

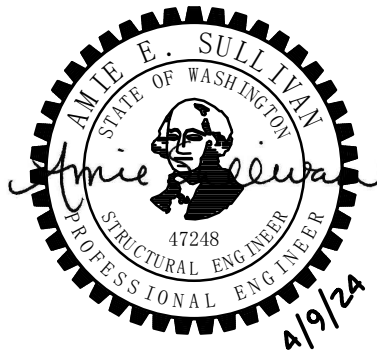
OLSON KUNDIG
Fused Elements Residence
Mercer Island, WA

Supplemental Structural Calculations

CALCULATIONS INCLUDED:

Pages 1 through 32

**These Calculations cover supplemental calculations in
response to Cycle 2 permit comments from City of
Mercer Island.**



kpff

1601 5th Avenue, Suite 1600
Seattle, WA 98101 206.622.5822

KPFF Project No. 2200638

April 9th, 2024

Shoring Design Including Seismic Load



1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements	by	JRS	sheet no.
location	Mercer Island, WA	date	4/3/2024	
client	OK			job no.
	Shoring Wall With Seismic Loads			2200638

Analysis of Permanent Shoring Wall Subject to Seismic Loads

Geotechnical report states that seismic surcharge loads should be used in conjunction with soil pressures for permanent walls.

Seismic surcharge = $5 \cdot H$ for unrestrained walls
= $10 \cdot H$ for restrained walls

where H = height of wall in feet

Since the permanent shoring wall is allowed to deflect and not supporting any building elements above, it can be classified as unrestrained.

Shoring wall was already designed for 70 psf horizontal surcharge due to vehicle traffic. So, this additional analysis is only performed where $5 \cdot H$ pressure exceeds 70 psf. This occurs at 17' and 21' wall designs only.

Seismic surcharge at 17' = 85 psf
Seismic surcharge at 21' = 105 psf

Seismic surcharge is not assumed to act at Stage 1 temporary cantilever condition due to short term construction sequencing.

See attached revised shoring criteria and design on following pages. Note that loads have been refined to take advantage of lower earth pressure in Pre-Olympia Deposits per the Geotech report.

No changes to the pile size is required, lock-off load increases at 21' wall.

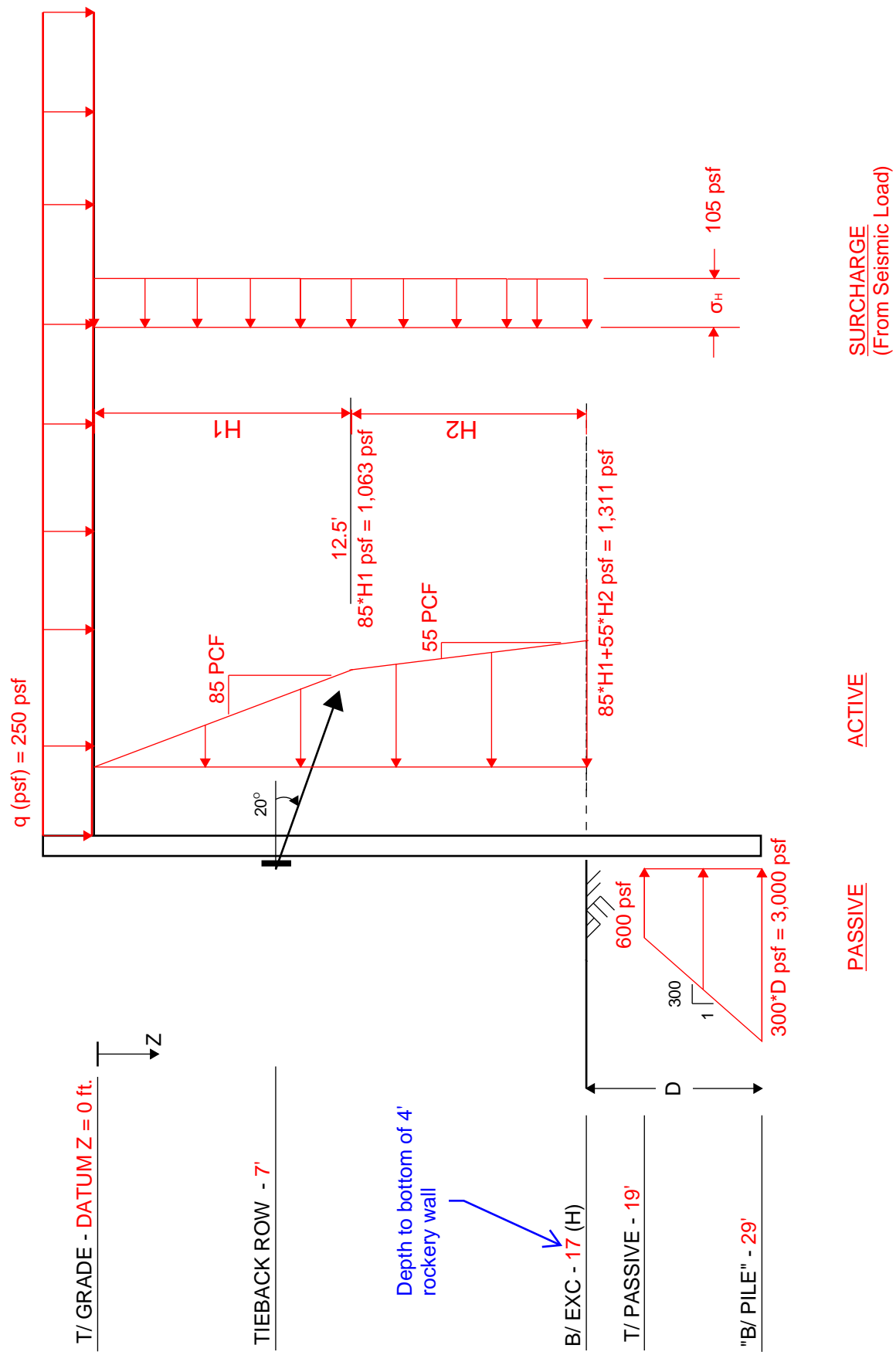


1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Shoring	by	JRS	sheet no.
location	Mercer Island, WA	date	4/3/2024	
client	Olson Kundig			job no.
	Shoring Design Pressures			2200638

- NOTES:**
1. Piles @ 8'-0" OC
 2. Shaft $\varnothing = 2$ ft
 3. Passive over 2.5 x pile \varnothing
 4. $\mu = 2$ ksf; EB = 18 ksf
 5. 2H:1V backslope pressures

DESIGN SECTION 17' Tall Wall With Tiebacks



SURCHARGE
(From Seismic Load)

ACTIVE

PASSIVE

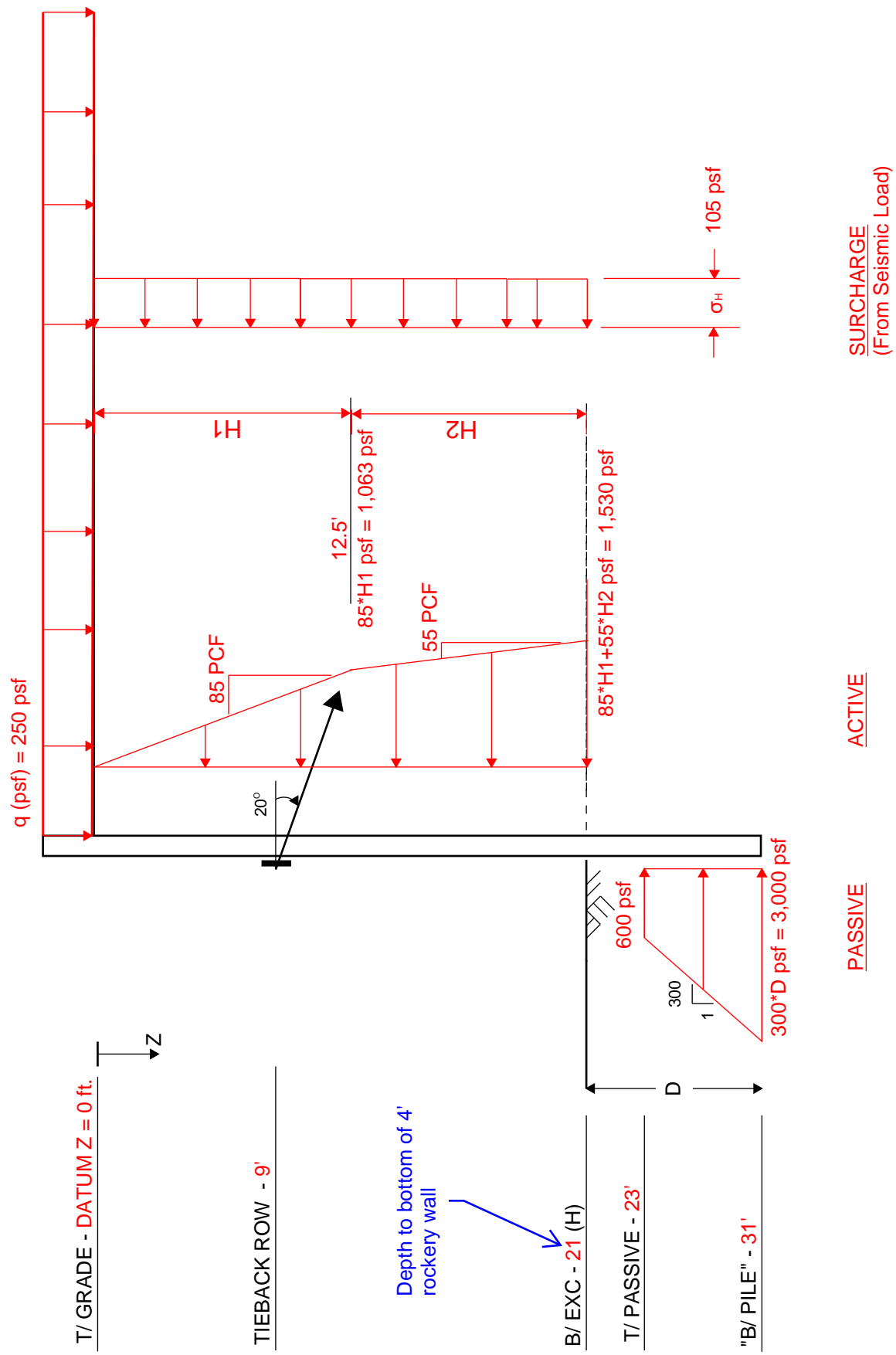


1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements Shoring	by	JRS	sheet no.
location	Mercer Island, WA	date	4/3/2024	
client	Olson Kundig			job no.
	Shoring Design Pressures			2200638

DESIGN SECTION 21' Tall Wall With Tiebacks

- NOTES:**
1. Piles @ 8'-0" OC
 2. Shaft $\varnothing = 2$ ft
 3. Passive over 2.5 x pile \varnothing
 4. $\mu = 2$ ksf; EB = 18 ksf
 5. 2H:1V backslope pressures



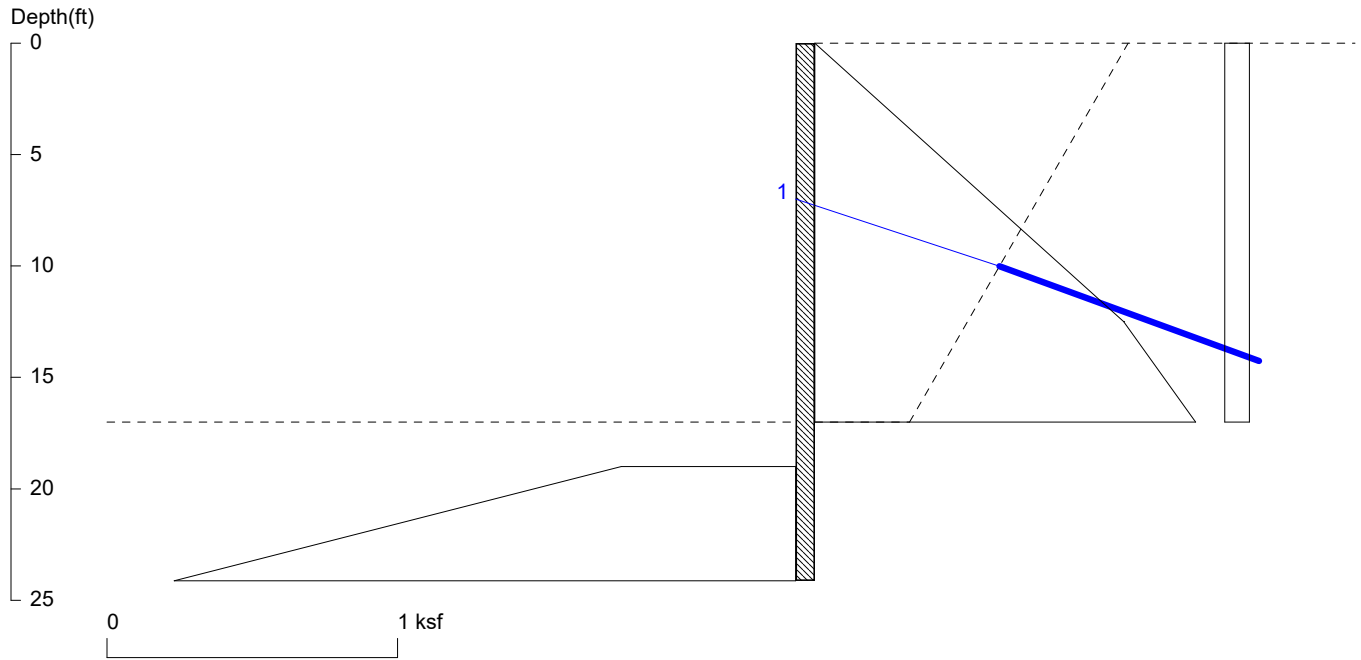
SURCHARGE
(From Seismic Load)

ACTIVE

PASSIVE

FE - 17' w/ tiebacks

Section S-1 Stage 1



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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Date: 4/4/2024

File: G:\2022_projects\2200638 - Fused Elements Residence\01 Design Phase\40 Calculations\Shoring\CTShoring\2024.04.

Wall Height=17.0

Pile Diameter=2.0

Pile Spacing=8.0

Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=7.13 Min. Pile Length=24.13

MOMENT IN PILE: Max. Moment=178.31 per Pile Spacing=8.0 at Depth=14.34

VERTICAL BEARING CAPACITY: Vertical Loading=28.9, Resistance=130.2, Vertical Factor of Safety=4.51

PILE SELECTION:

Request Min. Section Modulus = 64.8 in³/pile=1062.56 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W12X53 has Section Modulus = 70.6 in³/pile=1156.92 cm³/pile. It is greater than Min. Requirements!

Top Deflection = -0.68(in) based on E (ksi)=29000.00 and I (in⁴)/pile=425.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L _{free}	Fixed Length
1. Tieback	7.0	20.0	8.0	84.4	79.3	28.9	8.8	26.9

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	12.5	1.063	0.085
12.5	1.063	17	1.310	0.055
0	0.085	17	0.085	0

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
19	0.6	999	294.600	0.3

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	17.00	2.00

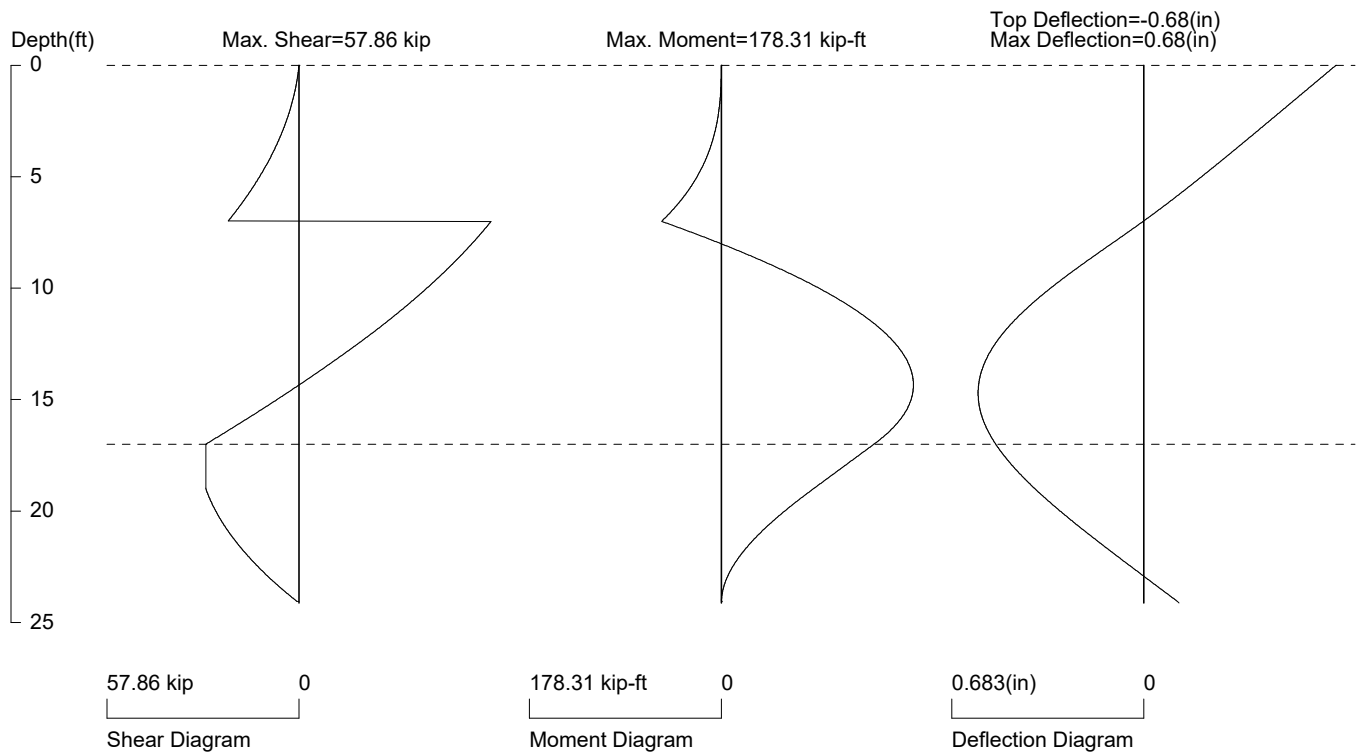
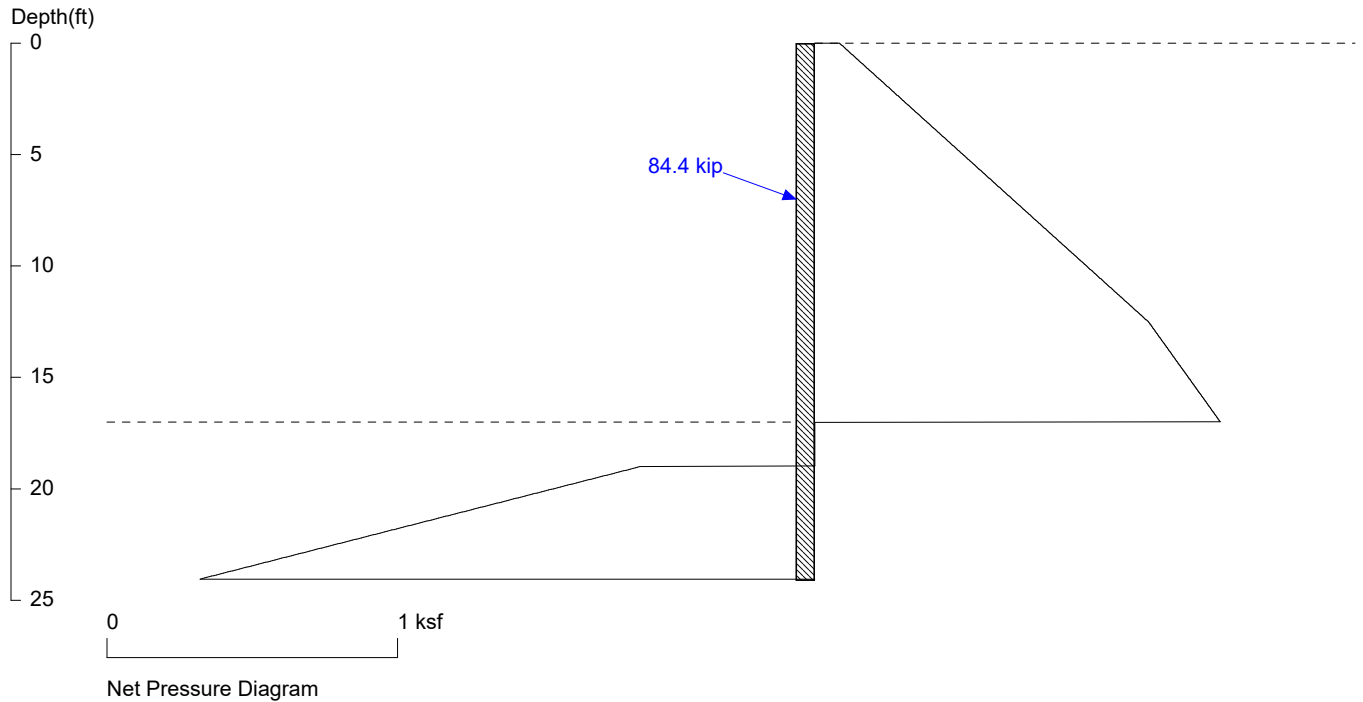
PASSIVE SPACING:

No.	Z depth	Spacing
1	17.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

FE - 17' w/ tiebacks

Section S-1 Stage 1



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

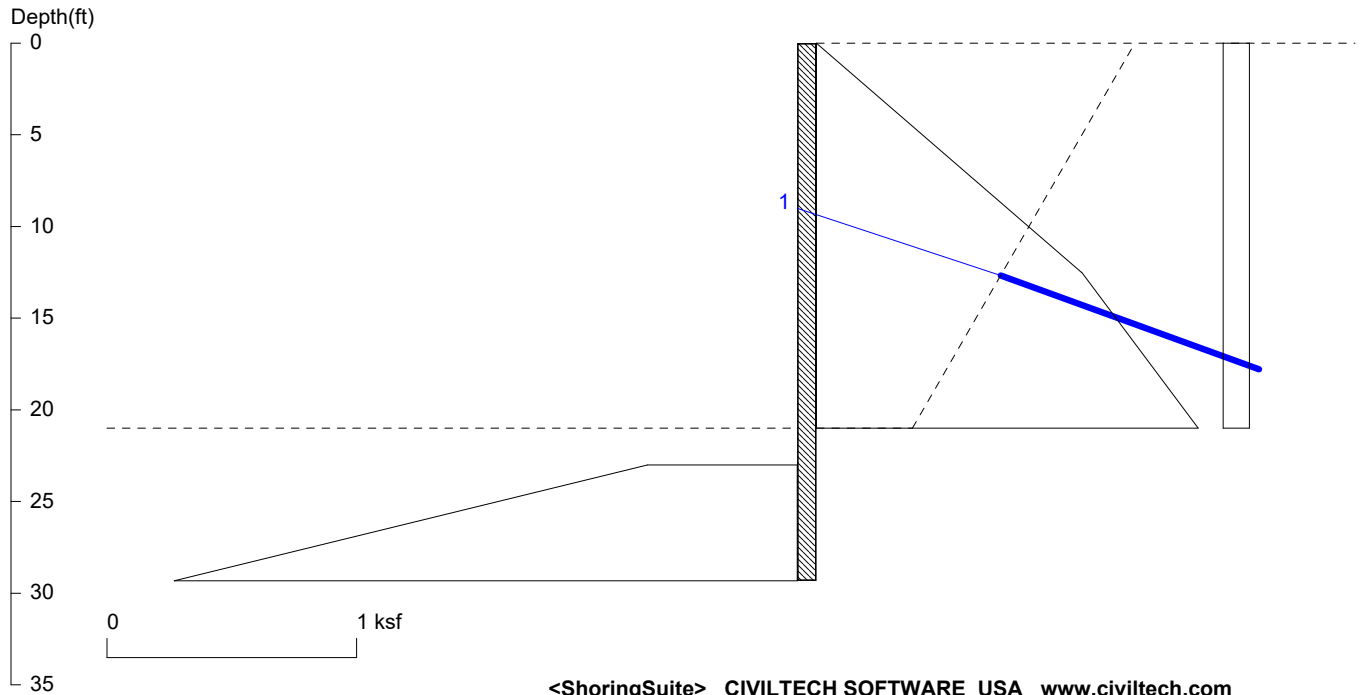
Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X53: E (ksi)=29000.0, I (in⁴)/pile=425.0

projects\2200638 - Fused Elements Residence\01 Design Phase\40 Calculations\Shoring\CTShoring\2024.04.04 Permit Rev 2 Tests\FE - 17 ft wall, tiebacks - seismic

FE - 21' w/ tiebacks

Section S-1 Stage 1



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Date: 4/4/2024

File: G:\2022_projects\2200638 - Fused Elements Residence\01 Design Phase\40 Calculations\Shoring\CTShoring\2024.04.

Wall Height=21.0 Pile Diameter=2.0 Pile Spacing=8.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=8.32 Min. Pile Length=29.32

MOMENT IN PILE: Max. Moment=287.92 per Pile Spacing=8.0 at Depth=17.84

VERTICAL BEARING CAPACITY: Vertical Loading=43.6, Resistance=145.2, Vertical Factor of Safety=3.33

PILE SELECTION:

Request Min. Section Modulus = 104.7 in³/pile=1715.70 cm³/pile, F_y= 50 ksi = 345 MPa, F_b/F_y=0.66

W12X87 has Section Modulus = 118.0 in³/pile=1933.67 cm³/pile. It is greater than Min. Requirements!

Top Deflection = -0.87(in) based on E (ksi)=29000.00 and I (in⁴)/pile=740.0

BRACE FORCE: Strut, Tieback, Plate Anchor, Deadman, Sheet Pile as Anchor

No. & Type	Depth	Angle	Space	Total F.	Horiz. F.	Vert. F.	L _{free}	Fixed Length
1. Tieback	9.0	20.0	8.0	127.5	119.8	43.6	10.7	40.6

UNITS: Width,Diameter,Spacing,Length,Depth,and Height - ft; Force - kip; Bond Strength and Pressure - ksf

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	12.5	1.063	0.085
12.5	1.063	21	1.530	0.055
0	0.105	21	0.105	0

PASSIVE PRESSURES:

Z1	P1	Z2	P2	Slope
23	0.6	999	293.4	0.3

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	8.00
2	21.00	2.00

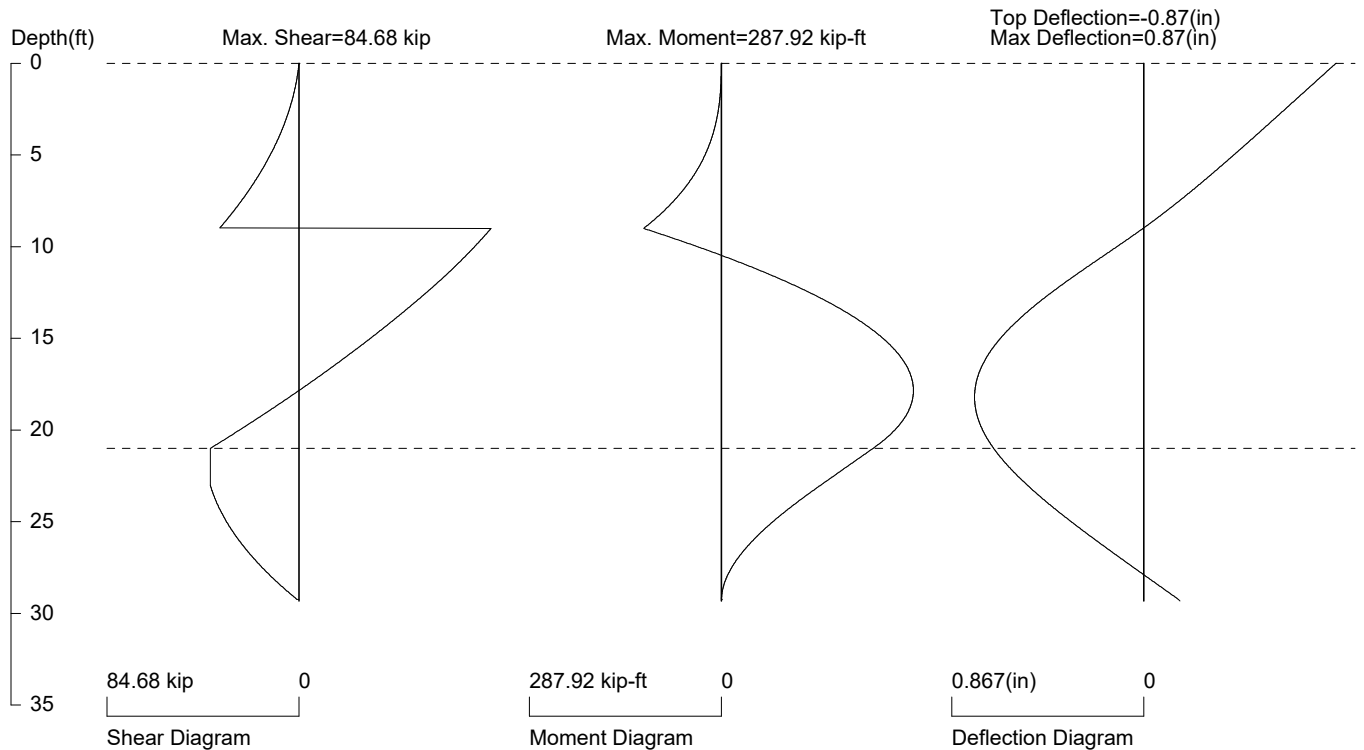
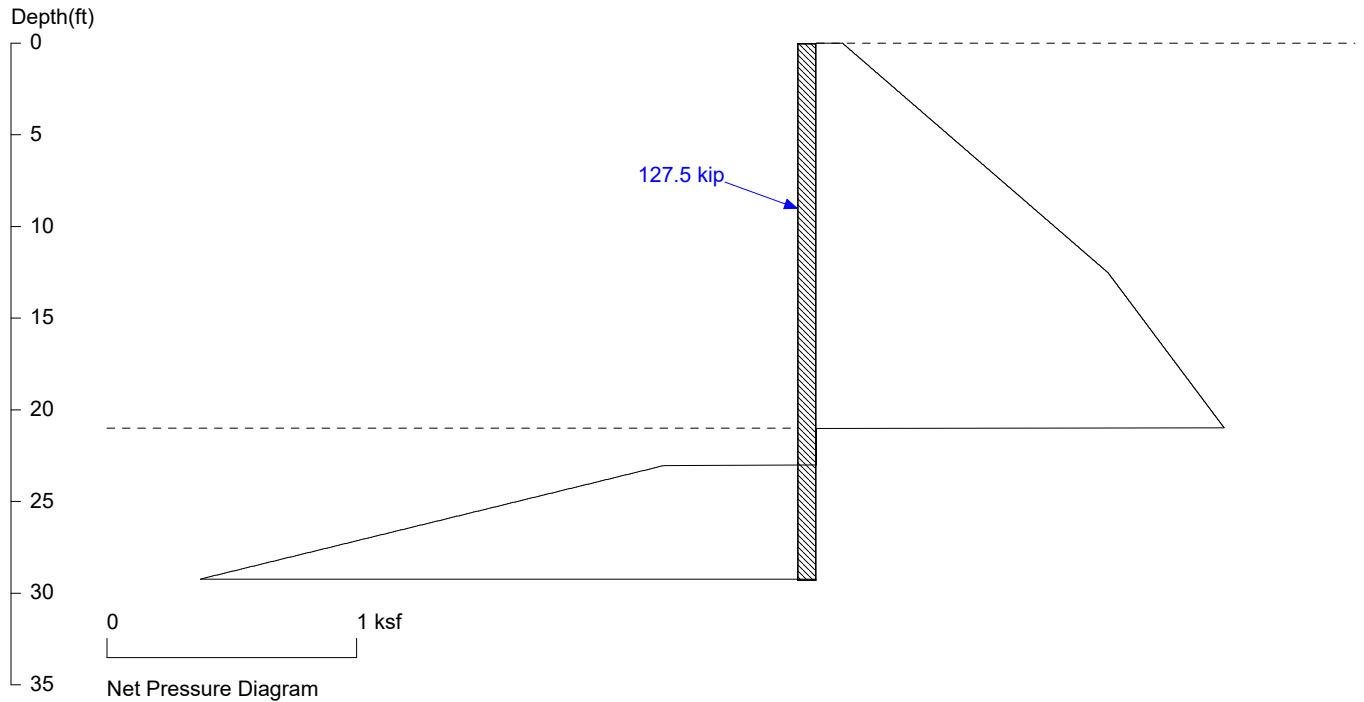
PASSIVE SPACING:

No.	Z depth	Spacing
1	21.00	4.00

UNITS: Width, Spacing, Diameter, Length, and Depth - ft; Force - kip; Moment - kip-ft
Friction, Bearing, and Pressure - ksf; Pres. Slope - kip/ft³; Deflection - in

FE - 21' w/ tiebacks

Section S-1 Stage 1



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 8.0 foot or meter

User Input Pile, W12X87: E (ksi)=29000.0, I (in⁴)/pile=740.0

projects\2200638 - Fused Elements Residence\01 Design Phase\40 Calculations\Shoring\CTShoring\2024.04.04 Permit Rev 2 Tests\FE - 21 ft wall, tiebacks - seismic

Garage Revision - Framing Design



1601 5th Avenue, Suite 1600
Seattle, WA 98101 206 622-5822

project	Fused Elements	by	JRS	sheet no.
location	Mercer Island, WA	date	4/3/2024	
client	OK			job no.
	Revised Garage Framing			2200638

Design of Revised Garage Framing

Elevated slab above garage was revised to try and reduce overall member depths and increase clear space below. Deck direction was flipped to North-South and beams are now upturned inside the deck, with top of beam approximately 4" above bottom of deck. All beams are designed as non-composite.

25' long girders extend into the wood floor of the main residence.

Design Loads:

Garage:

Live load = 250 psf

Dead load:

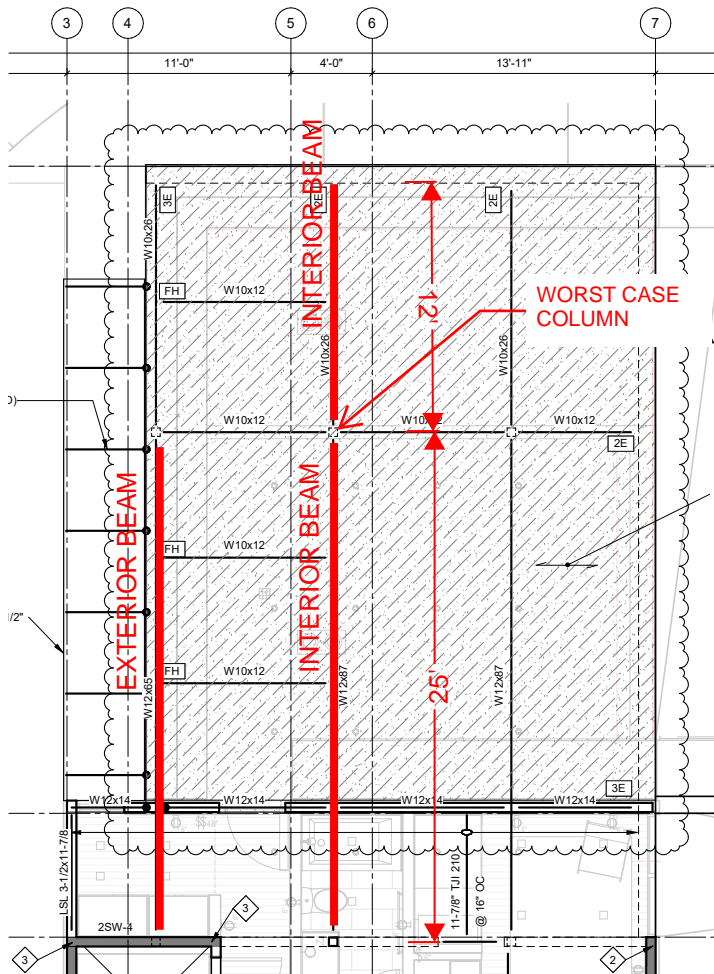
- 2 1/2" concrete over 3" deck = 55 psf
- 3" max (1.5" average concrete slope to drain) = 19 psf
- 4" topping slab = 50 psf
- Soffit/lights/misc = 6 psf

-> Total design dead load on steel beams = 130 psf

Interior space:

Live load = 40 psf

Dead load = 13 psf



Schematic plan to the left illustrates worst-case beams and columns that are shown in these calculations.

Worst case tributary width for beam framing = 8.75'.

Worst case trib area for column = $8.75' \times (12'/2 + 25'/2) = 162 \text{ ft}^2$

See attached Enercalc output for framing design and analysis

INTERIOR BEAM - 25' SPAN

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC#: KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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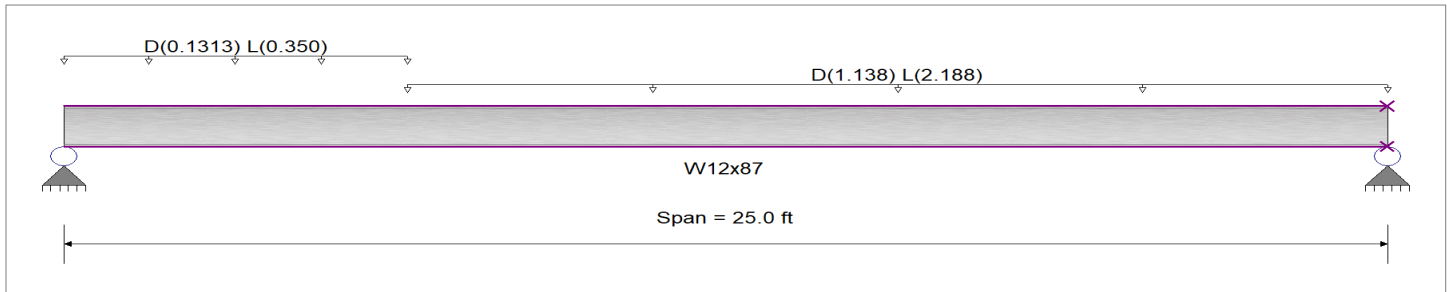
DESCRIPTION: CD - Garage Interior Beam - 25' span - Upturned

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis : Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
 Load for Span Number 1

Uniform Load : D = 0.130, L = 0.250 ksf, Extent = 6.50 --> 25.0 ft, Tributary Width = 8.750 ft

Uniform Load : D = 0.0150, L = 0.040 ksf, Extent = 0.0 --> 6.50 ft, Tributary Width = 8.750 ft

DESIGN SUMMARY

Design OK

<p>Maximum Bending Stress Ratio = 0.698 : 1</p> <p>Section used for this span: W12x87</p> <p>Mu : Applied: 345.662 k-ft</p> <p>Mn * Phi : Allowable: 495.000 k-ft</p> <p>Load Combination: +1.20D+1.60L</p> <p>Span # where maximum occurs: Span # 1</p> <p>Maximum Deflection</p> <p>Max Downward Transient Deflection: 0.782 in Ratio = 383 >=360</p> <p>Max Upward Transient Deflection: 0.000 in Ratio = 0 <360</p> <p>Max Downward Total Deflection: 1.223 in Ratio = 245 >=240</p> <p>Max Upward Total Deflection: 0.000 in Ratio = 0 <240.0</p>	<p>Maximum Shear Stress Ratio = 0.303 : 1</p> <p>Section used for this span: W12x87</p> <p>Vu : Applied: 58.613 k</p> <p>Vn * Phi : Allowable: 193.125 k</p> <p>Load Combination: +1.20D+1.60L</p> <p>Location of maximum on span: 25.000 ft</p> <p>Span # where maximum occurs: Span # 1</p>
---	---

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
			M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx
+1.40D	Dsgn. L = 25.00 ft	1	0.241	0.105	119.46	119.46	550.00	495.00	1.00	1.00	20.24	193.13	193.13
+1.20D+1.60L	Dsgn. L = 25.00 ft	1	0.698	0.303	345.66	345.66	550.00	495.00	1.00	1.00	58.61	193.13	193.13
+1.20D+L	Dsgn. L = 25.00 ft	1	0.514	0.223	254.44	254.44	550.00	495.00	1.00	1.00	43.14	193.13	193.13
+1.20D	Dsgn. L = 25.00 ft	1	0.207	0.090	102.40	102.40	550.00	495.00	1.00	1.00	17.35	193.13	193.13
+0.90D	Dsgn. L = 25.00 ft	1	0.155	0.067	76.80	76.80	550.00	495.00	1.00	1.00	13.01	193.13	193.13

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	1.2228	12.786		0.0000	0.000

Vertical Reactions

Support notation : Far left is #'

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	26.569	40.247
Overall MINimum	5.770	8.674

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage Interior Beam - 25' span - Upturned

Vertical Reactions

Support notation : Far left is #

Values in KIPS

Load Combination	Support 1	Support 2
D Only	9.616	14.456
+D+L	26.569	40.247
+D+0.750L	22.330	33.799
+0.60D	5.770	8.674
L Only	16.953	25.791

EXTERIOR BEAM - 25' SPAN

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC#: KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

(c) ENERCALC INC 1983-2022

DESCRIPTION: CD - Garage Exterior Beam - 25' span - Uprturned

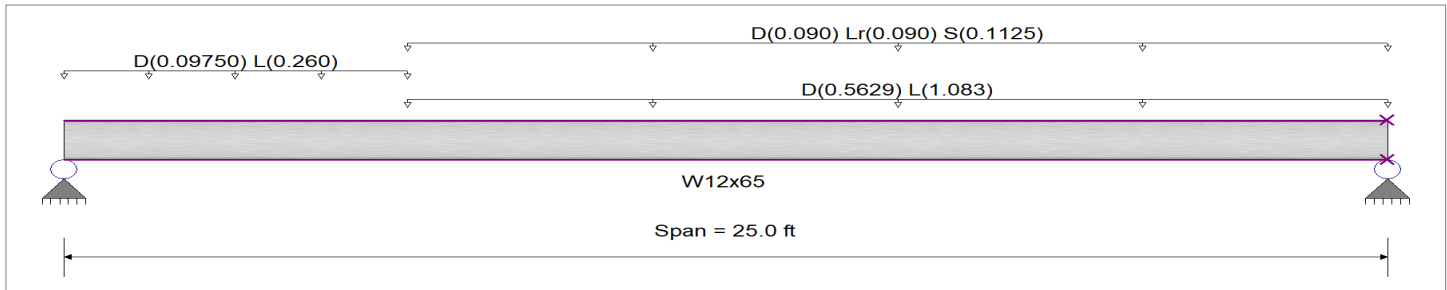
CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-16

Material Properties

Analysis Method Load Resistance Factor Design
 Beam Bracing : Beam is Fully Braced against lateral-torsional buckling
 Bending Axis : Major Axis Bending

Fy : Steel Yield : 50.0 ksi
 E: Modulus : 29,000.0 ksi



Applied Loads

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

Beam self weight calculated and added to loading
 Load for Span Number 1

Uniform Load : D = 0.130, L = 0.250 ksf, Extent = 6.50 --> 25.0 ft, Tributary Width = 4.330 ft

Uniform Load : D = 0.0150, L = 0.040 ksf, Extent = 0.0 --> 6.50 ft, Tributary Width = 6.50 ft

Uniform Load : D = 0.020, Lr = 0.020, S = 0.0250 ksf, Extent = 6.50 --> 25.0 ft, Tributary Width = 4.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.522 : 1	Maximum Shear Stress Ratio =	0.222 : 1
Section used for this span	W12x65	Section used for this span	W12x65
Mu : Applied	186.036 k-ft	Vu : Applied	31.399 k
Mn * Phi : Allowable	356.217 k-ft	Vn * Phi : Allowable	141.570 k
Load Combination	+1.20D+1.60L+0.50S	Load Combination	+1.20D+1.60L+0.50S
Span # where maximum occurs	Span # 1	Location of maximum on span	25.000 ft
		Span # where maximum occurs	Span # 1
Maximum Deflection			
Max Downward Transient Deflection	0.546 in	Ratio =	549 >=360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.907 in	Ratio =	331 >=240.
Max Upward Total Deflection	0.000 in	Ratio =	0 <240.0

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
			M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx
+1.40D	Dsgn. L = 25.00 ft	1	0.198	0.084	70.52	70.52	395.80	356.22	1.00	1.00	11.91	141.57	141.57
+1.20D+0.50Lr+1.60L	Dsgn. L = 25.00 ft	1	0.520	0.221	185.27	185.27	395.80	356.22	1.00	1.00	31.27	141.57	141.57
+1.20D+1.60L+0.50S	Dsgn. L = 25.00 ft	1	0.522	0.222	186.04	186.04	395.80	356.22	1.00	1.00	31.40	141.57	141.57
+1.20D+1.60Lr+L	Dsgn. L = 25.00 ft	1	0.411	0.175	146.33	146.33	395.80	356.22	1.00	1.00	24.72	141.57	141.57
+1.20D+1.60Lr	Dsgn. L = 25.00 ft	1	0.197	0.084	70.23	70.23	395.80	356.22	1.00	1.00	11.88	141.57	141.57
+1.20D+L+1.60S	Dsgn. L = 25.00 ft	1	0.418	0.178	148.78	148.78	395.80	356.22	1.00	1.00	25.14	141.57	141.57
+1.20D+1.60S	Dsgn. L = 25.00 ft	1	0.204	0.087	72.67	72.67	395.80	356.22	1.00	1.00	12.30	141.57	141.57
+1.20D+0.50Lr+L	Dsgn. L = 25.00 ft	1	0.392	0.166	139.61	139.61	395.80	356.22	1.00	1.00	23.57	141.57	141.57

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage Exterior Beam - 25' span - Upturned

Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values			
			M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx	Phi*Vnx
+1.20D+L+0.50S														
Dsgn. L = 25.00 ft	25.00 ft	1	0.394	0.167	140.37	140.37	395.80	356.22	1.00	1.00	23.70	141.57	141.57	
+0.90D														
Dsgn. L = 25.00 ft	25.00 ft	1	0.127	0.054	45.34	45.34	395.80	356.22	1.00	1.00	7.65	141.57	141.57	
+1.20D+L+0.20S														
Dsgn. L = 25.00 ft	25.00 ft	1	0.388	0.165	138.08	138.08	395.80	356.22	1.00	1.00	23.30	141.57	141.57	

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.9066	12.714		0.0000	0.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl	Location in Span	Span	Max. Upward Defl	Location in Span
D Only	1	0.3610	12.714		0.0000	0.000
+D+L	1	0.9066	12.714		0.0000	0.000
+D+Lr	1	0.4044	12.786		0.0000	0.000
+D+S	1	0.4153	12.786		0.0000	0.000
+D+0.750Lr+0.750L	1	0.8028	12.714		0.0000	0.000
+D+0.750L+0.750S	1	0.8109	12.714		0.0000	0.000
+0.60D	1	0.2166	12.714		0.0000	0.000
Lr Only	1	0.0435	12.786		0.0000	0.000
L Only	1	0.5456	12.714		0.0000	0.000
S Only	1	0.0543	12.786		0.0000	0.000

Vertical Reactions

Support notation : Far left is #'

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	14.713	21.341
Overall MINimum	0.616	1.049
D Only	5.833	8.504
+D+L	14.713	21.341
+D+Lr	6.449	9.553
+D+S	6.603	9.816
+D+0.750Lr+0.750L	12.955	18.918
+D+0.750L+0.750S	13.071	19.115
+0.60D	3.500	5.103
Lr Only	0.616	1.049
L Only	8.880	12.836
S Only	0.770	1.311

Steel Section Properties : W12x65

Depth	=	12.100 in	I xx	=	533.00 in^4	J	=	2.180 in^4
Web Thick	=	0.390 in	S xx	=	87.90 in^3	Cw	=	5,780.00 in^6
Flange Width	=	12.000 in	R xx	=	5.280 in			
Flange Thick	=	0.605 in	Zx	=	96.800 in^3			
Area	=	19.100 in^2	I yy	=	174.000 in^4			
Weight	=	65.000 plf	S yy	=	29.100 in^3	Wno	=	34.500 in^2
Kdesign	=	1.200 in	R yy	=	3.020 in	Sw	=	62.600 in^4
K1	=	1.000 in	Zy	=	44.100 in^3	Qf	=	20.200 in^3
rts	=	3.380 in				Qw	=	47.500 in^3
Ycg	=	6.050 in						

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

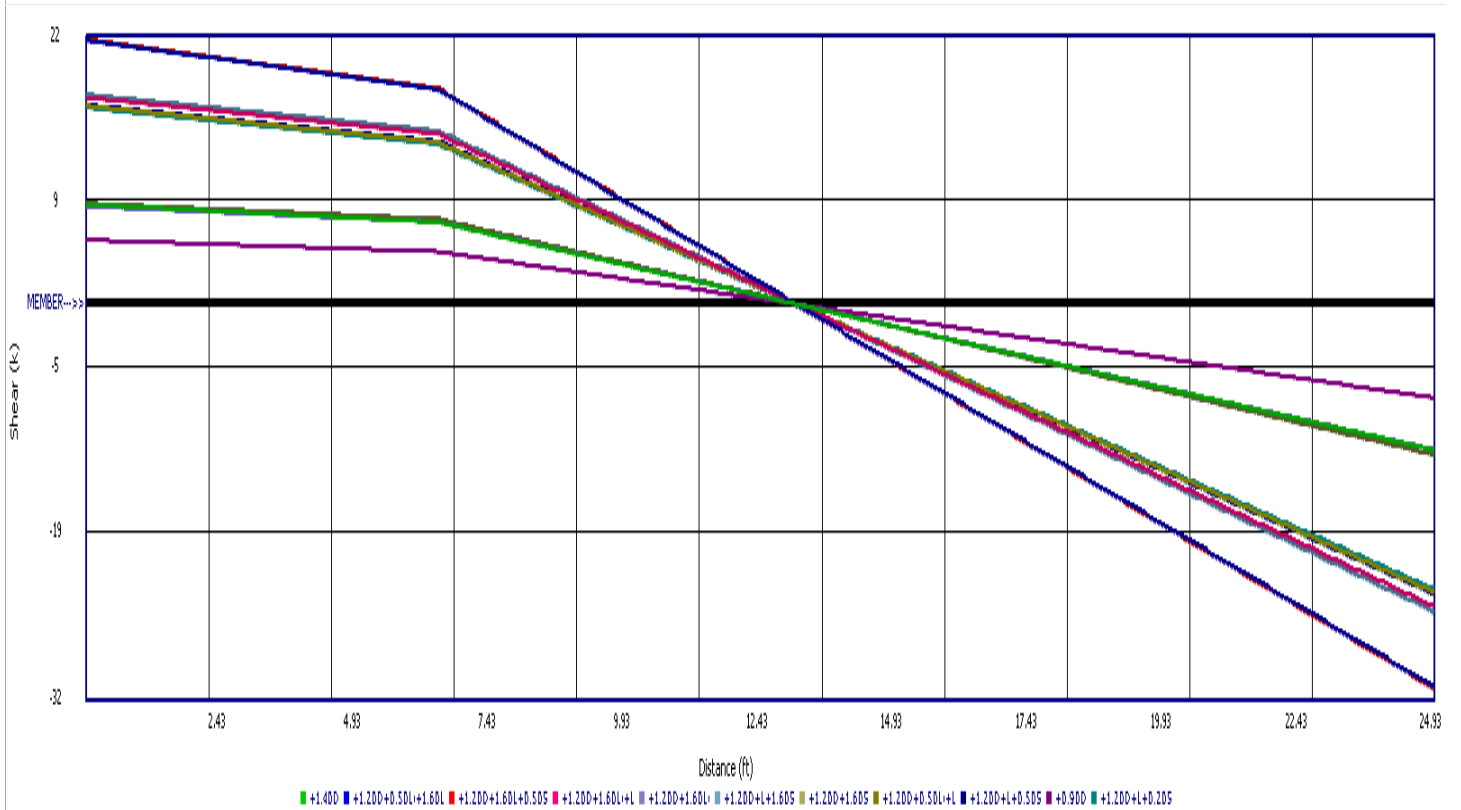
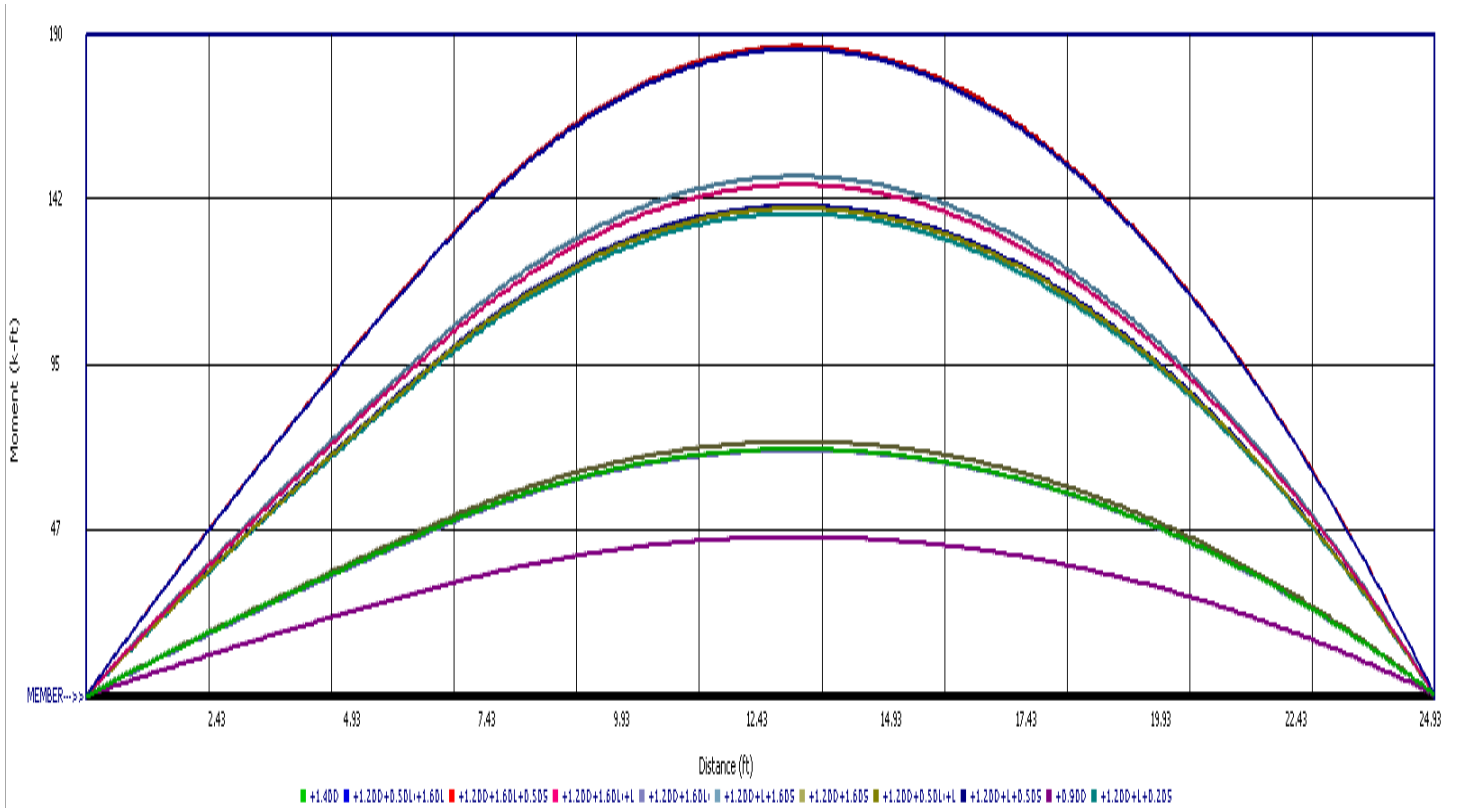
Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

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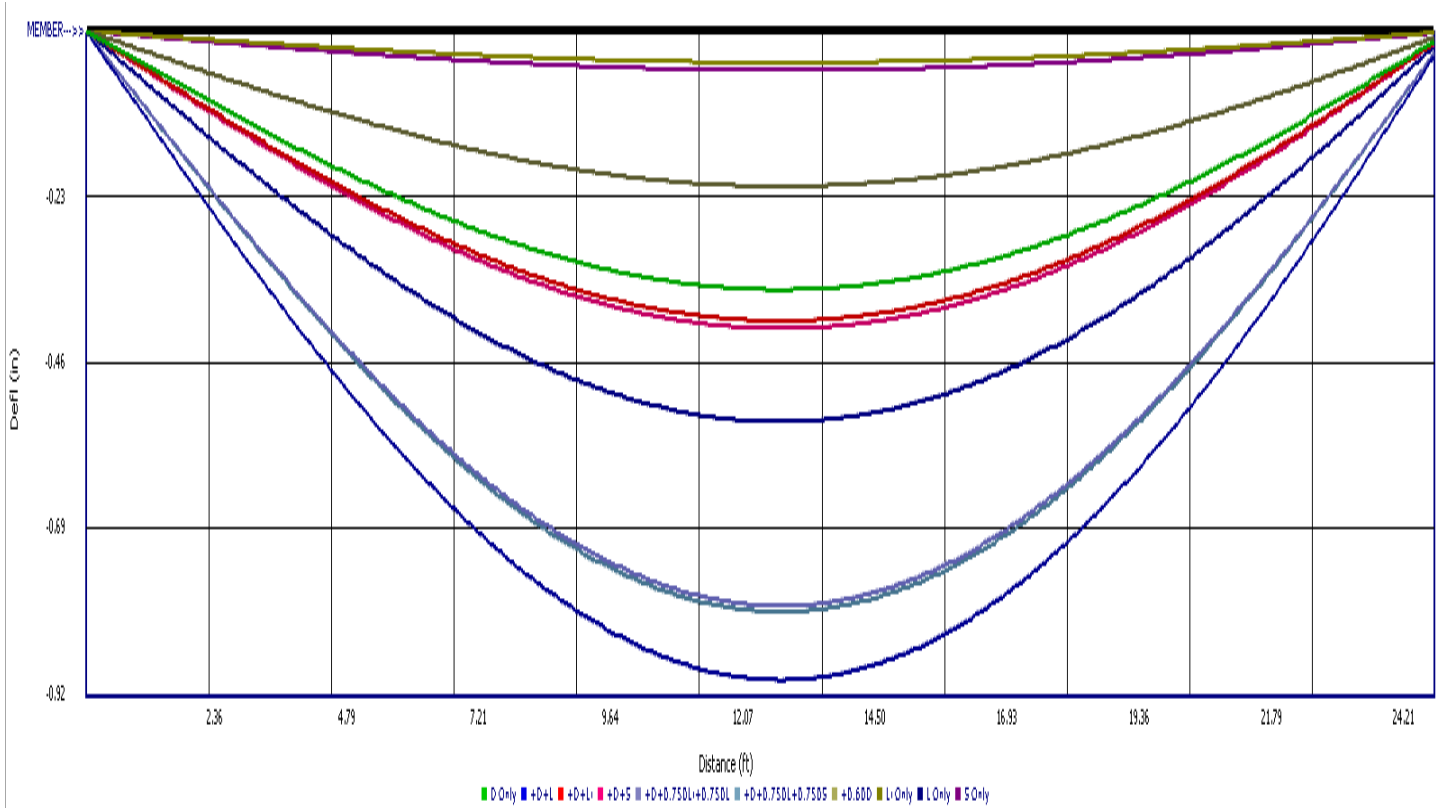
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DESCRIPTION: CD - Garage Exterior Beam - 25' span - Upruned



Steel Beam

DESCRIPTION: CD - Garage Exterior Beam - 25' span - Uprturned



Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+1.40D	0.00	Span 1	8.166	0.000
+1.40D	2.50	Span 1	7.597	19.704
+1.40D	5.00	Span 1	7.029	37.987
+1.40D	7.50	Span 1	5.682	54.459
+1.40D	10.00	Span 1	3.170	65.524
+1.40D	12.50	Span 1	0.657	70.307
+1.40D	15.00	Span 1	-1.856	68.809
+1.40D	17.50	Span 1	-4.368	61.029
+1.40D	20.00	Span 1	-6.881	46.968
+1.40D	22.50	Span 1	-9.394	26.625
+1.40D	25.00	Span 1	-11.906	0.000
+1.20D+0.50Lr+1.60L	0.00	Span 1	21.516	0.000
+1.20D+0.50Lr+1.60L	2.50	Span 1	19.988	51.880
+1.20D+0.50Lr+1.60L	5.00	Span 1	18.461	99.941
+1.20D+0.50Lr+1.60L	7.50	Span 1	14.906	143.169
+1.20D+0.50Lr+1.60L	10.00	Span 1	8.309	172.188
+1.20D+0.50Lr+1.60L	12.50	Span 1	1.713	184.716
+1.20D+0.50Lr+1.60L	15.00	Span 1	-4.883	180.754
+1.20D+0.50Lr+1.60L	17.50	Span 1	-11.479	160.301
+1.20D+0.50Lr+1.60L	20.00	Span 1	-18.075	123.358
+1.20D+0.50Lr+1.60L	22.50	Span 1	-24.672	69.924
+1.20D+0.50Lr+1.60L	25.00	Span 1	-31.268	0.000
+1.20D+1.60L+0.50S	0.00	Span 1	21.593	0.000
+1.20D+1.60L+0.50S	2.50	Span 1	20.065	52.072
+1.20D+1.60L+0.50S	5.00	Span 1	18.538	100.326
+1.20D+1.60L+0.50S	7.50	Span 1	14.971	143.741
+1.20D+1.60L+0.50S	10.00	Span 1	8.347	172.889
+1.20D+1.60L+0.50S	12.50	Span 1	1.723	185.476
+1.20D+1.60L+0.50S	15.00	Span 1	-4.902	181.502
+1.20D+1.60L+0.50S	17.50	Span 1	-11.526	160.968
+1.20D+1.60L+0.50S	20.00	Span 1	-18.150	123.873

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

(c) ENERCALC INC 1983-2022

DESCRIPTION: CD - Garage Exterior Beam - 25' span - Upturned

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+1.20D+1.60L+0.50S	22.50	Span 1	-24.775	70.217
+1.20D+1.60L+0.50S	25.00	Span 1	-31.399	0.000
+1.20D+1.60Lr+L	0.00	Span 1	16.865	0.000
+1.20D+1.60Lr+L	2.50	Span 1	15.728	40.741
+1.20D+1.60Lr+L	5.00	Span 1	14.590	78.639
+1.20D+1.60Lr+L	7.50	Span 1	11.820	112.876
+1.20D+1.60Lr+L	10.00	Span 1	6.600	135.900
+1.20D+1.60Lr+L	12.50	Span 1	1.380	145.875
+1.20D+1.60Lr+L	15.00	Span 1	-3.840	142.800
+1.20D+1.60Lr+L	17.50	Span 1	-9.060	126.675
+1.20D+1.60Lr+L	20.00	Span 1	-14.280	97.500
+1.20D+1.60Lr+L	22.50	Span 1	-19.500	55.275
+1.20D+1.60Lr+L	25.00	Span 1	-24.720	0.000
+1.20D+1.60Lr	0.00	Span 1	7.985	0.000
+1.20D+1.60Lr	2.50	Span 1	7.498	19.354
+1.20D+1.60Lr	5.00	Span 1	7.010	37.489
+1.20D+1.60Lr	7.50	Span 1	5.712	54.000
+1.20D+1.60Lr	10.00	Span 1	3.199	65.138
+1.20D+1.60Lr	12.50	Span 1	0.685	69.992
+1.20D+1.60Lr	15.00	Span 1	-1.829	68.562
+1.20D+1.60Lr	17.50	Span 1	-4.343	60.848
+1.20D+1.60Lr	20.00	Span 1	-6.856	46.850
+1.20D+1.60Lr	22.50	Span 1	-9.370	26.567
+1.20D+1.60Lr	25.00	Span 1	-11.884	0.000
+1.20D+L+1.60S	0.00	Span 1	17.112	0.000
+1.20D+L+1.60S	2.50	Span 1	15.974	41.357
+1.20D+L+1.60S	5.00	Span 1	14.837	79.871
+1.20D+L+1.60S	7.50	Span 1	12.030	114.706
+1.20D+L+1.60S	10.00	Span 1	6.720	138.144
+1.20D+L+1.60S	12.50	Span 1	1.410	148.307
+1.20D+L+1.60S	15.00	Span 1	-3.900	145.196
+1.20D+L+1.60S	17.50	Span 1	-9.210	128.809
+1.20D+L+1.60S	20.00	Span 1	-14.520	99.148
+1.20D+L+1.60S	22.50	Span 1	-19.830	56.211
+1.20D+L+1.60S	25.00	Span 1	-25.139	0.000
+1.20D+1.60S	0.00	Span 1	8.232	0.000
+1.20D+1.60S	2.50	Span 1	7.744	19.970
+1.20D+1.60S	5.00	Span 1	7.257	38.721
+1.20D+1.60S	7.50	Span 1	5.923	55.830
+1.20D+1.60S	10.00	Span 1	3.319	67.382
+1.20D+1.60S	12.50	Span 1	0.715	72.425
+1.20D+1.60S	15.00	Span 1	-1.888	70.958
+1.20D+1.60S	17.50	Span 1	-4.492	62.983
+1.20D+1.60S	20.00	Span 1	-7.096	48.498
+1.20D+1.60S	22.50	Span 1	-9.700	27.503
+1.20D+1.60S	25.00	Span 1	-12.303	0.000
+1.20D+0.50Lr+L	0.00	Span 1	16.188	0.000
+1.20D+0.50Lr+L	2.50	Span 1	15.050	39.047
+1.20D+0.50Lr+L	5.00	Span 1	13.913	75.250
+1.20D+0.50Lr+L	7.50	Span 1	11.241	107.843
+1.20D+0.50Lr+L	10.00	Span 1	6.269	129.730
+1.20D+0.50Lr+L	12.50	Span 1	1.296	139.186
+1.20D+0.50Lr+L	15.00	Span 1	-3.676	136.211
+1.20D+0.50Lr+L	17.50	Span 1	-8.649	120.805
+1.20D+0.50Lr+L	20.00	Span 1	-13.621	92.968
+1.20D+0.50Lr+L	22.50	Span 1	-18.594	52.700
+1.20D+0.50Lr+L	25.00	Span 1	-23.566	0.000
+1.20D+L+0.50S	0.00	Span 1	16.265	0.000
+1.20D+L+0.50S	2.50	Span 1	15.127	39.240
+1.20D+L+0.50S	5.00	Span 1	13.990	75.635
+1.20D+L+0.50S	7.50	Span 1	11.307	108.415
+1.20D+L+0.50S	10.00	Span 1	6.306	130.431

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

(c) ENERCALC INC 1983-2022

DESCRIPTION: CD - Garage Exterior Beam - 25' span - Upturned

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+1.20D+L+0.50S	12.50	Span 1	1.306	139.946
+1.20D+L+0.50S	15.00	Span 1	-3.695	136.960
+1.20D+L+0.50S	17.50	Span 1	-8.695	121.472
+1.20D+L+0.50S	20.00	Span 1	-13.696	93.483
+1.20D+L+0.50S	22.50	Span 1	-18.697	52.992
+1.20D+L+0.50S	25.00	Span 1	-23.697	0.000
+0.90D	0.00	Span 1	5.250	0.000
+0.90D	2.50	Span 1	4.884	12.667
+0.90D	5.00	Span 1	4.518	24.420
+0.90D	7.50	Span 1	3.653	35.009
+0.90D	10.00	Span 1	2.038	42.123
+0.90D	12.50	Span 1	0.422	45.198
+0.90D	15.00	Span 1	-1.193	44.234
+0.90D	17.50	Span 1	-2.808	39.233
+0.90D	20.00	Span 1	-4.423	30.194
+0.90D	22.50	Span 1	-6.039	17.116
+0.90D	25.00	Span 1	-7.654	0.000
+1.20D+L+0.20S	0.00	Span 1	16.034	0.000
+1.20D+L+0.20S	2.50	Span 1	14.896	38.662
+1.20D+L+0.20S	5.00	Span 1	13.759	74.480
+1.20D+L+0.20S	7.50	Span 1	11.110	106.699
+1.20D+L+0.20S	10.00	Span 1	6.193	128.328
+1.20D+L+0.20S	12.50	Span 1	1.277	137.666
+1.20D+L+0.20S	15.00	Span 1	-3.639	134.714
+1.20D+L+0.20S	17.50	Span 1	-8.555	119.471
+1.20D+L+0.20S	20.00	Span 1	-13.471	91.938
+1.20D+L+0.20S	22.50	Span 1	-18.388	52.114
+1.20D+L+0.20S	25.00	Span 1	-23.304	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	2.57	Span 1	0.280
Overall MAXimum Envelope	5.14	Span 1	0.533
Overall MAXimum Envelope	7.71	Span 1	0.735
Overall MAXimum Envelope	10.29	Span 1	0.864
Overall MAXimum Envelope	12.86	Span 1	0.907
Overall MAXimum Envelope	15.43	Span 1	0.856
Overall MAXimum Envelope	18.00	Span 1	0.716
Overall MAXimum Envelope	20.57	Span 1	0.498
Overall MAXimum Envelope	23.14	Span 1	0.225
Overall MAXimum Envelope	25.00	Span 1	0.008
D Only	0.00	Span 1	0.000
D Only	2.57	Span 1	0.111
D Only	5.14	Span 1	0.212
D Only	7.71	Span 1	0.293
D Only	10.29	Span 1	0.344
D Only	12.86	Span 1	0.361
D Only	15.43	Span 1	0.341
D Only	18.00	Span 1	0.285
D Only	20.57	Span 1	0.198
D Only	23.14	Span 1	0.089
D Only	25.00	Span 1	0.003
+D+L	0.00	Span 1	0.000
+D+L	2.57	Span 1	0.280
+D+L	5.14	Span 1	0.533
+D+L	7.71	Span 1	0.735
+D+L	10.29	Span 1	0.864
+D+L	12.86	Span 1	0.907
+D+L	15.43	Span 1	0.856
+D+L	18.00	Span 1	0.716

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage Exterior Beam - 25' span - Uprturned

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
+D+L	20.57	Span 1	0.498
+D+L	23.14	Span 1	0.225
+D+L	25.00	Span 1	0.008
+D+Lr	0.00	Span 1	0.000
+D+Lr	2.57	Span 1	0.125
+D+Lr	5.14	Span 1	0.237
+D+Lr	7.71	Span 1	0.328
+D+Lr	10.29	Span 1	0.385
+D+Lr	12.86	Span 1	0.404
+D+Lr	15.43	Span 1	0.382
+D+Lr	18.00	Span 1	0.320
+D+Lr	20.57	Span 1	0.223
+D+Lr	23.14	Span 1	0.100
+D+Lr	25.00	Span 1	0.004
+D+S	0.00	Span 1	0.000
+D+S	2.57	Span 1	0.128
+D+S	5.14	Span 1	0.244
+D+S	7.71	Span 1	0.336
+D+S	10.29	Span 1	0.396
+D+S	12.86	Span 1	0.415
+D+S	15.43	Span 1	0.392
+D+S	18.00	Span 1	0.328
+D+S	20.57	Span 1	0.229
+D+S	23.14	Span 1	0.103
+D+S	25.00	Span 1	0.004
+D+0.750Lr+0.750L	0.00	Span 1	0.000
+D+0.750Lr+0.750L	2.57	Span 1	0.248
+D+0.750Lr+0.750L	5.14	Span 1	0.472
+D+0.750Lr+0.750L	7.71	Span 1	0.651
+D+0.750Lr+0.750L	10.29	Span 1	0.765
+D+0.750Lr+0.750L	12.86	Span 1	0.803
+D+0.750Lr+0.750L	15.43	Span 1	0.758
+D+0.750Lr+0.750L	18.00	Span 1	0.634
+D+0.750Lr+0.750L	20.57	Span 1	0.441
+D+0.750Lr+0.750L	23.14	Span 1	0.199
+D+0.750Lr+0.750L	25.00	Span 1	0.007
+D+0.750L+0.750S	0.00	Span 1	0.000
+D+0.750L+0.750S	2.57	Span 1	0.250
+D+0.750L+0.750S	5.14	Span 1	0.477
+D+0.750L+0.750S	7.71	Span 1	0.657
+D+0.750L+0.750S	10.29	Span 1	0.773
+D+0.750L+0.750S	12.86	Span 1	0.811
+D+0.750L+0.750S	15.43	Span 1	0.766
+D+0.750L+0.750S	18.00	Span 1	0.640
+D+0.750L+0.750S	20.57	Span 1	0.446
+D+0.750L+0.750S	23.14	Span 1	0.201
+D+0.750L+0.750S	25.00	Span 1	0.007
+0.60D	0.00	Span 1	0.000
+0.60D	2.57	Span 1	0.067
+0.60D	5.14	Span 1	0.127
+0.60D	7.71	Span 1	0.176
+0.60D	10.29	Span 1	0.207
+0.60D	12.86	Span 1	0.217
+0.60D	15.43	Span 1	0.204
+0.60D	18.00	Span 1	0.171
+0.60D	20.57	Span 1	0.119
+0.60D	23.14	Span 1	0.054
+0.60D	25.00	Span 1	0.002
Lr Only	0.00	Span 1	0.000
Lr Only	2.57	Span 1	0.013

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage Exterior Beam - 25' span - Uprturned

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Lr Only	5.14	Span 1	0.025
Lr Only	7.71	Span 1	0.035
Lr Only	10.29	Span 1	0.041
Lr Only	12.86	Span 1	0.043
Lr Only	15.43	Span 1	0.041
Lr Only	18.00	Span 1	0.034
Lr Only	20.57	Span 1	0.024
Lr Only	23.14	Span 1	0.011
Lr Only	25.00	Span 1	0.000
L Only	0.00	Span 1	0.000
L Only	2.57	Span 1	0.168
L Only	5.14	Span 1	0.321
L Only	7.71	Span 1	0.443
L Only	10.29	Span 1	0.520
L Only	12.86	Span 1	0.546
L Only	15.43	Span 1	0.515
L Only	18.00	Span 1	0.431
L Only	20.57	Span 1	0.300
L Only	23.14	Span 1	0.135
L Only	25.00	Span 1	0.005
S Only	0.00	Span 1	0.000
S Only	2.57	Span 1	0.017
S Only	5.14	Span 1	0.032
S Only	7.71	Span 1	0.044
S Only	10.29	Span 1	0.052
S Only	12.86	Span 1	0.054
S Only	15.43	Span 1	0.051
S Only	18.00	Span 1	0.043
S Only	20.57	Span 1	0.030
S Only	23.14	Span 1	0.014
S Only	25.00	Span 1	0.000

INTERIOR BEAM - 12' SPAN

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPPF CONSULTING ENGINEERS SEA

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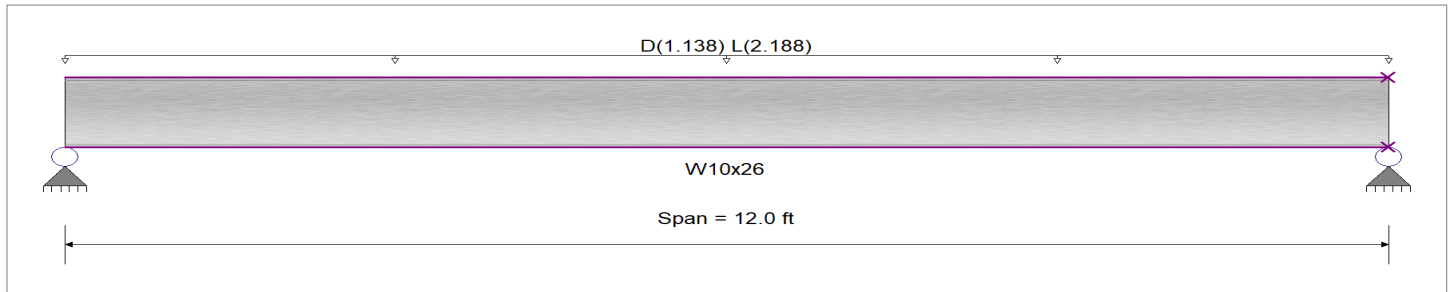
DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned

CODE REFERENCES

Calculations per AISC 360-16, IBC 2018, CBC 2019, ASCE 7-16
 Load Combination Set : ASCE 7-16

Material Properties

Analysis Method Load Resistance Factor Design	Fy : Steel Yield :	50.0 ksi
Beam Bracing : Beam is Fully Braced against lateral-torsional buckling	E: Modulus :	29,000.0 ksi
Bending Axis : Major Axis Bending		



Applied Loads

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

Beam self weight calculated and added to loading
 Load for Span Number 1

Uniform Load : D = 0.130, L = 0.250 ksf, Extent = 0.0 --> 12.0 ft, Tributary Width = 8.750 ft

DESIGN SUMMARY

Design OK

<p>Maximum Bending Stress Ratio = 0.751 : 1</p> <p>Section used for this span W10x26</p> <p>Mu : Applied 88.132 k-ft Mn * Phi : Allowable 117.375 k-ft</p> <p>Load Combination +1.20D+1.60L</p> <p>Span # where maximum occurs Span # 1</p> <p>Maximum Deflection</p> <p>Max Downward Transient Deflection 0.245 in Ratio = 586 >=360 Max Upward Transient Deflection 0.000 in Ratio = 0 <360 Max Downward Total Deflection 0.376 in Ratio = 383 >=240. Max Upward Total Deflection 0.000 in Ratio = 0 <240.0</p>	<p>Maximum Shear Stress Ratio = 0.366 : 1</p> <p>Section used for this span W10x26</p> <p>Vu : Applied 29.377 k Vn * Phi : Allowable 80.340 k</p> <p>Load Combination +1.20D+1.60L</p> <p>Location of maximum on span 0.000 ft</p> <p>Span # where maximum occurs Span # 1</p>
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Maximum Forces & Stresses for Load Combinations

Load Combination	Segment Length	Span #	Max Stress Ratios		Summary of Moment Values						Summary of Shear Values		
			M	V	max Mu +	max Mu -	Mu Max	Mnx	Phi*Mnx	Cb	Rm	VuMax	Vnx
+1.40D	Dsgn. L = 12.00 ft	1	0.250	0.122	29.32	29.32	130.42	117.38	1.00	1.00	9.77	80.34	80.34
+1.20D+1.60L	Dsgn. L = 12.00 ft	1	0.751	0.366	88.13	88.13	130.42	117.38	1.00	1.00	29.38	80.34	80.34
+1.20D+L	Dsgn. L = 12.00 ft	1	0.550	0.268	64.51	64.51	130.42	117.38	1.00	1.00	21.50	80.34	80.34
+1.20D	Dsgn. L = 12.00 ft	1	0.214	0.104	25.13	25.13	130.42	117.38	1.00	1.00	8.38	80.34	80.34
+0.90D	Dsgn. L = 12.00 ft	1	0.161	0.078	18.85	18.85	130.42	117.38	1.00	1.00	6.28	80.34	80.34

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+L	1	0.3761	6.034		0.0000	0.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl	Location in Span	Span	Max. Upward Defl	Location in Span
D Only	1	0.1306	6.034		0.0000	0.000
+D+L	1	0.3761	6.034		0.0000	0.000
+D+0.750L	1	0.3147	6.034		0.0000	0.000
+0.60D	1	0.0784	6.034		0.0000	0.000
L Only	1	0.2455	6.034		0.0000	0.000

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

(c) ENERCALC INC 1983-2022

DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned

Vertical Reactions

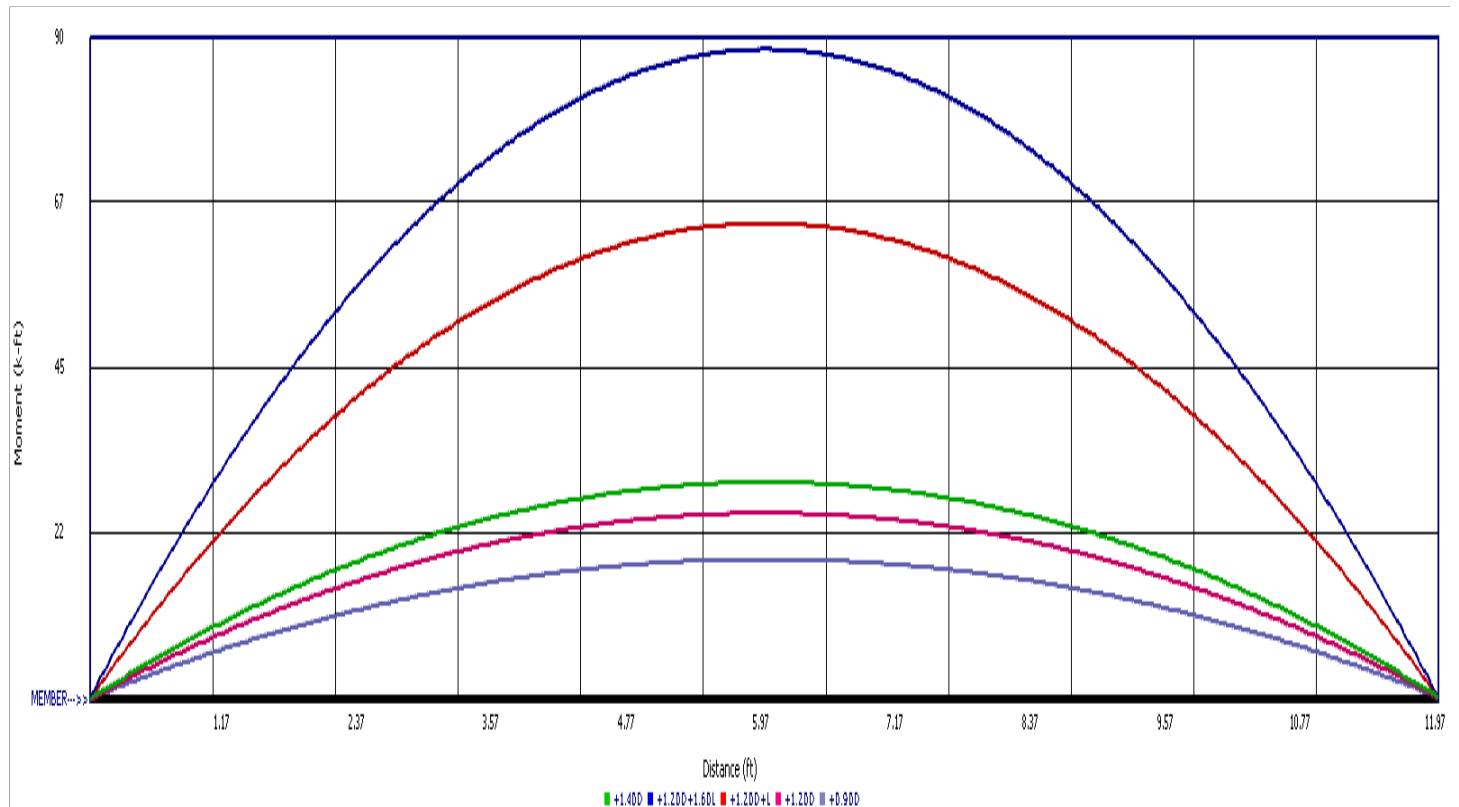
Support notation : Far left is #'

Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	20.106	20.106
Overall MINimum	4.189	4.189
D Only	6.981	6.981
+D+L	20.106	20.106
+D+0.750L	16.825	16.825
+0.60D	4.189	4.189
L Only	13.125	13.125

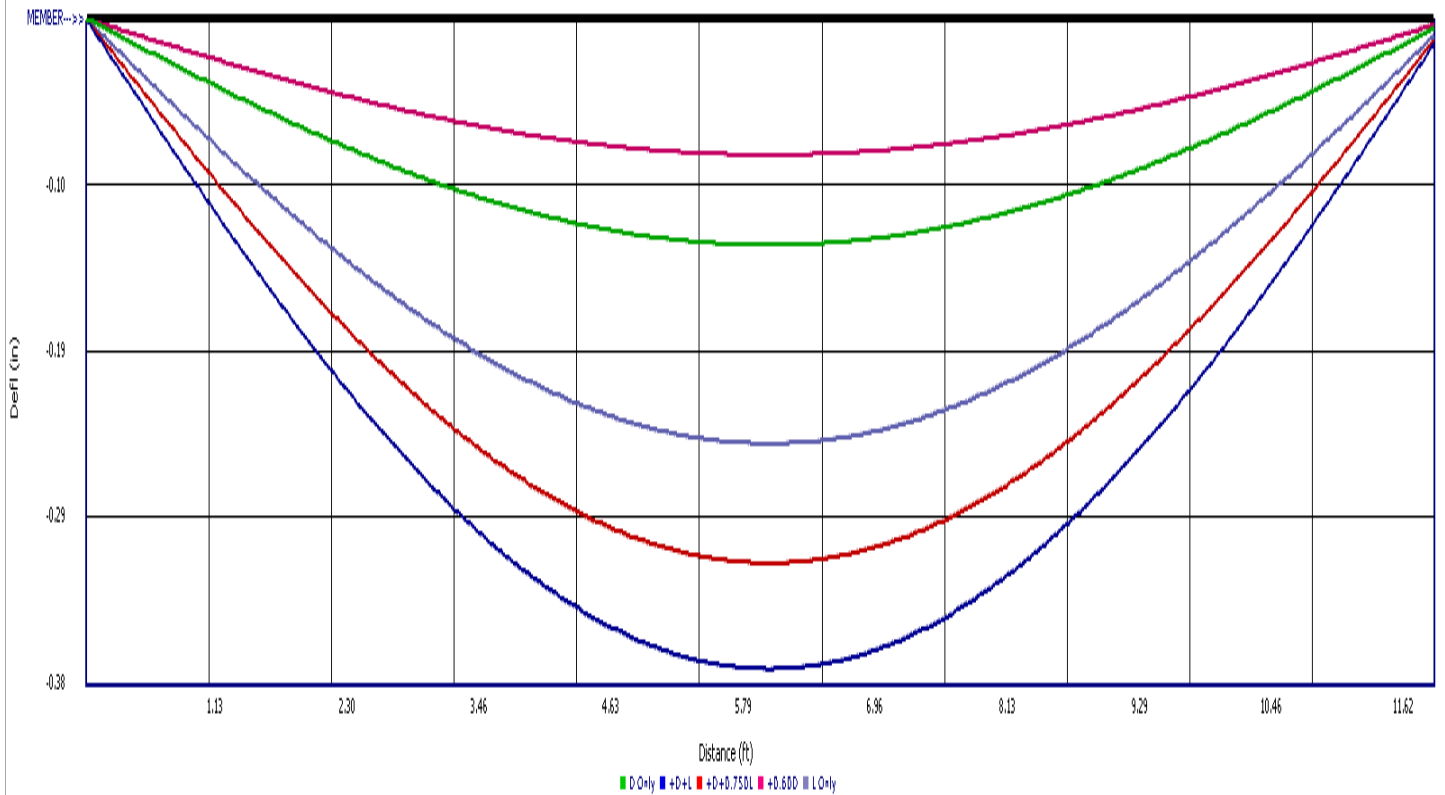
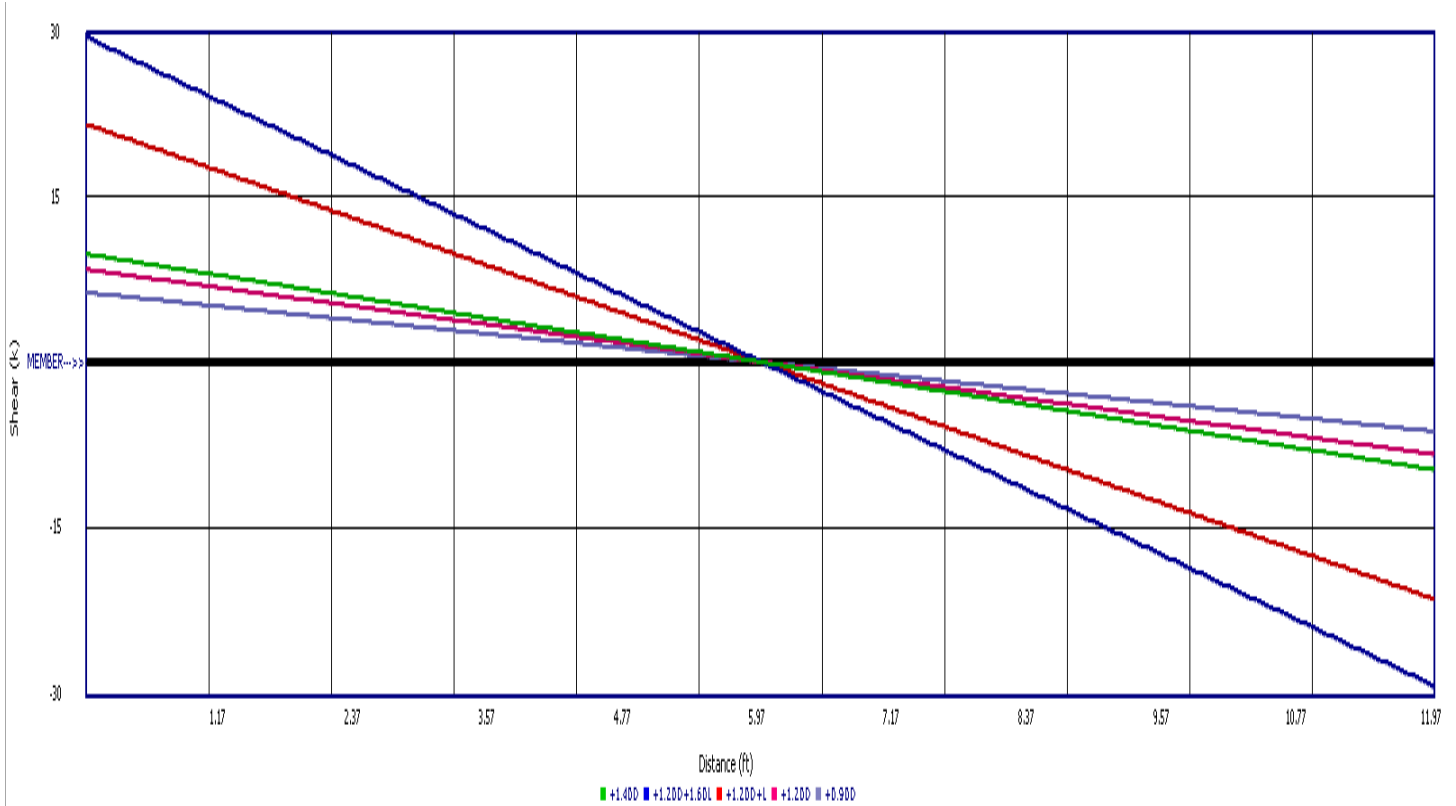
Steel Section Properties : W10x26

Depth	=	10.300 in	I xx	=	144.00 in ⁴	J	=	0.402 in ⁴
Web Thick	=	0.260 in	S xx	=	27.90 in ³	Cw	=	345.00 in ⁶
Flange Width	=	5.770 in	R xx	=	4.350 in			
Flange Thick	=	0.440 in	Zx	=	31.300 in ³			
Area	=	7.610 in ²	I yy	=	14.100 in ⁴	Wno	=	14.200 in ²
Weight	=	26.000 plf	S yy	=	4.890 in ³	Sw	=	9.030 in ⁴
Kdesign	=	0.740 in	R yy	=	1.360 in	Qf	=	5.980 in ³
K1	=	0.688 in	Zy	=	7.500 in ³	Qw	=	15.400 in ³
rts	=	1.580 in						
Ycg	=	5.150 in						



Steel Beam

DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned



Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+1.40D	0.00	Span 1	9.773	0.000

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

(c) ENERCALC INC 1983-2022

DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned

Beam Span Moments & Shears at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Shear (k)	Moment (ft-k)
+1.40D	1.20	Span 1	7.819	10.555
+1.40D	2.40	Span 1	5.864	18.765
+1.40D	3.60	Span 1	3.909	24.629
+1.40D	4.80	Span 1	1.955	28.147
+1.40D	6.00	Span 1	0.000	29.320
+1.40D	7.20	Span 1	-1.955	28.147
+1.40D	8.40	Span 1	-3.909	24.629
+1.40D	9.60	Span 1	-5.864	18.765
+1.40D	10.80	Span 1	-7.819	10.555
+1.40D	12.00	Span 1	-9.773	0.000
+1.20D+1.60L	0.00	Span 1	29.377	0.000
+1.20D+1.60L	1.20	Span 1	23.502	31.727
+1.20D+1.60L	2.40	Span 1	17.626	56.404
+1.20D+1.60L	3.60	Span 1	11.751	74.031
+1.20D+1.60L	4.80	Span 1	5.875	84.606
+1.20D+1.60L	6.00	Span 1	0.000	88.132
+1.20D+1.60L	7.20	Span 1	-5.875	84.606
+1.20D+1.60L	8.40	Span 1	-11.751	74.031
+1.20D+1.60L	9.60	Span 1	-17.626	56.404
+1.20D+1.60L	10.80	Span 1	-23.502	31.727
+1.20D+1.60L	12.00	Span 1	-29.377	0.000
+1.20D+L	0.00	Span 1	21.502	0.000
+1.20D+L	1.20	Span 1	17.202	23.222
+1.20D+L	2.40	Span 1	12.901	41.284
+1.20D+L	3.60	Span 1	8.601	54.186
+1.20D+L	4.80	Span 1	4.300	61.926
+1.20D+L	6.00	Span 1	0.000	64.507
+1.20D+L	7.20	Span 1	-4.300	61.926
+1.20D+L	8.40	Span 1	-8.601	54.186
+1.20D+L	9.60	Span 1	-12.901	41.284
+1.20D+L	10.80	Span 1	-17.202	23.222
+1.20D+L	12.00	Span 1	-21.502	0.000
+1.20D	0.00	Span 1	8.377	0.000
+1.20D	1.20	Span 1	6.702	9.047
+1.20D	2.40	Span 1	5.026	16.084
+1.20D	3.60	Span 1	3.351	21.111
+1.20D	4.80	Span 1	1.675	24.126
+1.20D	6.00	Span 1	0.000	25.132
+1.20D	7.20	Span 1	-1.675	24.126
+1.20D	8.40	Span 1	-3.351	21.111
+1.20D	9.60	Span 1	-5.026	16.084
+1.20D	10.80	Span 1	-6.702	9.047
+1.20D	12.00	Span 1	-8.377	0.000
+0.90D	0.00	Span 1	6.283	0.000
+0.90D	1.20	Span 1	5.026	6.786
+0.90D	2.40	Span 1	3.770	12.063
+0.90D	3.60	Span 1	2.513	15.833
+0.90D	4.80	Span 1	1.257	18.095
+0.90D	6.00	Span 1	0.000	18.849
+0.90D	7.20	Span 1	-1.257	18.095
+0.90D	8.40	Span 1	-2.513	15.833
+0.90D	9.60	Span 1	-3.770	12.063
+0.90D	10.80	Span 1	-5.026	6.786
+0.90D	12.00	Span 1	-6.283	0.000

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	0.00	Span 1	0.000
Overall MAXimum Envelope	1.23	Span 1	0.121
Overall MAXimum Envelope	2.47	Span 1	0.228
Overall MAXimum Envelope	3.70	Span 1	0.311
Overall MAXimum Envelope	4.94	Span 1	0.362

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
Overall MAXimum Envelope	6.17	Span 1	0.376
Overall MAXimum Envelope	7.41	Span 1	0.352
Overall MAXimum Envelope	8.64	Span 1	0.293
Overall MAXimum Envelope	9.87	Span 1	0.203
Overall MAXimum Envelope	11.11	Span 1	0.091
Overall MAXimum Envelope	12.00	Span 1	0.003
D Only	0.00	Span 1	0.000
D Only	1.23	Span 1	0.042
D Only	2.47	Span 1	0.079
D Only	3.70	Span 1	0.108
D Only	4.94	Span 1	0.126
D Only	6.17	Span 1	0.130
D Only	7.41	Span 1	0.122
D Only	8.64	Span 1	0.102
D Only	9.87	Span 1	0.071
D Only	11.11	Span 1	0.032
D Only	12.00	Span 1	0.001
+D+L	0.00	Span 1	0.000
+D+L	1.23	Span 1	0.121
+D+L	2.47	Span 1	0.228
+D+L	3.70	Span 1	0.311
+D+L	4.94	Span 1	0.362
+D+L	6.17	Span 1	0.376
+D+L	7.41	Span 1	0.352
+D+L	8.64	Span 1	0.293
+D+L	9.87	Span 1	0.203
+D+L	11.11	Span 1	0.091
+D+L	12.00	Span 1	0.003
+D+0.750L	0.00	Span 1	0.000
+D+0.750L	1.23	Span 1	0.101
+D+0.750L	2.47	Span 1	0.191
+D+0.750L	3.70	Span 1	0.260
+D+0.750L	4.94	Span 1	0.303
+D+0.750L	6.17	Span 1	0.314
+D+0.750L	7.41	Span 1	0.295
+D+0.750L	8.64	Span 1	0.245
+D+0.750L	9.87	Span 1	0.170
+D+0.750L	11.11	Span 1	0.077
+D+0.750L	12.00	Span 1	0.003
+0.60D	0.00	Span 1	0.000
+0.60D	1.23	Span 1	0.025
+0.60D	2.47	Span 1	0.048
+0.60D	3.70	Span 1	0.065
+0.60D	4.94	Span 1	0.075
+0.60D	6.17	Span 1	0.078
+0.60D	7.41	Span 1	0.073
+0.60D	8.64	Span 1	0.061
+0.60D	9.87	Span 1	0.042
+0.60D	11.11	Span 1	0.019
+0.60D	12.00	Span 1	0.001
L Only	0.00	Span 1	0.000
L Only	1.23	Span 1	0.079
L Only	2.47	Span 1	0.149
L Only	3.70	Span 1	0.203
L Only	4.94	Span 1	0.236
L Only	6.17	Span 1	0.245
L Only	7.41	Span 1	0.230
L Only	8.64	Span 1	0.191
L Only	9.87	Span 1	0.133
L Only	11.11	Span 1	0.060

Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

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DESCRIPTION: CD - Garage Interior Beam - 12' span - Upturned

Beam Span Deflections at Incremental Locations

Load Type/ Combination	Span Location (ft)	Span ID	Deflection (in)
L Only	12.00	Span 1	0.002

Project Title:
 Engineer:
 Project ID:
 Project Descr:

Steel Column

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage worst case column

Extreme Reactions

Item	Extreme Value	Axial Reaction	X-X Axis Reaction		k	Y-Y Axis Reaction		Mx - End Moments		k-ft	My - End Moments	
		@ Base	@ Base	@ Top		@ Base	@ Top	@ Base	@ Top		@ Base	@ Top
"	Minimum	12.777										
Reaction, X-X Axis Base	Maximum	21.295										
"	Minimum	21.295										
Reaction, Y-Y Axis Base	Maximum	21.295										
"	Minimum	21.295										
Reaction, X-X Axis Top	Maximum	21.295										
"	Minimum	21.295										
Reaction, Y-Y Axis Top	Maximum	21.295										
"	Minimum	21.295										
Moment, X-X Axis Base	Maximum	21.295										
"	Minimum	21.295										
Moment, Y-Y Axis Base	Maximum	21.295										
"	Minimum	21.295										
Moment, X-X Axis Top	Maximum	21.295										
"	Minimum	21.295										
Moment, Y-Y Axis Top	Maximum	21.295										
"	Minimum	21.295										

Maximum Deflections for Load Combinations

Load Combination	Max. X-X Deflection	Distance	Max. Y-Y Deflection	Distance
D Only	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+D+0.750L	0.0000 in	0.000 ft	0.000 in	0.000 ft
+0.60D	0.0000 in	0.000 ft	0.000 in	0.000 ft
L Only	0.0000 in	0.000 ft	0.000 in	0.000 ft

Steel Section Properties : HSS5x5x3/8

Depth	=	5.000 in	I xx	=	21.70 in^4	J	=	36.100 in^4
Design Thick	=	0.349 in	S xx	=	8.68 in^3			
Width	=	5.000 in	R xx	=	1.870 in			
Wall Thick	=	0.375 in	Zx	=	10.600 in^3			
Area	=	6.180 in^2	I yy	=	21.700 in^4	C	=	14.900 in^3
Weight	=	22.370 plf	S yy	=	8.680 in^3			
			R yy	=	1.870 in			
Ycg	=	0.000 in						

Steel Column

Project File: Fused Elements Calcs.ec6

LIC# : KW-06018139, Build:20.22.6.4

KPFF CONSULTING ENGINEERS SEA

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DESCRIPTION: CD - Garage worst case column

Sketches

