

BEAM CALCULATIONS

ADDRESS: 4307 E Mercer Way, Mercer Island

LRFD

CARPORT BEAM B-1

5.5"x14" GLB, Fb=1850 psi, E=1800 psi

Span	16 ft
Snow, Live, Dead Tributary Length	10 ft
Self Weight	16.04166667 plf
Dead Load	10 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
Live load per ft	0 plf
Dead load per ft	116.0416667 plf
Snow load per ft	250 plf

Relevant Load Combinations	Shear or force on columns
1.4 (D)	162 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	264 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	539 plf
1.2 (D) + 1.6 (W) + L + 0.5 (S)	264 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	189 plf
0.9 (D) + 1.6 (W)	104 plf
0.9 (D) - 1.6 (W)	104 plf
0.9 (D) + 1.0 (E)	104 plf
0.9 (D) - 1.0 (E)	104 plf
Max of Live, Snow (DEFLECTION ONLY)	400 plf
Largest Load	539 plf

Mmax	23,008 ft-lbs
E	1,800,000 psi
E (LRFD Conversion, for deflection only, for stability calculations use E)	2,601,000 psi
I	1,258 in ⁴
d	14.00 in
B	5.50 in
Delta max D	0.243079 in
Deflection Limit D L/180	1.066667 in
Delta max L	0.180309 in
Deflection Limit L L/360	0.533333 in
V	4,314 lbs
S	179.6666667 in ³
Fb (includes C factors + Add time effect factor)	1,850 psi
Fb (LRFD Conversion) (no Cd)	2,716 psi
Moment Capacity	40664.88494 ft-lbs
FS Bending + resistance factor	1.2

allowable shear parallel to grain	250 psi
Vallowable (LRFD conversion) (no Cd)	324 psi
Transverse Shear	84 psi
FS shear + resistance factor	2.3

POSTS

Largest Load	4,314 lbs
COLUMN LENGTH	8 ft
L (column length in inches)	96.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	52.1 in ⁴
d	5.5 in
b	5.5 in
K	1.0 dimensionless
Critical Bucling Load	44,283.9 lbs
phi	0.5
Critical Bucling Capacity with FS	22,142.0 lbs
Column FS	5.132583241

POST FOOTINGS

L	3 ft
W	3 ft
Phi	0.5
Bearing Factor	1.3
Soil Capacity	1500 psi
FS	2.034075104

LRFD

CARPORT JOISTS

2x6 #2 HF @ 24" O.C.

Span	16 ft
Snow, Live, Dead Tributary Length	10 ft
Self Weight	16.04166667 plf
Dead Load	10 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
Live load per ft	0 plf
Dead load per ft	116.0416667 plf
Snow load per ft	250 plf

OK by Table AWC R-14
L/180 deflection limitation

LRFD

HEADER A

3.5"x10.5" GLB

8 ft	Span	10.5 ft
2 ft	Snow, Live, Dead Tributary Length	9.75 ft
0 plf	Self Weight	7.65625 plf
10 psf	Dead Load	15 psf
25 psf	Snow Load	25 psf
0 psf	Live Load	20 psf
0 psf	Live load per ft	195 plf
	Dead load per ft	153.90625 plf
	Snow load per ft	243.75 plf

Relevant Load Combinations	Shear or force on columns
1.4 (D)	215 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	619 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	575 plf
1.2 (D) + 1.6 (W) + L + 0.5 (S)	502 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	428 plf
0.9 (D) + 1.6 (W)	139 plf
0.9 (D) - 1.6 (W)	139 plf
0.9 (D) + 1.0 (E)	139 plf
0.9 (D) - 1.0 (E)	139 plf
Max of Live, Snow (DEFLECTION ONLY)	488 plf
Largest Load	619 plf

Mmax	8,525 ft-lbs
E	1,800,000 psi
E (LRFD Conversion, for deflection only, for stability calculations)	2,601,000 psi
I	338 in ⁴
d	10.50 in
B	3.50 in
Delta max	0.151817 in
Deflection Limit L/600	0.210000 in
V	3,247 lbs
S	64.3125 in ³
Fb (includes C factors + Add time effect fz)	1,850 psi
Fb (LRFD Conversion) (no Cd)	2,716 psi
Moment Capacity	14556.18041 ft-lbs
FS Bending + resistance factor	1.2

allowable shear parallel to grain	250 psi
Vallowable (LRFD conversion) (no Cd)	324 psi
Transverse Shear	133 psi
FS shear + resistance factor	1.5

JACK AND KING STUDS

Largest Load	3,247 lbs
COLUMN LENGTH	8 ft
L (column length in inches)	96.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	9.0 in ⁴
d	3.5 in
b	4.5 in
K	1.0 dimenti
Critical Bucling Load	7,652.3 lbs
phi	0.5
Critical Bucling Capacity with FS	3,826.1 lbs
Column FS	1.178194496

GLUE LAM POST (WHERE SUPPORTING TWO BEAMS)

GLUE LAM POST (WHERE SUPPORTING TWO BEAMS)

Largest Load	6,495
COLUMN LENGTH	8
L (column length in inches)	96.0
E	1,900,000
Adjusted E	3,142,881
I	12.4
d	3.5
b	6.0
K	1.0
Critical Bucling Load	18,174.1
phi	0.5
Critical Bucling Capacity with FS	9,087.1
Column FS	1.399105963

LFRD
SUPPORT BEAM C
PT 4x8 #2 HF, DF

Span	7 ft
Snow, Live, Dead Tributary Leng	4 ft
Self Weight	6.015625 plf
Dead Load	25 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	40 psf
Live load per ft	160 plf
Dead load per ft	106.015625 plf
Snow load per ft	100 plf

LFRD
BEAM D
4x8 #2 HF, DF

Span	7 ft
Snow, Live, Dead Tributary L	8 ft
Self Weight	5.28645833 plf
Dead Load	12 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
Live load per ft	0 plf
Dead load per ft	101.286458 plf
Snow load per ft	200 plf

LFRD
RIDGE BEAM E1
3x, 2x12 HF2

Span	9 ft
Snow, Live, Dead Tributary Leng	10 ft
Self Weight	10.546875 plf
Dead Load	10 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
Live load per ft	0 plf
Dead load per ft	110.546875 plf
Snow load per ft	250 plf

LFRD
RIDGE BEAM E2
3x, 2x10 HF2

Span	13 ft
Snow, Live, Dead Tributary Length	10 ft
Tributary Area	50 sqf
Dead Load	10 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
Live load per ft	0 lbs
Dead load per ft	500 lbs
Snow load per ft	1250 lbs

Relevant Load Combinations	Shear or force on column
1.4 (D)	148 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	433 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	287 plf
1.2 (D) + 1.6 (W) + L +0.5 (S)	337 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	307 plf
0.9 (D) + 1.6 (W)	95 plf
0.9 (D) - 1.6 (W)	95 plf
0.9 (D) + 1.0 (E)	95 plf
0.9 (D) - 1.0 (E)	95 plf
Max of Live, Snow (DEFLECTION)	306 plf
Largest Load	433 plf
Mmax	2,653 ft-lbs
Mmax	2,653 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stability)	1,589,500 psi
I	164 in^4
d	8.25 in
B	3.50 in
Delta max D	0.089903 in
Deflection Limit D L/180	0.466667 in
Delta max L	0.063502 in
Deflection Limit L L/360	0.233333 in
V	1,516 lbs
S	39.703125 in^3
Fb (includes C factors + Add time	816 psi
Fb (LRFD Conversion) (no Cd)	1,198 psi
Moment Capacity	3963.648728 ft-lbs
FS Bending + resistance factor	1.0

Relevant Load Combinations	Shear or force on columns
1.4 (D)	142 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	222 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	442 plf
1.2 (D) + 1.6 (W) + L +0.5 (S)	222 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	162 plf
0.9 (D) + 1.6 (W)	91 plf
0.9 (D) - 1.6 (W)	91 plf
0.9 (D) + 1.0 (E)	91 plf
0.9 (D) - 1.0 (E)	91 plf
Max of Live, Snow (DEFLECT	320 plf
Largest Load	442 plf
Mmax	2,704 ft-lbs
Mmax	2,704 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for s	1,589,500 psi
I	111 in^4
d	7.25 in
B	3.50 in
Delta max D	0.135017 in
Deflection Limit D L/180	0.466667 in
Delta max L	0.097851 in
Deflection Limit L L/360	0.233333 in
V	1,545 lbs
S	30.6614583 in^3
Fb (includes C factors + Add	1,020 psi
Fb (LRFD Conversion) (no Cd)	1,762 psi
Moment Capacity	4501.47002 ft-lbs
FS Bending + resistance fact	1.1

Relevant Load Combinations	Shear or force on col
1.4 (D)	155 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	258 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	533 plf
1.2 (D) + 1.6 (W) + L +0.5 (S)	258 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	183 plf
0.9 (D) + 1.6 (W)	99 plf
0.9 (D) - 1.6 (W)	99 plf
0.9 (D) + 1.0 (E)	99 plf
0.9 (D) - 1.0 (E)	99 plf
Max of Live, Snow (DEFLECTIO	400 plf
Largest Load	533 plf
Mmax	5,393 ft-lbs
Mmax	5,393 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stabil	1,589,500 psi
I	534 in^4
d	11.25 in
B	4.50 in
Delta max D	0.092651 in
Deflection Limit D L/180	0.600000 in
Delta max L	0.069577 in
Deflection Limit L L/360	0.300000 in
V	2,397 lbs
S	94.921875 in^3
Fb (includes C factors + Add tim	680 psi
Fb (LRFD Conversion) (no Cd)	998 psi
Moment Capacity	7896.87984 ft-lbs
FS Bending + resistance factor	1.0

Relevant Load Combinations	Shear or force on col
1.4 (D)	155 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	1,225 lbs
1.2 (D) + 1.6 (S) + 0.8 (W)	2,600 lbs
1.2 (D) + 1.6 (W) + L +0.5 (S)	1,225 lbs
1.2 (D) + 1.0 (E) + L + 0.2 (S)	850 lbs
0.9 (D) + 1.6 (W)	450 lbs
0.9 (D) - 1.6 (W)	450 lbs
0.9 (D) + 1.0 (E)	450 lbs
0.9 (D) - 1.0 (E)	450 lbs
Max of Live, Snow (DEFLECTION ONLY)	2,000 lbs
Largest Load	2,600 lbs
Mmax	4,337 ft-lbs
Mmax	4,337 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stability calculations	1,589,500 psi
I	297 in^4
d	9.25 in
B	4.50 in
Delta max D	0.272840 in
Deflection Limit D L/180	0.866667 in
Delta max L	0.209877 in
Deflection Limit L L/360	0.433333 in
V	1,733 lbs
S	64.171875 in^3
Fb (includes C factors + Add time effect fa	850 psi
Fb (LRFD Conversion) (no Cd)	1,468 psi
Moment Capacity	7851.00109 ft-lbs
FS Bending + resistance factor	1.2

allowable shear parallel to grain 150 psi
Vallowable (LRFD conversion) (n 194.4 psi

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Vallowable (LRFD conversion) 194.4 psi

allowable shear parallel to grain 150 psi
Vallowable (LRFD conversion) (i 194.4 psi

allowable shear parallel to grain 150 psi
Vallowable (LRFD conversion) (no Cd) 194.4 psi

BEAM

Transverse Shear	79 psi
FS shear + resistance factor	1.5

BEAM

Transverse Shear	91 psi
FS shear + resistance factor	1.3

BEAM

Transverse Shear	71 psi
FS shear + resistance factor	1.6

BEAM

Transverse Shear	62 psi
FS shear + resistance factor	1.9

POSTS

Largest Load	3,093 lbs
COLUMN LENGTH	4 ft

POSTS

Largest Load	3,091 lbs
COLUMN LENGTH	8 ft

POSTS

Largest Load	7,191 lbs
COLUMN LENGTH	12 ft

POSTS

Largest Load	7,191 lbs
COLUMN LENGTH	12 ft

L (column length in inches)	48.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	11.3 in^4
d	3.5 in
b	5.5 in
K	1.0 dimentional
Critical Bucleing Load	38,261.3 lbs
phi	0.5
Critical Bucleing Capacity with FS	19,130.7 lbs
Column FS	6.308478101

L (column length in inches)	96.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	12.4 in^4
d	3.5 in
b	6.0 in
K	1.0 dimentionales
Critical Bucleing Load	10,521.9 lbs
phi	0.5
Critical Bucleing Capacity with FS	5,260.9 lbs
Column FS	1.70212244

L (column length in inches)	144.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	52.1 in^4
d	5.5 in
b	5.5 in
K	1.0 dimentionales
Critical Bucleing Load	19,681.7 lbs
phi	0.5
Critical Bucleing Capacity with FS	9,840.9 lbs
Column FS	1.36852529

L (column length in inches)	144.0 in
E	1,100,000 psi
Adjusted E	1,942,881 psi
I	52.1 in^4
d	5.5 in
b	5.5 in
K	1.0 dimentionales
Critical Bucleing Load	19,681.7 lbs
phi	0.5
Critical Bucleing Capacity with FS	9,840.9 lbs
Column FS	1.36852529

POST FOOTINGS

L	2 ft
W	2 ft
Phi	0.5
Bearing Factor	1.3
Soil Capacity	1500 psi
FS	2.572108096

POST FOOTINGS

L	2 ft
W	2 ft
Phi	0.5
Bearing Factor	1.3
Soil Capacity	1500 psi
FS	1.627065611

LFRD

HEADER F
3x, 2x12 #2 HF, DF

Span	12 ft
a	2
b	10

LFRD

FLOOR JOISTS
2x8 #2 HF, DF

Span	9.5 ft
Snow, Live, Dead Tributary Length	1.33 ft
Self Weight	5.28645833 plf
Dead Load	10 psf
Snow Load	0 psf
Rain-on-snow	0 psf
Live Load	40 psf
Live load per ft	53.2 plf
Dead load per ft	18.5864583 plf
Snow load per ft	0 plf

LFRD

PROPOSED WINDOW HEADERS
2x8 #2 HF, DF

Span	6 ft
Snow, Live, Dead Tributary Length	6.5 ft
Self Weight	5.286458333 plf
Dead Load	12 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	40 psf
Live load per ft	260 plf
Dead load per ft	83.28645833 plf
Snow load per ft	162.5 plf

umns

	Relevant Load Combinations	Shear or force on col	Relevant Load Combinations	Shear or force on columns
	1.4 (D)	26 plf	1.4 (D)	117 plf
	1.2 (D) + 1.6 (L) + 0.5 (S)	107 plf	1.2 (D) + 1.6 (L) + 0.5 (S)	597 plf
	1.2 (D) + 1.6 (S) + 0.8 (W)	22 plf	1.2 (D) + 1.6 (S) + 0.8 (W)	360 plf
	1.2 (D) + 1.6 (W) + L + 0.5 (S)	76 plf	1.2 (D) + 1.6 (W) + L + 0.5 (S)	441 plf
	1.2 (D) + 1.0 (E) + L + 0.2 (S)	76 plf	1.2 (D) + 1.0 (E) + L + 0.2 (S)	392 plf
	0.9 (D) + 1.6 (W)	17 plf	0.9 (D) + 1.6 (W)	75 plf
	0.9 (D) - 1.6 (W)	17 plf	0.9 (D) - 1.6 (W)	75 plf
	0.9 (D) + 1.0 (E)	17 plf	0.9 (D) + 1.0 (E)	75 plf
	0.9 (D) - 1.0 (E)	17 plf	0.9 (D) - 1.0 (E)	75 plf
	Max of Live, Snow (DEFLECTION)	85 plf	Max of Live, Snow (DEFLECTIC)	497 plf
	Largest Load	107 plf	Largest Load	597 plf
Mmax	3,995 ft-lbs	1,212 ft-lbs	Mmax	2,687 ft-lbs
E	1,100,000 psi	1,100,000 psi	E	1,100,000 psi
E (LFRD Conversion, for deflection only, for stabil	1,589,500 psi	1,589,500 psi	E (LFRD Conversion, for deflection only, for stabil	1,589,500 psi
I	415 in ⁴	111 in ⁴	I	111 in ⁴
d	11.25 in	7.25 in	d	7.25 in
B	3.50 in	3.50 in	B	3.50 in
Delta max D	0.000000 in	0.111434 in	Delta max D	0.098569 in
Deflection Limit D L/180	0.800000 in	0.633333 in	Deflection Limit D L/180	0.400000 in
Delta max L	0.000000 in	0.088297 in	Delta max L	0.082073 in
Deflection Limit L L/360	0.400000 in	0.316667 in	Deflection Limit L L/360	0.200000 in
V	1,198 lbs	510 lbs	V	1,792 lbs
S	73.828125 in ³	30.6614583 in ³	S	30.66145833 in ³
Fb (includes C factors + Add tim	680 psi	680 psi	Fb (includes C factors + Add tim	1,020 psi
Fb (LRF Conversion) (no Cd)	998 psi	998 psi	Fb (LRF Conversion) (no Cd)	1,762 psi
Moment Capacity	6142.017656 ft-lbs	2550.83301 ft-lbs	Moment Capacity	4501.470021 ft-lbs
FS Bending + reistance factor	1.0	1.4	FS Bending + reistance factor	1.1
allowable shear parallel to grain	150 psi	150 psi	allowable shear parallel to grain	150 psi
Vallowable (LRF conversion) (194.4 psi	194.4 psi	Vallowable (LRF conversion) (194.4 psi
Transverse Shear	46 psi	30 psi	Transverse Shear	106 psi
FS shear + reistance factor	2.6	3.9	FS shear + reistance factor	1.1