

2273 74TH AVE SE,
MERCER ISLAND, WA 98040

STRUCTURAL CALCULATIONS
FOR
EXISTING RESIDENCE
INTERIOR REMODEL



Date Signed: 01-19-2024

2018 International Residential Code
2018 International Building Code

PROJECT NAME

ADDRESS

PROJECT #

DATE

2273 74TH AVE SE MERCER ISLAND

1/11/2024

BUILDING CODE

2018 International Residential Code

2018 International Building Code

WIND DESIGN

Vult = 110 MPH

Vasd = 85 MPH

Exposure = B

Kzt = 1.00

Importance Factor = 1.0

SEISMIC DESIGN

Ss(g) = 1.391 Sms(g) = 1.669 Sps(g) = 1.112

Si(g) = 0.484

Seismic Design Category = D

Site Class = D

Importance Factor = 1.0

DESIGN LOADING

Roof Snow Load = 25 PSF

Floor Live Load = 40 PSF

Bedroom Live Load = 30 PSF

Deck & Balcony Live Load = 60 PSF

Roof Dead Load = 15 PSF

Floor Dead Load = 15 PSF (For framing gravity design)

Exterior Wall Dead Load = 10 PSF

Partition Wall Seismic Weight = 10 PSF

Floor Seismic Weight = 10 PSF

Allowable Soil Pressure = 1500 PSF

Lateral Earth (Restrained) Pressure = 50 PCF

Passive Pressure = 300 PCF

Coefficient of Friction = 0.4

SCOPE OF WORK

Existing residence interior remodel design

USGS web services were down for some period of time and as a result this tool wasn't operational, resulting in *timeout* error.
 USGS web services are now operational so this tool should work as expected.



OSHDPD

2273 74th Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5893416, -122.2408187



Date	1/15/2024, 4:08:27 PM
Design Code Reference Document	ASCE7-16
Risk Category	II
Site Class	D - Default (See Section 11.4.3)

Type	Value	Description
S _s	1.391	MCE _R ground motion. (for 0.2 second period)
S ₁	0.484	MCE _R ground motion. (for 1.0s period)
S _{MS}	1.669	Site-modified spectral acceleration value
S _{M1}	null -See Section 11.4.8	Site-modified spectral acceleration value
S _{DS}	1.112	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	0.595	MCE _G peak ground acceleration
F _{PGA}	1.2	Site amplification factor at PGA
PGA _M	0.714	Site modified peak ground acceleration
T _L	6	Long-period transition period in seconds
S _{sRT}	1.391	Probabilistic risk-targeted ground motion. (0.2 second)
S _{sUH}	1.541	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
S _{sD}	3.156	Factored deterministic acceleration value. (0.2 second)
S _{1RT}	0.484	Probabilistic risk-targeted ground motion. (1.0 second)
S _{1UH}	0.54	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S _{1D}	1.295	Factored deterministic acceleration value. (1.0 second)

Type	Value	Description
PGAd	1.093	Factored deterministic acceleration value. (Peak Ground Acceleration)
PGA _{UH}	0.595	Uniform-hazard (2% probability of exceedance in 50 years) Peak Ground Acceleration
C _{RS}	0.903	Mapped value of the risk coefficient at short periods
C _{R1}	0.896	Mapped value of the risk coefficient at a period of 1 s
C _V	1.378	Vertical coefficient

EXISTING BUILDING LATERAL DESIGN CHECK.

→ COMPARE E-W SW LENGTH REDUCED W/ NEW WALL LAYOUT, CHECK EXISTING SW LENGTH.

$$\text{ROOF WT} = 2331 \quad (15 \text{ PSP} + 10 \text{ PSP}/2) = 46.6 \text{ k}$$

→ BUILDING IS SINGLE STORY, SEISMIC DESIGN CONTROLS
CHECK E-W SW LENGTH

DESCRIPTION: Seismic Base Shear Analysis

Specific Description: HAUNG RESIDENCE

Risk Category

Calculations per ASCE 7-16

Risk Category of Building or Other Structure : "II" : All Buildings and other structures except those listed as Category I, III, and IV *SCE 7-16, Page 4, Table 1.5-1*

Seismic Importance Factor = 1 *ASCE 7-16, Page 5, Table 1.5-2*

USER DEFINED Ground Motion

ASCE 7-16 11.4.2

Max. Ground Motions, 5% Damping

$S_S = 1.391$ g, 0.2 sec response

$S_1 = 0.4840$ g, 1.0 sec response

For the closest datapoint grid location . . .

Latitude = 0.000 deg North

Longitude = 0.000 deg West

Conforms to ASCE 7 Section 12.8.1.3: Regular structure with period of 0.5 s or less, SDS limited to max of $0.7 \cdot SDS$ or 1.0 for calculator

Site Class, Site Coeff. and Design Category

Classification: "D" : Shear Wave Velocity 600 to 1,200 ft/sec = **D** (By Default per 11.4.3) *ASCE 7-16 Table 20.3-1*

Site Coefficients F_a & F_v $F_a = 1.20$ *ASCE 7-16 Table 11.4-1 & 11.4-2*
(using straight-line interpolation from table values) $F_v = 1.82$

Maximum Considered Earthquake Acceleration $S_{MS} = F_a \cdot S_s = 1.669$ *ASCE 7-16 Eq. 11.4-1*
 $S_{M1} = F_v \cdot S_1 = 0.879$ *ASCE 7-16 Eq. 11.4-2*

Design Spectral Acceleration $S_{DS} = S_{MS}^{2/3} = 1.113$ *ASCE 7-16 Eq. 11.4-3*
 $S_{D1} = S_{M1}^{2/3} = 0.588$ *ASCE 7-16 Eq. 11.4-4*

Seismic Design Category = **D** *ASCE 7-16 Table 11.6-1 & -2*

Resisting System

ASCE 7-16 Table 12.2-1

Basic Seismic Force Resisting System . . .

Bearing Wall Systems

15. Light-frame (wood) walls sheathed w/wood structural panels rated for shear resistance.

Response Modification Coefficient "R" = 6.50 Building height Limits :
System Overstrength Factor "Wo" = 3.00 Category "A & B" Limit: No Limit
Deflection Amplification Factor "Cd" = 4.00 Category "C" Limit: No Limit
Category "D" Limit: Limit = 65
Category "E" Limit: Limit = 65
Category "F" Limit: Limit = 65

NOTE! See ASCE 7-16 for all applicable footnotes

Lateral Force Procedure

ASCE 7-16 Section 12.8.2

Equivalent Lateral Force Procedure

The "Equivalent Lateral Force Procedure" is being used according to the provisions of ASCE 7-16 12.8

Determine Building Period

Use ASCE 12.8-7

Structure Type for Building Period Calculation: All Other Structural Systems

"Ct" value = 0.020 "hn" : Height from base to highest level = 10.0 ft

"x" value = 0.75

"Ta" Approximate fundamental period using Eq. 12.8-7 : $T_a = C_t \cdot (h_n)^x = 0.112$ sec

"TL" : Long-period transition period per ASCE 7-16 Maps 22-14 -> 22-17 = 6.000 sec

Building Period "Ta" Calculated from Approximate Method $T_a = 0.112$

DESCRIPTION: Seismic Base Shear Analysis

"Cs" Response Coefficient		<i>ASCE 7-16 Section 12.8.1.1</i>	
S_{DS} : Short Period Design Spectral Response	= 1.113	From Eq. 12.8-2, Preliminary C_s	= 0.154
"R" : Response Modification Factor	= 6.50	From Eq. 12.8-3 & 12.8-4, C_s need not exceed	= 0.802
"I" : Seismic Importance Factor	= 1	From Eq. 12.8-5 & 12.8-6, C_s not be less than	= 0.044
User has selected ASCE 12.8.1.3 : Regular structure,		C_s : Seismic Response Coefficient =	= 0.1538
Less than 5 Stories and with $T \leq 0.5$ sec, SO $S_s \leq 1.5$ for C_s calcul			

Seismic Base Shear		<i>ASCE 7-16 Section 12.8.1</i>	
C_s =	0.1538 from 12.8.1.1	W (see Sum W_i below) =	46.60 k
		Seismic Base Shear $V = C_s * W =$	7.17 k

Vertical Distribution of Seismic Forces *ASCE 7-16 Section 12.8.3*

"k" : hx exponent based on $T_a = 1.00$

Table of building Weights by Floor Level...

Level #	W_i : Weight	H_i : Height	$(W_i * H_i^k)$	C_{vx}	$F_x = C_{vx} * V$	Sum Story Shear	Sum Story Moment
1	46.60	10.00	466.00	1.0000	7.17	7.17	0.00
Sum $W_i =$		46.60 k	Sum $W_i * H_i =$	466.00 k-ft	Total Base Shear =	7.17 k	Base Moment = 71.7 k-ft

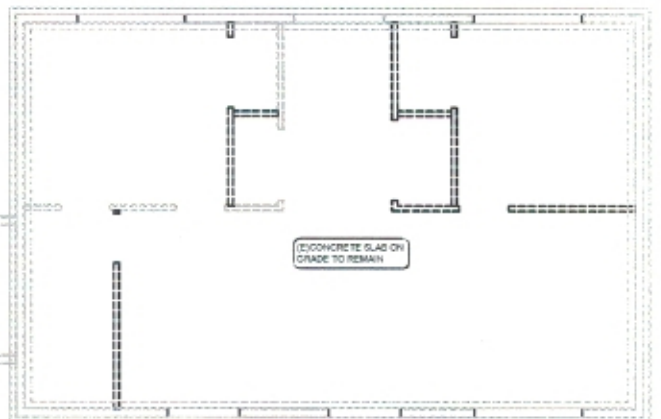
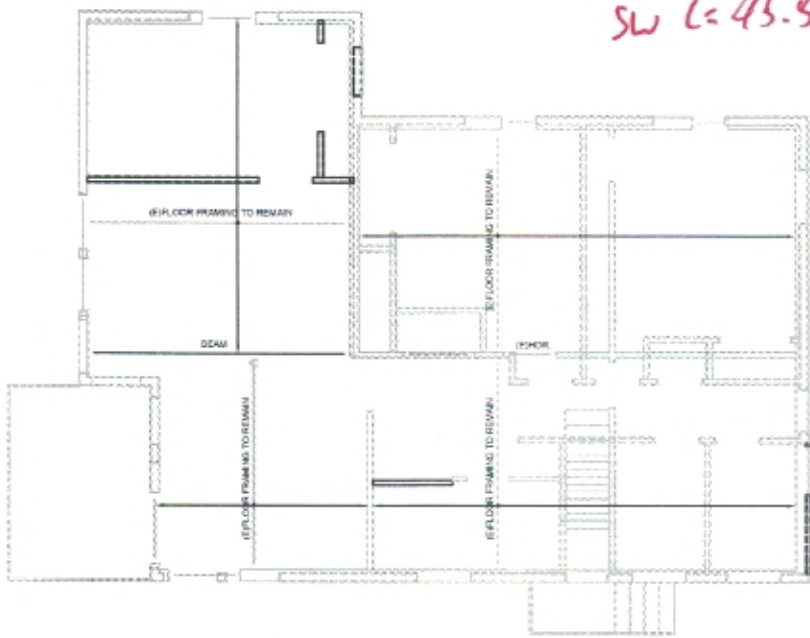
Diaphragm Forces : Seismic Design Category "B" to "F" *ASCE 7-16 12.10.1.1*

Level #	W_i	F_i	Sum F_i	Sum W_i	F_{px} : Calcd	F_{px} : Min	F_{px} : Max	F_{px}	Dsgn. Force
1	46.60	7.17	7.17	46.60	7.17	10.37	20.74	10.37	10.37

- W_{px} Weight at level of diaphragm and other structure elements attached to it.
- F_i Design Lateral Force applied at the level.
- Sum F_i Sum of "Lat. Force" of current level plus all levels above
- MIN Req'd Force @ Level ... $0.20 * S_{DS} * I * W_{px}$
- MAX Req'd Force @ Level .. $0.40 * S_{DS} * I * W_{px}$
- F_{px} : Design Force @ Level . $W_{px} * \text{SUM}(x \rightarrow n) F_i / \text{SUM}(x \rightarrow n) w_i$, x = Current level, n = Top Level

SW L = 45.5' (SW2)

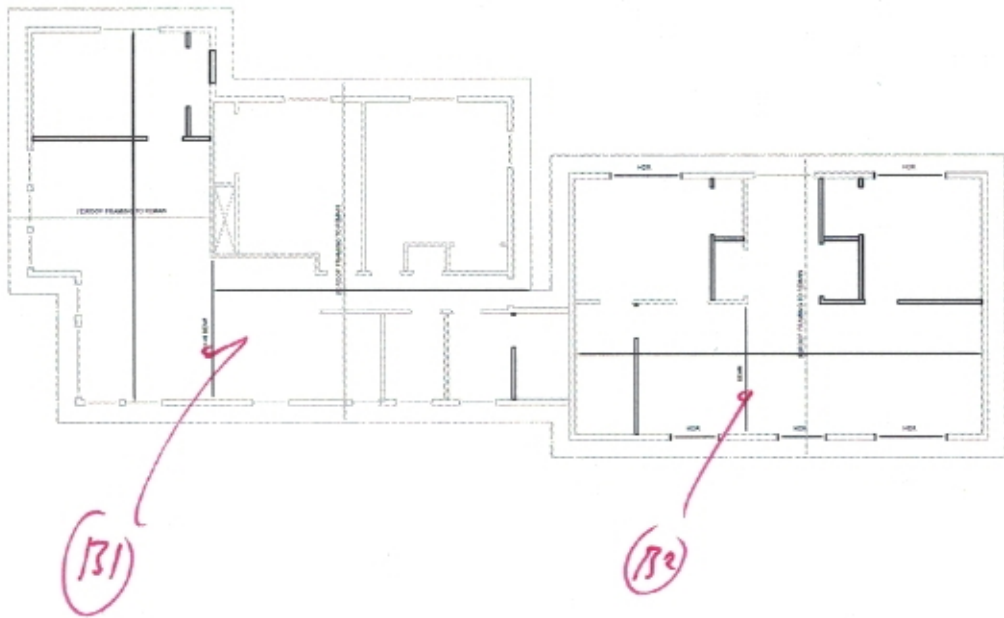
$V_s = 3.6k.$
→



→ $V_s = 3.6k.$

SW L = 40' (SW1)

ROOF FRAMING PLAN



B1, L = 12'2", TL = 5'6" ROOF.

→ 4x8.

B2, L = 11'2", TL = 9' ROOF.

→ 4x10.

ROOF LOADING: DL: 2x4 @ 24" c. 3 PSF.

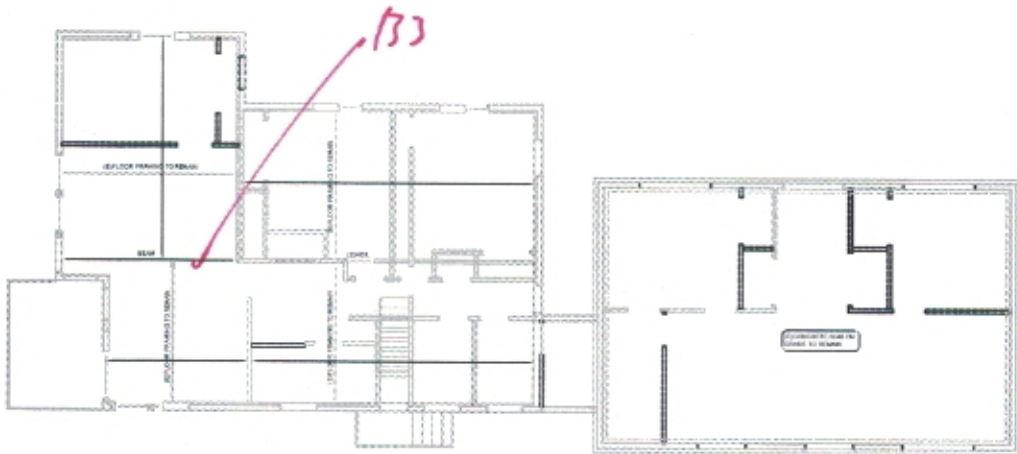
1/2" PLT WOOD. 1.5 PSF.

INSULATION 1.8 PSF.

MISC. 2 PSF.

8 PSF.

LOWER FLOOR.



133, L: 14'8", W: 6'6" → 6x10.

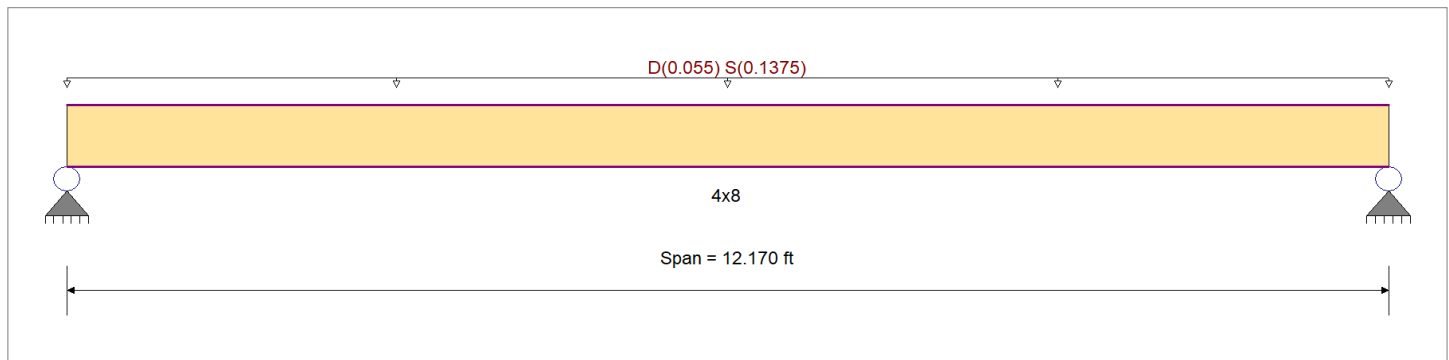
DESCRIPTION: B1

CODE REFERENCES

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

Material Properties

Analysis Method : Load Resistance Factor D	Fb +	1300 psi	<i>E : Modulus of Elasticity</i>	
Load Combination ASCE 7-16	Fb -	1300 psi	Ebend- xx	1600ksi
	Fc - Prll	925 psi	Eminbend - xx	580ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625 psi		
Wood Grade : No.1	Fv	170 psi		
	Ft	675 psi	Density	30.59pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
 Uniform Load : D = 0.010, S = 0.0250 ksf, Tributary Width = 5.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.726 < 1	Maximum Shear Stress Ratio	=	0.324 < 1
Section used for this span		4x8	Section used for this span		4x8
fb: Actual	=	2,119.14psi	fv: Actual	=	95.22 psi
F'b	=	2,920.32psi	F'v	=	293.76 psi
Load Combination	=	+1.20D+1.60S	Load Combination	=	+1.20D+1.60S
Location of maximum on span	=	6.085ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection	0.384 in	Ratio =	380 >= 360	Span: 1 : S Only	
Max Upward Transient Deflection	0 in	Ratio =	0 < 360	n/a	
Max Downward Total Deflection	0.552 in	Ratio =	264 >= 240	Span: 1 : +D+S	
Max Upward Total Deflection	0 in	Ratio =	0 < 240	n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	λ	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	Mu	fb	Fb	Vu	fv	Fv	
+1.40D	Length = 12.170 ft	1	0.280	0.125	0.60	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.57	612.6	2,190.2	0.0	0.00	0.0	0.0
+1.20D	Length = 12.170 ft	1	0.180	0.080	0.80	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.34	525.1	2,920.3	0.0	0.00	0.0	0.0
+1.20D+0.50S	Length = 12.170 ft	1	0.350	0.157	0.80	1.00	1.00	1.00	1.300	1.00	1.00	1.00	2.61	1,023.2	2,920.3	0.0	0.00	0.0	0.0
+1.20D+1.60S	Length = 12.170 ft	1	0.726	0.324	0.80	1.00	1.00	1.00	1.300	1.00	1.00	1.00	5.41	2,119.1	2,920.3	0.0	0.00	0.0	0.0
+0.90D	Length = 12.170 ft	1	0.108	0.048	1.00	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.01	393.8	3,650.4	0.0	0.00	0.0	0.0

DESCRIPTION: B1

Maximum Forces & Stresses for Load Combinations

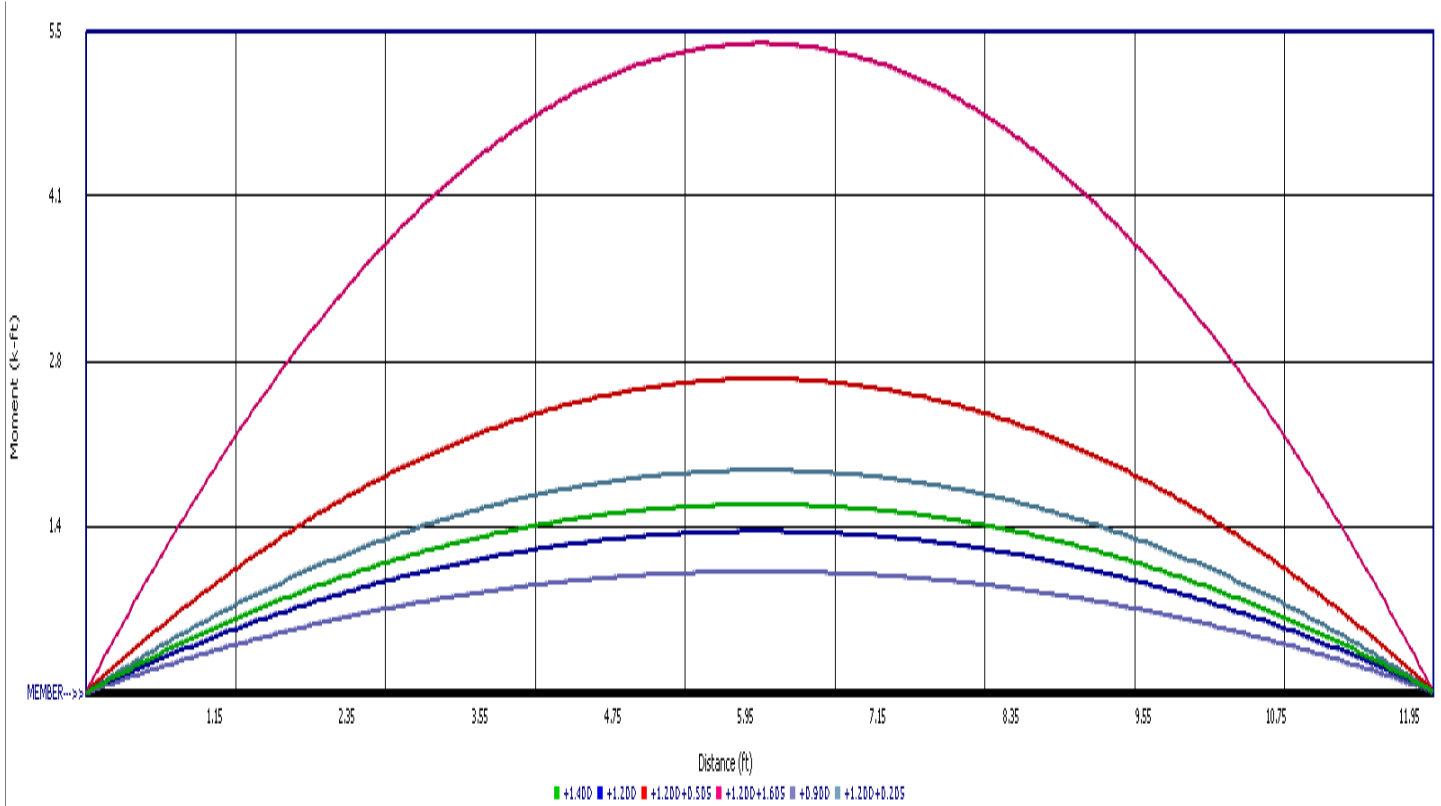
Load Combination	Max Stress Ratios											Moment Values			Shear Values			
	Segment Length	Span #	M	V	λ	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Mu	fb	Fb	Vu	fv	Fv
+1.20D+0.20S						1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 12.170 ft	1		0.198	0.089	1.00	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.85	724.3	3,650.4	0.55	32.5	367.2

Vertical Reactions

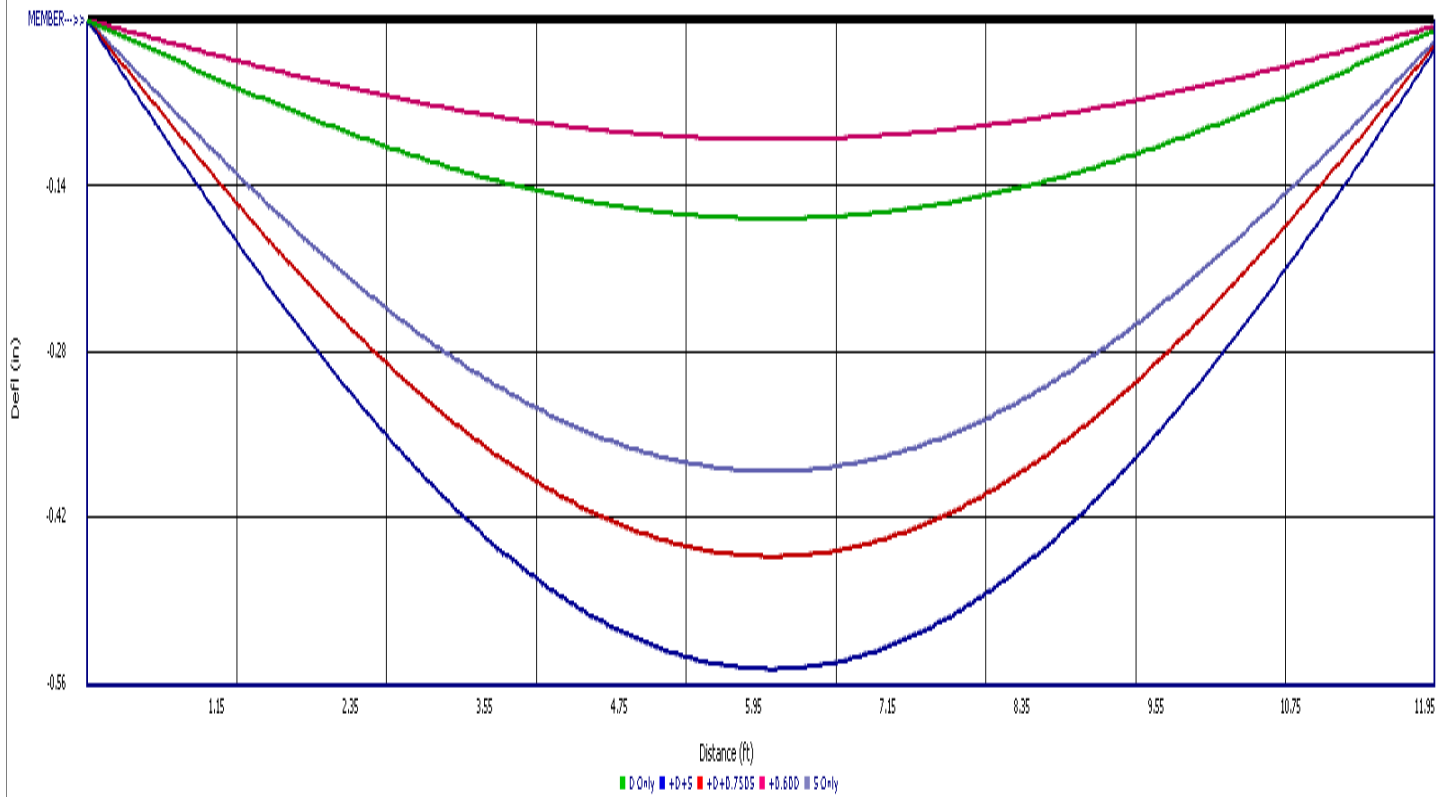
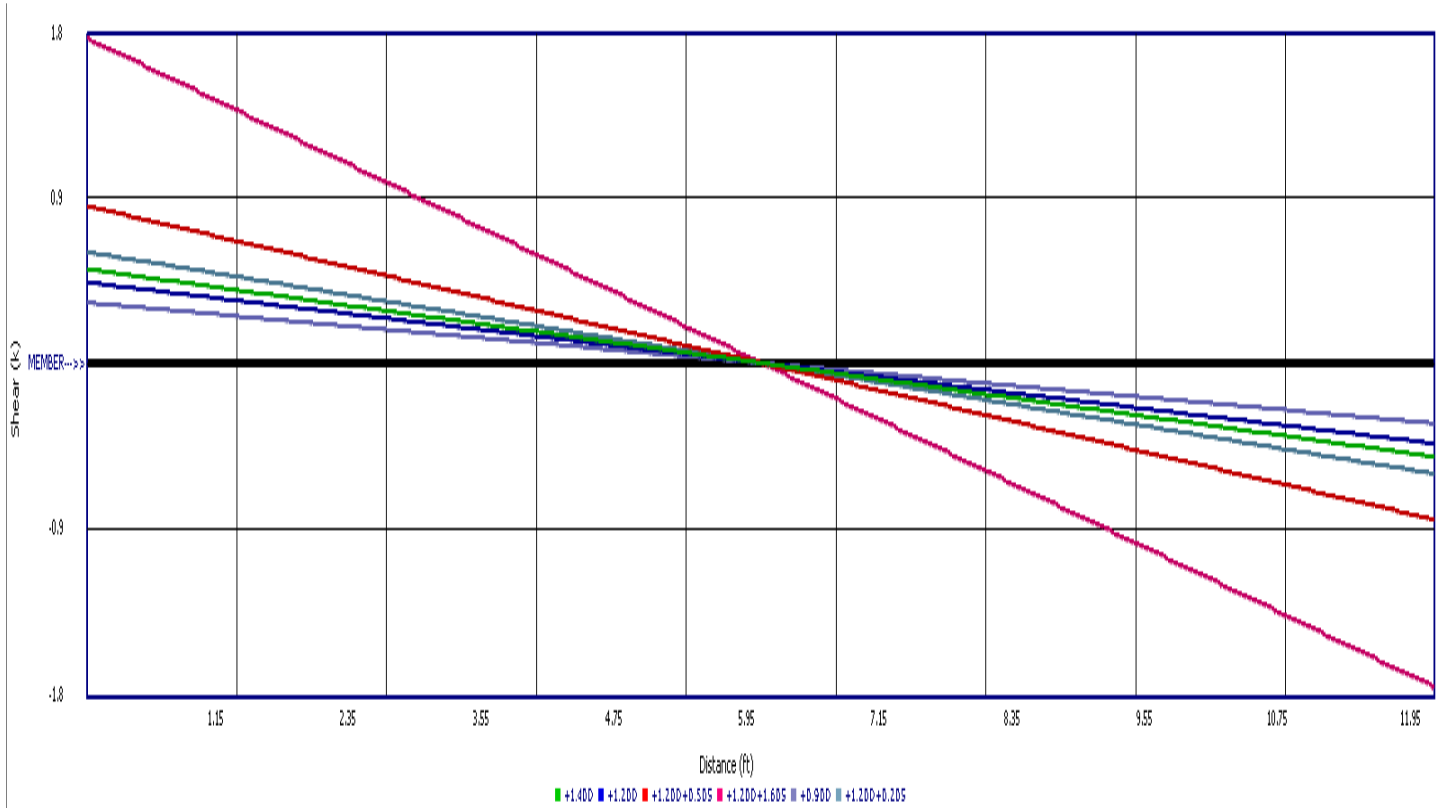
Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.204	1.204
Max Upward from Load Combinations	1.204	1.204
Max Upward from Load Cases	0.837	0.837
D Only	0.367	0.367
+D+S	1.204	1.204
+D+0.750S	0.995	0.995
+0.60D	0.220	0.220
S Only	0.837	0.837



DESCRIPTION: B1



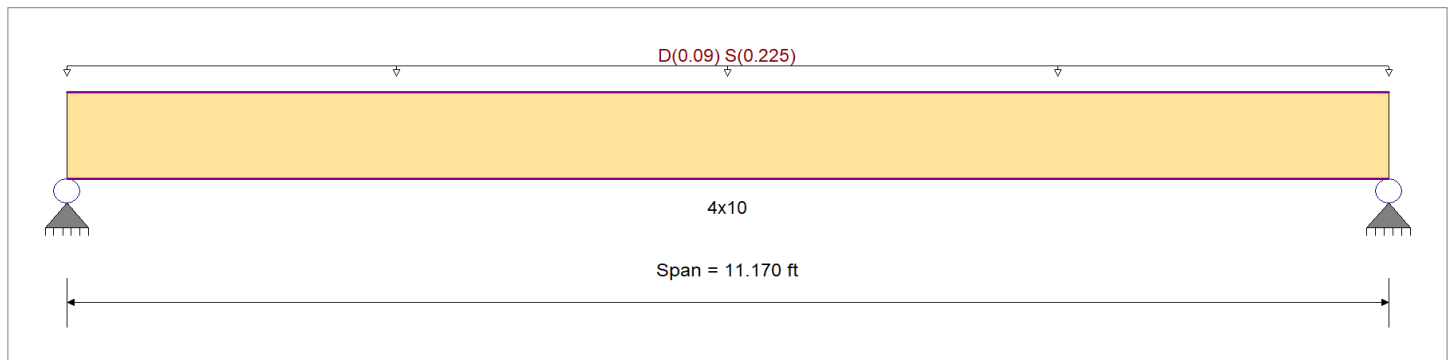
DESCRIPTION: B2

CODE REFERENCES

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

Material Properties

Analysis Method : Load Resistance Factor D	Fb +	1300 psi	<i>E : Modulus of Elasticity</i>	
Load Combination ASCE 7-16	Fb -	1300 psi	Ebend- xx	1600ksi
	Fc - Prll	925 psi	Eminbend - xx	580ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625 psi		
Wood Grade : No.1	Fv	170 psi		
	Ft	675 psi	Density	30.59pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
 Uniform Load : D = 0.010, S = 0.0250 ksf, Tributary Width = 9.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.662 1	Maximum Shear Stress Ratio	=	0.364 : 1
Section used for this span		4x10	Section used for this span		4x10
fb: Actual	=	1,785.81 psi	fv: Actual	=	107.05 psi
F'b	=	2,695.68 psi	F'v	=	293.76 psi
Load Combination	=	+1.20D+1.60S	Load Combination	=	+1.20D+1.60S
Location of maximum on span	=	5.585ft	Location of maximum on span	=	10.436 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection	0.215 in	Ratio =	624	>=360	Span: 1 : S Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.307 in	Ratio =	436	>=240	Span: 1 : +D+S
Max Upward Total Deflection	0 in	Ratio =	0	<240	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values				
			M	V	λ	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	Mu	fb	Fb	Vu	fv	Fv		
+1.40D	Length = 11.170 ft	1	0.252	0.138	0.60	1.00	1.00	1.00	1.200	1.00	1.00	1.00	2.12	508.6	2,021.8	0.00	0.00	0.0	0.0	220.3
+1.20D	Length = 11.170 ft	1	0.162	0.089	0.80	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.81	435.9	2,695.7	0.00	0.00	0.0	0.0	293.8
+1.20D+0.50S	Length = 11.170 ft	1	0.318	0.175	0.80	1.00	1.00	1.00	1.200	1.00	1.00	1.00	3.57	857.8	2,695.7	0.00	0.00	0.0	0.0	293.8
+1.20D+1.60S	Length = 11.170 ft	1	0.662	0.364	0.80	1.00	1.00	1.00	1.200	1.00	1.00	1.00	7.43	1,785.8	2,695.7	0.00	0.00	0.0	0.0	293.8
+0.90D	Length = 11.170 ft	1	0.097	0.053	1.00	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.36	326.9	3,369.6	0.00	0.00	0.0	0.0	0.0
	Length = 11.170 ft	1	0.097	0.053	1.00	1.00	1.00	1.00	1.200	1.00	1.00	1.00	1.36	326.9	3,369.6	0.42	19.6	367.2		

DESCRIPTION: B2

Maximum Forces & Stresses for Load Combinations

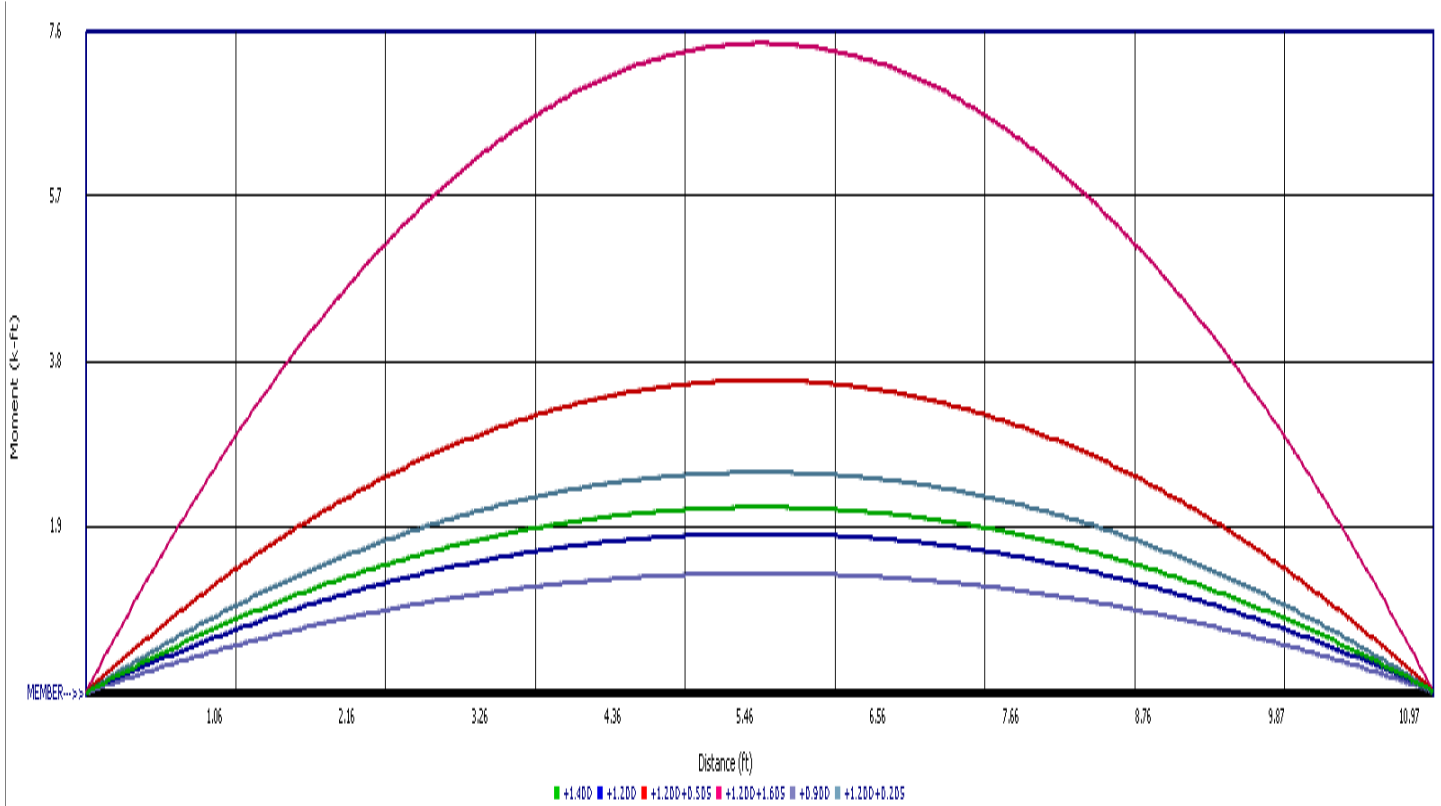
Load Combination	Max Stress Ratios											Moment Values			Shear Values			
	Segment Length	Span #	M	V	λ	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	Mu	fb	Fb	Vu	fv	Fv
+1.20D+0.20S						1.00	1.00	1.00	1.200	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 11.170 ft	1		0.179	0.099	1.00	1.00	1.00	1.00	1.200	1.00	1.00	1.00	2.51	604.7	3,369.6	0.78	36.2	367.2

Vertical Reactions

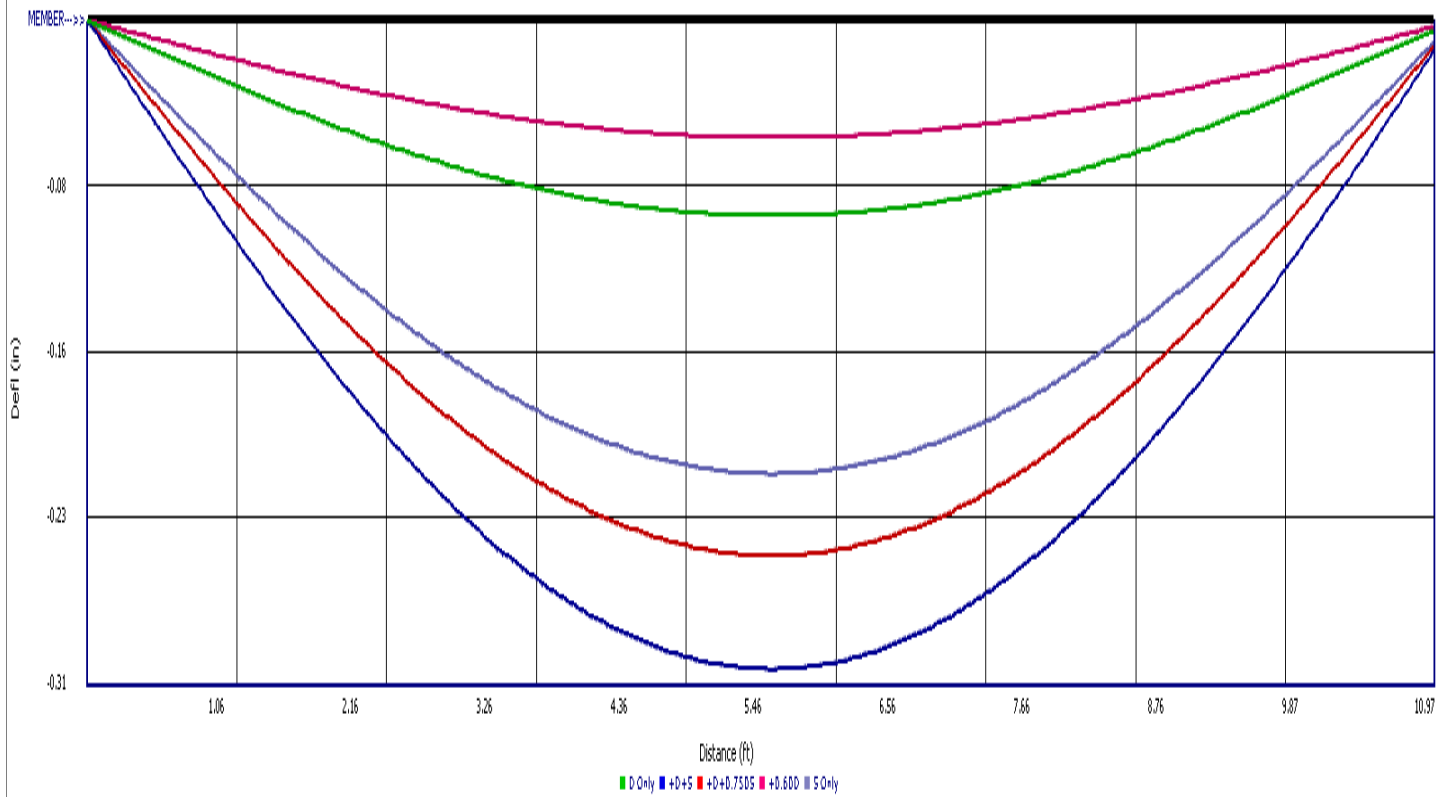
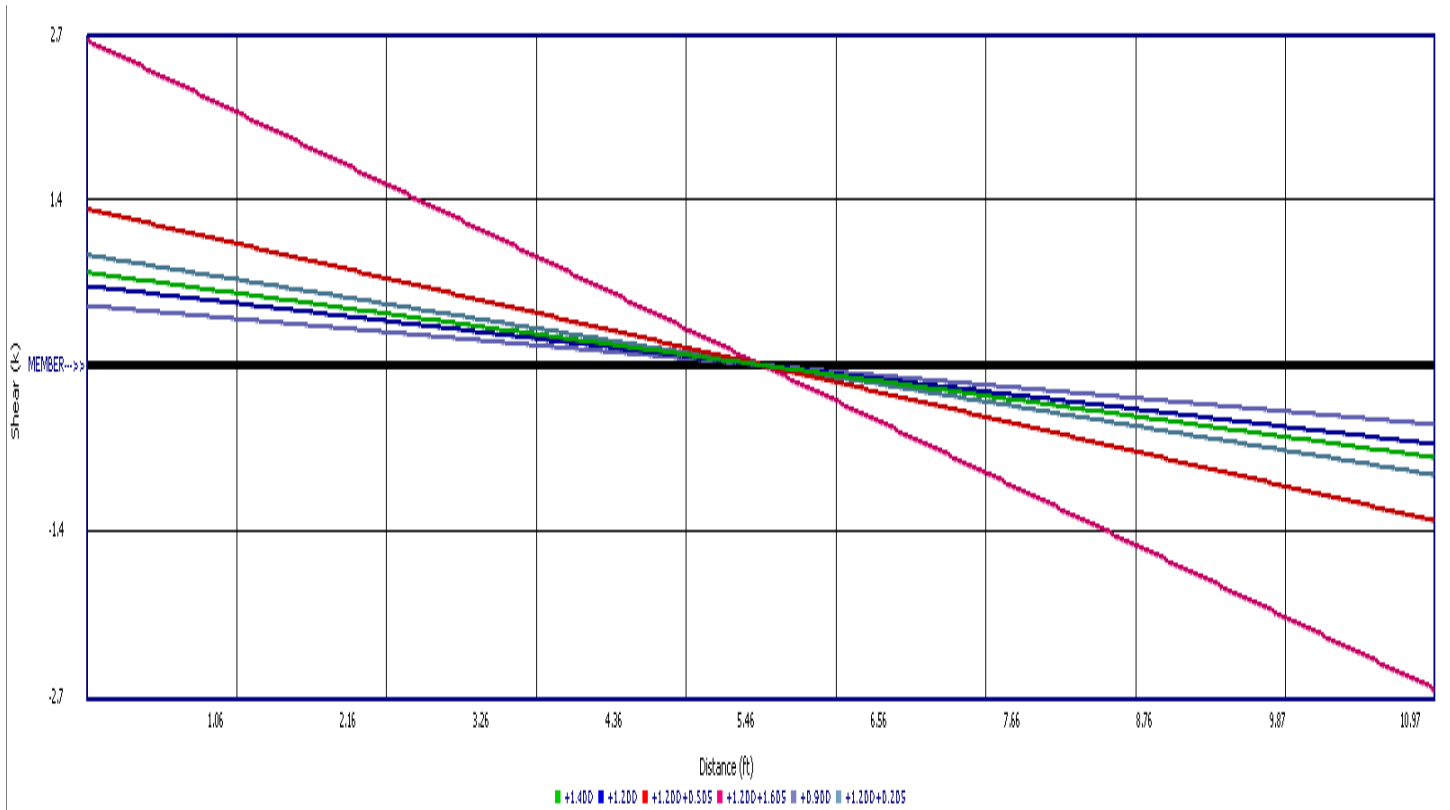
Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.798	1.798
Max Upward from Load Combinations	1.798	1.798
Max Upward from Load Cases	1.257	1.257
D Only	0.541	0.541
+D+S	1.798	1.798
+D+0.750S	1.484	1.484
+0.60D	0.325	0.325
S Only	1.257	1.257



DESCRIPTION: B2



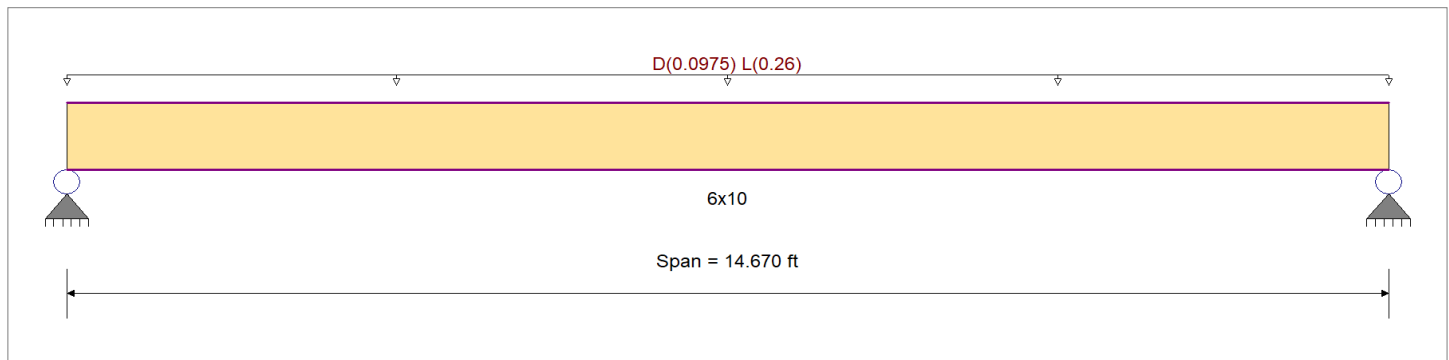
DESCRIPTION: B3

CODE REFERENCES

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

Material Properties

Analysis Method : Load Resistance Factor D	Fb +	1300 psi	<i>E : Modulus of Elasticity</i>	
Load Combination ASCE 7-16	Fb -	1300 psi	Ebend- xx	1600ksi
	Fc - Prll	925 psi	Eminbend - xx	580ksi
Wood Species : Douglas Fir-Larch (North)	Fc - Perp	625 psi		
Wood Grade : No.1	Fv	170 psi		
	Ft	675 psi	Density	30.59pcf
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling				



Applied Loads

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

Beam self weight calculated and added to loading
 Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 6.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.949 : 1	Maximum Shear Stress Ratio	=	0.352 : 1
Section used for this span		6x10	Section used for this span		6x10
fb: Actual	=	2,131.77 psi	fv: Actual	=	103.28 psi
F'b	=	2,246.40 psi	F'v	=	293.76 psi
Load Combination	=	+1.20D+1.60L	Load Combination	=	+1.20D+1.60L
Location of maximum on span	=	7.335ft	Location of maximum on span	=	0.000ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1
Maximum Deflection					
Max Downward Transient Deflection	0.433 in	Ratio =	406 >=360	Span: 1 : L Only	
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a	
Max Downward Total Deflection	0.614 in	Ratio =	286 >=240	Span: 1 : +D+L	
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a	

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios										Moment Values			Shear Values			
			M	V	λ	CM	C _t	CLx	C _F	C _{fu}	C _i	C _r	Mu	fb	Fb	Vu	fv	Fv	
+1.40D	Length = 14.670 ft	1	0.352	0.130	0.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.09	593.3	1,684.8	0.0	0.00	0.0	0.0
+1.20D+1.60L	Length = 14.670 ft	1	0.949	0.352	0.80	1.00	1.00	1.00	1.000	1.00	1.00	1.00	14.70	2,131.8	2,246.4	3.60	103.3	293.8	0.0
+1.20D+L	Length = 14.670 ft	1	0.678	0.251	0.80	1.00	1.00	1.00	1.000	1.00	1.00	1.00	10.50	1,523.0	2,246.4	2.57	73.8	293.8	0.0
+1.20D	Length = 14.670 ft	1	0.226	0.084	0.80	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.51	508.5	2,246.4	0.86	24.6	293.8	0.0
+0.90D	Length = 14.670 ft	1	0.136	0.050	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	2.63	381.4	2,808.0	0.64	18.5	367.2	0.0

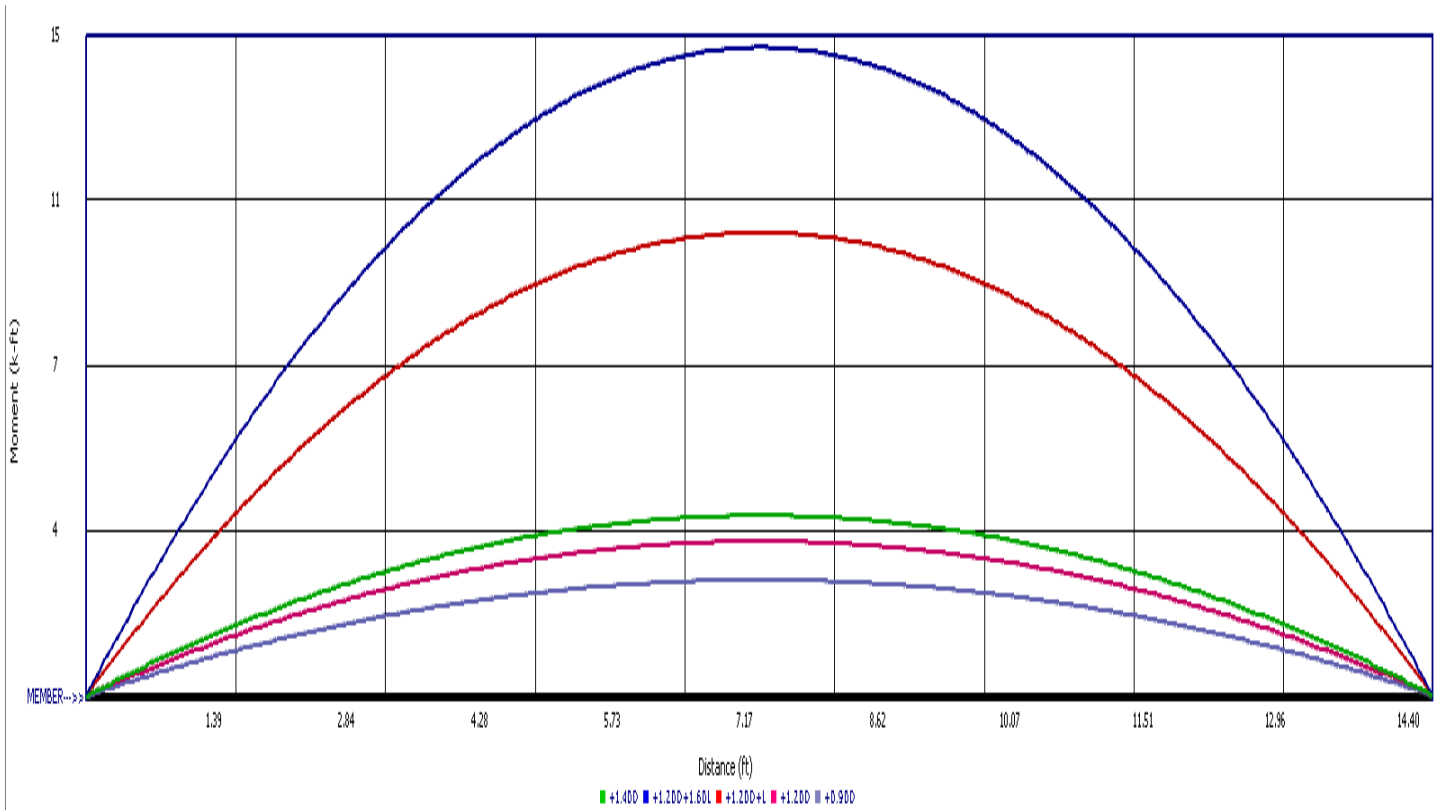
DESCRIPTION: B3

Vertical Reactions

Support notation : Far left is #1

Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.704	2.704
Max Upward from Load Combinations	2.704	2.704
Max Upward from Load Cases	1.907	1.907
D Only	0.797	0.797
+D+L	2.704	2.704
+D+0.750L	2.227	2.227
+0.60D	0.478	0.478
L Only	1.907	1.907



DESCRIPTION: B3

