BE BURT ENGINEERING

18530 MERIDIAN AVE N.
SHORELINE, WA 98133

Structural Calculations

Van Winkle Shop Alteration
7011 78th Ave SE
Mercer Island, WA 98040

BE Project # 22028

February 18, 2022

2018 International Building Code

BE BURT ENGINEERING

STRUCTURAL ENGINEERING
BUILDING CODE CONSULTING

PROJECT: VAN WINKLE — PROJECT #: 22028 — DATE: 2.17.22
SUBJECT: 7011 78TH AVE SE — SHEET: — OF:
MERCER ISLAND — BY: CB

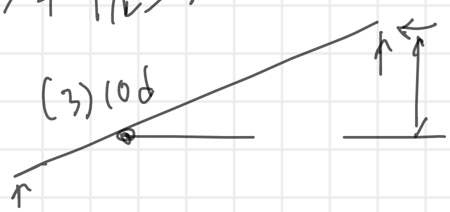
SCOPE: EXTEND ROOF OF (E) SHOP AREA TO RAISE CEILING PER ARCH.

DESIGN: ROOF 25PSF - SNOW
WIND - 110 / B / KZT=1.0
SEISMIC: 1.137 = S_{DS}

$\tan 18.6° = \frac{x}{12}$

$\therefore \frac{4}{12}$ SLOPE

DESIGN RAFTERS + TIES:



$M = \frac{2' \times 13^2}{8} \times \left(\frac{25}{15}\right) = 22.78 \times \left(\frac{25}{15}\right) = 911$ Ft.lb

$\frac{911 \text{ Ft.lb}}{2.5'} = 364$ lb.

(3) 10d NAILS COLLAR TIE TO RAFTER @ 2/3 d

RAFTER OK - 2X12 BY INSP.

TIE OK - 2X6 BY INSP.

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cb@burtengineering.com
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Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 22 MAR 2022, 1:38AM

Wood Beam

Project File: vanwinkle.ec6

DESCRIPTION: header

CODE REFERENCES

Calculations per NDS 2018, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : IBC 2018

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : IBC 2018

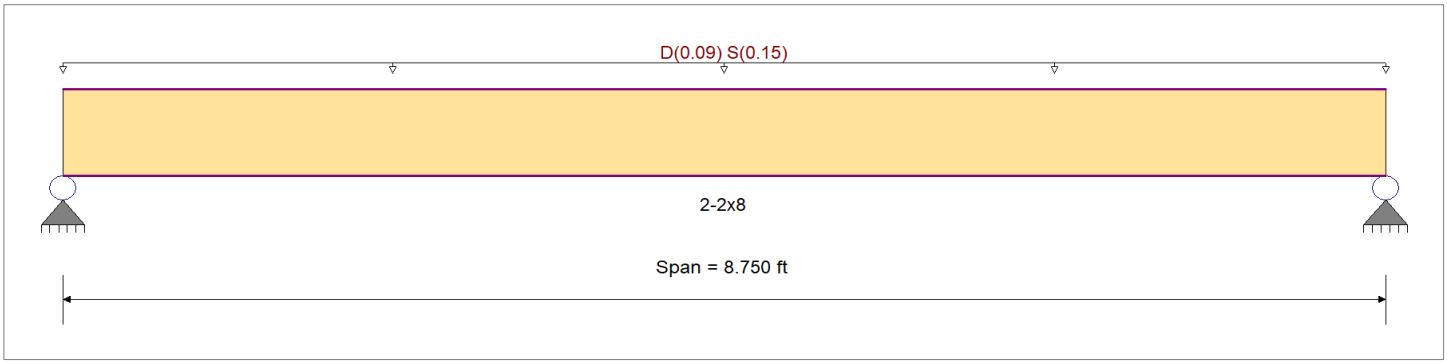
Wood Species : Douglas Fir-Larch
Wood Grade : No.2

Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	900.0 psi
Fb -	900.0 psi
Fc - Prll	1,350.0 psi
Fc - Perp	625.0 psi
Fv	180.0 psi
Ft	575.0 psi

E : Modulus of Elasticity

Ebend- xx	1,600.0 ksi
Eminbend - xx	580.0 ksi
Density	31.210 pcf



Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0150, S = 0.0250 ksf, Tributary Width = 6.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.844 : 1	Maximum Shear Stress Ratio	=	0.304 : 1
Section used for this span		2-2x8	Section used for this span		2-2x8
fb: Actual	=	1,048.75 psi	fv: Actual	=	62.90 psi
Fb: Allowable	=	1,242.00 psi	Fv: Allowable	=	207.00 psi
Load Combination		+D+S	Load Combination		+D+S
Location of maximum on span	=	4.375 ft	Location of maximum on span	=	0.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.131 in	Ratio =	804 >=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.209 in	Ratio =	502 >=180	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios									Moment Values			Shear Values		
Segment Length	Span #	M	V	C_d	$C_{F/V}$	C_i	C_r	C_m	C_t	C_L	M	fb	F'b	V	fv	F'v
D Only													0.00	0.00	0.00	0.00
Length = 8.750 ft	1	0.405	0.146	0.90	1.200	1.00	1.00	1.00	1.00	1.00	0.86	393.28	972.00	0.34	23.59	162.00
+D+S					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.750 ft	1	0.844	0.304	1.15	1.200	1.00	1.00	1.00	1.00	1.00	2.30	1,048.75	1242.00	0.91	62.90	207.00
+D+0.750S					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.750 ft	1	0.712	0.256	1.15	1.200	1.00	1.00	1.00	1.00	1.00	1.94	884.88	1242.00	0.77	53.07	207.00
+0.60D					1.200	1.00	1.00	1.00	1.00	1.00			0.00	0.00	0.00	0.00
Length = 8.750 ft	1	0.137	0.049	1.60	1.200	1.00	1.00	1.00	1.00	1.00	0.52	235.97	1728.00	0.21	14.15	288.00

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+S	1	0.2089	4.407		0.0000	0.000

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Wood Beam

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DESCRIPTION: header

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0783	in	4.407 ft	0.0000	in	0.000	ft
+D+S	1	0.2089	in	4.407 ft	0.0000	in	0.000	ft
+D+0.750S	1	0.1762	in	4.407 ft	0.0000	in	0.000	ft
+0.60D	1	0.0470	in	4.407 ft	0.0000	in	0.000	ft
S Only	1	0.1305	in	4.407 ft	0.0000	in	0.000	ft

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	1.050	1.050
Overall MINimum	0.656	0.656
D Only	0.394	0.394
+D+S	1.050	1.050
+D+0.750S	0.886	0.886
+0.60D	0.236	0.236
S Only	0.656	0.656

PROJECT VAN WINKLE PROJECT # 22028 DATE 2.17.22
SUBJECT 7011 78TH AVE SE SHEET ____ OF ____
MERCER ISLAND BY CB

CHECK SHEARWALLS @ OUTER END -

2'-4" WIDE

7'-10" TALL DOOR $\frac{2.33}{7.833} = 3.36$

$\frac{7.83}{2.33} = 3.36$

3.36 < 3.5 ok

ASPECT RATIO:

$1.25 - 0.125\left(\frac{h}{b}\right) = 1.25 - 0.125(3.36)$

≈ 0.83

SEISMIC: $V = C_{SW} \times I_P = 1.0$

$W = 21' \times 14' \times 20PSF = 5880$

$V = 1.137 \times \frac{5880}{6.5(1.4)} = 734\ lb$ TOTAL

1/2 TO OUTER WALL W6 BY INSP.

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WMD: 16 psf × $\frac{10' + 2'}{2}$ = 112 plf

112 × $\frac{21'}{2}$ = 1260

WMD CONTROLS : $\frac{1260}{2}$ ÷ 640 lb ÷ 4.66' = 138 plf

$\frac{138}{0.83}$ = 166 ← w6, NO HOLDDOWN.

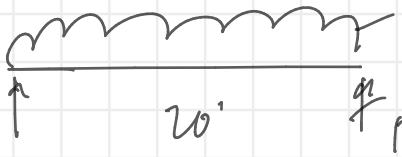
ANCHORS INTO (E) FOUNDATION

PROJECT _____ PROJECT #_____ DATE_____
SUBJECT _____ SHEET_____ OF_____
_____ BY_____

DESIGN BEAM @ CUT-OFF

CHECK REDUCED GLB: 5 1/2 x 18 24F-V4

DEMO A PORTION OF BEAM:



FOOTING: $\frac{4000}{1500} = 2.67$

→ F2.0 O.K. 2'-0" x 2'-0" x 10" w/ (3) #4 E.W

7011 78th Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.57228449999999, -122.2342177

Date	2/17/2022, 10:58:56 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S_S	1.422	MCE_R ground motion. (for 0.2 second period)
S_1	0.494	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.706	Site-modified spectral acceleration value
S_{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S_{DS}	1.137	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

Type	Value	Description
SDC	null -See Section 11.4.8	Seismic design category
F_a	1.2	Site amplification factor at 0.2 second
F_v	null -See Section 11.4.8	Site amplification factor at 1.0 second
PGA	0.609	MCE_G peak ground acceleration
F_{PGA}	1.2	Site amplification factor at PGA
PGA_M	0.73	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.422	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.576	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	3.633	Factored deterministic acceleration value. (0.2 second)
S1RT	0.494	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.551	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.45	Factored deterministic acceleration value. (1.0 second)
PGAd	1.237	Factored deterministic acceleration value. (Peak Ground Acceleration)
C_{RS}	0.902	Mapped value of the risk coefficient at short periods
C_{R1}	0.897	Mapped value of the risk coefficient at a period of 1 s