WILSON & HAJ CONSULTANT ENGINEERS, LLC
909 S. 336TH. ST. #104
FEDERAL WAY, WA
206 979 3819

JOB TITLE	THE WRIGHT/HIGASHIJIMA 4701 88TH. AVE. SE, MERCER ISLAND,		
JOB NO.		**SHEET NO.**	
CALCULATED BY	HAJ	**DATE**	3/9/23
CHECKED BY	HAJ	**DATE**	3/16/23

CS2018 Ver 2021.03.22

W & HAJ

Wilson & HAJ Consultant Engineers, LLC

STRUCTURAL CALCULATIONS

FOR

THE WRIGHT/HIGASHIJIMA

SON & HAJ CONSULTANT ENGINEERS, LLC
909 S. 336TH. ST. #104
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JOB TITLE	THE WRIGHT/HIGASHIJIMA		
	4701 88TH. AVE. SE, MERCER ISLAND, W		
JOB NO.		**SHEET NO.**	
CALCULATED BY	HAJ	**DATE**	3/9/23
CHECKED BY	HAJ	**DATE**	3/16/23

Code Search

Code: International Building Code 2018

Occupancy:

Occupancy Group = R Residential

Risk Category & Importance Factors:

Risk Category =	II
Wind factor =	1.00
Snow factor =	1.00
Seismic factor =	1.00

Type of Construction:

Fire Rating:

Roof =	1.0 hr
Floor =	1.0 hr

Building Geometry:

Roof angle (θ)	2.00 / 12	9.5 deg
Building length	53.0 ft	
Least width	29.0 ft	
Mean Roof Ht (h)	20.0 ft	
Parapet ht above grd	0.0 ft	
Minimum parapet ht	0.0 ft	

Live Loads:

Roof
0 to 200 sf: 20 psf
200 to 600 sf: 24 - 0.02Area, but not less than 12 psf
over 600 sf: 12 psf

Floor:

Typical Floor	40 psf
Partitions	15 psf
Balconies (1.5 times live load)	60 psf
Habitable attics & sleeping areas	30 psf
Attics without storage	10 psf
Attics with storage	20 psf

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JOB NO.		**SHEET NO.**	
CALCULATED BY	HAJ	**DATE**	3/9/23
CHECKED BY	HAJ	**DATE**	3/16/23

Wind Loads : ASCE 7- 16

Ultimate Wind Speed	110 mph
Nominal Wind Speed	85.2 mph
Risk Category	II
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure	+/-0.18
Directionality (Kd)	0.85
Kh case 1	0.902
Kh case 2	0.902
Type of roof	Gable

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4701 88TH. AVE. SE, MERCER ISLAND, WA 9
JOB NO. **SHEET NO.**
CALCULATED BY HAJ **DATE** 3/9/23
CHECKED BY HAJ **DATE** 3/16/23

Wind Loads - MWFRS h≤60' (Low-rise Buildings) except for open buildings

Kz = Kh (case 1) = 0.90
Base pressure (qh) = **23.7 psf**
GCpi = +/-0.18

Edge Strip (a) = 3.0 ft
End Zone (2a) = 6.0 ft
Zone 2 length = 14.5 ft

Wind Pressure Coefficients

	CASE A				CASE B		
		θ = 9.5 deg					
Surface	GCpf	w/-GCpi	w/+GCpi		GCpf	w/-GCpi	w/+GCpi
1	0.44	0.62	0.26		-0.45	-0.27	-0.63
2	-0.69	-0.51	-0.87		-0.69	-0.51	-0.87
3	-0.40	-0.22	-0.58		-0.37	-0.19	-0.55
4	-0.33	-0.15	-0.51		-0.45	-0.27	-0.63
5					0.40	0.58	0.22
6					-0.29	-0.11	-0.47
1E	0.67	0.85	0.49		-0.48	-0.30	-0.66
2E	-1.07	-0.89	-1.25		-1.07	-0.89	-1.25
3E	-0.58	-0.40	-0.76		-0.53	-0.35	-0.71
4E	-0.49	-0.31	-0.67		-0.48	-0.30	-0.66
5E					0.61	0.79	0.43
6E					-0.43	-0.25	-0.61

Ultimate Wind Surface Pressures (psf)

1		14.7	6.1		-6.4	-15.0
2		-12.1	-20.7		-12.1	-20.7
3		-5.3	-13.8		-4.5	-13.1
4		-3.6	-12.1		-6.4	-15.0
5					13.8	5.2
6					-2.6	-11.2
1E		20.1	11.6		-7.1	-15.7
2E		-21.1	-29.7		-21.1	-29.7
3E		-9.4	-18.0		-8.3	-16.9
4E		-7.4	-16.0		-7.1	-15.7
5E					18.8	10.2
6E					-5.9	-14.5

Parapet

Windward parapet = 0.0 psf (GCpn = +1.5)
Leeward parapet = 0.0 psf (GCpn = -1.0)

Windward roof overhangs = 16.6 psf (upward) add to windward roof pressure

Horizontal MWFRS Simple Diaphragm Pressures (psf)

Transverse direction (normal to L)

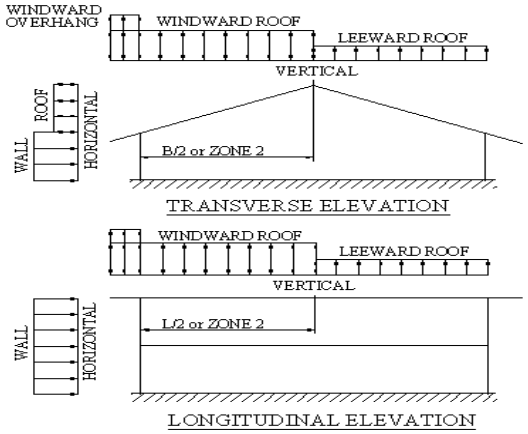
Interior Zone: Wall 18.3 psf
Roof -6.8 psf **
End Zone: Wall 27.5 psf
Roof -11.7 psf **

Longitudinal direction (parallel to L)

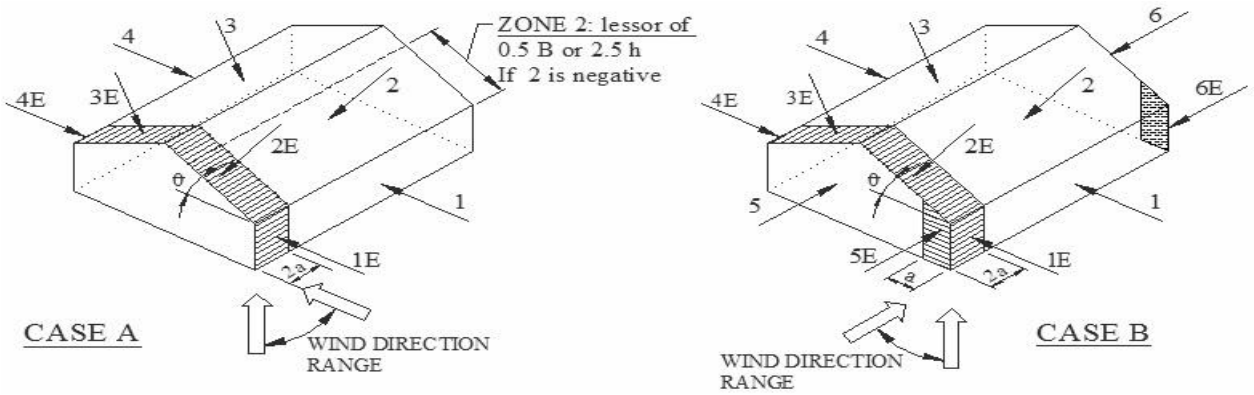
Interior Zone: Wall 16.4 psf
End Zone: Wall 24.7 psf

** NOTE: Total horiz force shall not be less than that determined by neglecting roof forces (except for MWFRS moment frames).

The code requires the MWFRS be designed for a min ultimate force of 16 psf multiplied by the wall area plus an 8 psf force applied to the vertical projection of the roof.

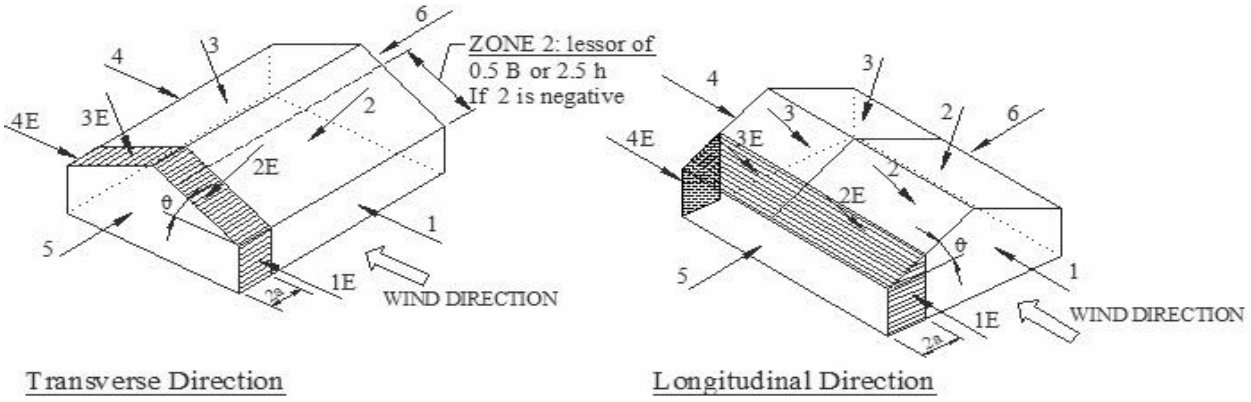


NOTE: You must also include wind on screen walls, rooftop equipment and rooftop structures with the MWFRS winds shown here.



NOTE: Torsional loads are 25% of zones 1 - 6. See code for loading diagram.
Exception: One story buildings h<30' and 1 to 2 storybuildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-98 & ASCE 7-10 (& later) - MWFRS wind pressure zones



NOTE: Torsional loads are 25% of zones 1 - 4. See code for loading diagram.
Exception: One story buildings h<30' and 1 to 2 storybuildings framed with light-frame construction or with flexible diaphragms need not be designed for the torsional load case.

ASCE 7-02 and ASCE 7-05 - MWFRS wind pressure zones

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Ultimate Wind Pressures

Wind Loads - Components & Cladding : h ≤ 60'

Kh (case 2) =	0.90	h =	20.0 ft
Base pressure (qh) =	**23.7 psf**	a =	3.0 ft
Minimum parapet ht =	0.0 ft	GCpi =	+/-0.18
Roof Angle (θ) =	9.5 deg	qi = qh =	23.7 psf
Type of roof =	Gable		

Roof

	Surface Pressure (psf)								User input	
Area	2 sf	10 sf	20 sf	50 sf	75 sf	100 sf	200 sf	250 sf	25 sf	50 sf
Negative Zone 1 & 2e	-51.8	-51.8	-51.8	-31.5	-22.5	-16.1	-16.1	-16.1	-46.8	-31.5
Negative Zone 2n, 2r &3e	-75.5	-75.5	-65.3	-51.8	-45.8	-41.5	-31.3	-28.0	-62.0	-51.8
Negative Zone 3r	-89.8	-89.8	-76.9	-59.9	-52.4	-47.0	-47.0	-47.0	-72.8	-59.9
Positive All Zones	20.9	17	16	16	16.0	16.0	16.0	16.0	16.0	16.0
Overhang Zone 1 & 2e	-59.4	-59.4	-59.4	-45.8	-39.9	-35.6	-35.6	-35.6	-56.1	-45.8
Overhang Zone 2n & 2r	-83.1	-83.1	-75.4	-65.3	-60.8	-57.6	-50.0	-47.5	-73.0	-65.3
Overhang Zone 3e	-97.4	-97.4	-84.1	-66.5	-58.7	-53.2	-39.9	-35.6	-79.8	-66.5
Overhang Zone 3r	-111.6	-111.6	-94.5	-71.8	-61.7	-54.6	-54.6	-54.6	-88.9	-71.8

Overhang pressures in the table above assume an internal pressure coefficient (Gcpi) of 0.0
Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 4.3 psf)

Parapet

qp = 0.0 psf

	Surface Pressure (psf)						User input
Solid Parapet Pressure	10 sf	20 sf	50 sf	100 sf	250 sf	500 sf	50 sf
CASE A: Zone 2e :	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zone 2n, 2r & 3e :	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Zone 3r :	0.0	0.0	0.0	0.0	0.0	0.0	0.0
CASE B : Interior zone :	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Corner zone :	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Walls

	GCp +/- GCpi				Surface Pressure at h				User input	
Area	10 sf	100 sf	200 sf	500 sf	10 sf	100 sf	200 sf	500 sf	10 sf	200 sf
Negative Zone 4	-1.17	-1.01	-0.96	-0.90	-27.8	-24.0	-22.9	-21.4	-27.8	-22.9
Negative Zone 5	-1.44	-1.12	-1.03	-0.90	-34.2	-26.6	-24.4	-21.4	-34.2	-24.4
Positive Zone 4 & 5	1.08	0.92	0.87	0.81	25.6	21.9	20.7	19.2	25.6	20.7

Note: GCp reduced by 10% due to roof angle <= 10 deg.

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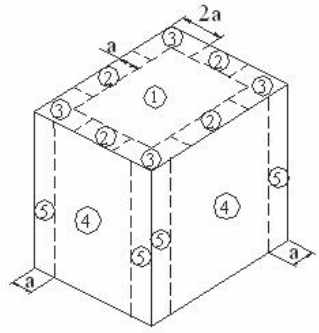
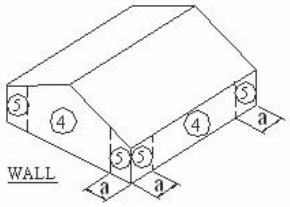
CHECKED BY	HAJ	**DATE**	3/16/23

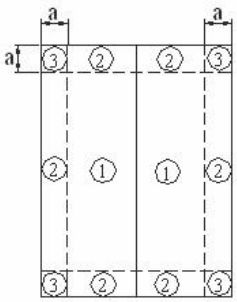
Location of C&C Wind Pressure Zones - ASCE 7-10 & earlier



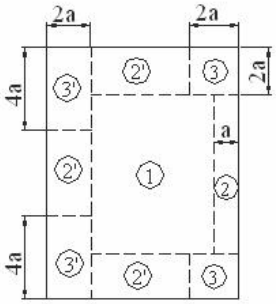
Roofs w/ θ ≤ 10°
and all walls
h > 60'



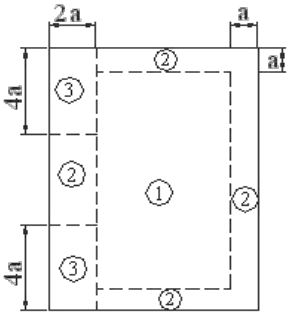
Walls h ≤ 60'
& alt design h<90'



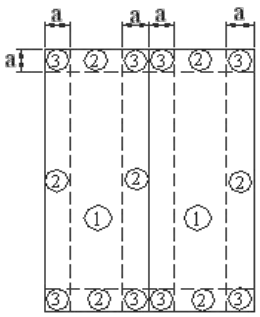
Gable, Sawtooth and
Multispan Gable θ ≤ 7 degrees &
Monoslope ≤ 3 degrees
h ≤ 60' & alt design h<90'



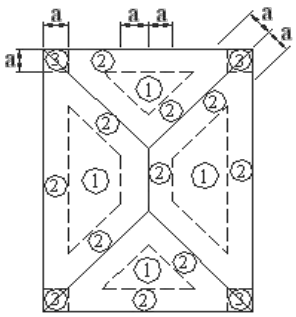
Monoslope roofs
3° < θ ≤ 10°
h ≤ 60' & alt design h<90'



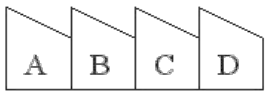
Monoslope roofs
10° < θ ≤ 30°
h ≤ 60' & alt design h<90'

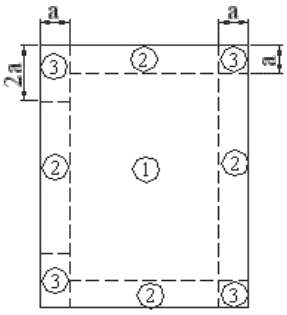


Multispan Gable &
Gable 7° < θ ≤ 45°

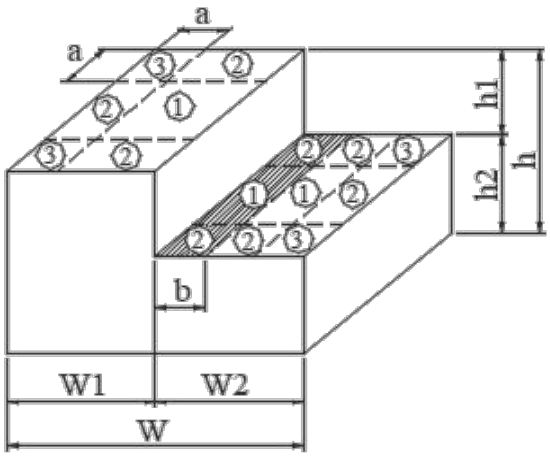


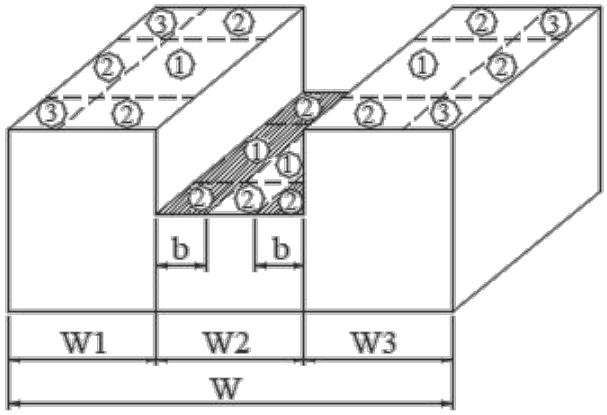
Hip 7° < θ ≤ 27°





Sawtooth 10° < θ ≤ 45°
h ≤ 60' & alt design h<90'





Stepped roofs θ ≤ 3°
h ≤ 60' & alt design h<90'

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JOB NO.		**SHEET NO.**	
CALCULATED BY	HAJ	**DATE**	3/9/23
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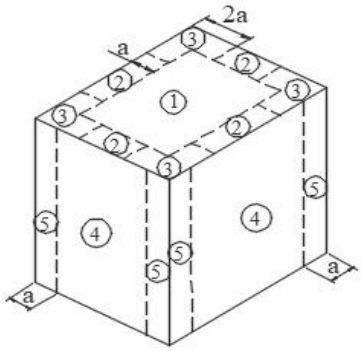
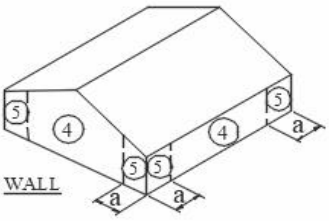
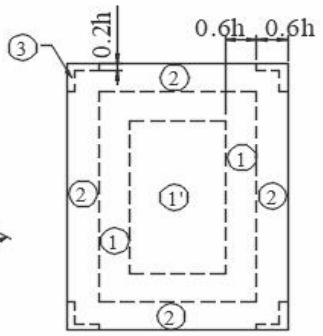
Location of C&C Wind Pressure Zones - ASCE 7-16



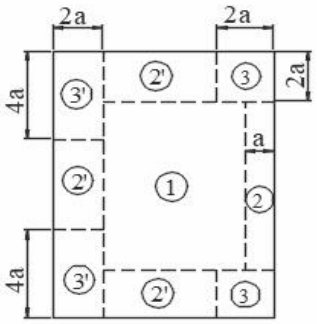
Roofs w/ θ ≤ 10°
and all walls
h > 60'



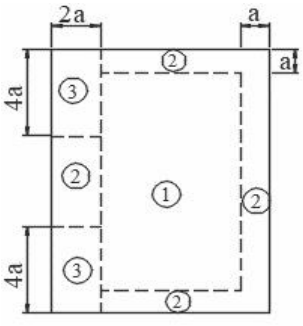
Walls h ≤ 60'
& alt design h<90'



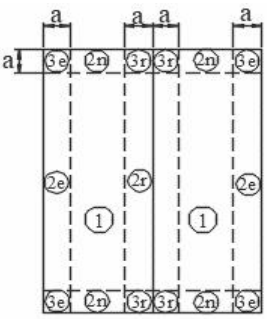
Gable, Sawtooth and
Multispan Gable θ ≤ 7 degrees &
Monoslope ≤ 3 degrees
h ≤ 60' & alt design h<90'



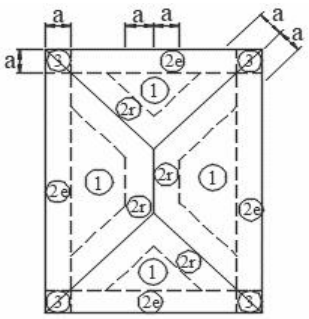
Monoslope roofs
3° < θ ≤ 10°
h ≤ 60' & alt design h<90'



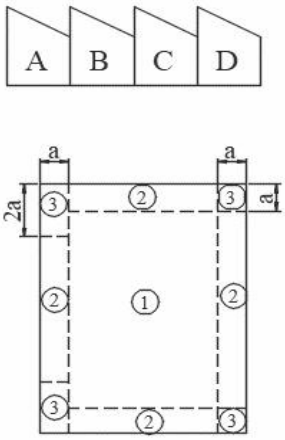
Monoslope roofs
10° < θ ≤ 30°
h ≤ 60' & alt design h<90'



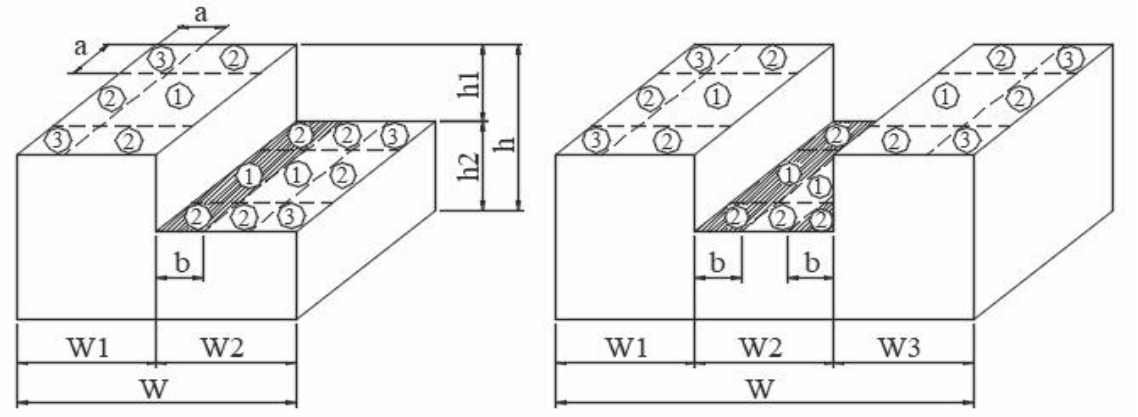
Multispan Gable &
Gable 7° < θ ≤ 45°



Hip 7° < θ ≤ 27°



Sawtooth 10° < θ ≤ 45°
h ≤ 60' & alt design h<90'



Stepped roofs θ ≤ 3°
h ≤ 60' & alt design h<90'

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Snow Loads : ASCE 7- 16

Nominal Snow Forces

Roof slope		=	9.5 deg
Horiz. eave to ridge dist (W)		=	14.5 ft
Roof length parallel to ridge (L)		=	53.0 ft
Type of Roof			Hip and gable w/ trussed systems
Ground Snow Load	Pg	=	30.1 psf
Risk Category		=	II
Importance Factor	I	=	1.0
Thermal Factor	Ct	=	1.20
Exposure Factor	Ce	=	1.2
Pf = 0.7*Ce*Ct*I*Pg		=	30.3 psf
Unobstructed Slippery Surface			no
Sloped-roof Factor	Cs	=	1.00
Balanced Snow Load		**=**	**30.3 psf**
Rain on Snow Surcharge Angle			0.29 deg
Code Maximum Rain Surcharge			5.0 psf
Rain on Snow Surcharge		=	0.0 psf
Ps plus rain surcharge		=	30.3 psf
Minimum Snow Load	Pm	=	20.0 psf
Uniform Roof Design Snow Load		=	**30.3 psf**

Near ground level surface balanced snow load = **30.1 psf**

NOTE: Alternate spans of continuous beams shall be loaded with half the design roof snow load so as to produce the greatest possible effect - see code for loading diagrams and exceptions for gable roofs..

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JOB NO. **SHEET NO.**
CALCULATED BY HAJ **DATE** 3/9/23
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Seismic Loads: IBC 2018 Strength Level Forces

Risk Category : II
Importance Factor (I) : 1.00
Site Class : D - code default

Ss (0.2 sec) = 143.60 %g
S1 (1.0 sec) = 49.90 %g
A site specific ground motion analysis is required for seismically isolated structures or with damping systems, see ASCE7 11.4.8

Fa =	1.200	Sms =	1.723	S_{DS} =	1.149	Design Category =	D
Fv =	1.801	Sm1 =	0.899	S_{D1} =	0.599	Design Category =	D

Seismic Design Category = **D**

Redundancy Coefficient ρ = 1.00 Code exception must be met for ρ to equal 1.0
Number of Stories: 1
Structure Type: Light Frame
Horizontal Struct Irregularities: No plan Irregularity
Vertical Structural Irregularities: No vertical Irregularity

Flexible Diaphragms: Yes
Building System: **Bearing Wall Systems**
Seismic resisting system: **Light frame (wood) walls with structural wood shear panels**
System Structural Height Limit: **65 ft**
Actual Structural Height (hn) = 20.0 ft
See ASCE7 Section 12.2.5 for exceptions and other system limitations

DESIGN COEFFICIENTS AND FACTORS

Response Modification Coefficient (R) = 6.5
Over-Strength Factor (Ωo) = 2.5
Deflection Amplification Factor (Cd) = 4
S_{DS} = 1.000 (Sds modified for Cs & Ev calculation since
S_{D1} = 0.599 meets ASCE 7 section 12.8.1.3)

Seismic Load Effect (E) = Eh +/-Ev = ρ Q_E +/- 0.2S_{DS} D = Qe +/- 0.200D Q_E = horizontal seismic force
Special Seismic Load Effect (Em) = Emh +/- Ev = Ωo Q_E +/- 0.2S_{DS} D = 2.5Qe +/- 0.230D D = dead load

PERMITTED ANALYTICAL PROCEDURES

Simplified Analysis - Use Equivalent Lateral Force Analysis

Equivalent Lateral-Force Analysis - Permitted
Building period coef. (C_T) = 0.020 Cu = 1.40
Approx fundamental period (Ta) = $C_T h_n^x$ = 0.189 sec x= 0.75 Tmax = CuTa = 0.265
User calculated fundamental period (T) = sec Use T = 0.189
Long Period Transition Period (TL) = ASCE7 map = 6

Seismic response coef. (Cs) = SdsI/R = 0.154 ASCE7 11.4.8 exception 2 equations used
but not less than Cs = 0.044SdsI = 0.044
USE Cs = 0.154
Design Base Shear V = 0.154W

Model & Seismic Response Analysis - Permitted (see code for procedure)

ALLOWABLE STORY DRIFT

Structure Type: All other structures
Allowable story drift Δa = 0.020hsx where hsx is the story height below level x

SON & HAJ CONSULTANT ENGINEERS, LLC
909 S. 336TH. ST. #104
FEDERAL WAY, WA
206 979 3819

JOB TITLE THE WRIGHT/HIGASHIJIMA
4701 88TH. AVE. SE, MERCER ISLAND, WA 98040
JOB NO. | **SHEET NO.**
CALCULATED BY HAJ | **DATE** 3/9/23
CHECKED BY HAJ | **DATE** 3/16/23

Roof Design Loads

Items	Description	Multiple	psf (max)	psf (min)
Roofing	Asphalt Shingles w/roll roofing		3.0	2.0
Decking	1/2" plywood/OSB		1.8	1.5
Framing	Wood Trusses @ 24"		3.0	2.5
Insulation	R-40 Fiberglass insul.	x 1.0	1.3	1.2
			0.0	0.0
Mech & Elec	Mech. & Elec.		2.0	0.0
Misc.	Misc.		0.5	0.0
			0.0	0.0
		Actual Dead Load	○ 11.6	○ 7.2
		Use this DL instead	◉ 15.0	◉ 15.0
		Live Load	20.0	0.0
		Snow Load	30.3	0.0
		Ultimate Wind (zone 2 - 100sf)	16.0	-41.5
ASD Loading		D + S	45.3	-
		D + 0.75(0.6*W + S)	45.0	-
		0.6*D + 0.6*W	-	-15.9
LRFD Loading		1.2D + 1.6 S + 0.5W	74.5	-
		1.2D + 1.0W + 0.5S	49.2	-
		0.9D + 1.0W	-	-28.0

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JOB NO. **SHEET NO.**
CALCULATED BY HAJ **DATE** 3/9/23
CHECKED BY HAJ **DATE** 3/16/23

Floor Design Loads

Items	Description	Multiple	psf (max)	psf (min)
Flooring	Carpet & pad		1.0	1.0
Decking	1/2" plywood/OSB	x 1.0	1.8	1.5
Framing	Wood 2x @24"		2.5	1.5
Insulation	R-30 Fiberglass insul.		0.9	0.9
	None		0.0	0.0
	None		0.0	0.0
	None		0.0	0.0
Mech & Elec	Mech. & Elec.		2.0	0.0
Misc.	Misc.		0.5	0.0
		Actual Dead Load	○ 8.7	○ 4.9
		Use this DL instead	◉ 15.0	◉ 15.0
		Partitions	15.0	0.0
		Live Load	40.0	0.0
		Total Live Load	55.0	0.0
		Total Load	70.0	15.0

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JOB TITLE	THE WRIGHT/HIGASHIJIMA 4701 88TH. AVE. SE, MERCER ISLAND, WA 98040		
JOB NO.		**SHEET NO.**	
CALCULATED BY	HAJ	**DATE**	3/9/23
CHECKED BY	HAJ	**DATE**	3/16/23

Wall Design Load #1

Items	Description	Multiple	psf (max)	psf (min)
Sheathing	7/16" plywood/OSB		1.6	1.4
Sheathing	5/8" gypsum		2.8	2.5
Framing	2x6 wood stud @ 16"		2.0	1.1
			0.0	0.0
Wall Covering	1" Wood Paneling	x 0.38	0.9	0.9
Insulation	R-11 Fiberglass insul.		0.4	0.4
Mech & Elec	Mech. & Elec.		1.0	0.0
Misc.	Misc.		0.5	0.0
		Actual Dead Load	○ 9.2	○ 6.2
		Use this DL instead	◉ 15.0	◉ 15.0

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JOB NO. | **SHEET NO.**
CALCULATED BY HAJ | **DATE** 3/9/23
CHECKED BY HAJ | **DATE** 3/16/23

CODE SUMMARY

Code: International Building Code 2018

Live Loads:

Roof	0 to 200 sf:	20 psf
	200 to 600 sf:	24 - 0.02Area, but not less than 12 psf
	over 600 sf:	12 psf

Typical Floor	40 psf
Partitions	15 psf
Balconies (1.5 times live load)	60 psf
Habitable attics & sleeping areas	30 psf
Attics without storage	10 psf
Attics with storage	20 psf

Dead Loads:

Floor	15.0 psf
Roof	15.0 psf

Wind Design Data:

Ultimate Design Wind Speed	110 mph
Nominal Design Wind Speed	85.21 mph
Risk Category	II
Mean Roof Ht (h)	20.0 ft
Exposure Category	C
Enclosure Classif.	Enclosed Building
Internal pressure Coef.	+/-0.18
Directionality (Kd)	0.85

Roof Snow Loads:

Design Uniform Roof Snow load		=	30.3 psf
Flat Roof Snow Load	Pf	=	30.3 psf
Balanced Snow Load	Ps	=	30.3 psf
Ground Snow Load	Pg	=	30.1 psf
Importance Factor	I	=	1.00
Snow Exposure Factor	Ce	=	1.20
Thermal Factor	Ct	=	1.20
Sloped-roof Factor	Cs	=	1.00
Drift Surcharge load	Pd	=	
Width of Snow Drift	w	=	

Earthquake Design Data:

Risk Category		=	II
Importance Factor	I	=	1.00
Mapped spectral response accelerat	Ss	=	143.60
	S1	=	49.90
Site Class		=	ode default
Spectral Response Coef.	Sds	=	1.000
	Sd1	=	0.599
Seismic Design Category		=	D
Basic Structural System		=	Bearing Wall Systems
Seismic Resisting System		=	Light frame (wood) walls with structural wood shear panels
Design Base Shear	V	=	0.154W
Seismic Response Coef.	Cs	=	0.154
Response Modification Factor	R	=	6.5
Analysis Procedure		=	Equivalent Lateral-Force Analysis

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JOB NO. **SHEET NO.**
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CHECKED BY HAJ **DATE** 3/16/23

CODE SUMMARY- continued

Component and cladding ultimate wind pressures

Roof	Surface Pressure (psf)							
Area	2 sf	10 sf	20 sf	50 sf	75 sf	100 sf	200 sf	250 sf
Negative Zone 1 & 2e	-51.8	-51.8	-51.8	-31.5	-22.5	-16.1	-16.1	-16.1
Negative Zone 2n, 2r &3e	-75.5	-75.5	-65.3	-51.8	-45.8	-41.5	-31.3	-28.0
Negative Zone 3r	-89.8	-89.8	-76.9	-59.9	-52.4	-47.0	-47.0	-47.0
Positive All Zones	20.9	17.0	16.0	16.0	16.0	16.0	16.0	16.0
Overhang Zone 1 & 2e	-59.4	-59.4	-59.4	-45.8	-39.9	-35.6	-35.6	-35.6
Overhang Zone 2n & 2r	-83.1	-83.1	-75.4	-65.3	-60.8	-57.6	-50.0	-47.5
Overhang Zone 3e	-97.4	-97.4	-84.1	-66.5	-58.7	-53.2	-39.9	-35.6
Overhang Zone 3r	-111.6	-111.6	-94.5	-71.8	-61.7	-54.6	-54.6	-54.6

Overhang soffit pressure equals adj wall pressure (which includes internal pressure of 4.3 psf)

Parapet		Solid Parapet Pressure (psf)					
	Area	10 sf	20 sf	50 sf	100 sf	250 sf	500 sf
CASE A:	Zone 2e :	0.0	0.0	0.0	0.0	0.0	0.0
	Zone 2n, 2r & 3e :	0.0	0.0	0.0	0.0	0.0	0.0
	Zone 3r :	0.0	0.0	0.0	0.0	0.0	0.0
CASE B :	Interior zone :	0.0	0.0	0.0	0.0	0.0	0.0
	Corner zone :	0.0	0.0	0.0	0.0	0.0	0.0

Wall	Surface Pressure (psf)			
Area	10 sf	100 sf	200 sf	500 sf
Negative Zone 4	-27.8	-24.0	-22.9	-21.4
Negative Zone 5	-34.2	-26.6	-24.4	-21.4
Positive Zone 4 & 5	25.6	21.9	20.7	19.2

Project Title:
Engineer: HAZIM AL KHALAF, P.E., M
Project ID:
Project Descr:

Wood Beam

Project File: ENERCALC.ec6

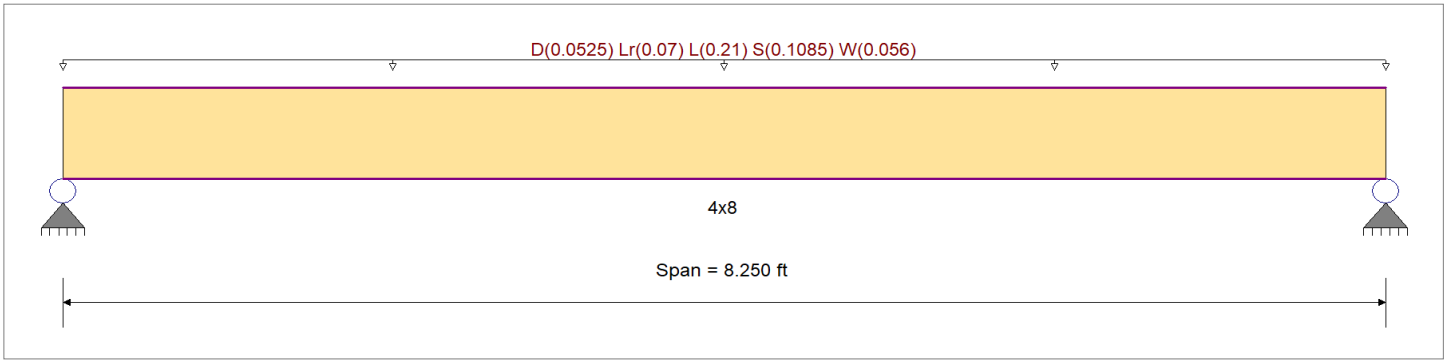
DESCRIPTION: BD48

CODE REFERENCES

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

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	875.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	875.0 psi	Ebend- xx	1,300.0 ksi
		Fc - Prll	600.0 psi	Eminbend - xx	470.0 ksi
Wood Species :	Douglas Fir-Larch (North)	Fc - Perp	625.0 psi		
Wood Grade :	No.2	Fv	170.0 psi		
		Ft	425.0 psi	Density	30.590 pcf
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, Lr = 0.020, L = 0.060, S = 0.0310, W = 0.0160 ksf, Tributary Width = 3.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.980 : 1	Maximum Shear Stress Ratio	=	0.410 : 1
Section used for this span		4x8	Section used for this span		4x8
fb: Actual	=	892.00 psi	fv: Actual	=	55.79 psi
F'b	=	910.00 psi	F'v	=	136.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.125 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	0.160 in	Ratio =	617 >=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <360	n/a
Max Downward Total Deflection	0.246 in	Ratio =	402 >=240	Span: 1 : +D+0.750L+0.750S+0.450W
Max Upward Total Deflection	0 in	Ratio =	0 <240	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination		Max Stress Ratios										Moment Values			Shear Values		
Segment Length	Span #	M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.235	0.098	0.90	1.00	1.00	1.00	1.300	1.00	0.80	1.00	0.49	192.8	819.0	0.20	12.1	122.4
+D+L					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.980	0.410	1.00	1.00	1.00	1.00	1.300	1.00	0.80	1.00	2.28	892.0	910.0	0.94	55.8	136.0
+D+Lr					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.374	0.157	1.25	1.00	1.00	1.00	1.300	1.00	0.80	1.00	1.09	425.8	1,137.5	0.45	26.6	170.0
+D+S					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.529	0.222	1.15	1.00	1.00	1.00	1.300	1.00	0.80	1.00	1.42	554.0	1,046.5	0.59	34.6	156.4
+D+0.750Lr+0.750L					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.784	0.328	1.25	1.00	1.00	1.00	1.300	1.00	0.80	1.00	2.28	892.0	1,137.5	0.94	55.8	170.0

Project Title:
Engineer: HAZIM AL KHALAF, P.E., M
Project ID:
Project Descr:

Wood Beam

Project File: ENERCALC.ec6

DESCRIPTION: BD48

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L+0.750S					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.944	0.395	1.15	1.00	1.00	1.00	1.300	1.00	0.80	1.00	2.52	988.1	1,046.5	1.05	61.8	156.4
+D+0.60W					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.209	0.088	1.60	1.00	1.00	1.00	1.300	1.00	0.80	1.00	0.78	304.6	1,456.0	0.32	19.1	217.6
+D+0.750Lr+0.750L+0.450W					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.670	0.280	1.60	1.00	1.00	1.00	1.300	1.00	0.80	1.00	2.49	975.9	1,456.0	1.03	61.0	217.6
+D+0.750L+0.750S+0.450W					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.736	0.308	1.60	1.00	1.00	1.00	1.300	1.00	0.80	1.00	2.74	1,072.1	1,456.0	1.13	67.0	217.6
+0.60D+0.60W					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.156	0.065	1.60	1.00	1.00	1.00	1.300	1.00	0.80	1.00	0.58	227.5	1,456.0	0.24	14.2	217.6
+0.60D					1.00	1.00	1.00	1.300	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 8.250 ft	1	0.079	0.033	1.60	1.00	1.00	1.00	1.300	1.00	0.80	1.00	0.30	115.7	1,456.0	0.12	7.2	217.6

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.450W	1	0.2459	4.155		0.0000	0.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0442	in	4.155 ft	0.0000	in	0.000	ft
+D+L	1	0.2046	in	4.155 ft	0.0000	in	0.000	ft
+D+Lr	1	0.0977	in	4.155 ft	0.0000	in	0.000	ft
+D+S	1	0.1271	in	4.155 ft	0.0000	in	0.000	ft
+D+0.750Lr+0.750L	1	0.2046	in	4.155 ft	0.0000	in	0.000	ft
+D+0.750L+0.750S	1	0.2267	in	4.155 ft	0.0000	in	0.000	ft
+D+0.60W	1	0.0699	in	4.155 ft	0.0000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W	1	0.2239	in	4.155 ft	0.0000	in	0.000	ft
+D+0.750L+0.750S+0.450W	1	0.2459	in	4.155 ft	0.0000	in	0.000	ft
+0.60D+0.60W	1	0.0522	in	4.155 ft	0.0000	in	0.000	ft
+0.60D	1	0.0265	in	4.155 ft	0.0000	in	0.000	ft
Lr Only	1	0.0535	in	4.155 ft	0.0000	in	0.000	ft
L Only	1	0.1604	in	4.155 ft	0.0000	in	0.000	ft
S Only	1	0.0829	in	4.155 ft	0.0000	in	0.000	ft
W Only	1	0.0428	in	4.155 ft	0.0000	in	0.000	ft

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

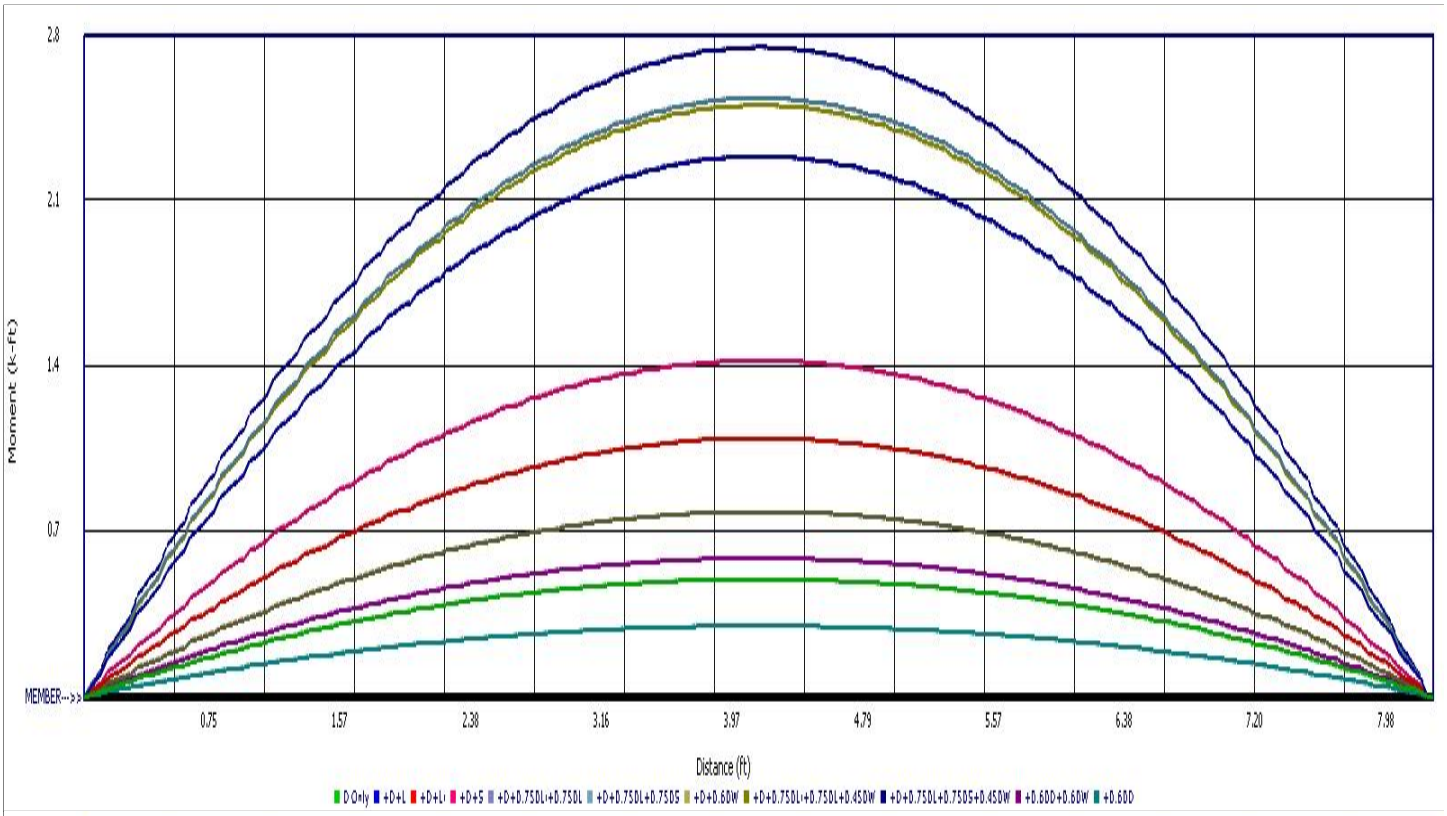
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.328	1.328
Max Upward from Load Combinations	1.328	1.328
Max Upward from Load Cases	0.866	0.866
D Only	0.239	0.239
+D+L	1.105	1.105
+D+Lr	0.528	0.528
+D+S	0.686	0.686
+D+0.750Lr+0.750L	1.105	1.105
+D+0.750L+0.750S	1.224	1.224
+D+0.60W	0.377	0.377
+D+0.750Lr+0.750L+0.450W	1.209	1.209
+D+0.750L+0.750S+0.450W	1.328	1.328
+0.60D+0.60W	0.282	0.282
+0.60D	0.143	0.143
Lr Only	0.289	0.289
L Only	0.866	0.866
S Only	0.448	0.448
W Only	0.231	0.231

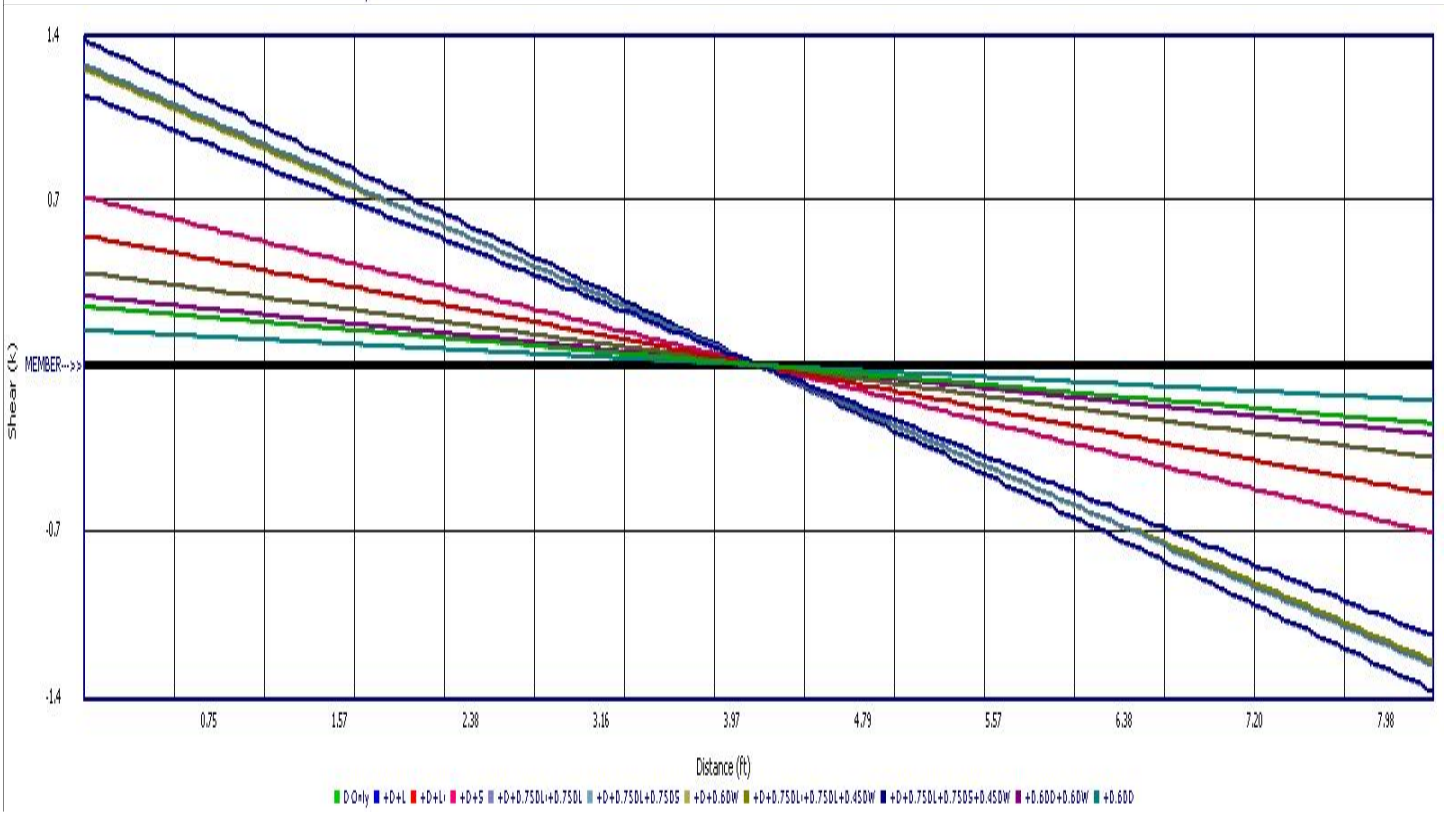
Project Title:
Engineer: HAZIM AL KHALAF, P.E., M
Project ID:
Project Descr:

Wood Beam

Project File: ENERCALC.ec6

DESCRIPTION: BD48





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Wood Beam

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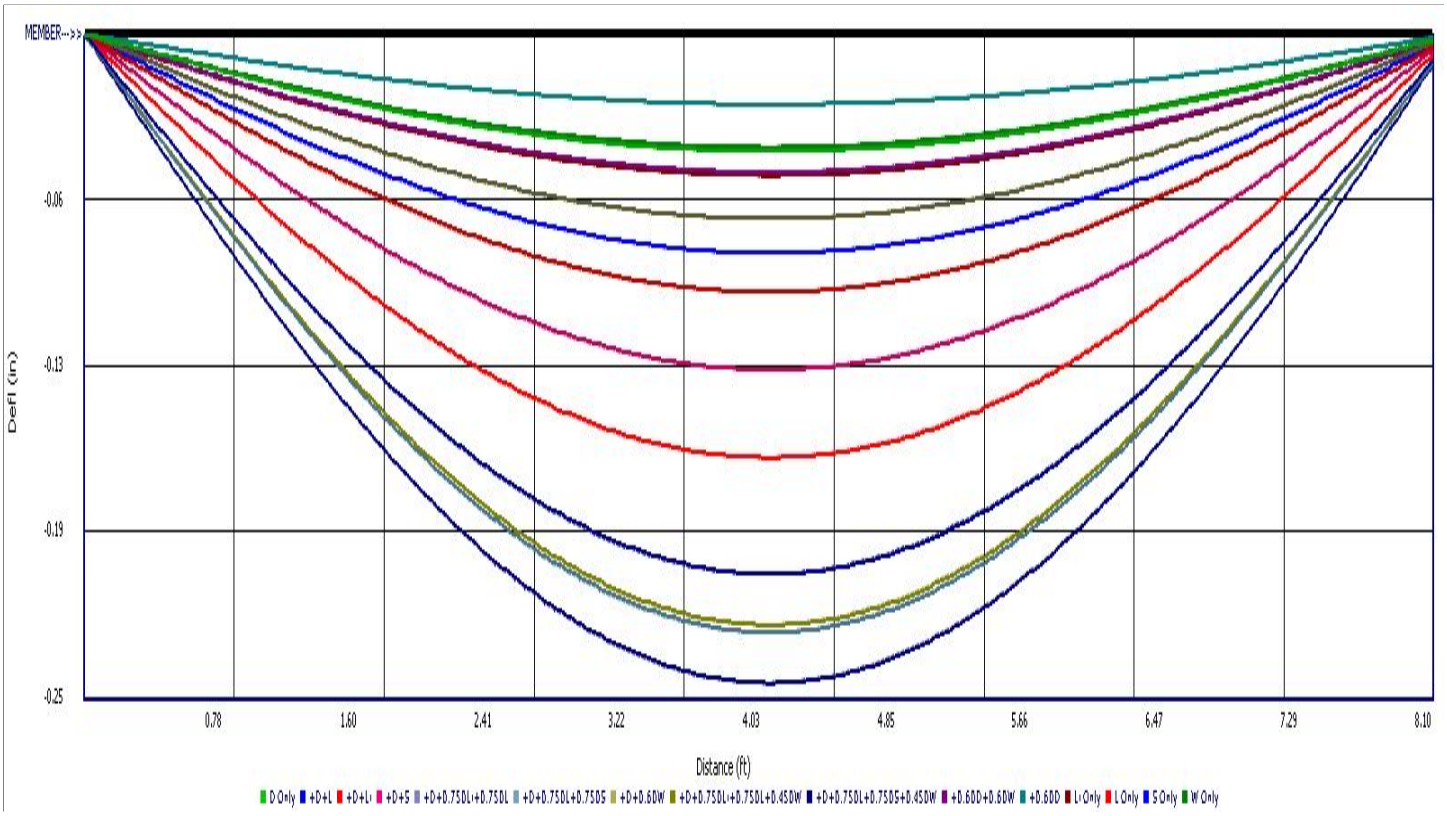


Project Title:
Engineer: HAZIM AL KHALAF, P.E., M
Project ID:
Project Descr:

Wood Beam

Project File: ENERCALC.ec6

DESCRIPTION: JD210 MAX. SPAN

CODE REFERENCES

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

Material Properties

Analysis Method : Allowable Stress Design
Load Combination : ASCE 7-16

Wood Species : Hem-Fir
Wood Grade : No.2

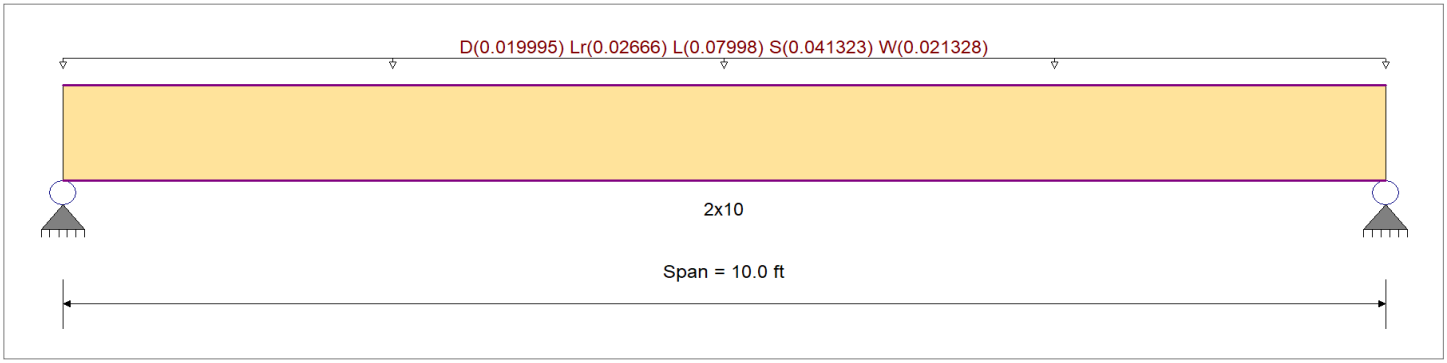
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling

Fb +	850.0 psi
Fb -	850.0 psi
Fc - Prll	1,300.0 psi
Fc - Perp	405.0 psi
Fv	150.0 psi
Ft	525.0 psi

E : Modulus of Elasticity

Ebend- xx	1,300.0 ksi
Eminbend - xx	470.0 ksi
Density	26.840 pcf

Repetitive Member Stress Increase



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, Lr = 0.020, L = 0.060, S = 0.0310, W = 0.0160 ksf, Tributary Width = 1.333 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.959 : 1	Maximum Shear Stress Ratio	=	0.393 : 1
Section used for this span		2x10	Section used for this span		2x10
fb: Actual	=	701.07 psi	fv: Actual	=	45.76 psi
F'b	=	731.17 psi	F'v	=	116.40 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	5.000 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	0.165 in	Ratio =	729 >=240	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0 <240	n/a
Max Downward Total Deflection	0.248 in	Ratio =	483 >=180	Span: 1 : +D+0.750L+0.750S+0.450W
Max Upward Total Deflection	0 in	Ratio =	0 <180	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.213	0.087	0.90	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.25	140.2	658.1	0.08	9.2	104.8
+D+L					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.959	0.393	1.00	0.85	1.00	1.00	1.100	1.00	0.80	1.15	1.25	701.1	731.2	0.42	45.8	116.4
+D+Lr					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.358	0.147	1.25	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.58	327.2	914.0	0.20	21.4	145.5
+D+S					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.511	0.210	1.15	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.77	430.0	840.8	0.26	28.1	133.9
+D+0.750Lr+0.750L					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.767	0.314	1.25	0.85	1.00	1.00	1.100	1.00	0.80	1.15	1.25	701.1	914.0	0.42	45.8	145.5

Project Title:
Engineer: HAZIM AL KHALAF, P.E., M
Project ID:
Project Descr:

Wood Beam

Project File: ENERCALC.ec6

DESCRIPTION: JD210 MAX. SPAN

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_F	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L+0.750S					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.925	0.379	1.15	0.85	1.00	1.00	1.100	1.00	0.80	1.15	1.39	778.2	840.8	0.47	50.8	133.9
+D+0.60W					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.197	0.081	1.60	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.41	229.9	1,169.9	0.14	15.0	186.2
+D+0.750Lr+0.750L+0.450W					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.657	0.269	1.60	0.85	1.00	1.00	1.100	1.00	0.80	1.15	1.37	768.4	1,169.9	0.46	50.1	186.2
+D+0.750L+0.750S+0.450W					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.723	0.296	1.60	0.85	1.00	1.00	1.100	1.00	0.80	1.15	1.51	845.5	1,169.9	0.51	55.2	186.2
+0.60D+0.60W					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.149	0.061	1.60	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.31	173.9	1,169.9	0.10	11.3	186.2
+0.60D					0.85	1.00	1.00	1.100	1.00	0.80	1.15			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.072	0.029	1.60	0.85	1.00	1.00	1.100	1.00	0.80	1.15	0.15	84.1	1,169.9	0.05	5.5	186.2

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.450W	1	0.2481	5.036		0.0000	0.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0412	in	5.036 ft	0.0000	in	0.000	ft
+D+L	1	0.2058	in	5.036 ft	0.0000	in	0.000	ft
+D+Lr	1	0.0960	in	5.036 ft	0.0000	in	0.000	ft
+D+S	1	0.1262	in	5.036 ft	0.0000	in	0.000	ft
+D+0.750Lr+0.750L	1	0.2058	in	5.036 ft	0.0000	in	0.000	ft
+D+0.750L+0.750S	1	0.2284	in	5.036 ft	0.0000	in	0.000	ft
+D+0.60W	1	0.0675	in	5.036 ft	0.0000	in	0.000	ft
+D+0.750Lr+0.750L+0.450W	1	0.2255	in	5.036 ft	0.0000	in	0.000	ft
+D+0.750L+0.750S+0.450W	1	0.2481	in	5.036 ft	0.0000	in	0.000	ft
+0.60D+0.60W	1	0.0510	in	5.036 ft	0.0000	in	0.000	ft
+0.60D	1	0.0247	in	5.036 ft	0.0000	in	0.000	ft
Lr Only	1	0.0549	in	5.036 ft	0.0000	in	0.000	ft
L Only	1	0.1646	in	5.036 ft	0.0000	in	0.000	ft
S Only	1	0.0850	in	5.036 ft	0.0000	in	0.000	ft
W Only	1	0.0439	in	5.036 ft	0.0000	in	0.000	ft

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	0.603	0.603
Max Upward from Load Combinations	0.603	0.603
Max Upward from Load Cases	0.400	0.400
D Only	0.100	0.100
+D+L	0.500	0.500
+D+Lr	0.233	0.233
+D+S	0.307	0.307
+D+0.750Lr+0.750L	0.500	0.500
+D+0.750L+0.750S	0.555	0.555
+D+0.60W	0.164	0.164
+D+0.750Lr+0.750L+0.450W	0.548	0.548
+D+0.750L+0.750S+0.450W	0.603	0.603
+0.60D+0.60W	0.124	0.124
+0.60D	0.060	0.060
Lr Only	0.133	0.133
L Only	0.400	0.400
S Only	0.207	0.207
W Only	0.107	0.107

Project Title:
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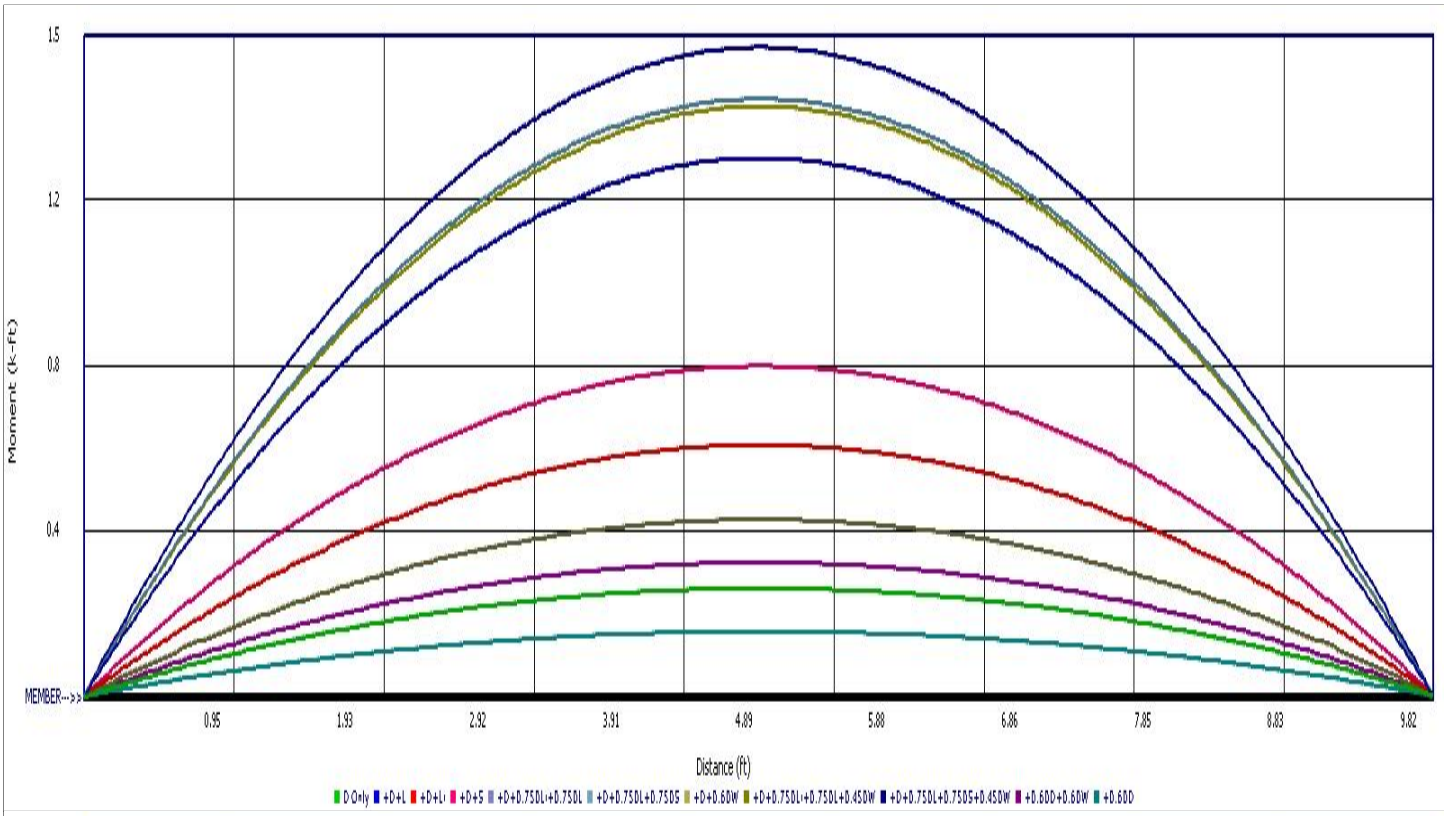
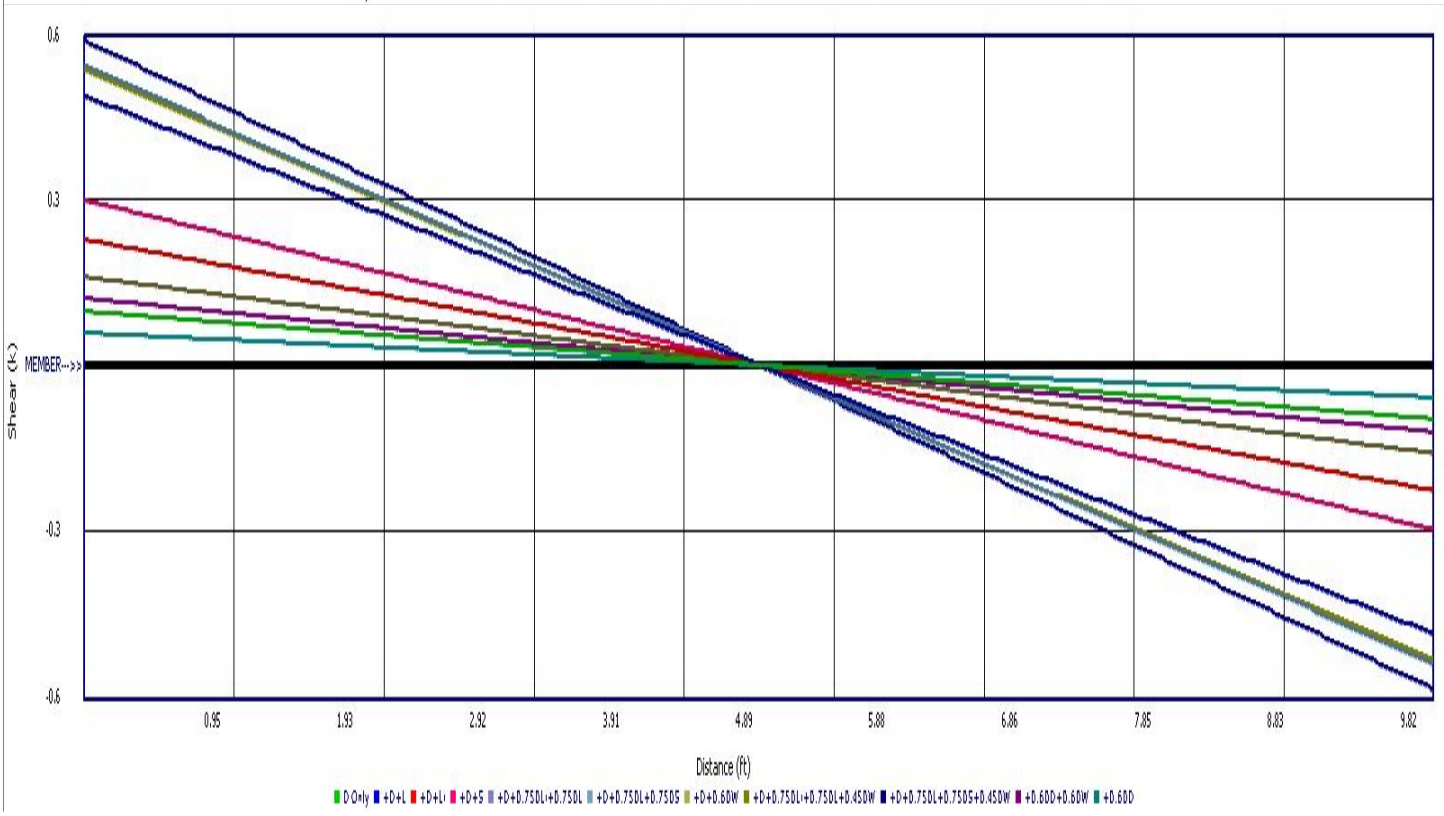
DESCRIPTION: JD210 MAX. SPAN





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