RB Engineers, Inc.

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JOB: ARTOUSH
PROJECT #: 25-9848
BY: R.B. / MJT
DATE: 09/19/2025

STRUCTURAL COMPUTATIONS FOR

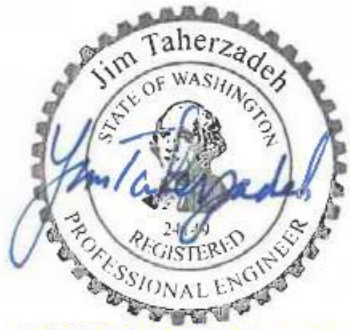
3427 72ND PL. SE.
MERCER ISLAND, WA

BASIS FOR DESIGN:

CODE: INTERNATIONAL BUILDING CODE (2021 EDITION)
WIND: 110 MPH, EXPOSURE "C" Kzt = 1.60
SEISMIC: Ss = 1.60, S1 = 0.57 (SITE CLASS D)
ROOF SNOW: 25 PSF
ALLOWABLE SOIL BEARING PRESSURE: 1500 PSF (ASSUMED)

INDEX TO COMPUTATIONS:

RB ENGINEERS, INC. IS NOT RESPONSIBLE FOR THE SITE, SOILS, WEATHER PROOFING, TRUSSES AND/OR EXISTING CONDITIONS.



EXPIRES FEB 2026

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Project:	Mercer Island	By:	RB/MJT
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LOADING CRITERIA FOR HIGH ROOF AND/OR CEILING

- Main Roof Area
- Canopy or Mansard Roof
- Ceiling Only
- Other

Item	Material	Load PSF
Roofing	Composition	2.2
Sheathing or Deckin	15/32 CDX	1.5
Insulation		2.8
Ceiling	5/8 GWB	2.6
Fixtures		1.0
Framing	Truss	2.3
Misc.		0.6
Misc./Photovoltaic		4.0

TOTAL DEAD LOAD = 17 PSF

Sprinkler (Only If A>4000 sqft)	2

LIVE LOADS

- Snow Load - 25 psf - non reducible
- Ceiling Only - 10 psf
- Increase in Fb and Fv of 15% allowed for duration of load

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LOADING CRITERIA FOR FLOOR/ LOW ROOF

Item	Material	Load PSF
Floor Covering	Carpet and Pad	3.0
Floor Sheathing	3/4" T&G CDX	2.3
Ceiling	1/2" GWB	2.2
Fixtures		1.0
Framing	TJI's	3.0
Misc		2.5

TOTAL DEAD LOAD = 14 PSF

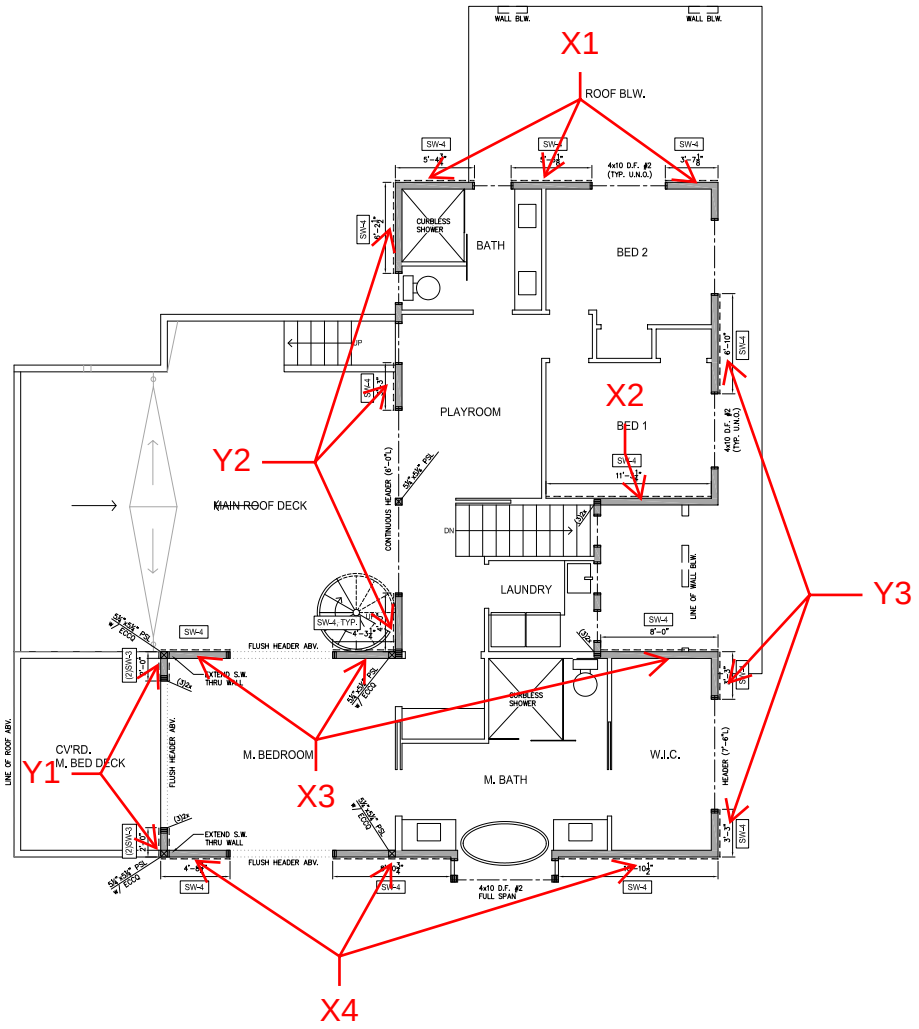
Sprinkler (Only If A>4000 sqft)	2

LIVE LOADS

- Residential - 40 psf (reducible)
- Office - 50 psf (reducible)
- Assembly - 100 psf (non-reducible)
- Corridors and Exits - 100 psf (reducible)
- Storage - 125 psf (non-reducible)
- Deck - 60 psf (non-reducible)

SHEAR WALL KEY PLAN

L1/



IMPORTANT NOTES:
SEE ARCHITECTURAL PLANS FOR ALL DIMENSIONS & VERIFY WITH STRUCTURAL PLANS

SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

– DENOTES POINT LOAD FROM ABV.
– DENOTES BEARING WALL (EXTERIOR BEARING WALLS ASSUMED)

FLOOR PLAN CONSTRUCTION NOTES:
ALL HEADERS SHALL BE 4x10 D.F. #2 (U.N.O.)

ALL HEADER SPANS 4'-0" OR LESS:
USE (1)2x H.F. #2 TRIMMER EACH END (U.N.O.)

ALL HEADER SPANS GREATER THAN 4'-0":
USE (2)2x H.F. #2 TRIMMERS EACH END (U.N.O.)

USE (2)2x H.F. #2 STUDS @ ALL BEAMS (U.N.O.)

SEE ENGINEERING 'S' SHEETS FOR SHEARWALL SCHEDULE

SEE ALSO ARCHITECTURAL PLANS

upper floor plan
SCALE: 1/4" = 1'-0"

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Project: 3427 72nd Pl SE, Mercer Island, 98040
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Drawn By:
Date: 9.10.2025
Rev.:

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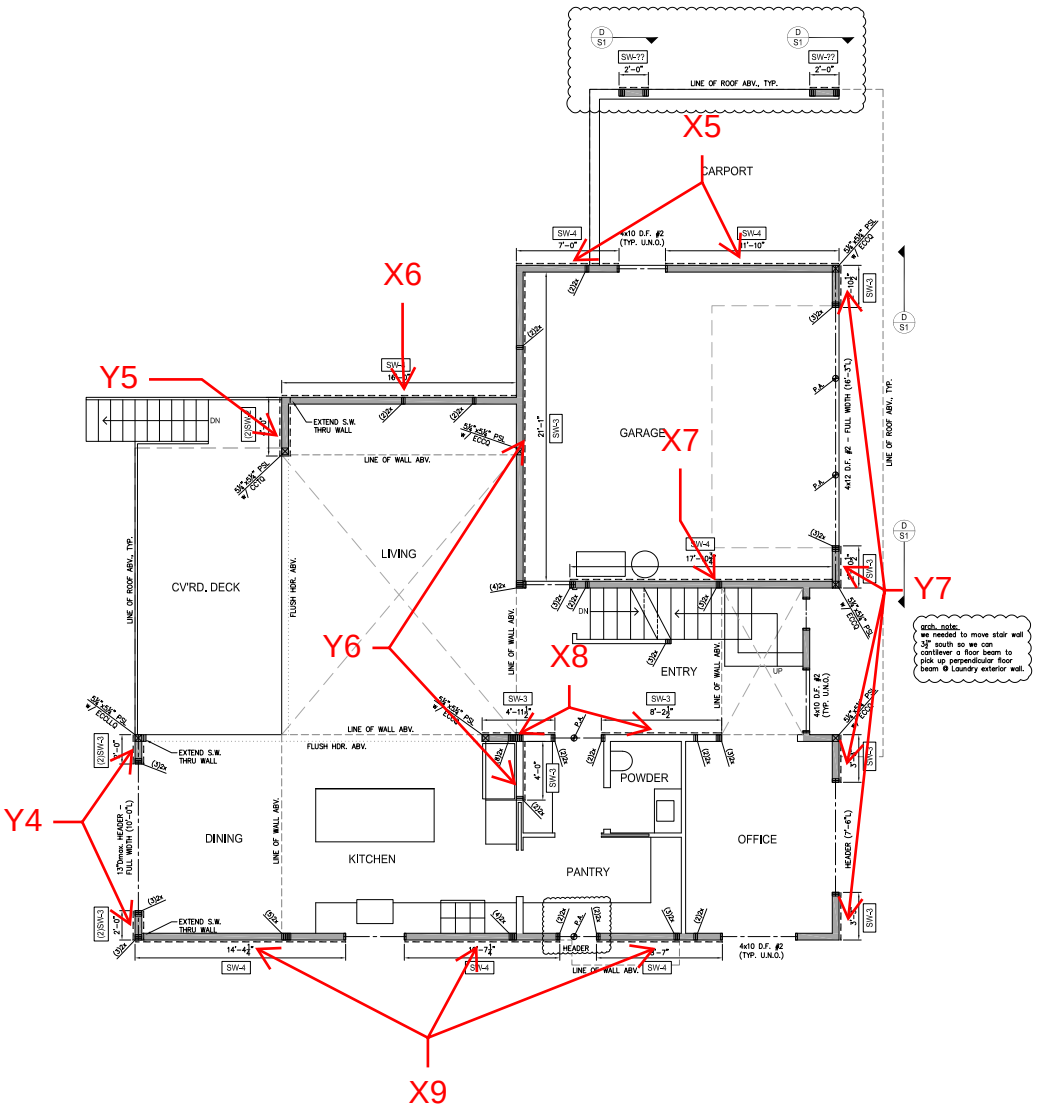
12" x 18" PLOT = 1/2 SCALE

SHEAR WALL KEY PLAN

L2/



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SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

p.p. – DENOTES POINT LOAD FROM ABV.

– DENOTES BEARING WALL (EXTERIOR BEARING WALLS ASSUMED)

FLOOR PLAN CONSTRUCTION NOTES:
ALL HEADERS SHALL BE 4x10 D.F. #2 (U.N.O.)

USE (2)2x H.F. #2 TRIMMERS @ ALL HEADERS (U.N.O.)

USE (2)2x H.F. #2 STUDS @ ALL BEAMS (U.N.O.)

SEE ENGINEERING 'S' SHEETS FOR SHEARWALL SCHEDULE

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main floor plan

SCALE: 1/4" = 1'-0"

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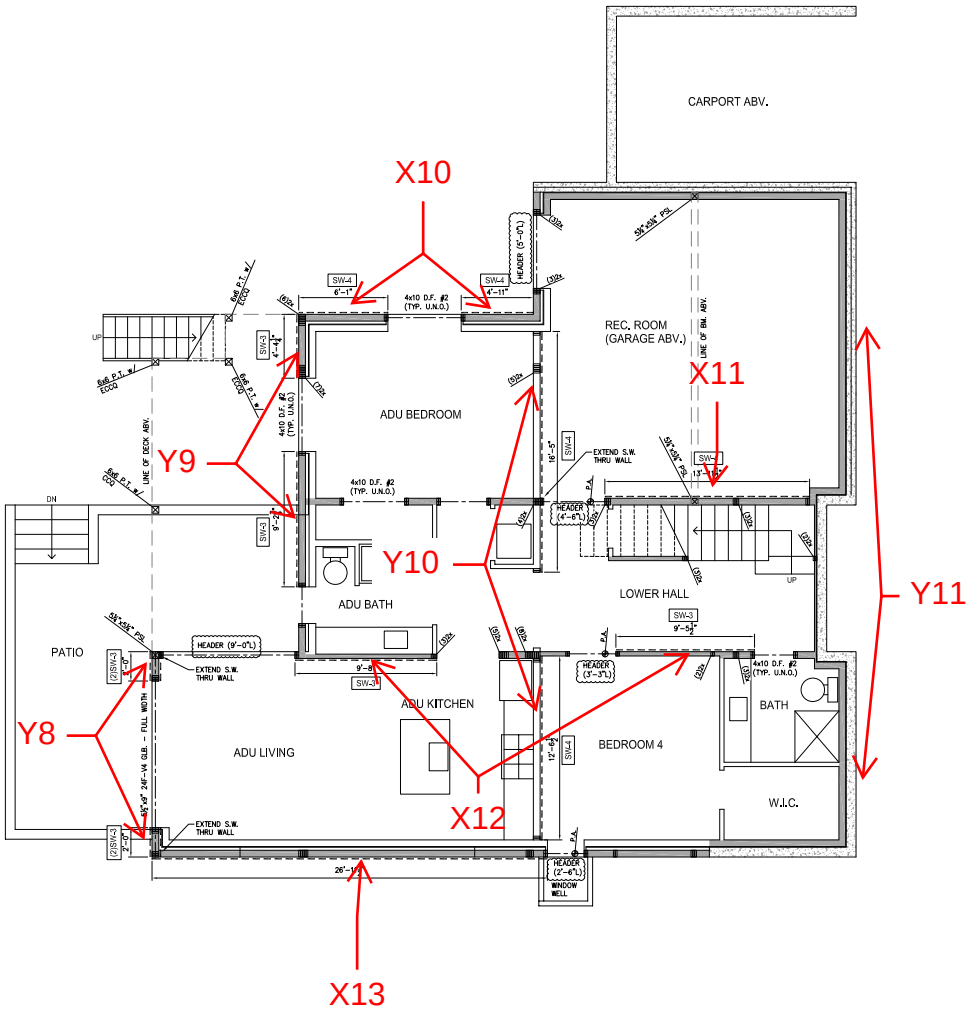
12" x18" PLOT = 1/2 SCALE

SHEAR WALL KEY PLAN

L3/



basement floor plan

SCALE: 1/4" = 1'-0"

IMPORTANT NOTES:
SEE ARCHITECTURAL PLANS FOR ALL DIMENSIONS & VERIFY WITH STRUCTURAL PLANS

SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

X" – DENOTES POINT LOAD FROM ABV.

– DENOTES BEARING WALL (EXTERIOR BEARING WALLS ASSUMED)

FLOOR PLAN CONSTRUCTION NOTES:
ALL HEADERS SHALL BE 4x10 D.F. #2 (U.N.O.)

USE (2)2x H.F. #2 TRIMMERS @ ALL HEADERS (U.N.O.)

USE (2)2x H.F. #2 STUDS @ ALL BEAMS (U.N.O.)

SEE ENGINEERING 'S' SHEETS FOR SHEARWALL SCHEDULE

SEE ALSO ARCHITECTURAL PLANS

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Rev.:

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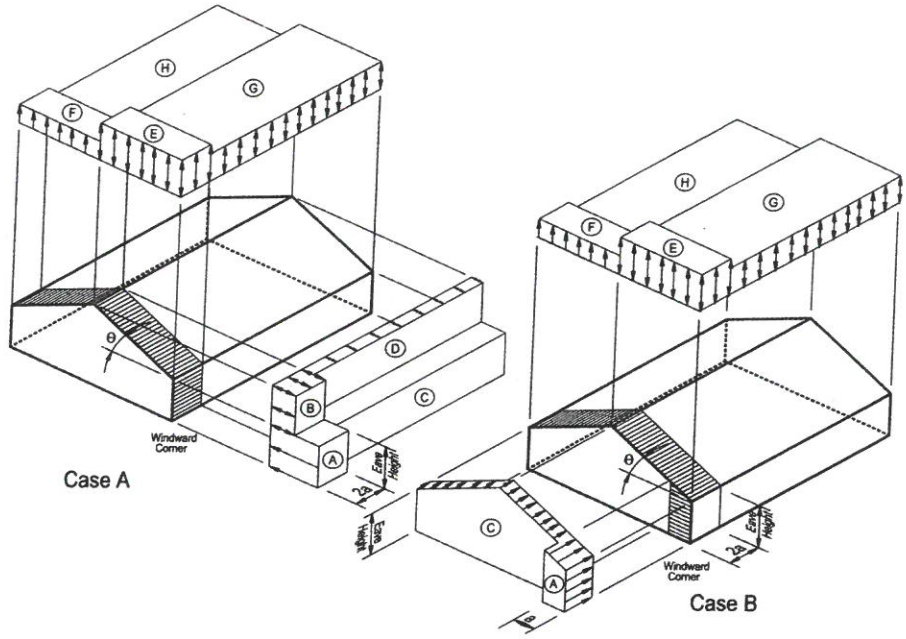
12"x18" PLOT = 1/2 SCALE

L4/

Diagrams



Notation

a 10% of least horizontal dimension or $0.4h$, whichever is smaller, but not less than either 4% of least horizontal dimension or 3 ft (0.9 m).
EXCEPTION: For buildings with $\theta = 0$ to 7° and a least horizontal dimension greater than 300 ft (90 m), dimension a shall be limited to a maximum of $0.8h$.

h Mean roof height, in ft (m), except that eave height shall be used for roof angles < 10°.

θ Angle of plane of roof from horizontal, in degrees.

Notes

1. Pressures shown are applied to the horizontal and vertical projections, for Exposure B, at $h = 30$ ft ($h = 9.1$ m). Adjust to other exposures and heights with adjustment factor λ.
2. The load patterns shown shall be applied to each corner of the building in turn as the reference corner (See Fig. 28.3-1).
3. For Case B, use $\theta = 0°$.
4. Load cases 1 and 2 must be checked for $25° < \theta \leq 45°$. Load case 2 at 25° is provided only for interpolation between 25° and 30°.
5. Plus and minus signs signify pressures acting toward and away from the projected surfaces, respectively.
6. For roof slopes other than those shown, linear interpolation is permitted.
7. The total horizontal load shall not be less than that determined by assuming $p_s = 0$ in Zones B and D.
8. Where Zone E or G falls on a roof overhang on the windward side of the building, use E_{OH} and G_{OH} for the pressure on the horizontal projection of the overhang. Overhangs on the leeward and side edges shall have the basic zone pressure applied.
9. Unit conversions for tables:

Adjustment Factor for Building Height and Exposure, λ

Mean roof height (ft)	Exposure B	Exposure C	Exposure D
15	1.00	1.21	1.47
20	1.00	1.29	1.55
25	1.00	1.35	1.61
30	1.00	1.40	1.66
35	1.05	1.45	1.70
40	1.09	1.49	1.74
45	1.12	1.53	1.78
50	1.16	1.56	1.81
55	1.19	1.59	1.84
60	1.22	1.62	1.87

Note: Unit conversions for tables: 1.0 ft = 0.3048 m; 1.0 lb/ft^2 = 0.0479 kN/m^2; 1 mph = 1.6 km/h

FIGURE 28.5-1 Main Wind Force Resisting System, Part 2 [$h \leq 60$ ft ($h \leq 18.3$ m)]: Design Wind Pressures for Enclosed Buildings—Walls and Roofs

continues

Simplified Design Wind Pressure, P_{s30} (psf) for Exposure B at h = 30 ft (h = 9.1 m)

Basic Wind Speed (mph)	Roof Angle (degrees)	Load Case	Zones									
			Horizontal Pressures				Vertical Pressures				Overhangs	
			A	B	C	D	E	F	G	H	E_{OH}	G_{OH}
105	0 to 5°	1	17.5	–9.1	11.6	–5.4	–21.0	–11.9	–14.6	–9.2	–29.4	–23.0
	10°	1	19.7	–8.2	13.1	–4.8	–21.0	–12.8	–14.6	–9.9	–29.4	–23.0
	15°	1	22.0	–7.3	14.6	–4.1	–21.0	–13.7	–14.6	–10.5	–29.4	–23.0
	20°	1	24.2	–6.4	16.1	–3.5	–21.0	–14.6	–14.6	–11.1	–29.4	–23.0
	25°	1	21.9	3.5	15.9	3.6	–9.7	–13.3	–7.1	–10.7	–18.2	–15.5
		2	—	—	—	—	–3.7	–7.2	–1.0	–4.6	—	—
	30 to 45	1	19.7	13.4	15.6	10.8	1.5	–11.9	0.5	–10.3	–6.9	–7.9
		2	19.7	13.4	15.6	10.8	7.6	–5.9	6.6	–4.2	–6.9	–7.9
110	0 to 5°	1	19.2	–10.0	12.7	–5.9	–23.1	–13.1	–16.0	–10.1	–32.3	–25.3
	10°	1	21.6	–9.0	14.4	–5.2	–23.1	–14.1	–16.0	–10.8	–32.3	–25.3
	15°	1	24.1	–8.0	16.0	–4.6	–23.1	–15.1	–16.0	–11.5	–32.3	–25.3
	20°	1	26.6	–7.0	17.7	–3.9	–23.1	–16.0	–16.0	–12.2	–32.3	–25.3
	25°	1	24.1	3.9	17.4	4.0	–10.7	–14.6	–7.7	–11.7	–19.9	–17.0
		2	—	—	—	—	–4.1	–7.9	–1.1	–5.1	—	—
	30 to 45	1	21.6	14.8	17.2	11.8	1.7	–13.1	0.6	–11.3	–7.6	–8.7
		2	21.6	14.8	17.2	11.8	8.3	–6.5	7.2	–4.6	–7.6	–8.7
115	0 to 5°	1	21.0	–10.9	13.9	–6.5	–25.2	–14.3	–17.5	–11.1	–35.3	–27.6
	10°	1	23.7	–9.8	15.7	–5.7	–25.2	–15.4	–17.5	–11.8	–35.3	–27.6
	15°	1	26.3	–8.7	17.5	–5.0	–25.2	–16.5	–17.5	–12.6	–35.3	–27.6
	20°	1	29.0	–7.7	19.4	–4.2	–25.2	–17.5	–17.5	–13.3	–35.3	–27.6
	25°	1	26.3	4.2	19.1	4.3	–11.7	–15.9	–8.5	–12.8	–21.8	–18.5
		2	—	—	—	—	–4.4	–8.7	–1.2	–5.5	—	—
	30 to 45	1	23.6	16.1	18.8	12.9	1.8	–14.3	0.6	–12.3	–8.3	–9.5
		2	23.6	16.1	18.8	12.9	9.1	–7.1	7.9	–5.0	–8.3	–9.5
120	0 to 5°	1	22.8	–11.9	15.1	–7.0	–27.4	–15.6	–19.1	–12.1	–38.4	–30.1
	10°	1	25.8	–10.7	17.1	–6.2	–27.4	–16.8	–19.1	–12.9	–38.4	–30.1
	15°	1	28.7	–9.5	19.1	–5.4	–27.4	–17.9	–19.1	–13.7	–38.4	–30.1
	20°	1	31.6	–8.3	21.1	–4.6	–27.4	–19.1	–19.1	–14.5	–38.4	–30.1
	25°	1	28.6	4.6	20.7	4.7	–12.7	–17.3	–9.2	–13.9	–23.7	–20.2
		2	—	—	—	—	–4.8	–9.4	–1.3	–6.0	—	—
	30 to 45	1	25.7	17.6	20.4	14.0	2.0	–15.6	0.7	–13.4	–9.0	–10.3
		2	25.7	17.6	20.4	14.0	9.9	–7.7	8.6	–5.5	–9.0	–10.3
125	0 to 5°	1	24.8	–12.9	16.4	–7.6	–29.8	–16.9	–20.7	–13.1	–41.7	–32.6
	10°	1	27.9	–11.6	18.6	–6.7	–29.8	–18.2	–20.7	–14.0	–41.7	–32.6
	15°	1	31.1	–10.3	20.7	–5.9	–29.8	–19.5	–20.7	–14.8	–41.7	–32.6
	20°	1	34.3	–9.1	22.9	–5.0	–29.8	–20.7	–20.7	–15.7	–41.7	–32.6
	25°	1	31.1	5.0	22.5	5.1	–13.8	–18.8	–10.0	–15.1	–25.7	–21.9
		2	—	—	—	—	–5.2	–10.2	–1.4	–6.6	—	—
	30 to 45	1	27.9	19.1	22.2	15.2	2.1	–16.9	0.7	–14.5	–9.8	–11.2
		2	27.9	19.1	22.2	15.2	10.7	–8.3	9.3	–6.0	–9.8	–11.2

FIGURE 28.5-1 (*Continued*). Main Wind Force Resisting System, Part 2 [$h \leq 60$ ft ($h \leq 18.3$ m)]: Design Wind Pressures for Enclosed Buildings—Walls and Roofs

continues

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LATERAL WIND FORCES
ENVELOPE PROCEDURE (ASCE 7-16 Chapter 28)

Design Wind Pressures

Roof Pitch: 0.25:12 (1.2°) Wind Speed: 110 mph
Wind Exposure: C λ = 1.4 ASCE 7-16 p.316 A: 19.2 C: 12.7
Minimum Pressure 16 psf (wall) 28.5.4 B: 0.0 D: 0.0
Minimum Pressure 8 psf (roof) 28.5.4
Kzt: 1.6
(ASCE 7-16) Using Allowable Stress Design, 2.4.5 Basic Combinations option 7: 0.6 D + 0.6 W

X – X Direction

Σ Fw Roof = 19.2x(9.5x6.5+9.5x7.5) + 12.7x(29x6.5-20x0.75+4.75x1) =

4.81 4.81 x 1.6 Kzt x 1.4 x 0.6 = 6.47 kip

Σ Fw Upper = 19.2x(2x9.5x11) + 12.7x(29x11-20x0.5) =

7.94 7.94 x 1.6 Kzt x 1.4 x 0.6 = 10.67 kip

Σ Fw Main = 19.2x(2x9.5x9.5) + 12.7x(29x9.5+20x1.25) =

7.30 7.30 x 1.6 Kzt x 1.4 x 0.6 = 9.81 kip

Roof Min = [(133+178)x16+(0)x8)]x1.6x1.4x0.6 = 6.69 kip

Upper Min = [(209+309)x16+(0)x8)]x1.6x1.4x0.6 = 11.35 kip

Main Min = [(181+301)x16+(0)x8)]x1.6x1.4x0.6 = 10.36 kip

Y – Y Direction

Σ Fw Roof = 19.2x(2x9.5x7.5) + 12.7x(29x7.5) =

5.51 5.51 x 1.6 Kzt x 1.4 x 0.6 = 7.41 kip

Σ Fw Upper = 19.2x(2x9.5x11) + 12.7x(29x11) =

8.06 8.06 x 1.6 Kzt x 1.4 x 0.6 = 10.84 kip

Σ Fw Main = 19.2x(9.5x(4+9.5)) + 12.7x(7.5x4+5/2x(6.5+9.5)+16.5x9.5) =

5.34 5.34 x 1.6 Kzt x 1.4 x 0.6 = 7.18 kip

Roof Min = [(143+218)x16+(0)x8)]x1.6x1.4x0.6 = 7.76 kip

Upper Min = [(209+319)x16+(0)x8)]x1.6x1.4x0.6 = 11.35 kip

Main Min = [(128+227)x16+(0)x8)]x1.6x1.4x0.6 = 7.63 kip

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QUAKE FORCES (ASCE 7-16)

Site Class "D" (Table 11.4.2)

Ss = Critical Values per Latest SEAOC website;	1.6
S1 = Critical Values per Latest SEAOC website;	0.57

Fa =per Table 11.4-1	1.2
Fv = per Table 11.4-2	1.8

Sms = Fa * Ss = 1.2 (1.6)	1.92	(11.4-1)
Sm1 = Fv * S1 = 1.8 (0.57)	1.03	(11.4-2)
Sds = 2/3 * Sms = 2/3 (1.92)	1.28	(11.4-3), Seismic Design Category "D", Table 11.6-1
Sd1 = 2/3 * Sm1 = 2/3 (1.03)	0.68	(11.4-4); Seismic Design Category D, Table 11.6-2

SEISMIC RESPONSE COEFFICIENT: Use Section (12.8.1.1) ASCE 7-16 Except as Noted

To = 0.2 (Sd1/Sds) =0.2(0.68/1.28)	0.11	Section 11.4.6
Ts = Sd1 /Sds =(0.68/1.28)	0.53	Section 11.4.6
Ct	0.02	
Hn (Bldg. height-ft))	35.00	
Tstruc = Ct * (Hn)^3/4 = 0.02(35^.75)	0.29	Table 12.8-2
Where To ≤ Tstruc ≤ Ts; Sa = Sds	1.28	Section 11.4.6, item 2
R	6.5	ASCE 7-16 Table 12.2-1, item 15
Ie	1	Section 11.5.1, Table 1.5-1 and 1.5-2)
Cs = Sds /(R/I) = 1.28 / (6.5/1) =	0.197	(12.8-2)

Cs = 0.20

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LATERAL QUAKE FORCES

Cs:	0.20		ρ:	1.3	
Roof Area:	1308	feet ^{2}	Roof Dead Load:	17	psf
Upper Area:	2248	feet ^{2}	Floor Dead Load:	14	psf
Main Area:	1905	feet ^{2}	Wall Dead Load:	10	psf

ASCE 7-16 Using Allowable Stress Design, 2.4.5 Basic Combination option 10: 0.6 D + 0.7 E_h-0.7E_v

ASCE 7-16 Table 12.2-1: Overstrength factor, Ω = 2.5

DEAD LOAD OF STRUCTURE

Roof Weight = 1308 x (17+10/2) = = 28.78 kip

Upper Weight = 2248 x (14+10) = = 53.95 kip

Main Weight = 1905 x (14+10) = = 45.72 kip

128.45 kip

V_{base} = Cs x Σ Weight = 0.20 x 128.45 = 25.69 kip

V_{asd} = V_{base} x 0.7 x ρ = **23.38** kip

LATERAL FORCES

	WEIGHT		HEIGHT		WEIGHT x HEIGHT
Roof:	28.78	kip	29.25	Feet	841.70
Upper:	53.95	kip	21.75	Feet	1173.46
Main:	45.72	kip	9.5	Feet	434.34
					2449.49

Fq Roof: 23.38 x (841.70/2449.49) = = 8.03 kip

Fq Upper: 23.38 x (1173.46/2449.49) = = 11.20 kip

Fq Main: 23.38 x (434.34/2449.49) = = 4.15 kip

Therefore quake governs all.

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WIND FORCES ON SHEAR WALLS

Shearwalls in X – X Direction

Fw X – X @ Roof: 6.69 kips — 6.69 k / 46 ft = 145 #/Ft

V @ X 1 = (6.69/46)(22/2) = 1.60 / 5.25'+5.5'+3.5' = 112 # / Ft — SW-4

V @ X 2 = (6.69/46)(22/2+10/2) = 2.33 / 14' = 166 # / Ft — SW-4

V @ X 3 = (6.69/46)(10/2+14/2) = 1.74 / 4.75'+4.25'+8' = 103 # / Ft — SW-4

V @ X 4 = 6.69/46)(14/2) = 1.02 / 4.75'+8'+10.75' = 43 # / Ft — SW-4

Fw X – X @ Upper: 11.35 kips — 11.35 k / 46 ft = 247 #/Ft

V @ X 5 = (11.35/46)(9/2) + 1.60 = 2.71 / 7'+11.75' = 145 # / Ft — SW-4

V @ X 6 = (11.35/46)(9/2+12.5/2) = 2.65 / 16' = 166 # / Ft — SW-4

V @ X 7 = (11.35/46)(12.5/2+10.5/2) + 2.33 = 2.84 / 17.5' = 162 # / Ft — SW-4

V @ X 8 = (11.35/46)(10.5/2+14/2) + 0.93 = 4.77 / 8.25'+5' = 360 # / Ft — SW-3

V @ X 9 = (11.35/46)(14/2) + 1.02 = 2.75 / 14.25'+10.5'+8.5' = 83 # / Ft — SW-4

Fw X – X @ Main: 10.36 kips — 10.36 k / 37 ft = 280 #/Ft

L10/

V @ X 10 (10.36/37)(12.5/2) SW-4 + 2.65 =	4.40 / 6'+4.75'	=	410	# / Ft
V @ X 11 (10.36/37)(12.5/2+10.5/2) SW-4 + 5.16 =	6.06 / 14'	=	433	# / Ft
V @ X 12 (10.36/37)(10.5/2+14/2) SW-3 + 4.77 =	8.20 / 9.5'+8'	=	469	# / Ft
V @ X 13 (10.36/37)(14/2) SW-4 + 2.75 =	4.71 / 22'	=	214	# / Ft

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Project: Mercer Island	By: RB/MJT
Client:	Date: 7/25/2025
Subject: Lateral	Page: L11/

WIND FORCES ON SHEAR WALLS

Shearwalls in Y – Y Direction

Fw Y – Y @ Roof: 7.76 kips — 7.76 k / 38 ft = 204 #/Ft

V @ Y 1 = (7.76/38)(16/2) = 1.63 / 2'+2' = 409 #/Ft
SW-3
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 2 = (7.76/38)(16/2+22/2) = 3.88 / 4'+6.25'+3.25' = 288 #/Ft
SW-4

V @ Y 3 = (7.76/38)(22/2) = 2.25 / 3.25'+3.25'+6.75' = 170 #/Ft
SW-4

Fw Y – Y @ Upper: 11.35 kips — 11.35 k / 48 ft = 237 #/Ft

V @ Y 4 = (11.35/48)(10/2) = 1.18 / 2'+2' = 296 #/Ft
SW-3
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 5 = (11.35/48)(10/2+16/2) = 4.71 / 4' = 1177 #/Ft
(2)SW-2 + 1.63 =

V @ Y 6 = (11.35/48)(16/2+22/2) = 8.38 / 22'+4' = 322 #/Ft
SW-3 + 3.88 =

V @ Y 7 = (11.35/48)(22/2) = 4.65 < 4.7k LRP Capacity
SW-4 + 2.25 =
LRP: 2(24"x8') = 2x1675lb = 3.35 x 1.4 = 4.7 kip LRP capacity

---

Fw Y – Y @ Main: 7.63 kips — 7.63 k / 48 ft = 159 #/Ft

V @ Y 8 = (7.63/48)(10/2) = 1.98 / 2'+2' = 494 #/Ft
SW-3 + 1.18 =
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 9 = (7.63/48)(10/2+16/2) = 6.78 / 9'+4.25' = 511 #/Ft
SW-3 + 4.71 =

L12/

V @ Y 10 SW-3	(7.63/48)(16/2+22/2) + 8.38 =	11.40 / 12.5'+16.5'	= 393	# / Ft
V @ Y 11 CONC.	(7.63/48)(22/2) + 4.85 =	9.75 / (14'+22')(12"/')(8")	= 3	psi

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QUAKE FORCES ON SHEAR WALLS

Shearwalls in X – X Direction

Fw X – X @ Roof: 8.03 kips — 8.03 k / 46 ft = 175 #/Ft

V @ X 1 = (8.03/46)(22/2) = 1.92 / 5.25'+5.5'+3.5' = 135 #/Ft
SW-4
(1.25-0.125x(9/3.5))x350 #/Ft = 325 #/Ft capacity per sect. 4.3.3 ANSI/AF+PA SDPWS 2021

V @ X 2 = (8.03/46)(22/2+10/2) = 2.79 / 14' = 200 #/Ft
SW-4

V @ X 3 = (8.03/46)(10/2+14/2) = 2.10 / 4.75'+4.25'+8' = 123 #/Ft
SW-4

V @ X 4 = (8.03/46)(14/2) = 1.22 / 4.75'+8'+10.75' = 52 #/Ft
SW-4

Fw X – X @ Upper: 11.20 kips — 11.20 k / 46 ft = 243 #/Ft

V @ X 5 = (11.20/46)(9/2) + 2.79 = 3.02 / 7'+11.75' = 161 #/Ft
SW-4

V @ X 6 = (11.20/46)(9/2+12.5/2) = 2.62 / 16' = 164 #/Ft
SW-4

V @ X 7 = (11.20/46)(12.5/2+10.5/2) + 2.79 = 2.80 / 17.5' = 160 #/Ft
SW-4

V @ X 8 = (11.20/46)(10.5/2+14/2) + 4.02 = 5.08 / 8.25'+5' = 383 #/Ft
SW-3

V @ X 9 = (11.20/46)(14/2) + 1.22 = 2.93 / 14.25'+10.5'+8.5' = 88 #/Ft
SW-4

L14/

Fw X – X @ Main: 4.15 kips 4.15 k / 46 ft = 90 #/Ft

V @ X 10 = (4.15/37)(12.5/2) 3.32 = 309 #/Ft
SW-4 + 2.62 = 6'+4.75'

V @ X 11 = (4.15/37)(12.5/2+10.5/2) 4.09 = 292 #/Ft
SW-4 + 2.80 = 14'

V @ X 12 = (4.15/37)(10.5/2+14/2) 6.45 = 369 #/Ft
SW-3 + 7.00 = 9.5'+8'

V @ X 13 = (4.15/37)(14/2) 3.71 = 169 #/Ft
SW-4 + 2.93 = 22'

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QUAKE FORCES ON SHEAR WALLS

Shearwalls in Y – Y Direction

Fw Y – Y @ Roof: 8.03 kips 8.03 k / 38 ft = 211 #/Ft

V @ Y 1 = (8.03/38)(16/2) = 1.69 / 2'+2' = 423 #/Ft
SW-3
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 2 = (8.03/38)(16/2+22/2) = 4.02 / 4'+6.25'+3.25' = 298 #/Ft
SW-4
(1.25-0.125x(9/3.25))x350 #/Ft = 320 #/Ft capacity per sect. 4.3.3 ANSI/AF+PA SDPWS 2021

V @ Y 3 = (8.03/38)(22/2) = 2.33 / 3.25'+3.25'+6.75' = 175 #/Ft
SW-4
(1.25-0.125x(9/3.25))x350 #/Ft = 320 #/Ft capacity per sect. 4.3.3 ANSI/AF+PA SDPWS 2021

Fw Y – Y @ Upper: 11.20 kips 11.20 k / 48 ft = 233 #/Ft

V @ Y 4 = (11.20/48)(10/2) = 1.17 / 2'+2' = 292 #/Ft
SW-3
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 5 = (11.20/48)(10/2+16/2) 4.72 / 4' = 1181 #/Ft
(2)SW-2 + 1.69 =

V @ Y 6 = (11.20/48)(16/2+22/2) 8.45 / 22'+4' = 325 #/Ft
SW-3 + 4.02 =

V @ Y 7 = (11.20/48)(22/2) 1.54 / 3.25'+3.25' = 237 #/Ft
SW-4 + 2.33 - 3.35 =
LRP: 2(24"x8') = 2x1675lb = 3.35 kip LRP capacity
(1.25-0.125x(9.5/3.25))x350 #/Ft = 310 #/Ft capacity per sect. 4.3.3 ANSI/AF+PA SDPWS 2021

Fw Y – Y @ Main: 4.15 kips 4.15 k / 48 ft = 86 #/Ft

V @ Y 8 = (4.15/48)(10/2) 1.60 / 2'+2' = 400 #/Ft
SW-3 + 1.17 =
Restrain top& bottom of openings to reduce H:W ratio.

V @ Y 9 = (4.15/48)(10/2+16/2) 5.85 / 9'+4.25' = 441 #/Ft
SW-3 + 4.72 =

L16/

V @ Y 10 SW-3	(4.15/48)(16/2+22/2) + 8.45 =	10.09 / 17'+13.5'	= 331	# / Ft
V @ Y 11 CONC.	(4.15/48)(22/2) + 1.54 =	5.84 / (14'+22')(12"/')(8")	= 2	psi

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CHECK OVERTURNING FOR: X 2 (Quake)

L =	14	ft	
P =	200	lb/ft	
P x L =	14 x 200	2.80	kip

MoT = 2.80 x 10 = 25.20 kip - ft

S_ds= 1.28 From Cs Calculations

Ev = .7(0.2*S_ds)= 0.18

MR = [(0.38+0.42)x0.5x14+0.13x14] = 7.42 kip - ft

H= 9

F = MoT - MR / L = **1.27** kip

Positive # : Hold down required
Negative # : No Hold down Required

Therefore use (1)CS16 hold downs at each end

TLRF = 5 ft (conservative)

Padj =	D	0.7Ev*D	(.6D)-.7Ev
	0.3	0.05	0.13

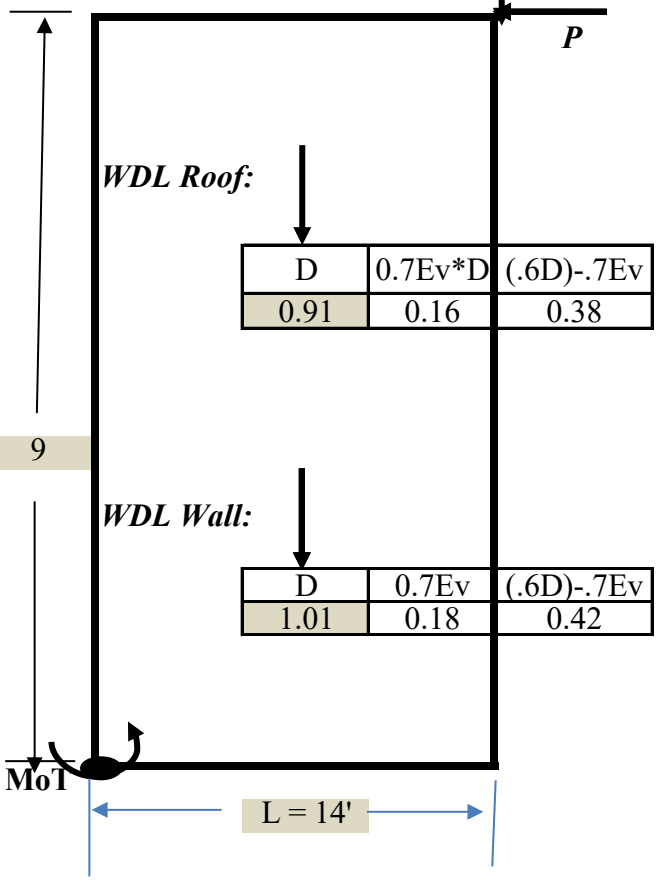
P

WDL Roof:

D	0.7Ev*D	(.6D)-.7Ev
0.91	0.16	0.38

WDL Wall:

D	0.7Ev	(.6D)-.7Ev
1.01	0.18	0.42



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CHECK OVERTURNING FOR: X 7 (Quake)

L =	5	ft	
P =	383	lb/ft	
P x L =	5 x 383	1.92	kip

MoT = 1.92 x 9.5 = 18.19 kip - ft

S_ds= 1.28 From Cs Calculations

Ev = .7(0.2*S_ds)= 0.18

MR = [(0.14+0.16)x0.5x5+0.25x5] = 2.00 kip - ft

H= 9.5

F = MoT - MR / L = **3.24** kip

Positive # : Hold down required
Negative # : No Hold down Required

Therefore use (2)CS16 hold downs at each end

TLRF = 5 ft (conservative)

	D	0.7Ev*D	(.6D)-.7Ev
Padj =	0.6	0.11	0.25

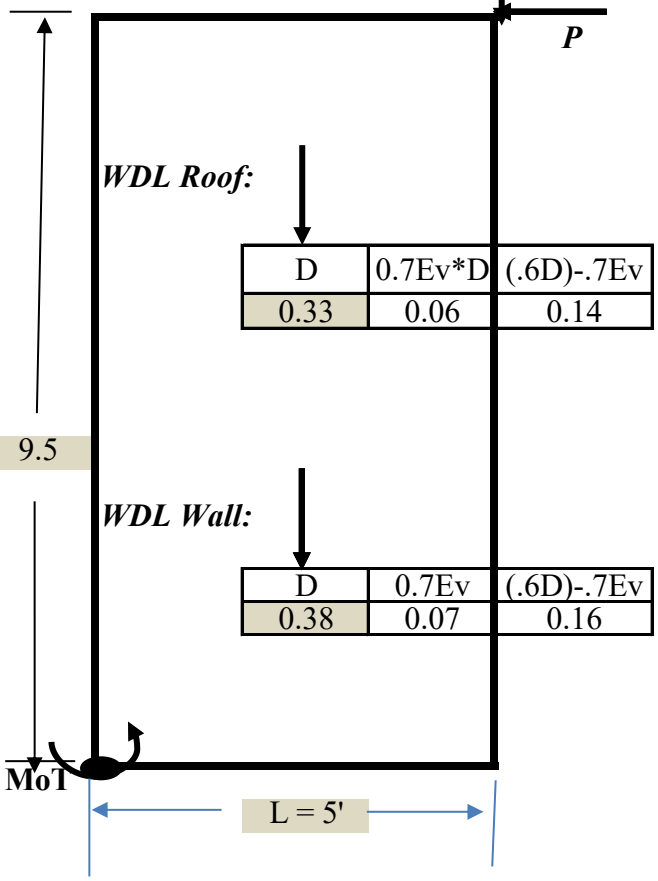
P

WDL Roof:

D	0.7Ev*D	(.6D)-.7Ev
0.33	0.06	0.14

WDL Wall:

D	0.7Ev	(.6D)-.7Ev
0.38	0.07	0.16



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CHECK OVERTURNING FOR: X 12 (Wind)

L =	8	ft	
P =	469	lb/ft	
P x L =	8 x 469	3.75	kip

MoT = 3.75 x 8.5 = 31.89 kip - ft

S_ds= 1.28 From Cs Calculations

Ev = .7(0.2*S_ds)= 0.18

MR = [(0.22+0.23)x0.5x8+0.38x8] = 4.82 kip - ft

F = MoT - MR / L = **3.38** kip

Positive # : Hold down required
Negative # : No Hold down Required

Therefore use STHD14 hold downs at each end

TLRF = 5 ft (conservative)

Padj =	D	0.7Ev*D	(.6D)-.7Ev
	0.9	0.16	0.38

P

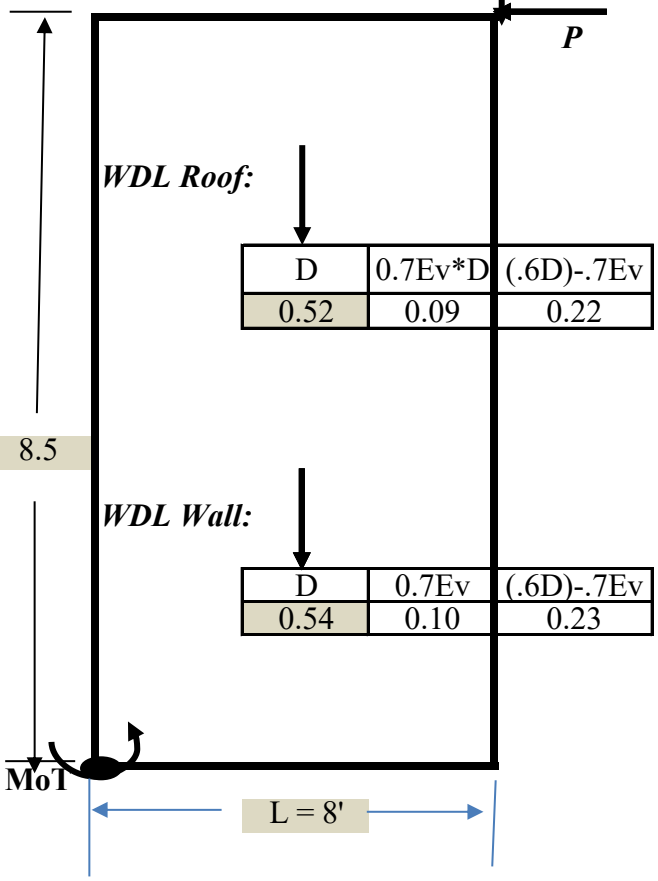
WDL Roof:

D	0.7Ev*D	(.6D)-.7Ev
0.52	0.09	0.22

H= 8.5

WDL Wall:

D	0.7Ev	(.6D)-.7Ev
0.54	0.10	0.23



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Project: Mercer Island	By: RB/MJT
Client:	Date: 7/25/2025
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CHECK OVERTURNING FOR: Y 1 (Quake)

L =	2	ft	
P =	423	lb/ft	
P x L =	2 x 423	0.85	kip

TLRF = 5 ft (conservative)

Padj =	D	0.7Ev*D	(.6D)-.7Ev
	0.3	0.05	0.13

MoT = 0.85 x 9 = 7.61 kip - ft

S_ds= 1.28 From Cs Calculations

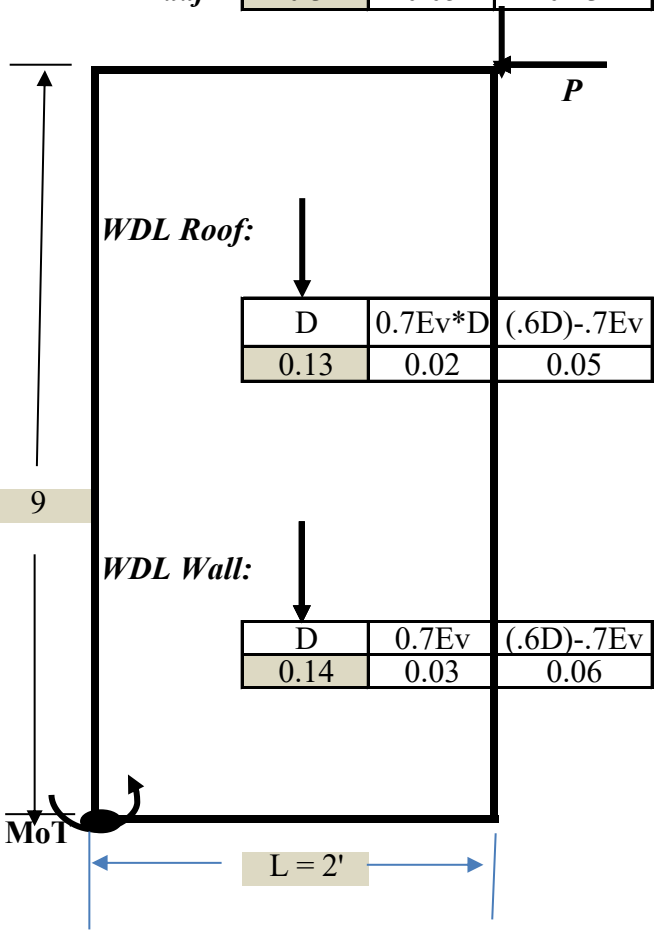
Ev = .7(0.2*S_ds)= 0.18

MR = [(0.05+0.06)x0.5x2+0.13x2] = 0.37 kip - ft

H= 9

F = MoT - MR / L = **3.62** kip

Positive # : Hold down required
Negative # : No Hold down Required



WDL Roof:	D	0.7Ev*D	(.6D)-.7Ev
	0.13	0.02	0.05

WDL Wall:	D	0.7Ev	(.6D)-.7Ev
	0.14	0.03	0.06

Therefore use (3)CS16 hold downs at each end

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Project:	By: RB/MJT
Client:	Date:
Subject: Lateral Calculations	Page: L21/

CHECK OVERTURNING FOR: Y4, Y8 (Quake)

TLRF = 5 ft (conservative)

L =	2	ft	
P =	292	lb/ft	
P x L =	292 x 2 =	0.58	kip

MoT1 = 0.58 x 9 = 5.26 kip - ft

S_ds= 1.28 From Cs Calcultions

.7(0.2*S_ds)= 0.18

MR1= [(0.05+0.06x2x0.5) + (0.13x2)] = 0.12 kip - ft

F1 = MoT1 - MR1 / L = **2.57** kip

Positive # : Hold down required

Negative # : No Hold down Required

Therefore, use (2)CS16 hold-downs at each end.

P =	108	lb/ft	
P x L =	108 x 2 =	0.22	kip

MoT2 = 0.22x8.5+0.58x17.5 = 12.06 kip - ft

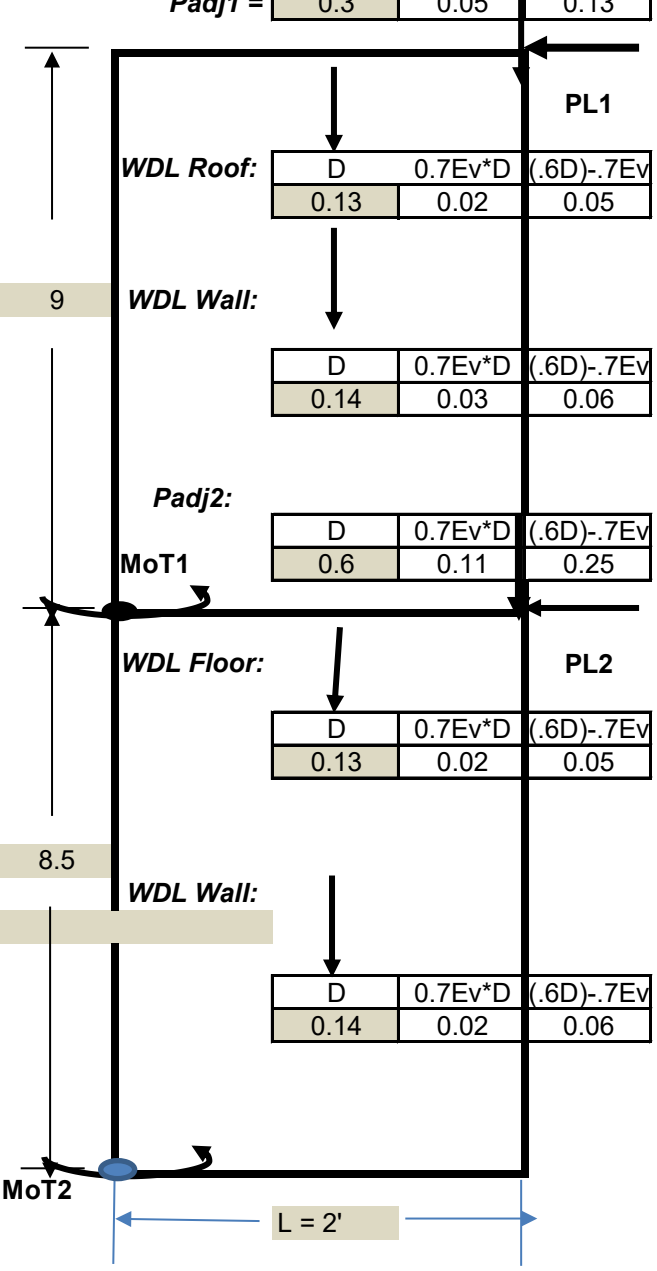
MR2= [(0.05+0.06)x2x0.5 + (0.13+0.25)x2] = 1.30 kip - ft

F = MoT2 - MR2 / L = **5.38** kip

Positive # : Hold down required

Negative # : No Hold down Required

Therefore, use HDQ8 hold-downs at each end.



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CHECK OVERTURNING FOR: Y 5 (Quake)

L =	4	ft	
P =	1181	lb/ft	
P x L =	4 x 1181	4.72	kip

MoT = 4.72 x 9.5 = 44.88 kip - ft

S_ds= 1.28 From Cs Calculations

Ev = .7(0.2*S_ds)= 0.18

MR = [(0.57+0.67)x0.5x21+0.25x21] = 1.48 kip - ft

H= 9.5

F = MoT - MR / L = **10.85** kip

Positive # : Hold down required
Negative # : No Hold down Required

Therefore use (6)CS16 hold downs at each end

TLRF = 5 ft (conservative)

Padj =	D	0.7Ev*D	(.6D)-.7Ev
	0.6	0.11	0.25

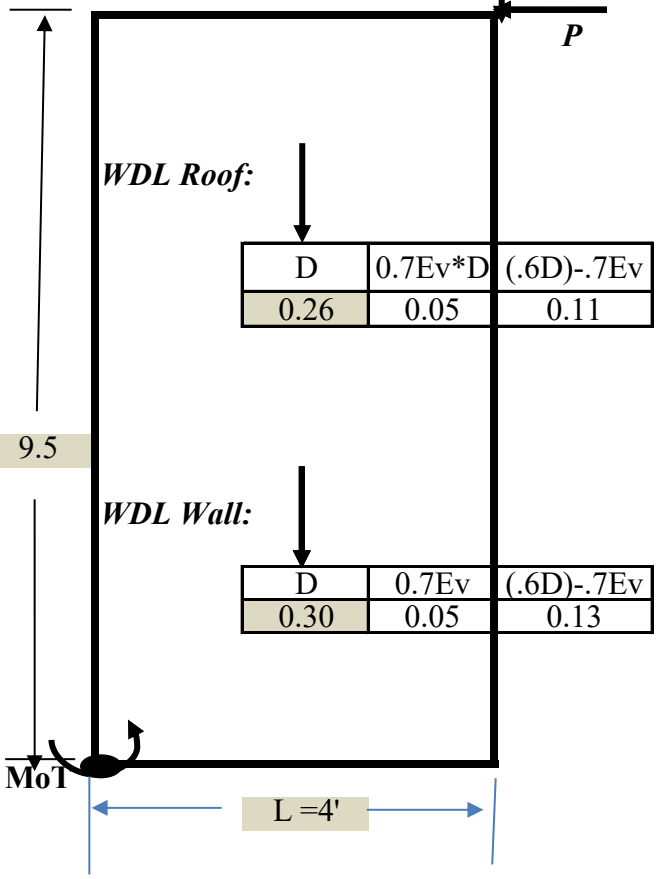
P

WDL Roof:

D	0.7Ev*D	(.6D)-.7Ev
0.26	0.05	0.11

WDL Wall:

D	0.7Ev	(.6D)-.7Ev
0.30	0.05	0.13



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CHECK OVERTURNING FOR: Y 9 (Wind)

L =	4.25	ft	
P =	511	lb/ft	
P x L =	4.25 x 511	2.17	kip

MoT = 2.17 x 8.5 = 18.46 kip - ft

S_ds= 1.28 From Cs Calculations

Ev = .7(0.2*S_ds)= 0.18

MR = [(0.12+0.12)x0.5x4.25+0.38x4.25] = 2.12 kip - ft

F = MoT - MR / L = **3.85** kip

Positive # : Hold down required
Negative # : No Hold down Required

Therefore use STHD14 hold downs at each end

TLRF = 5 ft (conservative)

Padj =	D	0.7Ev*D	(.6D)-.7Ev
	0.9	0.16	0.38

P

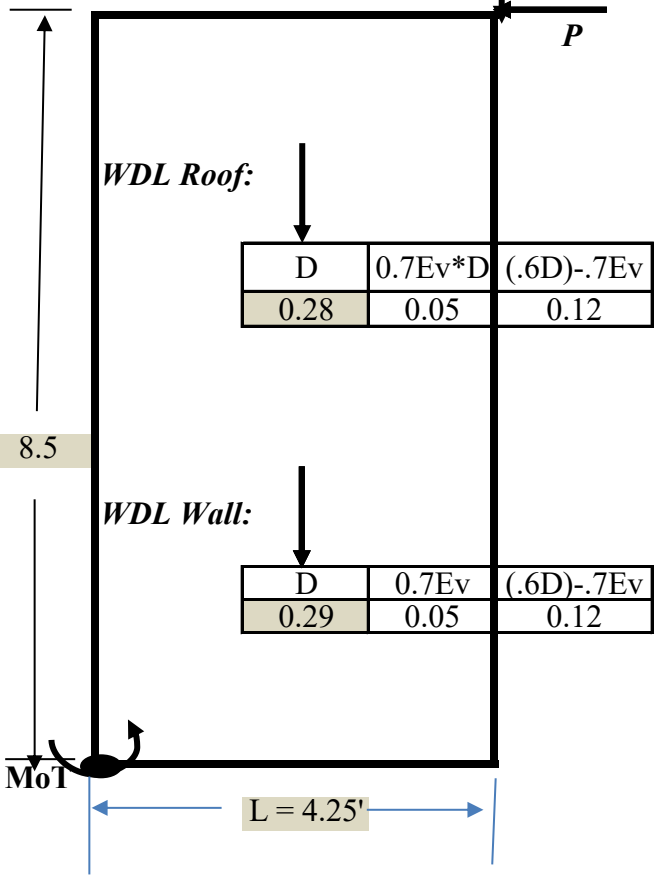
WDL Roof:

D	0.7Ev*D	(.6D)-.7Ev
0.28	0.05	0.12

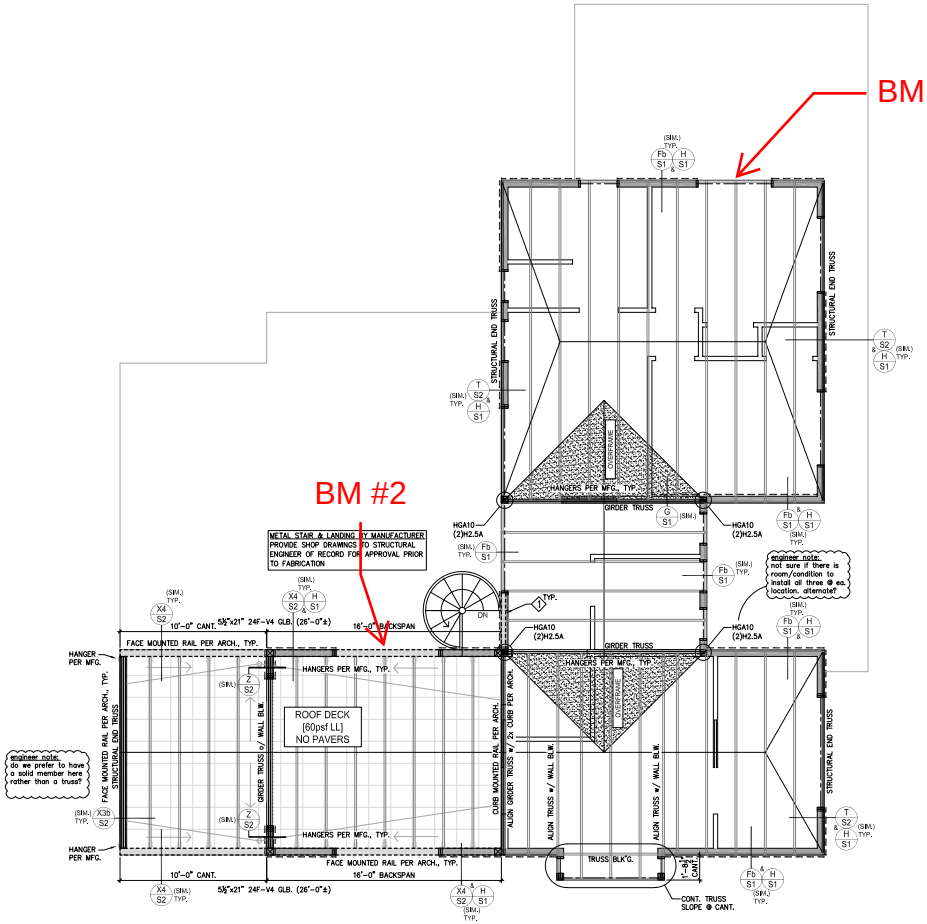
H= 8.5

WDL Wall:

D	0.7Ev	(.6D)-.7Ev
0.29	0.05	0.12



BEAM KEY PLAN



IMPORTANT NOTES:
SEE ARCHITECTURAL PLANS FOR ALL DIMENSIONS & VERIFY WITH STRUCTURAL PLANS

SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

TRUSS CONSTRUCTION NOTES:
ALL TRUSSES SHALL CARRY MFG. STAMP.

ALL TRUSSES SHALL BE INSTALLED & BRACED TO MFG. SPECIFICATIONS.

TRUSSES WILL NOT BE FIELD ALTERED WITHOUT PRIOR BLDG. DEPT. APPROVAL OR MFG. ENGINEERING CALC's.

ALL TRUSSES SHALL HAVE DESIGN DETAILS & DRAWINGS ON SITE FOR FRAMING INSPECTION.

SEALED CALCULATION SHALL BE SUBMITTED BY STAMPED BY AN ENGINEER REGISTERED IN THE STATE OF WASHINGTON.

ALL NON-BEARING WALLS SHALL BE HELD AWAY FROM TRUSS BOTTOM CHORD w/ AN APPROVED FASTENER TO INSURE NON-BEARING OF TRUSS ON WALL.

SPECIFIED APPROVED HANGERS MUST BE USED @ ALL CONNECTIONS OF RAFTERS, JACK OR HIP TRUSSES TO THE MAIN GIRDER AS PROVIDED BY TRUSS MFG.

KEYNOTES

1 MODIFY TRUSS TO ALLOW 4x12 D.F. #2 RIM FOR SPIRAL STAIR LANDING ATTACHMENT

– HATCH INDICATES OVERFRAMING AND/OR CRICKETS PER ARCHITECT. DRILL 2½"ø HOLES @ 24"o.c. EA. WAY IN CONTINUOUS ROOF SHEATHING BLW. TO ALLOW CROSS-VENTILATION

– DENOTES FLUSH BEAM AS NOTED PER FLOOR FRAMING PLAN

– DENOTES BEARING WALL BLW. (EXTERIOR BEARING WALLS ASSUMED)

ROOF CONSTRUCTION NOTES:
24"D TRUSSES w/ SLOPED TOP CHORD (¼:12) PER PLAN SPACED @ 24"o.c. (U.N.O.) w/ CONTINUOUS RIBBON TRUSS @ EAVE AS APPLICABLE.

FINAL DESIGN BY TRUSS MFG.

ALL SLOPES & DRAINAGE PER ARCHITECTURAL DRAWINGS.

SEE FLOOR PLAN (BELOW) FOR HEADER SIZES (U.N.O.)

PROVIDE ROOF VENTILATION PER ARCHITECTURAL PLANS

roof framing plan
SCALE: 1/4" = 1'-0"

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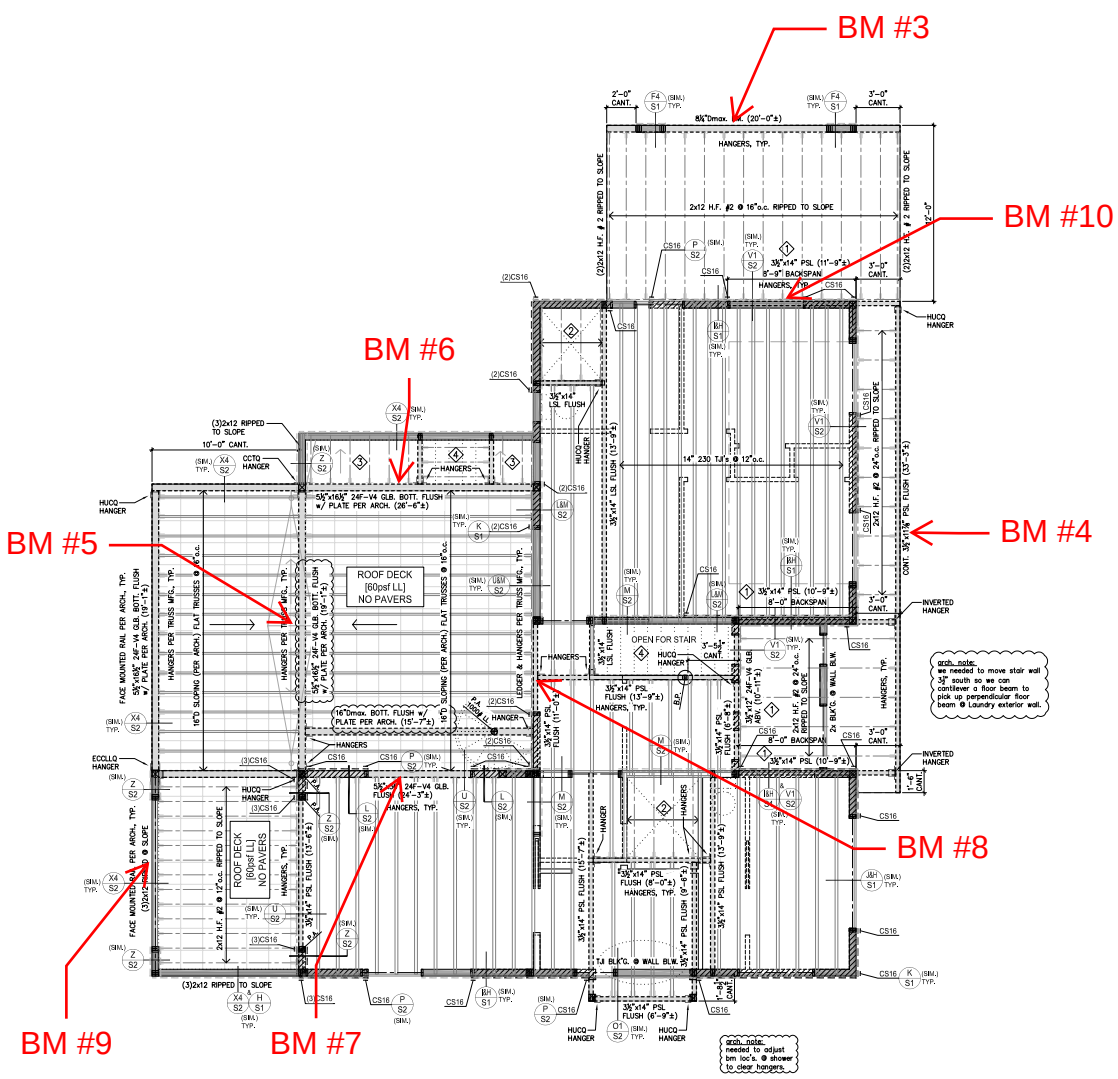
Artoush Co. & Remodeling LLC SFR
3427 72nd Pl SE, Mercer Island, WA 98040

Project: 3427 72nd Pl SE, Mercer Island, 98040
Project No.:
Drawn By:
Date: 9.10.2025
Rev.:

Sheet: S10

12"x18" PLOT = 1/2 SCALE

BEAM KEY PLAN



IMPORTANT NOTES:
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SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

HANGER SCHEDULE (U.N.O.)

BEAM	* SIMPSON HANGER	BEAM	* SIMPSON HANGER
(*USE NOTED BM. WIDTH & DEPTH FOR HANGER SIZE)			
3 1/2" x	HGUS	6 3/4" x	HHGU
5 1/4" x	HGUS	7" x	HGUS
5 1/2" x	HHGU		

KEYNOTES

1. FULL SPAN BEAM ABOVE. FRAMED INTO STUD WALL FRAMING BOTTOM FLUSH w/ MAIN FLOOR ROOF FRAMING PER ARCH.
2. 2x8min. H.F. #2 @ 16"o.c. w/ HANGERS @ OURBLESS SHOWER
3. 2x12min. H.F. #2 @ 16"o.c. RIPPED TO SLOPE PER ARCH. w/ HANGERS
4. 2x12 H.F. #2 STRINGERS @ 12"o.c.

TYPICAL FLOOR DESIGN (BY MFG.) NOTE:
LL=40psf w/ L/600 Deflection
LL=60psf @ DECK w/ L/600 Deflection
DL=15psf w/ L/480 Total Load Deflection

- DENOTES POINT LOAD FROM ABV.
- DENOTES FLUSH BEAM AS NOTED PER FLOOR FRAMING PLAN
- DENOTES BEARING WALL BLW. (EXTERIOR BEARING WALLS ASSUMED)
- DENOTES BEARING WALL ABV. (EXTERIOR BEARING WALLS ASSUMED)

FLOOR FRAMING CONSTRUCTION NOTES:
14" 230 TJI's @ 16"o.c. TYPICAL FLOOR JOISTS (U.N.O.)

ALL FLOOR JOISTS TO BE BLOCKED @ BEARING

SEE FLOOR PLAN (BELOW) FOR HEADER SIZES (U.N.O.)

USE (2)2x H.F. #2 STUDS @ ALL BEAMS (U.N.O.)

upper floor framing plan
SCALE: 1/4" = 1'-0"

RB ENGINEERS, INC.
12733 Holmes Point Dr. NE, Kirkland, WA 98034
Tel: (425) 822-3009, Fax: (425) 822-2679
Email: RBE1992@ GMAIL.COM
R-B-Engineers.com

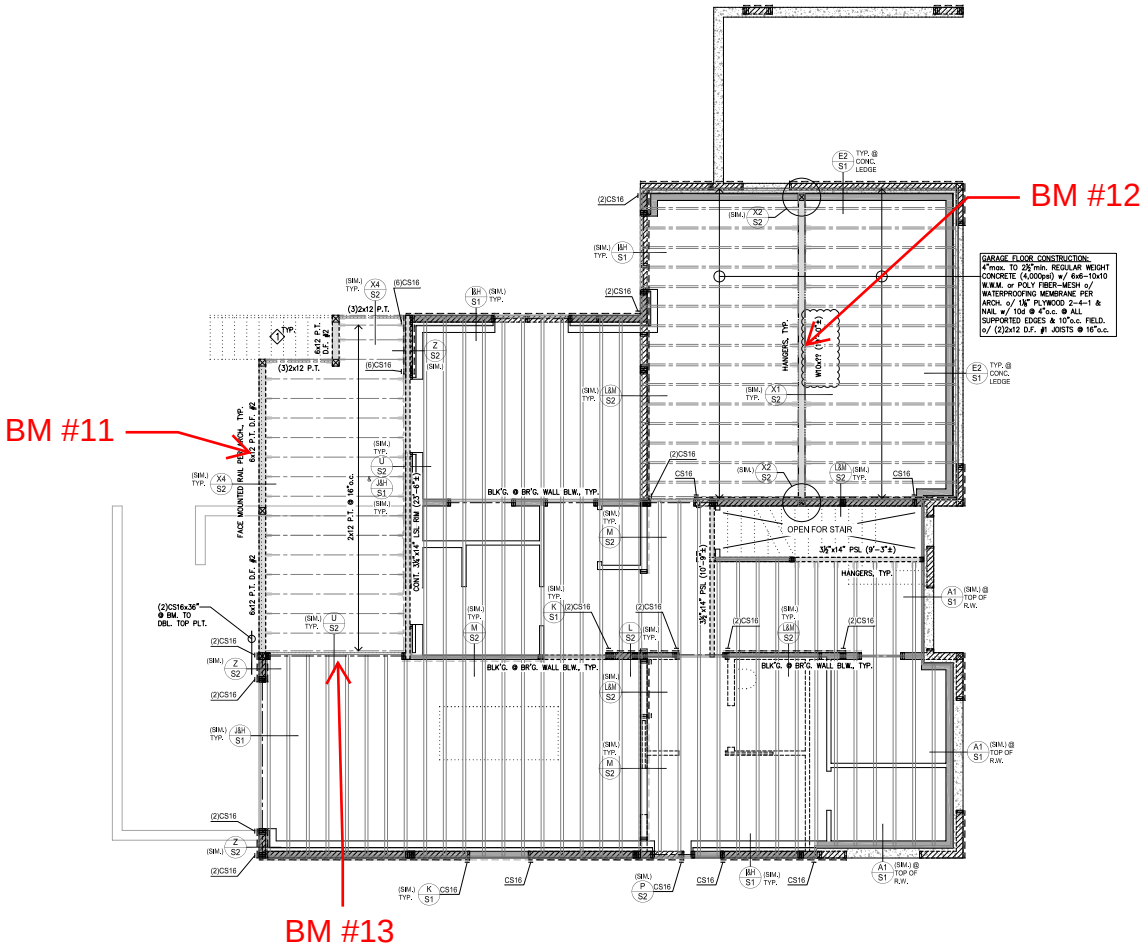
Artoush Co. & Remodeling LLC SFR
3427 72nd Pl SE, Mercer Island, WA 98040

Project: 3427 72nd Pl SE, Mercer Island, 98040
Project No.:
Drawn By:
Date: 9.10.2025
Rev.:

Sheet: S8

12"x18" PLOT = 1/2 SCALE

BEAM KEY PLAN



IMPORTANT NOTES:
SEE ARCHITECTURAL PLANS FOR ALL DIMENSIONS & VERIFY WITH STRUCTURAL PLANS

SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

KEYNOTES

1 2x12 H.F. #2 STRINGERS @ 12"o.c.

TYPICAL FLOOR DESIGN (BY MFG.) NOTE:
LL=40psf w/ L/600 Deflection
LL=60psf @ DECK w/ L/600 Deflection
DL=15psf w/ L/480 Total Load Deflection

- DENOTES POINT LOAD FROM ABV.
- DENOTES FLUSH BEAM AS NOTED PER FLOOR FRAMING PLAN
- DENOTES FLUSH STEEL BEAM AS NOTED PER FLOOR FRAMING PLAN
- DENOTES BEARING WALL BLW. (EXTERIOR BEARING WALLS ASSUMED)
- DENOTES BEARING WALL ABV. (EXTERIOR BEARING WALLS ASSUMED)

FLOOR FRAMING CONSTRUCTION NOTES:
14" 230 TJI's @ 16"o.c. TYPICAL FLOOR JOISTS (U.N.O.)

ALL FLOOR JOISTS TO BE BLOCKED @ BEARING

SEE FLOOR PLAN (BELOW) FOR HEADER SIZES (U.N.O.)

USE (2)2x H.F. #2 STUDS @ ALL BEAMS (U.N.O.)

main floor framing plan
SCALE: 1/4" = 1'-0"

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Artoush Co. & Remodeling LLC SFR
3427 72nd Pl SE, Mercer Island, WA 98040

Project: 3427 72nd Pl SE, Mercer Island, 98040
Project No.:
Drawn By:
Date: 9.10.2025
Rev.:

Sheet: S6

12"x18" PLOT = 1/2 SCALE

Wood Beam

Project File: 2728 Mercer Island.ec6

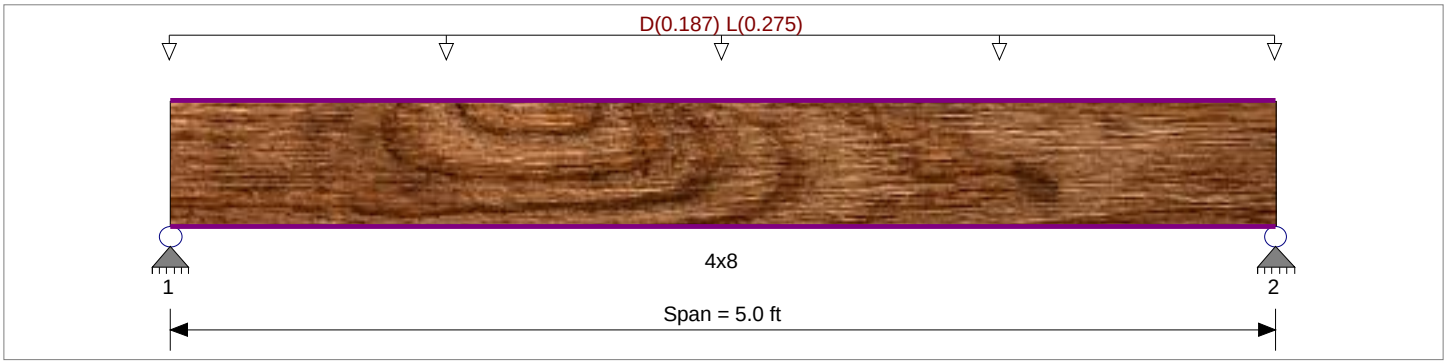
DESCRIPTION: BM #1

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	900 psi	Ebend- xx	1600 ksi
		Fc - Prll	1350 psi	Eminbend - xx	580 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625 psi		
Wood Grade :	No.2	Fv	180 psi		
		Ft	575 psi	Density	31.21 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 NOT internally calculated and added
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 11.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.483 : 1	Maximum Shear Stress Ratio	=	0.288 : 1
Section used for this span		4x8	Section used for this span		4x8
fb: Actual	=	565.04 psi	fv: Actual	=	51.83 psi
F'b	=	1,170.00 psi	F'v	=	180.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	2.500 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	0.022 in	Ratio = 2743	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio = 0	<360	n/a
Max Downward Total Deflection	0.037 in	Ratio = 1632	>=240	Span: 1 : +D+L
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 = 5.0 ft	1	0.217	0.129	0.90	1.00	1.00	1.00	1.300	1.00	1.00	1.00	0.58	228.7	1,053.0	0.35	21.0	162.0
+D+L					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1	0.483	0.288	1.00	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.44	565.0	1,170.0	0.88	51.8	180.0
+D+0.750L					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1	0.329	0.196	1.25	1.00	1.00	1.00	1.300	1.00	1.00	1.00	1.23	481.0	1,462.5	0.75	44.1	225.0
+0.60D					1.00	1.00	1.00	1.300	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 5.0 ft	1	0.073	0.044	1.60	1.00	1.00	1.00	1.300	1.00	1.00	1.00	0.35	137.2	1,872.0	0.21	12.6	288.0

Wood Beam

DESCRIPTION: BM #1

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0367	2.518		0.0000	0.000

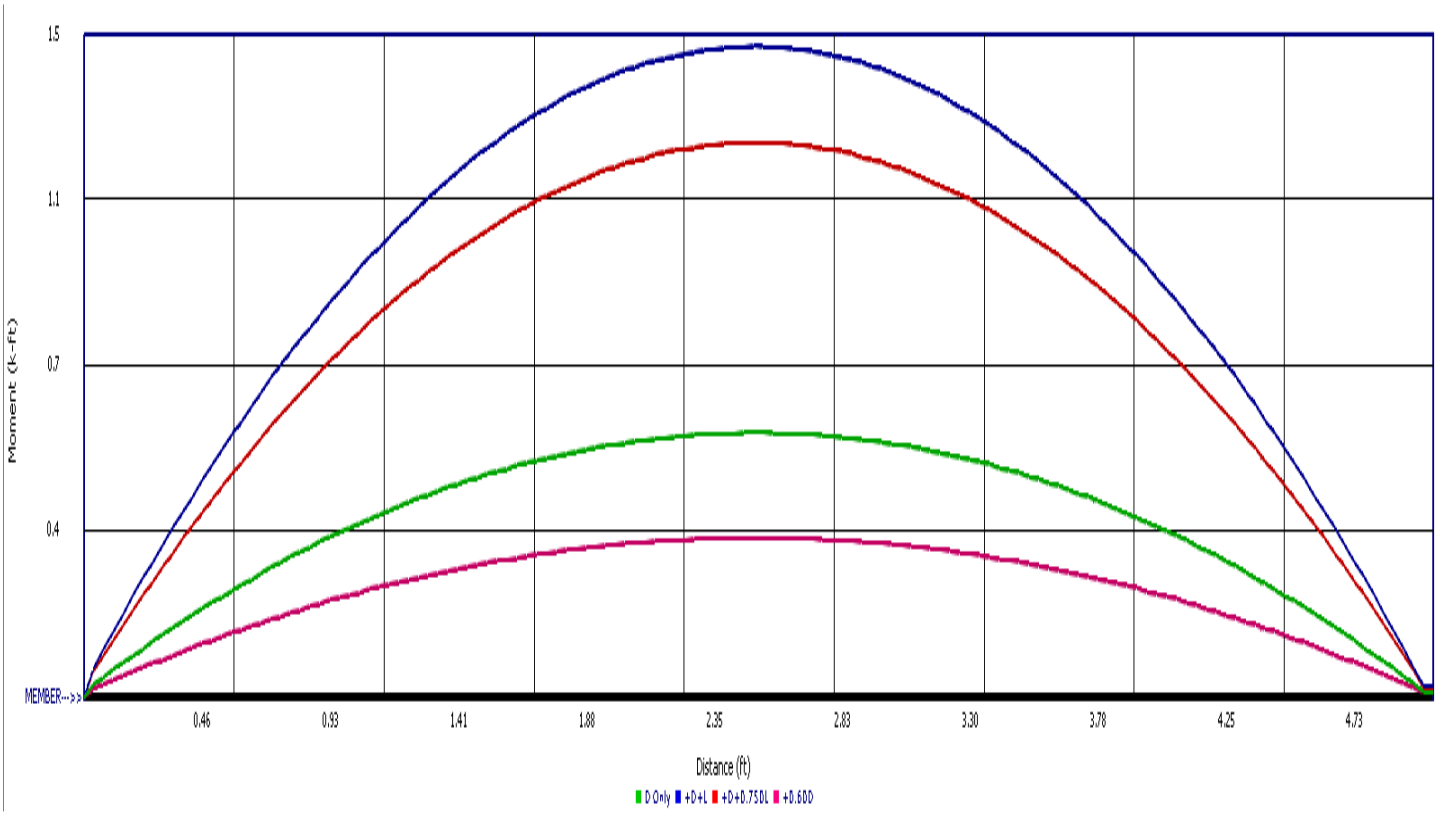
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0149	in	2.518 ft	0.0000	in	0.000	ft
+D+L	1	0.0367	in	2.518 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.0313	in	2.518 ft	0.0000	in	0.000	ft
+0.60D	1	0.0089	in	2.518 ft	0.0000	in	0.000	ft
L Only	1	0.0219	in	2.518 ft	0.0000	in	0.000	ft

Vertical Reactions

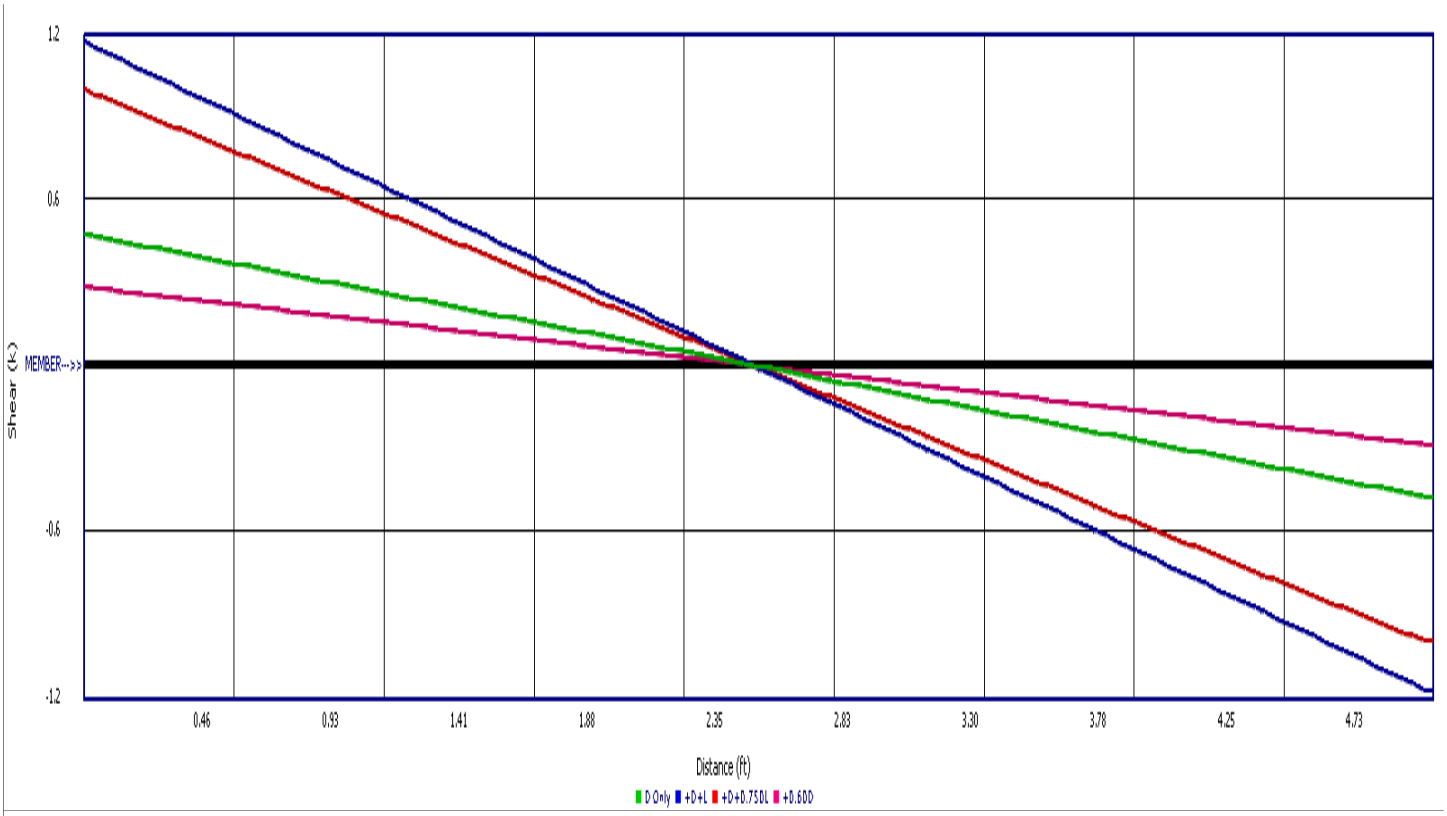
Support notation : Far left is #1 Values in KIPS

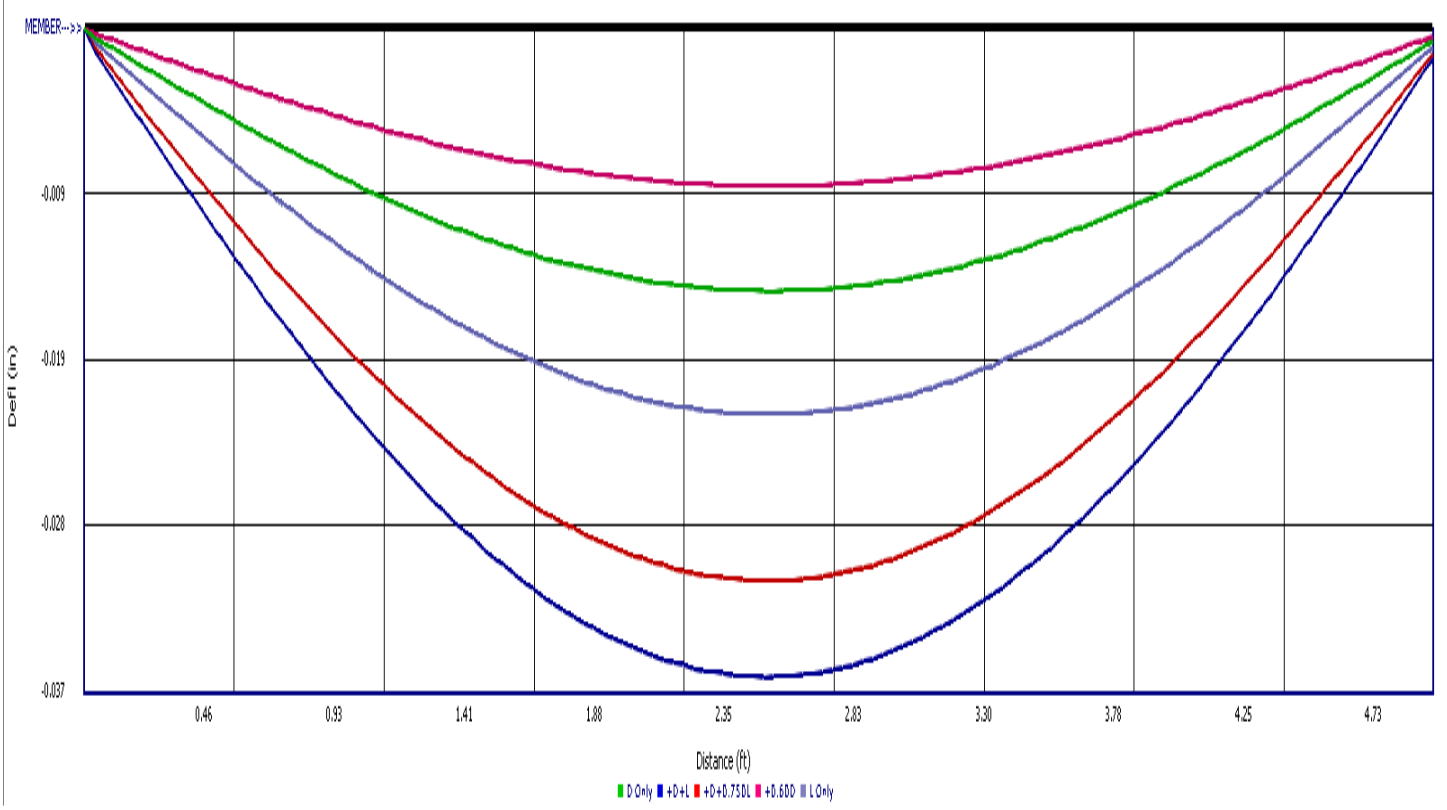
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.155	1.155
Max Upward from Load Combinations	1.155	1.155
Max Upward from Load Cases	0.688	0.688
D Only	0.468	0.468
+D+L	1.155	1.155
+D+0.750L	0.983	0.983
+0.60D	0.281	0.281
L Only	0.688	0.688



Wood Beam

DESCRIPTION: BM #1





Wood Beam

Project File: 2728 Mercer Island.ec6

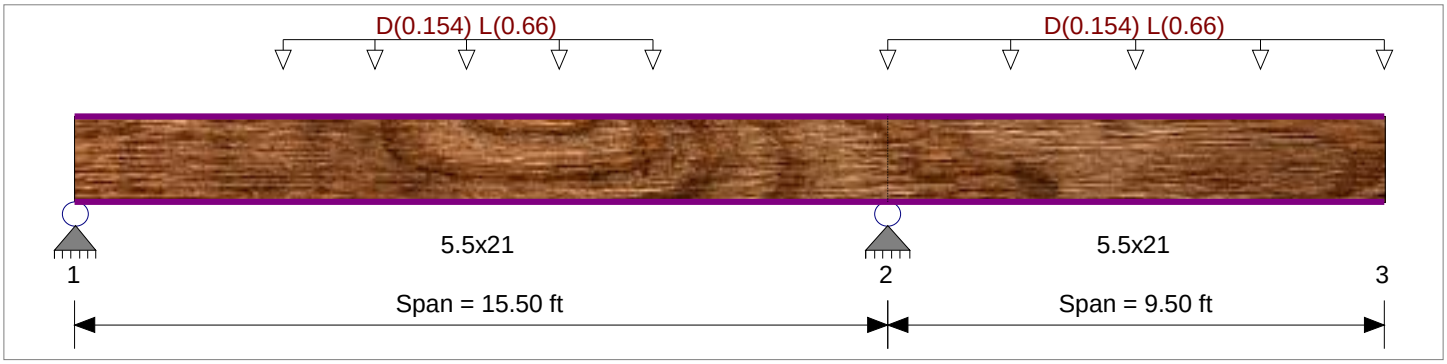
DESCRIPTION: BM #2

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2400 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	1850 psi	Ebend- xx	1800 ksi
		Fc - Prll	1650 psi	Eminbend - xx	950 ksi
Wood Species :	DF/DF	Fc - Perp	650 psi		
Wood Grade :	24F-V4	Fv	265 psi		
		Ft	1100 psi	Density	31.21 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 NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0140, L = 0.060 ksf, Extent = 4.0 -->> 11.0 ft, Tributary Width = 11.0 ft
Load for Span Number 2
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 11.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.609 : 1		Maximum Shear Stress Ratio	=	0.311 : 1	
Section used for this span		5.5x21		Section used for this span		5.5x21	
fb: Actual	=	1,090.37 psi		fv: Actual	=	82.47 psi	
F'b	=	1,790.56 psi		F'v	=	265.00 psi	
Load Combination		+D+L		Load Combination		+D+L	
Location of maximum on span	=	15.500 ft		Location of maximum on span	=	15.500 ft	
Span # where maximum occurs	=	Span # 1		Span # where maximum occurs	=	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.345 in	Ratio =	660	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.038 in	Ratio =	4931	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.425 in	Ratio =	536	>=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.047 in	Ratio =	3998	>=240	Span: 1 : +D+L

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_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 15.50 ft	1	0.128	0.065	0.90	1.00	1.00	1.00	0.968	1.00	1.00	1.00	6.95	206.3	1,611.5	1.20	15.6	238.5
Length = 9.50 ft	2	0.124	0.065	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	6.95	206.3	1,665.0	1.20	15.6	238.5
+D+L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	1	0.609	0.311	1.00	1.00	1.00	1.00	0.968	1.00	1.00	1.00	36.73	1,090.4	1,790.6	6.35	82.5	265.0
Length = 9.50 ft	2	0.589	0.311	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	36.73	1,090.4	1,850.0	6.35	82.5	265.0

Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #2

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
+D+0.750L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	1	0.388	0.199	1.25	1.00	1.00	1.00	0.968	1.00	1.00	1.00	29.29	869.3	2,238.2	5.06	65.8	331.3
Length = 9.50 ft	2	0.376	0.199	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	29.29	869.3	2,312.5	5.06	65.8	331.3
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	1	0.043	0.022	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	4.17	123.8	2,864.9	0.72	9.4	424.0
Length = 9.50 ft	2	0.042	0.022	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.17	123.8	2,960.0	0.72	9.4	424.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.0465	11.257
2	+D+L	0.4249	9.500		0.0000	11.257

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span		Max. Upward Defl		Location in Span	
D Only	2	0.0804	in	9.500	ft	0.0000	in	0.000	ft
+D+L	2	0.4249	in	9.500	ft	0.0000	in	0.000	ft
+D+0.750L	2	0.3388	in	9.500	ft	0.0000	in	0.000	ft
+0.60D	2	0.0482	in	9.500	ft	0.0000	in	0.000	ft
L Only	2	0.3445	in	9.500	ft	0.0000	in	0.000	ft

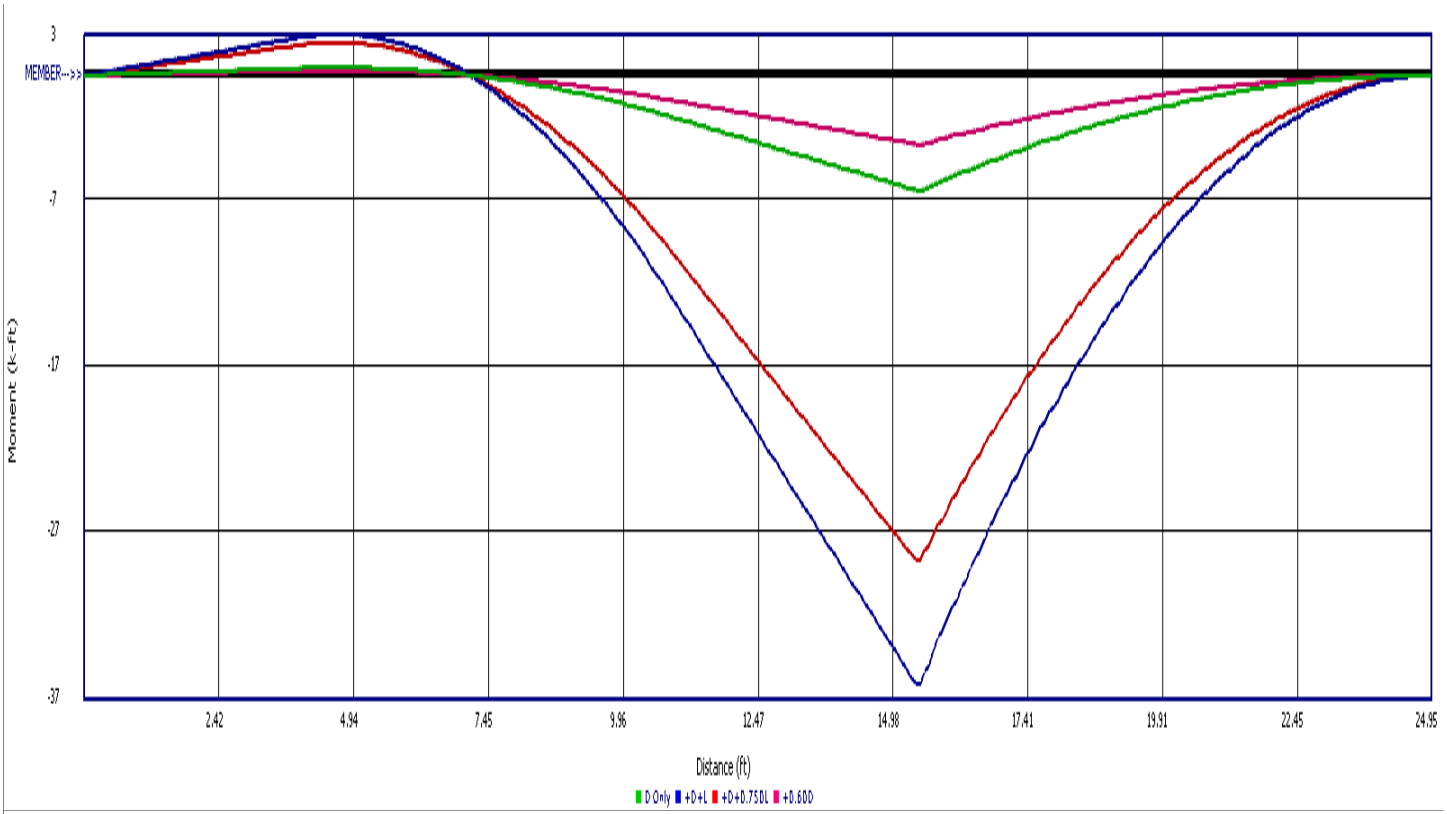
Vertical Reactions

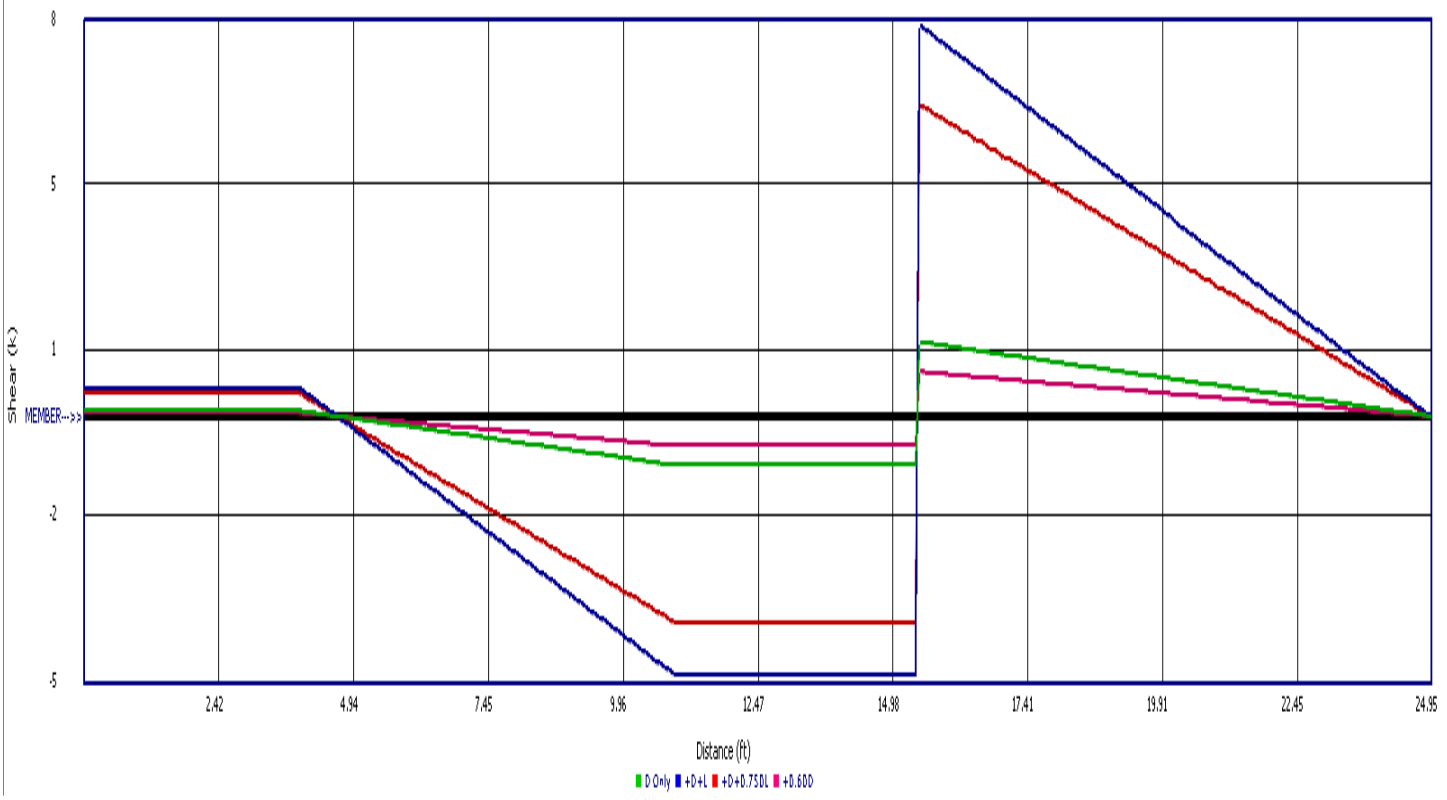
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.571	12.860	
Max Upward from Load Combinations	0.571	12.860	
Max Upward from Load Cases	0.463	10.427	
D Only	0.108	2.433	
+D+L	0.571	12.860	
+D+0.750L	0.455	10.253	
+0.60D	0.065	1.460	
L Only	0.463	10.427	

Wood Beam

DESCRIPTION: BM #2





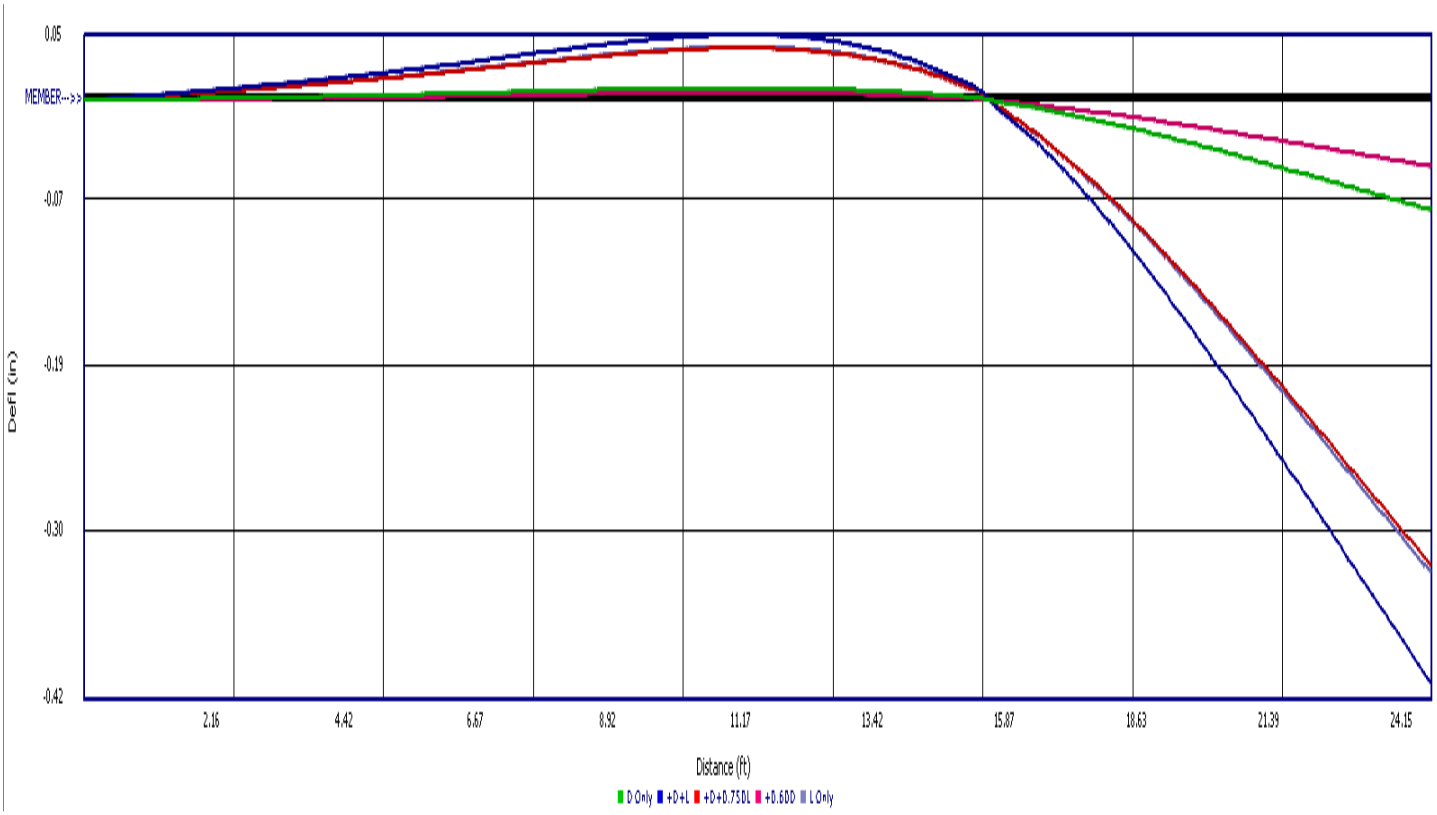
Kirkland, WA 98034

Printed: 28 JUL 2025, 1:29PM

Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #2



Wood Beam

DESCRIPTION: BM #3

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : NDS 2018
Load Combination Set : ASCE 7-16

Material Properties

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

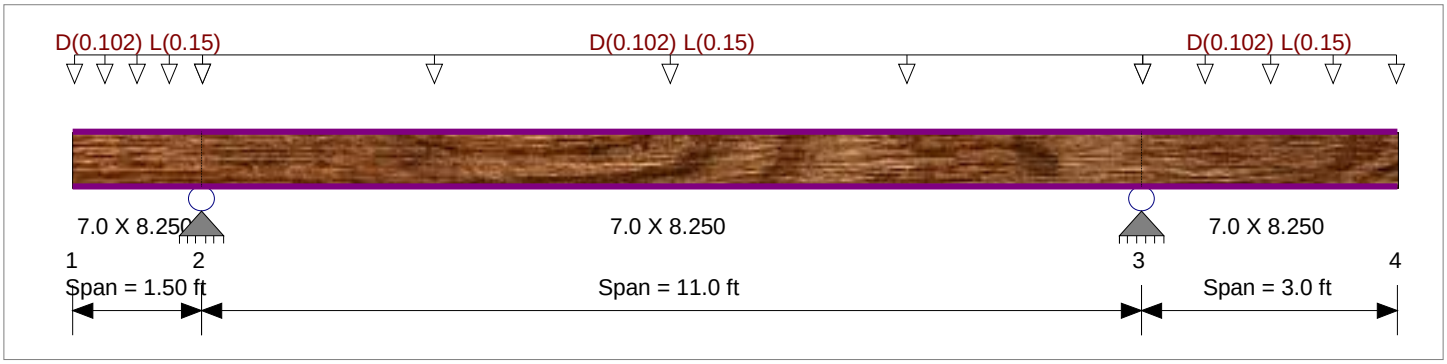
Wood Species : iLevel Truss Joist
Wood Grade : Parallam PSL 2.0E

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

Fb +	2900 psi
Fb -	2900 psi
Fc - Prll	2900 psi
Fc - Perp	750 psi
Fv	290 psi
Ft	2025 psi

E : Modulus of Elasticity

Ebend- xx	2000 ksi
Eminbend - xx	1016.535 ksi
Density	45.07 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 6.0 ft
Load for Span Number 2
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 6.0 ft
Load for Span Number 3
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 6.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.158 : 1	Maximum Shear Stress Ratio	=	0.116 : 1
Section used for this span		7.0 X 8.250	Section used for this span		7.0 X 8.250
fb: Actual	=	470.68 psi	fv: Actual	=	33.77 psi
F'b	=	2,985.01 psi	F'v	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	5.176 ft	Location of maximum on span	=	10.353 ft
Span # where maximum occurs	=	Span # 2	Span # where maximum occurs	=	Span # 2

Maximum Deflection

Max Downward Transient Deflection	0.059 in	Ratio =	2221	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.025 in	Ratio =	1420	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.100 in	Ratio =	1322	>=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.043 in	Ratio =	846	>=240	Span: 1 : +D+L

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 = 1.50 ft	1	0.006	0.046	0.90	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.11	17.3	2,686.5	0.46	12.0	261.0
Length = 11.0 ft	2	0.071	0.052	0.90	1.00	1.00	1.00	1.029	1.00	1.00	1.00	1.26	190.5	2,686.5	0.53	13.7	261.0
Length = 3.0 ft	3	0.026	0.024	0.90	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.46	69.4	2,686.5	0.24	6.1	261.0

Wood Beam

DESCRIPTION: BM #3

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+L					1.00	1.00	1.00	1.029	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 1.50 ft	1	0.014	0.103	1.00	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.28	42.8	2,985.0	1.15	29.8	290.0
Length = 11.0 ft	2	0.158	0.116	1.00	1.00	1.00	1.00	1.029	1.00	1.00	1.00	3.11	470.7	2,985.0	1.30	33.8	290.0
Length = 3.0 ft	3	0.057	0.052	1.00	1.00	1.00	1.00	1.029	1.00	1.00	1.00	1.13	171.4	2,985.0	0.58	15.2	290.0
+D+0.750L					1.00	1.00	1.00	1.029	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 1.50 ft	1	0.010	0.070	1.25	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.24	36.5	3,731.3	0.98	25.3	362.5
Length = 11.0 ft	2	0.107	0.079	1.25	1.00	1.00	1.00	1.029	1.00	1.00	1.00	2.65	400.6	3,731.3	1.11	28.7	362.5
Length = 3.0 ft	3	0.039	0.036	1.25	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.97	145.9	3,731.3	0.50	12.9	362.5
+0.60D					1.00	1.00	1.00	1.029	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 1.50 ft	1	0.002	0.016	1.60	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.07	10.4	4,776.0	0.28	7.2	464.0
Length = 11.0 ft	2	0.024	0.018	1.60	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.76	114.3	4,776.0	0.32	8.2	464.0
Length = 3.0 ft	3	0.009	0.008	1.60	1.00	1.00	1.00	1.029	1.00	1.00	1.00	0.28	41.6	4,776.0	0.14	3.7	464.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.0425	0.000
2	+D+L	0.0998	5.454		0.0000	0.000
3		0.0000	5.454	+D+L	-0.0669	3.000

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	2	0.0404	in	5.454 ft	0.0000	in	0.000	ft
+D+L	2	0.0998	in	5.454 ft	0.0000	in	0.000	ft
+D+0.750L	2	0.0850	in	5.454 ft	0.0000	in	0.000	ft
+0.60D	2	0.0242	in	5.454 ft	0.0000	in	0.000	ft
L Only	2	0.0594	in	5.454 ft	0.0000	in	0.000	ft

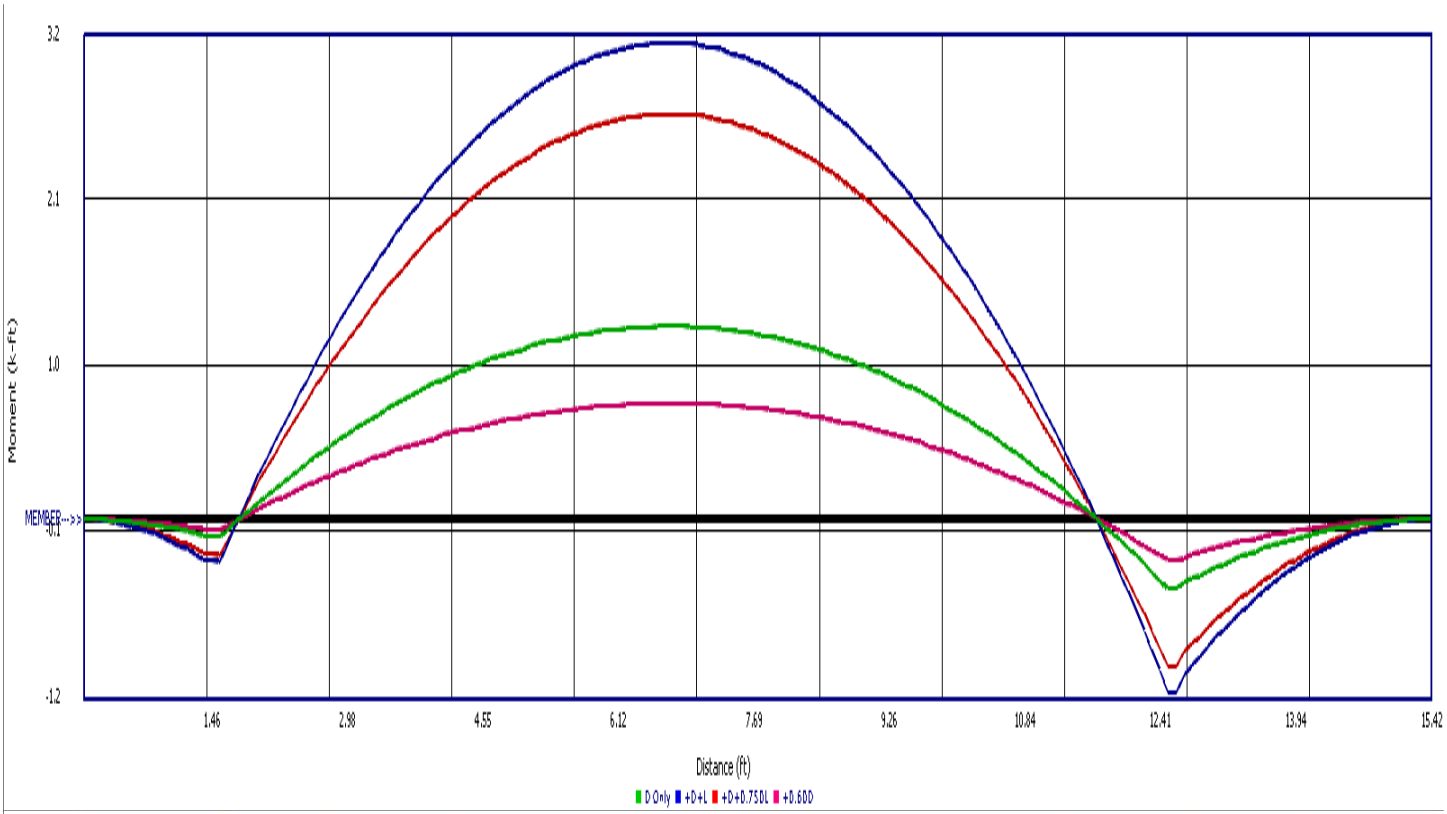
Vertical Reactions

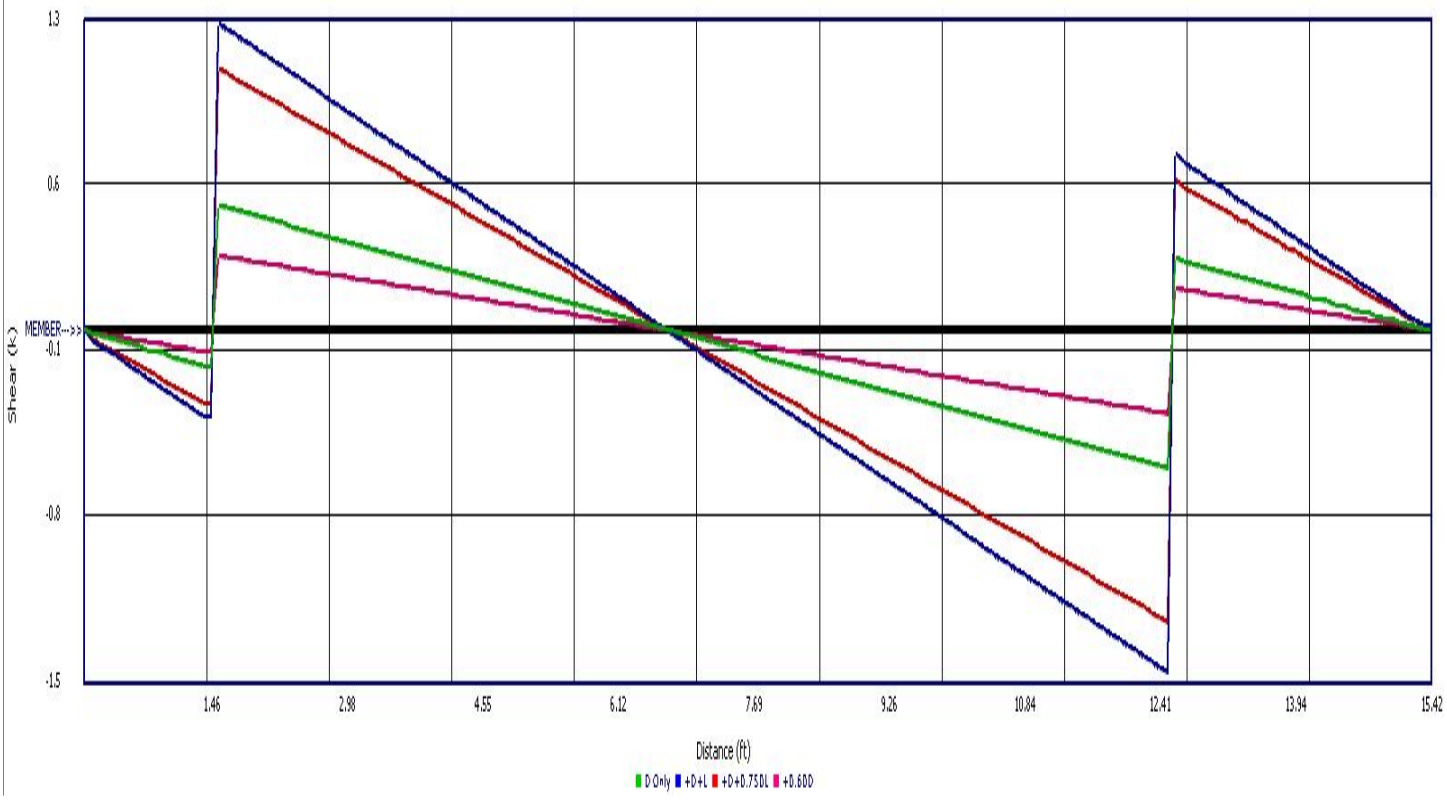
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3	Support 4
Max Upward from all Load Conditions		1.687	2.219	
Max Upward from Load Combinations		1.687	2.219	
Max Upward from Load Cases		1.004	1.321	
D Only		0.683	0.898	
+D+L		1.687	2.219	
+D+0.750L		1.436	1.889	
+0.60D		0.410	0.539	
L Only		1.004	1.321	

Wood Beam

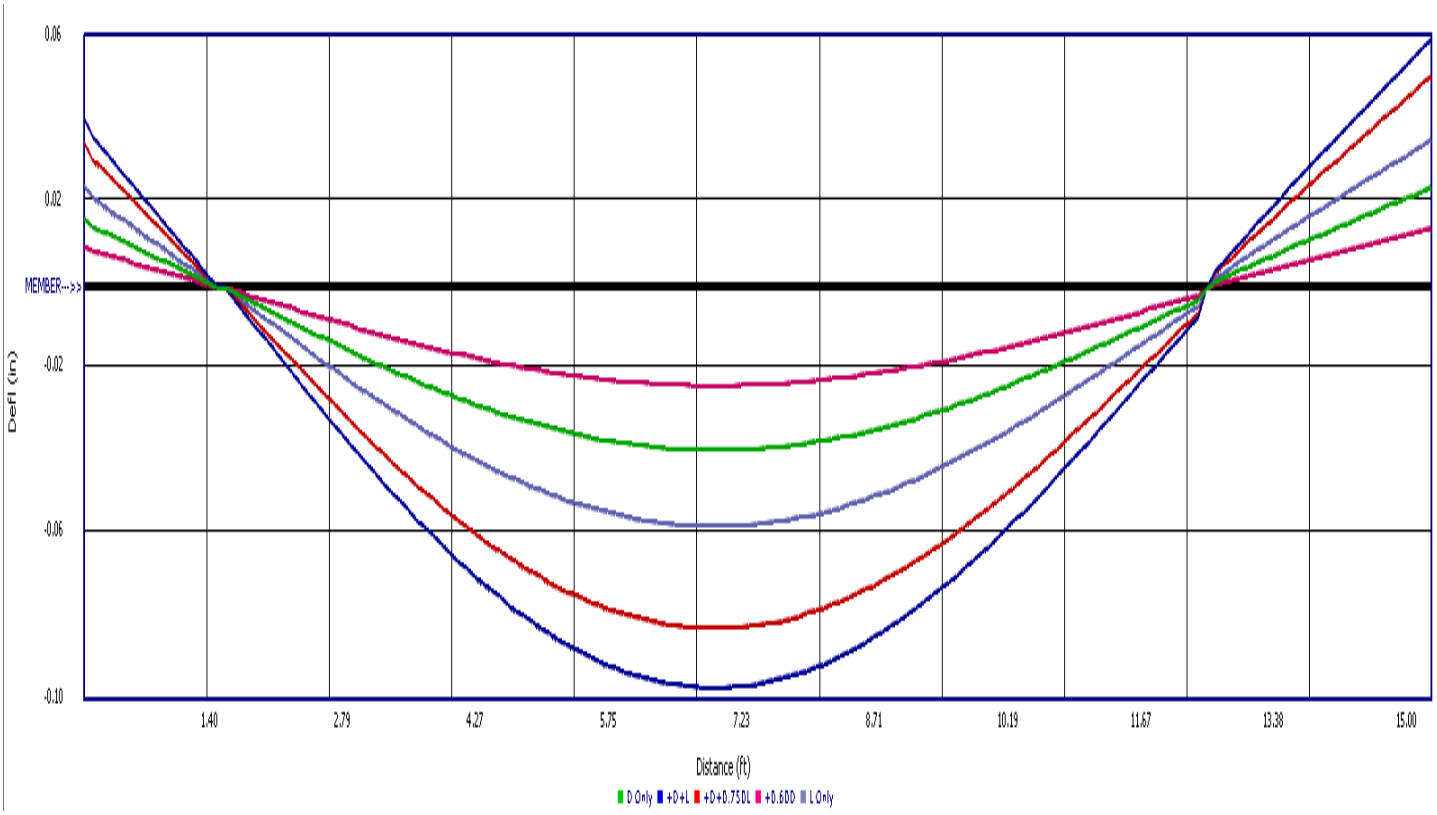
DESCRIPTION: BM #3





Wood Beam

DESCRIPTION: BM #3



Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #4

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : NDS 2018
Load Combination Set : ASCE 7-16

Material Properties

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

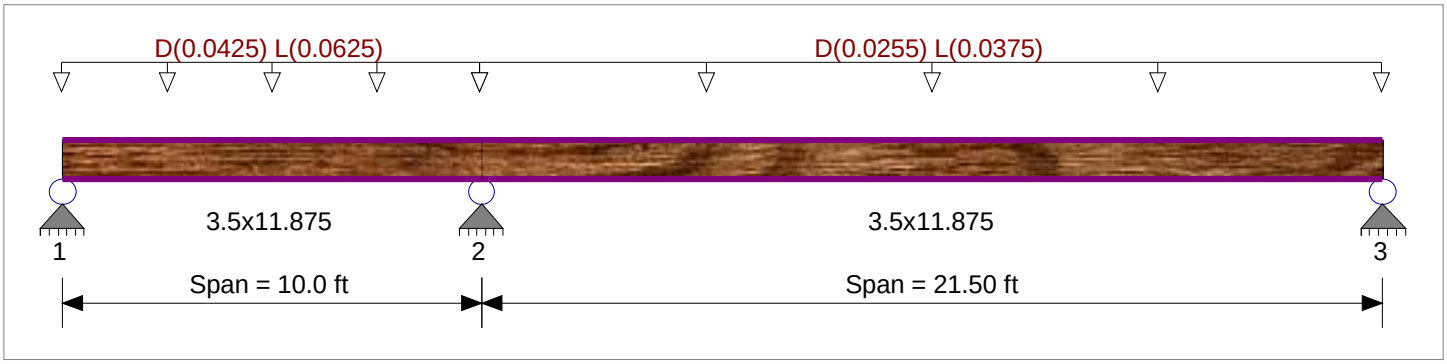
Wood Species : iLevel Truss Joist
Wood Grade : Parallam PSL 2.0E

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

Fb +	2900 psi
Fb -	2900 psi
Fc - Prll	2900 psi
Fc - Perp	750 psi
Fv	290 psi
Ft	2025 psi

E : Modulus of Elasticity

Ebend- xx	2000 ksi
Eminbend - xx	1016.535 ksi
Density	45.07 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 2.50 ft
Load for Span Number 2
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 1.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.146** : 1	Maximum Shear Stress Ratio	=	**0.094** : 1
Section used for this span		**3.5x11.875**	Section used for this span		**3.5x11.875**
fb: Actual	=	423.24 psi	fv: Actual	=	27.13 psi
F'b	=	2,903.37 psi	F'v	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	10.000 ft	Location of maximum on span	=	10.000 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.098 in	Ratio = 2626	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.007 in	Ratio = 18437	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.165 in	Ratio = 1563	>=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.011 in	Ratio = 10974	>=240	Span: 1 : +D+L

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	0.066	0.042	0.90	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.17	171.3	2,613.0	0.30	11.0	261.0
Length = 21.50 ft	2	0.066	0.042	0.90	1.00	1.00	1.00	1.001	1.00	1.00	1.00	1.17	171.3	2,613.0	0.30	11.0	261.0
+D+L					1.00	1.00	1.00	1.001	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.146	0.094	1.00	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.90	423.2	2,903.4	0.75	27.1	290.0

Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #4

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
Length = 21.50 ft	**2**	0.146	0.094	1.00	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.90	423.2	2,903.4	0.75	27.1	290.0
+D+0.750L					1.00	1.00	1.00	1.001	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	**1**	0.099	0.064	1.25	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.47	360.3	3,629.2	0.64	23.1	362.5
Length = 21.50 ft	**2**	0.099	0.064	1.25	1.00	1.00	1.00	1.001	1.00	1.00	1.00	2.47	360.3	3,629.2	0.64	23.1	362.5
+0.60D					1.00	1.00	1.00	1.001	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	**1**	0.022	0.014	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	0.70	102.8	4,645.4	0.18	6.6	464.0
Length = 21.50 ft	**2**	0.022	0.014	1.60	1.00	1.00	1.00	1.001	1.00	1.00	1.00	0.70	102.8	4,645.4	0.18	6.6	464.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.0109	7.263
2	+D+L	0.1650	12.011		0.0000	7.263

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	2	0.0668	in	12.011 ft	0.0000	in	0.000	ft
+D+L	2	0.1650	in	12.011 ft	0.0000	in	0.000	ft
+D+0.750L	2	0.1405	in	12.011 ft	0.0000	in	0.000	ft
+0.60D	2	0.0401	in	12.011 ft	0.0000	in	0.000	ft
L Only	2	0.0982	in	12.011 ft	0.0000	in	0.000	ft

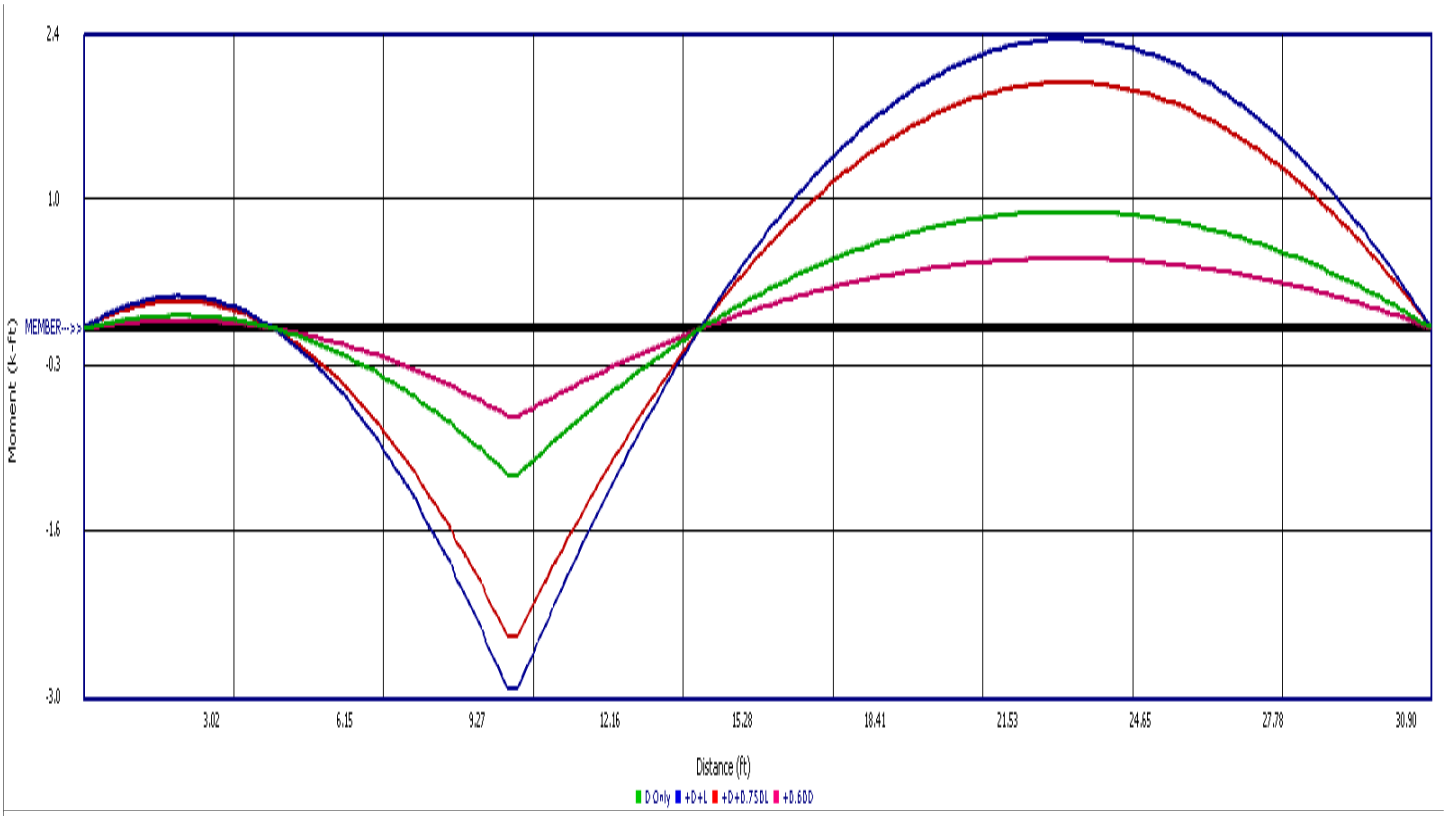
Vertical Reactions

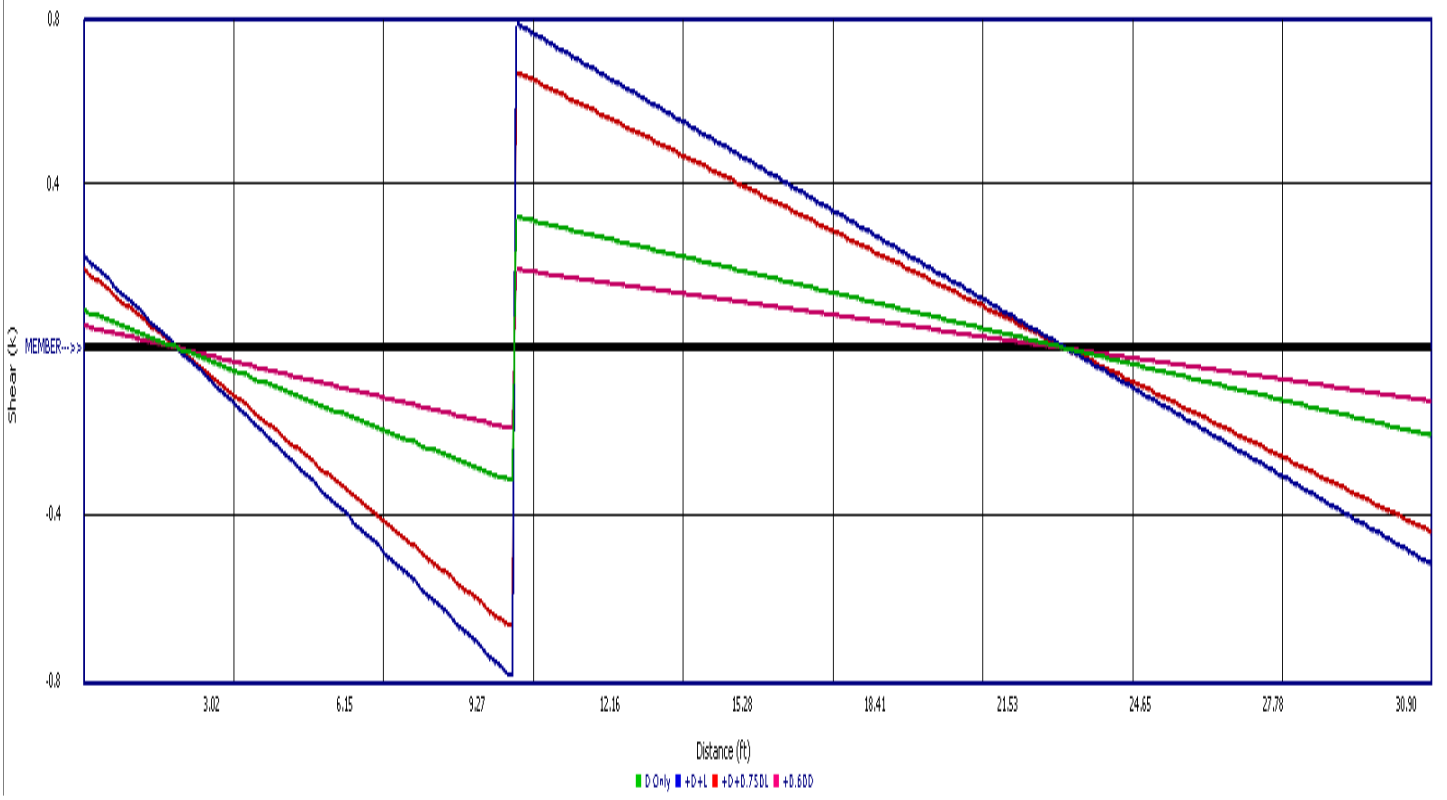
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	0.235	1.627	0.542
Max Upward from Load Combinations	0.235	1.627	0.542
Max Upward from Load Cases	0.140	0.969	0.323
D Only	0.095	0.659	0.220
+D+L	0.235	1.627	0.542
+D+0.750L	0.200	1.385	0.462
+0.60D	0.057	0.395	0.132
L Only	0.140	0.969	0.323

Wood Beam

DESCRIPTION: BM #4





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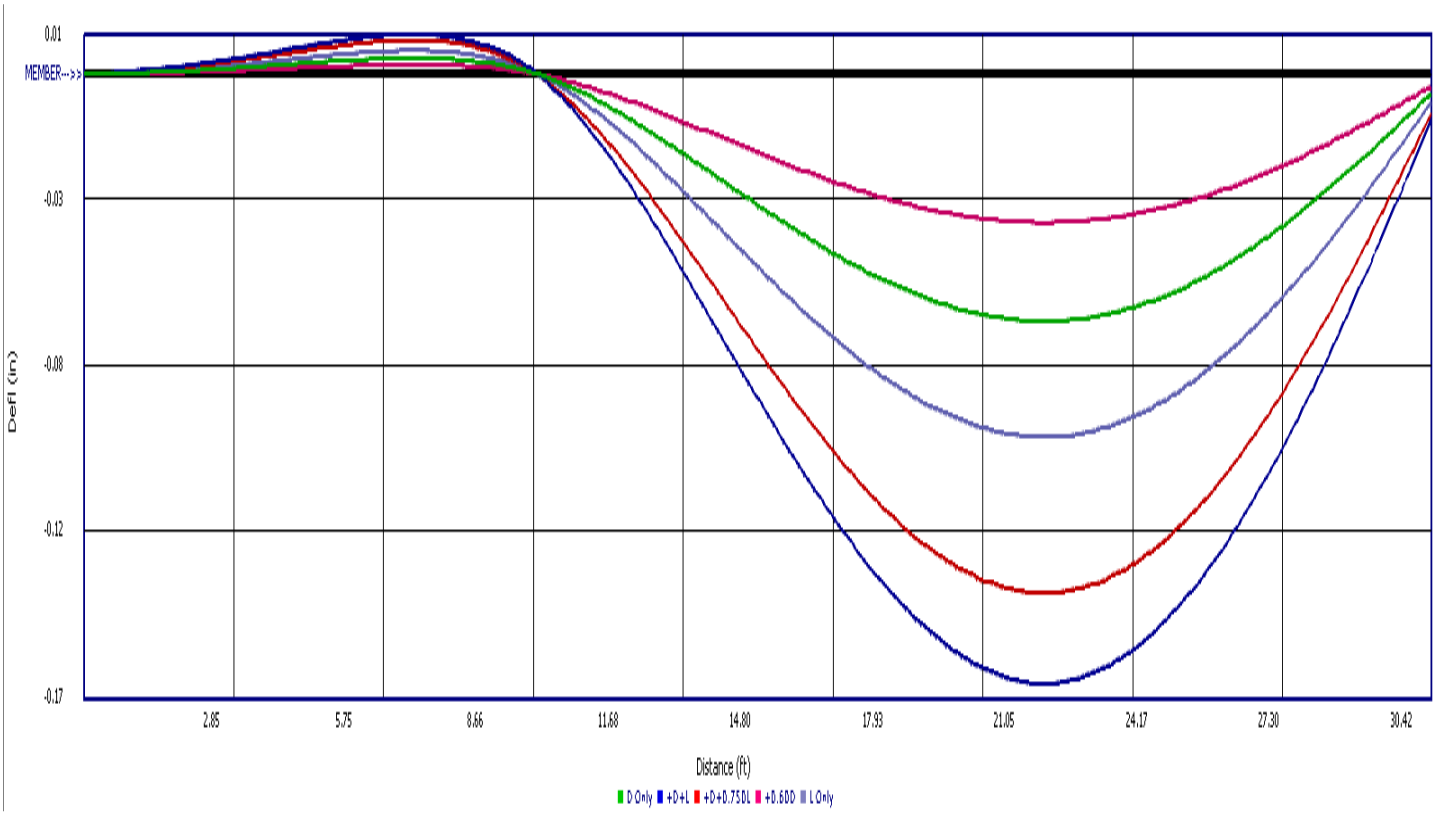
Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #4



Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #5

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

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

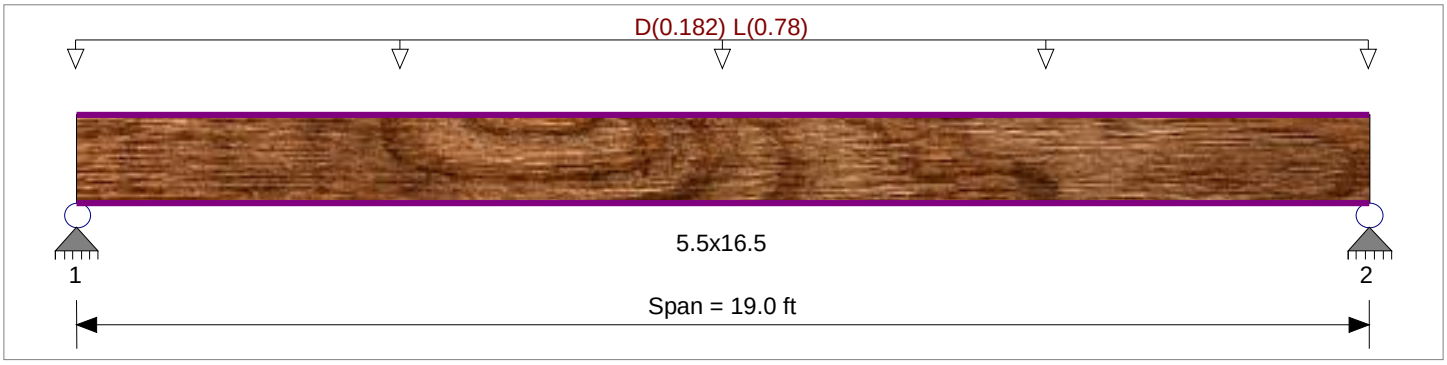
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 13.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.895 : 1	Maximum Shear Stress Ratio	=	0.491 : 1
Section used for this span		5.5x16.5	Section used for this span		5.5x16.5
fb: Actual	=	2,087.34 psi	fv: Actual	=	130.11 psi
F'b	=	2,331.64 psi	F'v	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	9.500 ft	Location of maximum on span	=	17.682 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.621 in	Ratio =	367	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.766 in	Ratio =	297	>=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 M	V	CD	CM	C_t	CLx	C_V	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 = 19.0 ft	1	0.188	0.103	0.90	1.00	1.00	1.00	0.972	1.00	1.00	1.00	8.21	394.9	2,098.5	1.49	24.6	238.5
+D+L					1.00	1.00	1.00	0.972	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 19.0 ft	1	0.895	0.491	1.00	1.00	1.00	1.00	0.972	1.00	1.00	1.00	43.41	2,087.3	2,331.6	7.87	130.1	265.0
+D+0.750L					1.00	1.00	1.00	0.972	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 19.0 ft	1	0.571	0.313	1.25	1.00	1.00	1.00	0.972	1.00	1.00	1.00	34.61	1,664.2	2,914.5	6.28	103.7	331.3
+0.60D					1.00	1.00	1.00	0.972	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 19.0 ft	1	0.064	0.035	1.60	1.00	1.00	1.00	0.972	1.00	1.00	1.00	4.93	236.9	3,730.6	0.89	14.8	424.0

Wood Beam

DESCRIPTION: BM #5

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.7656	9.569		0.0000	0.000

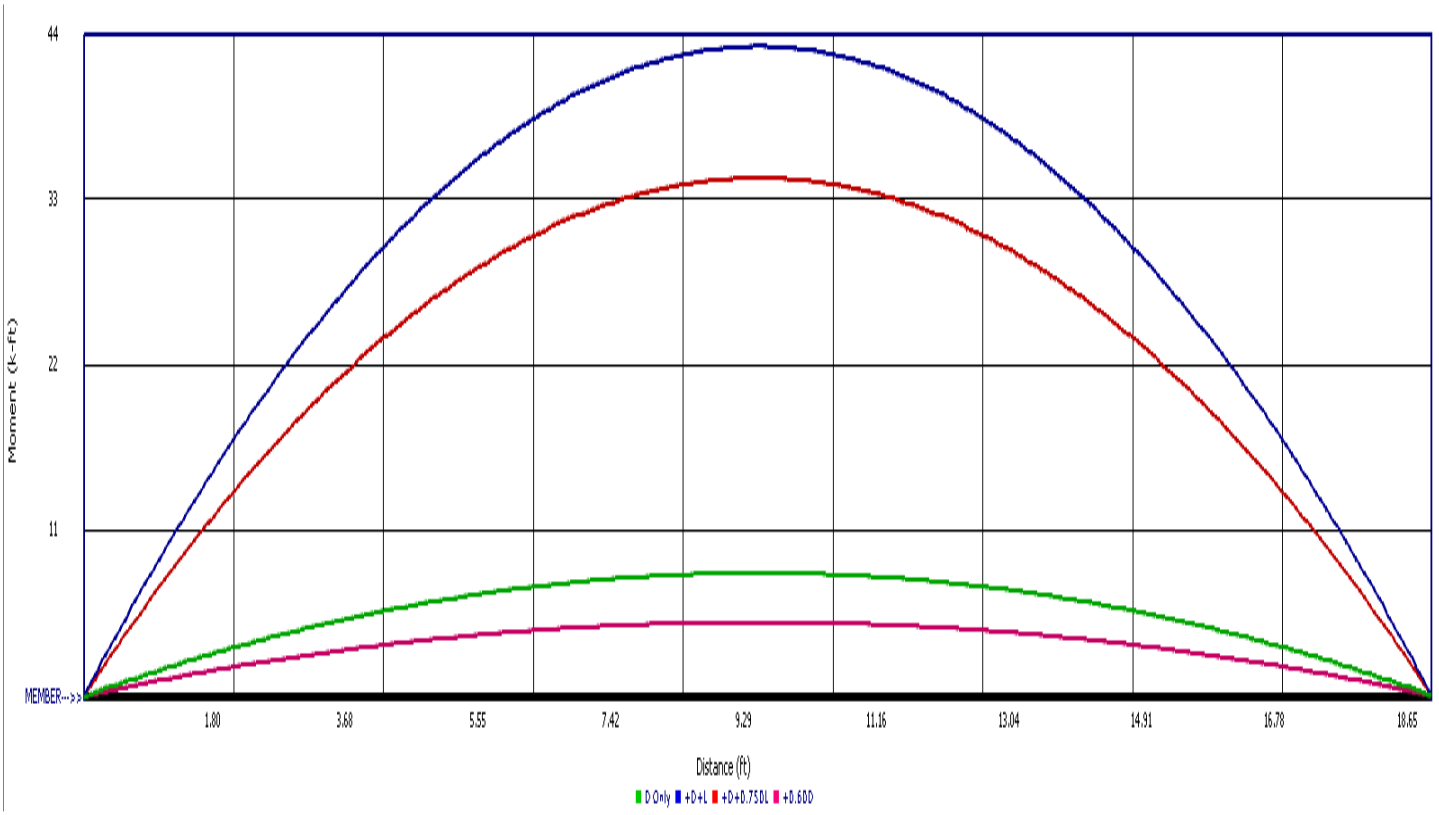
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.1448	in	9.569 ft	0.0000	in	0.000	ft
+D+L	1	0.7656	in	9.569 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.6104	in	9.569 ft	0.0000	in	0.000	ft
+0.60D	1	0.0869	in	9.569 ft	0.0000	in	0.000	ft
L Only	1	0.6207	in	9.569 ft	0.0000	in	0.000	ft

Vertical Reactions

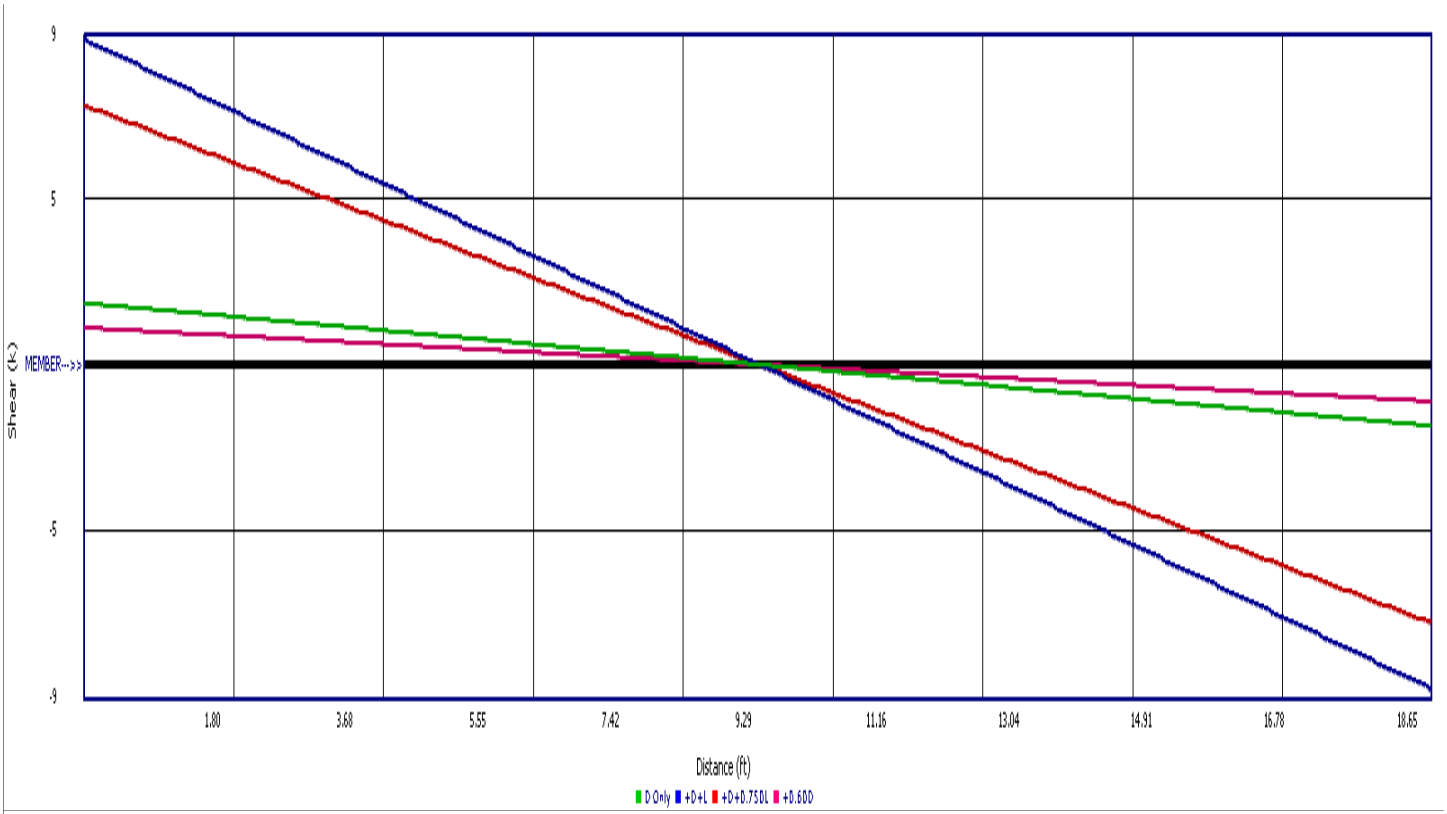
Support notation : Far left is #1 Values in KIPS

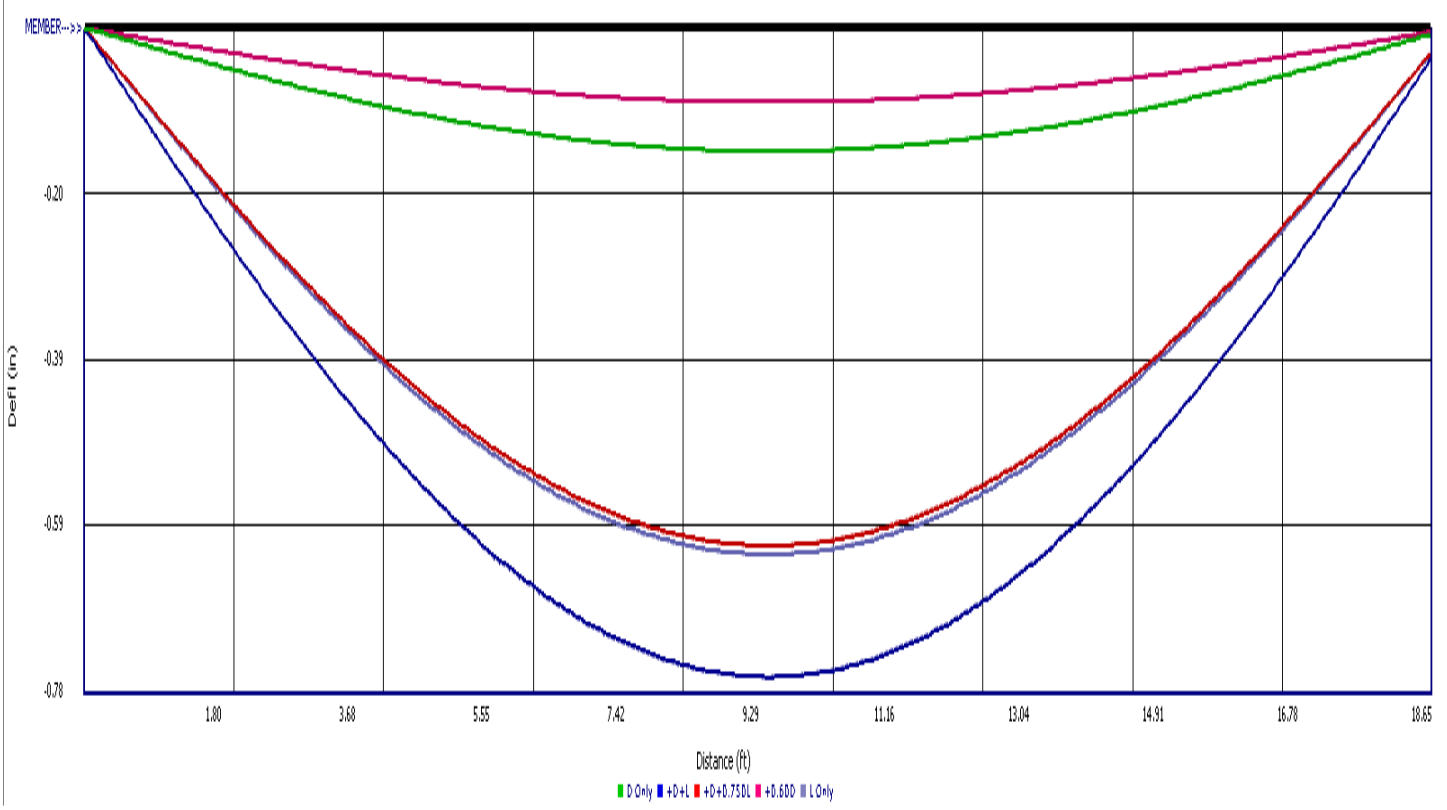
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	9.139	9.139
Max Upward from Load Combinations	9.139	9.139
Max Upward from Load Cases	7.410	7.410
D Only	1.729	1.729
+D+L	9.139	9.139
+D+0.750L	7.287	7.287
+0.60D	1.037	1.037
L Only	7.410	7.410



Wood Beam

DESCRIPTION: BM #5





Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #6

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

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

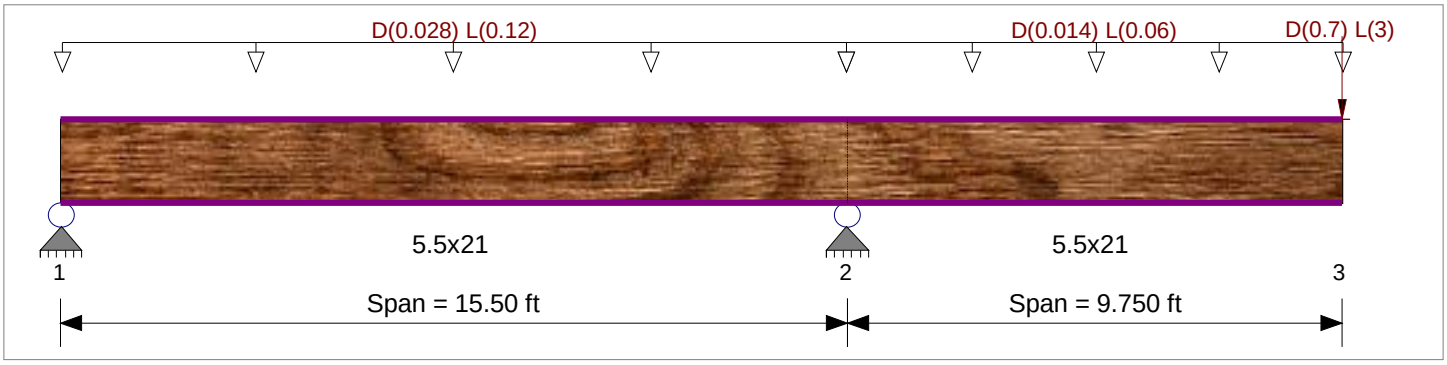
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 2.0 ft
Load for Span Number 2
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 1.0 ft
Point Load : D = 0.70, L = 3.0 k @ 9.750 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.656 : 1	Maximum Shear Stress Ratio	=	0.210 : 1
Section used for this span		5.5x21	Section used for this span		5.5x21
fb: Actual	=	1,175.28 psi	fv: Actual	=	55.75 psi
F'b	=	1,790.56 psi	F'v	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	15.500 ft	Location of maximum on span	=	15.500 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.549 in	Ratio = 426	>=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.093 in	Ratio = 2003	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.677 in	Ratio = 344	>=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.115 in	Ratio = 1624	>=240	Span: 1 : +D+L

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	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 = 15.50 ft	1	0.138	0.044	0.90	1.00	1.00	1.00	0.968	1.00	1.00	1.00	7.49	222.4	1,611.5	0.81	10.5	238.5
Length = 9.750 ft	2	0.134	0.044	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	7.49	222.4	1,665.0	0.81	10.5	238.5
+D+L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	1	0.656	0.210	1.00	1.00	1.00	1.00	0.968	1.00	1.00	1.00	39.59	1,175.3	1,790.6	4.29	55.7	265.0

Wood Beam

DESCRIPTION: BM #6

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 9.750 ft	**2**	0.635	0.210	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	39.59	1,175.3	1,850.0	4.29	55.7	265.0
+D+0.750L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	**1**	0.419	0.134	1.25	1.00	1.00	1.00	0.968	1.00	1.00	1.00	31.57	937.0	2,238.2	3.42	44.4	331.3
Length = 9.750 ft	**2**	0.405	0.134	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	31.57	937.0	2,312.5	3.42	44.4	331.3
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 15.50 ft	**1**	0.047	0.015	1.60	1.00	1.00	1.00	0.968	1.00	1.00	1.00	4.49	133.4	2,864.9	0.49	6.3	424.0
Length = 9.750 ft	**2**	0.045	0.015	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.49	133.4	2,960.0	0.49	6.3	424.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1		0.0000	0.000	+D+L	-0.1145	9.265
2	+D+L	0.6767	9.750		0.0000	9.265

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	2	0.1280	in	9.750 ft	0.0000	in	0.000	ft
+D+L	2	0.6767	in	9.750 ft	0.0000	in	0.000	ft
+D+0.750L	2	0.5396	in	9.750 ft	0.0000	in	0.000	ft
+0.60D	2	0.0768	in	9.750 ft	0.0000	in	0.000	ft
L Only	2	0.5487	in	9.750 ft	0.0000	in	0.000	ft

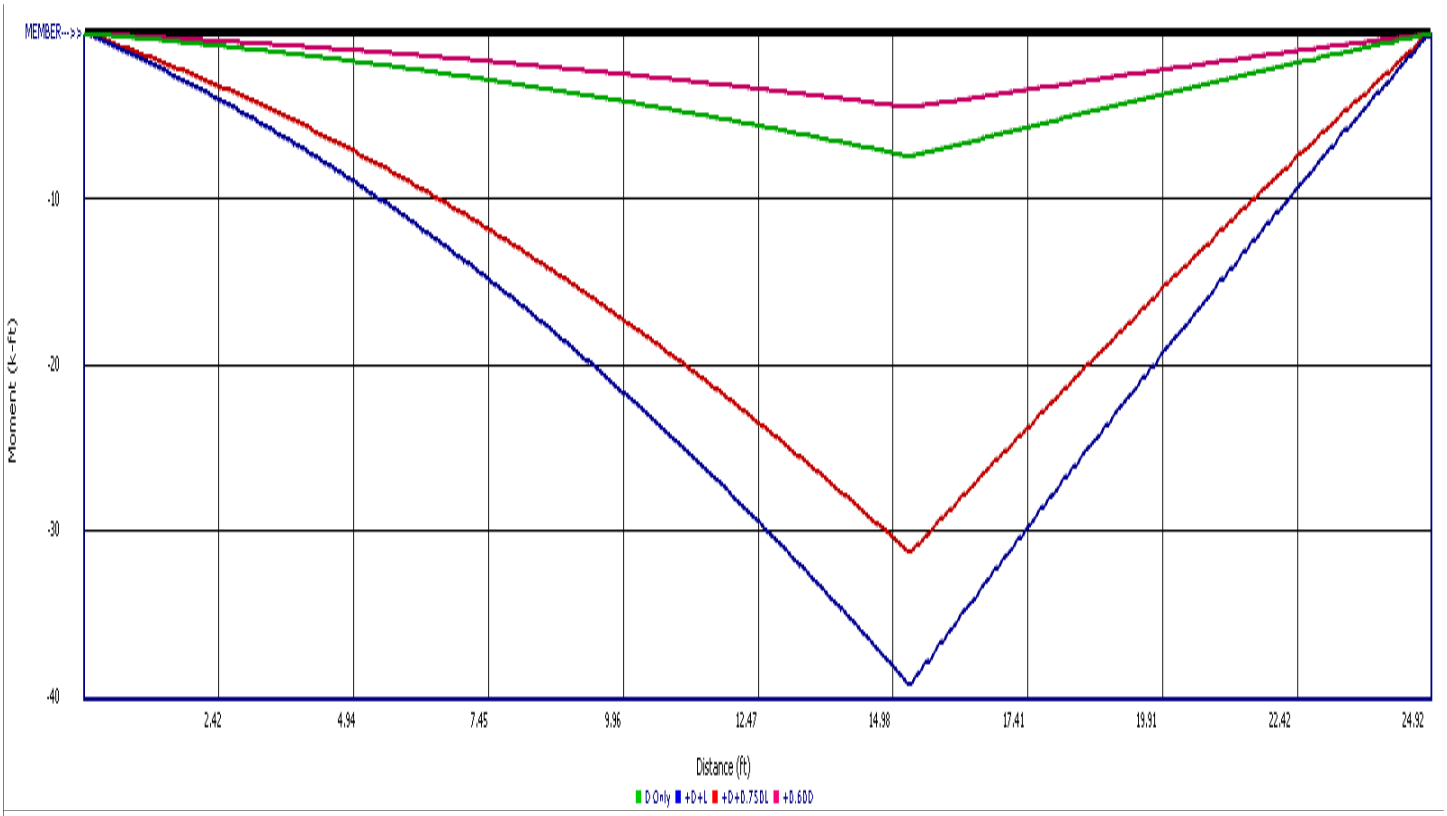
Vertical Reactions

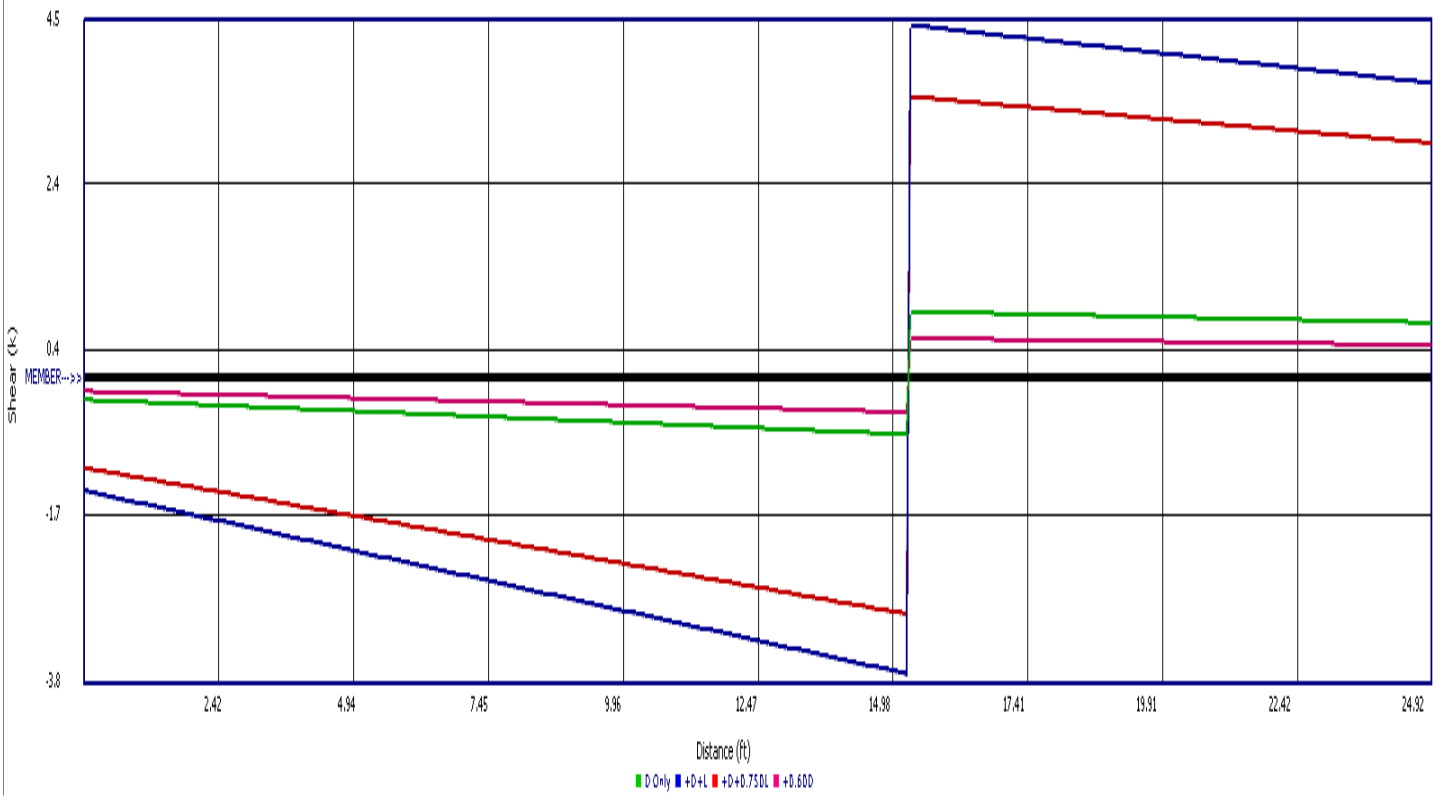
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions		8.123	
Max Upward from Load Combinations		8.123	
Max Upward from Load Cases		6.586	
Max Downward from all Load Conditions (Resisting Uplift)	-1.407		
Max Downward from Load Combinations (Resisting Uplift)	-1.407		
Max Downward from Load Cases (Resisting Uplift)	-1.141		
D Only	-0.266	1.537	
+D+L	-1.407	8.123	
+D+0.750L	-1.122	6.476	
+0.60D	-0.160	0.922	
L Only	-1.141	6.586	

Wood Beam

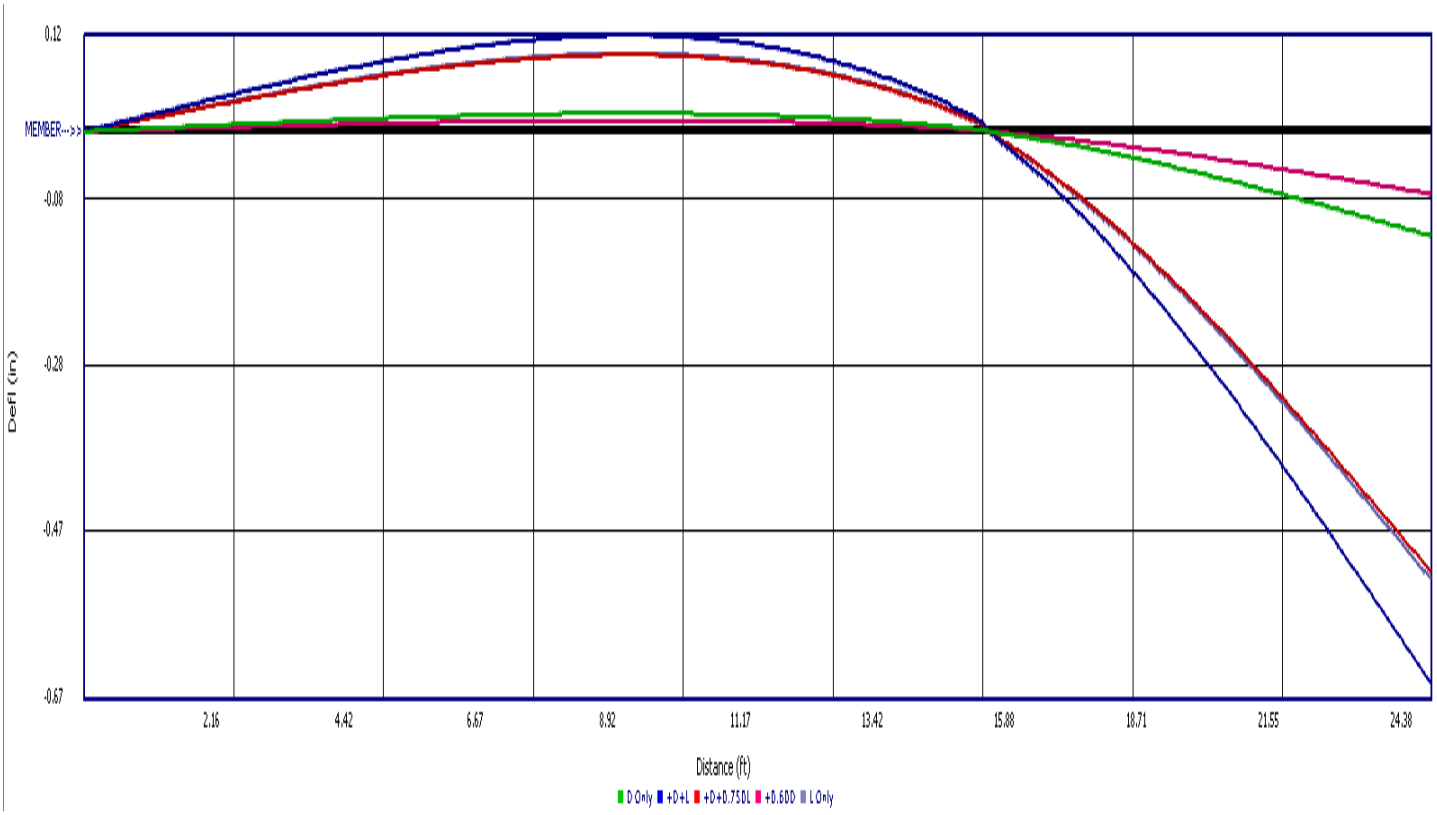
DESCRIPTION: BM #6





Wood Beam

DESCRIPTION: BM #6



Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #7

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

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

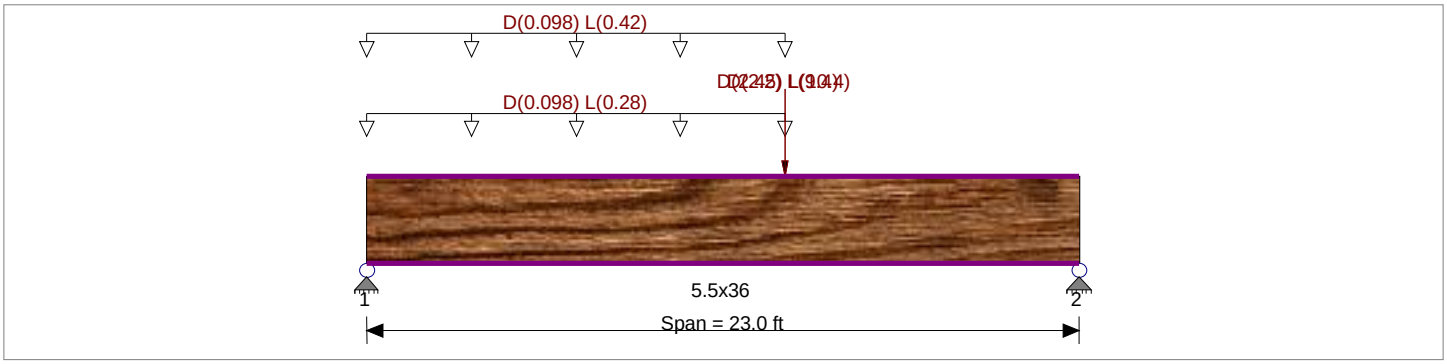
Wood Species : DF/DF
Wood Grade : 24F-V4

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

Fb +	2,400.0 psi
Fb -	1,850.0 psi
Fc - Prll	1,650.0 psi
Fc - Perp	650.0 psi
Fv	265.0 psi
Ft	1,100.0 psi

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0140, L = 0.040 ksf, Extent = 0.0 -->> 13.50 ft, Tributary Width = 7.0 ft
Point Load : D = 2.450, L = 10.40 k @ 13.50 ft
Point Load : D = 2.20, L = 9.40 k @ 13.50 ft
Uniform Load : D = 0.0140, L = 0.060 ksf, Extent = 0.0 -->> 13.50 ft, Tributary Width = 7.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.811 : 1	Maximum Shear Stress Ratio	=	0.512 : 1
Section used for this span		5.5x36	Section used for this span		5.5x36
fb: Actual	=	1,715.13 psi	fv: Actual	=	135.61 psi
F'b	=	2,115.83 psi	F'v	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	13.515 ft	Location of maximum on span	=	13.515 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.290 in	Ratio =	950	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.362 in	Ratio =	762	>=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 M	V	CD	CM	C_t	CLx	C_V	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 = 23.0 ft	1	0.176	0.111	0.90	1.00	1.00	1.00	0.882	1.00	1.00	1.00	33.25	335.9	1,904.2	3.51	26.6	238.5
+D+L					1.00	1.00	1.00	0.882	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 23.0 ft	1	0.811	0.512	1.00	1.00	1.00	1.00	0.882	1.00	1.00	1.00	169.80	1,715.1	2,115.8	17.90	135.6	265.0
+D+0.750L					1.00	1.00	1.00	0.882	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #7

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 23.0 ft	1	0.518	0.327	1.25	1.00	1.00	1.00	0.882	1.00	1.00	1.00	135.66	1,370.3	2,644.8	14.30	108.4	331.3
+0.60D					1.00	1.00	1.00	0.882	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 23.0 ft	1	0.060	0.038	1.60	1.00	1.00	1.00	0.882	1.00	1.00	1.00	19.95	201.5	3,385.3	2.10	15.9	424.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.3620	11.836		0.0000	0.000

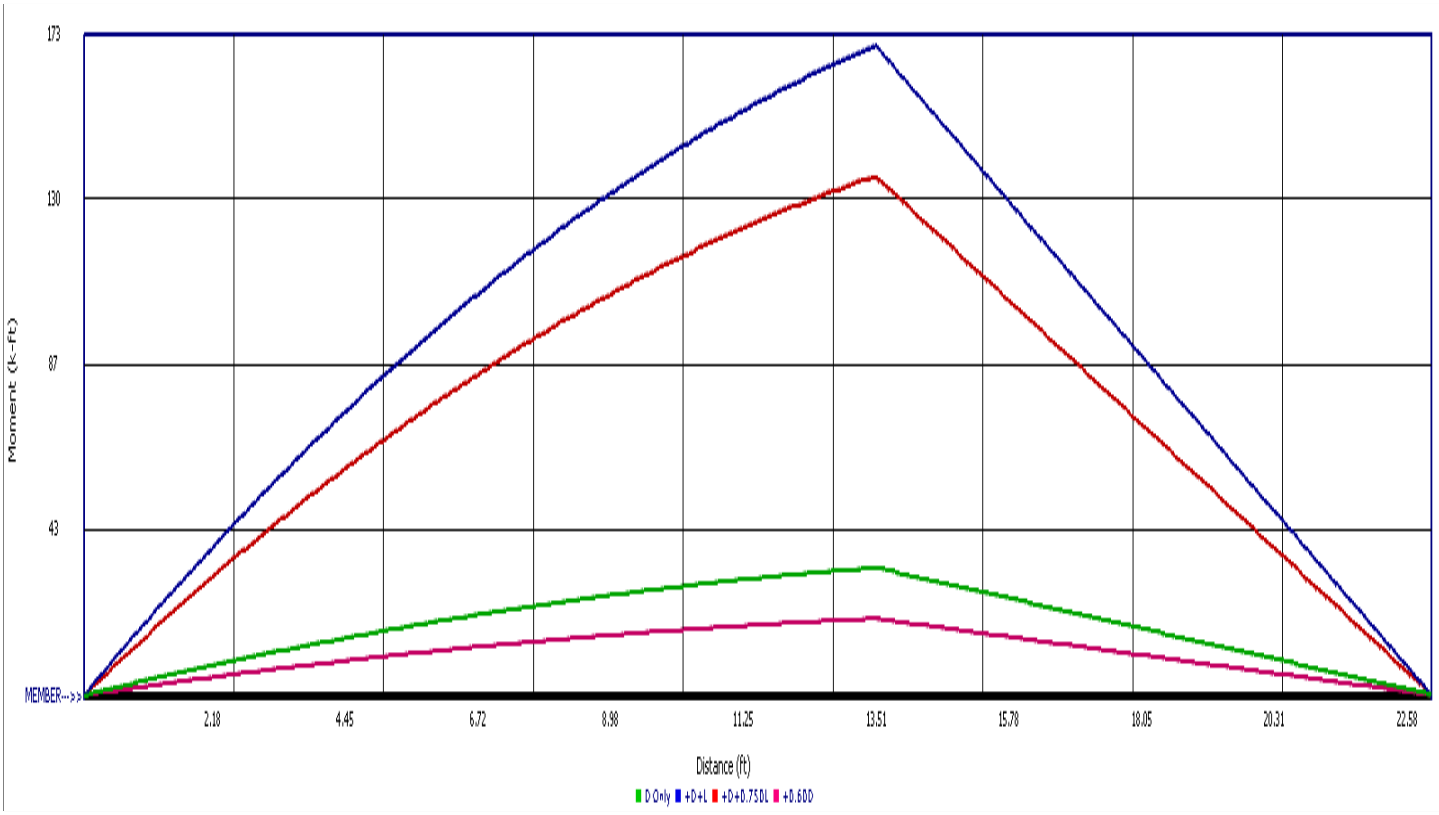
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0715	in	11.836 ft	0.0000	in	0.000	ft
+D+L	1	0.3620	in	11.836 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.2894	in	11.836 ft	0.0000	in	0.000	ft
+0.60D	1	0.0429	in	11.836 ft	0.0000	in	0.000	ft
L Only	1	0.2905	in	11.836 ft	0.0000	in	0.000	ft

Vertical Reactions

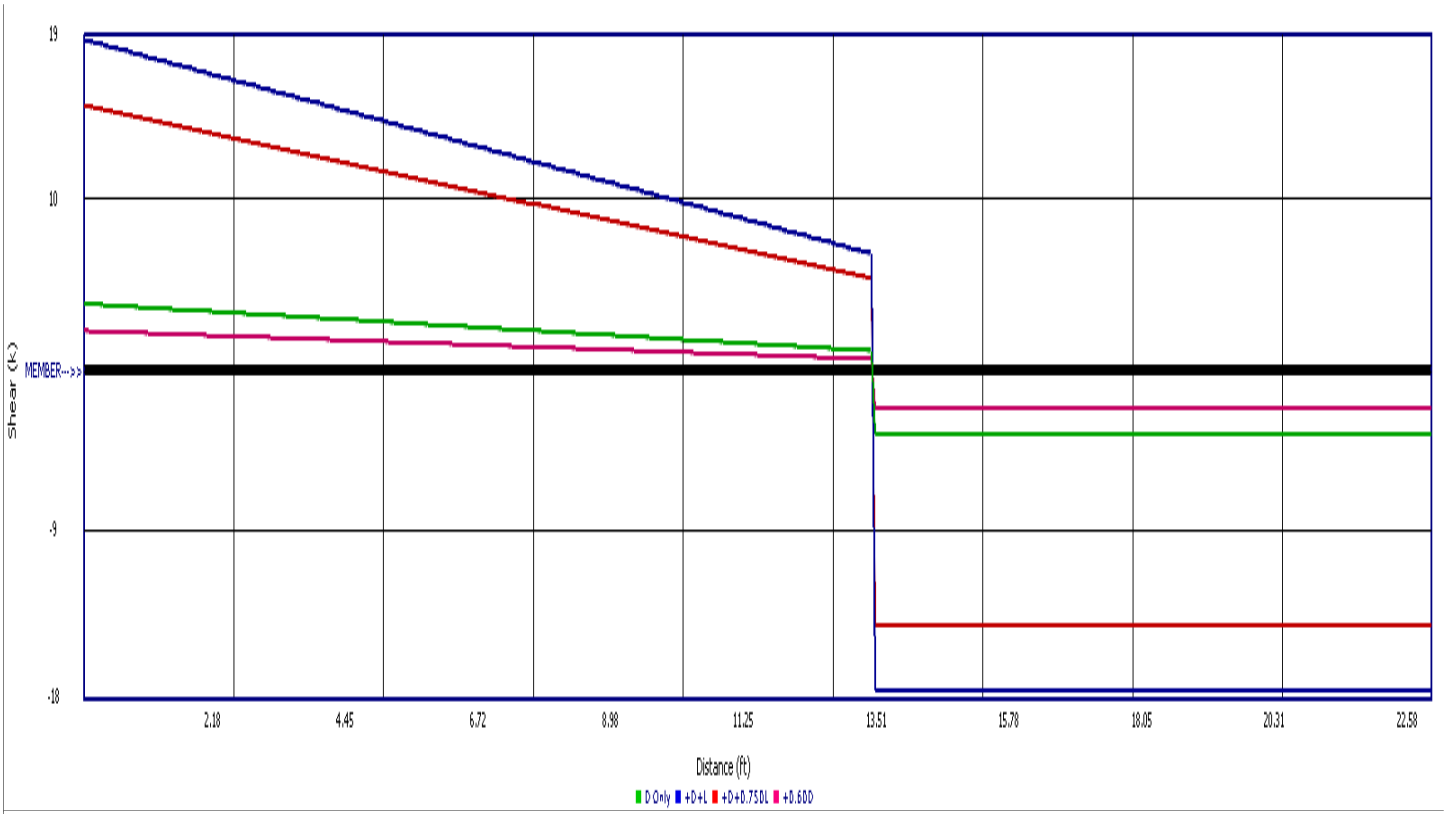
Support notation : Far left is #1 Values in KIPS

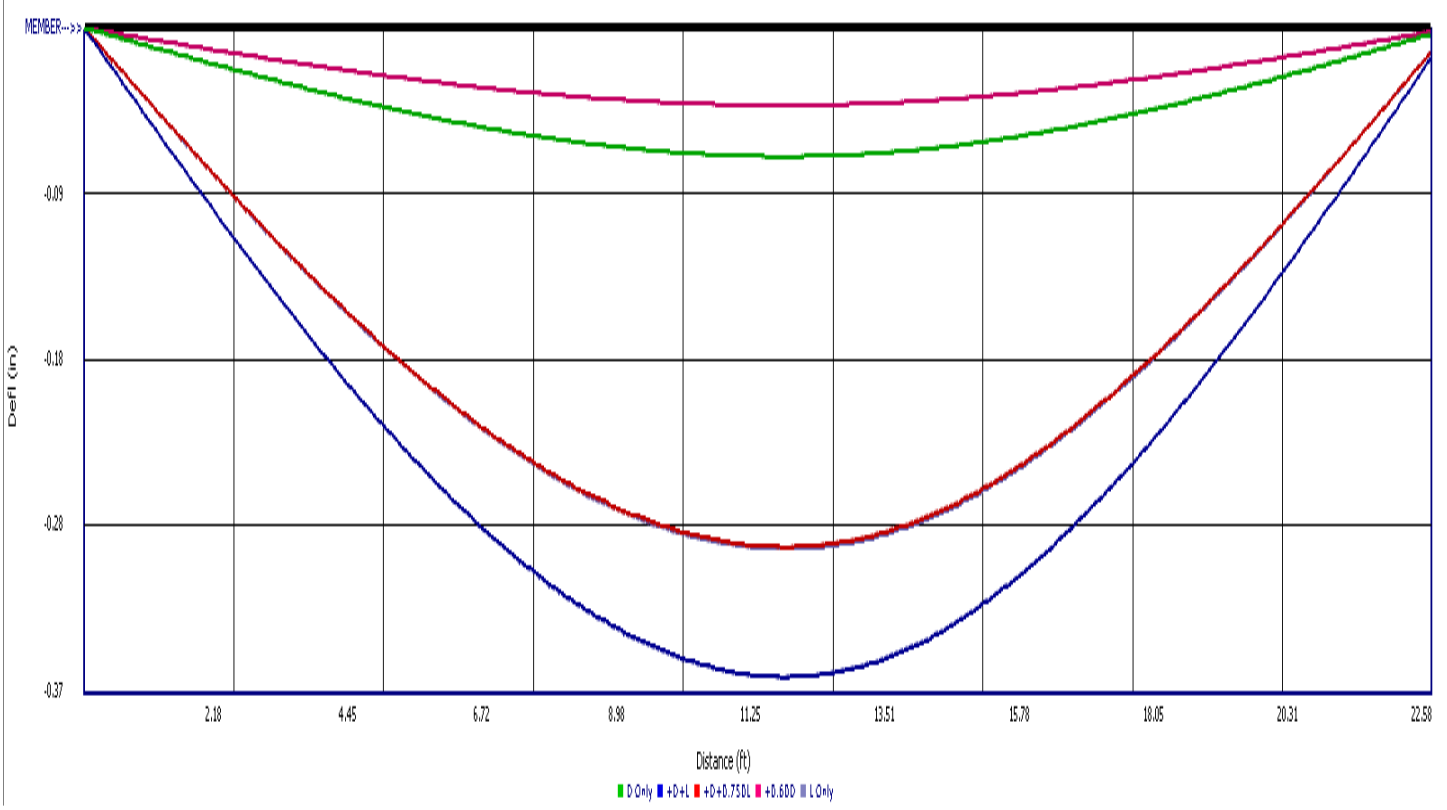
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	18.645	17.901
Max Upward from Load Combinations	18.645	17.901
Max Upward from Load Cases	14.855	14.395
D Only	3.790	3.506
+D+L	18.645	17.901
+D+0.750L	14.931	14.302
+0.60D	2.274	2.104
L Only	14.855	14.395



Wood Beam

DESCRIPTION: BM #7





Wood Beam

DESCRIPTION: BM #8

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : NDS 2018
Load Combination Set : ASCE 7-16

Material Properties

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

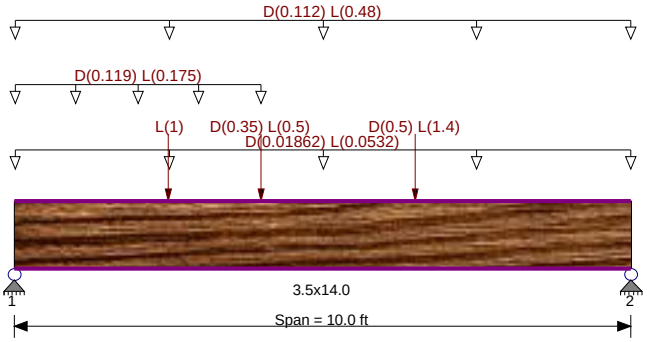
Wood Species : iLevel Truss Joist
Wood Grade : Parallam PSL 2.0E

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

Fb +	2,900.0 psi
Fb -	2,900.0 psi
Fc - Prll	2,900.0 psi
Fc - Perp	750.0 psi
Fv	290.0 psi
Ft	2,025.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,016.54 ksi
Density	45.070 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Uniform Load : D = 0.0140, L = 0.040 ksf, Tributary Width = 1.330 ft
Uniform Load : D = 0.0170, L = 0.0250 ksf, Extent = 0.0 -->> 4.0 ft, Tributary Width = 7.0 ft
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 8.0 ft
Point Load : L = 1.0 k @ 2.50 ft
Point Load : D = 0.350, L = 0.50 k @ 4.0 ft
Point Load : D = 0.50, L = 1.40 k @ 6.50 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.581 : 1	Maximum Shear Stress Ratio	=	0.538 : 1
Section used for this span		3.5x14.0	Section used for this span		3.5x14.0
fb: Actual	=	1,654.95 psi	fv: Actual	=	156.16 psi
F'b	=	2,850.80 psi	F'v	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.745 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	0.138 in	Ratio = 869	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio = 0	>=360	n/a
Max Downward Total Deflection	0.180 in	Ratio = 668	>=240	Span: 1 : +D+L
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 = 10.0 ft	1	0.151	0.133	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.70	388.1	2,565.7	1.14	34.8	261.0
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.581	0.538	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	15.77	1,655.0	2,850.8	5.10	156.2	290.0

Wood Beam

DESCRIPTION: BM #8

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					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.376	0.347	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	12.75	1,338.2	3,563.5	4.11	125.8	362.5
+0.60D					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.051	0.045	1.60	1.00	1.00	1.00	0.983	1.00	1.00	1.00	2.22	232.9	4,561.3	0.68	20.9	464.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.1796	5.000		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	0.0417	in	5.000 ft	0.0000	in	0.000	ft
+D+L	1	0.1796	in	5.000 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.1451	in	5.000 ft	0.0000	in	0.000	ft
+0.60D	1	0.0250	in	5.000 ft	0.0000	in	0.000	ft
L Only	1	0.1379	in	5.000 ft	0.0000	in	0.000	ft

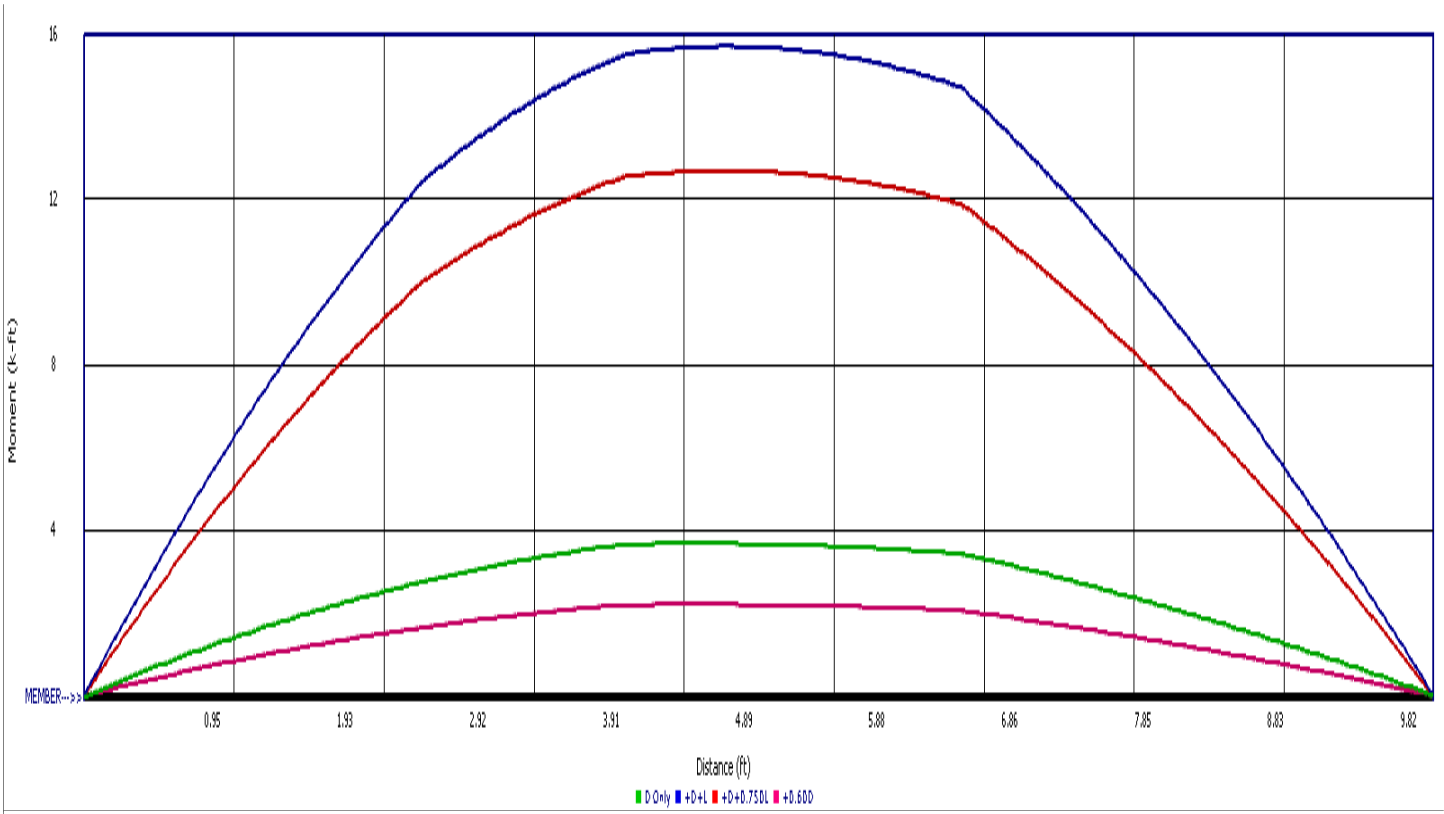
Vertical Reactions

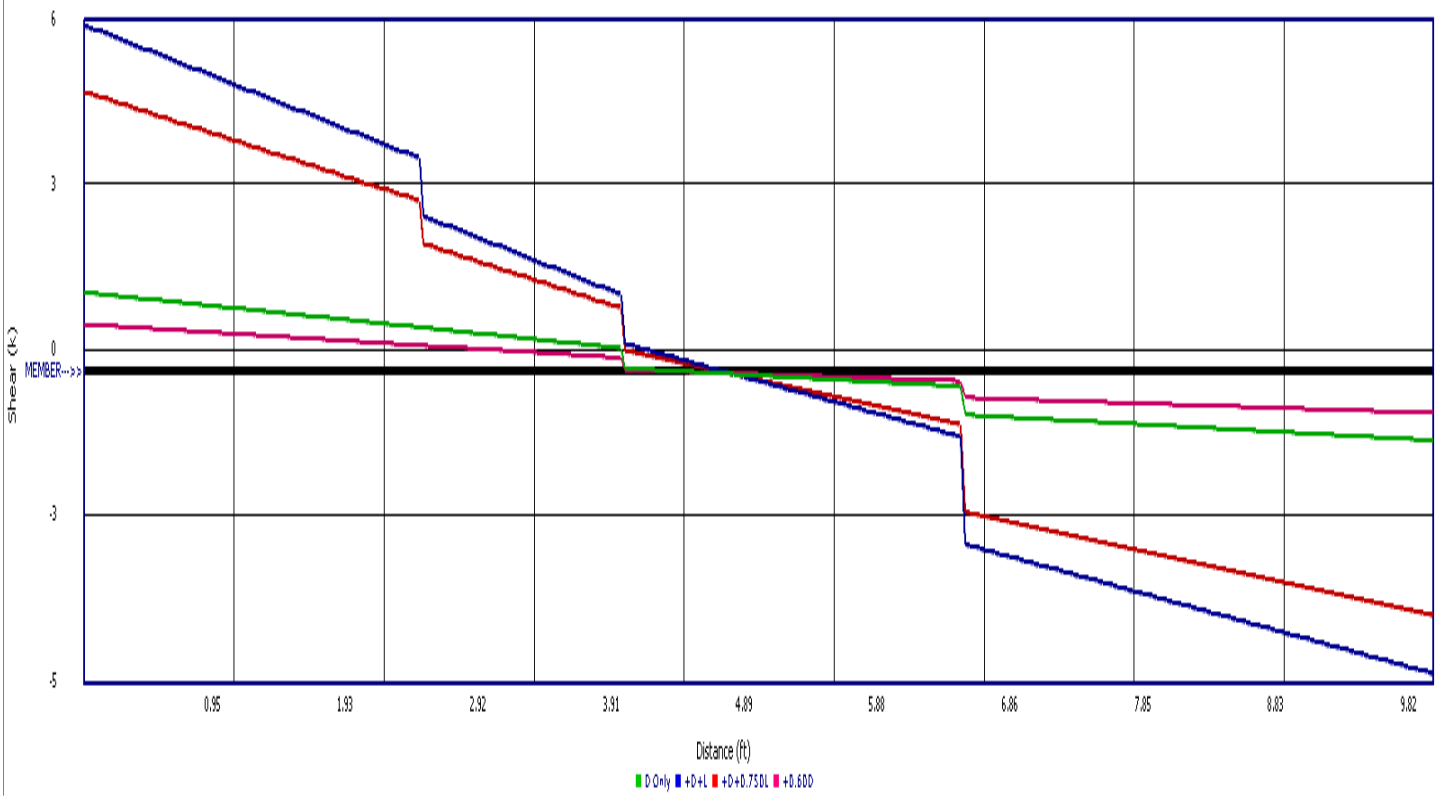
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	6.185	5.379
Max Upward from Load Combinations	6.185	5.379
Max Upward from Load Cases	4.766	4.166
D Only	1.419	1.213
+D+L	6.185	5.379
+D+0.750L	4.993	4.338
+0.60D	0.851	0.728
L Only	4.766	4.166

Wood Beam

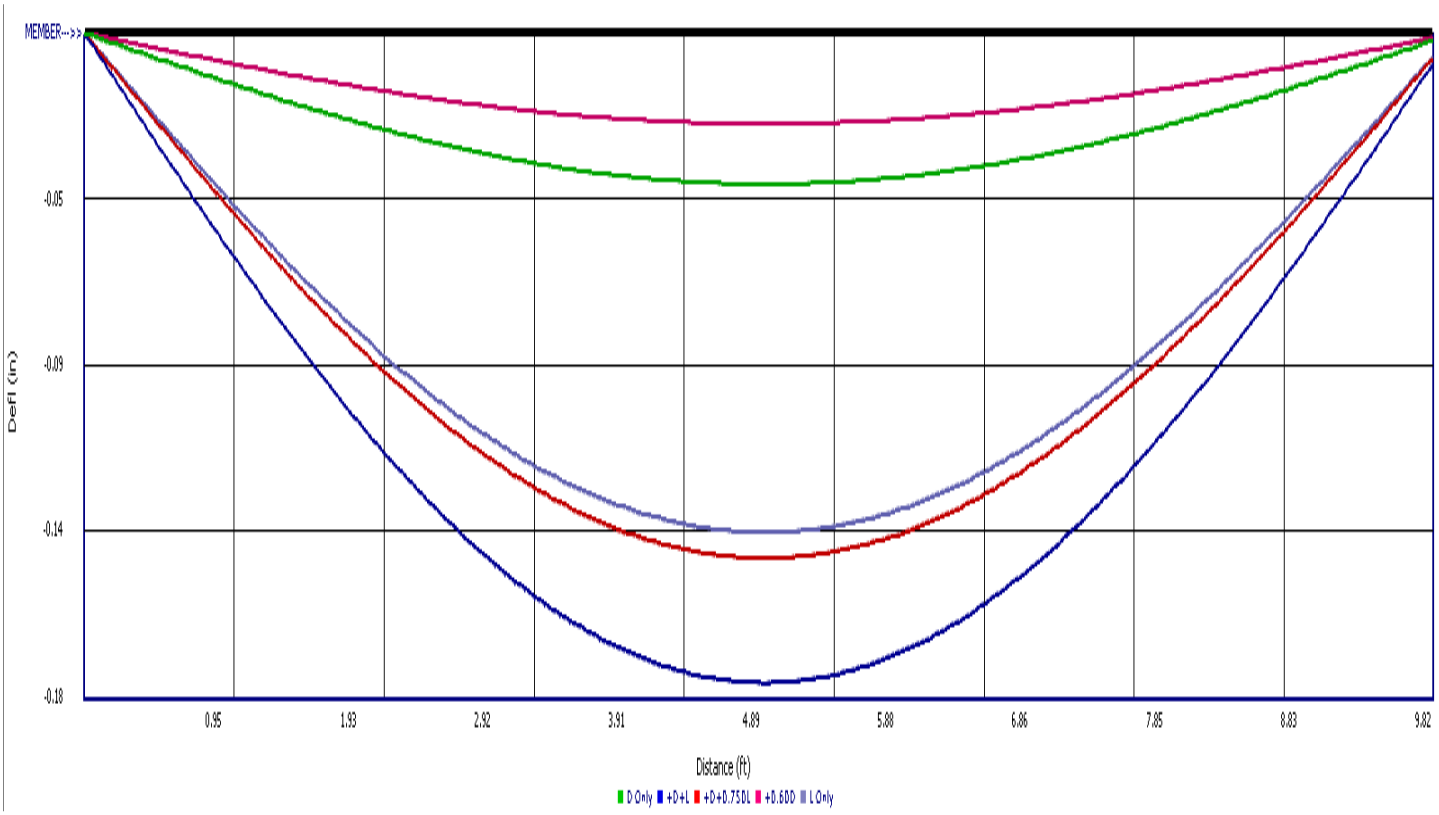
DESCRIPTION: BM #8





Wood Beam

DESCRIPTION: BM #8



Wood Beam

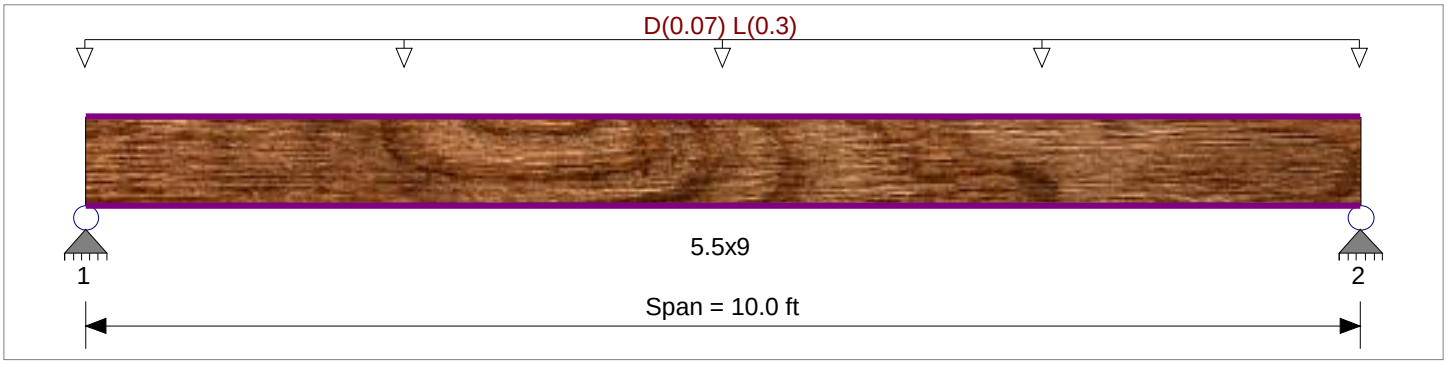
DESCRIPTION: BM #9

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2,400.0 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	1,850.0 psi	Ebend- xx	1,800.0 ksi
		Fc - Prll	1,650.0 psi	Eminbend - xx	950.0 ksi
Wood Species :	DF/DF	Fc - Perp	650.0 psi		
Wood Grade :	24F-V4	Fv	265.0 psi		
		Ft	1,100.0 psi	Density	31.210 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 NOT internally calculated and added
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 5.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.311 : 1		Maximum Shear Stress Ratio	=	0.181 : 1	
Section used for this span		5.5x9		Section used for this span		5.5x9	
fb: Actual	=	747.47	psi	fv: Actual	=	47.88	psi
F'b	=	2,400.00	psi	F'v	=	265.00	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	0.113 in	Ratio =	1062	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.139 in	Ratio =	861	>=240	Span: 1 : +D+L
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_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.065	0.038	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.88	141.4	2,160.0	0.30	9.1	238.5
+D+L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.311	0.181	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	4.63	747.5	2,400.0	1.58	47.9	265.0
+D+0.750L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.199	0.115	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.69	596.0	3,000.0	1.26	38.2	331.3
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 10.0 ft	1	0.022	0.013	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.53	84.8	3,840.0	0.18	5.4	424.0

Wood Beam

DESCRIPTION: BM #9

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.1392	5.036		0.0000	0.000

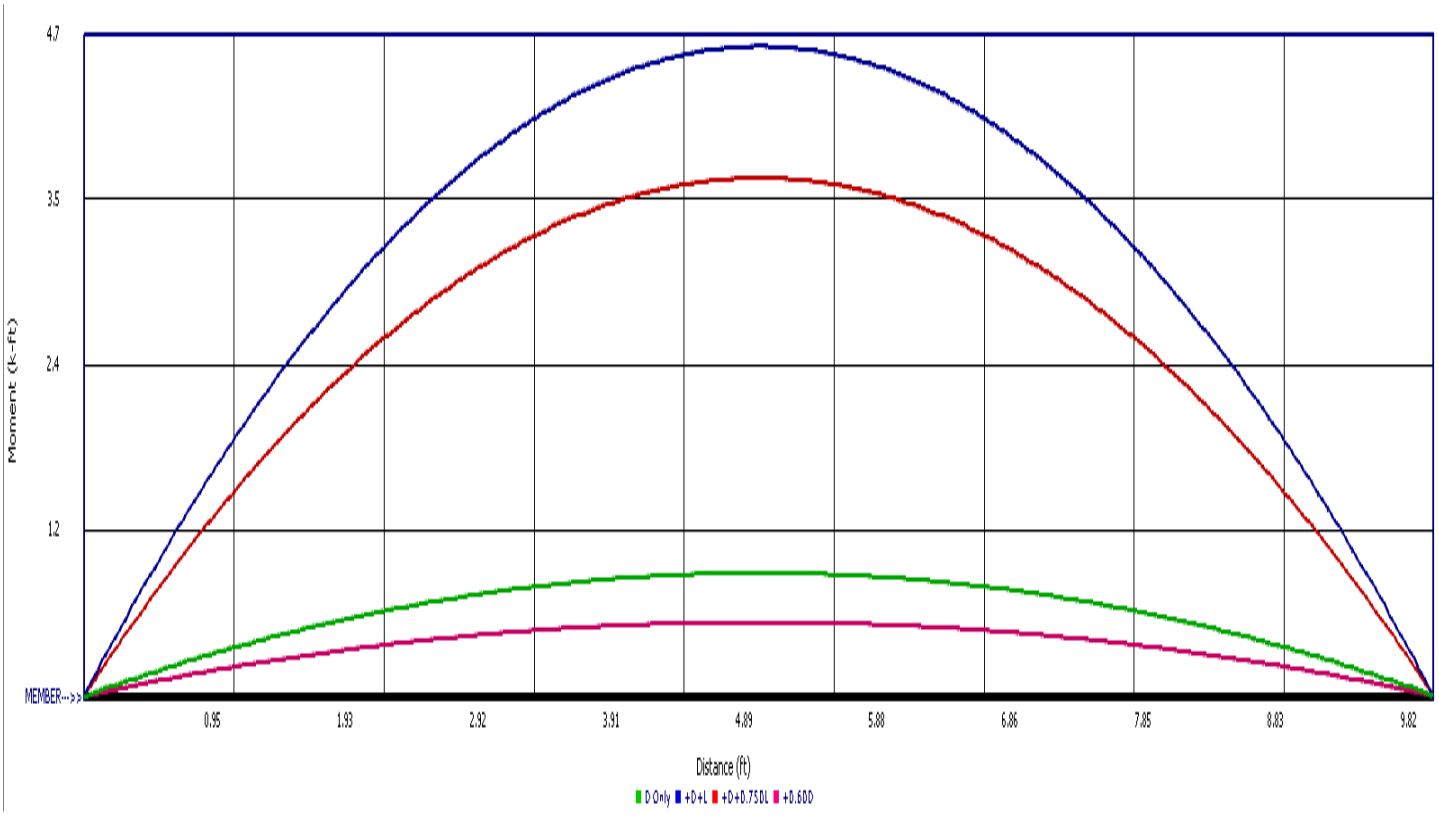
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0263	in	5.036 ft	0.0000	in	0.000	ft
+D+L	1	0.1392	in	5.036 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.1110	in	5.036 ft	0.0000	in	0.000	ft
+0.60D	1	0.0158	in	5.036 ft	0.0000	in	0.000	ft
L Only	1	0.1129	in	5.036 ft	0.0000	in	0.000	ft

Vertical Reactions

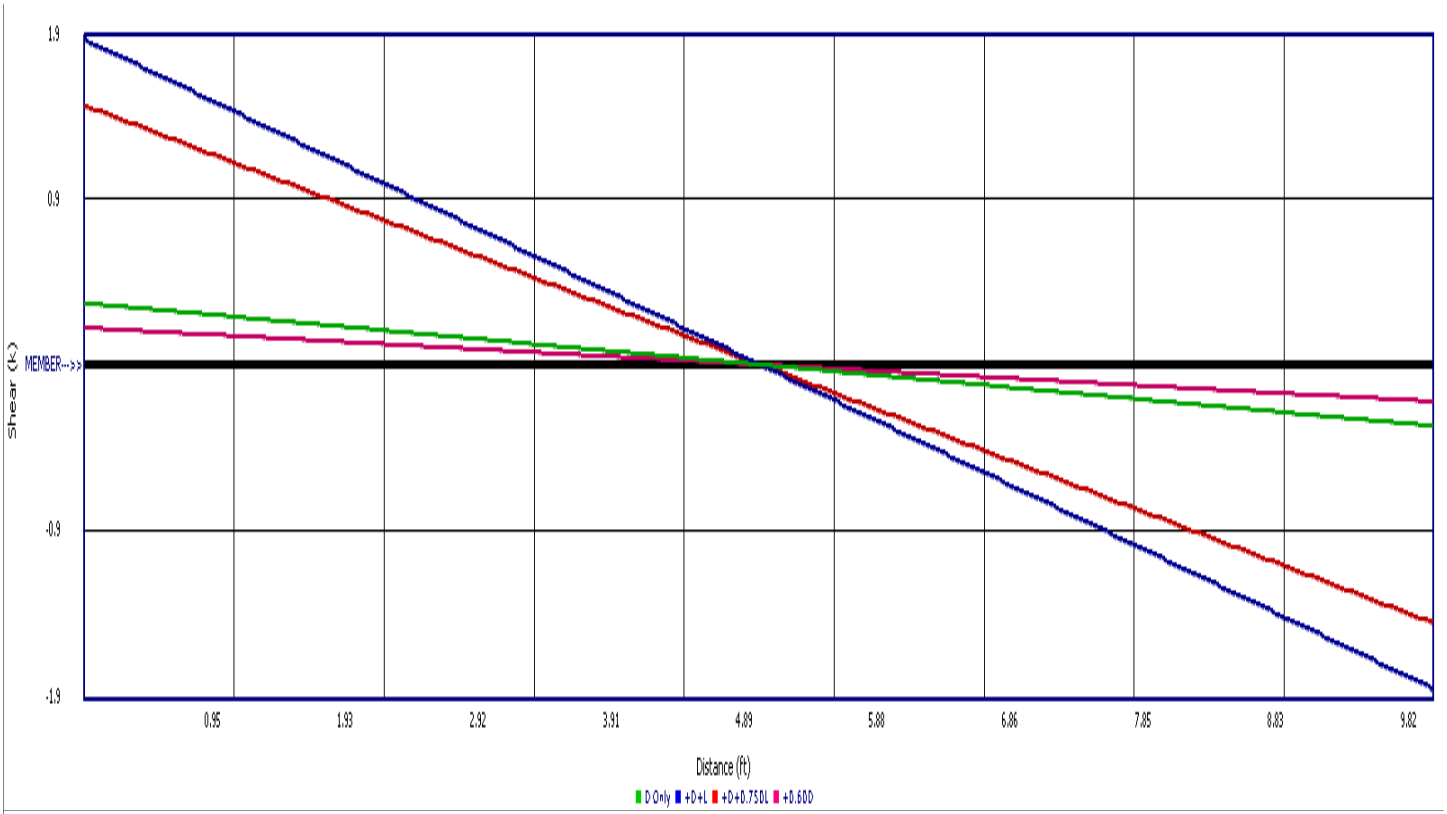
Support notation : Far left is #1 Values in KIPS

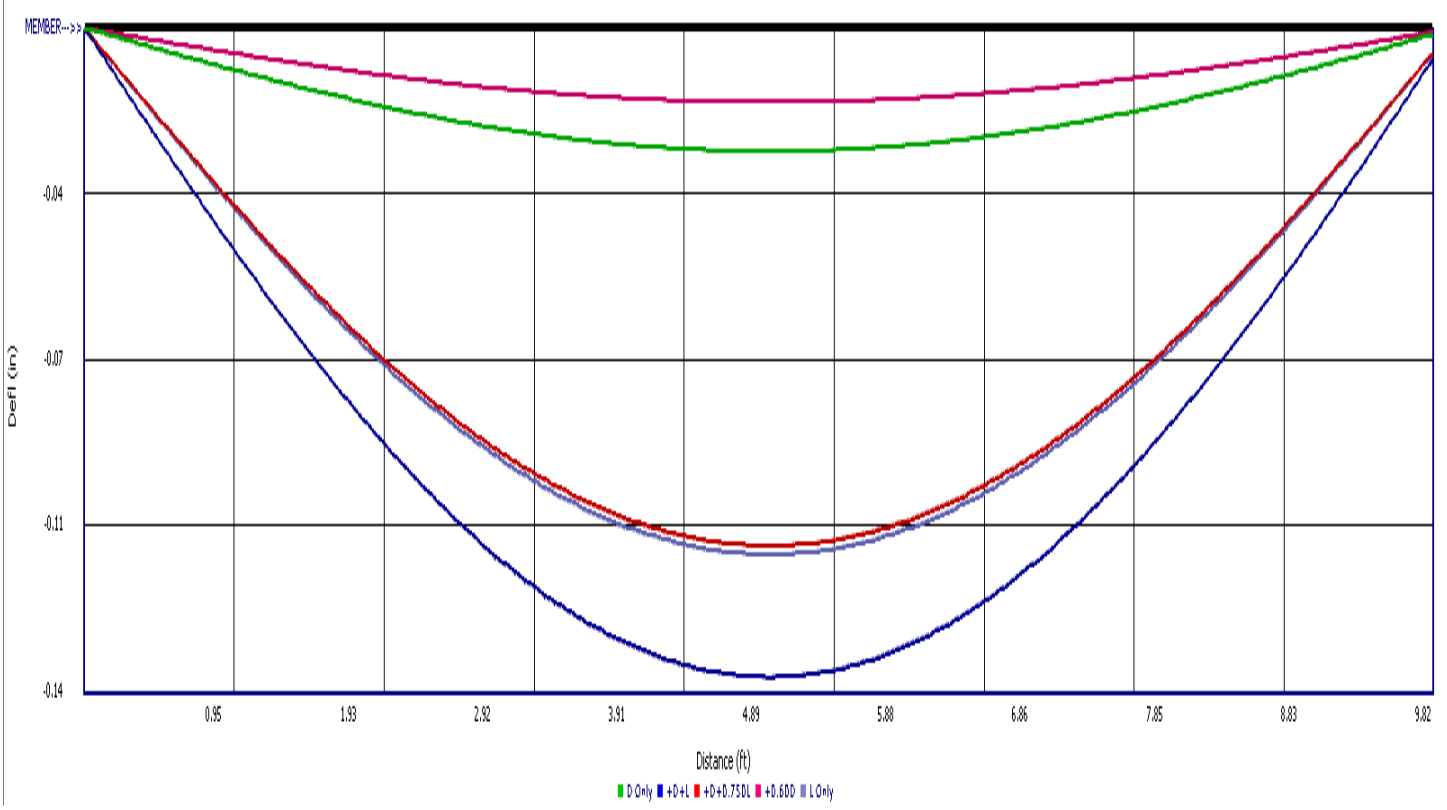
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.850	1.850
Max Upward from Load Combinations	1.850	1.850
Max Upward from Load Cases	1.500	1.500
D Only	0.350	0.350
+D+L	1.850	1.850
+D+0.750L	1.475	1.475
+0.60D	0.210	0.210
L Only	1.500	1.500



Wood Beam

DESCRIPTION: BM #9





Kirkland, WA 98034

Project Title: 2728
Engineer:
Project ID:
Project Descr:

B36/48

Printed: 12 AUG 2025, 3:50PM

Wood Beam

Project File: 2728 Mercer Island.ec6

LIC# : KW-06015928, Build:20.25.07.31 | RB Engineers, Inc. | (c) ENERCALC, LLC 1982-2025

DESCRIPTION: BM #10

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : NDS 2018
Load Combination Set : ASCE 7-16

Material Properties

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

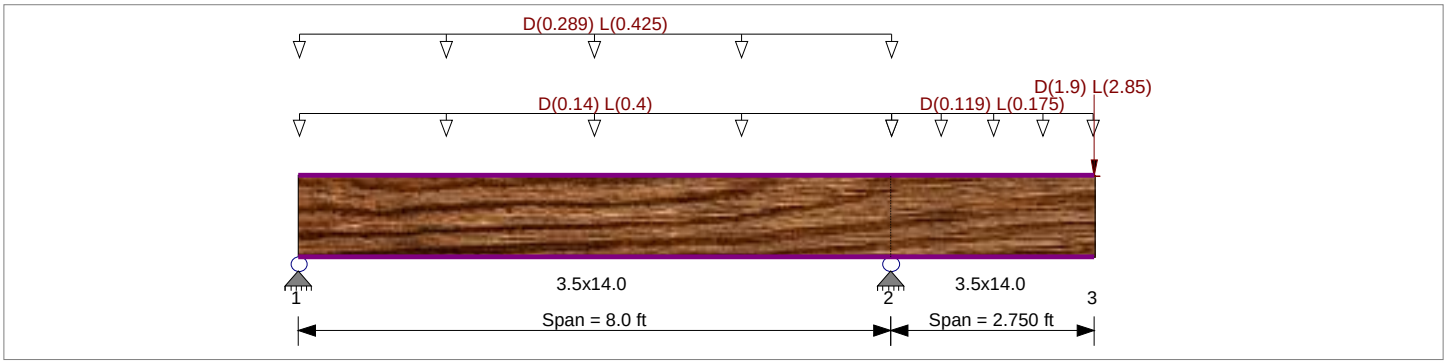
Wood Species : iLevel Truss Joist
Wood Grade : Parallam PSL 2.0E

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

Fb +	2,900.0 psi
Fb -	2,900.0 psi
Fc - Prll	2,900.0 psi
Fc - Perp	750.0 psi
Fv	290.0 psi
Ft	2,025.0 psi

E : Modulus of Elasticity

Ebend- xx	2,000.0 ksi
Eminbend - xx	1,016.54 ksi
Density	45.070 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.0140, L = 0.040 ksf, Tributary Width = 10.0 ft
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 17.0 ft
Load for Span Number 2
Uniform Load : D = 0.0170, L = 0.0250 ksf, Tributary Width = 7.0 ft
Point Load : D = 1.90, L = 2.850 k @ 2.750 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.522 : 1	Maximum Shear Stress Ratio	=	0.563 : 1
Section used for this span		3.5x14.0	Section used for this span		3.5x14.0
fb: Actual	=	1,487.67 psi	fv: Actual	=	163.18 psi
F'b	=	2,850.80 psi	F'v	=	290.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	8.000 ft	Location of maximum on span	=	6.838 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.038	in	Ratio =	1754 >=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.002	in	Ratio =	56930 >=360	Span: 1 : L Only
Max Downward Total Deflection	0.070	in	Ratio =	936 >=240	Span: 2 : +D+L
Max Upward Total Deflection	-0.005	in	Ratio =	18304 >=240	Span: 1 : +D+L

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_V	Cfu	C_i	C_r	M	fb	F'b	V	fv	F'v
D Only														0.0	0.00	0.0	0.0
Length = 8.0 ft	1	0.232	0.245	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	5.67	595.6	2,565.7	2.09	64.0	261.0
Length = 2.750 ft	2	0.232	0.245	0.90	1.00	1.00	1.00	0.983	1.00	1.00	1.00	5.67	595.6	2,565.7	2.09	64.0	261.0
+D+L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0

Wood Beam

DESCRIPTION: BM #10

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	CD	CM	C_t	CLx	C_V	Cfu	C_i	C_r	Moment Values M	fb	F'b	Shear Values V	fv	F'v
Length = 8.0 ft	1	0.522	0.563	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	14.17	1,487.7	2,850.8	5.33	163.2	290.0
Length = 2.750 ft	2	0.522	0.551	1.00	1.00	1.00	1.00	0.983	1.00	1.00	1.00	14.17	1,487.7	2,850.8	5.22	159.8	290.0
+D+0.750L					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 8.0 ft	1	0.355	0.378	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	12.05	1,264.7	3,563.5	4.48	137.1	362.5
Length = 2.750 ft	2	0.355	0.375	1.25	1.00	1.00	1.00	0.983	1.00	1.00	1.00	12.05	1,264.7	3,563.5	4.44	135.8	362.5
+0.60D					1.00	1.00	1.00	0.983	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 8.0 ft	1	0.078	0.083	1.60	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.40	357.4	4,561.3	1.25	38.4	464.0
Length = 2.750 ft	2	0.078	0.083	1.60	1.00	1.00	1.00	0.983	1.00	1.00	1.00	3.40	357.4	4,561.3	1.25	38.4	464.0

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0146	2.771	+D+L	-0.0052	7.017
2	+D+L	0.0705	2.750		0.0000	7.017

Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0023	in	2.145 ft	-0.0041	in	6.525	ft
D Only	2	0.0328	in	2.750 ft	0.0000	in	0.000	ft
+D+L	1	0.0146	in	2.771 ft	-0.0052	in	7.017	ft
+D+L	2	0.0705	in	2.750 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.0115	in	2.726 ft	-0.0049	in	6.972	ft
+D+0.750L	2	0.0610	in	2.750 ft	0.0000	in	0.000	ft
+0.60D	1	0.0014	in	2.145 ft	-0.0025	in	6.525	ft
+0.60D	2	0.0197	in	2.750 ft	0.0000	in	0.000	ft
L Only	1	0.0126	in	2.994 ft	-0.0017	in	7.285	ft
L Only	2	0.0376	in	2.750 ft	0.0000	in	0.000	ft

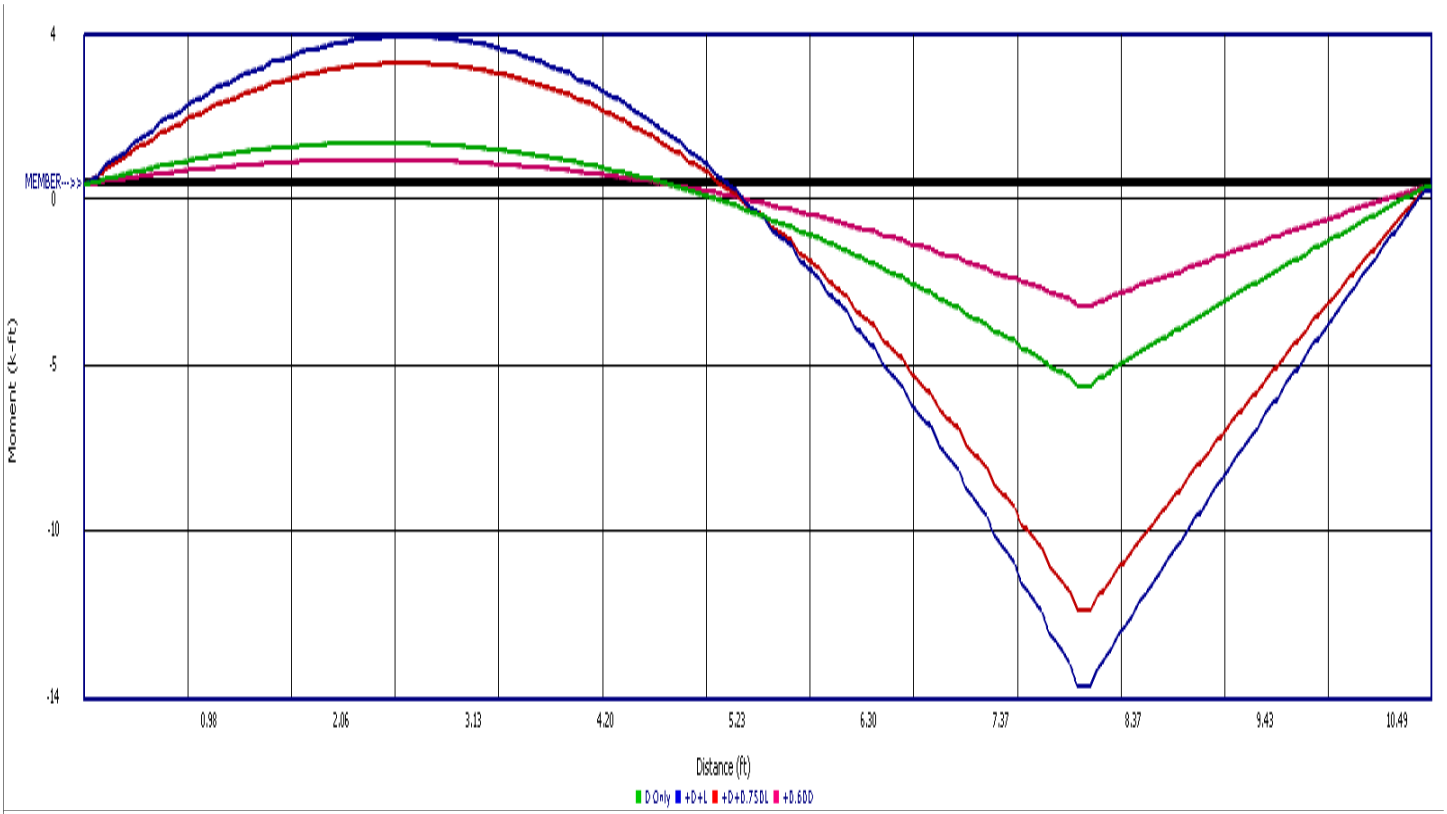
Vertical Reactions

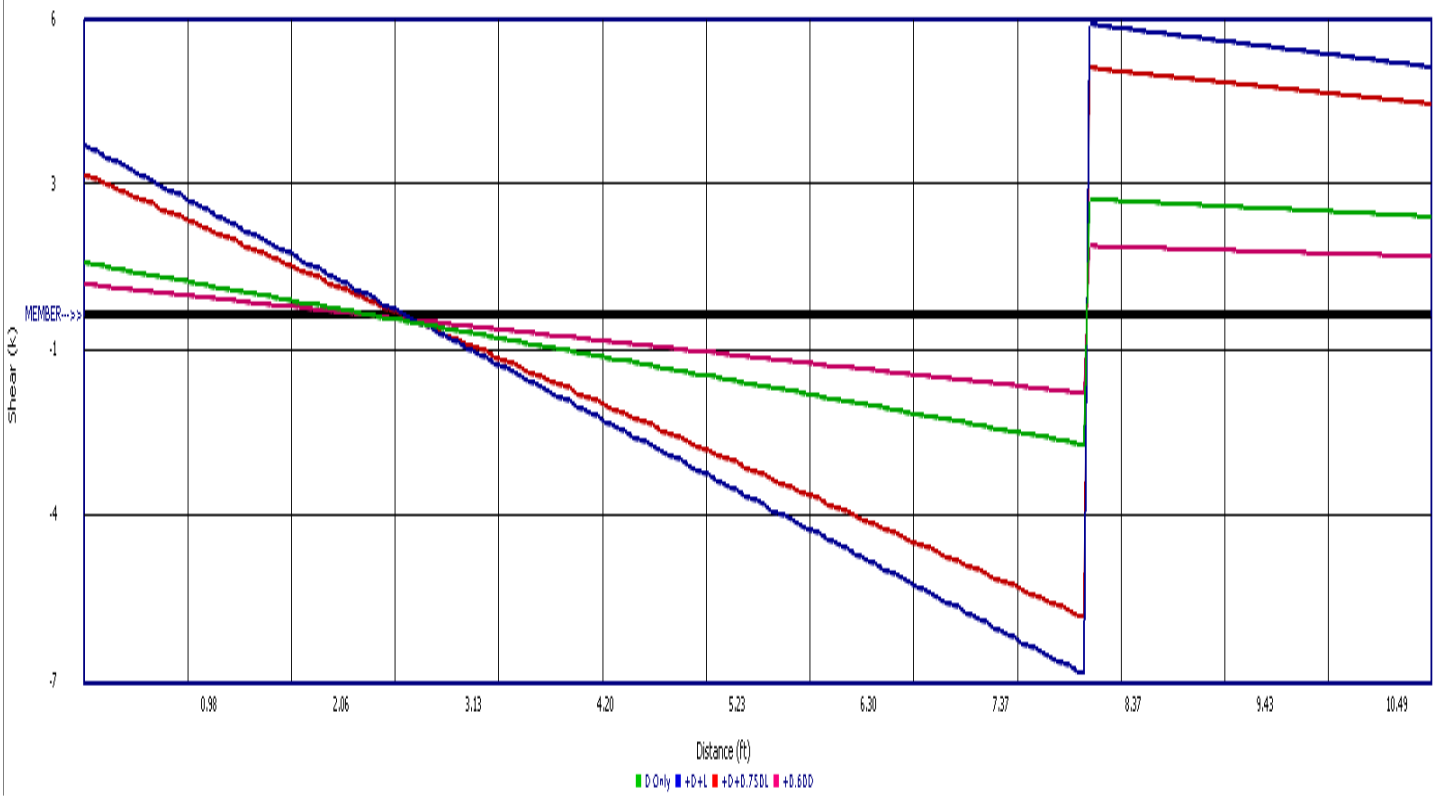
Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Max Upward from all Load Conditions	3.244	12.346	
Max Upward from Load Combinations	3.244	12.346	
Max Upward from Load Cases	2.238	7.694	
D Only	1.007	4.653	
+D+L	3.244	12.346	
+D+0.750L	2.685	10.423	
+0.60D	0.604	2.792	
L Only	2.238	7.694	

Wood Beam

DESCRIPTION: BM #10

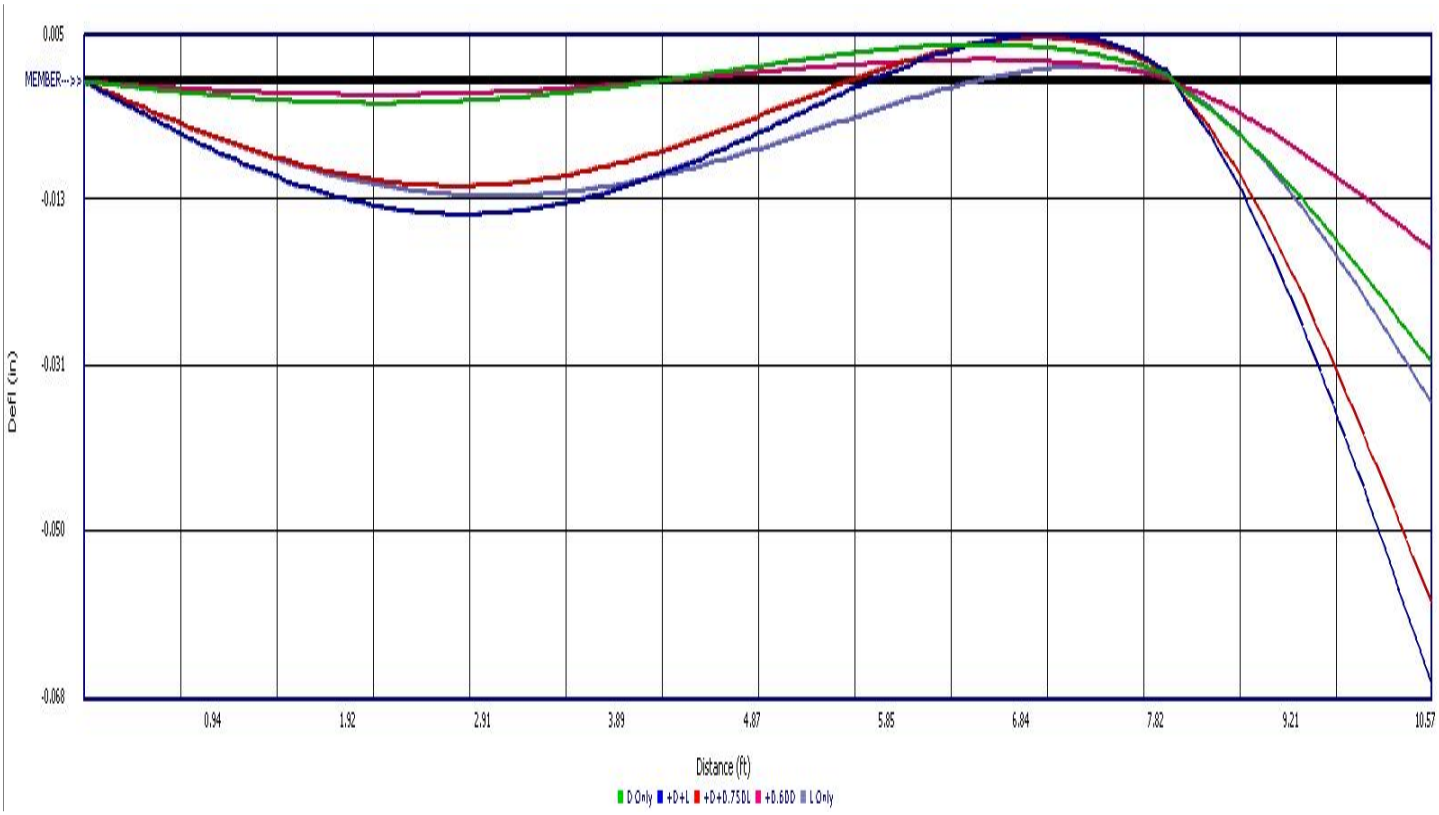




Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #10



Wood Beam

DESCRIPTION: BM #11

CODE REFERENCES

Calculations per NDS 2018, IBC 2021
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	900 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	900 psi	Ebend- xx	1600 ksi
		Fc - Prll	1350 psi	Eminbend - xx	580 ksi
Wood Species :	Douglas Fir-Larch	Fc - Perp	625 psi		
Wood Grade :	No.2	Fv	180 psi		
		Ft	575 psi	Density	31.21 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 NOT internally calculated and added
Uniform Load : D = 0.0140, L = 0.060 ksf, Tributary Width = 5.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.604 : 1	Maximum Shear Stress Ratio	=	0.241 : 1
Section used for this span		6x12	Section used for this span		6x12
fb: Actual	=	435.21 psi	fv: Actual	=	34.66 psi
F'b	=	720.00 psi	F'v	=	144.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.875 ft	Location of maximum on span	=	8.825 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.058 in	Ratio =	2020	>=360	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<360	n/a
Max Downward Total Deflection	0.071 in	Ratio =	1638	>=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 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 = 9.750 ft	1	0.127	0.051	0.90	1.00	1.00	1.00	1.000	1.00	0.80	1.00	0.83	82.3	648.0	0.28	6.6	129.6
+D+L					1.00	1.00	1.00	1.000	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 9.750 ft	1	0.604	0.241	1.00	1.00	1.00	1.00	1.000	1.00	0.80	1.00	4.40	435.2	720.0	1.46	34.7	144.0
+D+0.750L					1.00	1.00	1.00	1.000	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 9.750 ft	1	0.386	0.154	1.25	1.00	1.00	1.00	1.000	1.00	0.80	1.00	3.51	347.0	900.0	1.17	27.6	180.0
+0.60D					1.00	1.00	1.00	1.000	1.00	0.80	1.00			0.0	0.00	0.0	0.0
Length = 9.750 ft	1	0.043	0.017	1.60	1.00	1.00	1.00	1.000	1.00	0.80	1.00	0.50	49.4	1,152.0	0.17	3.9	230.4

Wood Beam

DESCRIPTION: BM #11

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0714	4.911		0.0000	0.000

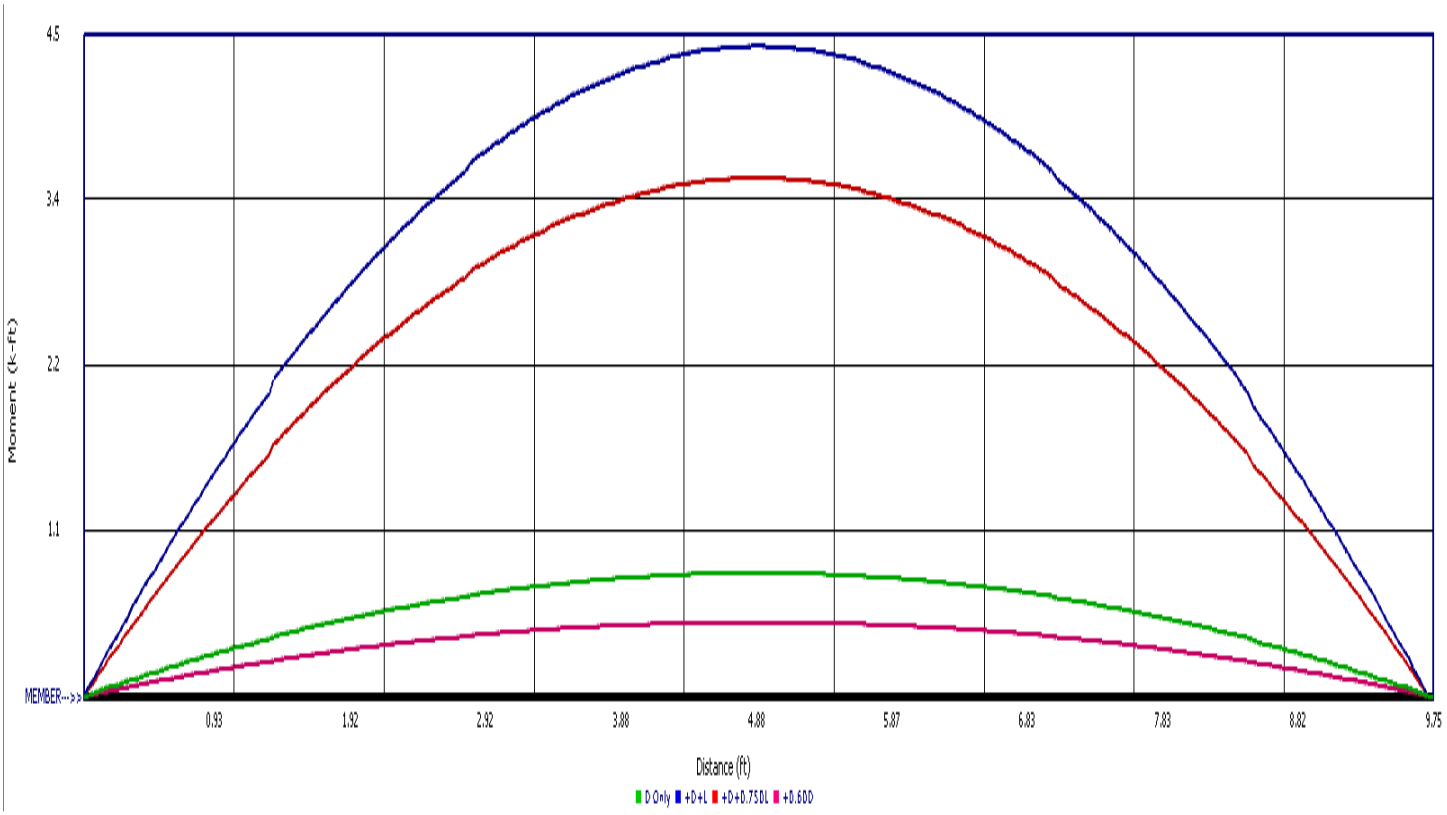
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl	Location in Span	Max. Upward Defl	Location in Span
D Only	1	0.0135 in	4.911 ft	0.0000 in	0.000 ft
+D+L	1	0.0714 in	4.911 ft	0.0000 in	0.000 ft
+D+0.750L	1	0.0569 in	4.911 ft	0.0000 in	0.000 ft
+0.60D	1	0.0081 in	4.911 ft	0.0000 in	0.000 ft
L Only	1	0.0579 in	4.911 ft	0.0000 in	0.000 ft

Vertical Reactions

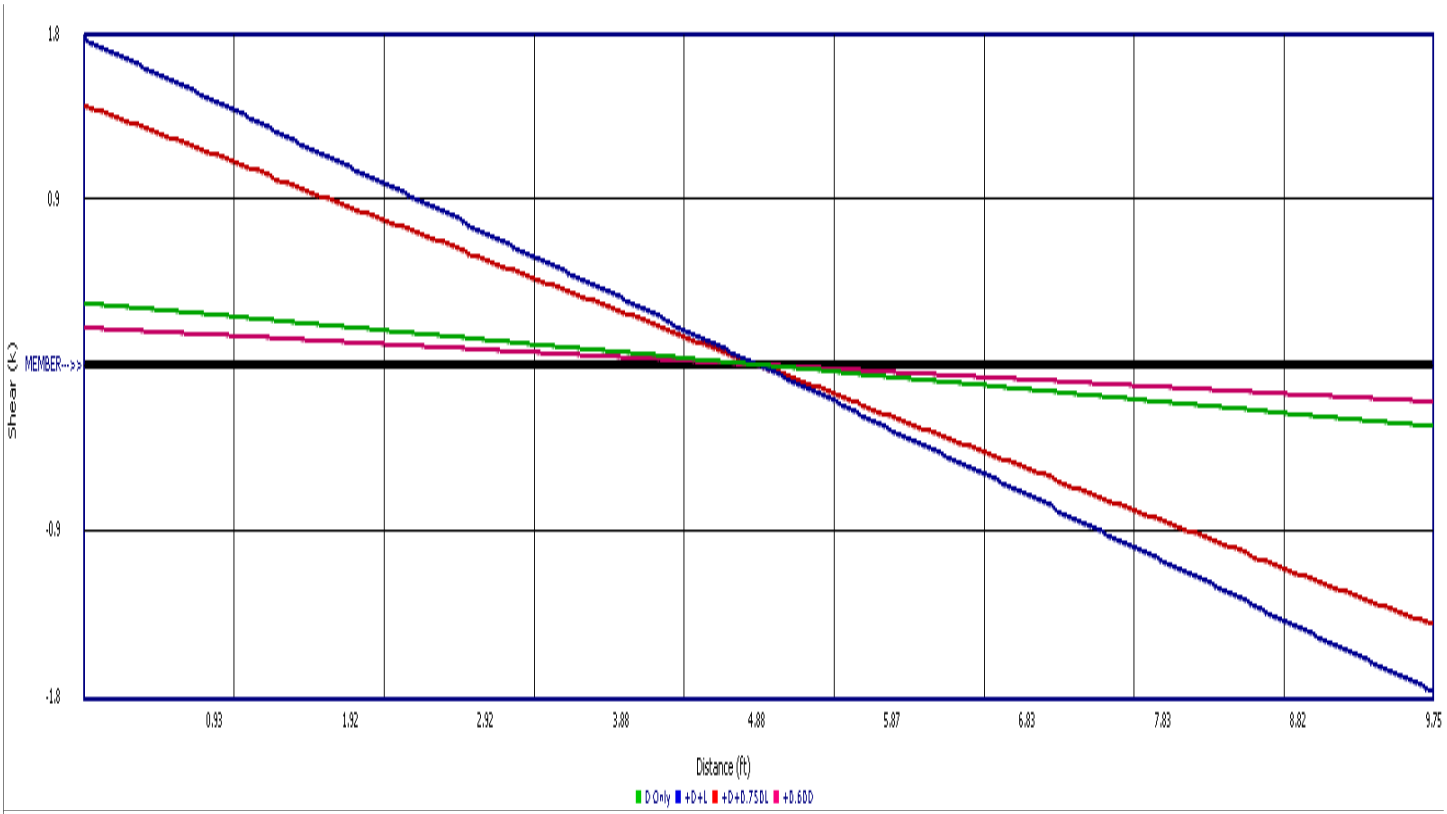
Support notation : Far left is #1 Values in KIPS

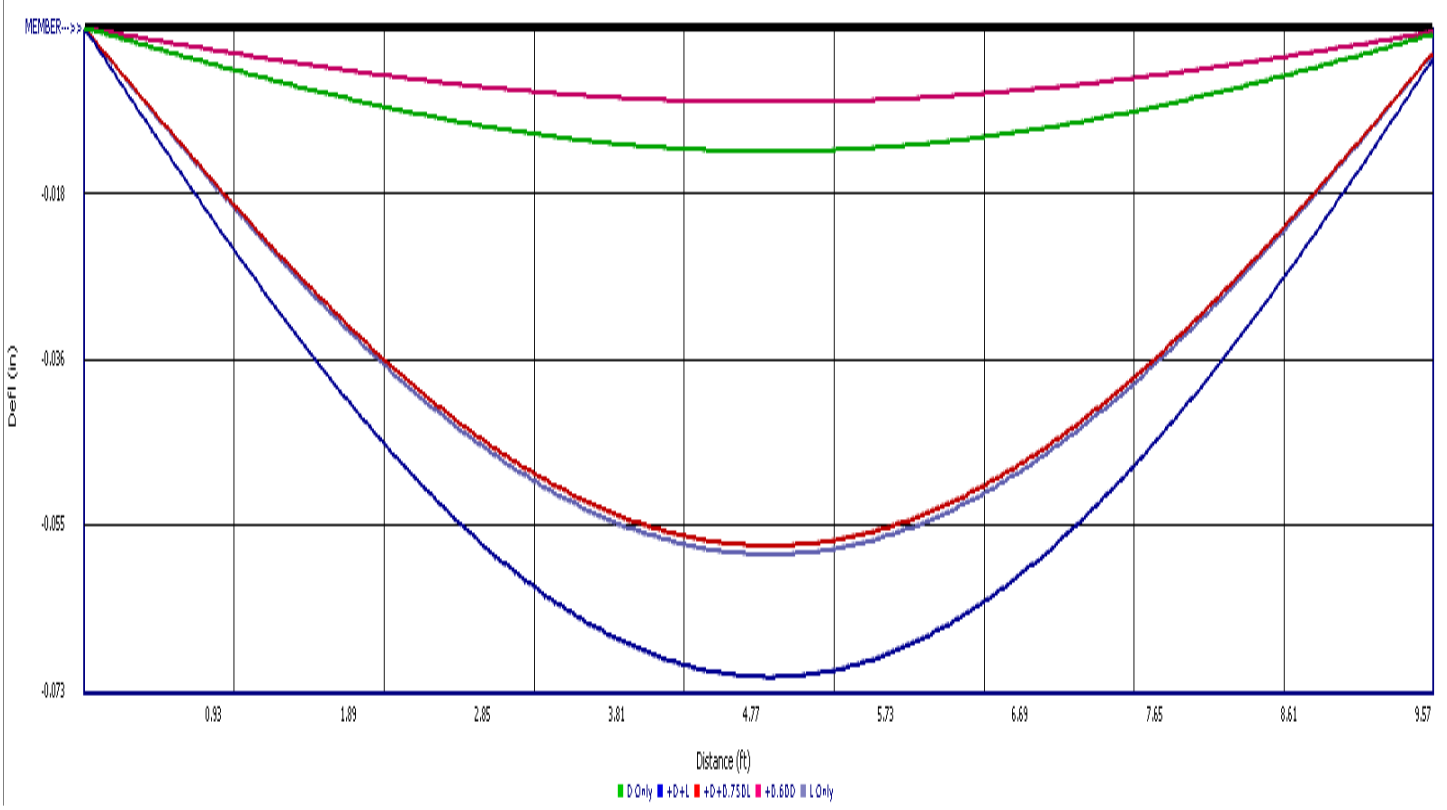
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.804	1.804
Max Upward from Load Combinations	1.804	1.804
Max Upward from Load Cases	1.463	1.463
D Only	0.341	0.341
+D+L	1.804	1.804
+D+0.750L	1.438	1.438
+0.60D	0.205	0.205
L Only	1.463	1.463



Wood Beam

DESCRIPTION: BM #11





Steel Beam

DESCRIPTION: BM #12

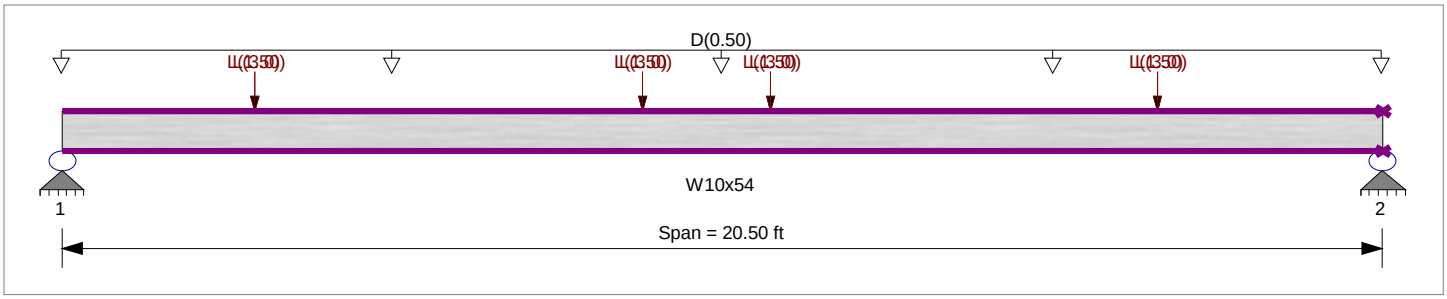
Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : AISC 360-16
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method : Allowable Strength 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 NOT internally calculated and added
Uniform Load : D = 0.050 ksf, Tributary Width = 10.0 ft
Point Load : L = 3.0 k @ 3.0 ft
Point Load : L = 1.50 k @ 3.0 ft
Point Load : L = 3.0 k @ 9.0 ft
Point Load : L = 1.50 k @ 9.0 ft
Point Load : L = 3.0 k @ 11.0 ft
Point Load : L = 1.50 k @ 11.0 ft
Point Load : L = 3.0 k @ 17.0 ft
Point Load : L = 1.50 k @ 17.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.497 : 1	Maximum Shear Stress Ratio =	0.192 : 1
Section used for this span	W10x54	Section used for this span	W10x54
Ma : Applied	82.564 k-ft	Va : Applied	14.345 k
Mn / Omega : Allowable	166.168 k-ft	Vn/Omega : Allowable	74.740 k
Load Combination	+D+L	Load Combination	+D+L
		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	0.461 in	Ratio =	533	>=480.	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	<480.0	n/a
Max Downward Total Deflection	0.688 in	Ratio =	357	>=240.	Span: 1 : +D+L
Max Upward Total Deflection	0 in	Ratio =	0	<240.0	n/a

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 20.50 ft	1	0.158	0.069	26.27		26.27	277.50	166.17	1.00	1.00	5.13	112.11	74.74
+D+L													
Dsgn. L = 20.50 ft	1	0.497	0.192	82.56		82.56	277.50	166.17	1.00	1.00	14.34	112.11	74.74
+D+0.750L													
Dsgn. L = 20.50 ft	1	0.412	0.161	68.48		68.48	277.50	166.17	1.00	1.00	12.04	112.11	74.74
+0.60D													
Dsgn. L = 20.50 ft	1	0.095	0.041	15.76		15.76	277.50	166.17	1.00	1.00	3.08	112.11	74.74

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.6882	10.250		0.0000	0.000

Steel Beam

DESCRIPTION: BM #12

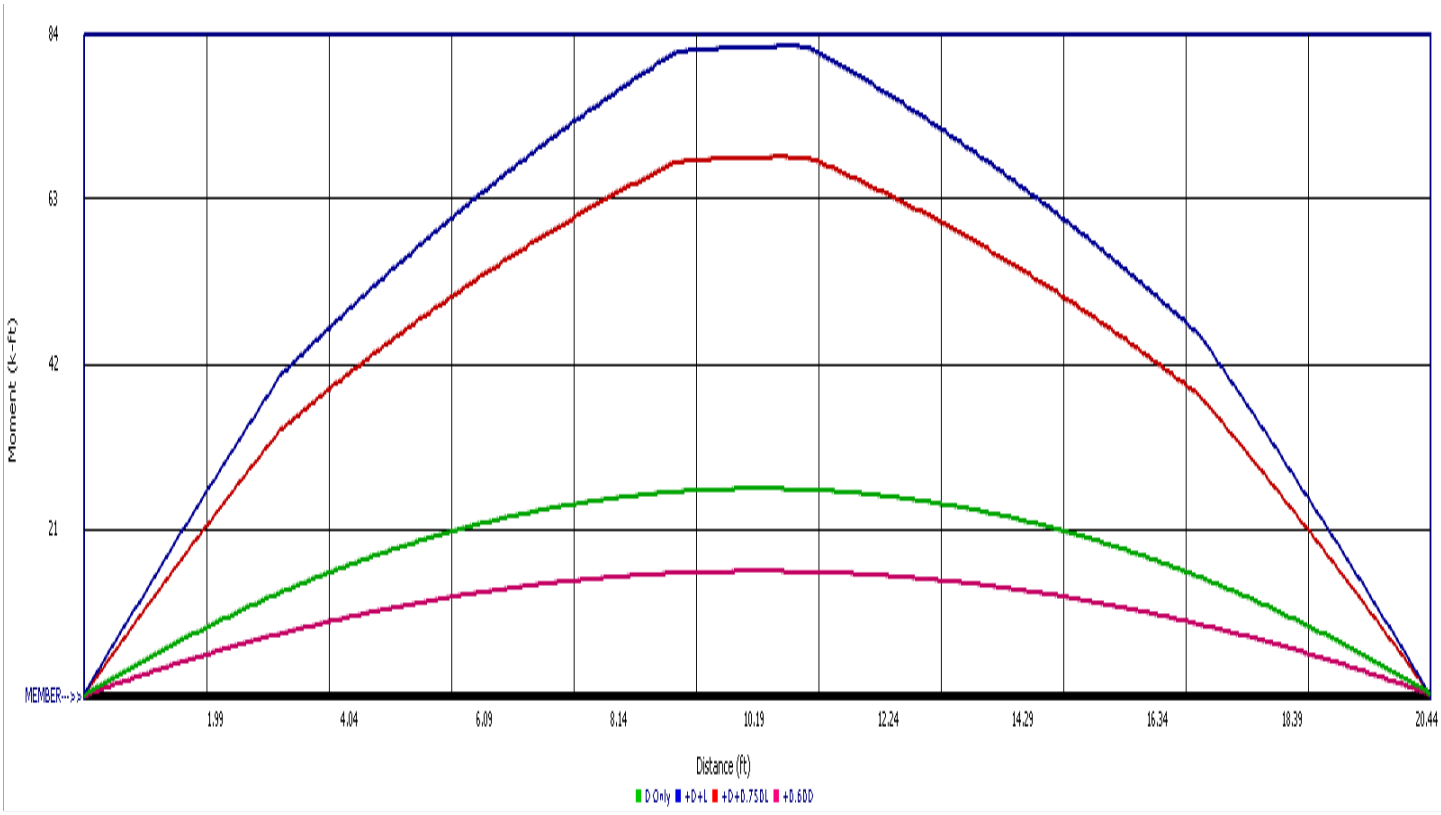
Vertical Reactions

Support notation : Far left is #: Values in KIPS

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	14.345	13.905
Max Upward from Load Combinations	14.345	13.905
Max Upward from Load Cases	9.220	8.780
D Only	5.125	5.125
+D+L	14.345	13.905
+D+0.750L	12.040	11.710
+0.60D	3.075	3.075
L Only	9.220	8.780

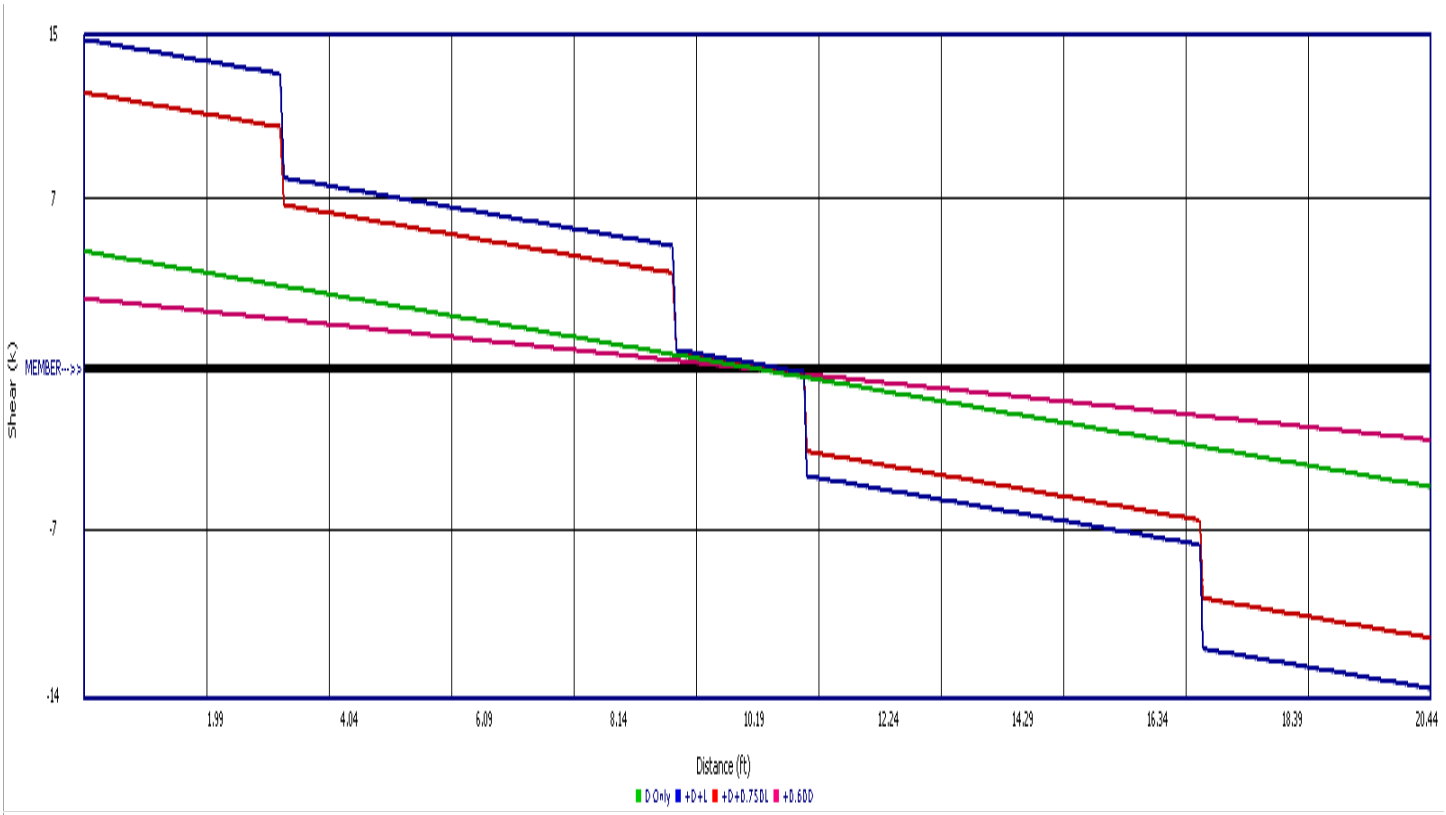
Steel Section Properties : W10x54

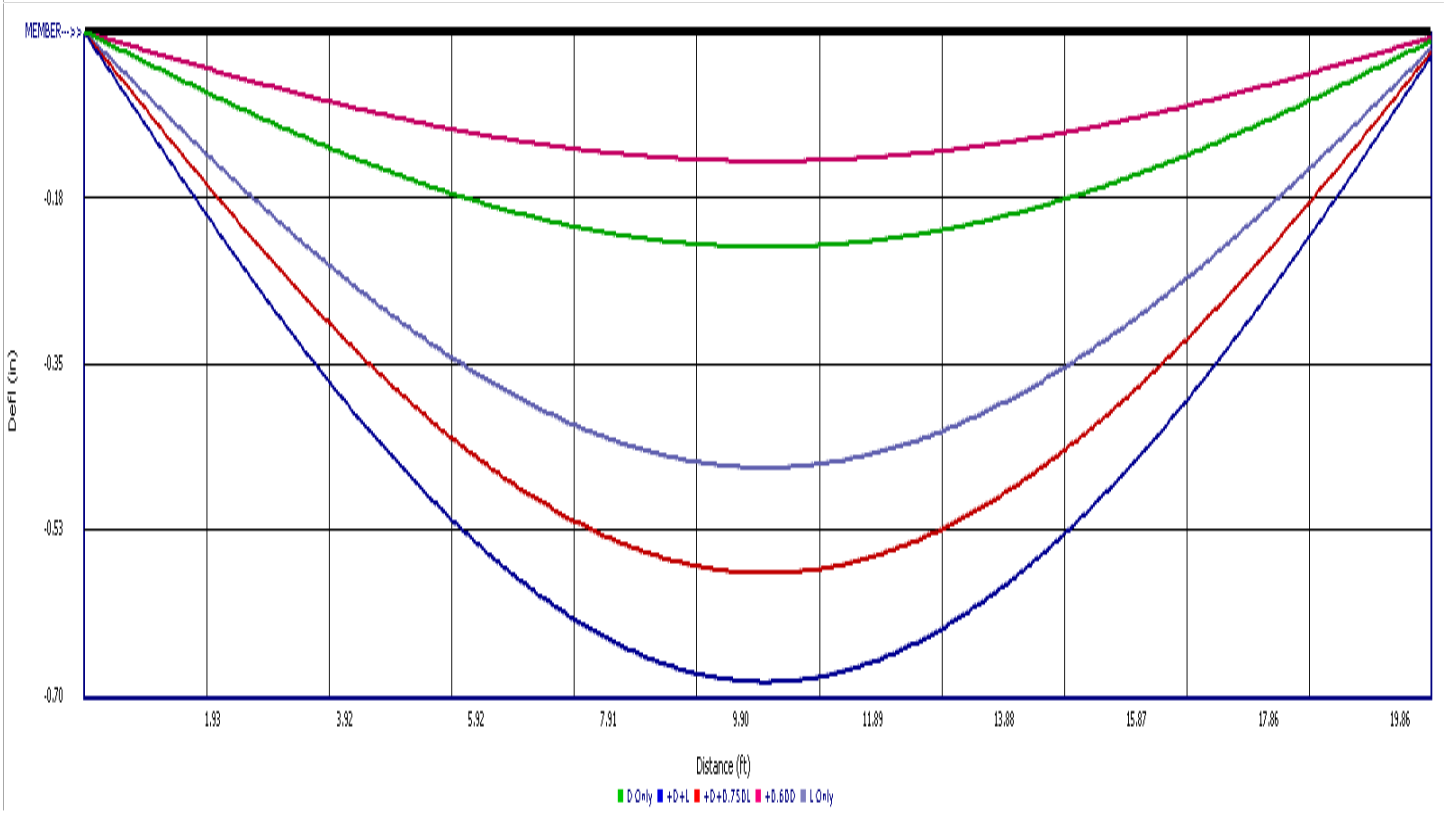
Depth	=	10.100	in	I xx	=	303.00	in^4	J	= 1.820 in^4
Web Thick	=	0.370	in	S xx		60.00	in^3	Cw	= 2,320.00 in^6
Flange Width	=	10.000	in	R xx	=	4.370	in		
Flange Thick	=	0.615	in	Zx	=	66.600	in^3		
Area	=	15.800	in^2	I yy	=	103.000	in^4		
Weight	=	54.000	plf	S yy	=	20.600	in^3	Wno	= 23.700 in^2
Kdesign	=	1.120	in	R yy	=	2.560	in	Sw	= 36.500 in^4
K1	=	0.813	in	Zy	=	31.300	in^3	Qf	= 14.000 in^3
rts	=	2.850	in					Qw	= 32.800 in^3
Ycg	=	5.050	in						



Steel Beam

DESCRIPTION: BM #12





Wood Beam

Project File: 2728 Mercer Island.ec6

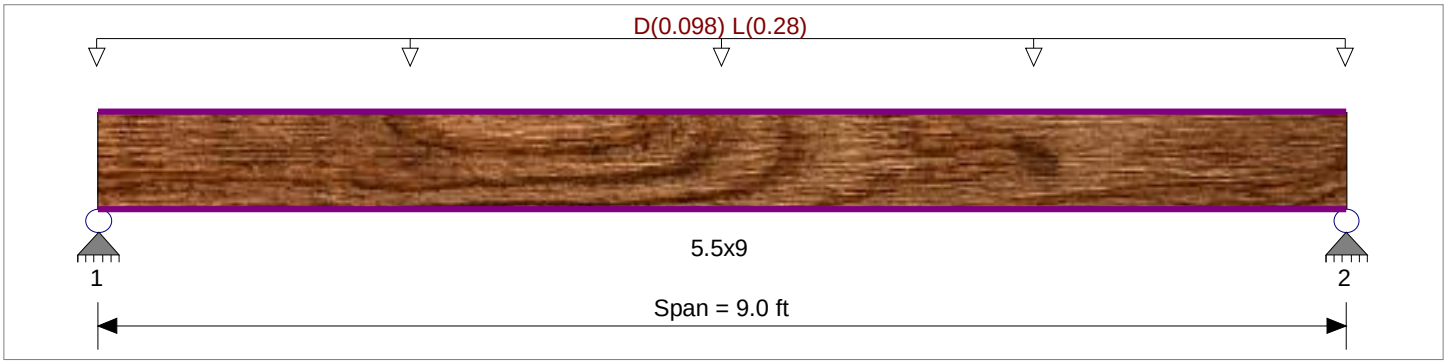
DESCRIPTION: BM #13

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : NDS 2018
Load Combination Set : ASCE 7-16

Material Properties

Analysis Method :	Allowable Stress Design	Fb +	2400 psi	*E : Modulus of Elasticity*	
Load Combination :	ASCE 7-16	Fb -	1850 psi	Ebend- xx	1800 ksi
		Fc - Prll	1650 psi	Eminbend - xx	950 ksi
Wood Species :	DF/DF	Fc - Perp	650 psi		
Wood Grade :	24F-V4	Fv	265 psi		
		Ft	1100 psi	Density	31.21 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 NOT internally calculated and added
Uniform Load : D = 0.0140, L = 0.040 ksf, Tributary Width = 7.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	**0.258** : 1	Maximum Shear Stress Ratio	=	**0.163** : 1
Section used for this span		**5.5x9**	Section used for this span		**5.5x9**
fb: Actual	=	618.55 psi	fv: Actual	=	43.27 psi
F'b	=	2,400.00 psi	F'v	=	265.00 psi
Load Combination		+D+L	Load Combination		+D+L
Location of maximum on span	=	4.500 ft	Location of maximum on span	=	8.277 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.069 in	Ratio =	1562	>=480	Span: 1 : L Only
Max Upward Transient Deflection	0 in	Ratio =	0	>=480	n/a
Max Downward Total Deflection	0.093 in	Ratio =	1157	>=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 M	V	CD	CM	C_t	CLx	C_V	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 = 9.0 ft	1	0.074	0.047	0.90	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.99	160.4	2,160.0	0.37	11.2	238.5
+D+L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.258	0.163	1.00	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.83	618.5	2,400.0	1.43	43.3	265.0
+D+0.750L					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.168	0.106	1.25	1.00	1.00	1.00	1.000	1.00	1.00	1.00	3.12	504.0	3,000.0	1.16	35.3	331.3
+0.60D					1.00	1.00	1.00	1.000	1.00	1.00	1.00			0.0	0.00	0.0	0.0
Length = 9.0 ft	1	0.025	0.016	1.60	1.00	1.00	1.00	1.000	1.00	1.00	1.00	0.60	96.2	3,840.0	0.22	6.7	424.0

Wood Beam

Project File: 2728 Mercer Island.ec6

DESCRIPTION: BM #13

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
1	+D+L	0.0933	4.533		0.0000	0.000

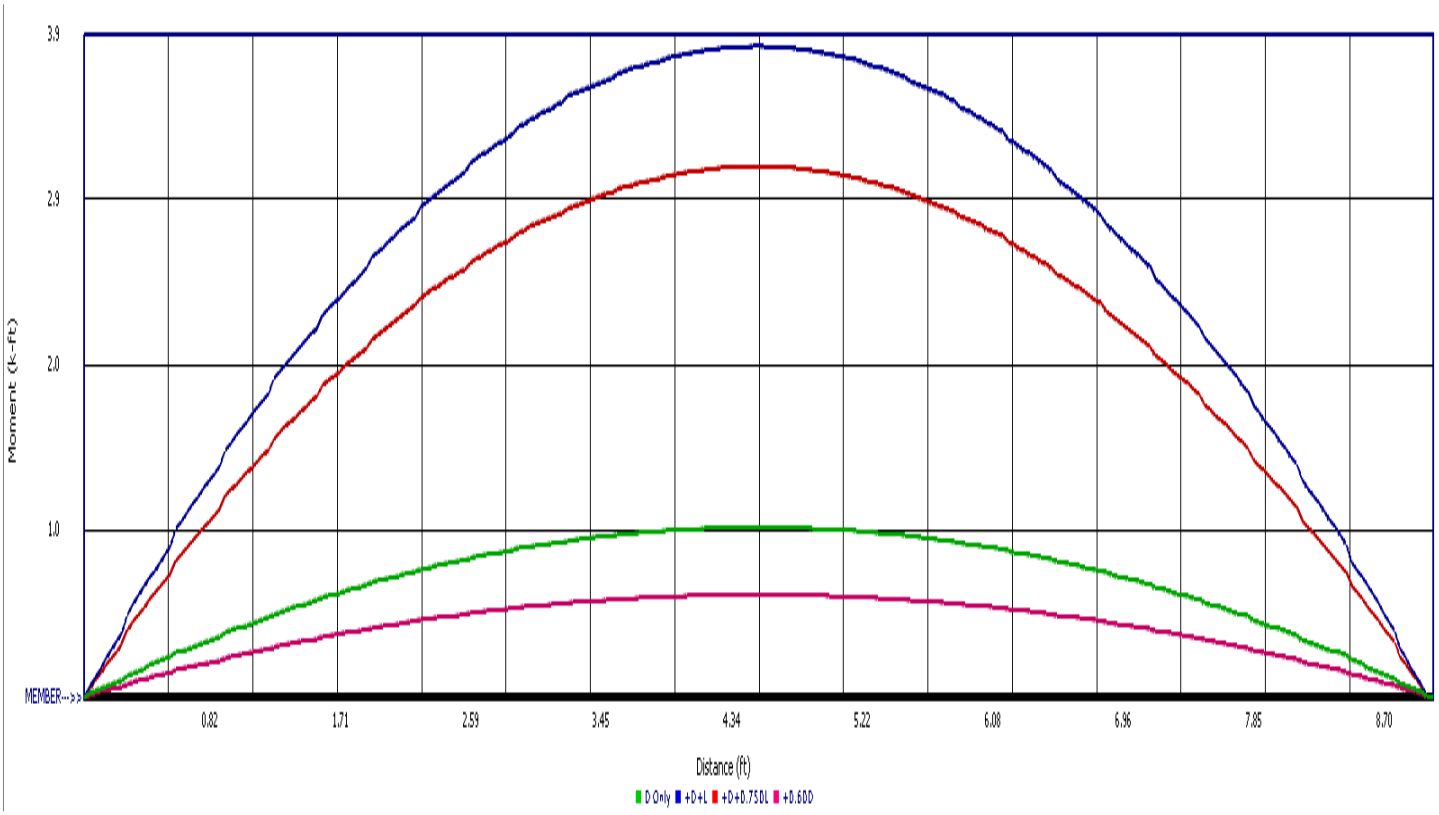
Maximum Deflections for Load Combinations

Load Combination	Span	Max. Downward Defl		Location in Span	Max. Upward Defl		Location in Span	
D Only	1	0.0242	in	4.533 ft	0.0000	in	0.000	ft
+D+L	1	0.0933	in	4.533 ft	0.0000	in	0.000	ft
+D+0.750L	1	0.0760	in	4.533 ft	0.0000	in	0.000	ft
+0.60D	1	0.0145	in	4.533 ft	0.0000	in	0.000	ft
L Only	1	0.0691	in	4.533 ft	0.0000	in	0.000	ft

Vertical Reactions

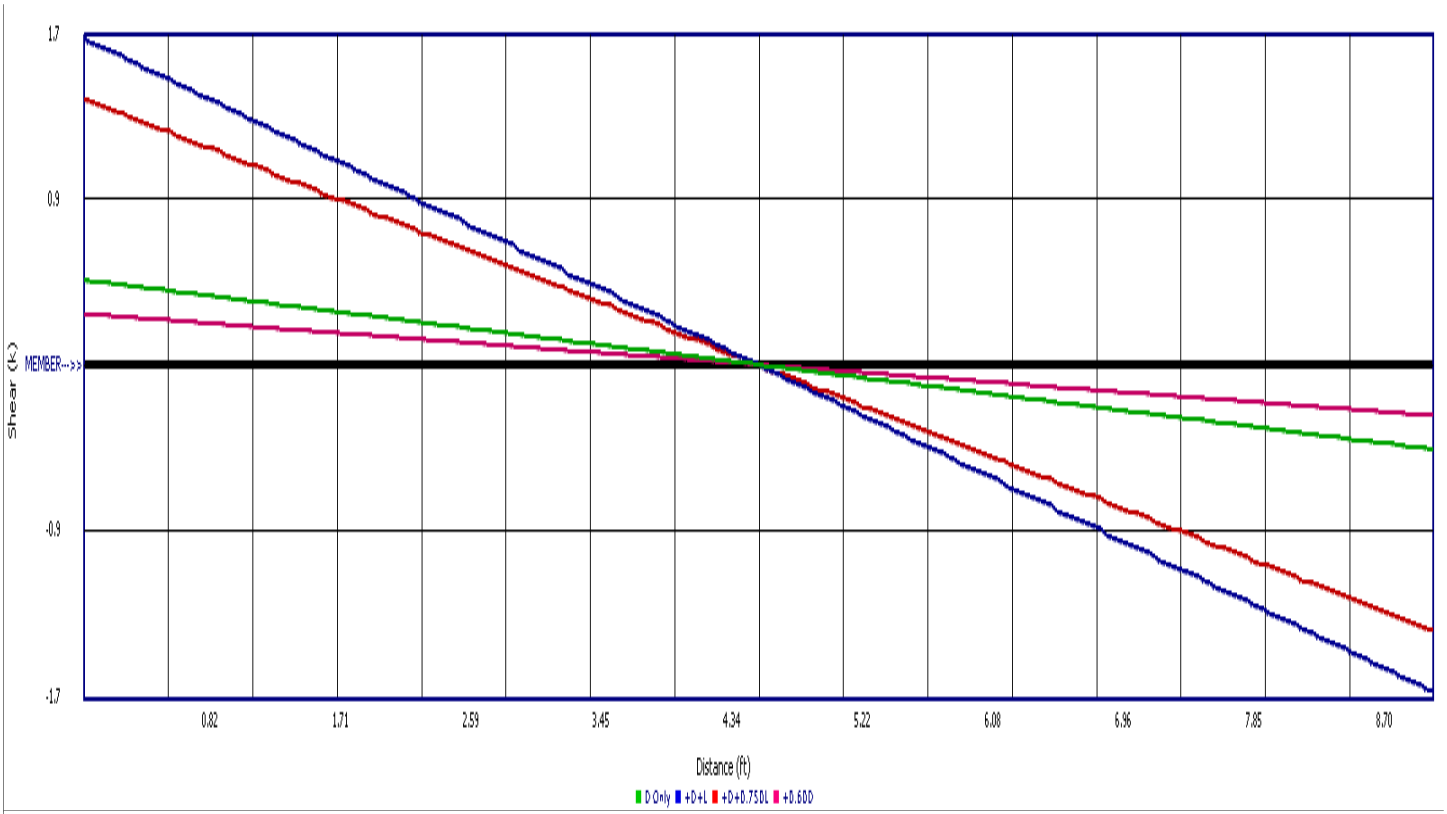
Support notation : Far left is #1 Values in KIPS

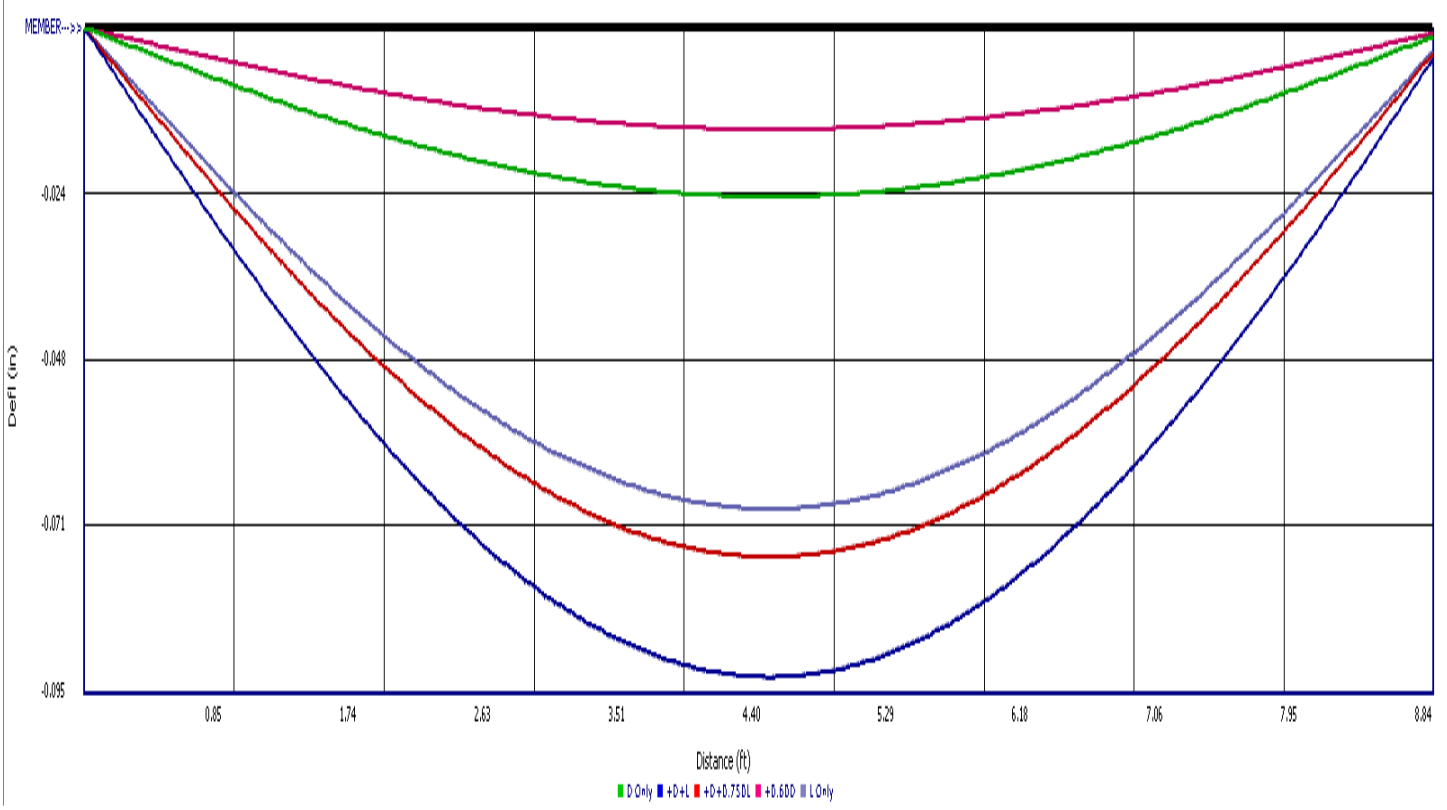
Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	1.701	1.701
Max Upward from Load Combinations	1.701	1.701
Max Upward from Load Cases	1.260	1.260
D Only	0.441	0.441
+D+L	1.701	1.701
+D+0.750L	1.386	1.386
+0.60D	0.265	0.265
L Only	1.260	1.260



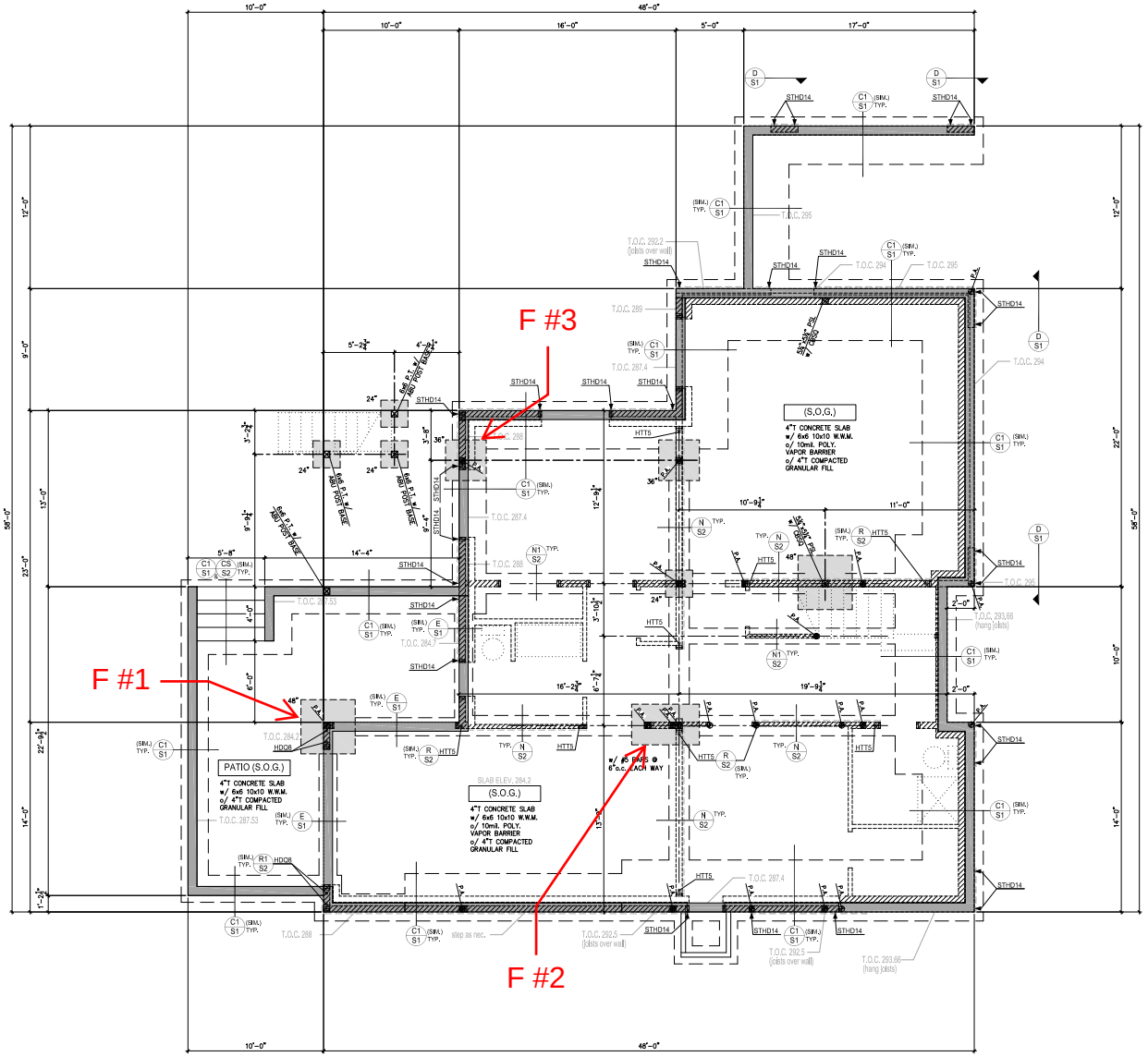
Wood Beam

DESCRIPTION: BM #13





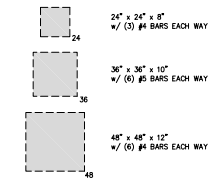
FOOTING KEY PLAN



IMPORTANT NOTES:
SEE ARCHITECTURAL PLANS FOR ALL DIMENSIONS & VERIFY WITH STRUCTURAL PLANS

SEE ARCHITECTURAL PLANS TO CONFIRM ALL ROOF SLOPES AND PLATE HEIGHTS.

FOOTING SCHEDULE



FOUNDATION CONSTRUCTION NOTES:
CONFIRM FOUNDATION TOP OF WALL STEPS & BOTTOM OF FOOTING STEPS PER ARCHITECTURAL (CONFIRM INDICATED NOTES)

PROVIDE CONTROL JOINTS @ ALL SLAB ON GRADE (S.O.G.) LOCATIONS. LAYOUT PER ARCHITECT or
4" THICK CONCRETE = 10'–0"max. EACH WAY
5" THICK CONCRETE = 15'–0"max. EACH WAY

ALL METAL HARDWARE USED IN CONJUNCTION w/ PRESS. TREATED WOOD SHALL BE SIMPSON Z–MAX OR HDG GRADE ZINC COATING.

foundation plan
SCALE: 1/4" = 1'-0"

RB ENGINEERS, INC.
12733 Holmes Point Dr. NE, Kirkland, WA 98034
Tel: (425) 822-3009, Fax: (425) 822-2679
Email: RBE1992@ GMAIL.COM
R-B-Engineers.com

Artoush Co. & Remodeling LLC SFR
3427 72nd Pl SE, Mercer Island, WA 98040

Project: 3427 72nd Pl SE, Mercer Island, 98040
Project No.:
Drawn By:
Date: 9.10.2025
Rev.:

Sheet: S4

12"x18" PLOT = 1/2 SCALE

General Footing

DESCRIPTION: F #1

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	40.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

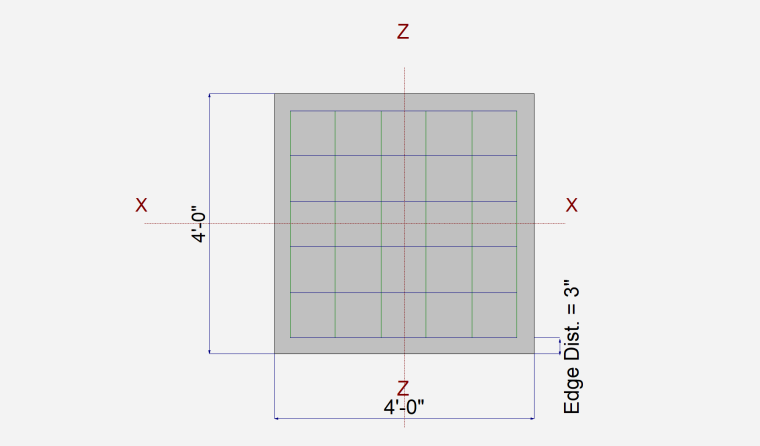
Width parallel to X-X Axis	=	4.0 ft
Length parallel to Z-Z Axis	=	4.0 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Bottom Reinforcing

Bars parallel to X-X Axis (resisting Z Flexure)

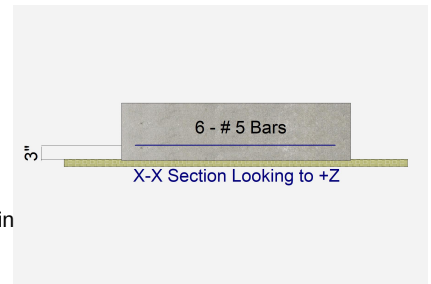
Number of Bars	=		6.0
Reinforcing Bar Size	=	#	5

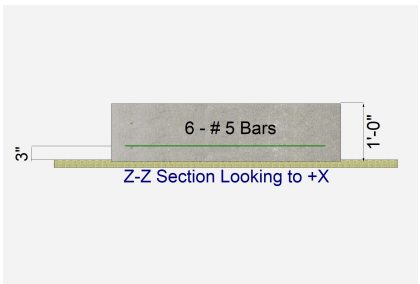
Bars parallel to Z-Z Axis (resisting X Flexure)

Number of Bars	=		6.0
Reinforcing Bar Size	=	#	5

Rebar Centerline to Edge of Concrete...

at Bottom of footing	=	3.0 in





General Footing

DESCRIPTION: F #1

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	3.80		14.90					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.8760	Soil Bearing	1.314 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2947	Z Flexure (+X) Bot Tens	3.550 k-ft/ft	12.046 k-ft/ft	+1.20D+1.60L
PASS	0.2947	Z Flexure (-X) Bot Tens	3.550 k-ft/ft	12.046 k-ft/ft	+1.20D+1.60L
PASS	0.557	Min Steel X Flexure Bottom	0.259 in2/ft	0.465 in2/ft	n/a
PASS	0.2947	X Flexure (+Z) Bot Tens	3.550 k-ft/ft	12.046 k-ft/ft	+1.20D+1.60L
PASS	0.2947	X Flexure (-Z) Bot Tens	3.550 k-ft/ft	12.046 k-ft/ft	+1.20D+1.60L
PASS	0.557	Min Steel Z Flexure Bottom	0.259 in2/ft	0.465 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.4176	1-way Shear (+X)	20.380 psi	48.805 psi	+1.20D+1.60L
PASS	0.4176	1-way Shear (-X)	20.380 psi	48.805 psi	+1.20D+1.60L
PASS	0.4176	1-way Shear (+Z)	20.380 psi	48.805 psi	+1.20D+1.60L
PASS	0.4176	1-way Shear (-Z)	20.380 psi	48.805 psi	+1.20D+1.60L
PASS	0.5654	2-way Punching	84.814 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	0.3825	0.3825	n/a	n/a	0.255
X-X, +D+L	1.50	n/a	0.0	1.314	1.314	n/a	n/a	0.876
X-X, +D+0.750L	1.50	n/a	0.0	1.081	1.081	n/a	n/a	0.721
X-X, +0.60D	1.50	n/a	0.0	0.2295	0.2295	n/a	n/a	0.153
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.3825	0.3825	0.255
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.314	1.314	0.876
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	1.081	1.081	0.721
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.2295	0.2295	0.153

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.6650	+Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK

General Footing

DESCRIPTION: F #1

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.6650	-Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D+1.60L	3.550	+Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D+1.60L	3.550	-Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D+L	2.433	+Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D+L	2.433	-Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D	0.570	+Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +1.20D	0.570	-Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +0.90D	0.4275	+Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
X-X, +0.90D	0.4275	-Z	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.40D	0.6650	-X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.40D	0.6650	+X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D+1.60L	3.550	-X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D+1.60L	3.550	+X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D+L	2.433	-X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D+L	2.433	+X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D	0.570	-X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +1.20D	0.570	+X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +0.90D	0.4275	-X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK
Z-Z, +0.90D	0.4275	+X	Bottom	0.2592	ACI 7.6.1.1	0.4650	12.046	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.82 psi	3.82 psi	3.82 psi	48.81 psi	0.08	OK
+1.20D+1.60L	20.38 psi	20.38 psi	20.38 psi	48.81 psi	0.42	OK
+1.20D+L	13.96 psi	13.96 psi	13.96 psi	48.81 psi	0.29	OK
+1.20D	3.27 psi	3.27 psi	3.27 psi	48.81 psi	0.07	OK
+0.90D	2.45 psi	2.45 psi	2.45 psi	48.81 psi	0.05	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	3.82 psi	3.82 psi	3.82 psi	48.81 psi	0.08	OK
+1.20D+1.60L	20.38 psi	20.38 psi	20.38 psi	48.81 psi	0.42	OK
+1.20D+L	13.96 psi	13.96 psi	13.96 psi	48.81 psi	0.29	OK
+1.20D	3.27 psi	3.27 psi	3.27 psi	48.81 psi	0.07	OK
+0.90D	2.45 psi	2.45 psi	2.45 psi	48.81 psi	0.05	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	15.89 psi	150.00 psi	0.11	OK
+1.20D+1.60L	84.81 psi	150.00 psi	0.57	OK
+1.20D+L	58.12 psi	150.00 psi	0.39	OK
+1.20D	13.62 psi	150.00 psi	0.09	OK
+0.90D	10.21 psi	150.00 psi	0.07	OK

General Footing

DESCRIPTION: F #2

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-16

General Information

Material Properties

f'c : Concrete 28 day strength	=	2.50	ksi
fy : Rebar Yield	=	40.0	ksi
Ec : Concrete Elastic Modulus	=	3,122.0	ksi
Concrete Density	=	145.0	pcf
φ Values Flexure	=	0.90	
Shear	=	0.750	

Analysis Settings

Min Steel % Bending Reinf.	=	
Min Allow % Temp Reinf.	=	
Min. Overturning Safety Factor	=	1.0 : 1
Min. Sliding Safety Factor	=	1.0 : 1
Add Ftg Wt for Soil Pressure	:	Yes
Use ftg wt for stability, moments & shears	:	Yes
Add Pedestal Wt for Soil Pressure	:	No
Use Pedestal wt for stability, mom & shear	:	No

Soil Design Values

Allowable Soil Bearing	=	1.50	ksf
Soil Density	=	110.0	pcf
Increase Bearing By Footing Weight	=	No	
Soil Passive Resistance (for Sliding)	=	250.0	pcf
Soil/Concrete Friction Coeff.	=	0.30	

Increases based on footing Depth

Footing base depth below soil surface	=	ft
Allow press. increase per foot of depth	=	ksf
when footing base is below	=	ft

Increases based on footing plan dimension

Allowable pressure increase per foot of depth	=	ksf
when max. length or width is greater than	=	ft

Dimensions

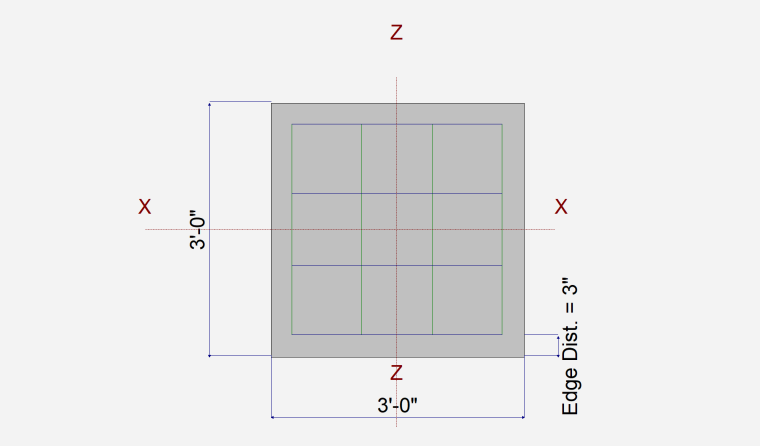
Width parallel to X-X Axis	=	3.0 ft
Length parallel to Z-Z Axis	=	3.0 ft
Footing Thickness	=	10.0 in

Pedestal dimensions...

px : parallel to X-X Axis	=	in
pz : parallel to Z-Z Axis	=	in
Height	=	in

Bandwidth Distribution Check (ACI 15.4.4.2)

Direction Requiring Closer Separation	n/a
# Bars required within zone	n/a
# Bars required on each side of zone	n/a



Bottom Reinforcing

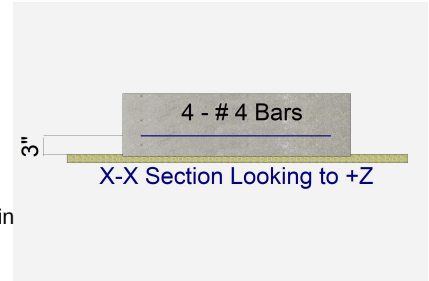
Bars parallel to X-X Axis (resisting Z Flexure)

Number of Bars	=		4.0
Reinforcing Bar Size	=	#	4

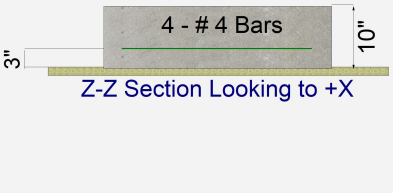
Bars parallel to Z-Z Axis (resisting X Flexure)

Number of Bars	=		4.0
Reinforcing Bar Size	=	#	4

Rebar Centerline to Edge of Concrete...
at Bottom of footing = 3.0 in



X-X Section Looking to +Z



Z-Z Section Looking to +X

General Footing

DESCRIPTION: F #2

Applied Loads

		D	Lr	L	S	W	E	H	
P : Column Load	=	1.50		6.60					k
OB : Overburden	=								ksf
M-xx	=								k-ft
M-zz	=								k-ft
V-x	=								k
V-z	=								k

DESIGN SUMMARY

Design OK

	Min. Ratio	Item	Applied	Capacity	Governing Load Combination
PASS	0.6807	Soil Bearing	1.021 ksf	1.50 ksf	+D+L about Z-Z axis
PASS	n/a	Overturning - X-X	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Overturning - Z-Z	0.0 k-ft	0.0 k-ft	No Overturning
PASS	n/a	Sliding - X-X	0.0 k	0.0 k	No Sliding
PASS	n/a	Sliding - Z-Z	0.0 k	0.0 k	No Sliding
PASS	n/a	Uplift	0.0 k	0.0 k	No Uplift
PASS	0.2844	Z Flexure (+X) Bot Tens	1.545 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L
PASS	0.2844	Z Flexure (-X) Bot Tens	1.545 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L
PASS	0.810	Min Steel X Flexure Bottom	0.216 in2/ft	0.267 in2/ft	n/a
PASS	0.2844	X Flexure (+Z) Bot Tens	1.545 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L
PASS	0.2844	X Flexure (-Z) Bot Tens	1.545 k-ft/ft	5.433 k-ft/ft	+1.20D+1.60L
PASS	0.810	Min Steel Z Flexure Bottom	0.216 in2/ft	0.267 in2/ft	n/a
PASS	0.0	Z Flexure (+X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	Z Flexure (-X) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel X Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.0	X Flexure (+Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.0	X Flexure (-Z) Top Tens	0 k-ft/ft	0.0 k-ft/ft	
PASS	0.000	Min Steel Z Flexure Top	0.000 in2/ft	0.000 in2/ft	n/a
PASS	0.3448	1-way Shear (+X)	15.205 psi	44.091 psi	+1.20D+1.60L
PASS	0.3448	1-way Shear (-X)	15.205 psi	44.091 psi	+1.20D+1.60L
PASS	0.3448	1-way Shear (+Z)	15.205 psi	44.091 psi	+1.20D+1.60L
PASS	0.3448	1-way Shear (-Z)	15.205 psi	44.091 psi	+1.20D+1.60L
PASS	0.4036	2-way Punching	60.539 psi	150.0 psi	+1.20D+1.60L

Detailed Results

Soil Bearing

Rotation Axis & Load Combination...	Gross Allowable	Xecc (in)	Zecc (in)	Actual Soil Bearing Stress @ Location Bottom, -Z	Top, +Z	Left, -X	Right, +X	Actual / Allow Ratio
X-X, D Only	1.50	n/a	0.0	0.2875	0.2875	n/a	n/a	0.192
X-X, +D+L	1.50	n/a	0.0	1.021	1.021	n/a	n/a	0.681
X-X, +D+0.750L	1.50	n/a	0.0	0.8375	0.8375	n/a	n/a	0.558
X-X, +0.60D	1.50	n/a	0.0	0.1725	0.1725	n/a	n/a	0.115
Z-Z, D Only	1.50	0.0	n/a	n/a	n/a	0.2875	0.2875	0.192
Z-Z, +D+L	1.50	0.0	n/a	n/a	n/a	1.021	1.021	0.681
Z-Z, +D+0.750L	1.50	0.0	n/a	n/a	n/a	0.8375	0.8375	0.558
Z-Z, +0.60D	1.50	0.0	n/a	n/a	n/a	0.1725	0.1725	0.115

Overturning Stability

Rotation Axis & Load Combination...	Overturning Moment	Resisting Moment	Stability Ratio	Status
Footing Has NO Overturning				

All units k

Sliding Stability

Force Application Axis Load Combination...	Sliding Force	Resisting Force	Stability Ratio	Status
Footing Has NO Sliding				

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.2625	+Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK

General Footing

DESCRIPTION: F #2

Footing Flexure

Flexure Axis & Load Combination	Mu k-ft	Side	Tension Surface	As Req'd in^2	Gvrn. As in^2	Actual As in^2	Phi*Mn k-ft	Status
X-X, +1.40D	0.2625	-Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D+1.60L	1.545	+Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D+1.60L	1.545	-Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D+L	1.050	+Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D+L	1.050	-Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D	0.2250	+Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +1.20D	0.2250	-Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +0.90D	0.1688	+Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
X-X, +0.90D	0.1688	-Z	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.40D	0.2625	-X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.40D	0.2625	+X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D+1.60L	1.545	-X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D+1.60L	1.545	+X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D+L	1.050	-X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D+L	1.050	+X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D	0.2250	-X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +1.20D	0.2250	+X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +0.90D	0.1688	-X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK
Z-Z, +0.90D	0.1688	+X	Bottom	0.2160	ACI 7.6.1.1	0.2667	5.433	OK

One Way Shear X

Load Combination...	Vu @ -X	Vu @ +X	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.58 psi	2.58 psi	2.58 psi	44.09 psi	0.06	OK
+1.20D+1.60L	15.21 psi	15.21 psi	15.21 psi	44.09 psi	0.34	OK
+1.20D+L	10.33 psi	10.33 psi	10.33 psi	44.09 psi	0.23	OK
+1.20D	2.21 psi	2.21 psi	2.21 psi	44.09 psi	0.05	OK
+0.90D	1.66 psi	1.66 psi	1.66 psi	44.09 psi	0.04	OK

One Way Shear Z

Load Combination...	Vu @ -Z	Vu @ +Z	Vu:Max	Phi Vn	Vu / Phi*Vn	Status
+1.40D	2.58 psi	2.58 psi	2.58 psi	44.09 psi	0.06	OK
+1.20D+1.60L	15.21 psi	15.21 psi	15.21 psi	44.09 psi	0.34	OK
+1.20D+L	10.33 psi	10.33 psi	10.33 psi	44.09 psi	0.23	OK
+1.20D	2.21 psi	2.21 psi	2.21 psi	44.09 psi	0.05	OK
+0.90D	1.66 psi	1.66 psi	1.66 psi	44.09 psi	0.04	OK

Two-Way "Punching" Shear

All units k

Load Combination...	Vu	Phi*Vn	Vu / Phi*Vn	Status
+1.40D	10.29 psi	150.00 psi	0.07	OK
+1.20D+1.60L	60.54 psi	150.00 psi	0.40	OK
+1.20D+L	41.14 psi	150.00 psi	0.27	OK
+1.20D	8.82 psi	150.00 psi	0.06	OK
+0.90D	6.61 psi	150.00 psi	0.04	OK

Combined Footing

Project File: 2728 Mercer Island.ec6

DESCRIPTION: F #3

Code References

Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19
Load Combinations Used : ASCE 7-16 (1)

General Information

Material Properties

f'c : Concrete 28 day strength	2.50	ksi
fy : Rebar Yield	40.0	ksi
Ec : Concrete Elastic Modulus	3,122.0	ksi
Concrete Density	145.0	pcf
ϕ : Phi Values Flexure :	0.90	
Shear :	0.750	

Analysis/Design Settings

Calculate footing weight as dead load ?	Yes
Calculate Pedestal weight as dead load ?	No
Min Steel Ratio per ACI 7.6.1.1 (ratio=Steel Area/Concrete Area)	0.0018
Min. Overturning Safety Factor	1.0: 1
Min. Sliding Safety Factor	1.0: 1

Soil Information

Allowable Soil Bearing	1.50	ksf
Increase Bearing By Footing Weight	No	
Soil Passive Sliding Resistance	250.0	pcf
(Uses entry for "Footing base depth below soil surface" for force)		
Coefficient of Soil/Concrete Friction	0.30	

Soil Bearing Increase

Footing base depth below soil surface	ft
Increases based on footing Depth	
Allowable pressure increase per foot	ksf
when base of footing is below	ft
Increases based on footing Width . . .	
Allowable pressure increase per foot	ksf
when maximum length or width is greater tha	ft
Maximum Allowed Bearing Pressure	10.0 ksf
(A value of zero implies no limit)	
Adjusted Allowable Soil Bearing	1.50 ksf
(Allowable Soil Bearing adjusted for footing weight and depth & width increases as specified by user.)	

Dimensions & Reinforcing

Distance Left of Column #1	=	2.0 ft
Between Columns	=	2.0 ft
Distance Right of Column #2	=	2.0 ft
Total Footing Length	=	6.0 ft
Footing Width	=	5.0 ft
Footing Thickness	=	12.0 in

Pedestal dimensions...

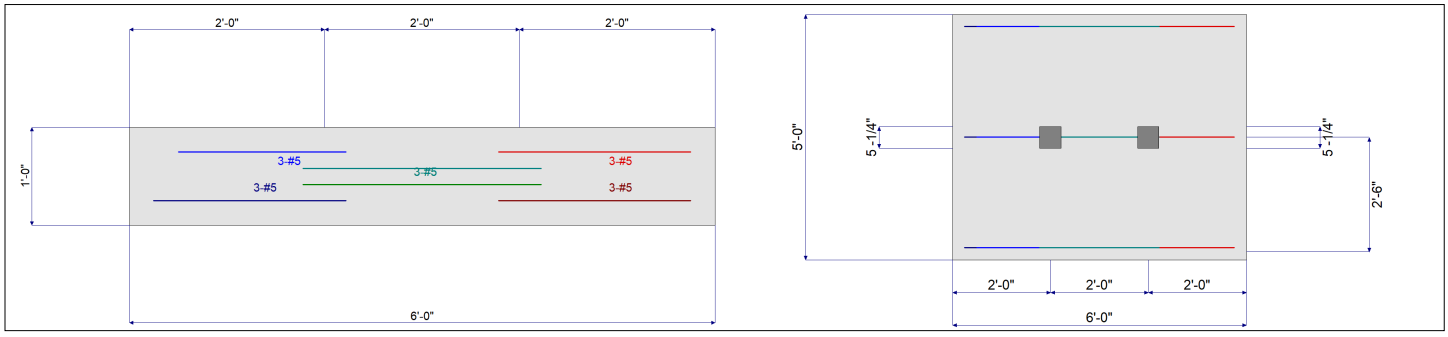
	Col #1	Col #2	
Sq. Dim. =	5.250	5.250	in
Height =			in

Rebar Center to Concrete Edge @ Top	=	3.0	in	
Rebar Center to Concrete Edge @ Bottom	=	3.0	in	

	Count	Size #	As Provided	As Req'd
Bars left of Col #1				
Bottom Bars	3.0	5	0.930	1.296 in^2
Top Bars	3.0	5	0.930	0.0 in^2
Bars Btwn Cols				
Bottom Bars	3.0	5	0.930	1.296 in^2
Top Bars	3.0	5	0.930	0.0 in^2
Bars Right of Col #2				
Bottom Bars	3.0	5	0.930	1.296 in^2
Top Bars	3.0	5	0.930	0.0 in^2

Applied Loads

Applied @ Left Column	D	Lr	L	S	W	E	H
Axial Load Downward =	3.90		15.40				k
Moment (+CW) =							k-ft
Shear (+X) =							k
Applied @ Right Column							
Axial Load Downward =	2.50		6.70				k
Moment (+CW) =							k-ft
Shear (+X) =							k
Overburden =							



Combined Footing

DESCRIPTION: F #3

DESIGN SUMMARY

Design OK

Factor of Safety	Item	Applied	Capacity	Governing Load Combination
PASS No OTM	Overturning	0.0 k-ft	0.0 k-ft	No OTM
PASS No Sliding	Sliding	0.0 k	3.225 k	No Sliding
PASS No Uplift	Uplift	0.0 k	0.0 k	No Uplift

Utilization Ratio	Item	Applied	Capacity	Governing Load Combination
PASS 0.9539	Soil Bearing	1.431 ksf	1.50 ksf	+D+L
PASS 0.4972	1-way Shear - Col #1	17.879 psi	35.960 psi	+1.20D+1.60L
PASS 0.2678	1-way Shear - Col #2	9.631 psi	35.960 psi	+1.20D+1.60L
PASS 0.3519	2-way Punching - Col #1	52.782 psi	150.0 psi	+1.20D+1.60L
PASS 0.3582	2-way Punching - Col #2	53.724 psi	150.0 psi	+1.20D+1.60L
PASS No Tension	Flexure - Left of Col #1 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.5873	Flexure - Left of Col #1 - Bottom	14.508 k-ft	24.703 k-ft	+1.20D+1.60L
PASS No Tension	Flexure - Between Cols - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.6498	Flexure - Between Cols - Bottom	16.053 k-ft	24.703 k-ft	+1.20D+1.60L
PASS No Tension	Flexure - Right of Col #2 - Top	0.0 k-ft	0.0 k-ft	N/A
PASS 0.3224	Flexure - Right of Col #2 - Bottom	7.965 k-ft	24.703 k-ft	+1.20D+1.60L

Soil Bearing

Load Combination...	Total Bearing	Eccentricity from Ftg CL	Actual Soil Bearing Stress @ Left Edge	@ Right Edge	Allowable	Actual / Allow Ratio
D Only	10.75 k	-0.130 ft	0.40 ksf	0.31 ksf	1.50 ksf	0.270
+D+L	32.85 k	-0.307 ft	1.43 ksf	0.76 ksf	1.50 ksf	0.954
+D+0.750L	27.33 k	-0.290 ft	1.17 ksf	0.65 ksf	1.50 ksf	0.783
+0.60D	6.45 k	-0.130 ft	0.24 ksf	0.19 ksf	1.50 ksf	0.162

Overturning Stability

Load Combination...	Moments about Left Edge k-ft Overturning	Resisting	Ratio	Moments about Right Edg k-ft Overturning	Resisting	Ratio
D Only	0.00	0.00	999.000	0.00	0.00	999.000
+D+L	0.00	0.00	999.000	0.00	0.00	999.000
+D+0.750L	0.00	0.00	999.000	0.00	0.00	999.000
+0.60D	0.00	0.00	999.000	0.00	0.00	999.000

Sliding Stability

Load Combination...	Sliding Force	Resisting Force	Sliding Safety Ratio
D Only	0.00 k	3.23 k	999
+D+L	0.00 k	9.86 k	999
+D+0.750L	0.00 k	8.20 k	999
+0.60D	0.00 k	1.94 k	999

One Way Shear

Load Combination...	Left of Column #1 vu (psi)	φ vn (psi)	vu / φ vn	Right of Column #1 vu (psi)	φ vn (psi)	vu / φ vn	Left of Column #2 vu (psi)	φ vn (psi)	vu / φ vn	Right of Column #2 vu (psi)	φ vn (psi)	vu / φ vn
+1.40D	3.4	36.0	0.094	1.0	36.0	0.027	2.4	36.0	0.065	0.8	36.0	0.023
+1.20D+1.60L	17.9	36.0	0.497	7.6	36.0	0.212	9.6	36.0	0.268	6.8	36.0	0.190
+1.20D+L	12.3	36.0	0.341	5.1	36.0	0.141	6.8	36.0	0.188	4.5	36.0	0.126
+1.20D	2.9	36.0	0.081	0.8	36.0	0.024	2.0	36.0	0.056	0.7	36.0	0.020
+0.90D	2.2	36.0	0.061	0.6	36.0	0.018	1.5	36.0	0.042	0.5	36.0	0.015

Two Way Shear

Load Combination...	Column #1 vu (psi)	φ vn (psi)	vu / φ vn	Column #2 vu (psi)	φ vn (psi)	vu / φ vn
+1.40D	9.8	150.0	0.065	9.9	150.0	0.066
+1.20D+1.60L	52.8	150.0	0.352	53.7	150.0	0.358
+1.20D+L	36.1	150.0	0.241	36.8	150.0	0.245

Combined Footing

DESCRIPTION: F #3

Two Way Shear

Load Combination...	Column #1 vu (psi)	Column #1 φ vn (psi)	Column #1 vu / φ vn	Column #2 vu (psi)	Column #2 φ vn (psi)	Column #2 vu / φ vn
+1.20D	8.4	150.0	0.056	8.5	150.0	0.057
+0.90D	6.3	150.0	0.042	6.4	150.0	0.042

Cantilevered Retaining Wall

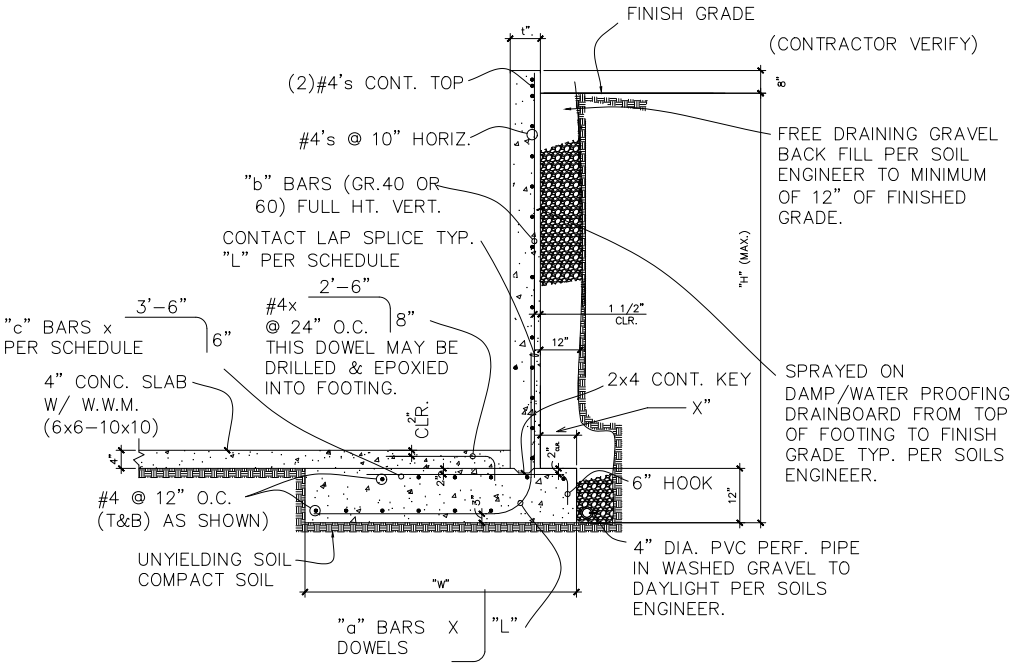
RETAINING WALL SCHEDULE							
"H" MAX.FT.	"W"	"a"	"b"	"c"	"L"	"t"	"X"
5'	2'-0"	#4@9"	#4@9"	#4@9"	3'-6"	8"	6"
6'	2'-6"	#4@9"	#4@9"	#4@9"	3'-9"	8"	6"
7'	3'-0"	#4@8"	#4@8"	#4@8"	4'-0"	8"	8"
8'	3'-6"	#4@8"	#4@8"	#4@8"	4'-3"	8"	8"
9'	4'-0"	#5@12"	#5@12"	#5@12"	4'-6"	8"	8"
10'	4'-6"	#5@12"	#5@12"	#5@12"	4'-9"	8"	8"
11'	5'-0"	#5@10"	#5@10"	#5@10"	5'-0"	10"	10"
12'	5'-6"	#5@10"	#5@10"	#5@10"	5'-3"	10"	10"
13'	6'-0"	#5@6"	#5@6"	#5@6"	5'-3"	10"	10"

RETAINING WALL NOTES:

1. 1,500 PSF SOIL BEARING, 0.4 CO. OF FRICTION (ASSUMED)
2. 35 PCF EQUIV. FLUID PRESSURE, 250 PCF PASSIVE PRESSURE.(ASSUMED)
3. 2,500 PSI CONCRETE.
4. GRADE 40 OR 60 REINF.
5. CONTRACTOR SHALL VERIFY ALL EXISTING & FINISH GRADES PRIOR TO CONSTRUCTION.
6. REINFORCING SHALL BE INSPECTED POURING CONCRETE.
7. BUILDING INSPECTOR/SOILS ENGINEER TO INSPECT & APPROVE SOILS BELOW FOOTING PRIOR TO CONSTRUCTION OF FOOTINGS.
8. THIS DESIGN SHALL NOT BE CONSTRUCTED ON SILT OR CLAY BEARING SOILS, OR WITH SILT OR CLAY BACKFILL BEHIND WALLS.
9. CONTRACTOR SHALL COMPLY WITH ALL O.S.H.A. & W.I.S.H.A. HEALTH & SAFETY STANDARDS.
10. BACKFILL SHOULD BE PLACED WITH EXTREME CARE TO AVOID EXCESSIVE HORIZONTAL LOADS ON THE WALL. THIS REQUIREMENT SHOULD TAKE PRECEDENCE OVER COMPLETE ADHERENCE TO THE COMPACTION CRITERIA.

IMPORTANT NOTES:

1. CONTRACTOR MAY BACKFILL "H"/3 MAX. BEHIND WALLS PRIOR TO PLACEMENT OF SLAB ON GRADE.
2. CONTRACTOR MAY NOT FULLY BACKFILL BEHIND WALL UNTIL REINF. SLAB IS IN PLACE & CURED.



"L" SHAPED RETAINING WALL

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab

Code References

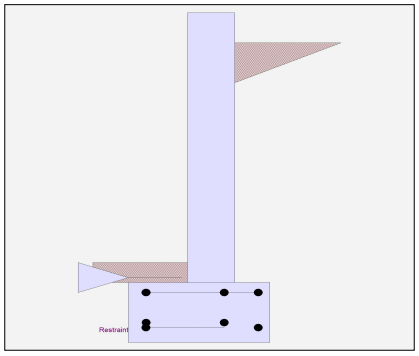
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.350

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.35	OK
Slab Resists All Sliding !			
Global Stability	=	2.36	

Total Bearing Load	=	1,254	lbs
...resultant ecc.	=	2.56	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,029	psf OK
Soil Pressure @ Heel	=	225	psf OK
Allowable	=	1,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,189	psf
ACI Factored @ Heel	=	260	psf
Footing Shear @ Toe	=	1.2	psi OK
Footing Shear @ Heel	=	4.8	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	437.5 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	9.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.077**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	280.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	373.3
Moment.....Allowable	=	4,832.2
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	3.7
Shear.....Allowable	psi =	45.8
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.021 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2667 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.27 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	0.83 ft
Heel Width	=	1.17
Total Footing Width	=	2.00
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,189	260	psf
Mu' : Upward	=	368	0	ft-#
Mu' : Downward	=	66	191	ft-#
Mu: Design	=	301	191	ft-#
φ Mn	=	6,834	7,634	ft-#
Actual 1-Way Shear	=	1.18	4.77	psi
Allow 1-Way Shear	=	40.93	39.48	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = # 4 @ 9.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.52 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		437.5	1.67	729.2	Soil Over HL (ab. water tbl)	249.7	1.75	436.8
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		1.75	436.8
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	34.7	0.42	14.5
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	450.0	1.17	524.9
					Earth @ Stem Transitions	=		
					Footing Weight	=	299.9	1.00	299.7
					Key Weight	=			
					Vert. Component	=	219.5	2.00	438.7
Total	=	437.5	**O.T.M.** =	729.2	**Total =**		1,253.7 lbs	**R.M.=**	1,714.4

Resisting/Overturning Ratio = **2.35**

Vertical Loads used for Soil Pressure = 1,253.7 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.064	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab

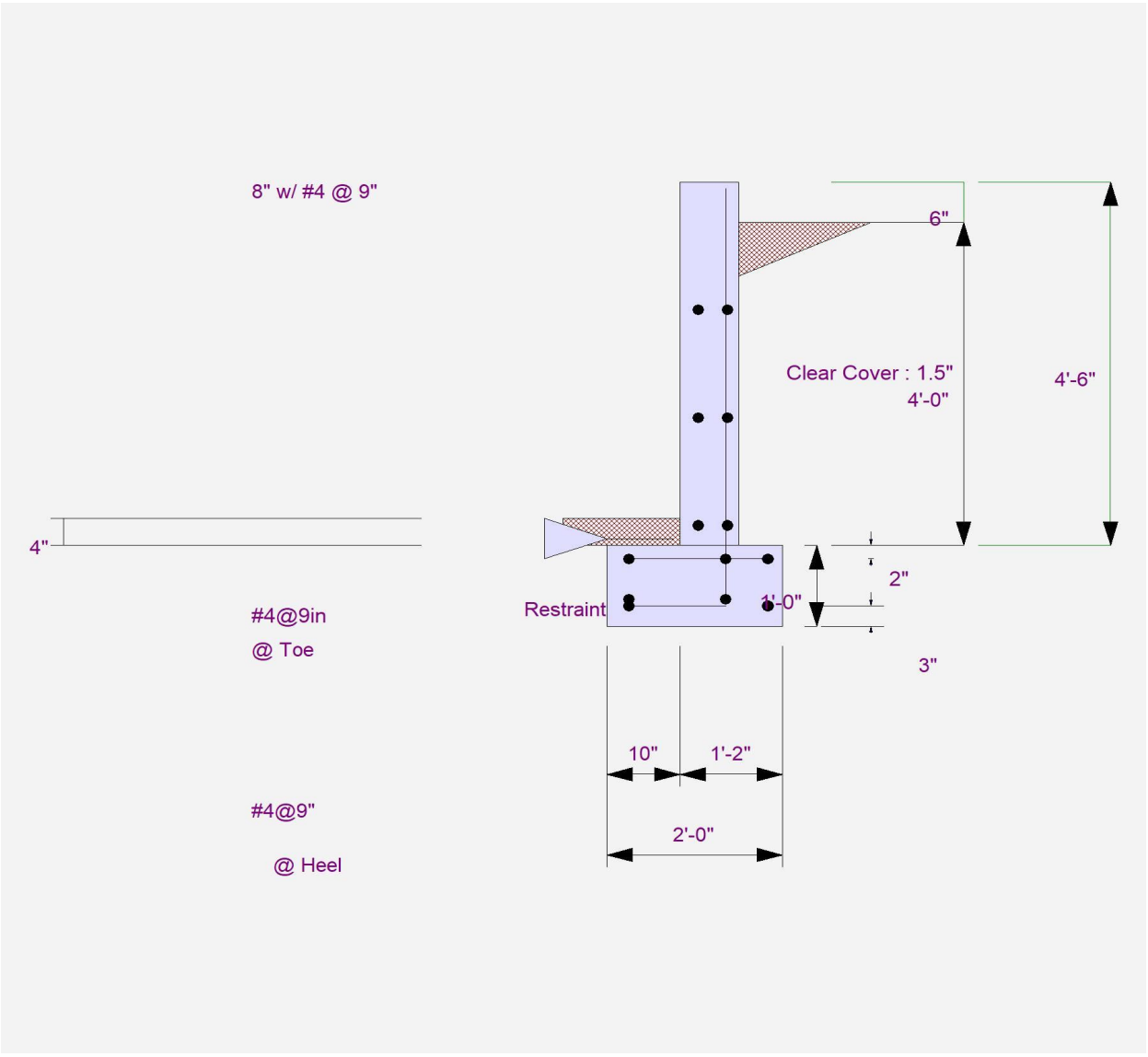
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2667 in2/ft
As Required =	0.1728 in2/ft

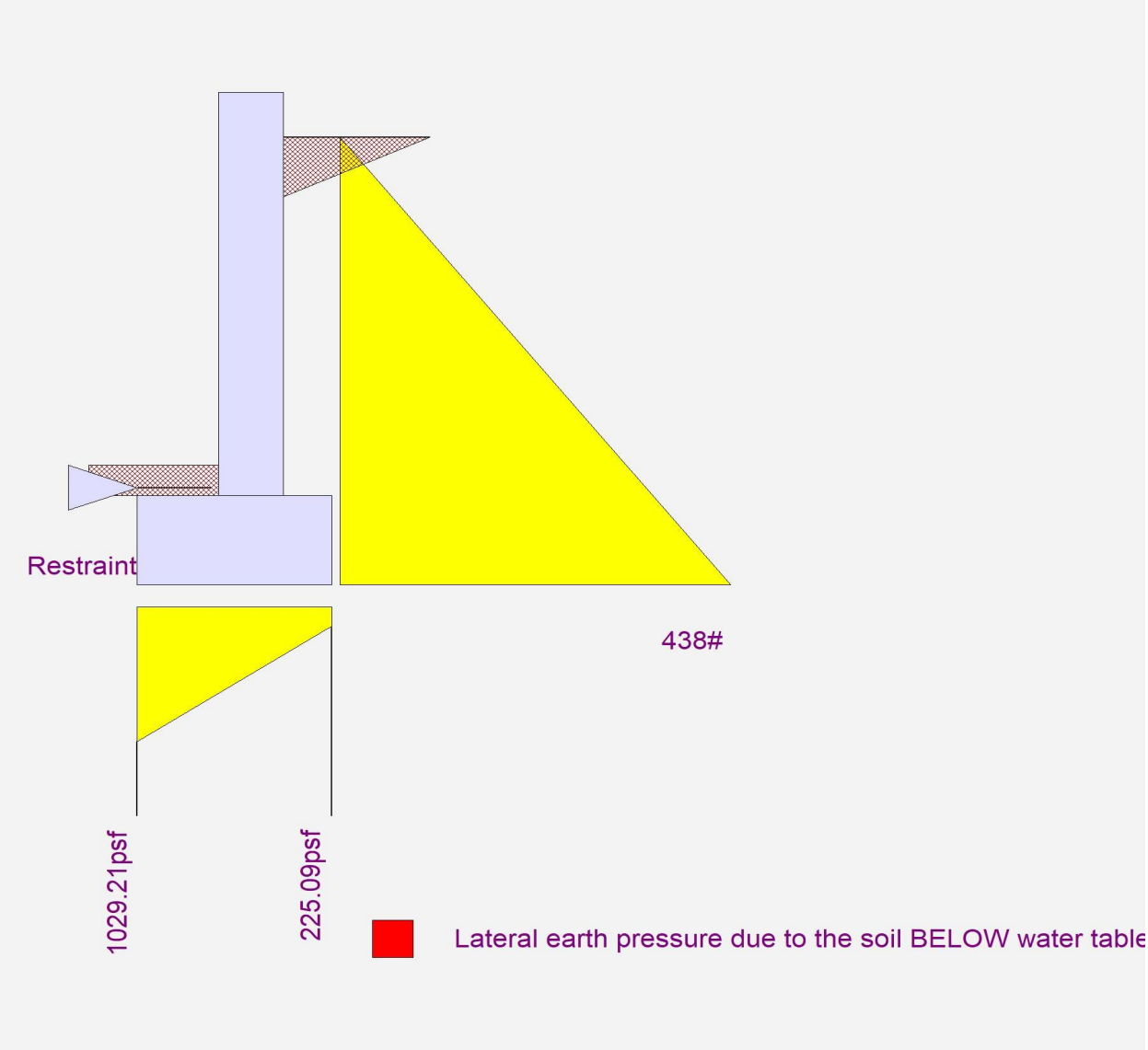
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=5' w/ Slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab

Code References

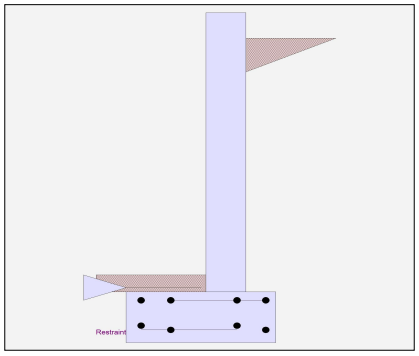
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	5.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	0.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.350

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.31	OK
Slab Resists All Sliding !			
Global Stability	=	1.95	

Total Bearing Load	=	1,608 lbs	
...resultant ecc.	=	2.67 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	989 psf	OK
Soil Pressure @ Heel	=	299 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,112 psf	
ACI Factored @ Heel	=	337 psf	
Footing Shear @ Toe	=	5.0 psi	OK
Footing Shear @ Heel	=	6.2 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	630.0 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	9.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.150**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	437.5
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	729.2
Moment.....Allowable	=	4,832.2
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	5.8
Shear.....Allowable	psi =	45.8
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.041 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.2667 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.27 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.33 ft
Heel Width	=	1.17
Total Footing Width	=	2.50
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,112	337	psf
Mu' : Upward	=	862	0	ft-#
Mu' : Downward	=	170	254	ft-#
Mu: Design	=	692	254	ft-#
φ Mn	=	6,834	7,634	ft-#
Actual 1-Way Shear	=	5.02	6.17	psi
Allow 1-Way Shear	=	40.93	39.48	psi

Toe Reinforcing = # 4 @ 9.00 in
Heel Reinforcing = # 4 @ 9.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.65 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	630.0	2.00	1,260.0			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	312.1	2.25	701.0
				Soil Over HL (bel. water tbl)		2.25	701.0
				Water Table			
				Sloped Soil Over Heel =			
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =	55.4	0.67	36.9
				Surcharge Over Toe =			
				Stem Weight(s) =	550.0	1.66	914.8
				Earth @ Stem Transitions =			
				Footing Weight =	374.4	1.25	467.3
				Key Weight =			
				Vert. Component =	316.0	2.50	788.8
Total =	630.0	**O.T.M.** =	1,260.0	**Total =**	1,607.9 lbs	**R.M.=**	2,908.8

Resisting/Overturning Ratio = **2.31**

Vertical Loads used for Soil Pressure = 1,607.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.061	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab

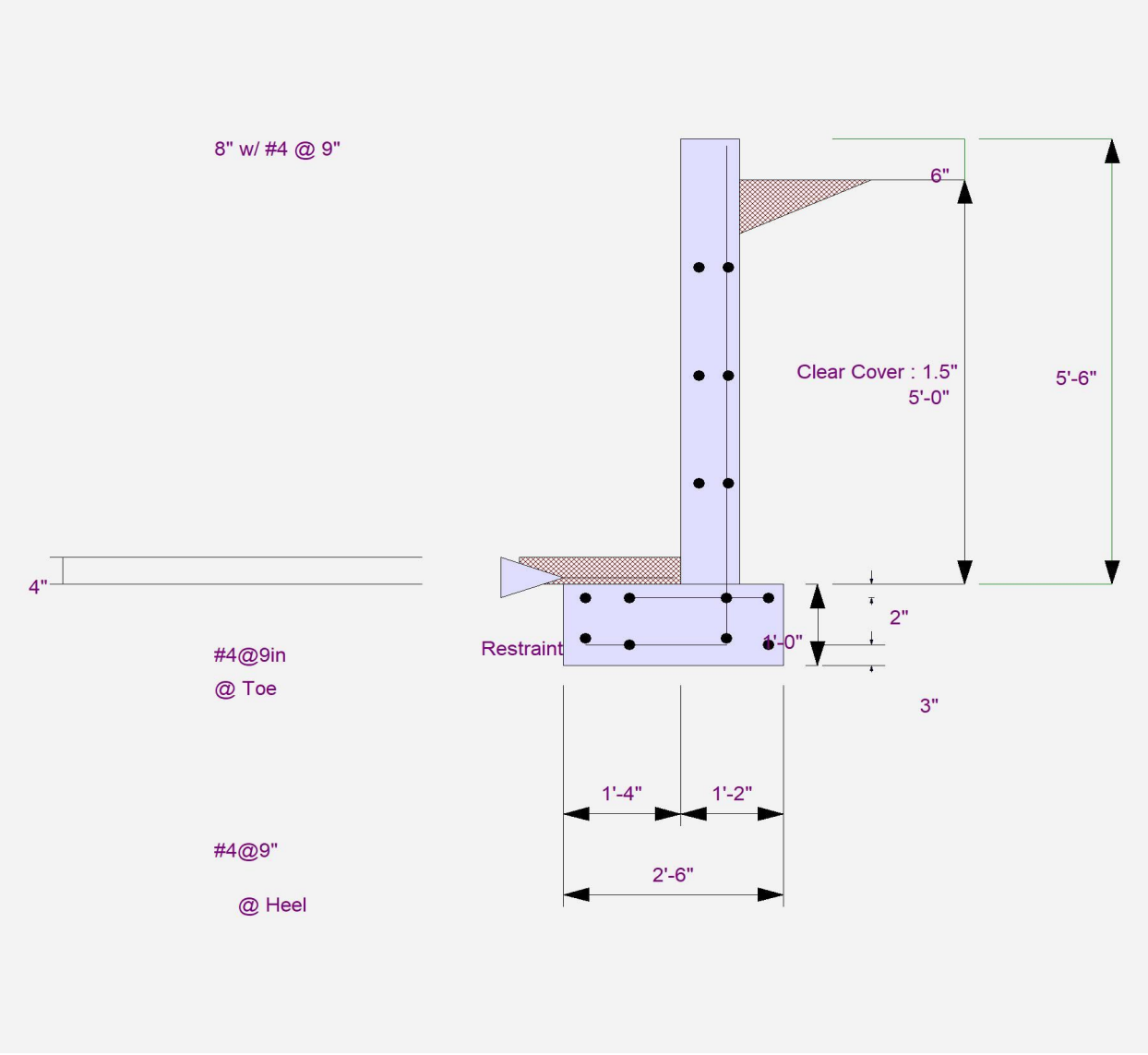
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2667 in2/ft
As Required =	0.1728 in2/ft

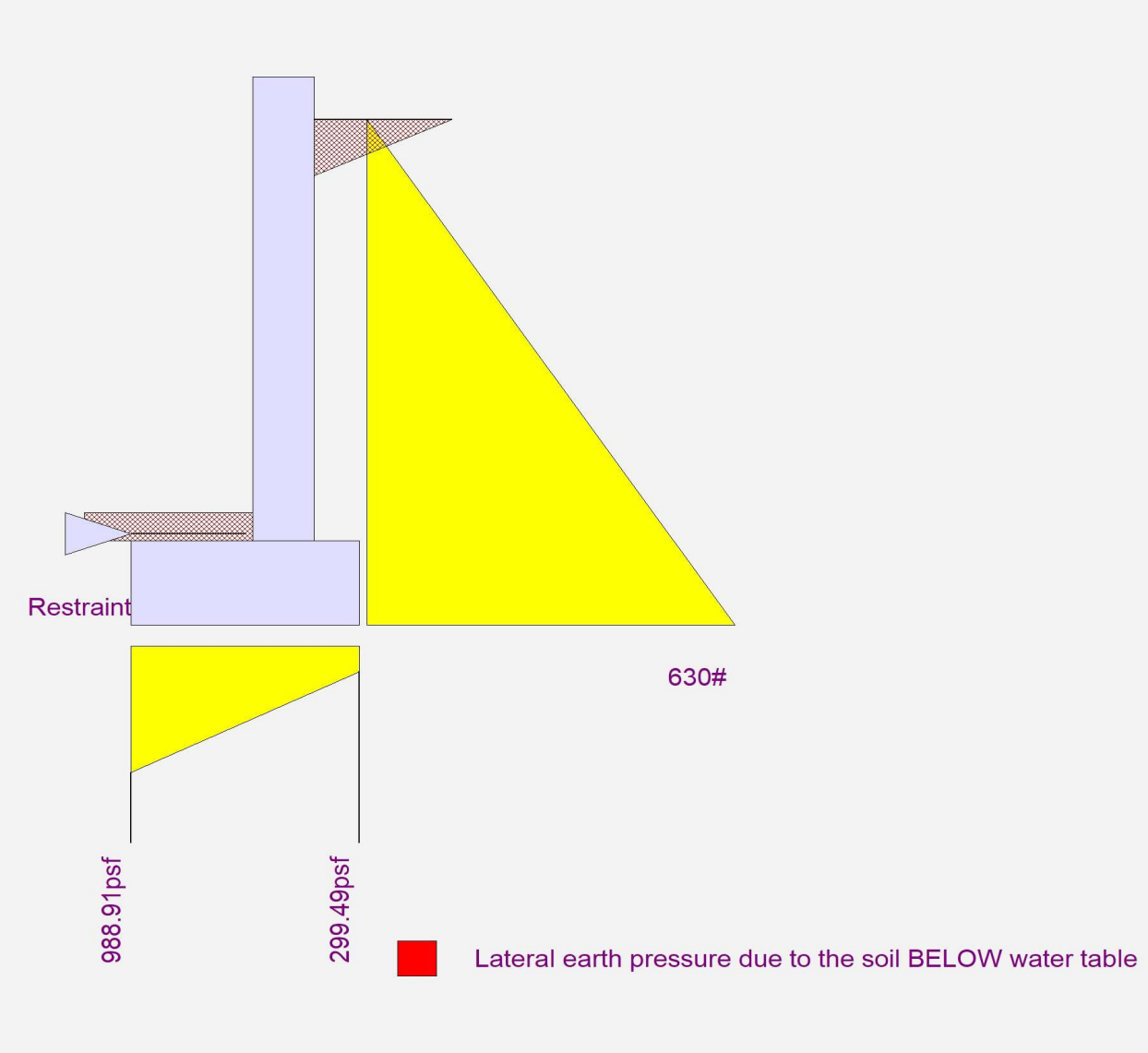
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret Wall H=6' w/ Slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=7' w/ slab

Code Reference

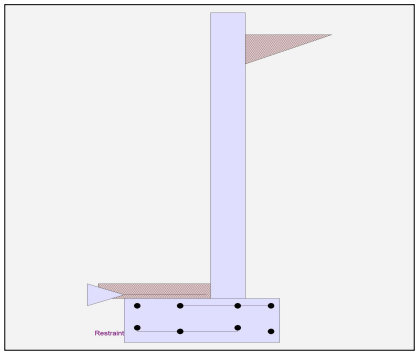
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.350

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=7' w/ slab

Design Summary

Wall Stability Ratios

Overturning	=	2.32	OK
Slab Resists All Sliding !			
Global Stability	=	1.74	
Total Bearing Load	=	2,095 lbs	
...resultant ecc.	=	2.87 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,037 psf	OK
Soil Pressure @ Heel	=	364 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,154 psf	
ACI Factored @ Heel	=	405 psf	
Footing Shear @ Toe	=	7.9 psi	OK
Footing Shear @ Heel	=	9.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	857.5 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.232**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	630.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	1,260.0
Moment.....Allowable	=	5,412.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	8.4
Shear.....Allowable	psi =	47.6
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=7' w/ slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0708 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.3 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.27 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	1.66 ft
Heel Width	=	1.33
Total Footing Width	=	2.99
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,154	405	psf
Mu' : Upward	=	1,399	0	ft-#
Mu' : Downward	=	264	483	ft-#
Mu: Design	=	1,135	483	ft-#
φ Mn	=	7,663	8,563	ft-#
Actual 1-Way Shear	=	7.87	9.01	psi
Allow 1-Way Shear	=	42.57	41.06	psi

Toe Reinforcing = # 4 @ 8.00 in
Heel Reinforcing = # 4 @ 8.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.78 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=7' w/ slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	857.5	2.33	2,000.8			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	497.5	2.66	1,322.5
				Soil Over HL (bel. water tbl)		2.66	1,322.5
				Water Table			
				Sloped Soil Over Heel =			
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =	69.2	0.83	57.4
				Surcharge Over Toe =			
				Stem Weight(s) =	650.0	1.99	1,295.7
				Earth @ Stem Transitions =			
				Footing Weight =	448.5	1.50	670.5
				Key Weight =			
				Vert. Component =	430.1	2.99	1,286.1
Total =	857.5	**O.T.M.** =	2,000.8	**Total =**	2,095.3 lbs	**R.M.=**	4,632.2

Resisting/Overturning Ratio = **2.32**

Vertical Loads used for Soil Pressure = 2,095.3 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.063	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

DESCRIPTION: L Shaped Ret wall H=7' w/ slab

Rebar Lap & Embedment Lengths Information

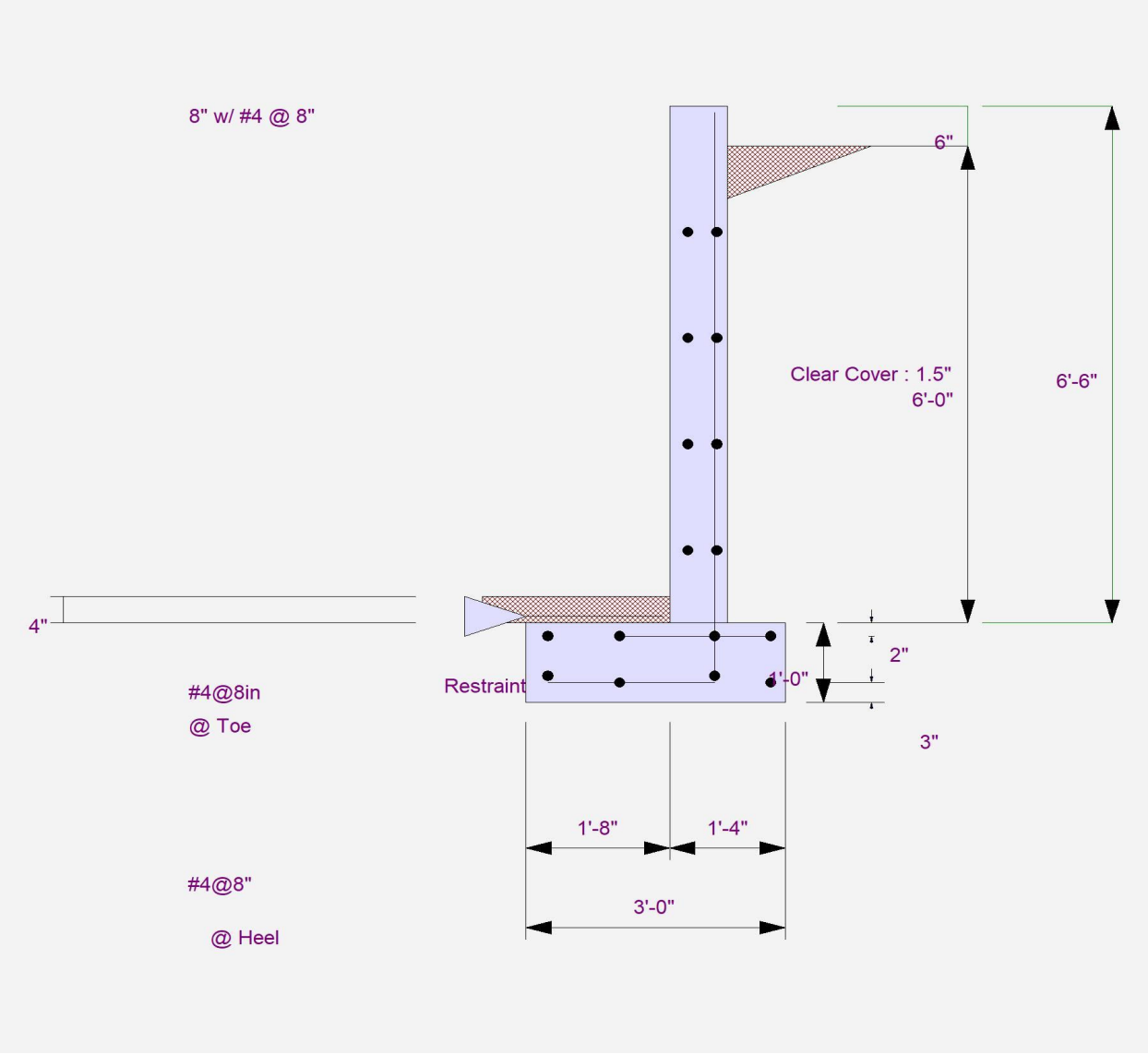
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.3000 in2/ft
As Required =	0.1728 in2/ft

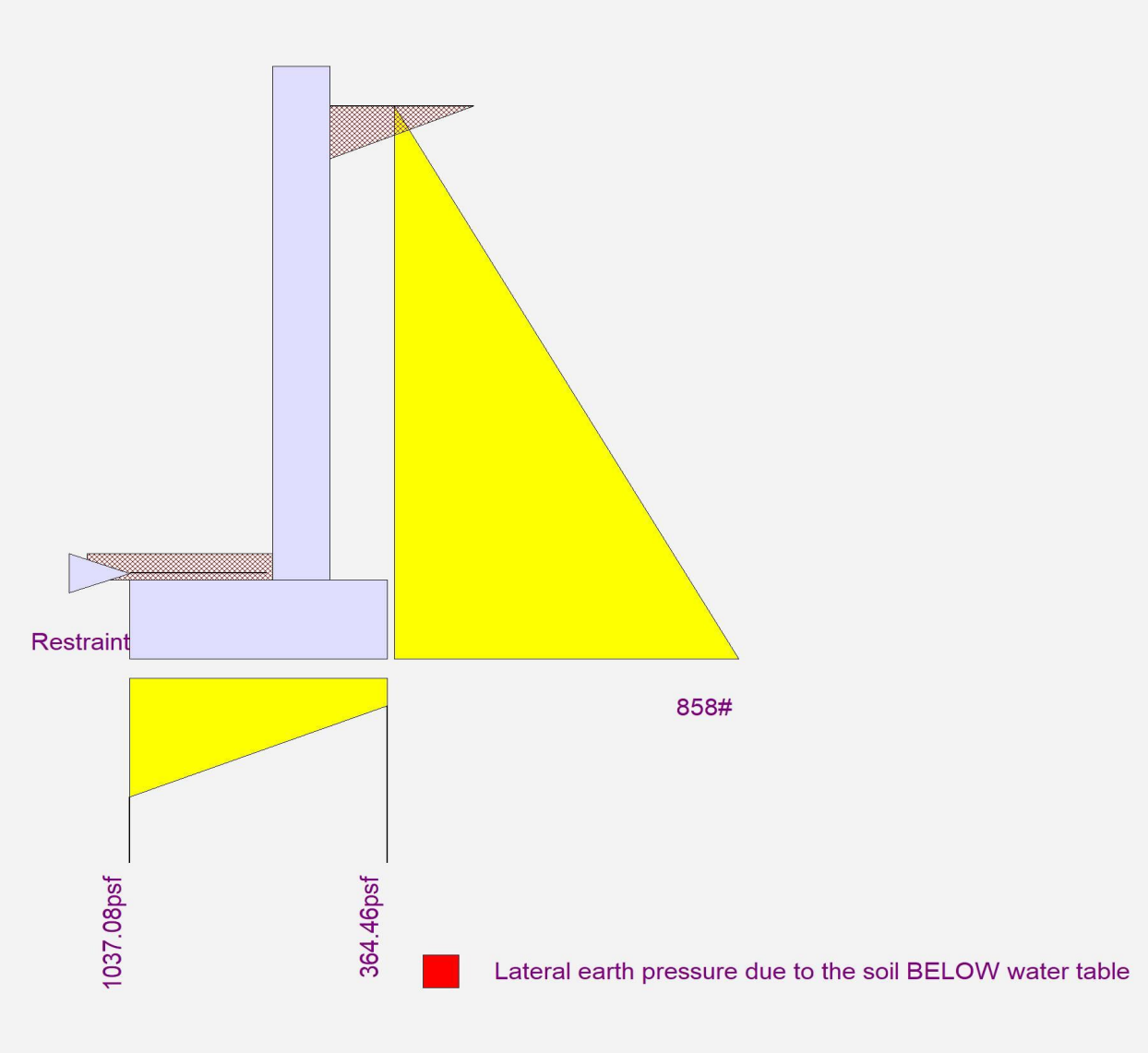
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=7' w/ slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=7' w/ slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=8' w/ slab

Code References

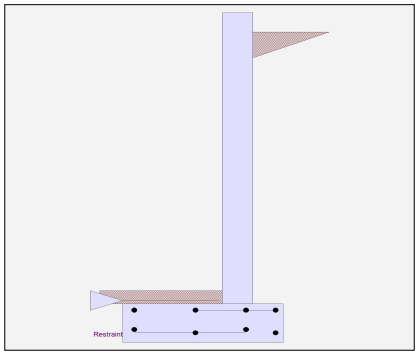
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	7.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.350

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=8' w/ slab

Design Summary

Wall Stability Ratios

Overturning	=	2.24	OK
Slab Resists All Sliding !			
Global Stability	=	1.53	

Total Bearing Load	=	2,507 lbs	
...resultant ecc.	=	3.25 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,050 psf	OK
Soil Pressure @ Heel	=	384 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,141 psf	
ACI Factored @ Heel	=	417 psf	
Footing Shear @ Toe	=	11.4 psi	OK
Footing Shear @ Heel	=	10.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,120.0 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.369**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	857.5
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	2,000.8
Moment.....Allowable	=	5,412.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	11.4
Shear.....Allowable	psi =	47.6
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.25

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=8' w/ slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1124 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.3 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.27 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	2.17 ft
Heel Width	=	1.33
Total Footing Width	=	3.50
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,141	417	psf
Mu' : Upward	=	2,326	0	ft-#
Mu' : Downward	=	450	598	ft-#
Mu: Design	=	1,876	598	ft-#
φ Mn	=	7,663	8,563	ft-#
Actual 1-Way Shear	=	11.41	10.89	psi
Allow 1-Way Shear	=	42.57	41.06	psi

Toe Reinforcing = # 4 @ 8.00 in
Heel Reinforcing = # 4 @ 8.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 0.91 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=8' w/ slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,120.0	2.67	2,986.7			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
Soil Over HL (ab. water tbl)				580.4	3.16	1,836.6
Soil Over HL (bel. water tbl)					3.16	1,836.6
Water Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =						
* Axial Live Load on Stem =						
Soil Over Toe =				90.3	1.08	97.7
Surcharge Over Toe =						
Stem Weight(s) =				750.0	2.50	1,874.5
Earth @ Stem Transitions =						
Footing Weight =				524.4	1.75	916.7
Key Weight =						
Vert. Component =				561.8	3.50	1,964.1
Total =	1,120.0	**O.T.M.** =	2,986.7	**Total =** 2,506.9 lbs	**R.M.=**	6,689.6

Resisting/Overturning Ratio = **2.24**

Vertical Loads used for Soil Pressure = 2,506.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.063	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=8' w/ slab

Rebar Lap & Embedment Lengths Information

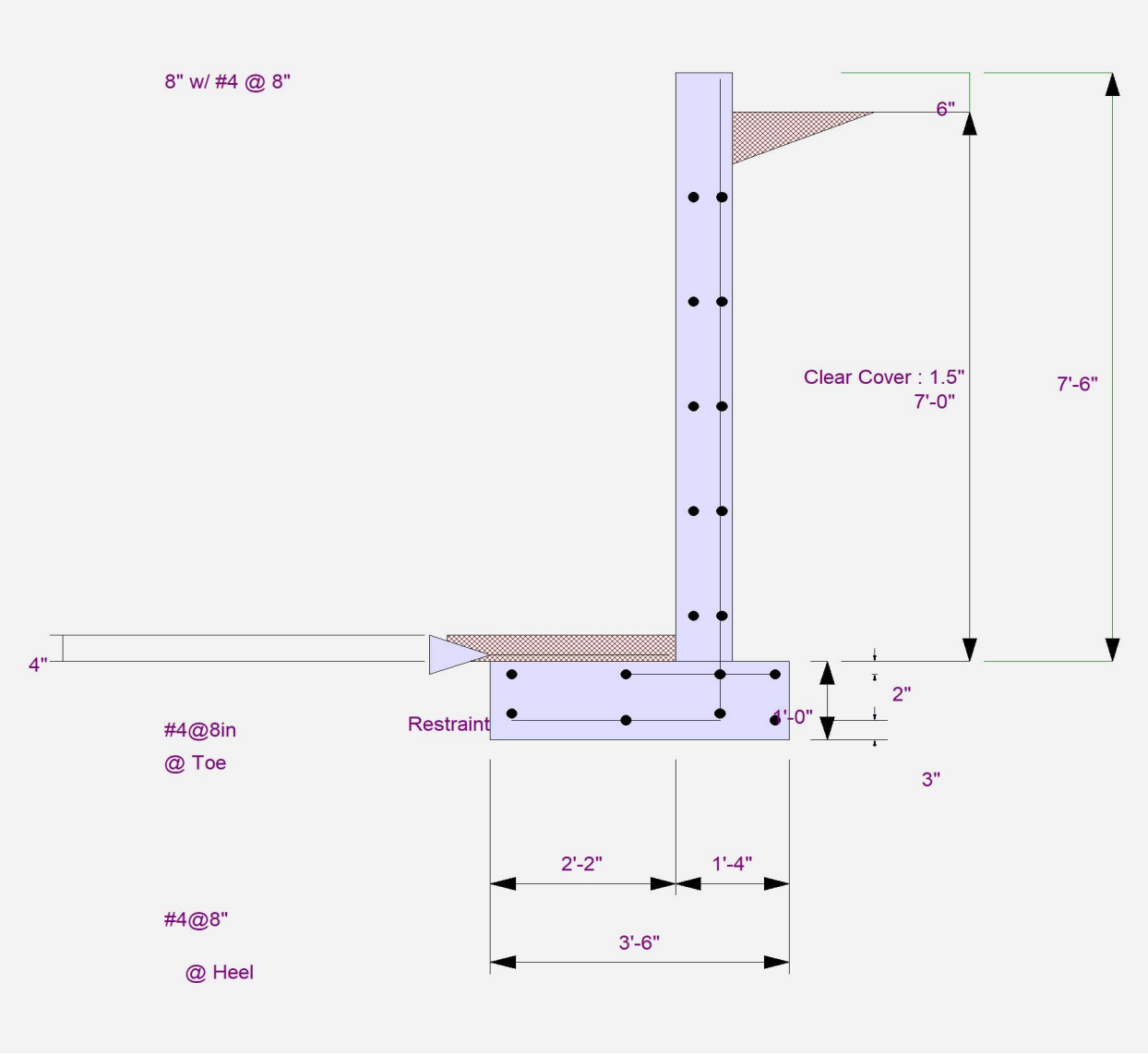
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #4 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.3000 in2/ft
As Required =	0.1728 in2/ft

Cantilevered Retaining Wall

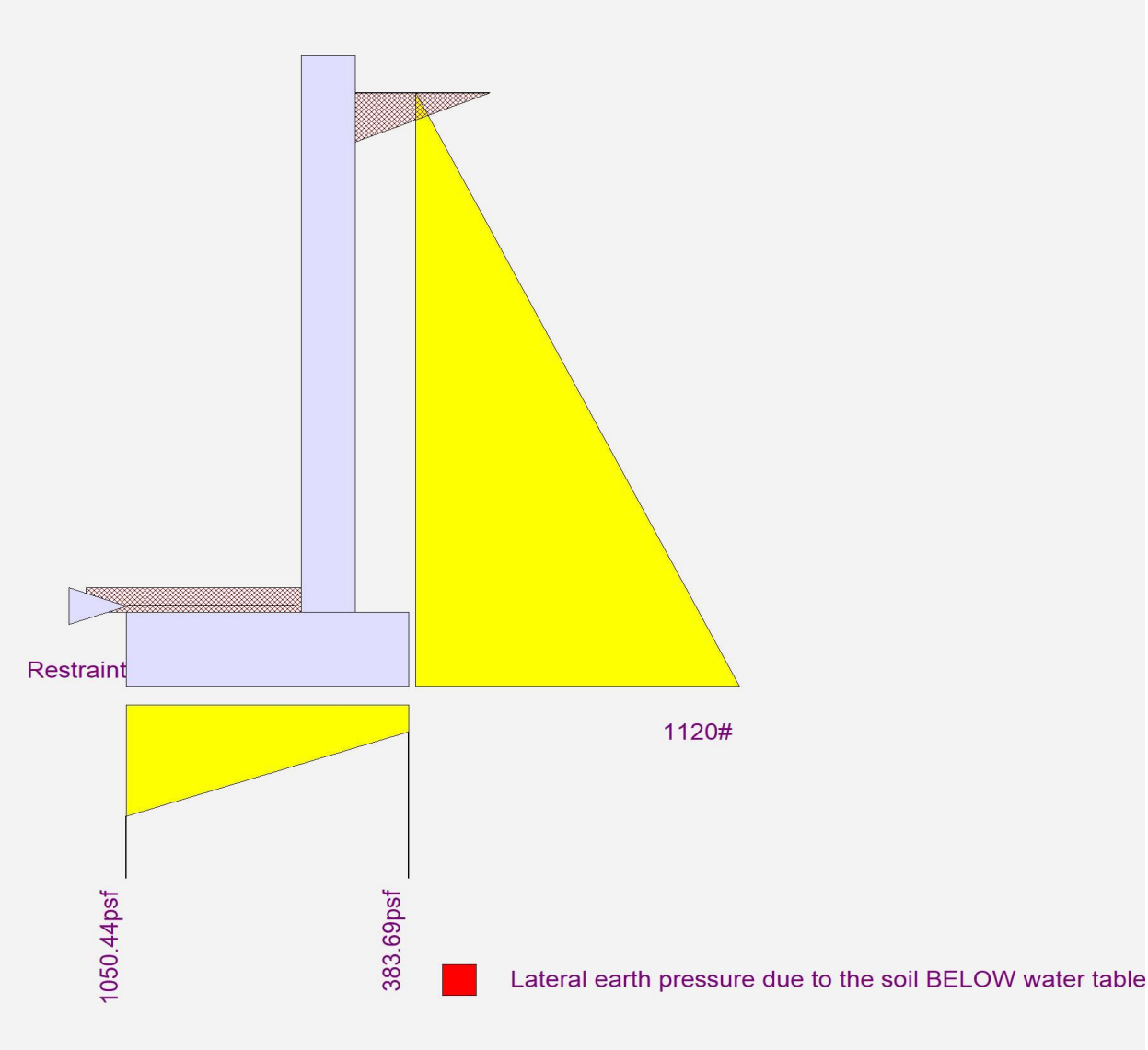
DESCRIPTION: L Shaped Ret wall H=8' w/ slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=8' w/ slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab

Code References

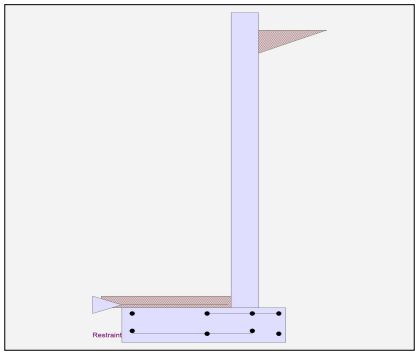
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.400

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.15	OK
Slab Resists All Sliding !			
Global Stability	=	1.35	
Total Bearing Load	=	2,934 lbs	
...resultant ecc.	=	3.91 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,095 psf	OK
Soil Pressure @ Heel	=	375 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,162 psf	
ACI Factored @ Heel	=	398 psf	
Footing Shear @ Toe	=	15.0 psi	OK
Footing Shear @ Heel	=	12.9 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,417.5 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.540**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,120.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	2,986.7
Moment.....Allowable	=	5,527.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	15.1
Shear.....Allowable	psi =	48.3
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1696 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.31 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.2573 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	2.66 ft
Heel Width	=	1.33
Total Footing Width	=	3.99
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,162	398	psf
Mu' : Upward	=	3,510	0	ft-#
Mu' : Downward	=	678	725	ft-#
Mu: Design	=	2,832	725	ft-#
φ Mn	=	7,853	8,783	ft-#
Actual 1-Way Shear	=	14.99	12.93	psi
Allow 1-Way Shear	=	43.14	41.60	psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.03 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,417.5	3.00	4,252.5			
HL Act Pres (be water tbl)				Soil Over HL (ab. water tbl)	663.3	3.66	2,426.7
Hydrostatic Force				Soil Over HL (bel. water tbl)		3.66	2,426.7
Buoyant Force =				Water Table			
Surcharge over Heel =				Sloped Soil Over Heel =			
Surcharge Over Toe =				Surcharge Over Heel =			
Adjacent Footing Load =				Adjacent Footing Load =			
Added Lateral Load =				Axial Dead Load on Stem =			
Load @ Stem Above Soil =				* Axial Live Load on Stem =			
=				Soil Over Toe =	110.8	1.33	147.4
				Surcharge Over Toe =			
				Stem Weight(s) =	850.0	2.99	2,544.3
				Earth @ Stem Transitions =			
				Footing Weight =	598.5	2.00	1,194.0
				Key Weight =			
				Vert. Component =	711.0	3.99	2,837.0
Total =	1,417.5	**O.T.M.** =	4,252.5	**Total =**	2,933.7 lbs	**R.M.=**	9,149.5

Resisting/Overturning Ratio = **2.15**

Vertical Loads used for Soil Pressure = 2,933.7 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.065	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab

Rebar Lap & Embedment Lengths Information

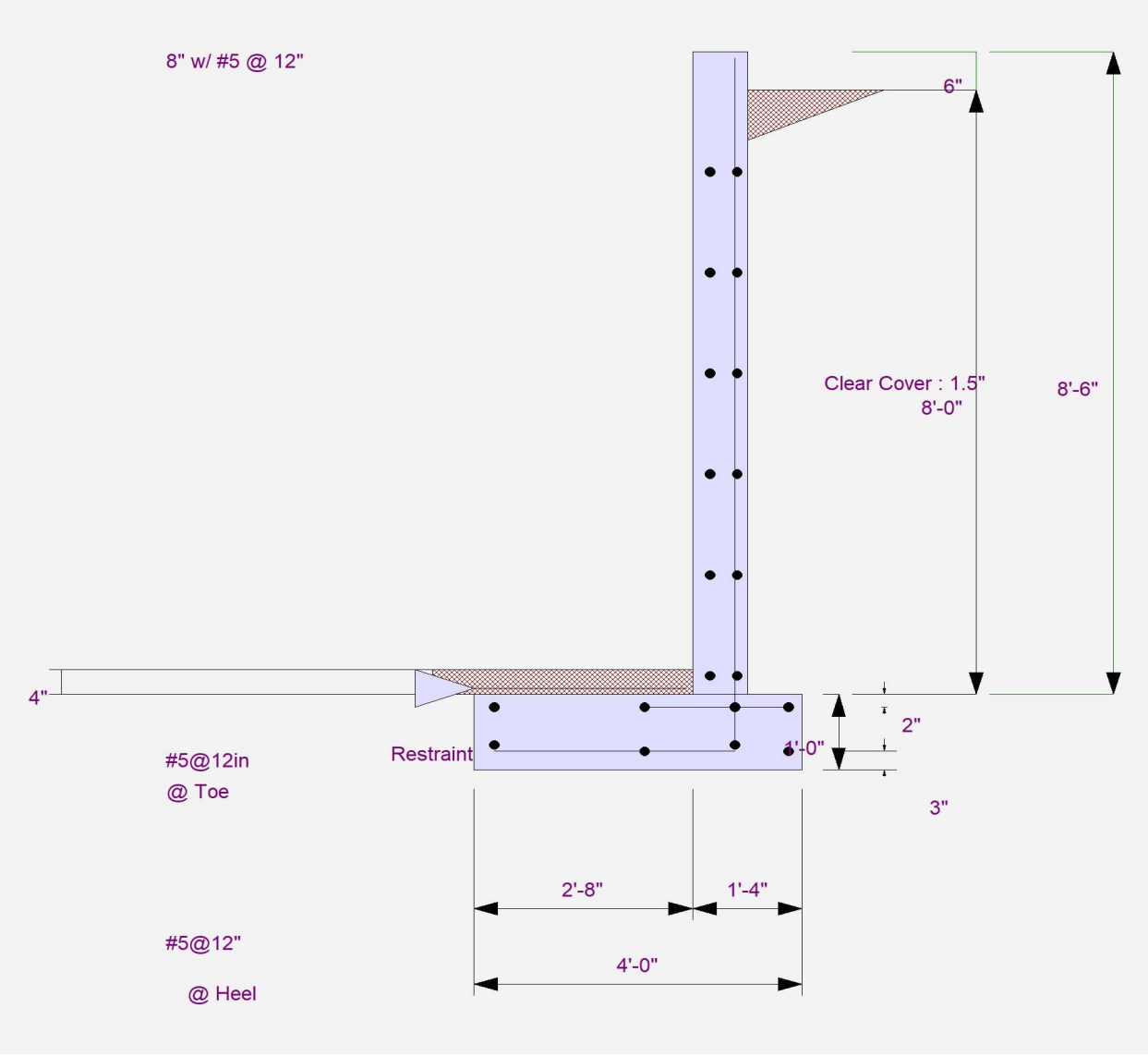
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #5 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.3100 in2/ft
As Required =	0.2262 in2/ft

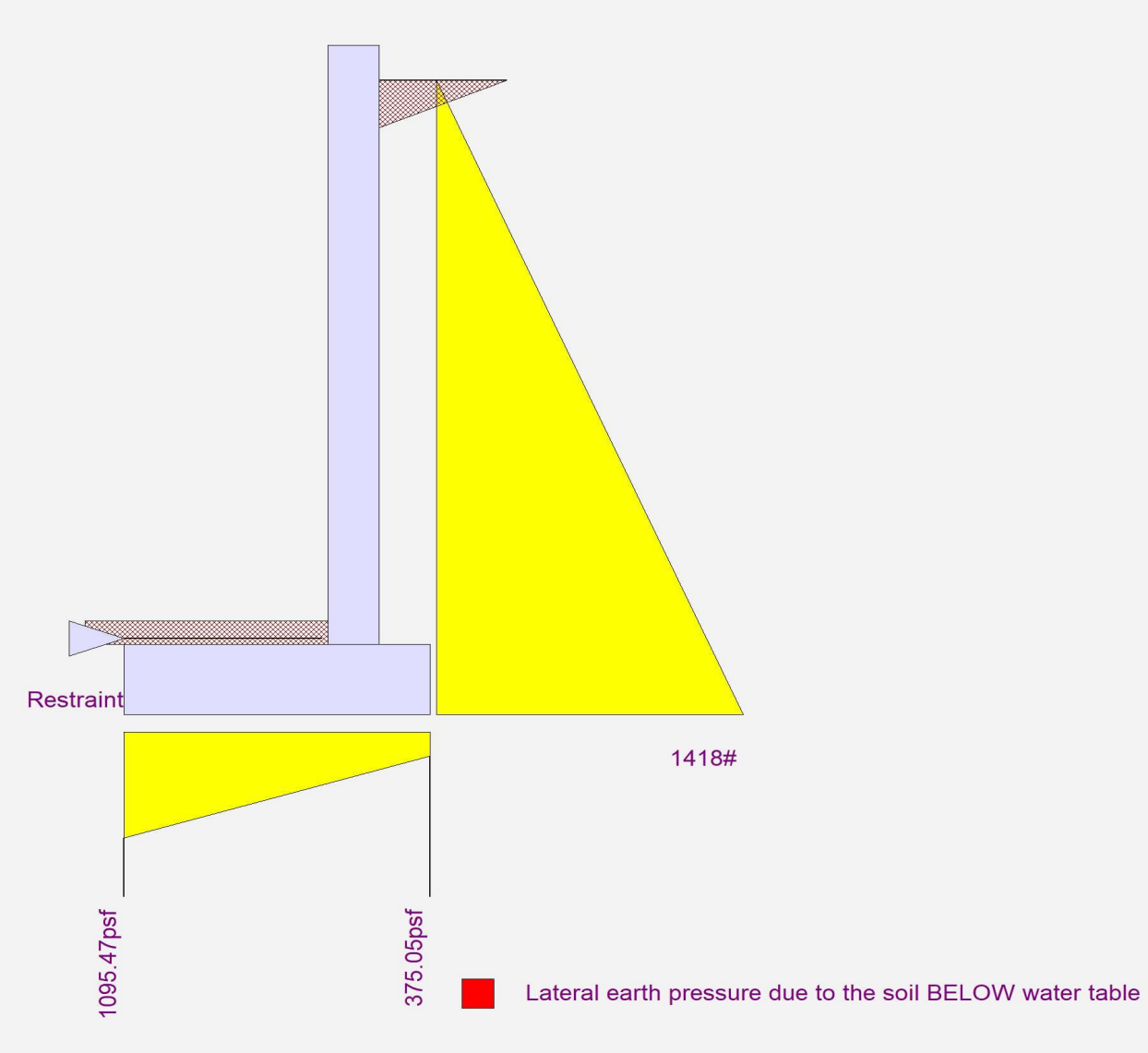
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=9' w/ Slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab

Code References

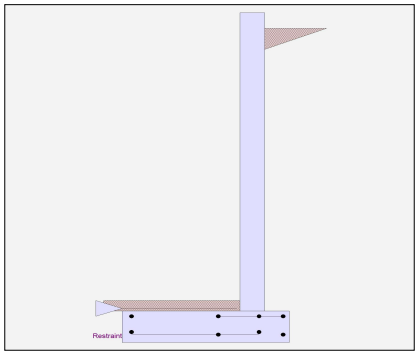
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.400

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.07	OK
Slab Resists All Sliding !			
Global Stability	=	1.21	

Total Bearing Load	=	3,380 lbs	
...resultant ecc.	=	4.72 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,146 psf	OK
Soil Pressure @ Heel	=	357 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,188 psf	
ACI Factored @ Heel	=	370 psf	
Footing Shear @ Toe	=	18.6 psi	OK
Footing Shear @ Heel	=	15.1 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,750.0 lbs	

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.769**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,417.5
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	4,252.5
Moment.....Allowable	=	5,527.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	19.1
Shear.....Allowable	psi =	48.3
Anet (Masonry)	in2 =	
Wall Weight	psf =	100.0
Rebar Depth 'd'	in =	6.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2415 in2/ft		
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2415 in2/ft	#4@ 13.89 in	#4@ 27.78 in
Provided Area :	0.31 in2/ft	#5@ 21.53 in	#5@ 43.06 in
Maximum Area :	1.2573 in2/ft	#6@ 30.56 in	#6@ 61.11 in

Footing Data

Toe Width	=	3.17 ft
Heel Width	=	1.33
Total Footing Width	=	4.50
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,188	370	psf
Mu' : Upward	=	4,993	0	ft-#
Mu' : Downward	=	961	863	ft-#
Mu: Design	=	4,032	863	ft-#
φ Mn	=	7,853	8,783	ft-#
Actual 1-Way Shear	=	18.62	15.12	psi
Allow 1-Way Shear	=	43.14	41.60	psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 12.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.17 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		1,750.0	3.33	5,833.3	Soil Over HL (ab. water tbl)	746.3	4.16	3,107.6
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.16	3,107.6
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Heel	=		
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=		
Added Lateral Load	=				* Axial Live Load on Stem	=		
Load @ Stem Above Soil	=				Soil Over Toe	=	131.9	1.58	208.8
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=	950.0	3.50	3,324.4
					Earth @ Stem Transitions	=		
					Footing Weight	=	674.4	2.25	1,516.1
					Key Weight	=			
					Vert. Component	=	877.8	4.50	3,946.7
Total	=	1,750.0	**O.T.M.** =	5,833.3	**Total =**		3,380.4 lbs	**R.M.=**	12,103.6

Resisting/Overturning Ratio = **2.07**

Vertical Loads used for Soil Pressure = 3,380.4 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.067	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab

Rebar Lap & Embedment Lengths Information

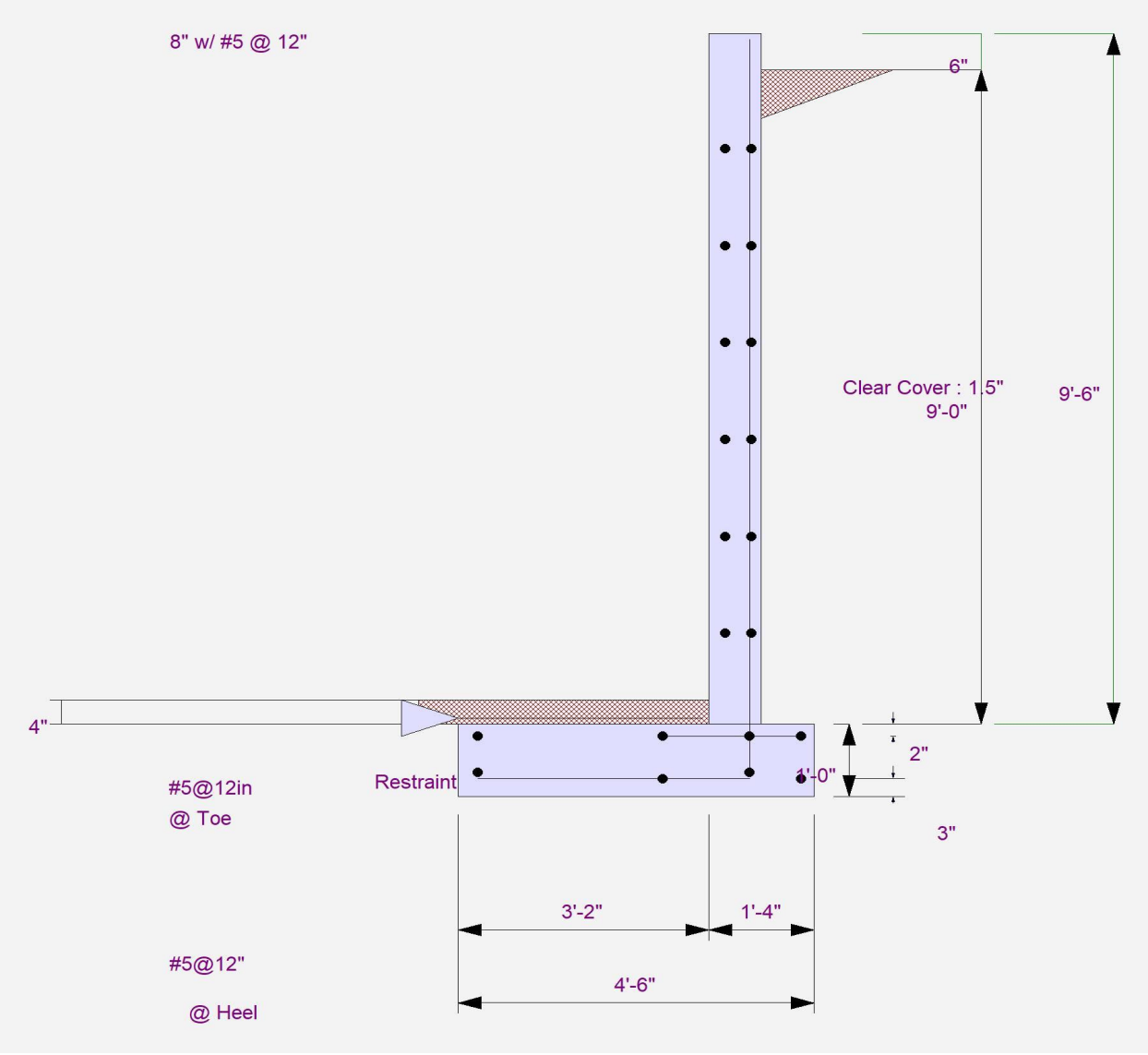
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #5 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.3100 in2/ft
As Required =	0.3220 in2/ft

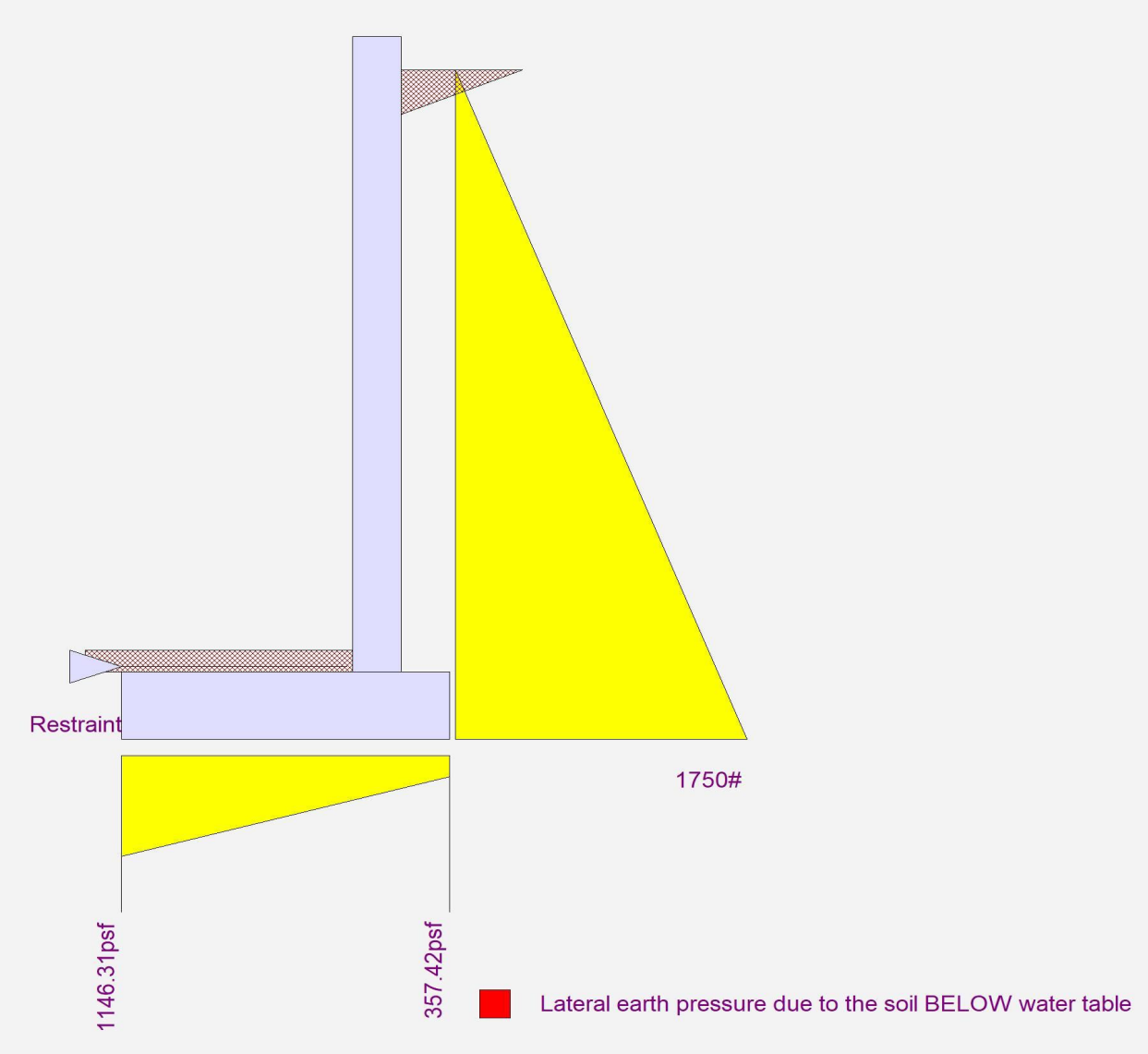
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=10' w/ Slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab

Code References

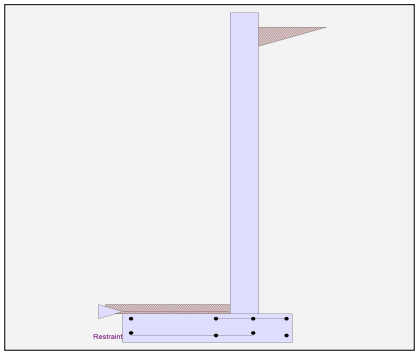
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.400

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.28	OK
Slab Resists All Sliding !			
Global Stability	=	1.30	

Total Bearing Load	=	4,506 lbs	
...resultant ecc.	=	3.49 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,216 psf	OK
Soil Pressure @ Heel	=	587 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,301 psf	
ACI Factored @ Heel	=	628 psf	
Footing Shear @ Toe	=	22.7 psi	OK
Footing Shear @ Heel	=	21.6 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,117.5 lbs	

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	10.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.662**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	1,750.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	5,833.3
Moment.....Allowable	=	8,810.7
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	17.8
Shear.....Allowable	psi =	46.8
Anet (Masonry)	in2 =	
Wall Weight	psf =	125.0
Rebar Depth 'd'	in =	8.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2471 in2/ft		
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2471 in2/ft	#4@ 11.11 in	#4@ 22.22 in
Provided Area :	0.372 in2/ft	#5@ 17.22 in	#5@ 34.44 in
Maximum Area :	1.6637 in2/ft	#6@ 24.44 in	#6@ 48.89 in

Footing Data

Toe Width	=	3.17 ft
Heel Width	=	1.83
Total Footing Width	=	5.00
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,301	628	psf
Mu' : Upward	=	5,808	0	ft-#
Mu' : Downward	=	961	1,761	ft-#
Mu: Design	=	4,847	1,761	ft-#
φ Mn	=	9,370	10,486	ft-#
Actual 1-Way Shear	=	22.74	21.59	psi
Allow 1-Way Shear	=	45.84	44.21	psi

Toe Reinforcing = # 5 @ 10.00 in
Heel Reinforcing = # 5 @ 10.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 9.11 in, #5@ 14.12 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.30 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,117.5	3.67	7,764.2			
HL Act Pres (be water tbl)						
Hydrostatic Force						
Buoyant Force =						
Surcharge over Heel =						
Surcharge Over Toe =						
Adjacent Footing Load =						
Added Lateral Load =						
Load @ Stem Above Soil =						
=						
				Soil Over HL (ab. water tbl)	1,249.6	4.50	5,622.1
				Soil Over HL (bel. water tbl)		4.50	5,622.1
				Water Table			
				Sloped Soil Over Heel =			
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =			
				* Axial Live Load on Stem =			
				Soil Over Toe =	131.9	1.58	208.8
				Surcharge Over Toe =			
				Stem Weight(s) =	1,312.5	3.58	4,702.3
				Earth @ Stem Transitions =			
				Footing Weight =	749.9	2.50	1,874.3
				Key Weight =			
				Vert. Component =	1,062.2	5.00	5,309.8
Total =	2,117.5	**O.T.M.** =	7,764.2	**Total =**	4,506.0 lbs	**R.M.=**	17,717.2

Resisting/Overturning Ratio = **2.28**

Vertical Loads used for Soil Pressure = 4,506.0 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.071	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab

Rebar Lap & Embedment Lengths Information

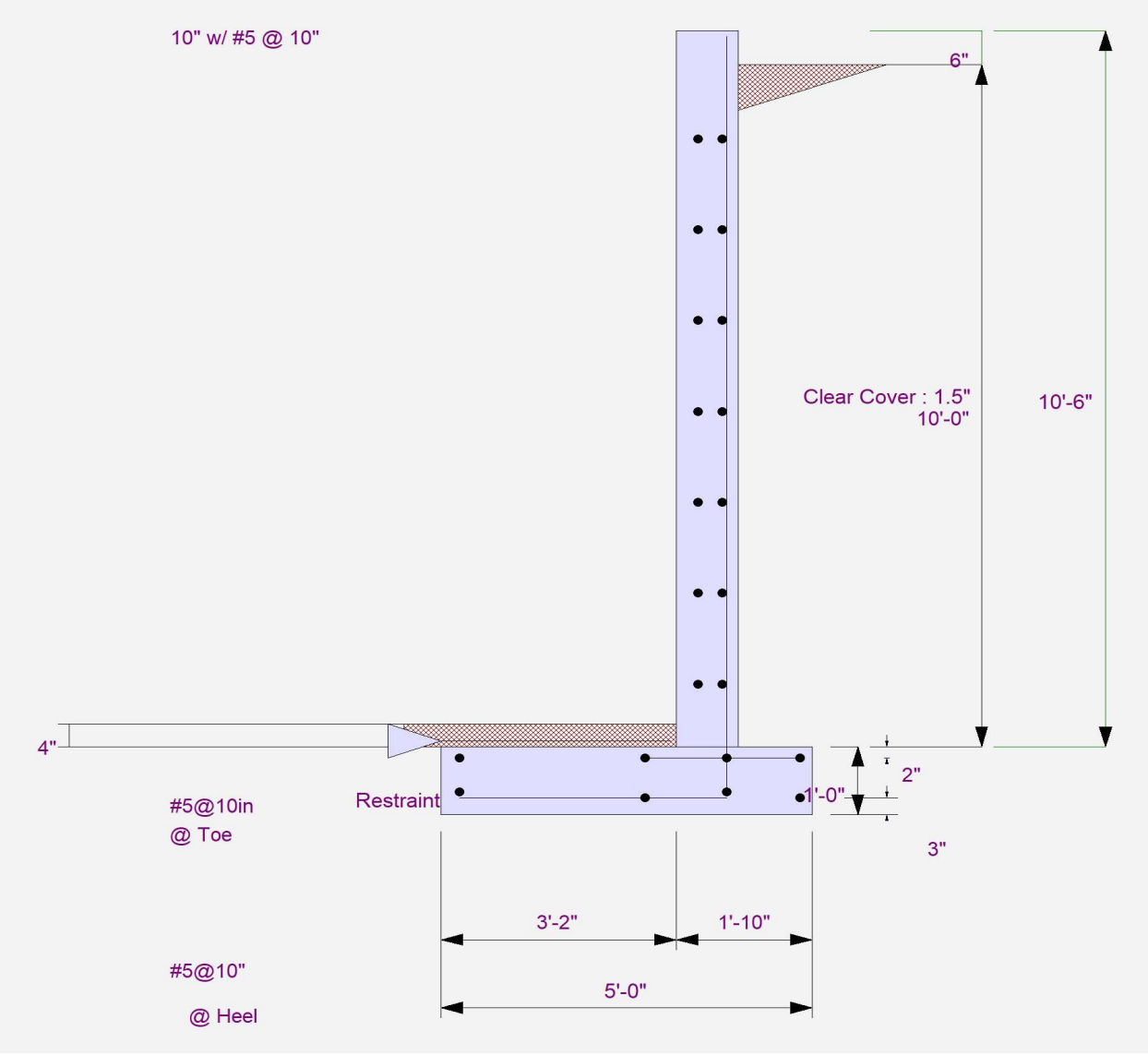
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #5 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.3720 in2/ft
As Required =	0.3295 in2/ft

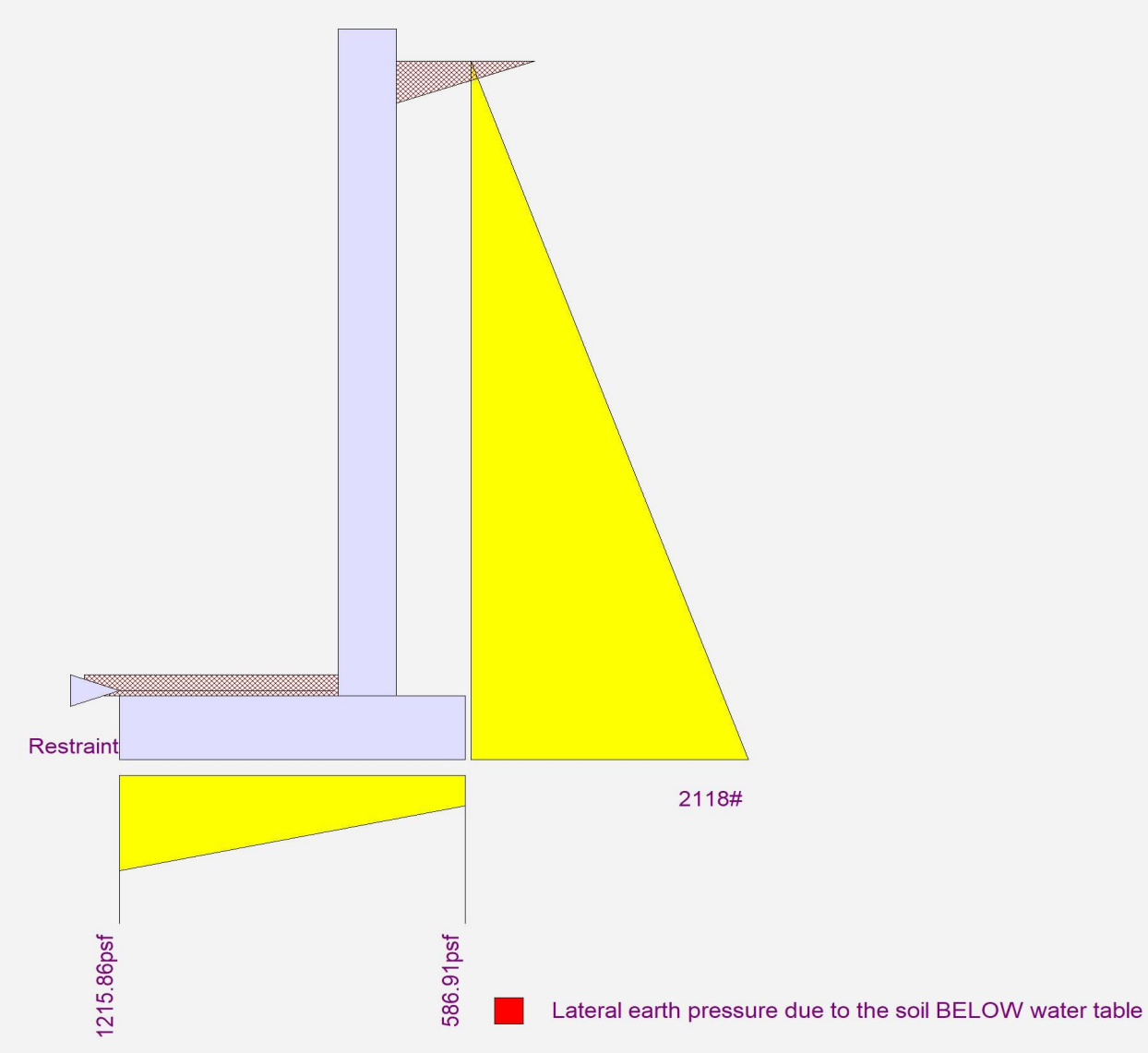
Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab



Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=11' w/ Slab



Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab

Code References

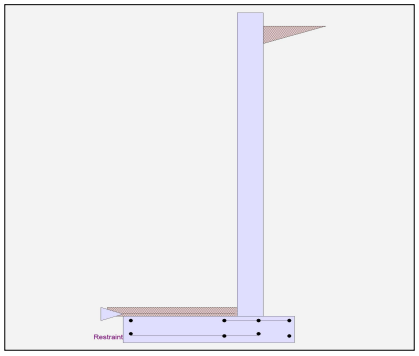
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	11.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
NOT Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.400

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab

Design Summary

Wall Stability Ratios

Overturning	=	2.20	OK
Slab Resists All Sliding !			
Global Stability	=	1.20	

Total Bearing Load	=	5,053	lbs
...resultant ecc.	=	4.15	in
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,267	psf OK
Soil Pressure @ Heel	=	572	psf OK
Allowable	=	1,500	psf
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,330	psf
ACI Factored @ Heel	=	601	psf
Footing Shear @ Toe	=	27.3	psi OK
Footing Shear @ Heel	=	24.5	psi OK
Allowable	=	75.0	psi

Sliding Calcs

Lateral Sliding Force	=	2,520.0	lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	10.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.881**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	2,117.5
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	7,764.2
Moment.....Allowable	=	8,810.7
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	21.6
Shear.....Allowable	psi =	46.8
Anet (Masonry)	in2 =	
Wall Weight	psf =	125.0
Rebar Depth 'd'	in =	8.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3289 in2/ft		
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3289 in2/ft	#4@ 11.11 in	#4@ 22.22 in
Provided Area :	0.372 in2/ft	#5@ 17.22 in	#5@ 34.44 in
Maximum Area :	1.6637 in2/ft	#6@ 24.44 in	#6@ 48.89 in

Footing Data

Toe Width	=	3.66 ft
Heel Width	=	1.83
Total Footing Width	=	5.49
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,330	601	psf
Mu' : Upward	=	7,825	0	ft-#
Mu' : Downward	=	1,284	2,026	ft-#
Mu: Design	=	6,542	2,026	ft-#
φ Mn	=	9,370	10,486	ft-#
Actual 1-Way Shear	=	27.28	24.46	psi
Allow 1-Way Shear	=	45.84	44.21	psi

Toe Reinforcing = # 5 @ 10.00 in
Heel Reinforcing = # 5 @ 10.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 6.75 in, #5@ 10.46 in, #6@ 14.85 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.42 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,520.0	4.00	10,080.0			
HL Act Pres (be water tbl)				Soil Over HL (ab. water tbl)	1,374.5	4.99	6,863.3
Hydrostatic Force				Soil Over HL (bel. water tbl)		4.99	6,863.3
Buoyant Force				Water Table			
Surcharge over Heel				Sloped Soil Over Heel			
Surcharge Over Toe				Surcharge Over Heel			
Adjacent Footing Load				Adjacent Footing Load			
Added Lateral Load				Axial Dead Load on Stem			
Load @ Stem Above Soil				* Axial Live Load on Stem			
				Soil Over Toe	152.5	1.83	279.1
				Surcharge Over Toe			
				Stem Weight(s)	1,437.5	4.08	5,860.2
				Earth @ Stem Transitions			
				Footing Weight	824.0	2.75	2,263.0
				Key Weight			
				Vert. Component	1,264.1	5.49	6,943.5
Total	2,520.0	**O.T.M.**	10,080.0	**Total**	5,052.6 lbs	**R.M.=**	22,209.1

Resisting/Overturning Ratio = **2.20**

Vertical Loads used for Soil Pressure = 5,052.6 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.074	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab

Rebar Lap & Embedment Lengths Information

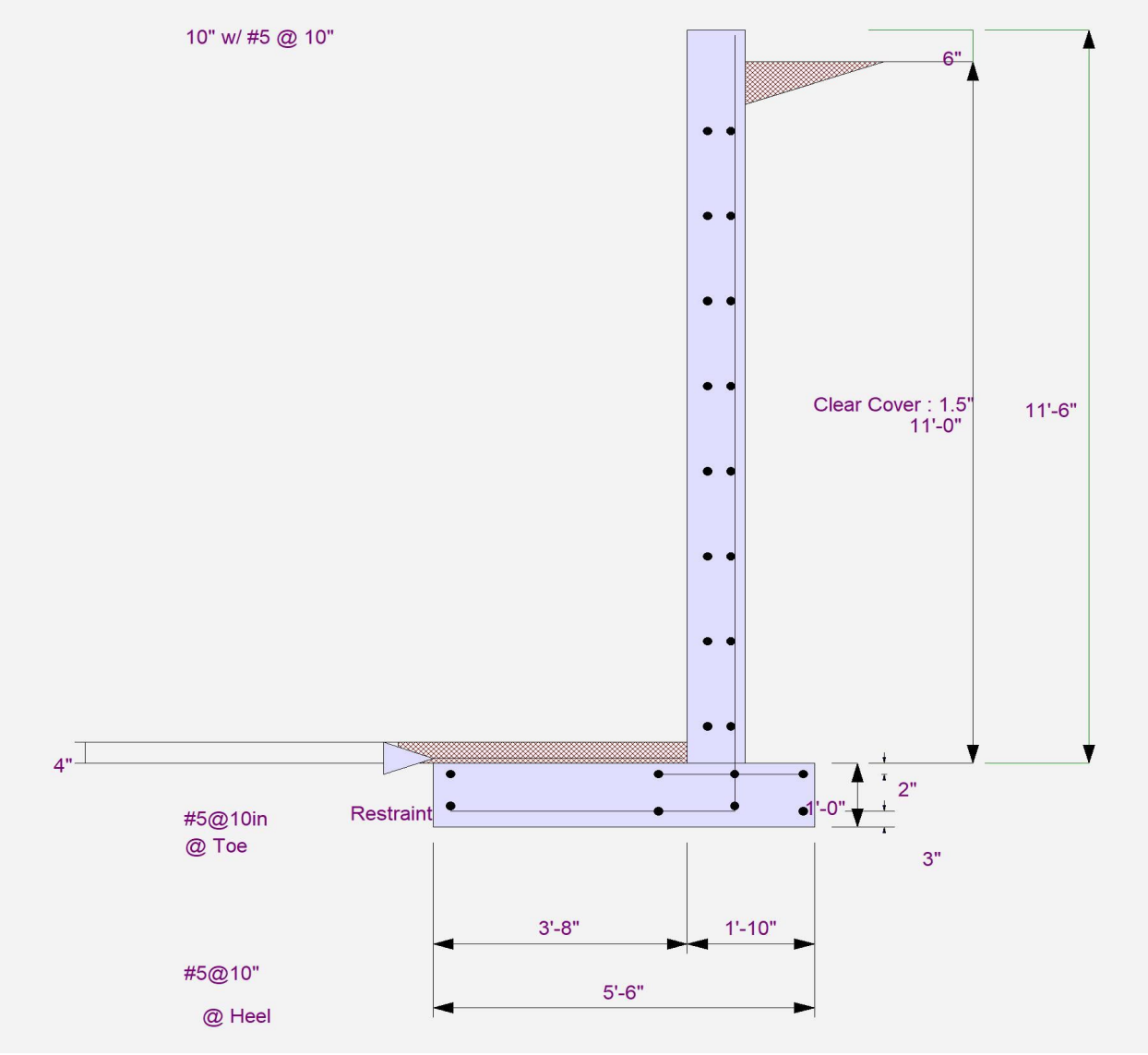
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #5 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.3720 in2/ft
As Required =	0.4385 in2/ft

Cantilevered Retaining Wall

DESCRIPTION: L Shaped Ret wall H=12' w/ Slab



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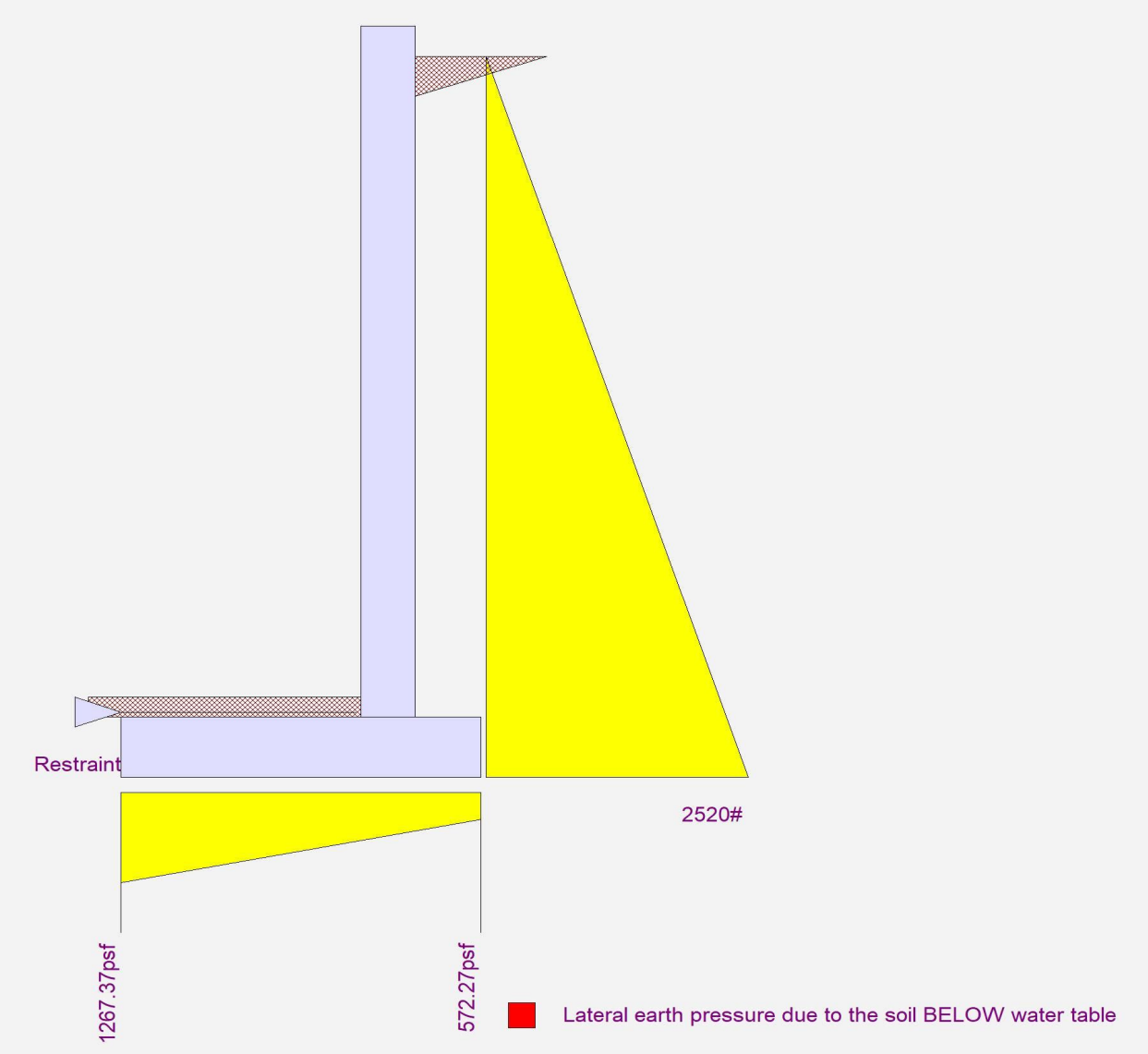


Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=13' w/ slab

Code References

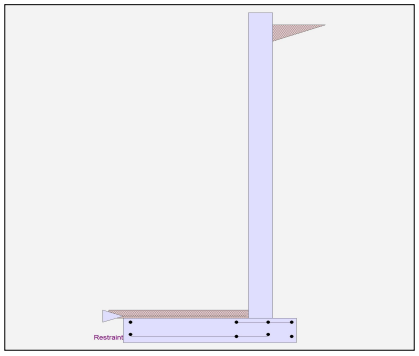
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	12.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	125.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	0.0 lbs
Axial Live Load	=	0.0 lbs
Axial Load Eccentricity	=	0.0 in

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
...Height to Top	=	0.00 ft
...Height to Bottom	=	0.00 ft
Load Type	=	Wind (W) (Service Level)
Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.400

Cantilevered Retaining Wall

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DESCRIPTION: L Shaped Ret wall H=13' w/ slab

Design Summary

Wall Stability Ratios

Overturning	=	2.05	OK
Slab Resists All Sliding !			
Global Stability	=	1.05	

Total Bearing Load	=	5,365 lbs	
...resultant ecc.	=	5.78 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,328 psf	OK
Soil Pressure @ Heel	=	464 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,345 psf	
ACI Factored @ Heel	=	469 psf	
Footing Shear @ Toe	=	31.5 psi	OK
Footing Shear @ Heel	=	25.0 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	2,957.5 lbs

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.000
Live Load	1.000
Earth, H	1.000
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	SD
Thickness	=	10.00
Rebar Size	=	# 5
Rebar Spacing	=	6.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.703**
Total Force @ Section		
Service Level	lbs =	
Strength Level	lbs =	2,520.0
Moment....Actual		
Service Level	ft-# =	
Strength Level	ft-# =	10,080.0
Moment.....Allowable	=	14,321.6
Shear.....Actual		
Service Level	psi =	
Strength Level	psi =	25.6
Shear.....Allowable	psi =	55.4
Anet (Masonry)	in2 =	
Wall Weight	psf =	125.0
Rebar Depth 'd'	in =	8.19

Masonry Data

f'm	psi =	
Fs	psi =	
Solid Grouting	=	
Modular Ratio 'n'	=	
Equiv. Solid Thick.	=	
Masonry Block Type	=	Normal Weight
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	40,000.0

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Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.427 in2/ft		
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.427 in2/ft	#4@ 11.11 in	#4@ 22.22 in
Provided Area :	0.62 in2/ft	#5@ 17.22 in	#5@ 34.44 in
Maximum Area :	1.6637 in2/ft	#6@ 24.44 in	#6@ 48.89 in

Footing Data

Toe Width	=	4.33 ft
Heel Width	=	1.66
Total Footing Width	=	5.99
Footing Thickness	=	12.00 in

f'c = 2,500 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,345	469	psf
Mu' : Upward	=	10,630	0	ft-#
Mu' : Downward	=	1,797	1,790	ft-#
Mu: Design	=	8,833	1,790	ft-#
φ Mn	=	15,254	17,114	ft-#
Actual 1-Way Shear	=	31.55	24.98	psi
Allow 1-Way Shear	=	54.35	52.41	psi

Toe Reinforcing = # 5 @ 6.00 in
Heel Reinforcing = # 5 @ 6.00 in
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

If torsion exceeds allowable, provide supplemental design for footing torsion.

Other Acceptable Sizes & Spacings

Toe: #4@ 5 in, #5@ 7.75 in, #6@ 11 in, #7@ 15 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Key: No key defined

Min footing T&S reinf Area 1.55 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 9.26 in	#4@ 18.52 in
#5@ 14.35 in	#5@ 28.70 in
#6@ 20.37 in	#6@ 40.74 in

Kirkland, WA 98034

Project Title:
Engineer:
Project ID:
Project Descr:

Printed: 4 AUG 2025, 12:28PM

Cantilevered Retaining Wall

Project File: L-Shaped Retaining Wall 1500 psf.ec6

DESCRIPTION: L Shaped Ret wall H=13' w/ slab

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,957.5	4.33	12,815.8			
HL Act Pres (be water tbl)				Soil Over HL (ab. water tbl)	1,240.0	5.58	6,915.1
Hydrostatic Force				Soil Over HL (bel. water tbl)		5.58	6,915.1
Buoyant Force				Water Table			
Surcharge over Heel				Sloped Soil Over Heel			
Surcharge Over Toe				Surcharge Over Heel			
Adjacent Footing Load				Adjacent Footing Load			
Added Lateral Load				Axial Dead Load on Stem			
Load @ Stem Above Soil				* Axial Live Load on Stem			
				Soil Over Toe	180.4	2.17	390.6
				Surcharge Over Toe			
				Stem Weight(s)	1,562.5	4.75	7,416.7
				Earth @ Stem Transitions			
				Footing Weight	898.5	3.00	2,691.0
				Key Weight			
				Vert. Component	1,483.5	5.99	8,886.3
Total	2,957.5	**O.T.M.**	12,815.8	**Total**	5,364.9 lbs	**R.M.=**	26,299.6

Resisting/Overturning Ratio = **2.05**

Vertical Loads used for Soil Pressure = 5,364.9 lbs

* Axial live load NOT included in total displayed, or used for overturning resistance, but is included for soil pressure calculation.

Vertical component of active lateral soil pressure IS considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS considered in the calculation of Overturning Resistance.

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus	250.0	pci
Horizontal Defl @ Top of Wall (approximate only)	0.077	in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe, because the wall would then tend to rotate into the retained soil.

Cantilevered Retaining Wall

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Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	15.60 in
Development length for #5 bar specified in this stem design segment =	12.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	6.00 in
As Provided =	0.6200 in2/ft
As Required =	0.4913 in2/ft

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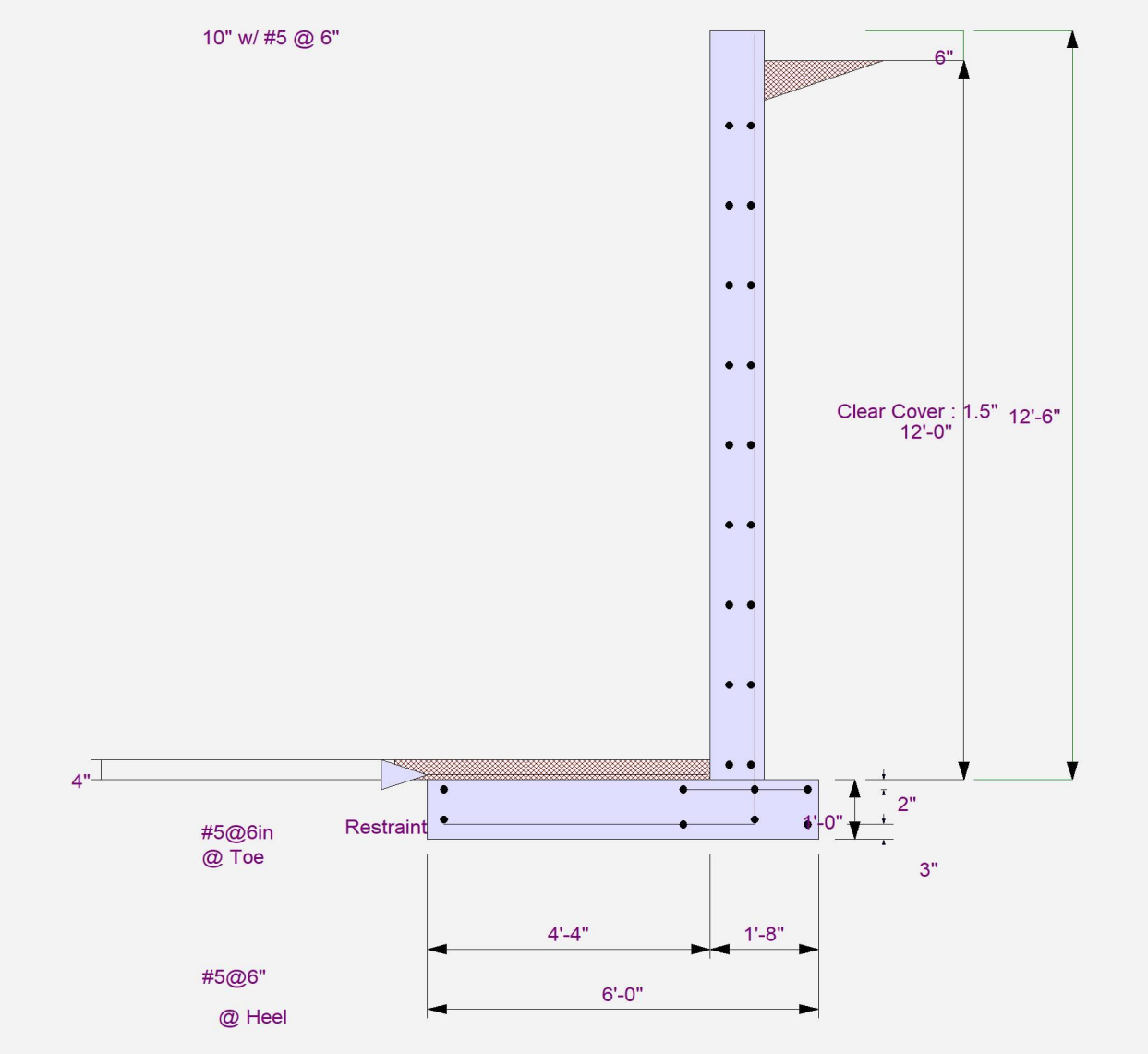

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