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 caclulations 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 efect factor)	1,850 psi
Fb (LRFD Conversion) (no Cd)	2,716 psi
Moment Capacity	40664.88494 ft-lbs
FS Bending + reistance factor	**1.2**
allowable shear parallel to grain	250 psi
Vallowable (LRFD conversion) (no Cd)	324 psi
Transverse Shear	84 psi
FS shear + reistance 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 dimentionaless
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	8 ft
Snow, Live, Dead Tributary Length	2 ft
Self Weight	0 plf
Dead Load	10 psf
Snow Load	25 psf
Rain-on-snow	0 psf
Live Load	0 psf
OK by Table AWC R-14	
L/180 deflection limitation	

LRFD

HEADER A

3.5"x10.5" GLB

Span	10.5 ft
Snow, Live, Dead Tributary Length	9.75 ft
Self Weight	7.65625 plf
Dead Load	15 psf
Snow Load	25 psf
Live Load	20 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 caclulations u	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 efect fa	1,850 psi
Fb (LRFD Conversion) (no Cd)	2,716 psi
Moment Capacity	14556.18041 ft-lbs
FS Bending + reistance factor	**1.2**
allowable shear parallel to grain	250 psi
Vallowable (LRFD conversion) (no Cd)	324 psi
Transverse Shear	133 psi
FS shear + reistance 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 dimentionaless
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 lbs
COLUMN LENGTH	8 ft
L (column length in inches)	96.0 in
E	1,900,000 psi
Adjusted E	3,142,881 psi
I	12.4 in^4
d	3.5 in
b	6.0 in
K	1.0 dimentionaless
Critical Bucling Load	18,174.1 lbs
phi	0.5
Critical Bucling Capacity with FS	9,087.1 lbs
Column FS	1.399105963

LRFD

SUPPORT BEAM C

PT 4x8 #2 HF, DF

Span	7 ft
Snow, Live, Dead Tributary Length	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**

Relevant Load Combinations	Shear or force on columns
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 c	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 + reistance factor	**1.0**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (no	194.4 psi
Transverse Shear	79 psi
FS shear + reistance factor	**1.5**

POSTS

Largest Load	3,033 lbs
COLUMN LENGTH	4 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 dimentionaless
Critical Bucling Load	38,261.3 lbs
phi	0.5
Critical Bucling Capacity with FS	19,130.7 lbs
Column FS	6.308478101

POST FOOTINGS

L	2 ft
W	2 ft
Phi	0.5
Bearing Factor	1.3
Soil Capacity	1500 psi
FS	2.572108696

Revised area is boxed

LRFD

BEAM D

4x8 #2 HF, DF+1.75"x7.25 LVL

Span	7 ft
Snow, Live, Dead Tributary Le	14 ft
Self Weight	7.9296875 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	**175.929688 plf**
Snow load per ft	**350 plf**

Relevant Load Combinations	Shear or force on columns
1.4 (D)	246 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	386 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	771 plf
1.2 (D) + 1.6 (W) + L +0.5 (S	386 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S	281 plf
0.9 (D) + 1.6 (W)	158 plf
0.9 (D) - 1.6 (W)	158 plf
0.9 (D) + 1.0 (E)	158 plf
0.9 (D) - 1.0 (E)	158 plf
Max of Live, Snow (DEFLECT	560 plf
Largest Load	771 plf
Mmax	4,723 ft-lbs
Mmax	4,723 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for st	1,589,500 psi
I	167 in^4
d	7.25 in
B	5.25 in
Delta max D	**0.157196 in**
Deflection Limit D L/180	0.466667 in
Delta max L	**0.114159 in**
Deflection Limit L L/360	0.233333 in
V	2,699 lbs
S	45.9921875 in^3
Fb (includes C factors + Add	1,020 psi
Fb (LRFD Conversion) (no C	1,762 psi
Moment Capacity	6752.20503 ft-lbs
FS Bending + reistance fac	**1.0**
allowable shear parallel to gra	150 psi
Vallowable (LRFD conversion	194.4 psi
Transverse Shear	106 psi
FS shear + reistance factor	**1.1**

POSTS

Largest Load	5,398 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	15.8 in^4
d	3.5 in
b	7.5 in
K	1.0 dimentionales
Critical Bucling Load	13,391.5 lbs
phi	0.5
Critical Bucling Capacity with FS	6,695.7 lbs
Column FS	1.24045321

LRFD

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**

Relevant Load Combinations	Shear or force on colu
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 stabilit	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 + reistance factor	**1.0**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (r	194.4 psi
Transverse Shear	71 psi
FS shear + reistance factor	**1.6**

POSTS

Largest Load	7,191 lbs
COLUMN LENGTH	12 ft
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 dimenti
Critical Bucling Load	19,681.7 lbs
phi	0.5
Critical Bucling 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	1.627065611

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 columns
1.4 (D)	700 lbs
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 caclulations u	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 efect fa	850 psi
Fb (LRFD Conversion) (no Cd)	1,468 psi
Moment Capacity	7851.00109 ft-lbs
FS Bending + reistance factor	**1.2**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (no Cd)	194.4 psi
Transverse Shear	62 psi
FS shear + reistance factor	**1.9**

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LFRD

HEADER F

3x, 2x12 #2 HF, DF

Span	12 ft
a	2
b	10

Mmax	3,995 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stabilit	1,589,500 psi
I	415 in^4
d	11.25 in
B	3.50 in
Delta max D	**0.000000 in**
Deflection Limit D L/180	0.800000 in
Delta max L	**0.000000 in**
Deflection Limit L L/360	0.400000 in
V	1,198 lbs
S	73.828125 in^3
Fb (includes C factors + Add tim	680 psi
Fb (LRFD Conversion) (no Cd)	998 psi
Moment Capacity	6142.017656 ft-lbs
FS Bending + reistance factor	**1.0**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (i	194.4 psi
Transverse Shear	46 psi
FS shear + reistance factor	**2.6**

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**

Relevant Load Combinations	Shear or force on colu
1.4 (D)	26 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	107 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	22 plf
1.2 (D) + 1.6 (W) + L +0.5 (S)	76 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	76 plf
0.9 (D) + 1.6 (W)	17 plf
0.9 (D) - 1.6 (W)	17 plf
0.9 (D) + 1.0 (E)	17 plf
0.9 (D) - 1.0 (E)	17 plf
Max of Live, Snow (DEFLECTION	85 plf
Largest Load	107 plf
Mmax	1,212 ft-lbs
Mmax	1,212 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stability ca	1,589,500 psi
I	111 in^4
d	7.25 in
B	3.50 in
Delta max D	**0.111434 in**
Deflection Limit D L/180	0.633333 in
Delta max L	**0.088297 in**
Deflection Limit L L/360	0.316667 in
V	510 lbs
S	30.6614583 in^3
Fb (includes C factors + Add time	680 psi
Fb (LRFD Conversion) (no Cd)	998 psi
Moment Capacity	2550.83301 ft-lbs
FS Bending + reistance factor	**1.4**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (no	194.4 psi
Transverse Shear	30 psi
FS shear + reistance factor	**3.9**

LFRD

PROPOSED WINDOW HEADERS

2x8 #2 HF, DF

Span	6 ft
Snow, Live, Dead Tributary Leng	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**

Relevant Load Combinations	Shear or force on columns
1.4 (D)	117 plf
1.2 (D) + 1.6 (L) + 0.5 (S)	597 plf
1.2 (D) + 1.6 (S) + 0.8 (W)	360 plf
1.2 (D) + 1.6 (W) + L +0.5 (S)	441 plf
1.2 (D) + 1.0 (E) + L + 0.2 (S)	392 plf
0.9 (D) + 1.6 (W)	75 plf
0.9 (D) - 1.6 (W)	75 plf
0.9 (D) + 1.0 (E)	75 plf
0.9 (D) - 1.0 (E)	75 plf
Max of Live, Snow (DEFLECTIO	497 plf
Largest Load	597 plf
Mmax	2,687 ft-lbs
Mmax	2,687 ft-lbs
E	1,100,000 psi
E (LRFD Conversion, for deflection only, for stabilit	1,589,500 psi
I	111 in^4
d	7.25 in
B	3.50 in
Delta max D	**0.098569 in**
Deflection Limit D L/180	0.400000 in
Delta max L	**0.082073 in**
Deflection Limit L L/360	0.200000 in
V	1,792 lbs
S	30.66145833 in^3
Fb (includes C factors + Add tim	1,020 psi
Fb (LRFD Conversion) (no Cd)	1,762 psi
Moment Capacity	4501.470021 ft-lbs
FS Bending + reistance factor	**1.1**
allowable shear parallel to grain	150 psi
Vallowable (LRFD conversion) (r	194.4 psi
Transverse Shear	106 psi
FS shear + reistance factor	**1.1**