Structural Calculations Cover Sheet

Project Number: 2024.104 **Date:** December 13, 2024
Project Name: Cahoon **Architect:**

Structural Design For: Structural design for a remodel and deck addition to an existing residence.
Construction Type: Conventional wood framing with conventional concrete foundation.

CODES

2021 International Building Code (IBC)
2018 NDS
ASCE 7-16

LOADS

Dead Loads	As required
Roof Load	25 psf
Live Load	40 psf (60 psf deck)
Wind	110 mph, Exposure C, Per ASCE 7-16 Section 28, Kzt = 1.60
Seismic	Per ASCE 7-16 Section 12

Peak Ground Accelerations (PGA) based on USGS Hazards Program 2003, by Lat/Lon.
PGA 1 sec = .485 PGA .2 sec = 1.392 %V = .171 * DL

Material Design Values

Soils (assumed)	Minimum 1,500 psf allowed bearing (subject to field verification)	
Concrete	f'c=2,500 psi; 5-1/2 sack mix, or alternate mix pre-approved by bldg. dept.	
Reinforcing	Grade 60; Fy=60,000 psi minimum	
Sawn Lumber	Joists, Rafters:	Hem-Fir #2 and better
	Beams, Posts:	DF-L #2
	Studs & Plates:	Hem-Fir Standard
Parallam Beams	2.2E PSL, Fb=2,900 psi, Fv=290 psi, E=2.2*10^6 psi (minimum)	
Microllam Beams	1.9E LVL, Fb=2,600 psi, Fv=285 psi, E=1.9*10^6 psi (minimum)	
Timberstrand Bms	1.7E LSL, Fb=2,600 psi, Fv=400 psi, E=1.7*10^6 psi (minimum)	
Anchor Bolts	F1554 Anchor Bolts, A307 other bolts	

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Structural Engineering Consulting and Design

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2024.104**
Project:	**Cahoon**	Date:	13-Dec-24
Architect:		Page number:	UD 1

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Upper Floor Deck Joists - 16'

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	16.25 ft	Tributary Width:	1.33 ft	P Location:	16.25 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	162 lbs	DL Reaction 2:	162 lbs	Note: Design automatically uses
LL Reaction 1:	648 lbs	LL Reaction 2:	648 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**810 lbs**	Total Reaction 2:	**810 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	850 psi	Fb'	782 psi
Fv	150 psi	Fv'	120 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240		
For LL only: Allowed deflection criteria, span/			480		
Max. allowed total defl:	0.81 in		Max LL defl:	0.41 in	
Total defl. * I:	126.72 in^4		Required I:	155.96 in^4	
LL defl. * I:	101.38 in^4		Required I:	249.54 in^4	
Actual deflections:	TOTAL:	0.36 in		0.28 in	

Force analysis:

Max. moment:	3293 ft-lb	Max Shear:	810 lbs

Selected Member:	(2) HF #2	**1.5**	**x**	**11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	355.96 in^4		249.54 in^4
Section Modulus:	63.28 in^3		50.52 in^3
Section Area:	33.75 in^2		10.13 in^2
Bearing Area:			2. in^2
Minimum bearing dimensions:	3. in	x	0.67 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: UD 2

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Upper Floor Deck Joists - 7' max

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	6.67 ft	Tributary Width:	1.33 ft	P Location:	6.67 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	67 lbs	DL Reaction 2:	67 lbs	Note: Design automatically uses
LL Reaction 1:	266 lbs	LL Reaction 2:	266 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**333 lbs**	Total Reaction 2:	**333 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	850 psi	Fb'	782 psi
Fv	150 psi	Fv'	120 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.33 in	Max LL defl:	0.17 in
Total defl. * I:	3.6 in^4	Required I:	10.79 in^4
LL defl. * I:	2.88 in^4	Required I:	17.26 in^4
Actual deflections:	TOTAL: 0.02 in		0.02 in

Force analysis:

Max. moment:	555 ft-lb	Max Shear:	333 lbs

Selected Member:	(1) HF #2	**1.5**	**x**	**11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	177.98 in^4		17.26 in^4
Section Modulus:	31.64 in^3		8.51 in^3
Section Area:	16.88 in^2		4.16 in^2
Bearing Area:			0.82 in^2
Minimum bearing dimensions:	1.5 in	x	0.55 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: UD 3

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: East Edge Beam

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	17.75 ft	Tributary Width:	8 ft	P Location:	17.75 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1065 lbs	DL Reaction 2:	1065 lbs	Note: Design automatically uses
LL Reaction 1:	4260 lbs	LL Reaction 2:	4260 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**5325 lbs**	Total Reaction 2:	**5325 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2347 psi
Fv	265 psi	Fv'	265 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.89 in	Max LL defl:	0.44 in
Total defl. * I:	744.48 in^4	Required I:	838.85 in^4
LL defl. * I:	595.59 in^4	Required I:	1342.17 in^4
Actual deflections:	TOTAL: 0.54 in		0.43 in

Force analysis:

Max. moment:	23630 ft-lb	Max Shear:	5325 lbs

Selected Member: (1) GLB **6.75** **x** **13.5**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	1383.96 in^4		1342.17 in^4
Section Modulus:	205.03 in^3		120.84 in^3
Section Area:	91.13 in^2		30.14 in^2
Bearing Area:			8.19 in^2
Minimum bearing dimensions:	6.75 in	x	1.21 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

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BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Center Deck Beam - 13.5'

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	13.5 ft	Tributary Width:	10.5 ft	P Location:	13.5 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1063 lbs	DL Reaction 2:	1063 lbs	Note: Design automatically uses
LL Reaction 1:	4253 lbs	LL Reaction 2:	4253 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**5316 lbs**	Total Reaction 2:	**5316 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2400 psi
Fv	265 psi	Fv'	265 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.68 in	Max LL defl:	0.34 in
Total defl. * I:	326.96 in^4	Required I:	484.39 in^4
LL defl. * I:	261.57 in^4	Required I:	775.02 in^4
Actual deflections:	TOTAL: 0.41 in		0.33 in

Force analysis:

Max. moment:	17940 ft-lb	Max Shear:	5316 lbs

Selected Member: (1) GLB **5.5** **x** **12**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	792. in^4		775.02 in^4
Section Modulus:	132. in^3		89.7 in^3
Section Area:	66. in^2		30.09 in^2
Bearing Area:			8.18 in^2
Minimum bearing dimensions:	5.5 in	x	1.49 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: UD 5

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Center Deck Beam - 13'

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	13.75 ft	Tributary Width:	2.5 ft	P Location:	13.75 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	258 lbs	DL Reaction 2:	258 lbs	Note: Design automatically uses
LL Reaction 1:	1031 lbs	LL Reaction 2:	1031 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1289 lbs**	Total Reaction 2:	**1289 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	875 psi	Fb'	770 psi
Fv	170 psi	Fv'	136 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.69 in	Max LL defl:	0.34 in
Total defl. * I:	122.1 in^4	Required I:	177.6 in^4
LL defl. * I:	97.68 in^4	Required I:	284.17 in^4
Actual deflections:	TOTAL: 0.19 in		0.15 in

Force analysis:

Max. moment:	4431 ft-lb	Max Shear:	1289 lbs

Selected Member: (1) DF #2 **5.5** **x** **11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	652.59 in^4		284.17 in^4
Section Modulus:	116.02 in^3		69.06 in^3
Section Area:	61.88 in^2		14.22 in^2
Bearing Area:			2.06 in^2
Minimum bearing dimensions:	5.5 in	x	0.38 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2024.104**
Project:	**Cahoon**	Date:	13-Dec-24
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BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: South Deck Beam

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	6.75 ft	Tributary Width:	1.33 ft	P Location:	1.75 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	1063.125 lbs
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	4252.5 lbs
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	855 lbs	DL Reaction 2:	343 lbs	Note: Design automatically uses
LL Reaction 1:	3419 lbs	LL Reaction 2:	1372 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**4274 lbs**	Total Reaction 2:	**1715 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	875 psi	Fb'	770 psi
Fv	170 psi	Fv'	136 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240		
For LL only: Allowed deflection criteria, span/			480		
Max. allowed total defl:	0.34 in		Max LL defl:	0.17 in	
Total defl. * I:	38.05 in^4		Required I:	112.73 in^4	
LL defl. * I:	30.44 in^4		Required I:	180.36 in^4	
Actual deflections:	TOTAL:	0.06 in		0.05 in	

Force analysis:

Max. moment:	7327 ft-lb	Max Shear:	4274 lbs

Selected Member:	(1) DF #2	**5.5**	**x**	**11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	652.59 in^4		180.36 in^4
Section Modulus:	116.02 in^3		114.19 in^3
Section Area:	61.88 in^2		47.14 in^2
Bearing Area:			6.84 in^2
Minimum bearing dimensions:	5.5 in	x	1.24 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: UD 7

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: West Deck Beam

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	4.33 ft	Tributary Width:	6.75 ft	P Location:	4.33 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	219 lbs	DL Reaction 2:	219 lbs	Note: Design automatically uses
LL Reaction 1:	877 lbs	LL Reaction 2:	877 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**1096 lbs**	Total Reaction 2:	**1096 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	850 psi	Fb'	748 psi
Fv	150 psi	Fv'	120 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.22 in	Max LL defl:	0.11 in
Total defl. * I:	3.24 in^4	Required I:	14.98 in^4
LL defl. * I:	2.59 in^4	Required I:	23.96 in^4
Actual deflections:	TOTAL: 0.01 in		0.01 in

Force analysis:

Max. moment:	1186 ft-lb	Max Shear:	1096 lbs

Selected Member: (1) HF #2 **3.5** **x** **11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	415.28 in^4		23.96 in^4
Section Modulus:	73.83 in^3		19.03 in^3
Section Area:	39.38 in^2		13.7 in^2
Bearing Area:			2.71 in^2
Minimum bearing dimensions:	3.5 in	x	0.77 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: U 1

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Existing Dining Room Beam

Fully Supported:	1	Snow Load:	1	Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	11.33 ft	Tributary Width:	2.5 ft	P Location:	11.33 ft
Add'l uniform DL:	195 lbs/ft	DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:	325 lbs/ft	LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1317 lbs	DL Reaction 2:	1317 lbs	Note: Design automatically uses
LL Reaction 1:	2691 lbs	LL Reaction 2:	2691 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**4008 lbs**	Total Reaction 2:	**4008 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2760 psi
Fv	265 psi	Fv'	305 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 360

Max. allowed total defl:	0.57 in	Max LL defl:	0.38 in
Total defl. * I:	145.73 in^4	Required I:	257.25 in^4
LL defl. * I:	97.84 in^4	Required I:	259.07 in^4
Actual deflections:	TOTAL: 0.44 in		0.29 in

Force analysis:

Max. moment:	11353 ft-lb	Max Shear:	4008 lbs

Selected Member: (1) GLB **5.5** **x** **9**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	334.13 in^4		259.07 in^4
Section Modulus:	74.25 in^3		49.36 in^3
Section Area:	49.5 in^2		19.73 in^2
Bearing Area:			6.17 in^2
Minimum bearing dimensions:	5.5 in	x	1.12 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: U 2

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: New E-W Beam - 15'

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	15.25 ft	Tributary Width:	17.5 ft	P Location:	15.25 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	2002 lbs	DL Reaction 2:	2002 lbs	Note: Design automatically uses
LL Reaction 1:	5338 lbs	LL Reaction 2:	5338 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**7339 lbs**	Total Reaction 2:	**7339 lbs**	

Material Properties:

E	1.8 msi	E'	1.8 msi
Fb	2400 psi	Fb'	2400 psi
Fv	265 psi	Fv'	265 psi
Fc perp	650 psi	Fc perp'	650 psi
Emin	0.95 msi	Emin'	0.95 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.76 in	Max LL defl:	0.38 in
Total defl. * I:	650.71 in^4	Required I:	853.4 in^4
LL defl. * I:	473.25 in^4	Required I:	1241.3 in^4
Actual deflections:	TOTAL: 0.42 in		0.31 in

Force analysis:

Max. moment:	27980 ft-lb	Max Shear:	7339 lbs

Selected Member: (1) GLB **5.5** **x** **15**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	1546.88 in^4		1241.3 in^4
Section Modulus:	206.25 in^3		139.9 in^3
Section Area:	82.5 in^2		41.54 in^2
Bearing Area:			11.29 in^2
Minimum bearing dimensions:	5.5 in	x	2.05 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: U 3

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: New N-S Beam -23'

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:		P.T. Lumber:		Wet Use:	

Geometry and Loads:

Span:	23.25 ft	Tributary Width:	1.33 ft	P Location:	10.67 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	2442.3 lbs
Add'l uniform LL:		LL unit load:	40 psf	Concentrated LL:	8117.2 lbs
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	1553 lbs	DL Reaction 2:	1353 lbs	Note: Design automatically uses
LL Reaction 1:	5010 lbs	LL Reaction 2:	4344 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**6564 lbs**	Total Reaction 2:	**5696 lbs**	

Material Properties:

E	2.2 msi	E'	2.2 msi
Fb	2900 psi	Fb'	2772 psi
Fv	290 psi	Fv'	290 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.914 msi	Emin'	0.914 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	1.16 in	Max LL defl:	0.58 in
Total defl. * I:	2370.93 in^4	Required I:	2039.51 in^4
LL defl. * I:	1813.5 in^4	Required I:	3120. in^4
Actual deflections:	TOTAL: 0.7 in		0.53 in

Force analysis:

Max. moment:	65872 ft-lb	Max Shear:	6564 lbs

Selected Member: (1) PSL **7** **x** **18**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	3402. in^4		3120. in^4
Section Modulus:	378. in^3		285.12 in^3
Section Area:	126. in^2		33.95 in^2
Bearing Area:			10.5 in^2
Minimum bearing dimensions:	7. in	x	1.5 in

John S. Apolis, P.E.	**CSES, Inc.**	Job number:	**2024.104**
Project:	**Cahoon**	Date:	13-Dec-24
Architect:		Page number:	D 1

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Main Floor Deck Joists

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	12 ft	Tributary Width:	1.33 ft	P Location:	12 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	120 lbs	DL Reaction 2:	120 lbs	Note: Design automatically uses
LL Reaction 1:	479 lbs	LL Reaction 2:	479 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**599 lbs**	Total Reaction 2:	**599 lbs**	

Material Properties:

E	1.3 msi	E'	1.235 msi
Fb	850 psi	Fb'	782 psi
Fv	150 psi	Fv'	120 psi
Fc perp	405 psi	Fc perp'	405 psi
Emin	0.47 msi	Emin'	0.4465 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/			240		
For LL only: Allowed deflection criteria, span/			480		
Max. allowed total defl:	0.6 in		Max LL defl:	0.3 in	
Total defl. * I:	37.68 in^4		Required I:	62.81 in^4	
LL defl. * I:	30.15 in^4		Required I:	100.49 in^4	
Actual deflections:	TOTAL:	0.21 in		0.17 in	

Force analysis:

Max. moment:	1796 ft-lb	Max Shear:	599 lbs

Selected Member:	(1) HF #2	**1.5**	**x**	**11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	177.98 in^4		100.49 in^4
Section Modulus:	31.64 in^3		27.55 in^3
Section Area:	16.88 in^2		7.48 in^2
Bearing Area:			1.48 in^2
Minimum bearing dimensions:	1.5 in	x	0.99 in

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**

Project: **Cahoon** Date: 13-Dec-24

Architect: Page number: D 2

BEAM DESIGN (Uniform Load+Concentrated Load)

2021 International Building Code (IBC) **2018 NDS**

Beam Description: Main Floor Deck Beam

Fully Supported:	1	Snow Load:		Wind Load:	
Repetitive Member:	1	P.T. Lumber:	1	Wet Use:	

Geometry and Loads:

Span:	9 ft	Tributary Width:	6 ft	P Location:	9 ft
Add'l uniform DL:		DL unit load:	15 psf	Concentrated DL:	
Add'l uniform LL:		LL unit load:	60 psf	Concentrated LL:	
Add'l uniform SL:		SL unit load:		Concentrated SL:	
Add'l uniform WL:		WL unit load:		Concentrated WL:	

DL Reaction 1:	405 lbs	DL Reaction 2:	405 lbs	Note: Design automatically uses
LL Reaction 1:	1620 lbs	LL Reaction 2:	1620 lbs	ASD load combinations
SL Reaction 1:	0 lbs	SL Reaction 2:	0 lbs	
WL Reaction 1:	0 lbs	WL Reaction 2:	0 lbs	
Total Reaction 1:	**2025 lbs**	Total Reaction 2:	**2025 lbs**	

Material Properties:

E	1.6 msi	E'	1.52 msi
Fb	900 psi	Fb'	911 psi
Fv	180 psi	Fv'	144 psi
Fc perp	625 psi	Fc perp'	625 psi
Emin	0.58 msi	Emin'	0.551 msi

Deflection analysis:

For total load: Allowed deflection criteria, span/ 240

For LL only: Allowed deflection criteria, span/ 480

Max. allowed total defl:	0.45 in	Max LL defl:	0.23 in
Total defl. * I:	43.7 in^4	Required I:	97.12 in^4
LL defl. * I:	34.96 in^4	Required I:	155.39 in^4
Actual deflections:	TOTAL: 0.11 in		0.08 in

Force analysis:

Max. moment:	4556 ft-lb	Max Shear:	2025 lbs

Selected Member:	(1) DF #2	**3.5**	**x**	**11.25**

Member properties:	**Provided:**		**Required:**
Moment of inertia:	415.28 in^4		155.39 in^4
Section Modulus:	73.83 in^3		60.03 in^3
Section Area:	39.38 in^2		21.09 in^2
Bearing Area:			3.24 in^2
Minimum bearing dimensions:	3.5 in	x	0.93 in

DECK FOOTING - POSTS W/ UPPER DECK LOAD

LOAD = 5,316 lb + 1,242 lb = 6,558 lb
(VD4) (VD5)

ALT. LOAD = 5,325 lb + 2,025 lb × 2 = 9,375 lb
(VD3) (D2)

ASSUMED SOIL PRESSURE = 1,500 psf

$\frac{9,375 \text{ lb}}{1,500 \text{ psf}} = 6.25 \text{ ft}^2 < 7.6 \text{ ft}^2$ ∴ 33" × 33" × 12" DEEP FOOTING

DECK FOOTING - MAIN FLOOR

LOAD = 2 × 2,025 lb = 4,050 lb
(D2)

$\frac{4,050 \text{ lb}}{1,500 \text{ psf}} = 2.7 \text{ ft}^2 < 3.1 \text{ ft}^2$ ∴ 21" × 21" × 12" DEEP FOOTING

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Project No. 2024.104 Date 12-13-24
Project Name CARLSON
Comments
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2268 66th Ave SE, Mercer Island, WA 98040, USA
Latitude, Longitude: 47.5899104, -122.2464146

Date	12/10/2024, 1:57:03 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.392	MCE_R ground motion. (for 0.2 second period)
S_1	0.485	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.67	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.113	Numeric seismic design value at 0.2 second SA
S_{D1}	null -See Section 11.4.8	Numeric seismic design value at 1.0 second SA

John S. Apolis, P.E. **CSES, Inc.** Job number: **2024.104**
Project: **Cahoon** Date: 13-Dec-24
Architect: Page number: **L 1**

Lateral Loads Design per ASCE 7-16, Wind: Section 28 Seismic: Section 12

(Simplified Envelope Procedure Part 2) 2021 International Building Code (IBC)

WIND LOADS **110** mph Basic Wind Speed 2018 NDS

Ps = lambda * Kzt * Ps(30) * 0.6 Exposure C Roof Slope: **5.00** : 12 = 22.6

Least Horizontal Dimension, feet: **45.67** Mean Roof Ht, feet: **22** (degrees)

lambda = 1.31 a = 4.6 ft, 2a = 9.1 ft

Iw = 1.00 KzT = **1.60**

Tabulated Ps(30): (Refer to ASCE 7-10, Figure 28.6-1)	**Zone**	**Tabulated Wind Pressure**		**Calc'd Design Pressure** (*lambda*KzT*0.6)	**Min Design Pressure**
(horizontal)	A	25.3	psf	**31.9**	**31.9**
"	B	-1.3	psf	**-1.6**	**10.1**
"	C	17.5	psf	**22.1**	**22.1**
"	D	0.2	psf	**0.3**	**10.1**
(vertical)	E	-16.6	psf	**-21.0**	
"	F	-15.3	psf	**-19.3**	
"	G	-11.7	psf	**-14.7**	
"	H	-11.9	psf	**-15.1**	
(uplift on overhangs)	E(oh)	-25.8	psf	**-32.5**	
"	G(oh)	-21.0	psf	**-26.4**	

(Per section 28.6.4 minimum tabulated wind pressure is 16 PSF for zonesA,C, and 8 PSF for zones B, D)

(Equivalent Lateral Force Procedure, Section 12.8)

SEISMIC LOADS Ie 1.0 R = 6.5 ASCE 7-10, Table 12.2.1

Seismic Parameters per ASCE 7-16) Group I Site Class: **D**

PGA (.2 sec) 1.3920 Fa = 1.20 ASCE 7-10 Table 11.4-1

PGA (1 sec) 0.4850 Fv = 1.60 ASCE 7-10 Table 11.4-2

Seismic Design Categories per ASCE 7-16 Tables 11.6-1, 11.6-2

Based on Sds: **D** Based on Sd1: **D**

PGA's based on peak ground accelerations per latest USGS Hazards Program (based on lat/lon).

Ss = 1.3920 Sms = Fa * Ss = 1.67 Equation 11.4-1

S1 = 0.4850 Sm1 = Fv * S1 = 0.78 Equation 11.4-2

Equations 11.4-3, 11.4-4 Sds = 2/3 * Sms = 1.11 Sd1 = 2/3 * Sm1 = 0.52

Equation 12.14-11 Cs (%V) = (Sds / (R/I)) = 0.171 **Building period < 0.5 s per IBC eq 12.8-7**

Base Shear = %V * W * 0.7 = 5.04 psf, uniformly distributed over floor area

(0.7 reduction factor per ASCE 7-16, Section 2.4.1, Eq (seismic vertical distribution per IBC eqs 12.8-11 & 12)

Base = top of foundation	**Roof DL (psf)**	**Wall DL (psf) dist. over floor area**	**Story Height Above Base (ft)**	**Lateral Load (psf)**
Roof	**12**	**6**	**18.25**	**2.94**
Upper Floor	**12**	**12**	**9.75**	**2.10**

Total Seismic DL: **42** Sum **5.04**

STAIR SHEAR WALL L = 13' + 6.5' = 19.5'

P_W = 10.1 psf (19.25' × 9.67') + 22.1 psf (19.25' × 13.25') = 7,517 lb

P_E = 2.94 psf (19.25' × 37.25') + 2.1 psf (19.25' × 45.75') = 3,958 lb

$V = \frac{7,517 \text{ lb}}{19.5'}$ = 385 plf < 550 plf ∴ SW3

Uplift = 385 plf × 8' = 3,084 lb < 4,340 lb ∴ HDU5

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