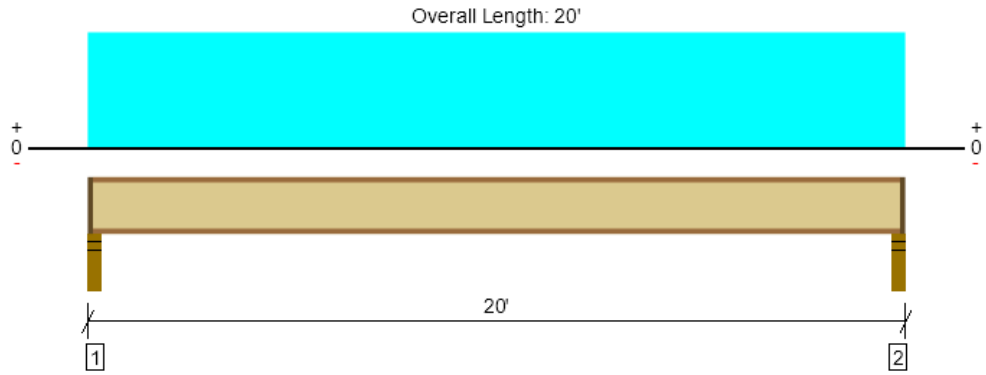
FORTEWEB

MEMBER REPORT

PASSED

Level, Floor: Joist

1 piece(s) 16" TJI® 210 @ 16" OC



Drawing is Conceptual. 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)	660 @ 2 1/2"	1134 (2.25")	Passed (58%)	1.00	1.0 D + 1.0 L (All Spans)
Shear (lbs)	647 @ 3 1/2"	2190	Passed (30%)	1.00	1.0 D + 1.0 L (All Spans)
Moment (Ft-lbs)	3196 @ 10'	5140	Passed (62%)	1.00	1.0 D + 1.0 L (All Spans)
Live Load Defl. (in)	0.266 @ 10'	0.653	Passed (L/882)	--	1.0 D + 1.0 L (All Spans)
Total Load Defl. (in)	0.333 @ 10'	0.979	Passed (L/706)	--	1.0 D + 1.0 L (All Spans)
TJ-Pro™ Rating	47	Any	Passed	--	--

Member Length : 19' 9 1/2"
System : Floor
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD

- Deflection criteria: LL (L/360) and TL (L/240).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- A structural analysis of the deck has not been performed.
- Deflection analysis is based on composite action with a single layer of 23/32" Weyerhaeuser Edge™ Panel (24" Span Rating) that is glued and nailed down.
- Additional considerations for the TJ-Pro™ Rating include: None.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Floor Live	Factored	
1 - Stud wall - HF	3.50"	2.25"	1.75"	133	533	667	1 1/4" Rim Board
2 - Stud wall - HF	3.50"	2.25"	1.75"	133	533	667	1 1/4" Rim Board

• Rim Board is assumed to carry all loads applied directly above it, bypassing the member being designed.

Lateral Bracing	Bracing Intervals	Comments
Top Edge (Lu)	4' 10" o/c	
Bottom Edge (Lu)	19' 10" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.
•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Floor Live (1.00)	Comments
1 - Uniform (PSF)	0 to 20'	16"	10.0	40.0	Default Load

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

ForteWEB Software Operator	Job Notes
Patrick Kessler Tuff Shed (303) 474-5617 pkessler@tuffshed.com	

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File Name: 180-2060259-Vernoon

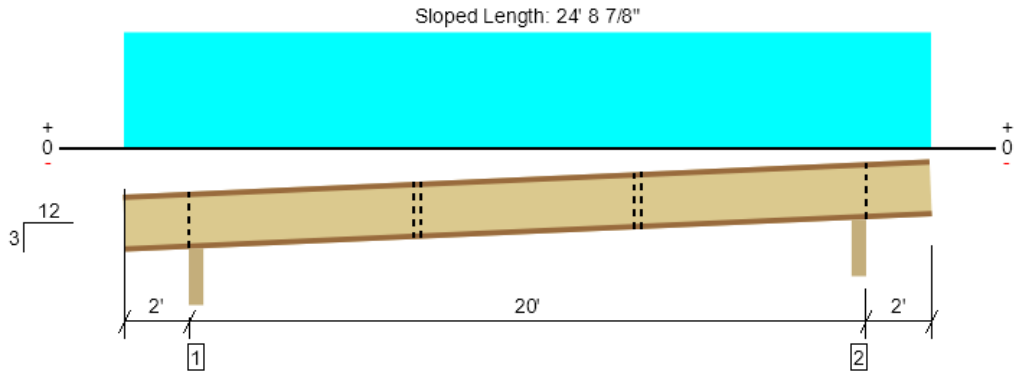
FORTEWEB

MEMBER REPORT

PASSED

Roof, Roof: Joist

1 piece(s) 11 7/8" TJI® 110 @ 24" OC



Drawing is Conceptual. 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)	730 @ 2' 1 3/4"	2493 (3.50")	Passed (29%)	1.25	1.0 D + 1.0 Lr (Adj Spans)
Shear (lbs)	569 @ 2' 3 1/2"	1950	Passed (29%)	1.25	1.0 D + 1.0 Lr (Adj Spans)
Moment (Ft-lbs)	2850 @ 12'	3950	Passed (72%)	1.25	1.0 D + 1.0 Lr (Alt Spans)
Live Load Defl. (in)	0.560 @ 12'	1.016	Passed (L/435)	--	1.0 D + 1.0 Lr (Alt Spans)
Total Load Defl. (in)	0.840 @ 12'	1.354	Passed (L/290)	--	1.0 D + 1.0 Lr (Alt Spans)

Member Length : 24' 11 13/16"
System : Roof
Member Type : Joist
Building Use : Residential
Building Code : IBC 2021
Design Methodology : ASD
Member Pitch : 3/12

- Deflection criteria: LL (L/240) and TL (L/180).
- Overhang deflection criteria: LL (2L/240) and TL (2L/180).
- Allowed moment does not reflect the adjustment for the beam stability factor.
- Permanent bracing at third points in the back span or a direct applied ceiling over the entire back span length is required at the left and right span of the member. See literature detail (PB1) For clarification.

Supports	Bearing Length			Loads to Supports (lbs)			Accessories
	Total	Available	Required	Dead	Roof Live	Factored	
1 - Beveled Plate - HF	3.50"	3.50"	3.50"	247	482	730	Blocking
2 - Beveled Plate - HF	3.50"	3.50"	3.50"	247	482	730	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)	3' 4" o/c	
Bottom Edge (Lu)	7' 4" o/c	

•TJI joists are only analyzed using Maximum Allowable bracing solutions.

•Maximum allowable bracing intervals based on applied load.

Vertical Load	Location	Spacing	Dead (0.90)	Roof Live (1.25)	Comments
1 - Uniform (PSF)	0 to 24'	24"	10.0	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

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