civil engineering
structural design
land surveying

STRUCTURAL CALCULATIONS

FIRE REBUILD

STAMPER
15303 EARLHAM STREET
PACIFIC PALISADES, CA 90272
Job No: 26-501

May 26, 2026

27315 Valley Center Road – Valley Center, CA 92082 – (760) 749-8722 – Fax (760) 749-9412
Email: wynneng@wynnengineering.com – Los Angeles (310) 306-9728 – Fax (310) 306-2129

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SCALE: _____

STRUCTURAL DESIGN SPECIFICATIONS

BUILDING CODE - 2025 California Building Code & ASCE 7-22

WOOD FRAMING - Design per 2024 NDS Specification for Wood Construction & Supplement

Douglas Fir-Larch graded per WCLIB or WWPA grading rules as follows:

Member Type	*Grade*	*Fb (psi)*	*Member Type*	*Grade*	*Fb (psi)*
Joists	No 2	900	Studs	STUD	700
Beams (2x - 4x)	No 1	1000	Posts (4x)	No 1	1000
Beams(6x or larger	B&S No 1	1350	Posts (6x or larger)	P&T No 1	1200

STEEL - Design per AISC Specification 360-22

Hot rolled steel complying with ASTM specifications as follows:

Section	*Grade*	*Fy/Fu (ksi)*	*Section*	*Grade*	*Fy/Fu (ksi)*
W - Wide Flange	A992	50 / 65	Standard Pipe	A53 Gr B	35 / 60
HSS - Tube	A500 Gr C	50 / 62	Plates & Misc	A36	36 / 58

WELDING - E70XX Electrodes with Fy = 70ksi unless noted otherwise in calculations

CONCRETE - Design per CBC Chapter 19 and ACI 318-19 Specification for reinforced concrete

Concrete fc = 2500psi at 28 days unless noted otherwise in calculations. Type II Cement

CONCRETE MASONRY - Design per CBC Chapter 21 and TMS 602-22 Specification for Reinforced Masonry

Medium weight solid grouted CMU with fm = 2000psi unless noted otherwise in calculations

Mortar - Type M or S

Grout fg ≥ 2000psi

STEEL REINFORCING - Bars complying with ASTM A615 (A706 for Welded Bars) as follows:

Bar Size	*Grade*	*Fy (ksi)*	*Bar Size*	*Grade*	*Fy (ksi)*
#3, #4	A615 Gr 40	40	#5 and larger	A615 Gr 60	60

STRUCTURAL COMPOSITE LUMBER - Manufactured by Trus Joist per ICC-ER ESR-1387.

Member Type	*Grade*	*Fb (psi)*	*Member Type*	*Grade*	*Fb (psi)*
Parallam (PSL)	DF - 2.0E	2900	Timberstrand (LSL)	DF - 1.7E	2600
Microlam (LVL)	DF - 1.9E	2600			

GLUE LAMINATED LUMBER - Douglas Fir-Larch Combination 24F-V4 unless noted otherwise in calculations

MANUFACTURED WOOD I JOISTS - TJI Pro series by Trus Joist per ICC-ES ESR 1153

RETROFIT EPOXY - Hilti RE-500 V3 designed per ICC ER-3814 or Simpson SET-3G designed per ICC ESR-4057

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GRAVITY STRUCTURAL LOADS

ROOF LOADS	Load (psf)
Dead Loads	**32.0**
Concrete Tile Roofing	10.0
2x T&G	4.5
Framing	4.0
Insulation	0.5
Drywall	2.5
Mechanical	1.0
Solar/Misc.	4.5
USG Panels	5.0
Live Load	**20.0**
Total Load	**52.0**

FLOOR LOADS	Load (psf)
Dead Loads	**17.5**
Finish Flooring	3.0
USG Panels	5.0
Framing	4.0
Insulation	0.5
Drywall	2.5
Mechanical	1.0
Misc	1.5
Live Load - General Residential	**40.0**
Total Load	**57.5**

ROOF DECK LOADS	Load (psf)
Dead Loads	**24.5**
Finish Flooring	10.0
USG Panels	5.0
Framing	4.0
Insulation	0.5
Drywall	2.5
Mechanical	1.0
Misc	1.5
Live Load	**100.0**
Total Load	**124.5**

BALCONY LOADS	Load (psf)
Dead Loads	**30.5**
Finish Flooring	10.0
USG Panels	5.0
Framing	4.0
Stucco	10.0
Misc	1.5
Live Load	**60.0**
Total Load	**90.5**

WALL LOADS	Load (psf)
Dead Loads	
Exterior Walls - 10" HI-R-H	**73.0**
8" CMU	**75.0**
Interior Walls	**10.0**
Lateral Live Load - Code Minimum	**5.0**

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SEISMIC STRUCTURAL LOADS

Structure Height	h_n	23.0ft
Risk Category		II
Site Class		Default
Response Modification Factor	R	5
Importance Factor	I	1.00
Structure Period	Ct	0.020
	x	0.75
	T_a	0.210s
	TL	8.000s

Mapped 0.2s Acceleration	S_S	1.95
Mapped 1.0s Acceleration	S_1	0.70
Design 0.2s Acceleration	S_{DS}	1.56
Design 1.0s Acceleration	S_{D1}	0.79
Redundancy Factor	ρ	1.00
Seismic Design Category		**D**

EQUIVALENT LATERAL FORCE PROCEDURE

$$C_s = \frac{\rho S_{DS}}{(R/I)} \quad \text{(Eq 12.8−3)} \quad = 0.31$$

$$C_S \le \frac{\rho S_{D1}}{T(R/I)} \quad \text{(Eq 12.8−4)} \quad = 0.75$$

when TL > Ta

$$C_S \ge \frac{0.5\rho S_1}{(R/I)} \text{ when } S_1 \ge 0.60 \quad \text{(Eq 12.8-6)} \quad = 0.07$$

$$C_S = 0.044 S_{DS} I \ge 0.01 \quad \text{(Eq 12.8−7)} \quad = 0.07$$

Governing Seismic Response Coefficient C_S ***= 0.31***

VERTICAL DISTRIBUTION

	Level	Height h_x ft	Area a_x ft²	Weight[1] Diaph w_d psf	Wall w_w psf	Story w_x kip	Moment[2] h_x x w_x ft-kip	%	Fx[3] Cs x Σw_x x % kip	psf
A	3rd floor Roof	33	290	32	50	23.8	785	13%	**13.8**	**47.7**
B	deck/high roof	23	2140	24.5	40	138.0	3175	51%	**55.9**	**26.1**
C	Floor/low roof	12	2550	17.5	52	177.2	2127	34%	**37.5**	**14.7**
D	Balconies	12	430	30.5		13.1	157	3%	**2.8**	**6.4**
E										
F										
	* These are Ultimate Loads, Multiply by 0.7 for ASD					*352.2*	*6244*	*100%*	***110.0***	

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SEISMIC STRUCTURAL LOADS - DETACHED GARAGE

Structure Height	h_n	15.0ft
Risk Category		II
Site Class		Default
Response Modification Factor	R	5
Importance Factor	I	1.00
Structure Period	Ct	0.020
	x	0.75
	T_a	0.152s
	TL	8.000s

Mapped 0.2s Acceleration	S_S	1.95
Mapped 1.0s Acceleration	S_1	0.70
Design 0.2s Acceleration	S_{DS}	1.56
Design 1.0s Acceleration	S_{D1}	0.79
Redundancy Factor	ρ	1.00
Seismic Design Category		**D**

EQUIVALENT LATERAL FORCE PROCEDURE

$$C_s = \frac{\rho S_{DS}}{(R/I)} \quad \text{(Eq 12.8−3)} \quad = 0.31$$

$$C_S \le \frac{\rho S_{D1}}{T(R/I)} \quad \text{(Eq 12.8−4)} \quad = 1.04$$

when TL > Ta

$$C_S \ge \frac{0.5\rho S_1}{(R/I)} \text{ when } S_1 \ge 0.60 \quad \text{(Eq 12.8-6)} \quad = 0.07$$

$$C_S = 0.044 S_{DS} I \ge 0.01 \quad \text{(Eq 12.8−7)} \quad = 0.07$$

Governing Seismic Response Coefficient C_S ***= 0.31***

VERTICAL DISTRIBUTION

	Level	Height h_x ft	Area a_x ft²	Weight[1] Diaph w_d psf	Wall w_w psf	Story w_x kip	Moment[2] $h_x \times w_x$ ft-kip	%	Fx[3] Cs x Σw_x x % kip	psf
A	Garage Roof	15	530	32	50	43.5	652	100%	**13.6**	**25.6**
B										
C										
D										
E										
F										
						43.5	*652*	*100%*	***13.6***	

* These are Ultimate Loads, Multiply by 0.7 for ASD

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WIND STRUCTURAL LOADS

Mean Roof Height	h	25.0ft
Basic Wind Speed	V	100 mph
Wind directionality Factor	Kd	0.85
Ground Elevation Factor	Ke	1.00
Enclosure Classification		E

E= Enclosed PC= Partly Enclosed O=Open

Risk Category		II
Exposure		C
Topographic Factor	K_{zt}	1.00
Gust Effect Factor	G	0.85
Internal Pressure Coefficient	GCPi	-0.18
Roof Angle	ϕ	20deg

Velocity Pressure Exposure Coefficient	Kz	0.85
Velocity Pressure	qz	**21.76**

qz = .00256 Kz Kzt Ke V^2

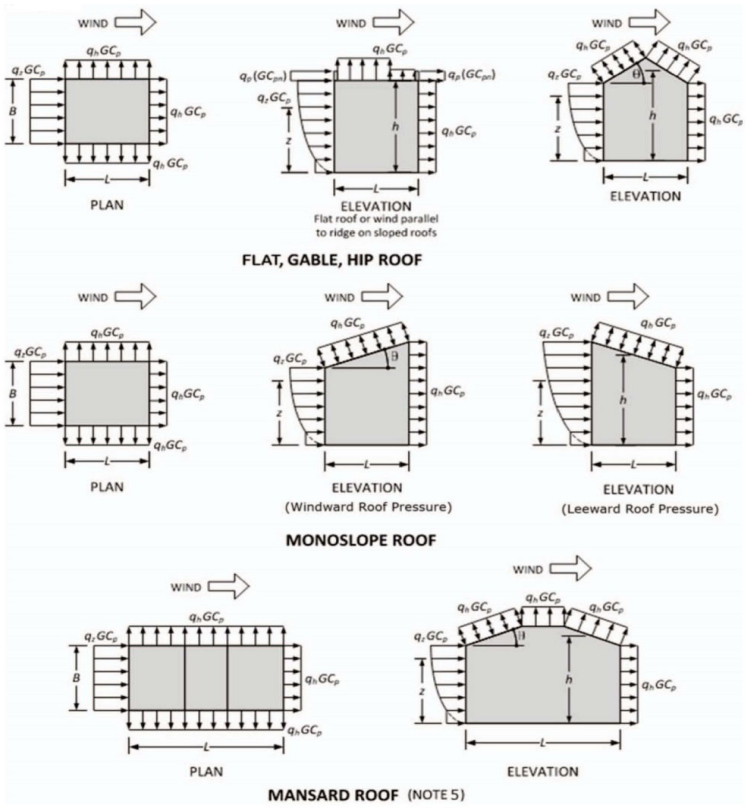
Design Wind Pressure p ASCE 7-22 27.3-1

These are ultimate Loads. For ASD Multiply by 0.6

	Cp	p (psf)
Windward Wall	0.8	15.91
Leeward Wall	-0.5	-4.53
Side Wall	-0.7	-7.68
Roof Windward	-0.3	-1.39
Roof Leeward	-0.6	-6.10
Windward + Lee	0.8	**20.44**

ASCE 7-22 Sections

V see Figures 26.5-1B for Risk Category II
Kd Table 26.6-1
Kzt 26.8
Ke 26.9
G 26.11.1 *Assumed Rigid OK for h<60 ft*
Enclosure Classification 26.12
GCPi Table 26.13-1
Kz Table 26.10-1
Cp Figure 27.3-1



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SOILS PARAMETERS & LOADING

Parameters Based on Soils Report By:

Soils Engineer	SASSAN Geosciences, inc.
Report No	*8/1/2025*
Dated	8-15-25

General Soils Parameters:

Allowable Net Soil Pressure at Minimum Depth	2000 psf
Plus an increase per depth or width of	200 psf/ft
To a maximum allowable of	2000 psf
Minimum Footing Depth	24 in
Minimum Footing Width	24 in
Coefficient of Friction	0.25
Passive Pressure - EFP	300 pcf
Maximum allowable of	3000 psf

Retaining Wall Soils Parameters:

Allowable Net Soil Pressure at Minimum Depth	2000 psf
Plus an increase per depth or width of	300 psf/ft
To a maximum allowable of	3000 psf
Minimum Footing Depth	24 in
Coefficient of Friction	0.25
Passive Pressure - EFP	300 pcf
Maximum allowable of	-
At Rest Pressure - EFP	-
Active Pressure - Level Slope - EFP	35 pcf
Active Pressure - 2:1 Slope - EFP	-

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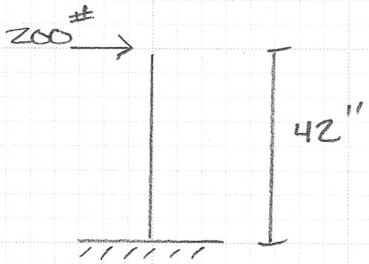
TYPICAL GUARD RAIL

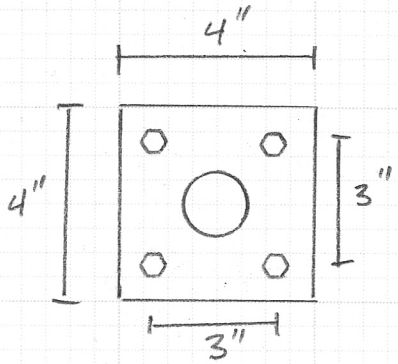


$M = 200(42) = 8400 \#IN$

$Z_{REQD} = \frac{8400(1.67)}{35000} = 0.40\ in^3$

- USE 2"Ø STD PIPE @ 48" OC

($Z = 0.713\ in^3$)



$T/LAG = 8400 / (3 \times 2) = 1400\#$ (2 BOLTS)

$T_{ALLOW} = (305)(5) = 1525\#$

3/8" WITHDRAWAL, 5" EMBED

- USE 3/8" LAG W/ 5" EMBED.

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Square Pad Footing Schedule

Foundation Parameters

Allowable Soil Pressure	pa	2000	psf
Concrete Strength	fc	2500	psi
Reinforcing Strength	fy	40000	psi
Concrete Shear Capacity	vc	100	psi
Minimum Column Diameter	Dc	3.5	in

Mark	Length		Depth [2]		Reinforcing					Capacity				
	L		D	d	Count	Size	As	Rho >	Rho (min) [3]	Pu	Bearing [4]	One Way [5]	Two Way [6]	Bending [7]
	ft	*in*	*in*	*in*	*n*	*#*	*sq in*	*%*	*%*	*kip*	*lb*	*lb*	*lb*	*lb*
A	**1.5**	18	**24**	20	**3**	**4**	0.59	0.16%	0.14%	**4.5**	4500	36000	94000	109172
B	**2**	24	**24**	20	**4**	**4**	0.79	0.16%	0.14%	**8.0**	8000	48000	94000	109172
C	**2.5**	30	**24**	20	**5**	**4**	0.98	0.16%	0.14%	**12.5**	12500	60000	94000	109172
D	**3**	36	**24**	20	**6**	**4**	1.18	0.16%	0.14%	**18.0**	18000	72000	94000	109172
E	**3.5**	42	**24**	20	**7**	**4**	1.37	0.16%	0.14%	**24.5**	24500	84000	94000	109172
F	**4**	48	**24**	20	**7**	**4**	1.37	0.14%	0.14%	**32.0**	32000	96000	94000	95712
G	**4.5**	54	**24**	20	**8**	**4**	1.57	0.15%	0.14%	**40.5**	40500	108000	94000	97211
H	**5**	60	**24**	20	**9**	**4**	1.77	0.15%	0.14%	**50.0**	50000	120000	94000	98409
J	**5.5**	66	**24**	20	**10**	**4**	1.96	0.15%	0.14%	**60.5**	60500	132000	94000	99388

(1) Concrete Shear Capacity. 100psi $v_c = 2\sqrt{f_c}$

(2) Depth to Steel. Assume 4in from

(3) Minimum Steel $\rho_{\min} = 0.0014$

(4) Soil Bearing $P_u = p_a L^2$

(5) One Way Shear Capacity $P_u = \frac{1}{1.7}\phi_v v_c \times 2dL$

(6) Two Way Shear Capacity $P_u = \frac{1}{1.7}\phi_v v_c \times 4(D_c + d)d$

(7) Bending Capacity $P_u = \frac{1}{1.7}\phi_b 8\rho d^2 f_y \left(1 - \frac{1}{1.7}\frac{\rho f_y}{f_c}\right)$

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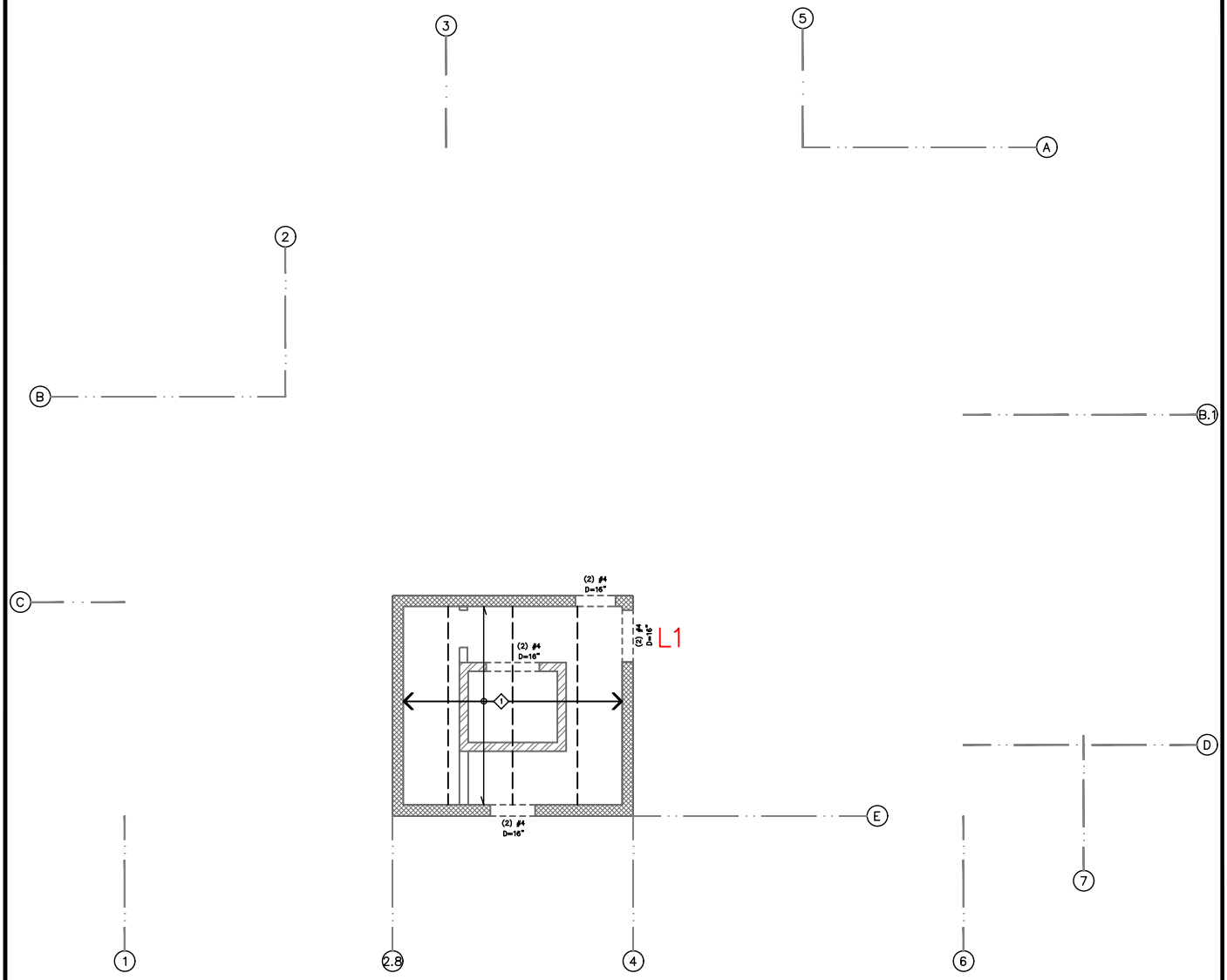
HIGH ROOF KEY PLAN S4.0



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File: F:\2026\26-501 STAMPER\DWG\CURRENT\S4.0 HIGH ROOF.DWG

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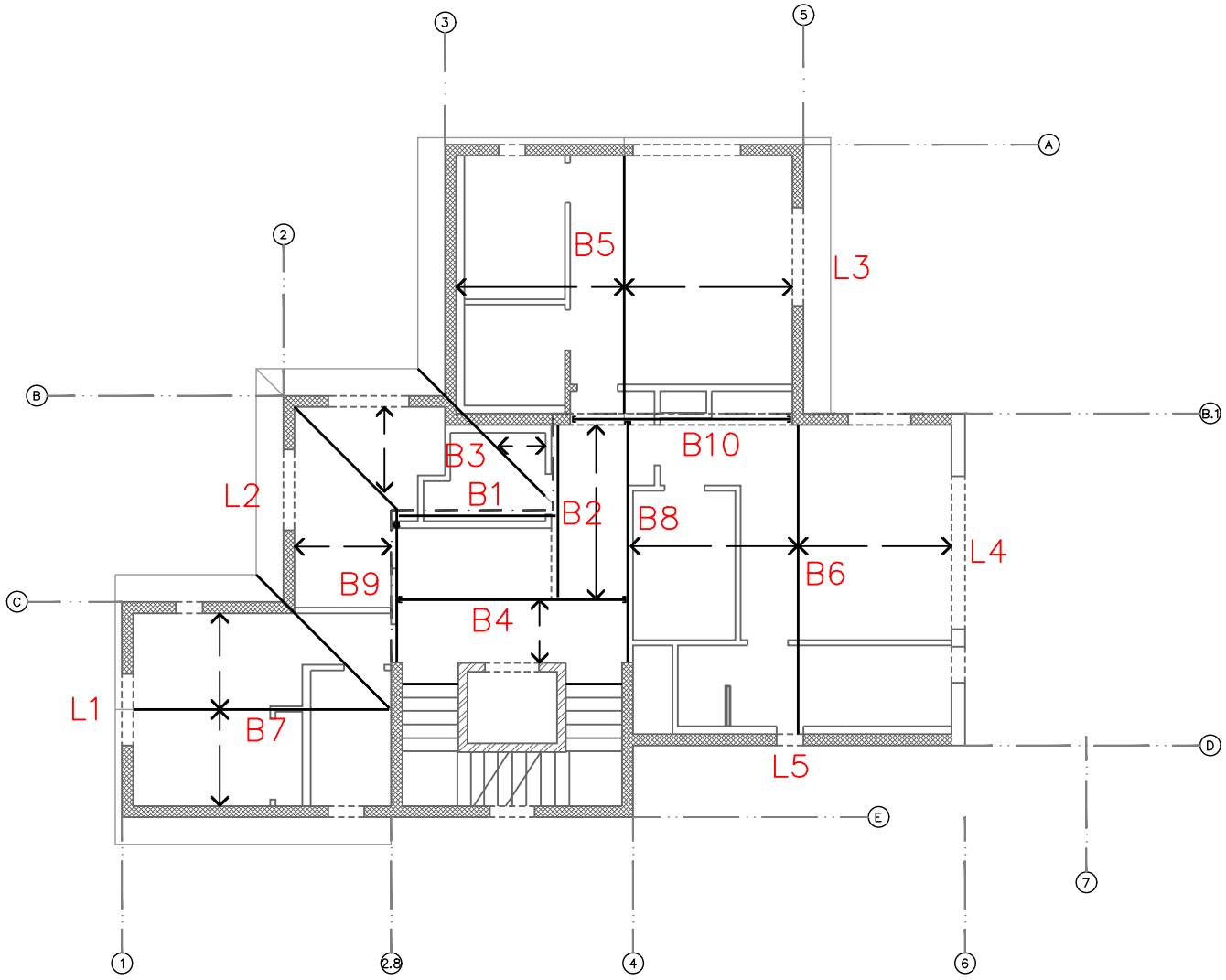
HIGH ROOF / ROOF DECK KEY PLAN



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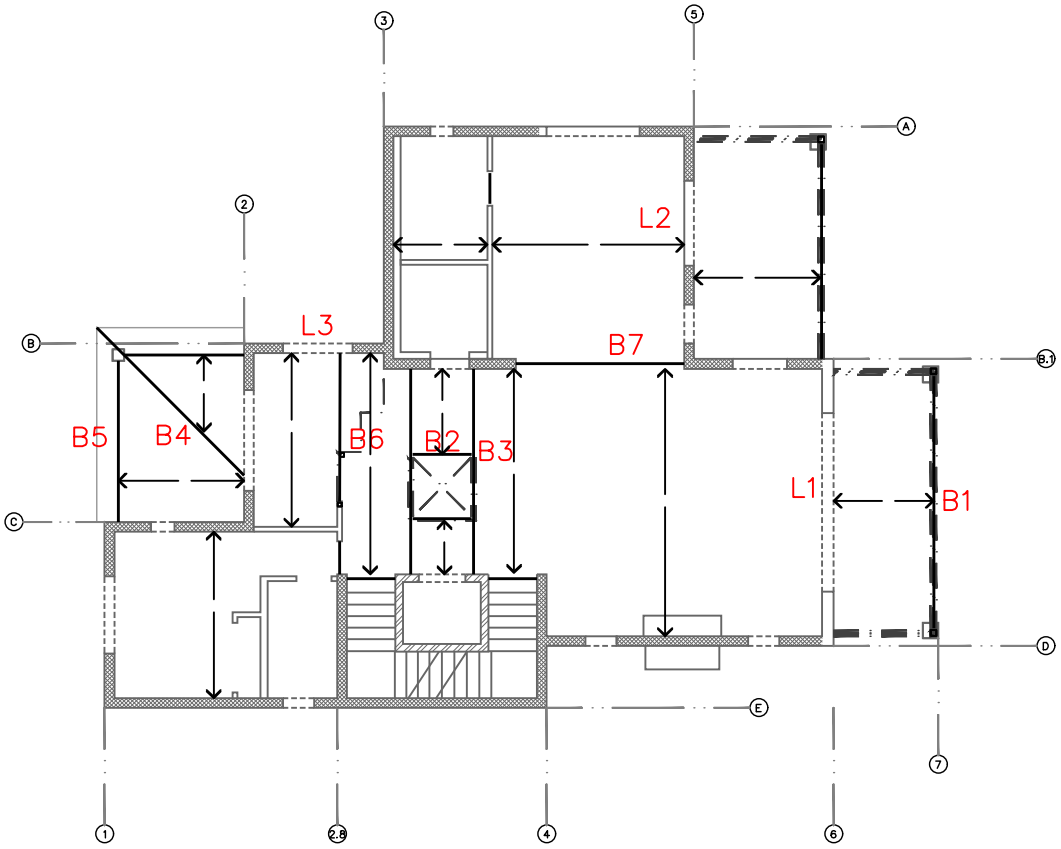
LOW ROOF / FLOOR KEY PLAN



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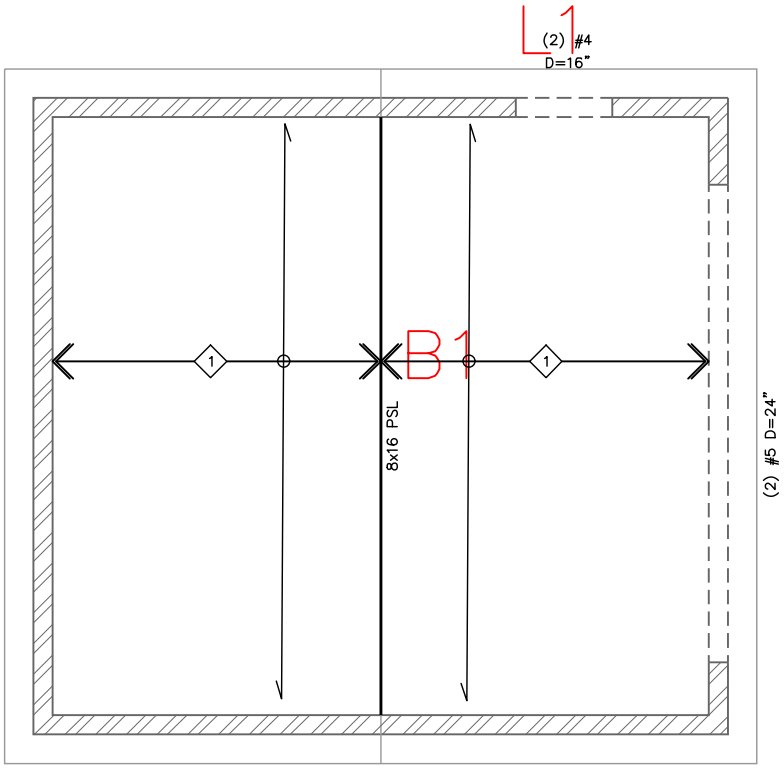
DETACHED GARAGE KEY PLAN



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ROOF & FLOOR JOISTS

☒ ROOF DECK FLOOR JOIST (WORST CASE) SHEET S3.0

L = 15'-0"

D = 24.5psf → 125psf USE SSMA FLOOR JOIST TABLE
L = 100psf FOR D=15 & L=125
Σ 140psf > 125psf

USE 1200S200-97 @16"

☒ HIGH ROOF ROOF JOISTS (SHEET S3.0)

L = 12'-6"

Wd = 30.5psf x 2' = 61#/'

WL = 20psf x 2' = 40#/'

☒ ROOF JOIST (SHEET S2.0)

L = 11'-0"

Wd = 61#/' WL = 40#/'

☒ FLOOR JOIST (SHEET S2.0)

L = 23'

Wd = 17.5 WL = 40 → USE TABLE D+L = 10+50

USE 1200S200-97 @ 16"

☒ BALCONY JOIST (SHEET S2.0)

L = 11'-0" USE 15+125 TABLE

Wd = 30.5psf

WL = 60psf 1000S162-68 @16"

15 psf Lateral Load

Wall Height (ft)	Spacing (in) oc	400S137				400S162				400S200				550S162			
		33 ksi		50 ksi		33 ksi		50 ksi		33 ksi		50 ksi		33 ksi		50 ksi	
		33	43	54	68	33	43	54	68	33	43	54	68	33	43	54	68
8	12	1.24	1.92	3.32	4.60	1.62	2.45	4.22	5.77	1.97	3.10	5.32	7.19	2.08	3.09	5.36	7.19
	16	1.06	1.74	3.14	4.41	1.42	2.25	4.04	5.57	1.76	2.88	5.10	6.97	1.93	2.95	5.22	7.06
	24	0.72	1.38	2.81	4.06	1.05	1.86	3.67	5.18	1.35	2.46	4.68	6.55	1.64	2.68	4.96	6.80
9	12	1.05	1.71	3.05	4.30	1.40	2.20	3.87	5.33	1.73	2.80	4.86	6.63	1.94	2.94	5.20	7.07
	16	0.84	1.49	2.83	4.07	1.17	1.95	3.64	5.08	1.47	2.53	4.59	6.36	1.75	2.77	5.03	6.90
	24	0.44 [4]	1.06	2.43	3.63	0.73 [4]	1.49	3.20	4.61	0.99	2.03	4.09	5.84	1.38	2.42	4.69	6.56
10	12	0.86	1.49	2.74	3.89	1.17	1.93	3.48	4.83	1.47	2.48	4.36	6.01	1.77	2.77	4.97	6.90
	16	0.62 [4]	1.22	2.49	3.62	0.90	1.64	3.21	4.54	1.18	2.17	4.05	5.69	1.54	2.56	4.76	6.69
	24	0.17 [3]	0.74 [3]	2.03 [4]	3.11	0.41 [3]	1.12 [4]	2.70	3.99	0.64 [4]	1.59	3.47	5.09	1.10	2.14	4.34	6.26
12	12	0.48 [3]	1.01 [4]	2.08	2.99	0.72 [4]	1.37	2.65	3.73	0.96 [4]	1.81	3.33	4.69	1.39	2.36	4.40	6.22
	16	0.19 [3]	0.70 [3]	1.78 [4]	2.67	0.41 [3]	1.03 [3]	2.33 [4]	3.38	0.61 [3]	1.44 [4]	2.96	4.31	1.08	2.07	4.10	5.91
	24	-	0.14 [2]	1.25 [3]	2.09 [3]	-	0.43 [3]	1.75 [3]	2.76 [3]	-	0.78 [3]	2.31 [3]	3.62 [4]	0.52 [4]	1.51	3.54	5.32
14	12	0.15 [2]	0.58 [3]	1.46 [3]	2.15 [4]	0.33 [3]	0.86 [3]	1.89 [3]	2.70	0.50 [3]	1.21 [3]	2.39 [4]	3.44	0.97	1.90	3.71	5.36
	16	-	0.25 [2]	1.15 [3]	1.82 [3]	-	0.50 [3]	1.56 [3]	2.35 [3]	0.14 [2]	0.81 [3]	2.01 [3]	3.05 [4]	0.61 [3]	1.53	3.34	4.97
	24	-	-	0.62 [2]	1.24 [2]	-	-	0.98 [2]	1.72 [3]	-	0.13 [2]	1.36 [2]	2.36 [3]	-	0.87 [3]	2.66 [4]	4.24
16	12	-	0.23 [2]	0.97 [2]	1.49 [3]	-	0.44 [2]	1.30 [3]	1.92 [3]	0.14 [2]	0.71 [3]	1.67 [3]	2.48 [3]	0.58 [3]	1.41 [4]	2.98	4.42
	16	-	-	0.67 [2]	1.17 [2]	-	-	0.98 [2]	1.58 [3]	-	0.32 [2]	1.30 [2]	2.10 [3]	0.18 [3]	1.00 [3]	2.57 [4]	3.97
	24	-	-	0.16 [1]	0.62 [1]	-	-	0.42 [1]	0.98 [2]	-	-	0.68 [1]	1.45 [2]	-	0.28 [2]	1.83 [3]	3.18 [3]

15 psf Lateral Load

Wall Height (ft)	Spacing (in) oc	600S137					600S162					600S200				
		33 ksi		50 ksi			33 ksi		50 ksi			33 ksi		50 ksi		
		33	43	54	68	97	33	43	54	68	97	33	43	54	68	97
8	12	1.54	2.28	3.62	4.86	7.38	2.14	3.14	5.37	7.22	11.17	2.57	4.01	7.16	9.69	15.37
	16	1.42	2.17	3.53	4.77	7.30	2.00	3.02	5.25	7.10	11.06	2.43	3.86	7.01	9.55	15.23
	24	1.19	1.95	3.34	4.58	7.14	1.73	2.77	5.02	6.87	10.83	2.15	3.56	6.71	9.27	14.95
9	12	1.44	2.18	3.54	4.78	7.31	2.02	3.03	5.26	7.11	11.06	2.43	3.84	6.92	9.43	15.02
	16	1.29	2.04	3.41	4.66	7.21	1.85	2.87	5.11	6.96	10.91	2.26	3.65	6.73	9.25	14.84
	24	1.01	1.76	3.17	4.42	7.00	1.51	2.56	4.81	6.67	10.62	1.90	3.27	6.35	8.89	14.48
10	12	1.33	2.07	3.44	4.68	7.22	1.89	2.91	5.14	6.98	10.93	2.28	3.65	6.65	9.12	14.60
	16	1.15	1.90	3.28	4.53	7.09	1.67	2.71	4.94	6.79	10.74	2.06	3.41	6.41	8.89	14.37
	24	0.80	1.55	2.98	4.23	6.83	1.26	2.32	4.57	6.42	10.37	1.63	2.96	5.94	8.45	13.91
12	12	1.07	1.81	3.20	4.44	7.00	1.54	2.56	4.76	6.66	10.59	1.91	3.19	5.96	8.33	13.50
	16	0.82	1.56	2.97	4.21	6.80	1.25	2.28	4.48	6.37	10.29	1.60	2.86	5.63	8.00	13.16
	24	0.35 [4]	1.08	2.54	3.78	6.41	0.70	1.75	3.94	5.82	9.73	1.03	2.24	4.98	7.37	12.50
14	12	0.78	1.50	2.89	4.12	6.70	1.15	2.13	4.15	5.95	10.05	1.49	2.65	5.14	7.34	12.10
	16	0.46 [4]	1.17	2.59	3.81	6.42	0.79	1.78	3.79	5.58	9.63	1.11	2.24	4.71	6.92	11.64
	24	-	0.57 [3]	2.02 [4]	3.22	5.87	0.14 [3]	1.12 [4]	3.11	4.87	8.83	0.42 [3]	1.48	3.92	6.13	10.77
16	12	0.46 [3]	1.16	2.53	3.73	6.31	0.75 [4]	1.67	3.45	5.08	8.73	1.05	2.09	4.26	6.25	10.49
	16	-	0.76 [3]	2.15 [4]	3.33	5.92	0.35 [3]	1.26 [4]	3.03	4.64	8.21	0.62 [3]	1.62	3.76	5.75	9.94
	24	-	-	1.47 [3]	2.61 [3]	5.21	-	0.51 [3]	2.28 [3]	3.82 [4]	7.28	-	0.76 [3]	2.88 [4]	4.84	8.92

15 psf Lateral Load

Wall Height (ft)	Spacing (in) oc	800S137				800S162					800S200				
		33 ksi	50 ksi			33 ksi	50 ksi				33 ksi	50 ksi			
		43	54	68	97	43	54	68	97	118	43	54	68	97	118
8	12	2.27	3.44	4.62	7.10	3.17	5.26	7.08	11.09	14.16	4.25	7.53	10.09	15.79	20.28
	16	2.19	3.38	4.56	7.04	3.07	5.18	7.00	11.01	14.09	4.14	7.42	9.99	15.70	20.19
	24	2.03	3.25	4.44	6.93	2.89	5.01	6.83	10.85	13.95	3.93	7.21	9.80	15.51	20.00
9	12	2.20	3.39	4.57	7.05	3.09	5.19	7.01	11.02	14.10	4.16	7.44	10.00	15.71	20.20
	16	2.10	3.31	4.49	6.98	2.97	5.08	6.90	10.92	14.01	4.02	7.30	9.88	15.59	20.08
	24	1.91	3.14	4.34	6.83	2.73	4.87	6.69	10.71	13.83	3.74	7.02	9.63	15.35	19.84
10	12	2.13	3.33	4.51	6.99	3.00	5.11	6.93	10.94	14.03	4.06	7.33	9.90	15.61	20.10
	16	2.01	3.22	4.42	6.90	2.85	4.97	6.80	10.81	13.92	3.88	7.15	9.75	15.46	19.95
	24	1.76	3.02	4.22	6.72	2.56	4.70	6.53	10.55	13.69	3.54	6.81	9.43	15.16	19.65
12	12	1.96	3.18	4.37	6.86	2.79	4.91	6.73	10.74	13.85	3.80	7.06	9.66	15.37	19.85
	16	1.78	3.03	4.23	6.72	2.57	4.71	6.53	10.55	13.68	3.55	6.81	9.42	15.14	19.62
	24	1.43	2.74	3.95	6.45	2.15	4.31	6.14	10.16	13.33	3.05	6.30	8.95	14.68	19.16
14	12	1.75	3.00	4.20	6.69	2.53	4.65	6.48	10.48	13.62	3.45	6.63	9.27	15.04	19.52
	16	1.51	2.80	4.00	6.50	2.24	4.38	6.20	10.20	13.37	3.11	6.28	8.94	14.71	19.18
	24	1.04	2.40	3.61	6.12	1.68	3.84	5.66	9.65	12.88	2.46	5.59	8.29	14.05	18.52
16	12	1.51	2.79	3.99	6.48	2.23	4.35	6.16	10.14	13.31	3.02	6.00	8.55	14.22	18.82
	16	1.20	2.53	3.73	6.22	1.86	3.98	5.80	9.77	12.96	2.59	5.55	8.12	13.78	18.35
	24	0.61	2.02	3.22	5.73	1.15	3.29	5.09	9.03	12.29	1.79	4.71	7.30	12.92	17.45

If no note, deflection meets L/720

[1]Deflection meets L/120 *[2]Deflection meets L/240* *[3]Deflection meets L/360* *[4]Deflection meets L/600*

See Table Notes on page 37.

Interior Wall Limiting Heights - Non-Composite - Fully Braced

Section	Fy (ksi)	L_u (in)	Spacing (in) oc	5 psf			7.5 psf			10 psf		
				L/120	L/240	L/360	L/120	L/240	L/360	L/120	L/240	L/360
400S125-18 [1]	33	28.7	12	14' 9"e	14' 9"e	13' 6"e	12' 1"e	12' 1"e	11' 9"e	10' 5"e	10' 5"e	10' 5"e
			16	12' 10"e	12' 10"e	12' 3"e	10' 5"e	10' 5"e	10' 5"e	9' 1"e	9' 1"e	9' 1"e
			24	10' 5"e	10' 5"e	10' 5"e	8' 6"e	8' 6"e	8' 6"e	7' 5"e	7' 5"e	7' 5"e
400S125-30	33	28.5	12	21' 5"	18' 5"	16' 1"	17' 6"	16' 1"	14' 0"	15' 2"	14' 7"	12' 9"
			16	18' 6"	16' 8"	14' 7"	15' 2"	14' 7"	12' 9"	13' 1"	13' 1"	11' 7"
			24	15' 2"	14' 7"	12' 9"	12' 4"	12' 4"	11' 2"	10' 8"	10' 8"	10' 1"
400S125-33	33	28.4	12	23' 2"	19' 0"	16' 7"	18' 11"	16' 7"	14' 6"	16' 4"	15' 1"	13' 2"
			16	20' 0"	17' 3"	15' 1"	16' 4"	15' 1"	13' 2"	14' 2"	13' 9"	12' 0"
			24	16' 4"	15' 1"	13' 2"	13' 4"	13' 2"	11' 6"	11' 7"	11' 7"	10' 6"
400S125-43	33	28.2	12	26' 1"	20' 9"	18' 1"	22' 10"	18' 1"	15' 10"	19' 11"	16' 5"	14' 4"
			16	23' 9"	18' 10"	16' 5"	19' 11"	16' 5"	14' 4"	17' 3"	14' 11"	13' 1"
			24	19' 11"	16' 5"	14' 4"	16' 3"	14' 4"	12' 7"	14' 1"	13' 1"	11' 5"
400S125-54	50	22.7	12	27' 11"	22' 2"	19' 4"	24' 5"	19' 4"	16' 11"	22' 2"	17' 7"	15' 4"
			16	25' 4"	20' 2"	17' 7"	22' 2"	17' 7"	15' 4"	20' 2"	16' 0"	13' 11"
			24	22' 2"	17' 7"	15' 4"	19' 4"	15' 4"	13' 5"	17' 7"	13' 11"	12' 2"
400S125-68	50	22.5	12	29' 10"	23' 8"	20' 8"	26' 1"	20' 8"	18' 1"	23' 8"	18' 10"	16' 5"
			16	27' 2"	21' 6"	18' 10"	23' 8"	18' 10"	16' 5"	21' 6"	17' 1"	14' 11"
			24	23' 8"	18' 10"	16' 5"	20' 8"	16' 5"	14' 4"	18' 10"	14' 11"	13' 0"
550S125-30	33	27.9	12	25' 8"	23' 9"	20' 10"	21' 0"	20' 8"	18' 2"	18' 2"	18' 2"	16' 6"
			16	22' 3"	21' 6"	18' 11"	18' 2"	18' 2"	16' 6"	15' 9"	15' 9"	14' 11"
			24	18' 2"	18' 2"	16' 6"	14' 10"	14' 10"	14' 4"	12' 10" e	12' 10" e	12' 10" e
550S125-33	33	27.8	12	27' 9"	24' 8"	21' 6"	22' 8"	21' 6"	18' 10"	19' 8"	19' 6"	17' 1"
			16	24' 1"	22' 4"	19' 7"	19' 8"	19' 6"	17' 1"	17' 0"	17' 0"	15' 6"
			24	19' 8"	19' 6"	17' 1"	16' 0"	16' 0"	14' 11"	13' 11"	13' 11"	13' 6"
550S125-43	33	27.6	12	33' 9"	26' 10"	23' 5"	27' 8"	23' 5"	20' 5"	24' 0"	21' 3"	18' 7"
			16	29' 4"	24' 4"	21' 3"	24' 0"	21' 3"	18' 7"	20' 9"	19' 4"	16' 11"
			24	24' 0"	21' 3"	18' 7"	19' 7"	18' 7"	16' 3"	16' 11"	16' 11"	14' 9"
550S125-54	50	22.1	12	36' 2"	28' 9"	25' 1"	31' 7"	25' 1"	21' 11"	28' 9"	22' 9"	19' 11"
			16	32' 10"	26' 1"	22' 9"	28' 9"	22' 9"	19' 11"	26' 1"	20' 8"	18' 1"
			24	28' 9"	22' 9"	19' 11"	25' 1"	19' 11"	17' 5"	22' 9"	18' 1"	15' 10"
550S125-68	50	21.8	12	38' 8"	30' 8"	26' 10"	33' 9"	26' 10"	23' 5"	30' 8"	24' 4"	21' 3"
			16	35' 2"	27' 11"	24' 4"	30' 8"	24' 4"	21' 3"	27' 11"	22' 2"	19' 4"
			24	30' 8"	24' 4"	21' 3"	26' 10"	21' 3"	18' 7"	24' 4"	19' 4"	16' 11"
600S125-30	33	27.6	12	26' 10"	25' 2"	22' 0"	21' 11"	21' 11"	19' 3"	18' 11"	18' 11"	17' 6"
			16	23' 3"	22' 11"	20' 0"	18' 11"	18' 11"	17' 6"	16' 5"	16' 5"	15' 10"
			24	18' 11"	18' 11"	17' 6"	15' 6"	15' 6"	15' 3"	13' 5"e	13' 5"e	13' 5"e
600S125-33	33	27.6	12	29' 0"	26' 2"	22' 10"	23' 8"	22' 10"	19' 11"	20' 6"	20' 6"	18' 1"
			16	25' 2"	23' 9"	20' 9"	20' 6"	20' 6"	18' 1"	17' 9"	17' 9"	16' 6"
			24	20' 6"	20' 6"	18' 1"	16' 9"	16' 9"	15' 10"	14' 6"	14' 6"	14' 5"
600S125-43	33	27.3	12	35' 6"	28' 9"	25' 1"	29' 0"	25' 1"	21' 11"	25' 1"	22' 10"	19' 11"
			16	30' 9"	26' 1"	22' 10"	25' 1"	22' 10"	19' 11"	21' 9"	20' 9"	18' 1"
			24	25' 1"	22' 10"	19' 11"	20' 6"	19' 11"	17' 5"	17' 9"	17' 9"	15' 10"
600S125-54	50	21.9	12	38' 9"	30' 9"	26' 10"	33' 10"	26' 10"	23' 6"	30' 9"	24' 5"	21' 4"
			16	35' 3"	27' 11"	24' 5"	30' 9"	24' 5"	21' 4"	27' 11"	22' 2"	19' 5"
			24	30' 9"	24' 5"	21' 4"	26' 10"	21' 4"	18' 8"	24' 1"	19' 5"	16' 11"
600S125-68	50	21.6	12	41' 7"	33' 0"	28' 10"	36' 4"	28' 10"	25' 2"	33' 0"	26' 2"	22' 10"
			16	37' 9"	30' 0"	26' 2"	33' 0"	26' 2"	22' 10"	30' 0"	23' 9"	20' 9"
			24	33' 0"	26' 2"	22' 10"	28' 10"	22' 10"	20' 0"	26' 2"	20' 9"	18' 2"
800S125-43	33	26.3	12	40' 11"	36' 1"	31' 6"	33' 5"	31' 6"	27' 6"	28' 11"	28' 8"	25' 0"
			16	35' 5"	32' 9"	28' 8"	28' 11"	28' 8"	25' 0"	25' 1"	25' 1"	22' 9"
			24	28' 11"	28' 8"	25' 0"	23' 8"	23' 8"	21' 10"	20' 6"	20' 6"	19' 10"
800S125-54	50	21.1	12	48' 10"	38' 9"	33' 10"	42' 8"	33' 10"	29' 7"	38' 9"	30' 9"	26' 10"
			16	44' 4"	35' 2"	30' 9"	38' 9"	30' 9"	26' 10"	34' 1"	27' 11"	24' 5"
			24	38' 9"	30' 9"	26' 10"	32' 1"	26' 10"	23' 6"	27' 10"	24' 5"	21' 4"
800S125-68	50	20.8	12	52' 10"	41' 11"	36' 8"	46' 2"	36' 8"	32' 0"	41' 11"	33' 4"	29' 1"
			16	48' 0"	38' 1"	33' 4"	41' 11"	33' 4"	29' 1"	38' 1"	30' 3"	26' 5"
			24	41' 11"	33' 4"	29' 1"	36' 8"	29' 1"	25' 5"	33' 3"	26' 5"	23' 1"

[1] Web height-to-thickness ratio exceeds 200. Web stiffeners are required at all support points and concentrated loads.

"e" web stiffeners required at ends.

See Table Notes on page 22.

WYNN ENGINEERING INC.
27315 Valley Center Road
Valley Center, CA 92082
Valley Center (760) 749-8722
Los Angeles (310) 306-9728
www.wynnengineering.com

JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

54.0

L1

L = 4'-0"

Wd = 9' x 32 = 288 #/'

WLr = 180 #/'

USE (2) #5 BARS
D = 16"

Masonry Beam

Project File: 26-501 vertical design.ec6

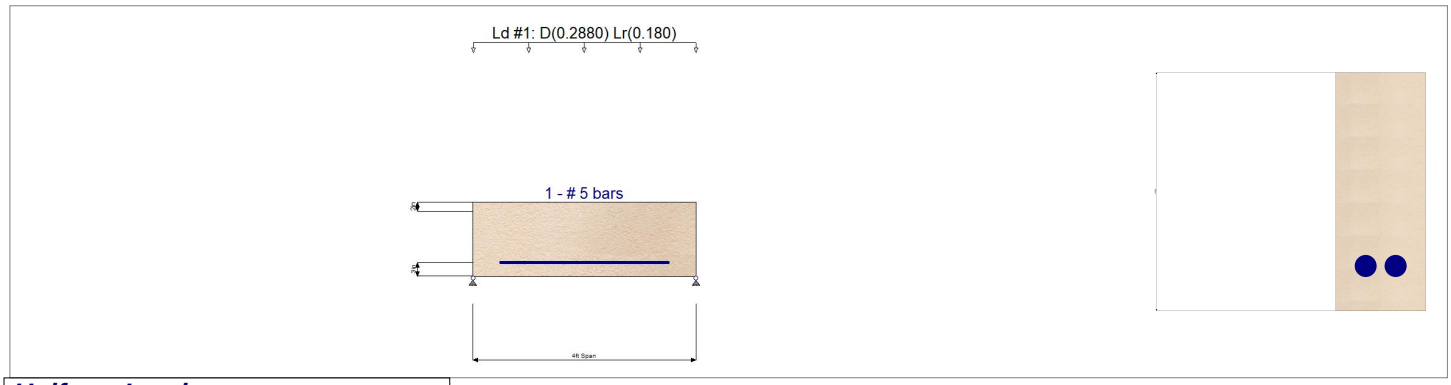
DESCRIPTION: L1

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

f'm	2,000.0	psi	Clear Span	4.0	ft	Rebar Size	5
Fs	32,000.0	psi	Beam Depth	1.330	ft	# Bars E/F	1
Em = f'm *	900.0		Thickness	6	in	Top Clear	2.0 in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin		Btm Clear	3.0 in
Block Type	Normal Wt		Equiv. Solid Thick	5.620	in	# Bar Sets	1
Lateral Wind Load	15.0	psf	Wall Weight	64.0	psf	Bar Spacing	2.0 in
Beam is Fully Braced ?	Yes		E	1,800.0	ksi		
Lateral Wall Weight Seismic Factor	0.330		n	16.111			
Calculate vertical beam weight ?	Yes						



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	0.0 ft	4.0 ft	0.2880		0.180			k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.08929	0.0	**0.08929** : 1.00
fv/Fv	0.2053	0.0	**0.2053** : 1.00

Minimum Mn = 1.3 * Fcr * S = 2.587 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads for Load Combination D+Lr	1.106 k-ft	12.389 k-ft
Lateral Loads for Load Combination D+0.70E	0.03931 k-ft	2.564

Maximum Shear

	Actual	Allowable
Vertical Loads for Load Combination D+Lr	12.322 psi	60.021 psi
Lateral Loads for Load Combination D+0.70E	0.6463 psi	44.721 psi

Vertical Strength

As	0.620 in^2
rho	0.008505
np	0.1370
k : ((np)^2+2np)^.5-np	0.4041
j = 1 - k/3	0.8653
M:mas=Fb k j b d^2/2	12.389 k-ft
M:Stl = Fs As j d	18.541 k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310 in^2
rho	0.005095
np	0.08208
k : (np^2+2np)^.5-np	0.3313
j = 1 - k/3	0.8896
M:mas=Fb k j b d^2/2	2.564 k-ft
M:Stl = Fs As j d	2.804 k-ft

Masonry Beam

Project File: 26-501 vertical design.ec6

DESCRIPTION: L1

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	0.75	12.39	8.31	60.02	0.00	2.56	0.00	44.72
+D+Lr	1.11	12.39	12.32	60.02	0.00	2.56	0.00	44.72
+D+0.750Lr	1.02	12.39	11.32	60.02	0.00	2.56	0.00	44.72
+D+0.60W	0.75	12.39	8.31	60.02	0.02	2.56	0.39	44.72
+D+0.750Lr+0.450W	1.02	12.39	11.32	60.02	0.02	2.56	0.30	44.72
+D+0.450W	0.75	12.39	8.31	60.02	0.02	2.56	0.30	44.72
+0.60D+0.60W	0.45	12.39	4.99	60.02	0.02	2.56	0.39	44.72
+D+0.70E	0.75	12.39	8.31	60.02	0.04	2.56	0.65	44.72
+D+0.5250E	0.75	12.39	8.31	60.02	0.03	2.56	0.48	44.72
+0.60D+0.70E	0.45	12.39	4.99	60.02	0.04	2.56	0.65	44.72

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SHEET NO. _____ OF _____

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SCALE _____

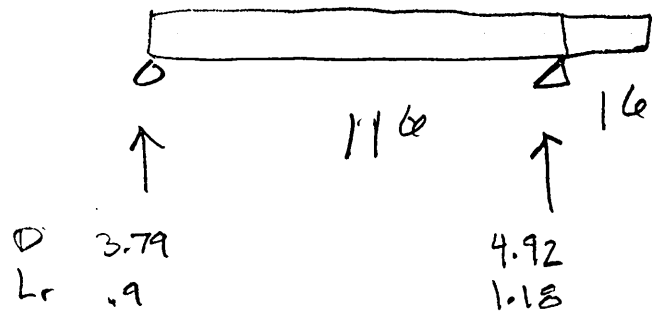
VERTICAL DESIGN - SHEET S3.0

B1

$W_d = (5' + 3') \times 32psf = 256^{\#/'}$

$W_{Lr} = (5' + 3') \times 20psf = 160^{\#/'}$

$W_d = 5' \times 75psf = 375^{\#/'}$



W10x39

B2

WALL ABOVE

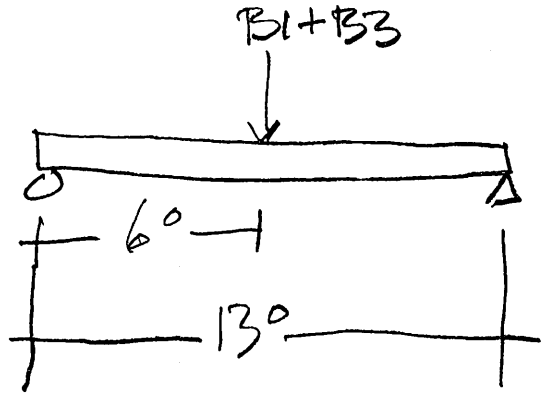
$W_D = 10' \times 75psf = 750^{\#/'}$

$W_d = 3' \times 32psf = 96^{\#/'}$

$W_{Lr} = 3' \times 20psf = 60^{\#/'}$

$P_D = 3.79 + .80 = 4.59^k$

$P_{Lr} = .9 + .46 = 1.36^k$

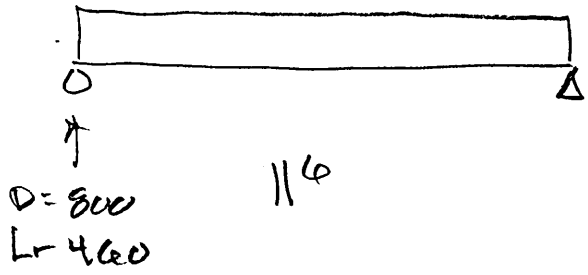


W10x39

B3

$W_d = 4' \times 32psf = 128^{\#/'}$

$W_{Lr} = 4 \times 20psf = 80^{\#/'}$



6x10

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53.0

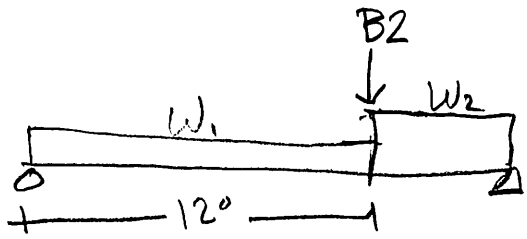
B4

$W_{D_1} = 2.5' \times 17.5 psf = 44^{\#1}$

$W_{L_1} = 2.5 \times 100 psf = 250$

$W_{D_2} = 9' \times 24.5 psf = 221^{\#1}$

$W_{L_2} = 9' \times 100 psf = 900^{\#1}$



19.63
.31
2.77

17°

D 13.4
Lr .74
L 2.77

$P_D = 7.63$

$P_{L_r} = 1.05$

$P_L = .58$

W10 x 60

W_D = 750 (WALL ABOVE) "FULL LENGTH"

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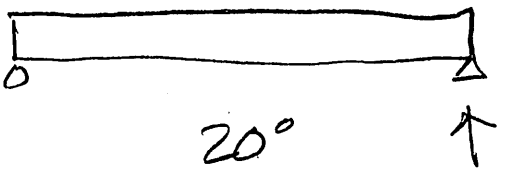
53.0

B5

$W_d = 32psf \times 12.5' = 400^{\#l}$

$W_{Lr} = 20psf \times 12.5' = 250^{\#l}$



20°

5.25x16.0 PSL

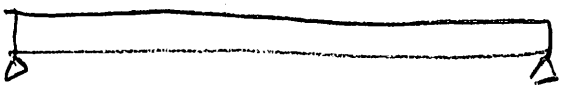
D 4.26
Lr 2.5

B6

$W_d = 12' \times 24.5psf = 294^{\#l}$

$W_L = 12' \times 100psf = 1200^{\#l}$

WD x 6.88



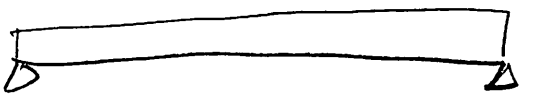
23°

$\Delta = D + L = .647"$
L/426

B7

$W_d = 7' \times 32psf = 224^{\#l}$

$W_{Lr} = 7' \times 20psf = 140^{\#l}$



19°

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SCALE _____

53.0

B8

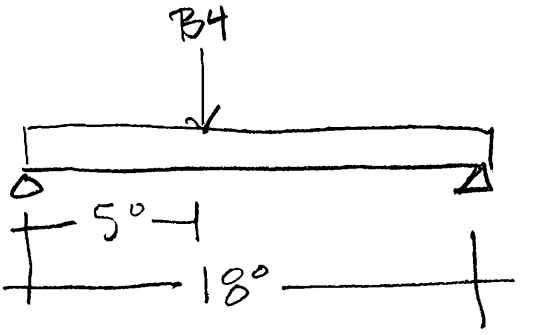
$W_d = 24.5 psf \times 7 = 172^{\#1}$

$W_L = 100 psf \times 7' = 700^{\#1}$

P_D 7.63

P_{Lr} 1.05

P_L 0.58



W10×60

B9

$W_d = 5' \times 32 psf = 192^{\#1}$

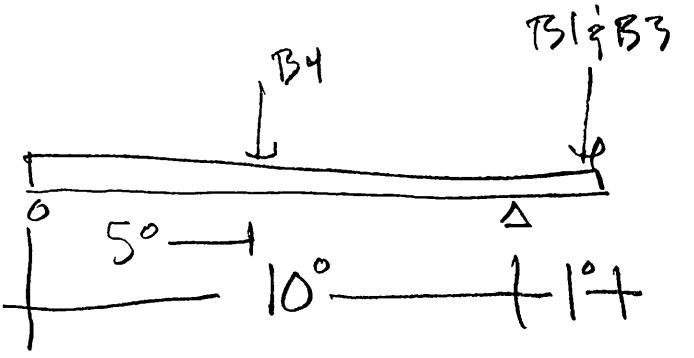
$W_{Lr} = 5 \times 20 = 100^{\#1}$

P_D 9.63

P_L 2.77

P_{Lr} 0.31

$W_{(w \& LL)} = 750^{\#1}$



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SCALE _____

53.0

B10

$W_{d_1} = 7' \times 24.5 psf = 172^{\#/'}$

$W_{L_1} = 7 \times 100 psf = 700^{\#/'}$

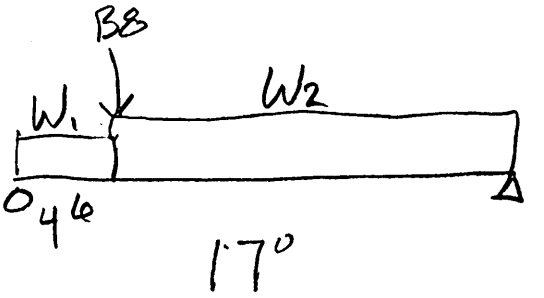
$W_{D_2} = 24.5 + 375 = 400^{\#/'}$

$W_{L_2} = 100$

P_D 4.2k

P_{L_r} .76k

P_L 6.72k



W 8x67

B1C

24 x 51 = 1224

1.

9840

2.8 FOR ASD

1462

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Description : S3.O VERTICAL DESIGN STEEL AND WOOD

Steel Beam Design : B1

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x39, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	9.920 in	Flange Thick	0.530 in	Area =	11.500 in^2	Flange Width	7.990 in	Web Thick =	0.315 in		
I xx =	209.00 in^4	yy =	45.000 in^4	Iz =	0.000 in^4	Zx =	46.800 in^3	Zy =	17.200 in^3		
Weight =	39.146 plf	J =	0.976 in^4								

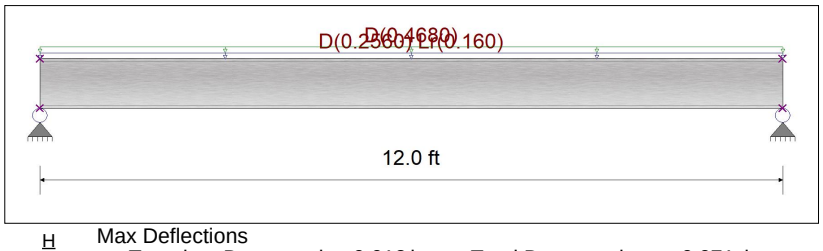
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0320, Lr = 0.020 k/ft, Trib= 8.0 ft
Unif Load: D = 0.0780 k/ft, Trib= 6.0 ft

Design Summary

Max fb/Fb Ratio = **0.120** : 1
Mu : Applied 21.092 k-ft at 6.000 ft in Span # 1
Mn * Phi : Allow 175.500 k-ft
Load Comb : +1.20D+1.60Lr

Max fv/FvRatio = **0.075** : 1
Vu : Applied 7.031 k at 0.000 ft in Span # 1
Vn * Phi : Allow 93.744 k
Load Comb : +1.20D+1.60Lr



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	4.58	0.96					
Right Support	4.58	0.96					

Max Deflections

Transient Downward	0.012 in	Total Downward	0.071 in
Ratio	9999		2015
	LC: Lr Only		LC: +D+Lr
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : B2

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x39, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	9.920 in	Flange Thick	0.530 in	Area =	11.500 in^2	Flange Width	7.990 in	Web Thick =	0.315 in		
I xx =	209.00 in^4	yy =	45.000 in^4	Iz =	0.000 in^4	Zx =	46.800 in^3	Zy =	17.200 in^3		
Weight =	39.146 plf	J =	0.976 in^4								

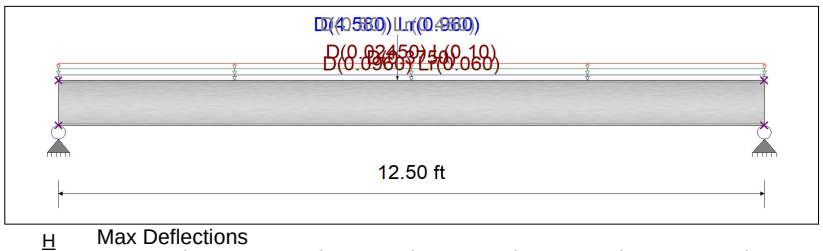
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0320, Lr = 0.020 k/ft, Trib= 3.0 ft
Unif Load: D = 0.0750 k/ft, Trib= 5.0 ft
Unif Load: D = 0.02450, L = 0.10 k/ft, Trib= 1.0 ft
1Point: D = 4.580, Lr = 0.960 k @ 6.0 ft
2Point: D = 0.80, Lr = 0.460 k @ 6.0 ft

Design Summary

Max fb/Fb Ratio = **0.248** : 1
Mu : Applied 43.564 k-ft at 6.000 ft in Span # 1
Mn * Phi : Allow 175.500 k-ft
Load Comb : +1.20D+1.60Lr+L

Max fv/FvRatio = **0.104** : 1
Vu : Applied 9.773 k at 0.000 ft in Span # 1
Vn * Phi : Allow 93.744 k
Load Comb : +1.20D+1.60Lr+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	6.14	1.11	0.63				
Right Support	5.92	1.06	0.63				

Max Deflections

Transient Downward	0.022 in	Total Downward	0.135 in
Ratio	6822		1114
	LC: Lr Only		LC: +D+0.750Lr+0.750L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Wood Beam Design : B3

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x10, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch				Wood Grade :	No.1			
Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Wood Beam Design : B3

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x10, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch				Wood Grade :	No.1			
Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

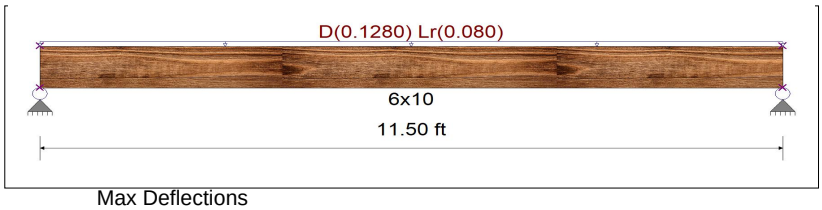
Beam self weight calculated and added to loads
Unif Load: D = 0.0320, Lr = 0.020 k/ft, Trib= 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.315** : 1 at 5.750 ft in Span # 1
fb : Actual : 525.91 psi
Fb : Allowable : 1,667.80 psi
Load Comb : +D+Lr

Max fv/FvRatio = **0.148** : 1 at 0.000 ft in Span # 1
fv : Actual : 31.38 psi
Fv : Allowable : 212.50 psi
Load Comb : +D+Lr

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.80	0.46					
Right Support	0.80	0.46					



Max Deflections

Transient Downward	0.050 in	Total Downward	0.138 in
Ratio	2741	Ratio	999
	LC: Lr Only		LC: +D+Lr
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Steel Beam Design : B4

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x60, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data : Depth = 10.200 in Flange Thick 0.680 in Area = 17.600 in^2 Flange Width #.### in Web Thick = 0.420 in
I xx = 341.00 in^4 yy = 116.000 in^4 Iz = 0.000 in^4 Zx = 74.600 in^3 Zy = 35.000 in^3
Weight = 59.910 plf J = 2.480 in^4

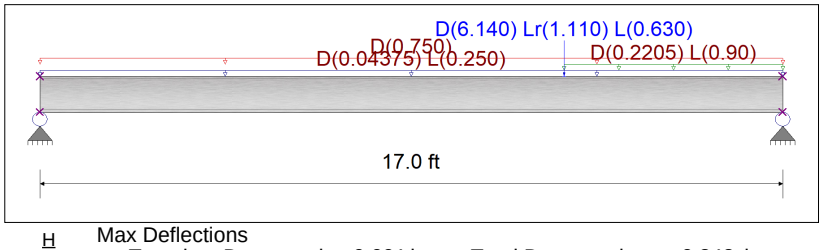
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.01750, L = 0.10 k/ft, Trib= 2.50 ft
Unif Load: D = 0.02450, L = 0.10 k/ft, 12.0 to 17.0 ft, Trib= 9.0 ft
Unif Load: D = 0.0750 k/ft, Trib= 10.0 ft
1Point: D = 6.140, Lr = 1.110, L = 0.630 k @ 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.321** : 1
Mu : Applied 89.722 k-ft at 11.220 ft in Span # 1
Mn * Phi : Allow 279.750 k-ft
Load Comb : +1.20D+0.50Lr+1.60L

Max fv/FvRatio = **0.200** : 1
Vu : Applied 25.681 k at 17.000 ft in Span # 1
Vn * Phi : Allow 128.520 k
Load Comb : +1.20D+0.50Lr+1.60L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	9.22	0.33	2.97				
Right Support	12.53	0.78	6.41				

Max Deflections

Transient Downward	0.091 in	Total Downward	0.348 in
Ratio	2252	Ratio	585
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : B5

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **5.25x16.0, Parallam PSL, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.0E

Fb - Tension	2,900.0 psi	Fc - Prll	2,900.0 psi	Fv	290.0 psi	Ebend- xx	2,000.0 ksi	Density	45.070 pcf
Fb - Compr	2,900.0 psi	Fc - Perp	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,016.54 ksi		

Wood Beam Design : B5

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **5.25x16.0, Parallam PSL, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : iLevel Truss Joist Wood Grade : Parallam PSL 2.0E

Fb - Tension	2,900.0 psi	Fc - Prll	2,900.0 psi	Fv	290.0 psi	Ebend- xx	2,000.0 ksi	Density	45.070 pcf
Fb - Compr	2,900.0 psi	Fc - Perp	750.0 psi	Ft	2,025.0 psi	Eminbend - xx	1,016.54 ksi		

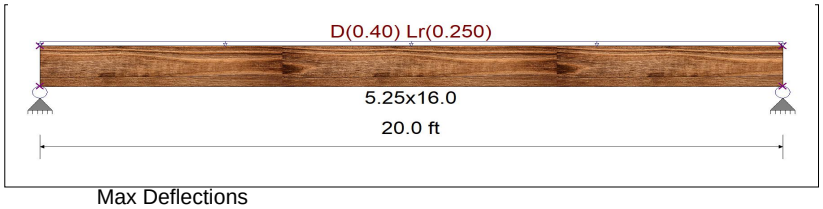
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0320, Lr = 0.020 k/ft, Trib= 12.50 ft

Design Summary

Max fb/Fb Ratio = **0.568** : 1
fb : Actual : 1,811.49 psi at 10.000 ft in Span # 1
Fb : Allowable : 3,187.66 psi
Load Comb : +D+Lr

Max fv/FvRatio = **0.291** : 1
fv : Actual : 105.47 psi at 18.733 ft in Span # 1
Fv : Allowable : 362.50 psi
Load Comb : +D+Lr



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	4.26	2.50					
Right Support	4.26	2.50					

Max Deflections

Transient Downward	0.252 in	Total Downward	0.683 in
Ratio	950	Ratio	351
	LC: Lr Only		LC: +D+Lr
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Steel Beam Design : B6

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x112, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Beam Design : B6

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x112, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data : Depth = 11.400 in Flange Thick 1.250 in Area = 32.900 in^2 Flange Width #.### in Web Thick = 0.755 in
I xx = 716.00 in^4 yy = 236.000 in^4 Iz = 0.000 in^4 Zx = 147.000 in^3 Zy = 69.200 in^3
Weight = 111.992 plf J = 15.100 in^4

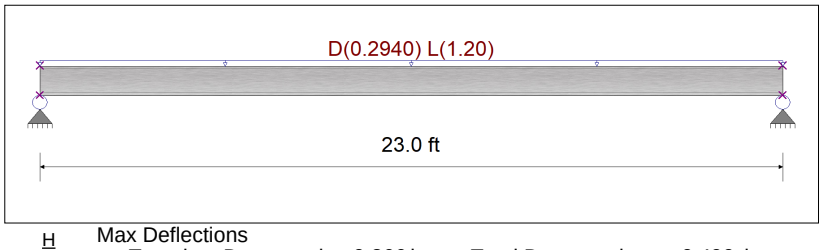
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.02450, L = 0.10 k/ft, Trib= 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.289** : 1
Mu : Applied 159.175 k-ft at 11.500 ft in Span # 1
Mn * Phi : Allow 551.250 k-ft
Load Comb : +1.20D+1.60L

Max fv/FvRatio = **0.107** : 1
Vu : Applied 27.683 k at 0.000 ft in Span # 1
Vn * Phi : Allow 258.210 k
Load Comb : +1.20D+1.60L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	4.67		13.80				
Right Support	4.67		13.80				

Max Deflections

Transient Downward	0.366 in	Total Downward	0.490 in
Ratio	754		563
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Wood Beam Design : B7

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x14, Sawn, Fully Unbraced**

Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species : Douglas Fir-Larch Wood Grade : No.1

Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Wood Beam Design : B7

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x14, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch					Wood Grade :	No.1		
Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Applied Loads

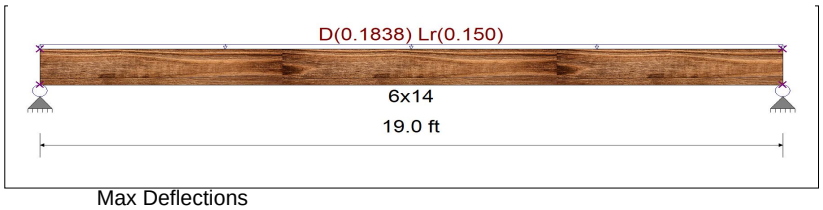
Beam self weight calculated and added to loads
Unif Load: D = 0.02450, Lr = 0.020 k/ft, Trib= 7.50 ft

Design Summary

Max fb/Fb Ratio = **0.707** : 1
fb : Actual : 1,133.95 psi at 9.500 ft in Span # 1
Fb : Allowable : 1,604.63 psi
Load Comb : +D+Lr

Max fv/FvRatio = **0.280** : 1
fv : Actual : 59.53 psi at 0.000 ft in Span # 1
Fv : Allowable : 212.50 psi
Load Comb : +D+Lr

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.90	1.43					
Right Support	1.90	1.43					



Max Deflections

Transient Downward	0.245 in	Total Downward	0.572 in
Ratio	930	Ratio	398
	LC: Lr Only		LC: +D+Lr
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : B8

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x60, Fully Unbraced**
Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data : Depth = 10.200 in Flange Thick 0.680 in Area = 17.600 in^2 Flange Width #.### in Web Thick = 0.420 in
I xx = 341.00 in^4 yy = 116.000 in^4 Iz = 0.000 in^4 Zx = 74.600 in^3 Zy = 35.000 in^3
Weight = 59.910 plf J = 2.480 in^4

Applied Loads

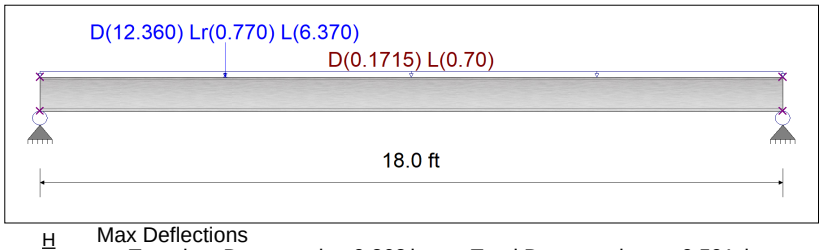
Beam self weight calculated and added to loads
Unif Load: D = 0.02450, L = 0.10 k/ft, Trib= 7.0 ft
1Point: D = 12.360, Lr = 0.770, L = 6.370 k @ 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.458** : 1
Mu : Applied 128.210 k-ft at 4.500 ft in Span # 1
Mn * Phi : Allow 279.750 k-ft
Load Comb : +1.20D+0.50Lr+1.60L

Max fv/FvRatio = **0.246** : 1
Vu : Applied 31.636 k at 0.000 ft in Span # 1
Vn * Phi : Allow 128.520 k
Load Comb : +1.20D+0.50Lr+1.60L

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	11.35	0.58	11.08				
Right Support	5.17	0.19	7.89				



Max Deflections

Transient Downward	0.262 in	Total Downward	0.501 in
Ratio	823	Ratio	430
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC (c) ENERCALC INC 1983-2023

Steel Beam Design : B9

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x60, Fully Unbraced**

Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.200 in	Flange Thick	0.680 in	Area =	17.600 in^2	Flange Width	#.### in	Web Thick =	0.420 in
I xx =	341.00 in^4	yy =	116.000 in^4	Iz =	0.000 in^4	Zx =	74.600 in^3	Zy =	35.000 in^3
Weight =	59.910 plf	J =	2.480 in^4						

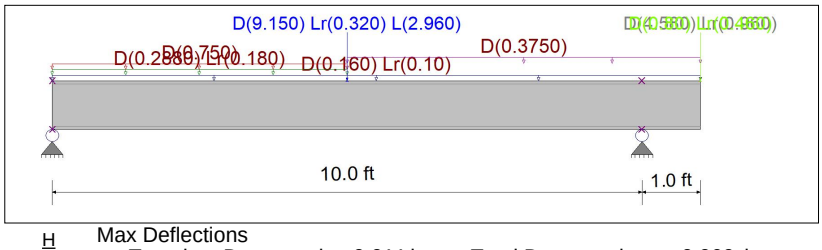
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.0320, Lr = 0.020 k/ft, Trib= 5.0 ft
Unif Load: D = 0.0320, Lr = 0.020 k/ft, 0.0 to 5.0 ft, Trib= 9.0 ft
Unif Load: D = 0.0750 k/ft, 0.0 to 5.0 ft, Trib= 10.0 ft
Unif Load: D = 0.0750 k/ft, 5.0 to 11.0 ft, Trib= 5.0 ft
1Point: D = 9.150, Lr = 0.320, L = 2.960 k @ 5.0 ft
2Point: D = 4.580, Lr = 0.960 k @ 11.0 ft
3Point: D = 0.80, Lr = 0.460 k @ 11.0 ft

Design Summary

Max fb/Fb Ratio = **0.182** : 1
Mu : Applied 51.000 k-ft at 5.000 ft in Span # 1
Mn * Phi : Allow 279.750 k-ft
Load Comb : +1.20D+0.50Lr+1.60L

Max fv/FvRatio = **0.115** : 1
Vu : Applied 14.743 k at 0.000 ft in Span # 1
Vn * Phi : Allow 128.520 k
Load Comb : +1.20D+1.60Lr+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	9.47	1.19	1.48				
Right Support	14.92	2.55	1.48				

Max Deflections

Transient Downward	0.011 in	Total Downward	0.060 in
Ratio	9999		2009
	LC: L Only		LC: +D+0.750Lr+0.750L
Transient Upward	-0.003 in	Total Upward	-0.016 in
Ratio	7424	Ratio	1496
	LC: L Only		LC: +D+L

Steel Beam Design : B10

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x88, Fully Unbraced**

Using Load Resistance Factor Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.800 in	Flange Thick	0.990 in	Area =	25.900 in^2	Flange Width	#.### in	Web Thick =	0.605 in
I xx =	534.00 in^4	yy =	179.000 in^4	Iz =	0.000 in^4	Zx =	113.000 in^3	Zy =	53.100 in^3
Weight =	88.164 plf	J =	7.530 in^4						

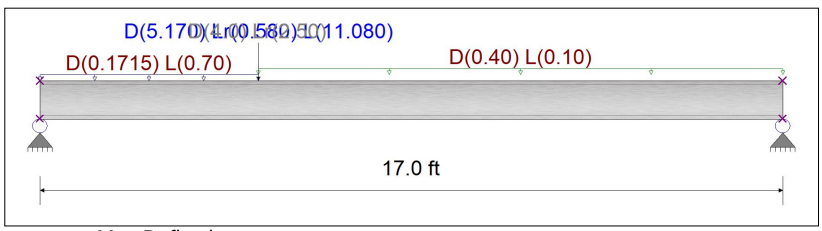
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.02450, L = 0.10 k/ft, 0.0 ft to 5.0 ft, Trib= 7.0 ft
Unif Load: D = 0.40, L = 0.10 k/ft, 5.0 to 17.0 ft, Trib= 1.0 ft
1Point: D = 5.170, Lr = 0.580, L = 11.080 k @ 5.0 ft
2Point: D = 4.0, Lr = 2.50 k @ 5.0 ft

Design Summary

Max fb/Fb Ratio = **0.319** : 1
Mu : Applied 134.972 k-ft at 5.043 ft in Span # 1
Mn * Phi : Allow 423.750 k-ft
Load Comb : +1.20D+0.50Lr+1.60L

Max fv/FvRatio = **0.156** : 1
Vu : Applied 30.632 k at 0.000 ft in Span # 1
Vn * Phi : Allow 196.020 k
Load Comb : +1.20D+0.50Lr+1.60L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	9.65	2.17	11.23				
Right Support	6.68	0.91	4.55				

Max Deflections

Transient Downward	0.127 in	Total Downward	0.264 in
Ratio	1602		772
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

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Los Angeles (310) 306-9728
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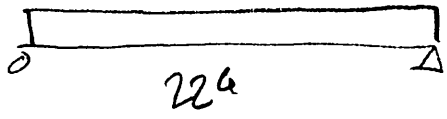
52.0 VERTICAL DESIGN

B1

$W_d = 30.5 psf \times 4.5' = 138^{\#/'}$

$W_{Lr} = 20 \times 4.5' = 90^{\#/'}$



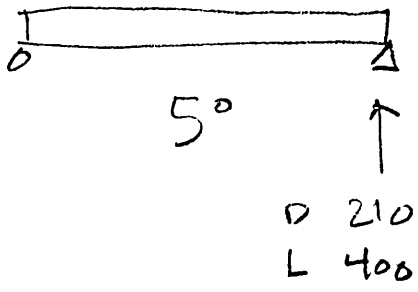
W10x30

B2

$W_d = 4' \times 17.5 psf$

$W_L = 4 \times 40 psf$

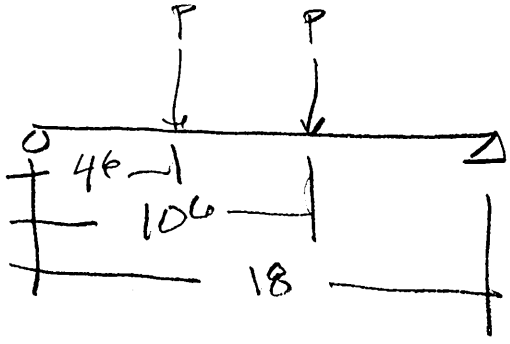
W10x19



B3

$P_D = 210$

$P_L = 400$



W10x19

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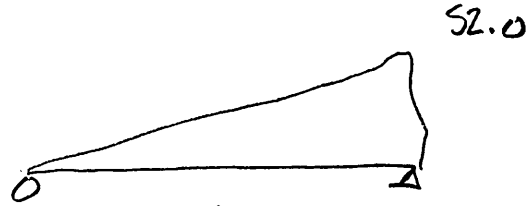
B4

$W_d = 11' \times 32psf = 352$

$W_{Lr} = 11' \times 20psf = 220$

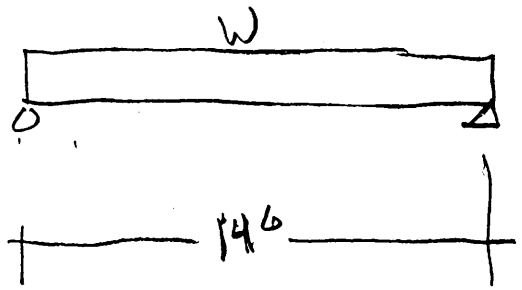


6x12

B5

$W_d = 6' \times 30.5psf = 183$

$W_{Lr} = 6' \times 20\ psf = 120$



6x12

B6

$P_D = 16.09$

$P_{Lr} = 2.06$

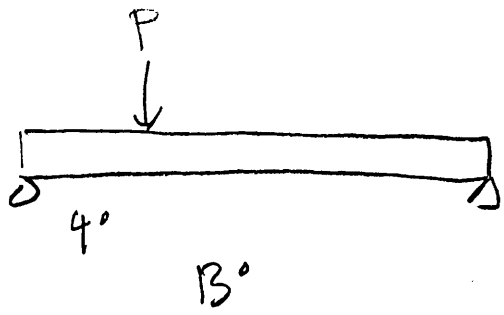
$P_L = 1.39$

$W_d = 6' \times 30.5psf = 183\#_{/ft}$

$W_{Lr} = 6' \times 20\ psf = 120\#_{/ft}$

$W_d = 2 \times 17.5 = 35$

$W_L = 2 \times 40 = 80$



W10x30

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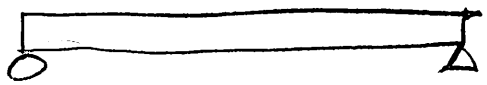
B7

52.0

$W_d = 12' \times 17.5 psf = 210^{\#/'}$

$W_L = 12' \times 40 psf = 480^{\#/'}$



15'

W10x60

Multiple Simple Beam

Description : S2.0 FRAMING PLAN

Steel Beam Design : B1

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x30, Fully Unbraced**

Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.500 in	Flange Thick	0.510 in	Area =	8.840 in^2	Flange Width	5.810 in	Web Thick =	0.300 in		
I xx =	170.00 in^4	yy =	16.700 in^4	Iz =	0.000 in^4	Zx =	36.600 in^3	Zy =	8.840 in^3		
Weight =	30.091 plf	J =	0.622 in^4								

Applied Loads

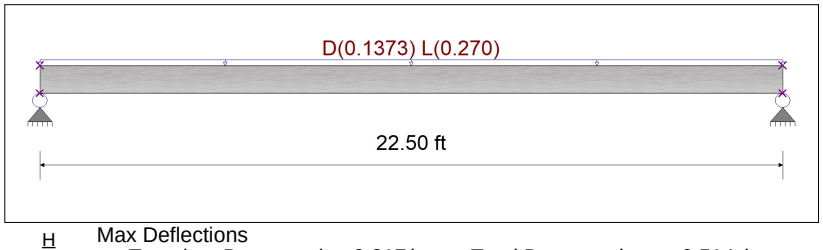
Beam self weight calculated and added to loads

Unif Load: D = 0.03050, L = 0.060 k/ft, Trib= 4.50 ft

Design Summary

Max fb/Fb Ratio = **0.652** : 1
Mu : Applied 27.676 k-ft at 11.250 ft in Span # 1
Mn / Omega : Allow 42.434 k-ft
Load Comb : +D+L

Max fv/FvRatio = **0.078** : 1
Vu : Applied 4.920 k at 0.000 ft in Span # 1
Vn / Omega : Allow 63.0 k
Load Comb : +D+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.88		3.04				
Right Support	1.88		3.04				

Max Deflections

Transient Downward	0.317 in	Total Downward	0.514 in
Ratio	850		525
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : B2

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x19, Fully Unbraced**

Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.200 in	Flange Thick	0.395 in	Area =	5.620 in^2	Flange Width	4.020 in	Web Thick =	0.250 in		
I xx =	96.30 in^4	yy =	4.290 in^4	Iz =	0.000 in^4	Zx =	21.600 in^3	Zy =	3.350 in^3		
Weight =	19.130 plf	J =	0.233 in^4								

Applied Loads

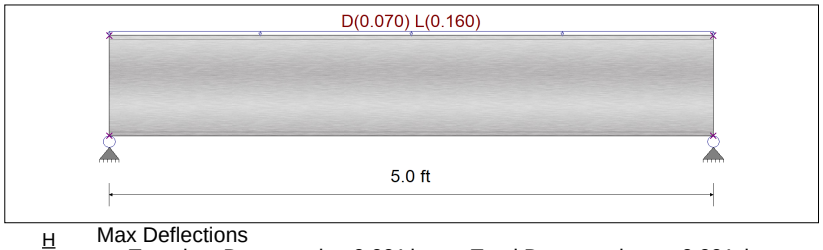
Beam self weight calculated and added to loads

Unif Load: D = 0.01750, L = 0.040 k/ft, Trib= 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.014** : 1
Mu : Applied 0.779 k-ft at 2.500 ft in Span # 1
Mn / Omega : Allow 53.892 k-ft
Load Comb : +D+L

Max fv/FvRatio = **0.012** : 1
Vu : Applied 0.6228 k at 5.000 ft in Span # 1
Vn / Omega : Allow 51.0 k
Load Comb : +D+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.22		0.40				
Right Support	0.22		0.40				

Max Deflections

Transient Downward	0.001 in	Total Downward	0.001 in
Ratio	9999		9999
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC (c) ENERCALC INC 1983-2023

Steel Beam Design : B3

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x19, Fully Braced**
Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data : Depth = 10.200 in Flange Thick 0.395 in Area = 5.620 in^2 Flange Width 4.020 in Web Thick = 0.250 in
I xx = 96.30 in^4 yy = 4.290 in^4 Iz = 0.000 in^4 Zx = 21.600 in^3 Zy = 3.350 in^3
Weight = 19.130 plf J = 0.233 in^4

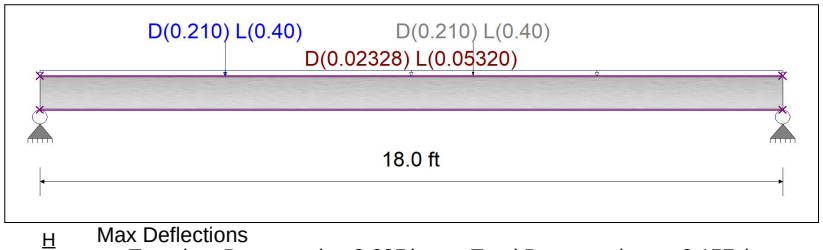
Applied Loads

Beam self weight calculated and added to loads
Unif Load: D = 0.01750, L = 0.040 k/ft, Trib= 1.330 ft
1Point: D = 0.210, L = 0.40 k @ 4.50 ft
2Point: D = 0.210, L = 0.40 k @ 10.50 ft

Design Summary

Max fb/Fb Ratio = **0.141** : 1
Mu : Applied 7.586 k-ft at 10.080 ft in Span # 1
Mn / Omega : Allow 53.892 k-ft
Load Comb : +D+L

Max fv/FvRatio = **0.031** : 1
Vu : Applied 1.572 k at 0.000 ft in Span # 1
Vn / Omega : Allow 51.0 k
Load Comb : +D+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	0.63		0.95				
Right Support	0.56		0.81				

Max Deflections

Transient Downward	0.095 in	Total Downward	0.157 in
Ratio	2271	Ratio	1373
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Wood Beam Design : B4

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.1

Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

Wood Beam Design : B4

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x10, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.1

Fb - Tension	1,350.0 psi	Fc - Prll	925.0 psi	Fv	170.0 psi	Ebend- xx	1,600.0 ksi	Density	31.210 pcf
Fb - Compr	1,350.0 psi	Fc - Perp	625.0 psi	Ft	675.0 psi	Eminbend - xx	580.0 ksi		

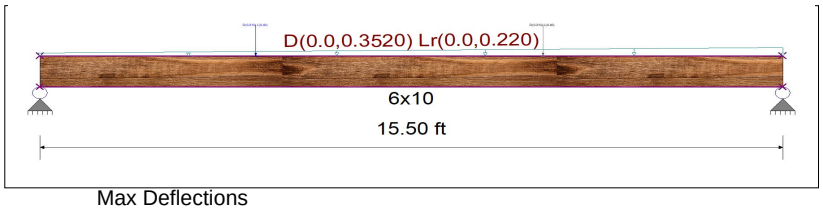
Applied Loads

Beam self weight calculated and added to loads
1Point: D = 0.210, L = 0.40 k @ 4.50 ft
2Point: D = 0.210, L = 0.40 k @ 10.50 ft
Unif Load: D= 0.0->0.3520, Lr = 0.0->0.220 k/ft, 0.0 to 15.50 ft

Design Summary

Max fb/Fb Ratio = **0.932** : 1
fb : Actual : 1,258.78 psi at 8.990 ft in Span # 1
Fb : Allowable : 1,350.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.385** : 1
fv : Actual : 81.91 psi at 14.725 ft in Span # 1
Fv : Allowable : 212.50 psi
Load Comb : +D+0.750Lr+0.750L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.21	0.57	0.41				
Right Support	2.11	1.14	0.39				

Max Deflections

Transient Downward	0.229 in	Total Downward	0.736 in
Ratio	813	Ratio	252
	LC: Lr Only		LC: +D+0.750Lr+0.750L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC (c) ENERCALC INC 1983-2023

Wood Beam Design : B5

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x12, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch					Wood Grade :	No.1				
Fb - Tension	1,350.0	psi	Fc - Prll	925.0	psi	Fv	170.0 psi	Ebend- xx	1,600.0	ksi	Density 31.210 pcf
Fb - Compr	1,350.0	psi	Fc - Perp	625.0	psi	Ft	675.0 psi	Eminbend - xx	580.0	ksi	

Wood Beam Design : B5

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **6x12, Sawn, Fully Braced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending

Wood Species :	Douglas Fir-Larch					Wood Grade :	No.1				
Fb - Tension	1,350.0	psi	Fc - Prll	925.0	psi	Fv	170.0 psi	Ebend- xx	1,600.0	ksi	Density 31.210 pcf
Fb - Compr	1,350.0	psi	Fc - Perp	625.0	psi	Ft	675.0 psi	Eminbend - xx	580.0	ksi	

Applied Loads

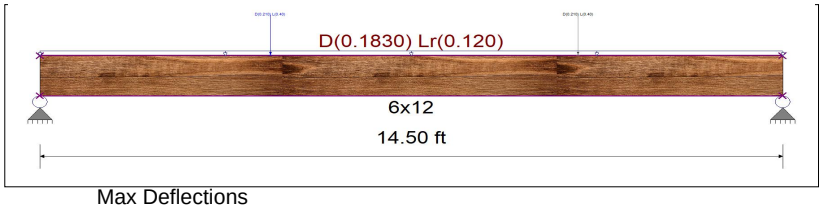
Beam self weight calculated and added to loads
Unif Load: D = 0.03050, Lr = 0.020 k/ft, Trib= 6.0 ft
1Point: D = 0.210, L = 0.40 k @ 4.50 ft
2Point: D = 0.210, L = 0.40 k @ 10.50 ft

Design Summary

Max fb/Fb Ratio = **0.569** : 1
fb : Actual : 768.46 psi at 7.153 ft in Span # 1
Fb : Allowable : 1,350.00 psi
Load Comb : +D+L

Max fv/FvRatio = **0.262** : 1
fv : Actual : 44.50 psi at 13.582 ft in Span # 1
Fv : Allowable : 170.00 psi
Load Comb : +D+L

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	1.63	0.87	0.39				
Right Support	1.64	0.87	0.41				



Max Deflections

Transient Downward	0.108 in	Total Downward	0.336 in
Ratio	1617	Ratio	518
	LC: Lr Only		LC: +D+0.750Lr+0.750L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Steel Beam Design : B6

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x30, Fully Braced**
Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.500 in	Flange Thick	0.510 in	Area =	8.840 in^2	Flange Width	5.810 in	Web Thick =	0.300 in
I xx =	170.00 in^4	yy =	16.700 in^4	Iz =	0.000 in^4	Zx =	36.600 in^3	Zy =	8.840 in^3
Weight =	30.091 plf	J =	0.622 in^4						

Applied Loads

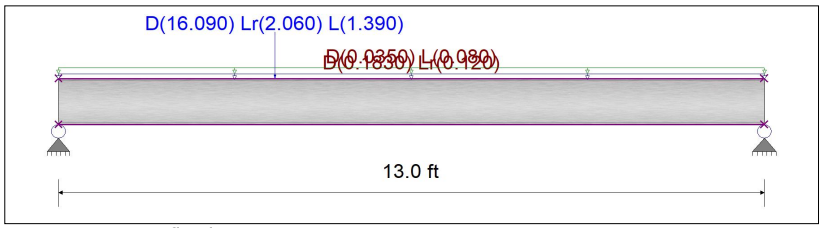
Beam self weight calculated and added to loads
Unif Load: D = 0.03050, Lr = 0.020 k/ft, Trib= 6.0 ft
Unif Load: D = 0.01750, L = 0.040 k/ft, Trib= 2.0 ft
1Point: D = 16.090, Lr = 2.060, L = 1.390 k @ 4.0 ft

Design Summary

Max fb/Fb Ratio = **0.643** : 1
Mu : Applied 58.745 k-ft at 4.030 ft in Span # 1
Mn / Omega : Allow 91.317 k-ft
Load Comb : +D+0.750Lr+0.750L

Max fv/FvRatio = **0.246** : 1
Vu : Applied 15.518 k at 0.000 ft in Span # 1
Vn / Omega : Allow 63.0 k
Load Comb : +D+0.750Lr+0.750L

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	12.75	2.21	1.48				
Right Support	6.56	1.41	0.95				



Max Deflections

Transient Downward	0.043 in	Total Downward	0.298 in
Ratio	3649	Ratio	524
	LC: Lr Only		LC: +D+0.750Lr+0.750L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Steel Beam Design : B7

Calculations per AISC 360-16, IBC 2021, ASCE 7-16

STEEL Section : **W10x60, Fully Braced**

Using Allowable Strength Design with ASCE 7-16 Load Combinations, Major Axis Bending

Fy = 50.0 ksi E = 29,000.0 ksi

Steel Section Data :

Depth =	10.200 in	Flange Thick	0.680 in	Area =	17.600 in^2	Flange Width	#.### in	Web Thick =	0.420 in		
I xx =	341.00 in^4	yy =	116.000 in^4	Iz =	0.000 in^4	Zx =	74.600 in^3	Zy =	35.000 in^3		
Weight =	59.910 plf	J =	2.480 in^4								

Applied Loads

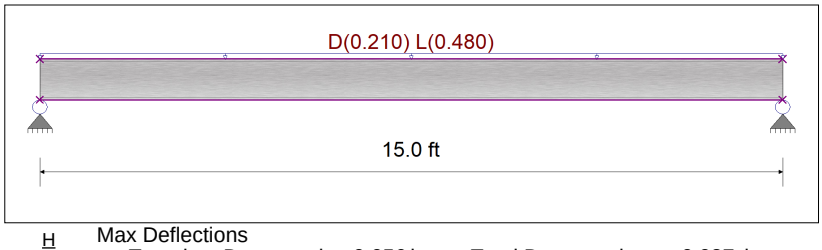
Beam self weight calculated and added to loads

Unif Load: D = 0.01750, L = 0.040 k/ft, Trib= 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.113** : 1
Mu : Applied 21.091 k-ft at 7.500 ft in Span # 1
Mn / Omega : Allow 186.128 k-ft
Load Comb : +D+L

Max fv/FvRatio = **0.066** : 1
Vu : Applied 5.624 k at 0.000 ft in Span # 1
Vn / Omega : Allow 85.680 k
Load Comb : +D+L



Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	2.02		3.60				
Right Support	2.02		3.60				

Max Deflections

Transient Downward	0.056 in	Total Downward	0.087 in
Ratio	3238		2072
	LC: L Only		LC: +D+L
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Masonry Beam

Project File: 26-501 vertical design.ec6

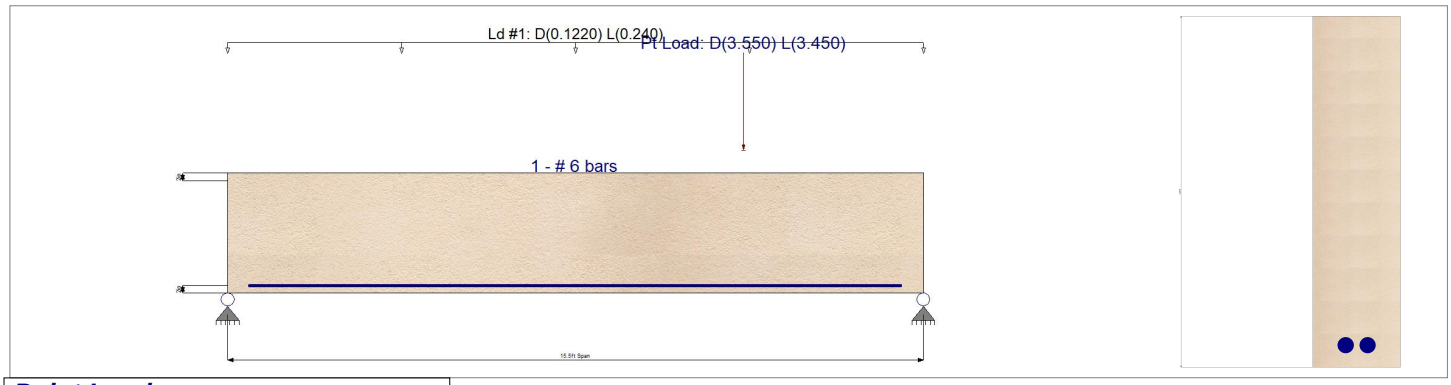
DESCRIPTION: L1

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

f'm	2,000.0	psi	Clear Span	15.50	ft	Rebar Size	6.0
Fs	32,000.0	psi	Beam Depth	2.667	ft	# Bars E/F	1
Em = f'm *	900.0		Thickness	8	in	Top Clear	2.0 in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin		Btm Clear	2.0 in
Block Type	Normal Wt		Equiv. Solid Thick	7.60	in	# Bar Sets	1
Lateral Wind Load	15.0	psf	Wall Weight	86.0	psf	Bar Spacing	2.0 in
Beam is Fully Braced ?	Yes		E	1,800.0	ksi		
Lateral Wall Weight Seismic Factor	0.330		n	16.111			
Calculate vertical beam weight ?	Yes						



Point Loads

	Distance	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	11.50 ft	3.550	3.450				k
#2	ft						k
#3	ft						k
#4	ft						k

Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	15.50 ft	0.1220	0.240				k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.5438	0.0	**0.5438** : 1.00
fv/Fv	0.7963	0.0	**0.7963** : 1.00

Minimum Mn = 1.3 * Fcr * S = 14.101 k-ft

Maximum Moment	Actual	Allowable
Vertical Loads for Load Combination +D+L	34.518 k-ft	63.474 k-ft
Lateral Loads for Load Combination +D+0.70E	1.590 k-ft	5.156

Maximum Shear	Actual	Allowable
Vertical Loads for Load Combination +D+L	40.063 psi	50.312 psi
Lateral Loads for Load Combination +D+0.70E	2.666 psi	44.721 psi

Masonry Beam

Project File: 26-501 vertical design.ec6

DESCRIPTION: L1

Vertical Strength

As	0.880	in^2
rho	0.003846	
np	0.06197	
k : ((np)^2+2np)^.5-np	0.2955	
j = 1 - k/3	0.9015	
M:mas=Fb k j b d^2/2	68.572	k-ft
M:Stl = Fs As j d	63.474	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.440	in^2
rho	0.002857	
np	0.04603	
k : (np^2+2np)^.5-np	0.2608	
j = 1 - k/3	0.9131	
M:mas=Fb k j b d^2/2	6.620	k-ft
M:Stl = Fs As j d	5.156	k-ft

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	18.85	63.47	21.95	50.31	0.00	5.16	0.00	44.72
+D+L	34.52	63.47	40.06	50.31	0.00	5.16	0.00	44.72
+D+0.750L	30.59	63.47	35.54	50.31	0.00	5.16	0.00	44.72
+D+0.60W	18.85	63.47	21.95	50.31	0.72	5.16	1.21	44.72
+D+0.450W	18.85	63.47	21.95	50.31	0.54	5.16	0.91	44.72
+0.60D+0.60W	11.31	63.47	13.17	50.31	0.72	5.16	1.21	44.72
+D+0.70E	18.85	63.47	21.95	50.31	1.59	5.16	2.67	44.72
+D+0.750L+0.5250E	30.59	63.47	35.54	50.31	1.19	5.16	2.00	44.72
+0.60D+0.70E	11.31	63.47	13.17	50.31	1.59	5.16	2.67	44.72

Masonry Beam

Project File: 26-501 vertical design.ec6

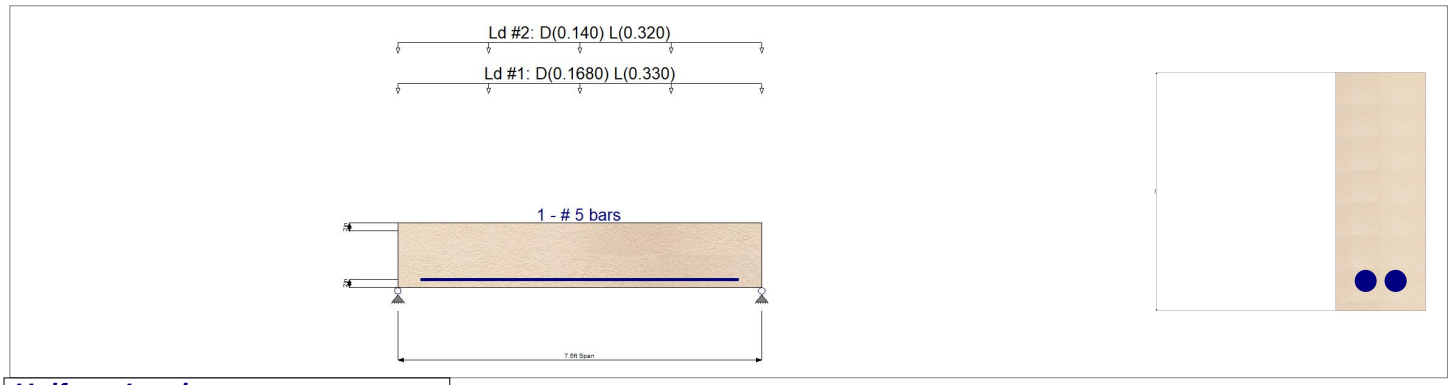
DESCRIPTION: L2

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

f'm	2,000.0 psi	Clear Span	7.50 ft	Rebar Size	5
Fs	32,000.0 psi	Beam Depth	1.330 ft	# Bars E/F	1
Em = f'm *	900.0	Thickness	6 in	Top Clear	2.0 in
Wall Wt Mult.	1.0	End Fixity	Pin-Pin	Btm Clear	2.0 in
Block Type	Normal Wt	Equiv. Solid Thick	5.620 in	# Bar Sets	1
Lateral Wind Load	15.0 psf	Wall Weight	64.0 psf	Bar Spacing	2.0 in
Beam is Fully Braced ?	Yes	E	1,800.0 ksi		
Lateral Wall Weight Seismic Factor	0.330	n	16.111		
Calculate vertical beam weight ?	Yes				
Note! Shear calculated at "d/2" from edge of bear					



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	7.50 ft	0.1680	0.330				k/ft
#2	ft	7.50 ft	0.140	0.320				k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.5225	0.0	**0.5225** : 1.00
fv/Fv	0.7320	0.0	**0.7320** : 1.00

Minimum Mn = 1.3 * Fcr * S = 2.587 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads for Load Combination D+L	7.334 k-ft	14.038 k-ft
Lateral Loads for Load Combination D+0.70E	0.1382 k-ft	2.564

Maximum Shear

	Actual	Allowable
Vertical Loads for Load Combination D+L	36.830 psi	50.312 psi
Lateral Loads for Load Combination D+0.70E	1.212 psi	44.721 psi

Vertical Strength

As	0.620 in^2
rho	0.007896
np	0.1272
k : ((np)^2+2np)^.5-np	0.3930
j = 1 - k/3	0.8690
M:mas=Fb k j b d^2/2	14.038 k-ft
M:Stl = Fs As j d	20.057 k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310 in^2
rho	0.005095
np	0.08208
k : (np^2+2np)^.5-np	0.3313
j = 1 - k/3	0.8896
M:mas=Fb k j b d^2/2	2.564 k-ft
M:Stl = Fs As j d	2.804 k-ft

Masonry Beam

Project File: 26-501 vertical design.ec6

DESCRIPTION: L2

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	2.76	14.04	13.88	50.31	0.00	2.56	0.00	44.72
+D+L	7.33	14.04	36.83	50.31	0.00	2.56	0.00	44.72
+D+0.750L	6.19	14.04	31.09	50.31	0.00	2.56	0.00	44.72
+D+0.60W	2.76	14.04	13.88	50.31	0.08	2.56	0.74	44.72
+D+0.450W	2.76	14.04	13.88	50.31	0.06	2.56	0.55	44.72
+0.60D+0.60W	1.66	14.04	8.33	50.31	0.08	2.56	0.74	44.72
+D+0.70E	2.76	14.04	13.88	50.31	0.14	2.56	1.21	44.72
+D+0.750L+0.5250E	6.19	14.04	31.09	50.31	0.10	2.56	0.91	44.72
+0.60D+0.70E	1.66	14.04	8.33	50.31	0.14	2.56	1.21	44.72

Masonry Beam

Project File: 26-501 vertical design.ec6

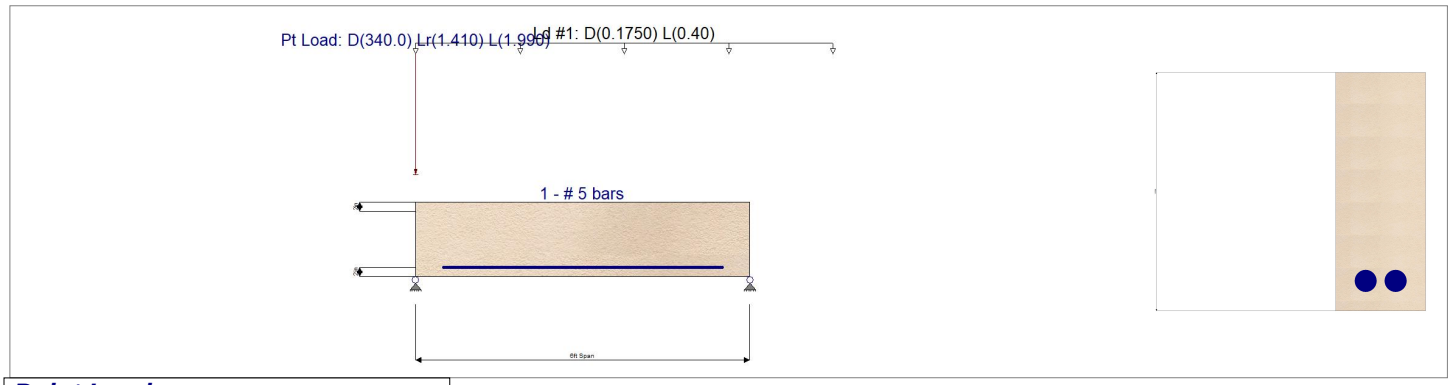
DESCRIPTION: L3

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

f'm	2,000.0	psi	Clear Span	6.0	ft	Rebar Size	5
Fs	32,000.0	psi	Beam Depth	1.330	ft	# Bars E/F	1
Em = f'm *	900.0		Thickness	6	in	Top Clear	2.0 in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin		Btm Clear	2.0 in
Block Type	Normal Wt		Equiv. Solid Thick	5.620	in	# Bar Sets	1
Lateral Wind Load	15.0	psf	Wall Weight	64.0	psf	Bar Spacing	2.0 in
Beam is Fully Braced ?	Yes		E	1,800.0	ksi		
Lateral Wall Weight Seismic Factor	0.330		n	16.111			
Calculate vertical beam weight ?	Yes						
Note! Shear calculated at "d/2" from edge of bear							



Point Loads

	Distance		Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1		ft	340.0	1.990	1.410			k
#2		ft						k
#3		ft						k
#4		ft						k

Uniform Loads

	Start X		End X		Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1		ft	7.50	ft	0.1750	0.40				k/ft
#2		ft		ft						k/ft
#3		ft		ft						k/ft
#4		ft		ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.2116	0.0	**0.2116** : 1.00
fv/Fv	0.3555	0.0	**0.3555** : 1.00

Minimum Mn = 1.3 * Fcr * S = 2.587 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads for Load Combination +D+L	2.971 k-ft	14.038 k-ft
Lateral Loads for Load Combination +D+0.70E	0.08845 k-ft	2.564

Maximum Shear

	Actual	Allowable
Vertical Loads for Load Combination +D+L	17.888 psi	50.312 psi
Lateral Loads for Load Combination +D+0.70E	0.9694 psi	44.721 psi

Masonry Beam

Project File: 26-501 vertical design.ec6

DESCRIPTION: L3

Vertical Strength

As	0.620	in^2
rho	0.007896	
np	0.1272	
k : ((np)^2+2np)^.5-np	0.3930	
j = 1 - k/3	0.8690	
M:mas=Fb k j b d^2/2	14.038	k-ft
M:Stl = Fs As j d	20.057	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310	in^2
rho	0.005095	
np	0.08208	
k : (np^2+2np)^.5-np	0.3313	
j = 1 - k/3	0.8896	
M:mas=Fb k j b d^2/2	2.564	k-ft
M:Stl = Fs As j d	2.804	k-ft

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	1.17	14.04	7.05	50.31	0.00	2.56	0.00	44.72
+D+L	2.97	14.04	17.89	50.31	0.00	2.56	0.00	44.72
+D+Lr	1.17	14.04	7.05	50.31	0.00	2.56	0.00	44.72
+D+0.750Lr+0.750L	2.52	14.04	15.18	50.31	0.00	2.56	0.00	44.72
+D+0.750L	2.52	14.04	15.18	50.31	0.00	2.56	0.00	44.72
+D+0.60W	1.17	14.04	7.05	50.31	0.05	2.56	0.59	44.72
+D+0.750Lr+0.450W	1.17	14.04	7.05	50.31	0.04	2.56	0.44	44.72
+D+0.450W	1.17	14.04	7.05	50.31	0.04	2.56	0.44	44.72
+0.60D+0.60W	0.70	14.04	4.23	50.31	0.05	2.56	0.59	44.72
+D+0.70E	1.17	14.04	7.05	50.31	0.09	2.56	0.97	44.72
+D+0.750L+0.5250E	2.52	14.04	15.18	50.31	0.07	2.56	0.73	44.72
+0.60D+0.70E	0.70	14.04	4.23	50.31	0.09	2.56	0.97	44.72

Multiple Simple Beam

Project File: 26-501 vertical design.ec6

Description :

Wood Beam Design : GB1

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **8x16, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.1

Fb - Tension	1350 psi	Fc - Prll	925 psi	Fv	170 psi	Ebend- xx	1600 ksi	Density	31.21 pcf
Fb - Compr	1350 psi	Fc - Perp	625 psi	Ft	675 psi	Eminbend - xx	580 ksi		

Wood Beam Design : GB1

Calculations per NDS 2018, IBC 2021, ASCE 7-16

BEAM Size : **8x16, Sawn, Fully Unbraced**
Using Allowable Stress Design with ASCE 7-16 Load Combinations, Major Axis Bending
Wood Species : Douglas Fir-Larch Wood Grade : No.1

Fb - Tension	1350 psi	Fc - Prll	925 psi	Fv	170 psi	Ebend- xx	1600 ksi	Density	31.21 pcf
Fb - Compr	1350 psi	Fc - Perp	625 psi	Ft	675 psi	Eminbend - xx	580 ksi		

Applied Loads

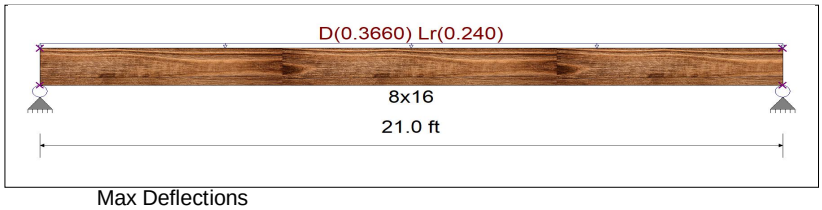
Beam self weight calculated and added to loads
Unif Load: D = 0.03050, Lr = 0.020 k/ft, Trib= 12.0 ft

Design Summary

Max fb/Fb Ratio = **0.865** : 1
fb : Actual : 1,390.34 psi at 10.500 ft in Span # 1
Fb : Allowable : 1,606.59 psi
Load Comb : +D+Lr

Max fv/FvRatio = **0.354** : 1
fv : Actual : 75.25 psi at 19.740 ft in Span # 1
Fv : Allowable : 212.50 psi
Load Comb : +D+Lr

Max Reactions (k)	D	Lr	L	S	W	E	H
Left Support	4.11	2.52					
Right Support	4.11	2.52					



Max Deflections

Transient Downward	0.284 in	Total Downward	0.746 in
Ratio	888	Ratio	337
	LC: Lr Only		LC: +D+Lr
Transient Upward	0.000 in	Total Upward	0.000 in
Ratio	9999	Ratio	9999
	LC:		LC:

Masonry Beam

Project File: 26-501 vertical design.ec6

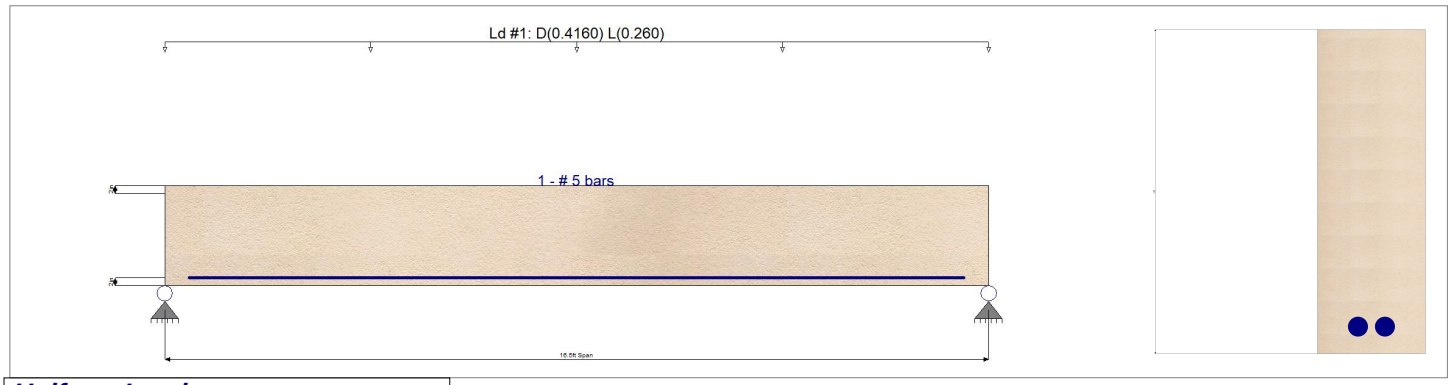
DESCRIPTION: GL1

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

f'm	2,000.0	psi	Clear Span	16.50	ft	Rebar Size	5.0
Fs	32,000.0	psi	Beam Depth	2.0	ft	# Bars E/F	1
Em = f'm *	900.0		Thickness	8	in	Top Clear	2.0 in
Wall Wt Mult.	1.0		End Fixity	Pin-Pin		Btm Clear	2.0 in
Block Type	Normal Wt		Equiv. Solid Thick	7.60	in	# Bar Sets	1
Lateral Wind Load	15.0	psf	Wall Weight	86.0	psf	Bar Spacing	2.0 in
Beam is Fully Braced ?	Yes		E	1,800.0	ksi		
Lateral Wall Weight Seismic Factor	0.330		n	16.111			
Calculate vertical beam weight ?	Yes						



Uniform Loads

	Start X	End X	Dead Load	L : Floor Live	Lr : Roof Live	S : Snow	W : Wind	E : Earthquake
#1	ft	16.50 ft	0.4160	0.260				k/ft
#2	ft	ft						k/ft
#3	ft	ft						k/ft
#4	ft	ft						k/ft

DESIGN SUMMARY

Design OK

Maximum Stress Ratios...

	Vertical	Lateral	SRSS Combination
fb/Fb	0.8785	0.0	**0.8785** : 1.00
fv/Fv	0.7599	0.0	**0.7599** : 1.00

Minimum Mn = 1.3 * Fcr * S = 7.930 k-ft

Maximum Moment

	Actual	Allowable
Vertical Loads for Load Combination D+L	28.858 k-ft	32.849 k-ft
Lateral Loads for Load Combination D+0.70E	1.352 k-ft	3.642

Maximum Shear

	Actual	Allowable
Vertical Loads for Load Combination D+L	38.230 psi	50.312 psi
Lateral Loads for Load Combination D+0.70E	2.838 psi	44.721 psi

Vertical Strength

As	0.620	in^2
rho	0.003696	
np	0.05955	
k : ((np)^2+2np)^.5-np	0.2907	
j = 1 - k/3	0.9031	
M:mas=Fb k j b d^2/2	36.327	k-ft
M:Stl = Fs As j d	32.849	k-ft

Lateral Strength

(Checking lateral bending for span)

As	0.310	in^2
rho	0.002684	
np	0.04324	
k : (np^2+2np)^.5-np	0.2540	
j = 1 - k/3	0.9153	
M:mas=Fb k j b d^2/2	4.846	k-ft
M:Stl = Fs As j d	3.642	k-ft

Masonry Beam

Project File: 26-501 vertical design.ec6

DESCRIPTION: GL1

Detailed Load Combination Results

Load Combinatic	Vertical				Lateral			
	Mmax k-ft	Mallow k-ft	fv : Vert psi	Fv : Vert psi	Mactual k-ft	Mallow k-ft	fv psi	Fv psi
D Only	20.01	32.85	26.51	50.31	0.00	3.64	0.00	44.72
+D+L	28.86	32.85	38.23	50.31	0.00	3.64	0.00	44.72
+D+0.750L	26.65	32.85	35.30	50.31	0.00	3.64	0.00	44.72
+D+0.60W	20.01	32.85	26.51	50.31	0.61	3.64	1.29	44.72
+D+0.450W	20.01	32.85	26.51	50.31	0.46	3.64	0.96	44.72
+0.60D+0.60W	12.01	32.85	15.90	50.31	0.61	3.64	1.29	44.72
+D+0.70E	20.01	32.85	26.51	50.31	1.35	3.64	2.84	44.72
+D+0.750L+0.5250E	26.65	32.85	35.30	50.31	1.01	3.64	2.13	44.72
+0.60D+0.70E	12.01	32.85	15.90	50.31	1.35	3.64	2.84	44.72

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SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

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SCALE _____

LATERAL DESIGN

☒ S4.0

$V_E = 18{,}000^{\#} / 2 \text{ walls} = 9000^{\#}$

☒ S3.0

$W_E = 0.7 \times 34 psf = 23.8 psf$

$W_{E_1} = 23.8 \times 16' = 381^{\#/'}$

$W_{E_2} = 23.8 \times 31' = 738^{\#/'}$

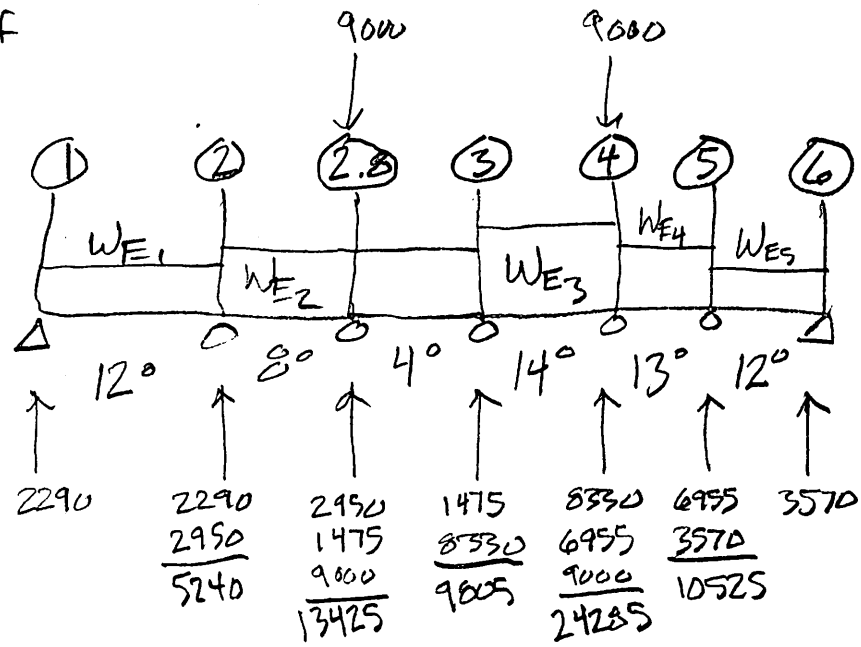
$W_{E_3} = 23.8 \times 50' = 1190^{\#/'}$

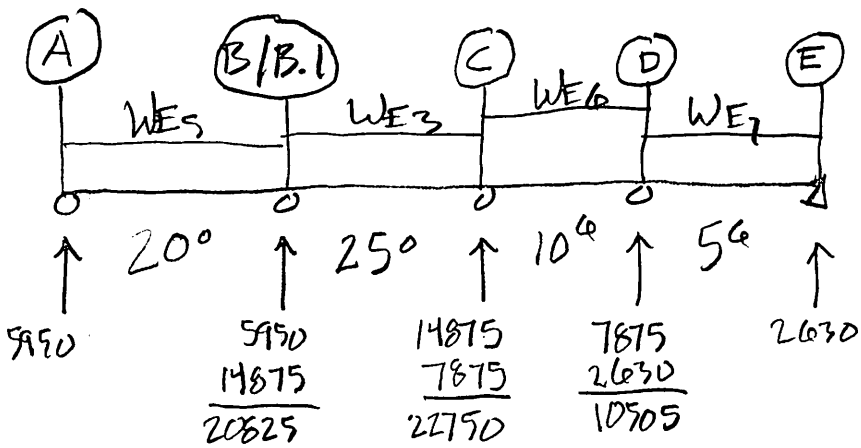
$W_{E_4} = 23.8 \times 45' = 1070^{\#/'}$

$W_{E_5} = 23.8 \times 25' = 595^{\#/'}$

$W_{E_6} = 23.8 \times 63' = 1500$

$W_{E_7} = 23.8 \times 40' = 955$





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52.0

$W_E = 14.7 psf \times .97 = 10.3 psf$

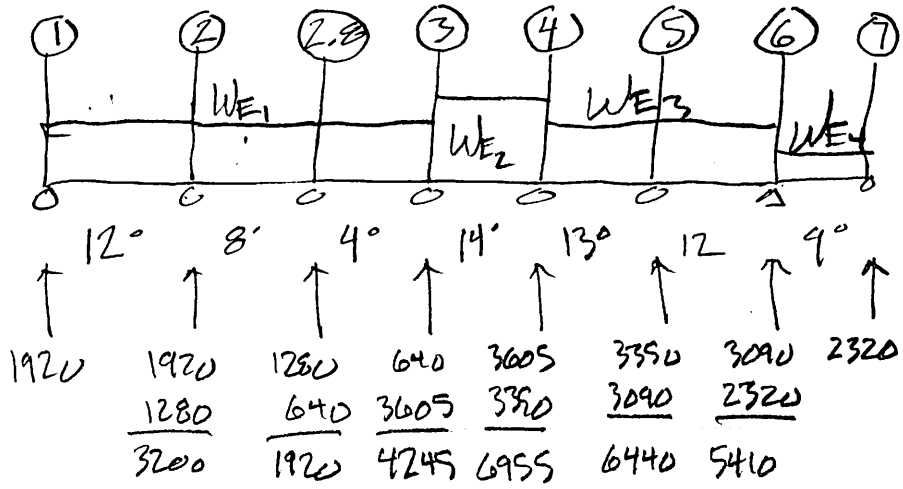
$W_E = 6.4 psf \times 0.7 = 4.5 psf$

$W_{E_1} = 10.3 psf \times 31' = 320^{\#}$

$W_{E_2} = 10.3 psf \times 50' = 515^{\#}$

$W_{E_3} = 10.3 \times 45 = 464^{\#}$

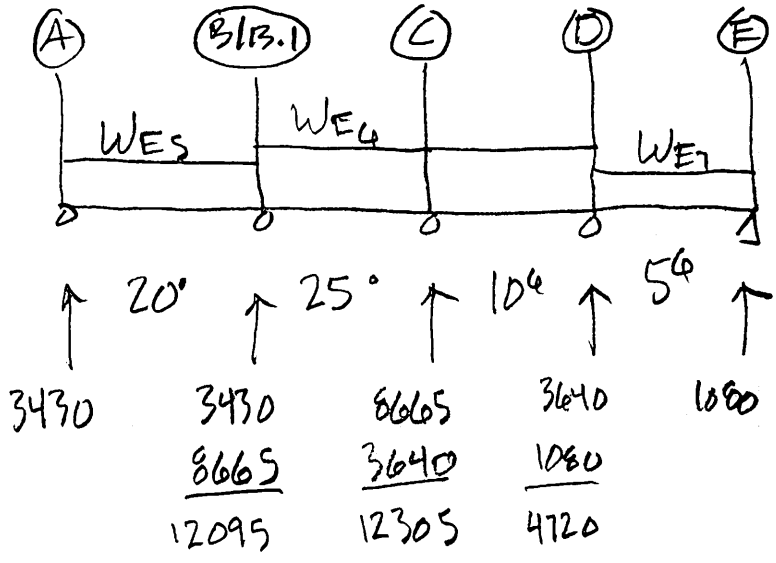
$W_{E_4} = 4.5 \times 24' = 108^{\#}$



$W_{E_5} = 10.3 \times 28 + 4.5 \times 12' = 343$

$W_{E_6} = 10.3 \times 62' + 4.5 \times 12 = 693$

$W_{E_7} = 10.3 \times 38' = 392$



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55.0 LATERAL DESIGN

$V_E = 13.6^k$

N-S

$$\frac{3'-0" \times 13.6^k}{3' + 2.5'} = 7.45'$$

SEE ENERCALC PRINT-OUT

USE #5@8"

W|

$V_E = 13.6^k$ $L = 16'-8"$

$$f_v = \frac{1.5 \times 13600^{\#}}{6" \times 16.6 \times 12} = 17 psi \rightarrow \#5@8" \text{ okay}$$

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SCALE _____

S.W. DESIGN

$F_V = \sqrt{f'_m} = \sqrt{2000} = 44.7$ psi

$f_v = \frac{1.5\,(V_E)}{MA \times 35\text{psi (UNREINFORCED)} \times L \times 12}$

☒ S4.0

LINE	Σ L [FT]	V_E [lb]	f_v [PSI]
2.8 & 4	11'	4830	10

☒ S3.0

1	10.5	1760	4
2	9'	8858	21
2.8	11.5	8235	15
3	20.5	7532	8
4	11.5	16578	31
5	13	8092	13
6	9	2742	7
A	16	4570	6
B/B.1	24	16000	14
C	35	22297	14
D	12	8052	14
E	15	6840	10

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SCALE _____

S2.0

LINE	EL [ft]	VE [#]	ABOVE VE [#]	SUM VE	fv [psi]
1	9	1920	1760	3680	9
2	9	3200	8858	12060	28
2.8	11.6	1920	8235	10155	19
3	20.5	4245	7532	11780	12
4	11	6955	16578	23535	45 ← SEE NEXT PAGE
5	13	6440	8092	14535	24
6	9	5410	2742	8155	19
7	—	2310		2310	—
A	16	3430	4570	8000	11
B/B1	20	12095	16000	28095	30
C	10.5	12305	22297	34602	67
D	19	4720	8052	12775	14
E	35	1080	6840	7920	5

#5	0.31						
#6	0.44	H inches		120			
#7	0.66		Es	29000000	n	29	
#8	1		Em	1000000			
b	6						
b	7.63						

WALL SEGMENTS

LINE	Ve								sum
1		3680	4.66	4.66					9.32
2		12060	4	3					7
2.8		10155	11.5						11.5
3		11780	21						21
4		23535	11.5						11.5
5		14535	4.66	3.33					7.99
6		8155	4.66	4.66					9.32
A		8000	4	8	4.66				16.66
B		28095	3.33	3.5	4	4	4	4	22.83
C		34602	4	6.66					10.66
D		12775	4	11.33	4.66				19.99
E		7920	15.3	20					35.3

d - Wall segments minus 8" [inches]

1		47.92	47.92				
2		40	28				
2.8		130					
3		244					
4		130					
5		47.92	31.96				
6		47.92	47.92				
A		40	88	47.92			
B		31.96	34	40	40	40	40
C		40	71.92				
D		40	127.96	47.92			
E		175.6	232				

Ve Segment on wall = Wi/sumW [pounds]

1	1840	1840	0	0	0	0
2	6891	5169	0	0	0	0
2.8	10155	0	0	0	0	0
3	11780	0	0	0	0	0
4	23535	0	0	0	0	0
5	8477	6058	0	0	0	0
6	4078	4078	0	0	0	0
A	1921	3842	2238	0	0	0
B	4098	4307	4922	4922	4922	4922
C	12984	21618	0	0	0	0
D	2556	7241	2978	0	0	0
E	3433	4487	0	0	0	0

	# bars	As
1	2	0.62
2	2	2.00
2.8	2	0.62
3	2	0.62
4	2	1.32
5	2	2.00
6	2	0.62
A	2	0.62
B	2	0.88
C	2	0.62
D	2	0.62
E	2	0.62

SEE ENERCALC DESIGNS BELOW FOR WALL DESIGNS

fb<500psi

1	120	120				
2	417	583				
2.8	133					
3	57					
4	228					
5	376	542				
6	266	266				
A	168	94	146			
B	463	439	382	382	382	382
C	1138	730				
D	224	97	194			
E	28	24				

fs<24000psi

1	8247.1	8247.1				
2	12376.7	13587.2				
2.8	16158.1					
3	9818.6					
4	18072.8					
5	12559.8	13824.2				
6	18275.9	18275.9				
A	10401.3	9147.8	10029.6			
B	20172.5	19859.8	19119.6	19119.6	19119.6	19119.6
C	70309.6	63466.8				
D	13842.6	11710.3	13348.1			
E	4008.7	3938.3				

Masonry Shear Wall

DESCRIPTION: Detached Garage line 2

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Wall Material	MASONRY		f'm	2.0	ksi	Block Class	
Total Wall Height		10.0 ft	Fy - Rebar	60.0	ksi	Concrete Density	150.0 pcf
Base Wall Length		2.50 ft	Fy - HJR	70.0	ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor			Em	3,120.0	ksi		
Ie: Seismic Import. Factor		1.0	Phi - Shear	0.80		Phi : Axial & Flexure	0.90

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	2.50 ft
Effective Length 'd'	22.0 in
Nominal Block Thickness	6.0 in
Solid Grout?	Solid Grouted

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	16 in
Horiz. joint reinf. area (HJR)	.55 in
HJR Spacing	48 in
Bond beam reinf. area	0.4 in
Spacing of bond beams	24 in

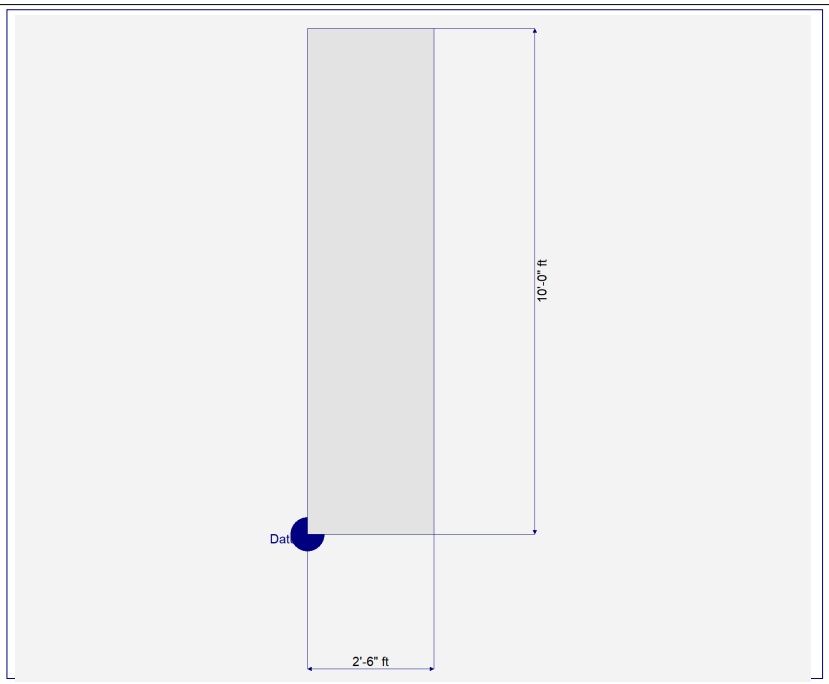
In each chord cell:

Vertical rebar size #	6
# Chord Cells @ Each End	2.0

Masonry Shear Wall

DESCRIPTION: Detached Garage line 2

Wall Sketch



Applied Concentrated Lateral Loads

	Load Magnitude (kips)					
Load "Y" Location (ft)	Dead Load	Roof Live Load	Floor Live Load	Wind Load	Seismic Load	Earth Load
10.0					6.180	

SHEAR ANALYSIS

	Bottom Level
Special Boundary Elements Req'd?	Not Req'd
Vu : Story Shear	7.178 k
for Load Combination	+1.512D+E
Controlling Mu/(Vud)	1.00
Vn Masonry	17.570 k
Vn Steel	21.625 k
Vn Masonry + Vn Steel	39.195 k
Vn Max	30.160 k
Phi Vn	24.128 k
Ratio: Vu/PhiVn (controlling)	**0.2975**
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

Masonry Shear Wall

DESCRIPTION: Detached Garage line 2

AXIAL ANALYSIS

	Bottom Level
H / d Ratio	5.45
Pu	2.419 k
for Load Combination	+1.512D+E
Phi Pn	+1.512D+E k
Ratio: Pu/PhiPn (controlling)	**0.009471**

BENDING ANALYSIS

	Bottom Level
"a" : Flexural compression	5.87 in
Length of defined chord zone is >= the "a" dimension of the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	22.0
As-flex < As-max ?	.880 <= 1.462
Mu	61.80 k
for Load Combination	+1.512D+E
Phi Mn	75.504 k
Ratio: Mu/PhiMn (controlling)	**0.8185**

Force Summary

Load Combination / Wall Level	Values for Wall section Vu (k)	Mu (k)	Pu (k)	Resultant Ecc (ft)	Overturning Ratio	Uplift (k) Left	Right
+1.40D							
Wall Level : 1			2.240				
+1.20D							
Wall Level : 1			1.920				
+0.90D							
Wall Level : 1			1.440				
+1.512D+E							
Wall Level : 1	7.178	61.800	2.419	25.546	0.032	32.618	32.618
+1.512D-E							
Wall Level : 1	7.178	61.800	2.419	25.546	0.032	32.618	32.618
+0.5880D+E							
Wall Level : 1	7.178	61.800	0.941	65.689	0.032	32.618	32.618
+0.5880D-E							
Wall Level : 1	7.178	61.800	0.941	65.689	0.032	32.618	32.618

Masonry Shear Wall

DESCRIPTION: Detached Garage line 2

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	3.0 ksi	Rebar Cover	3.0 in
Wall Length	2.50 ft	Fy	60.0 ksi	Footing Thickness	24.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	4.50 ft				

Max Factored Soil Pressures

@ Left Side of Footing	669.04	psf
.... governing load comb	+1.40D	
@ Right Side of Footing	669.04	psf
.... governing load comb	+1.40D	

Max UNfactored Soil Pressures

@ Left Side of Footing	477.882	psf
.... governing load comb	D Only	
@ Right Side of Footing	477.882	psf
.... governing load comb	D Only	

Footing One-Way Shear Check...

vu @ Left End of Footing	0.0	psi
vu @ Right End of Footing	0.0	psi
vn * phi : Allowable	93.113	psi

Overturning Stability...

	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	56.804 k-ft	56.804 k-ft
Resisting Moment	5.076 k-ft	5.076 k-ft
Stability Ratio	0.08936 : 1	0.08936 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

	@ Left End	@ Right End
Mu	0.6690 k-ft	0.6690 k-ft
Ru	0.8428 psi	0.8428 psi
As % Req'd	0.00180 in^2	0.00180 in^2
As Req'd in Footing Width	1.037 in^2	1.037 in^2

Masonry Shear Wall

DESCRIPTION: Line C

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Wall Material	MASONRY		f'm	2.0	ksi	Block Class	
Total Wall Height		10.0 ft	Fy - Rebar	60.0	ksi	Concrete Density	150.0 pcf
Base Wall Length		4.0 ft	Fy - HJR	70.0	ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor			Em	3,120.0	ksi		
Ie: Seismic Import. Factor		1.0	Phi - Shear	0.80		Phi : Axial & Flexure	0.90

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	4.0 ft
Effective Length 'd'	40.0 in
Nominal Block Thickness	6.0 in
Solid Grout?	Solid Grouted

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	16 in
Horiz. joint reinf. area (HJR)	0.55 in
HJR Spacing	48 in
Bond beam reinf. area	0.4 in
Spacing of bond beams	24 in

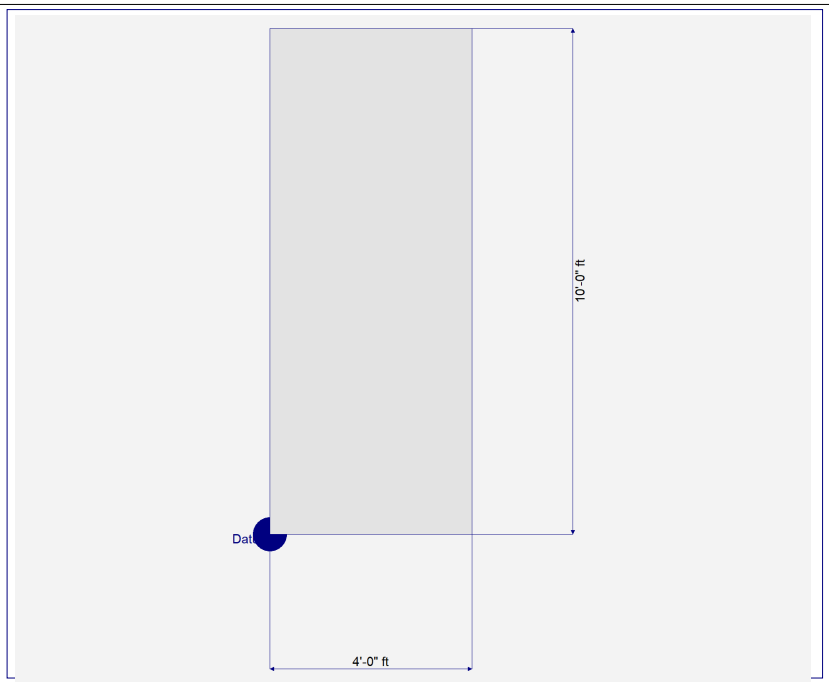
In each chord cell:

Vertical rebar size #	8
# Chord Cells @ Each End	2.0

Masonry Shear Wall

DESCRIPTION: Line C

Wall Sketch



SHEAR ANALYSIS

	Bottom Level
Special Boundary Elements Req'd?	Not Req'd
Vu : Story Shear	20.145 k
for Load Combination	+1.512D+E
Controlling Mu/(Vud)	1.00
Vn Masonry	28.112 k
Vn Steel	34.60 k
Vn Masonry + Vn Steel	62.712 k
Vn Max	48.256 k
Phi Vn	38.605 k
Ratio: Vu/PhiVn (controlling)	**0.5218**
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

AXIAL ANALYSIS

	Bottom Level
H / d Ratio	3.00
Pu	3.871 k
for Load Combination	+1.512D+E
Phi Pn	+1.512D+E k
Ratio: Pu/PhiPn (controlling)	**0.009562**

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line C

BENDING ANALYSIS

	Bottom Level
"a" : Flexural compression	10.53 in
Length of defined chord zone is >= the "a" dimension of the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	40.0
As-flex < As-max ?	580 <= 2.658
Mu	185.480 k
for Load Combination	+1.512D+E
Phi Mn	246.954 k
Ratio: Mu/PhiMn (controlling)	**0.7511**

Force Summary

Load Combination / Wall Level	Values for Wall section Vu (k)	Mu (k)	Pu (k)	Resultant Ecc (ft)	Overturning Ratio	Uplift (k) Left	Right
+1.40D							
Wall Level : 1			3.584				
+1.20D							
Wall Level : 1			3.072				
+0.90D							
Wall Level : 1			2.304				
+1.512D+E							
Wall Level : 1	20.145	185.480	3.871	47.919	0.028	54.108	54.108
+1.512D-E							
Wall Level : 1	20.145	185.480	3.871	47.919	0.028	54.108	54.108
+0.5880D+E							
Wall Level : 1	20.145	185.480	1.505	123.220	0.028	54.108	54.108
+0.5880D-E							
Wall Level : 1	20.145	185.480	1.505	123.220	0.028	54.108	54.108

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line C

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	3.0 ksi	Rebar Cover	3.0 in
Wall Length	4.0 ft	Fy	60.0 ksi	Footing Thickness	24.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	6.0 ft				

Max Factored Soil Pressures

@ Left Side of Footing 718.84 psf
.... governing load comb +1.40D

@ Right Side of Footing 718.84 psf
.... governing load comb +1.40D

Max UNfactored Soil Pressures

@ Left Side of Footing 513.46 psf
.... governing load comb D Only

@ Right Side of Footing 513.46 psf
.... governing load comb D Only

Footing One-Way Shear Check...

vu @ Left End of Footing 0.0 psi
vu @ Right End of Footing 0.0 psi
vn * phi : Allowable 93.113 psi

Overturning Stability...

	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	163.631 k-ft	163.631 k-ft
Resisting Moment	9.792 k-ft	9.792 k-ft
Stability Ratio	0.05984 : 1	0.05984 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

	@ Left End	@ Right End
Mu	0.7188 k-ft	0.7188 k-ft
Ru	0.9056 psi	0.9056 psi
As % Req'd	0.00180 in^2	0.00180 in^2
As Req'd in Footing Width	1.037 in^2	1.037 in^2

Masonry Shear Wall

DESCRIPTION: Line 2

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Wall Material	MASONRY		f'm	2.0	ksi	Block Class	
Total Wall Height		10.0 ft	Fy - Rebar	60.0	ksi	Concrete Density	150.0 pcf
Base Wall Length		3.0 ft	Fy - HJR	70.0	ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor			Em	3,120.0	ksi		
Ie: Seismic Import. Factor		1.0	Phi - Shear	0.80		Phi : Axial & Flexure	0.90

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	3.0 ft
Effective Length 'd'	28.0 in
Nominal Block Thickness	6.0 in
Solid Grout?	Solid Grouted

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	16 in
Horiz. joint reinf. area (HJR)	0.55 in
HJR Spacing	48 in
Bond beam reinf. area	0.4 in
Spacing of bond beams	24 in

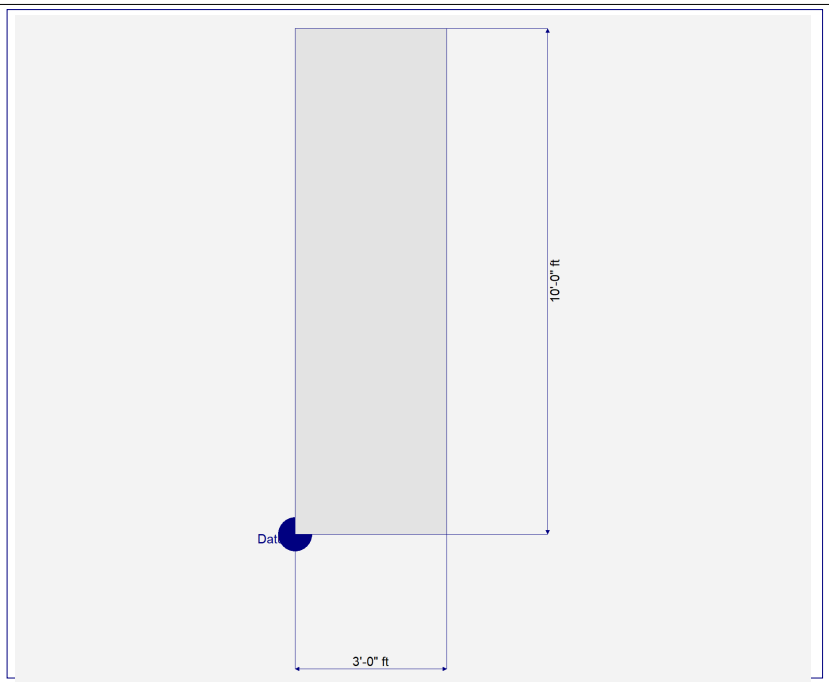
In each chord cell:

Vertical rebar size #	6
# Chord Cells @ Each End	2.0

Masonry Shear Wall

DESCRIPTION: Line 2

Wall Sketch



SHEAR ANALYSIS

	Bottom Level
Special Boundary Elements Req'd?	Not Req'd
Vu : Story Shear	8.583 k
for Load Combination	+1.512D+E
Controlling Mu/(Vud)	1.00
Vn Masonry	21.084 k
Vn Steel	25.950 k
Vn Masonry + Vn Steel	47.034 k
Vn Max	36.192 k
Phi Vn	28.954 k
Ratio: Vu/PhiVn (controlling)	**0.2964**
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

AXIAL ANALYSIS

	Bottom Level
H / d Ratio	4.29
Pu	2.903 k
for Load Combination	+1.512D+E
Phi Pn	+1.512D+E k
Ratio: Pu/PhiPn (controlling)	**0.009511**

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line 2

BENDING ANALYSIS

	Bottom Level
"a" : Flexural compression	5.87 in
Length of defined chord zone is >= the "a" dimension of the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	28.0
As-flex < As-max ?	880 <= 1.861
Mu	73.850 k
for Load Combination	+1.512D+E
Phi Mn	99.264 k
Ratio: Mu/PhiMn (controlling)	**0.7440**

Force Summary

Load Combination / Wall Level	Values for Wall section Vu (k)	Mu (k)	Pu (k)	Resultant Ecc (ft)	Overturning Ratio	Uplift (k) Left	Right
+1.40D							
Wall Level : 1			2.688				
+1.20D							
Wall Level : 1			2.304				
+0.90D							
Wall Level : 1			1.728				
+1.512D+E							
Wall Level : 1	8.583	73.850	2.903	25.439	0.039	30.416	30.416
+1.512D-E							
Wall Level : 1	8.583	73.850	2.903	25.439	0.039	30.416	30.416
+0.5880D+E							
Wall Level : 1	8.583	73.850	1.129	65.414	0.039	30.416	30.416
+0.5880D-E							
Wall Level : 1	8.583	73.850	1.129	65.414	0.039	30.416	30.416

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line 2

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	3.0 ksi	Rebar Cover	3.0 in
Wall Length	3.0 ft	Fy	60.0 ksi	Footing Thickness	24.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	5.0 ft				

Max Factored Soil Pressures

@ Left Side of Footing 688.96 psf
.... governing load comb +1.40D

@ Right Side of Footing 688.96 psf
.... governing load comb +1.40D

Max UNfactored Soil Pressures

@ Left Side of Footing 492.113 psf
.... governing load comb D Only

@ Right Side of Footing 492.113 psf
.... governing load comb D Only

Footing One-Way Shear Check...

vu @ Left End of Footing 0.0 psi
vu @ Right End of Footing 0.0 psi
vn * phi : Allowable 93.113 psi

Overturning Stability...

Overturning Stability...	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	67.905 k-ft	67.905 k-ft
Resisting Moment	6.480 k-ft	6.480 k-ft
Stability Ratio	0.09543 : 1	0.09543 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

Footing Bending Design...	@ Left End	@ Right End
Mu	0.6890 k-ft	0.6890 k-ft
Ru	0.8679 psi	0.8679 psi
As % Req'd	0.00180 in^2	0.00180 in^2
As Req'd in Footing Width	1.037 in^2	1.037 in^2

Masonry Shear Wall

DESCRIPTION: Line 5

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Wall Material	MASONRY		f'm	2.0	ksi	Block Class	
Total Wall Height		10.0 ft	Fy - Rebar	60.0	ksi	Concrete Density	150.0 pcf
Base Wall Length		3.330 ft	Fy - HJR	70.0	ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor			Em	3,120.0	ksi		
Ie: Seismic Import. Factor		1.0	Phi - Shear	0.80		Phi : Axial & Flexure	0.90

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	3.330 ft
Effective Length 'd'	31.960 in
Nominal Block Thickness	6.0 in
Solid Grout?	Solid Grouted

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	16 in
Horiz. joint reinf. area (HJR)	0.55 in
HJR Spacing	48 in
Bond beam reinf. area	0.4 in
Spacing of bond beams	24 in

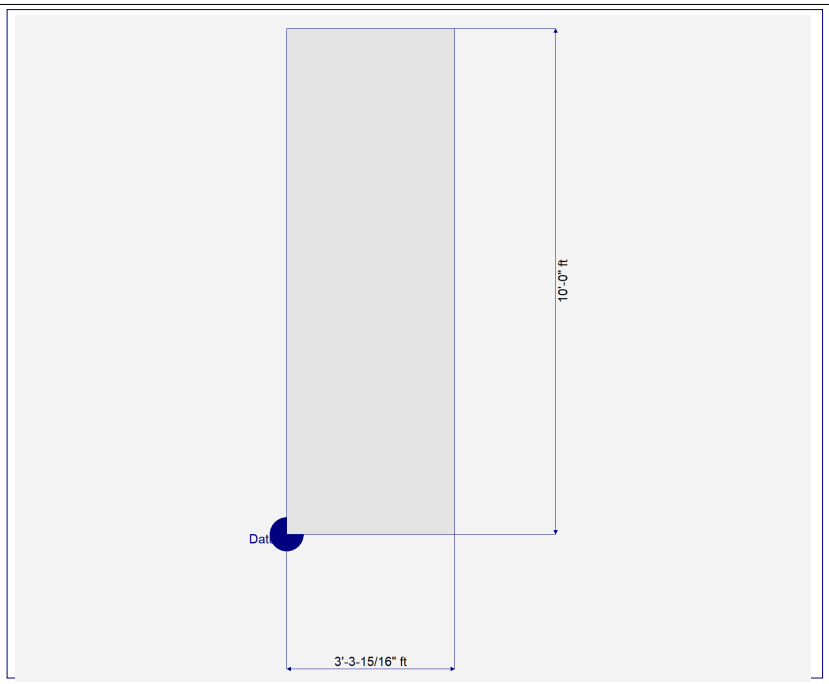
In each chord cell:

Vertical rebar size #	6
# Chord Cells @ Each End	2.0

Masonry Shear Wall

DESCRIPTION: Line 5

Wall Sketch



SHEAR ANALYSIS

	Bottom Level
Special Boundary Elements Req'd?	Not Req'd
Vu : Story Shear	9.985 k
for Load Combination	+1.512D+E
Controlling Mu/(Vud)	1.00
Vn Masonry	23.403 k
Vn Steel	28.805 k
Vn Masonry + Vn Steel	52.208 k
Vn Max	40.173 k
Phi Vn	32.139 k
Ratio: Vu/PhiVn (controlling)	**0.3107**
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

AXIAL ANALYSIS

	Bottom Level
H / d Ratio	3.75
Pu	3.222 k
for Load Combination	+1.512D+E
Phi Pn	+1.512D+E k
Ratio: Pu/PhiPn (controlling)	**0.009532**

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line 5

BENDING ANALYSIS

	Bottom Level
"a" : Flexural compression	5.87 in
Length of defined chord zone is >= the "a" dimension of the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	31.960
As-flex < As-max ?	880 <= 2.124
Mu	86.550 k
for Load Combination	+1.512D+E
Phi Mn	114.946 k
Ratio: Mu/PhiMn (controlling)	**0.7530**

Force Summary

Load Combination / Wall Level	Values for Wall section Vu (k)	Mu (k)	Pu (k)	Resultant Ecc (ft)	Overturning Ratio	Uplift (k) Left	Right
+1.40D							
Wall Level : 1			2.984				
+1.20D							
Wall Level : 1			2.557				
+0.90D							
Wall Level : 1			1.918				
+1.512D+E							
Wall Level : 1	9.985	86.550	3.222	26.859	0.041	31.165	31.165
+1.512D-E							
Wall Level : 1	9.985	86.550	3.222	26.859	0.041	31.165	31.165
+0.5880D+E							
Wall Level : 1	9.985	86.550	1.253	69.066	0.041	31.165	31.165
+0.5880D-E							
Wall Level : 1	9.985	86.550	1.253	69.066	0.041	31.165	31.165

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Line 5

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	3.0 ksi	Rebar Cover	3.0 in
Wall Length	3.330 ft	Fy	60.0 ksi	Footing Thickness	24.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	5.330 ft				

Max Factored Soil Pressures

@ Left Side of Footing 700.06 psf
.... governing load comb +1.40D

@ Right Side of Footing 700.06 psf
.... governing load comb +1.40D

Max UNfactored Soil Pressures

@ Left Side of Footing 500.04 psf
.... governing load comb D Only

@ Right Side of Footing 500.04 psf
.... governing load comb D Only

Footing One-Way Shear Check...

vu @ Left End of Footing 0.0 psi
vu @ Right End of Footing 0.0 psi
vn * phi : Allowable 93.113 psi

Overturning Stability...

	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	79.218 k-ft	79.218 k-ft
Resisting Moment	7.499 k-ft	7.499 k-ft
Stability Ratio	0.09466 : 1	0.09466 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

	@ Left End	@ Right End
Mu	0.7001 k-ft	0.7001 k-ft
Ru	0.8819 psi	0.8819 psi
As % Req'd	0.00180 in^2	0.00180 in^2
As Req'd in Footing Width	1.037 in^2	1.037 in^2

Masonry Shear Wall

DESCRIPTION: Detached Garage line 2

Code References

Calculations per TMS 402-16, IBC 2021, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Wall Material	MASONRY		f'm	2.0	ksi	Block Class	
Total Wall Height		10.0 ft	Fy - Rebar	60.0	ksi	Concrete Density	150.0 pcf
Base Wall Length		2.50 ft	Fy - HJR	70.0	ksi	Min. Bending As %	0.00180
R: Resp. Mod Factor			Em	3,120.0	ksi		
Ie: Seismic Import. Factor		1.0	Phi - Shear	0.80		Phi : Axial & Flexure	0.90

Wall Data

	Bottom
Analysis Height	0.00 ft
Wall Offset	(datum) ft
Wall Length	2.50 ft
Effective Length 'd'	22.0 in
Nominal Block Thickness	6.0 in
Solid Grout?	Solid Grouted

Reinforcing in Field of Wall

Vertical Bar Size #	5
Vertical Bar Spacing	16 in
Horiz. joint reinf. area (HJR)	.55 in
HJR Spacing	48 in
Bond beam reinf. area	0.4 in
Spacing of bond beams	24 in

In each chord cell:

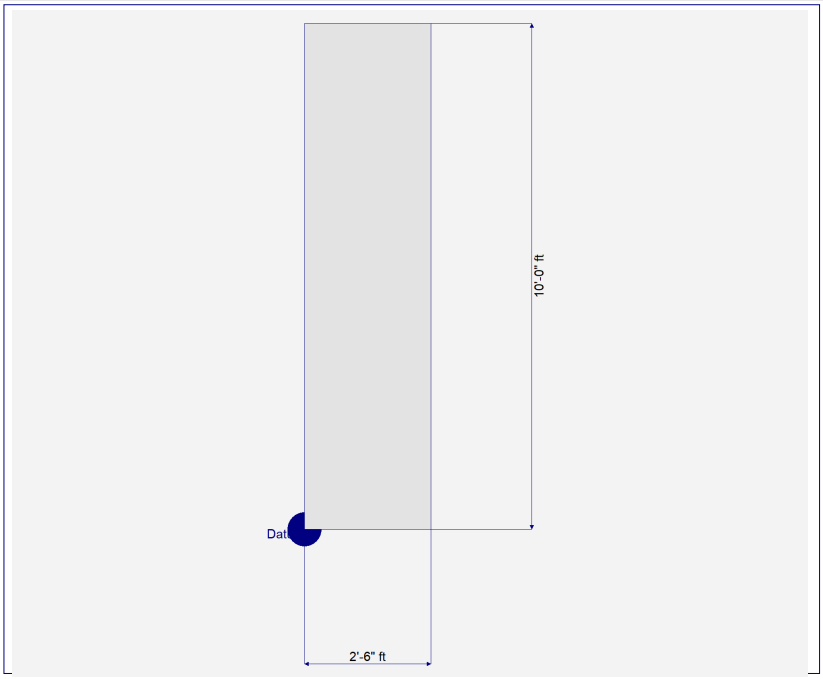
Vertical rebar size #	6
# Chord Cells @ Each End	2.0

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Detached Garage line 2

Wall Sketch



Applied Concentrated Lateral Loads

	Load Magnitude (kips)					
Load "Y" Location (ft)	Dead Load	Roof Live Load	Floor Live Load	Wind Load	Seismic Load	Earth Load
10.0					6.180	

SHEAR ANALYSIS

	Bottom Level
Special Boundary Elements Req'd?	Not Req'd
Vu : Story Shear	7.178 k
for Load Combination	+1.512D+E
Controlling Mu/(Vud)	1.00
Vn Masonry	17.570 k
Vn Steel	21.625 k
Vn Masonry + Vn Steel	39.195 k
Vn Max	30.160 k
Phi Vn	24.128 k
Ratio: Vu/PhiVn (controlling)	**0.2975**
Vertical As >= Av/3	OK
Vertical Bar Spacing <= 96"	OK

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Detached Garage line 2

AXIAL ANALYSIS

	Bottom Level
H / d Ratio	5.45
Pu	2.419 k
for Load Combination	+1.512D+E
Phi Pn	+1.512D+E k
Ratio: Pu/PhiPn (controlling)	**0.009471**

BENDING ANALYSIS

	Bottom Level
"a" : Flexural compression	5.87 in
Length of defined chord zone is >= the "a" dimension of the masonry (the compression zone)	OK
"d" : Eff depth to tension reinf	22.0
As-flex < As-max ?	.880 <= 1.462
Mu	61.80 k
for Load Combination	+1.512D+E
Phi Mn	75.504 k
Ratio: Mu/PhiMn (controlling)	**0.8185**

Force Summary

Load Combination / Wall Level	Values for Wall section Vu (k)	Mu (k)	Pu (k)	Resultant Ecc (ft)	Overturning Ratio	Uplift (k) Left	Right
+1.40D							
Wall Level : 1			2.240				
+1.20D							
Wall Level : 1			1.920				
+0.90D							
Wall Level : 1			1.440				
+1.512D+E							
Wall Level : 1	7.178	61.800	2.419	25.546	0.032	32.618	32.618
+1.512D-E							
Wall Level : 1	7.178	61.800	2.419	25.546	0.032	32.618	32.618
+0.5880D+E							
Wall Level : 1	7.178	61.800	0.941	65.689	0.032	32.618	32.618
+0.5880D-E							
Wall Level : 1	7.178	61.800	0.941	65.689	0.032	32.618	32.618

Masonry Shear Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Detached Garage line 2

Footing Information

Footing Dimensions

Dist. Left	1.0 ft	f'c	3.0 ksi	Rebar Cover	3.0 in
Wall Length	2.50 ft	Fy	60.0 ksi	Footing Thickness	24.0 in
Dist. Right	1.0 ft			Width	2.0 ft
Total Ftg Length	4.50 ft				

Max Factored Soil Pressures

@ Left Side of Footing 669.04 psf
.... governing load comb +1.40D

@ Right Side of Footing 669.04 psf
.... governing load comb +1.40D

Max UNfactored Soil Pressures

@ Left Side of Footing 477.882 psf
.... governing load comb D Only

@ Right Side of Footing 477.882 psf
.... governing load comb D Only

Footing One-Way Shear Check...

vu @ Left End of Footing 0.0 psi
vu @ Right End of Footing 0.0 psi
vn * phi : Allowable 93.113 psi

Overturning Stability...

	@ Left End of Ftg	@ Right End of Ftg
Overturning Moment	56.804 k-ft	56.804 k-ft
Resisting Moment	5.076 k-ft	5.076 k-ft
Stability Ratio	0.08936 : 1	0.08936 : 1
.... governing load comb	+0.60D+0.70E	+0.60D+0.70E

Footing Bending Design...

	@ Left End	@ Right End
Mu	0.6690 k-ft	0.6690 k-ft
Ru	0.8428 psi	0.8428 psi
As % Req'd	0.00180 in^2	0.00180 in^2
As Req'd in Footing Width	1.037 in^2	1.037 in^2

WYNN ENGINEERING INC.
27315 Valley Center Road
Valley Center, CA 92082
Valley Center (760) 749-8722
Los Angeles (310) 306-9728
www.wynnengineering.com

JOB _____

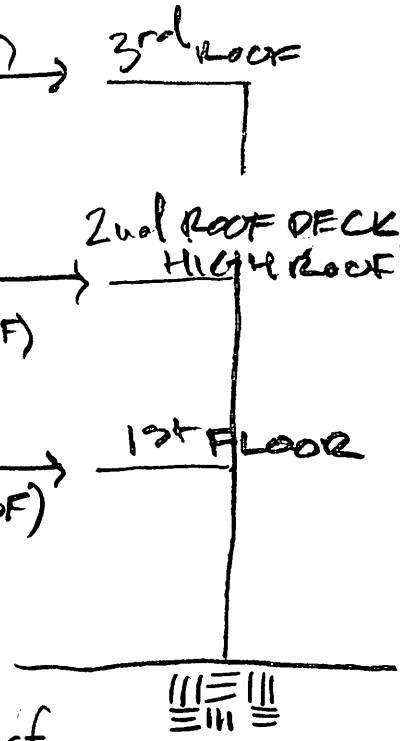
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

SEISMIC VERTICAL DISTRIBUTION - LOADING



WEIGHT AS PSF

10" INSULATED CMU GROUTED

V_3 = 18' x 1 WALL x 5' TRIB. WALL HT. x 73psf / 290 s.f.

V_3 = 23psf

$V_2 = \frac{63' \times 2 \text{ walls} \times 5' \text{ TRIB} \times 73 psf + 18' \times 73 \times 10'}{2130}$

V_2 = 28psf

V_1 = 63' x 2 walls x 10' TRIB. x 73psf / 2130sf = 44psf

V_3 (8" CMU) 8' x 2' WALLS x 5' x 75psf / 290sf = 21psf

ΣV_3 = 45psf

V_2 (8" CMU) = 8' x 2 WALLS x 10' x 75 / 2130 = 26psf ΣV_2 = 35psf

V_1 = 8 x 2 x 5 x 75 / 2130 = 3psf ΣV_1 = 47psf

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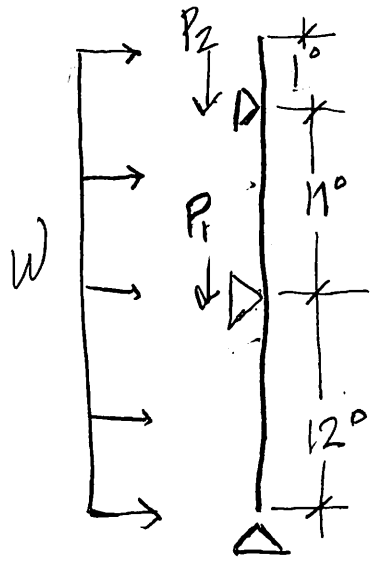
SLENDER WALL DESIGN - OUT OF PLANE

2 STORY



P_2

Dead = 12' x 24.5psf = 294#/1 x 1.33 = 391

LIVE = 12' x 100psf = 1200#/1 x 1.33 = 1596

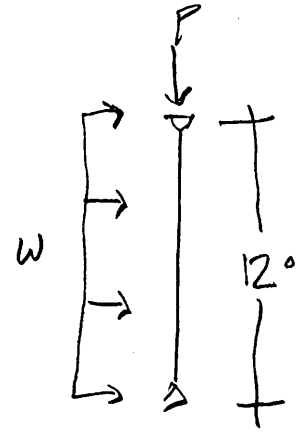
P_1 DEAD = 12' x 11.5psf = 210#/1 x 1.33 = 280

LIVE = 12' x 40psf = 480#/1 x 1.33 = 639

W_{WIND} = 20.44 psf

$W_{SEISMIC}$ = 0.4 x 0.7 x 125 x $\frac{8''}{12}$ = 24psf

1 STORY



P_{Dead} = 294#

P_{LIVE} = 1200#

W_W = 20.44 psf

W_E = 24psf

USE #4 BARS @ 16" O.C. Vertical

#4 BARS HORZ @ 24"

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Out-of Plane Design 1 Story

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Construction Type : Grouted Hollow Concrete Masonry

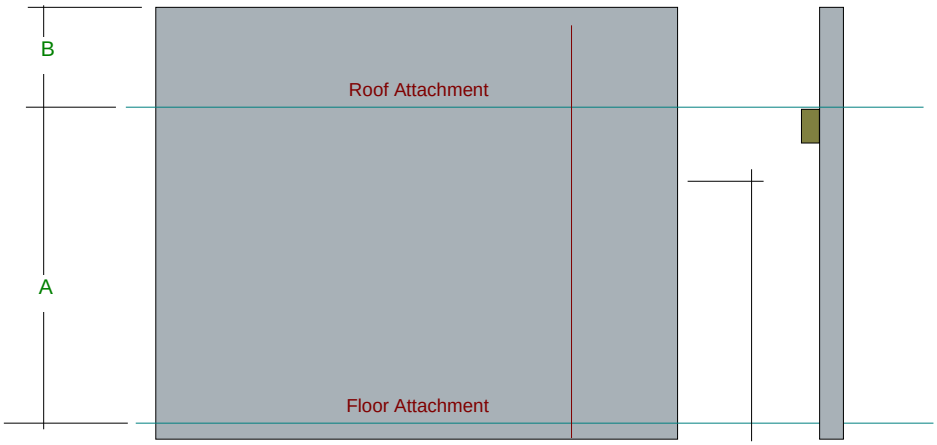
F'm	=	2.0 ksi	Nom. Wall Thickness	6	in	Temp Diff across thickness	=	deg F
Fy - Yield	=	40.0 ksi	Actual Thickness	5.625	in	Min Allow Out-of-plane Defl Ra	=	0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	2.8125	in			
Em = f'm *	=	900.0	Lower Level Rebar . . .			Minimum Vertical Steel %	=	0.0020
Max % of ρ bal.	=	0.01732	Bar Size	# 4				
Grout Density	=	140 pcf	Bar Spacing	16	in			
Block Weight		Normal Weight						
Wall Weight	=	64.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A	Clear Height	=	12.0 ft
B	Parapet height	=	2.0 ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . (Applied per foot of Strip Width)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	6.0 in	0.2940		1.20		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load 20.440 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : ASCE seismic factors entered

SDS Value per ASCE 12.11.1 S_{DS} * I = 1.560
Fp = Wall Wt. * 0.6240 = 39.936 psf

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Out-of Plane Design 1 Story

DESIGN SUMMARY

Results reported for "Strip Width" of 16.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check +1.512D+L+E	Maximum Bending Stress Rat	**0.8608**		
		Max Mu	1.740 k-ft	Phi * Mn	2.021 k-ft
PASS	Service Deflection Check +D+0.750L+0.5250E	Actual Defl. Ratio L/ Max. Deflection	261 0.5528 in	Allowable Defl. Ratio	150.0
PASS	Axial Load Check +1.512D+L+E	Max Pu / Ag Location	34.655 psi 7.0 ft	Max. Allow. Defl. 0.2 * f'm	0.960 in 400.0 psi
	Reinforcing Limit Check	Actual As/bd	0.004444	Max Allow As/bd	0.01732

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	0.4349 k
Base Horizontal	E Only	0.3106 k
Vertical Reaction	+D+L	3.187 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Axial Load 0.2*f'm*b*t k	Moment Values Mcr k-ft	Moment Values Mu k-ft	Moment Values Phi	Moment Values Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.40D at 11.60 to 12.00	0.627	27.024	0.32	0.21	0.90	1.20	0.150	0.0044	0.0170	0.00
+1.20D+1.60L at 11.60 to 12.00	2.458	27.024	0.32	1.14	0.90	1.54	0.150	0.0044	0.0157	0.00
+1.20D+L at 11.60 to 12.00	1.738	27.024	0.32	0.78	0.90	1.41	0.150	0.0044	0.0162	0.00
+1.20D+0.50W at 7.20 to 7.60	0.875	27.024	0.32	0.27	0.90	1.25	0.150	0.0044	0.0169	0.00
+1.20D-0.50W at 11.60 to 12.00	0.537	27.024	0.32	0.20	0.90	1.19	0.150	0.0044	0.0171	0.00
+1.20D+L+W at 8.00 to 8.40	2.014	27.024	0.32	0.91	0.90	1.46	0.150	0.0044	0.0160	0.00
+1.20D+L-W at 11.60 to 12.00	1.738	27.024	0.32	0.82	0.90	1.41	0.150	0.0044	0.0162	0.00
+0.90D+W at 6.00 to 6.40	0.725	27.024	0.32	0.42	0.90	1.22	0.150	0.0044	0.0170	0.00
+0.90D-W at 5.20 to 5.60	0.771	27.024	0.32	0.29	0.90	1.23	0.150	0.0044	0.0169	0.00
+1.512D+L+E at 6.80 to 7.20	2.341	27.024	0.32	1.30	0.90	1.52	0.150	0.0044	0.0158	0.00
+1.512D+L-E at 11.60 to 12.00	1.878	27.024	0.32	0.90	0.90	1.44	0.150	0.0044	0.0161	0.00
+0.5880D+E at 5.60 to 6.00	0.489	27.024	0.32	0.74	0.90	1.18	0.150	0.0044	0.0171	0.00
+0.5880D-E at 5.60 to 6.00	0.489	27.024	0.32	0.65	0.90	1.18	0.150	0.0044	0.0171	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Moment Values Mactual k-ft	Stiffness I gross in^4	Stiffness I cracked in^4	Stiffness I effective in^4	Deflections Deflection in	Deflections Defl. Ratio
D Only at 6.80 to 7.20	0.755	0.32	0.09	178.00	12.86	178.000	0.007	19,595.1
+D+L at 7.60 to 8.00	1.904	0.32	0.52	178.00	14.45	15.538	0.230	626.2
+D+0.750L at 8.00 to 8.40	1.578	0.32	0.42	178.00	14.01	16.641	0.120	1,195.2
+D+0.60W at 6.00 to 6.40	0.806	0.32	0.29	178.00	12.93	178.000	0.024	6,014.7
+D+0.450W at 6.00 to 6.40	0.806	0.32	0.23	178.00	12.93	178.000	0.020	7,285.7
+0.60D+0.60W at 6.00 to 6.40	0.484	0.32	0.25	178.00	12.47	178.000	0.021	6,856.2
+D+0.70E at 6.00 to 6.40	0.806	0.32	0.57	178.00	12.93	13.622	0.327	440.2
+D+0.750L+0.5250E at 6.40 to 6.80	1.680	0.32	0.75	178.00	14.15	14.428	0.553	260.5
+0.60D+0.70E at 6.00 to 6.40	0.484	0.32	0.53	178.00	12.47	13.355	0.278	518.2
L Only at 8.00 to 8.40	1.200	0.32	0.42	178.00	13.49	16.065	0.123	1,171.6
W Only at 5.60 to 6.00	0.000	0.32	0.35	178.00	11.75	20.252	0.044	3,270.0
E Only at 5.60 to 6.00	0.000	0.32	0.68	178.00	11.75	12.087	0.495	290.9

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Out-of Plane Design 1 Story

D Only	0.0 k	0.02 k	1.587 k
+D+L	0.1 k	0.08 k	3.187 k
+D+0.750L	0.1 k	0.07 k	2.787 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
+D+0.60W	0.1 k	0.12 k	1.587 k
+D+0.450W	0.1 k	0.08 k	1.587 k
+0.60D+0.60W	0.1 k	0.12 k	0.952 k
+D+0.70E	0.2 k	0.29 k	1.587 k
+D+0.750L+0.5250E	0.2 k	0.16 k	2.787 k
+0.60D+0.70E	0.2 k	0.30 k	0.952 k
L Only	0.1 k	0.07 k	1.600 k
W Only	0.2 k	0.22 k	0.000 k
E Only	0.3 k	0.43 k	0.000 k

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Out-of plane wall 2 stories

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Construction Type : Grouted Hollow Concrete Masonry

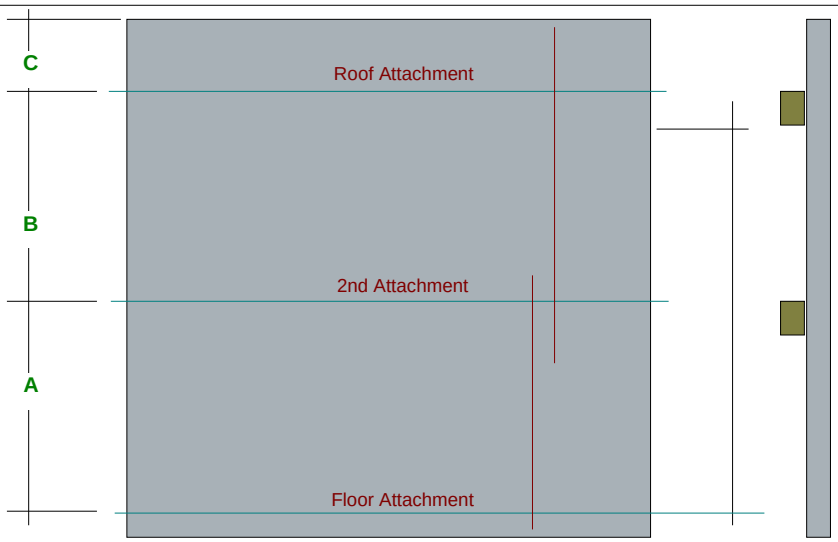
F'm	=	2.0 ksi	Nom. Wall Thickness	6 in	Temp Diff across thickness	=	deg F
Fy - Yield	=	40.0 ksi	Actual Thickness	5.625 in	Min Allow Out-of-plane Defl Ra	=	0.0
Fr - Rupture	=	61.0 psi	Rebar "d" distance	2.8125 in			
Em = f'm *	=	900.0	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020
Max % of ρ bal.	=	0.01694	Bar Size #	4			
Grout Density	=	140 pcf	Bar Spacing	16 in			
Block Weight		Normal Weight	Upper Level Rebar . . .				
Wall Weight	=	64.0 psf	Bar Size #	4			
		Wall is Solid Grouted	Bar Spacing	16 in			

Two-Story Wall Dimensions

A	1st Story Height	=	12.0 ft
B	2nd Story Height	=	10.0 ft
C	Parapet height	=	2.0 ft

Wall Support Condition Top & Bottom Pinned

Initial Lateral Disp. @ Top Support in



Vertical Loads

Vertical Uniform Loads . . . (Applied per foot of Strip Width)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	6.0 in	0.2940		1.20		k/ft
Concentric Load							k/ft

Mid-Height Vertical Uniform Loads . . . (Applied per foot of Strip Width)			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	6.0 in	0.210		0.480		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load 20.440 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 24.0 psf

Fp 1.0 = 24.0 psf

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Out-of plane wall 2 stories

DESIGN SUMMARY

Results reported for "Strip Width" of 16.0 in

Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS Moment Capacity Check	Maximum Bending Stress Rat	0.7364		
+1.20D+1.60L	Max Mu	1.515 k-ft	Phi * Mn	2.058 k-ft
PASS Service Deflection Check	Actual Defl. Ratio L/	950	Allowable Defl. Ratio	150.0
+D+L	Max. Deflection	0.1264 in		
PASS Axial Load Check	Max Pu / Ag	36.317 psi	Max. Allow. Defl.	0.80 in
+1.20D+1.60L	Location	21.833 ft	0.2 * f'm	400.0 psi
Reinforcing Limit Check	Actual As/bd	0.004444	Max Allow As/bd	0.01694

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	0.1851 k
Base Horizontal	E Only	0.1542 k
Mid-Ht Horizontal	E Only	0.4287 k
Vertical Reaction	+D+L	4.960 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.40D at 21.67 to 22.00	0.621	27.024	0.32	0.21	0.90	1.20	0.150	0.0044	0.0162	0.00
+1.20D+1.60L at 21.67 to 22.00	2.454	27.024	0.32	1.14	0.90	1.54	0.150	0.0044	0.0144	0.00
+1.20D+L at 21.67 to 22.00	1.733	27.024	0.32	0.78	0.90	1.41	0.150	0.0044	0.0151	0.00
+1.20D+0.50W at 12.00 to 12.33	1.274	27.024	0.32	0.22	0.90	1.33	0.150	0.0044	0.0164	0.00
+1.20D-0.50W at 21.67 to 22.00	0.532	27.024	0.32	0.20	0.90	1.19	0.150	0.0044	0.0164	0.00
+1.20D+L+W at 21.67 to 22.00	1.732	27.024	0.32	0.74	0.90	1.41	0.150	0.0044	0.0151	0.00
+1.20D+L-W at 21.67 to 22.00	1.733	27.024	0.32	0.82	0.90	1.41	0.150	0.0044	0.0151	0.00
+0.90D+W at 12.00 to 12.33	0.956	27.024	0.32	0.34	0.90	1.27	0.150	0.0044	0.0166	0.00
+0.90D-W at 11.60 to 12.00	1.168	27.024	0.32	0.25	0.90	1.31	0.150	0.0044	0.0166	0.00
+1.512D+L+E at 21.67 to 22.00	1.871	27.024	0.32	0.77	0.90	1.44	0.150	0.0044	0.0148	0.00
+1.512D+L-E at 21.67 to 22.00	1.871	27.024	0.32	0.87	0.90	1.44	0.150	0.0044	0.0148	0.00
+0.5880D+E at 12.00 to 12.33	0.624	27.024	0.32	0.36	0.90	1.20	0.150	0.0044	0.0169	0.00
+0.5880D-E at 11.60 to 12.00	0.763	27.024	0.32	0.30	0.90	1.23	0.150	0.0044	0.0169	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio
D Only at 18.33 to 18.67	0.657	0.32	0.07	178.00	13.98	178.000	0.034	3,490.2
+D+L at 19.00 to 19.33	1.814	0.32	0.44	178.00	16.12	18.409	0.126	949.6
+D+0.750L at 19.00 to 19.33	1.514	0.32	0.34	178.00	15.58	28.072	0.086	1,397.6
+D+0.60W at 18.00 to 18.33	0.678	0.32	0.13	178.00	14.01	178.000	0.058	2,082.0
+D+0.450W at 18.00 to 18.33	0.678	0.32	0.12	178.00	14.01	178.000	0.054	2,235.2
+0.60D+0.60W at 18.00 to 18.33	0.407	0.32	0.11	178.00	13.13	178.000	0.054	2,234.4
+D+0.70E at 18.00 to 18.33	0.678	0.32	0.15	178.00	14.01	178.000	0.058	2,071.5
+D+0.750L+0.5250E at 18.67 to 19.00	1.535	0.32	0.39	178.00	15.62	19.624	0.124	965.5
+0.60D+0.70E at 18.00 to 18.33	0.407	0.32	0.13	178.00	13.13	178.000	0.059	2,018.8
L Only at 19.00 to 19.33	1.200	0.32	0.34	178.00	14.15	25.302	0.095	1,265.9
W Only at 17.67 to 18.00	0.000	0.32	0.11	178.00	11.75	178.000	0.059	2,033.6
E Only at 17.67 to 18.00	0.000	0.32	0.12	178.00	11.75	178.000	0.058	2,055.6

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base

Masonry Slender Wall

DESCRIPTION: Out-of plane wall 2 stories

D Only	0.0 k	0.027 k	0.03 k	2.720 k
+D+L	0.0 k	0.163 k	0.15 k	4.960 k
+D+0.750L	0.0 k	0.131 k	0.12 k	4.400 k

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Mid Horizontal	Top Horizontal	Vertical @ Wall Base
+D+0.60W	0.1 k	0.244 k	0.07 k	2.720 k
+D+0.450W	0.1 k	0.188 k	0.04 k	2.720 k
+0.60D+0.60W	0.1 k	0.231 k	0.08 k	1.632 k
+D+0.70E	0.1 k	0.330 k	0.10 k	2.720 k
+D+0.750L+0.5250E	0.1 k	0.345 k	0.02 k	4.400 k
+0.60D+0.70E	0.1 k	0.314 k	0.11 k	1.632 k
L Only	0.0 k	0.136 k	0.12 k	2.240 k
W Only	0.1 k	0.359 k	0.16 k	0.000 k
E Only	0.2 k	0.429 k	0.19 k	0.000 k

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JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

JAMB DESIGN

$W_{1_D} = 20.44 psf \times 7' \times 3' = 429.3^{\#}$ (7' = ½ DOOR WIDTH + WALL DEPTH ABOVE; 3' = WALL DEPTH ABOVE)

$W_{1_E} = 24 psf \times 7' \times 3' = 504^{\#}$

$P_D = 12' \times 17.5 psf = 210^{\#}$

$P_L = 12' \times 40 psf = 480^{\#}$

$W_{2_D} = 20.44 psf \times 1.33' = 28^{\#}$

$W_{2_E} = 24 psf \times 1.33' = 32^{\#}$

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC

DESCRIPTION: Jamb Design

Code References

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Calculations per TMS 402-16, IBC 2018, CBC 2019, ASCE 7-16

Construction Type : Grouted Hollow Concrete Masonry

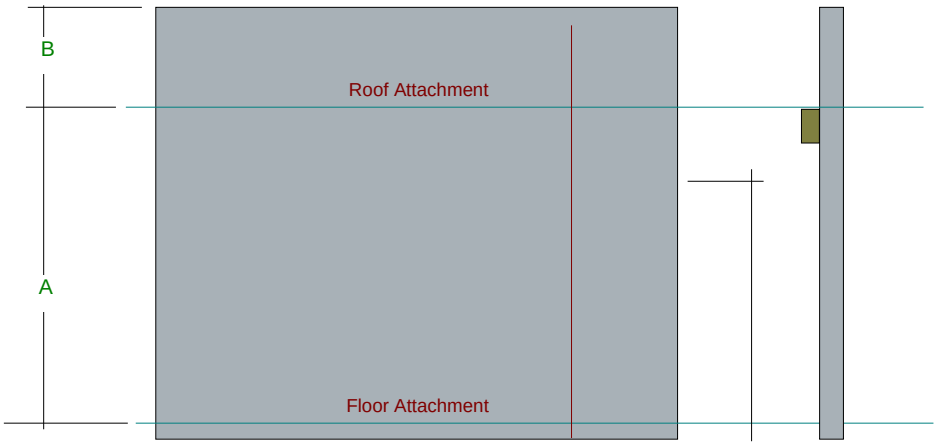
F'm	=	2.0 ksi	Nom. Wall Thickness	6 in	Temp Diff across thickness	=		deg F
Fy - Yield	=	60.0 ksi	Actual Thickness	5.625 in	Min Allow Out-of-plane Defl Ra	=	0.0	
Fr - Rupture	=	61.0 psi	Rebar "d" distance	2.8125 in				
Em = f'm *	=	900.0	Lower Level Rebar . . .		Minimum Vertical Steel %	=	0.0020	
Max % of ρ bal.	=	0.009428	Bar Size #	5				
Grout Density	=	140 pcf	Bar Spacing	16 in				
Block Weight		Normal Weight						
Wall Weight	=	64.0 psf						

Wall is Solid Grouted

One-Story Wall Dimensions

A Clear Height = 12.0 ft
B Parapet height = ft

Wall Support Condition Top & Bottom Pinned



Vertical Loads

Vertical Uniform Loads . . (Applied per foot of Strip Width			DL : Dead	Lr : Roof Live	Lf : Floor Live	S : Snow	W : Wind
Ledger Load	Eccentricity	6.0 in	0.210		0.480		k/ft
Concentric Load							k/ft

Lateral Loads

Wind Loads :
Full area WIND load 20.44 psf

Seismic Loads :
Wall Weight Seismic Load Input Method : Direct entry of Lateral Wall Weight
Seismic Wall Lateral Load 24 psf

Fp 1.0 = 24.0 psf

(Applied to full "STRIP Width")

	D	Lr	L	E	W	Endpoints from Base top	bottom
Distributed Lateral Load				0.5040	.43 k/ft	12.0	9.0 ft
Distributed Lateral Load				.032	.028 k/ft	9.0	ft

Masonry Slender Wall

Project File: 26-501 Stamper CMU calcs.ec6

DESCRIPTION: Jamb Design

DESIGN SUMMARY

Results reported for "Strip Width" of 16.0 in

	Governing Load Combination . . .	Actual Values . . .		Allowable Values . . .	
PASS	Moment Capacity Check	Maximum Bending Stress Rat	**0.7557**		
	+1.20D+L+E	Max Mu	2.542 k-ft	Phi * Mn	3.364 k-ft
PASS	Service Deflection Check	Actual Defl. Ratio L/	#####	Allowable Defl. Ratio	150.0
		Max. Deflection	0.0 in		
PASS	Axial Load Check	Max Pu / Ag	15.386 psi	Max. Allow. Defl.	0.960 in
	+1.20D+L+E	Location	8.20 ft	0.2 * f'm	400.0 psi
	Reinforcing Limit Check	Actual As/bd	0.006889	Max Allow As/bd	0.009428

Maximum Reactions *for Load Combination...*

Top Horizontal	E Only	1.468 k
Base Horizontal	E Only	0.5140 k
Vertical Reaction	+D+L	1.944 k

Design Maximum Combinations - Moments

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	0.2*f'm*b*t k	Moment Values Mcr k-ft	Mu k-ft	Phi	Phi Mn k-ft	As in^2	As Ratio	0.6 * rho bal	Bar 'd'
+1.40D at 11.60 to 12.00	0.330	27.024	0.32	0.15	0.90	2.41	0.233	0.0069	0.0094	0.00
+1.20D+1.60L at 11.60 to 12.00	1.051	27.024	0.32	0.51	0.90	2.53	0.233	0.0069	0.0090	0.00
+1.20D+L at 11.60 to 12.00	0.763	27.024	0.32	0.37	0.90	2.48	0.233	0.0069	0.0091	0.00
+1.20D+0.50W at 8.00 to 8.40	0.559	27.024	0.32	0.77	0.90	2.45	0.233	0.0069	0.0092	0.00
+1.20D+L+W at 8.00 to 8.40	1.039	27.024	0.32	1.67	0.90	2.53	0.233	0.0069	0.0090	0.00
+0.90D+W at 8.00 to 8.40	0.419	27.024	0.32	1.42	0.90	2.43	0.233	0.0069	0.0093	0.00
+1.20D+L+E at 8.00 to 8.40	1.039	27.024	0.32	1.91	0.90	2.53	0.233	0.0069	0.0090	0.00
+0.90D+E at 8.00 to 8.40	0.419	27.024	0.32	1.65	0.90	2.43	0.233	0.0069	0.0093	0.00

Design Maximum Combinations - Deflections

Results reported for "Strip Width" = 12 in.

Load Combination	Axial Load Pu k	Moment Values Mcr k-ft	Mactual k-ft	Stiffness I gross in^4	I cracked in^4	I effective in^4	Deflections Deflection in	Defl. Ratio

Reactions - Vertical & Horizontal

Load Combination	Base Horizontal	Top Horizontal	Vertical @ Wall Base
D Only	0.0 k	0.01 k	1.304 k
+D+L	0.0 k	0.04 k	1.944 k
+D+0.750L	0.0 k	0.03 k	1.784 k
+D+0.60W	0.3 k	0.74 k	1.304 k
+D+0.450W	0.2 k	0.55 k	1.304 k
+0.60D+0.60W	0.3 k	0.75 k	0.782 k
+D+0.70E	0.4 k	1.02 k	1.304 k
+D+0.750L+0.5250E	0.3 k	0.74 k	1.784 k
+0.60D+0.70E	0.4 k	1.02 k	0.782 k
L Only	0.0 k	0.03 k	0.640 k
W Only	0.4 k	1.25 k	0.000 k
E Only	0.5 k	1.47 k	0.000 k

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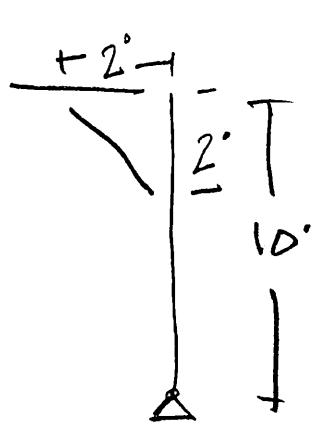
PATIO COVER

$V_E = 11' \times 23' \times 10psf = \frac{2530^{\#}}{2} = 1265^{\#}$



$\Sigma M_o = 2H - \frac{1265}{2} \times 10$

$H = 3163$

$P = \sqrt{2}(3163) = 4473$

WITHDRAWAL = 513 #/in (3/4" ϕ LAGS)

EMBED $\frac{4473}{513 \times 1.6} = 5.5"$

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CANTILEVER COLUMN

LINE 7 $V_E = 2320 \ 5/1.25 / 2 \text{ columns} = 4640$

$M_r = 4640 \times 10$

$Z_{req'd} = \dfrac{464000 \times 12 \times 1.67}{46 \text{ ksi}} = 20.2$

$\Delta = 0.0025 \times 10 \times 12 = 3''$

$I = \dfrac{4640 \times (120)^3}{3 \times 29 \times 3} = 30.72$

HSS 8x8x1/4

$I = 70.7$

$Z = 20.5$

Pole Footing Embedded in Soil

Project File: 26-501 vertical design.ec6

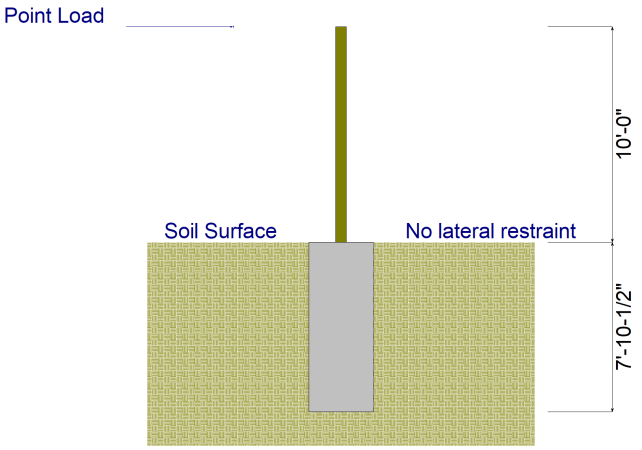
DESCRIPTION: POLE FOOTING

Code References

Calculations per IBC 2021 1807.3, ASCE 7-16
Load Combinations Used : ASCE 7-16

General Information

Pole Footing Shape	Circular
Pole Footing Diameter	36.0 in
Calculate Min. Depth for Allowable Pressures	
No Lateral Restraint at Ground Surface	
Allow Passive	300.0 pcf
Max Passive	2,000.0 psf



Controlling Values

Governing Load Combination	E Only * 0.70
Lateral Load	3.248 k
Moment	32.480 k-ft
NO Ground Surface Restraint	
Pressures at 1/3 Depth	
Actual	**778.97** psf
Allowable	**779.82** psf
Minimum Required Depth	**7.875 ft**
Footing Base Area	7.069 ft^2
Maximum Soil Pressure	0.0 ksf

Applied Loads

Lateral Concentrated Load (k)		Lateral Distributed Loads (kl		Vertical Load (k)	
D : Dead Load	k		k/ft		k
Lr : Roof Live	k		k/ft		k
L : Live	k		k/ft		k
S : Snow	k		k/ft		k
W : Wind	k		k/ft		k
E : Earthquake	4.640 k		k/ft		k
H : Lateral Earth	k		k/ft		k
Load distance above ground surface	10.0 ft	TOP of Load above ground surface	ft		
		BOTTOM of Load above ground surface	ft		

Load Combination Results

Load Combination	Forces @ Ground Surface Loads - (k)	Moments - (ft-k)	Required Depth - (ft)	Pressure at 1/3 Depth Actual - (psf)	Allow - (psf)	Soil Increase Factor
	0.000	0.000	0.13	0.0	0.0	1.000
E Only * 0.70	3.248	32.480	7.88	779.0	779.8	1.000
E Only * 0.5250	2.436	24.360	7.00	696.8	698.3	1.000

Date: (MM/DD/YYYY)

2013 MSJC Anchor Bolt Design
Allowable Stress Design

****user input indicated by blue cells*

DATA INPUT AND SUMMARY OF DESIGN

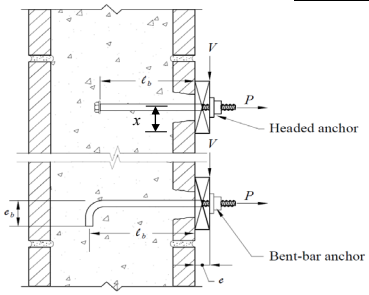
Propeties and Geometry

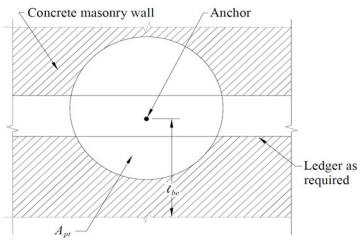
Weather or Soil Exposure	NO	
Top or Face Mount	Face	
**Assumed adequate distance from top/bottom of wall and spacing from adjacent anchors to develop breakout cone		
Anchor Type =	headed	
Anchor Yield Strength =	60000	psi
Anchor Diameter, d_b =	7/8	in
Anchor Hook Length, e_b =	0.00	in
**For headed anchor set hook length equal to 0		
f'_m =	2000	psi
Wall thickness, t =	6.000	in
Edge Distance, l_{be} =	10.00	in
Net Anchor Area, A_b =	0.462	in^2
Effective Embed. Length, l_b =	4.00	in

Loading

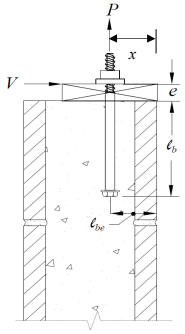
Shear Force, V_{total} =	1929	lbs
Offset distance, e =	0.00	in
Dist. From C.L. of Bolt To Edge of Ledger, x =	0.00	in
Direct Tension Force, P_{total} =	0	lbs

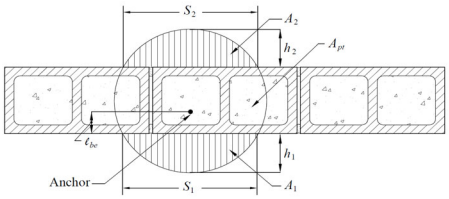
Face Mounted Anchor





Top Mounted Anchor





<<Anchor design is satisfactory. See detailed analysis>>

Detailed Analysis

Check minimum embed.

[TMS 402-13 §1.17.6] l_b= 4.00 in > l_{b_min} = min($4d_b$, 2 in) = 3.50 in ***<Satisfactory>***

Check minimum cover

[TMS 402-13 §1.16.4.1] $cover_{min}$= 1.50 in

$cover_{actual}$= (for top mounted) t - l_{eb} = 2.00 in

(for face mounted) t - l_b = ***<Satisfactory>***

Total Tension Force Considering Ecc., b_{af}

$$b_{af} = P_u + \frac{V_u e}{(\frac{5}{6})d} =$$ 0 lbs ****assuming that moment arm is (5/6) of 'd'*

Determine Tensile Capacity

h_1= 0.00 in s_1= 0.00 in A_1= 0.00 in^2

h_2= 0.00 in s_2= 0.00 in A_2= 0.00 in^2

$$A_{pt} = \pi {l_b}^2 =$$ 50.27 in^2

[TMS 402-13 Eqn. 8-1]	Masonry Tensile Breakout	$B_{ab} = 1.25A_{pt}\sqrt{f'_m} =$	2810	lbs	
[TMS 402-13 Eqn. 8-2]	Steel Tensile Yield	$B_{as} = 0.6A_b f_y =$	16632	lbs	
[TMS 402-13 Eqn. 8-4]	Anchor Pullout	$B_{ap} = (0.6{f'}_m e_b d_b + 120\pi(l_b + e_b + d_b)d_b) =$	N/A	lbs	
	Design Axial Strength	$B_a =$	2810	lbs	> b_{af} ***<Satisfactory>***

Governing Failure Mode: ***Breakout***

Determine Shear Capacity

$$A_{pv} = \frac{\pi {l_{be}}^2}{2} =$$ 157.08 in^2

[TMS 402-13 Eqn. 8-6]	Masonry Shear Breakout	$B_{vb} = 1.25A_{pv}\sqrt{f'_m} =$	8781	lbs	
[TMS 402-13 Eqn. 8-7]	Masonry Crushing	$B_{vc} = 350\sqrt[4]{f'_m A_b} =$	1930	lbs	
[TMS 402-13 Eqn. 8-8]	Anchor Shear Pryout	$B_{vpry} = 2.0B_{ab} = 2.5A_{pt}\sqrt{f'_m} =$	5620	lbs	
[TMS 402-13 Eqn. 8-9]	Steel Shear Yielding	$B_{vs} = 0.36A_b f_y =$	9979	lbs	
	Design Shear Strength	$B_v =$	1930	lbs	> b_{vf} ***<Satisfactory>***

Governing Failure Mode: ***Crushing***

Check Combined Tension and Shear Interaction

[TMS 402-13 Eqn. 8-10] $\frac{b_a}{B_a} + \frac{b_v}{B_v} =$ 1 > 1.000 ***<Satisfactory>***

NATIONAL CONCRETE MASONRY ASSOCIATION — NCMA TEK TECHNICAL SOLUTIONS

Revision Date: 03/19/2019

WYNN ENGINEERING INC.
27315 Valley Center Road
Valley Center, CA 92082
Valley Center (760) 749-8722
Los Angeles (310) 306-9728
www.wynnengineering.com

JOB _____

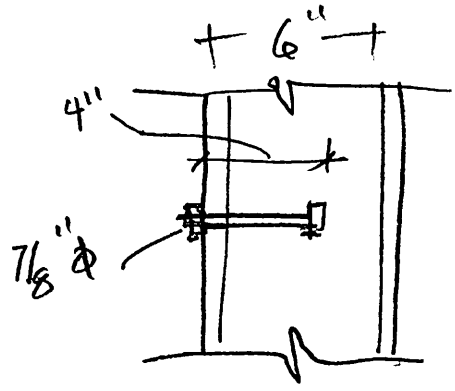
SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

CONNECTION DESIGN



SEE ANCHOR BOLT DESIGN

DESIGN SHEAR STRENGTH
= 1930#/BOLT

S3.0 BEAMS

B2 = 6.14+0.75(1.11+.63) = 7,450# / 1930 = 4 BOLTS

B3 = 1260 → 2 BOLTS (WOOD)

B5 = 6750 → 4 BOLTS (WOOD)

B6 = 18470 / 1930 → 10 BOLTS

B7 = 3330# → 4 BOLTS (WOOD)

B8 = 22430 / 1930 → 12 BOLTS ← THROUGH BOLTS?

B9 = 17943 / 1930 → 10 BOLTS ← " "

B10 20880 / 1930 → 12 BOLTS ← " "

11230 / 1930 → 6 BOLTS → END PLATE

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CHECKED BY _____ DATE _____

SCALE _____

CONNECTION DESIGN CONT.

S2.0 BEAMS

B3 1580 | 1930 → 2 BOLTS

B4 3050 → 2 BOLTS

B5 2300 → 2 BOLTS

B6 8300 | 1930 → 6 BOLTS

B7 5620 | 1930 → 4 BOLTS

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SCALE _____

ANCHORAGE

$F_p = 0.4 S_{DS} k_a W_p$

$F_p = 0.4 \times 1.56 \times \left(1 + \frac{12}{100}\right) \times 4' \times 10' \times 75 \times 0.7 = 1468^{\#}$

USE PA18 @ 48"

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JOB _____

SHEET NO. _____ OF _____

CALCULATED BY _____ DATE _____

CHECKED BY _____ DATE _____

SCALE _____

CONTINUOUS FOOTINGS

24" SQ FOOTINGS

$P_{all} = \frac{24" \times 48" \times 2 ksf}{144} = 16^k$

PAD FTG's

BLC D+L = 18.5^k

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained

Code Reference

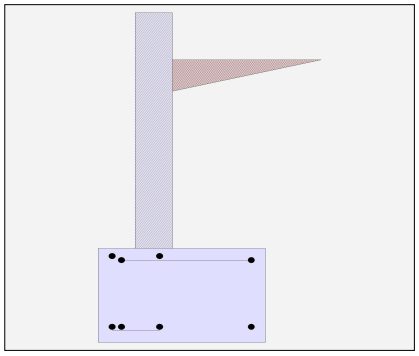
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Inverted Triangular

Load at top of Inverted Triangular Distribution . . . . . = 0.200 psf (Strength)

Total Strength-Level Seismic Load. . . . . = 0.600 lbs

Total Service-Level Seismic Load. . . . . = 0.420 lbs

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained

Design Summary

Wall Stability Ratios

Overturning	=	2.33	OK
Sliding	=	1.75	OK
Global Stability	=	3.35	

Total Bearing Load	=	1,633	lbs
...resultant ecc.	=	5.68	in

Eccentricity within middle third

Soil Pressure @ Toe	=	1,060 psf	OK
Soil Pressure @ Heel	=	29 psf	OK
Allowable	=	2,000 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	1,484 psf	
ACI Factored @ Heel	=	40 psf	
Footing Shear @ Toe	=	2.6 psi	OK
Footing Shear @ Heel	=	3.0 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	630.4 lbs	
less 100% Passive Force	-	450.0 lbs	
less 100% Friction Force	-	653.2 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom	
		Stem OK	
Design Height Above Ftg	ft =	0.00	
Wall Material Above "Ht"	=	Masonry	
Design Method	=	ASD	SD SD
Thickness	=	8.00	
Rebar Size	=	# 5	
Rebar Spacing	=	16.00	
Rebar Placed at	=	Edge	
Design Data			
fb/FB + fa/Fa	=	**0.156**	
Total Force @ Section			
Service Level	lbs =	280.5	
Strength Level	lbs =		
Moment....Actual			
Service Level	ft-# =	374.6	
Strength Level	ft-# =		
Moment.....Allowable	=	2,386.2	
Shear.....Actual			
Service Level	psi =	3.1	
Strength Level	psi =		
Shear.....Allowable	psi =	50.3	
Anet (Masonry)	in2 =	91.50	
Wall Weight	psf =	0.0	
Rebar Depth 'd'	in =	5.25	

Masonry Data

f'm	psi =	2,000
Fs	psi =	32,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	16.11
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =	
Fy	psi =	

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained

Footing Data

Toe Width	=	0.67 ft
Heel Width	=	2.33
Total Footing Width	=	3.00
Footing Thickness	=	24.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 3.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	1,484		40	psf
Mu' : Upward	=	305		427	ft-#
Mu' : Downward	=	120		1,479	ft-#
Mu: Design	=	186	OK	1,052	ft-# OK
phiMn	=	56,022		56,022	ft-#
Actual 1-Way Shear	=	2.61		3.03	psi
Allow 1-Way Shear	=	82.16		82.16	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, phi Tu	=	0.00	ft-lbs		

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

Other Acceptable Sizes & Spacings

Toe: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Heel: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Key: No key defined

Min footing T&S reinf Area 1.55 in2
Min footing T&S reinf Area per foot 0.52 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC

DESCRIPTION: Site Retaining Walls 0-4' Retained

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	Soil Over HL (ab. water tbl)	733.2	2.17	1,588.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.17	1,588.0
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	=		
Seismic Earth Load	=	0.4	4.00	1.7	Surcharge Over Toe	=		
	=				Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
Total	=	630.4	**O.T.M.** =	1,261.7	Footing Weight	=	899.7	1.50	1,349.1
					Key Weight	=		
					Vert. Component	=		
					Total =		1,632.9 lbs	**R.M.=**	2,937.1

Resisting/Overturning Ratio = **2.33**

Vertical Loads used for Soil Pressure = 1,632.9 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.049	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: Site Retaining Walls 0-4' Retained

Rebar Lap & Embedment Lengths Information

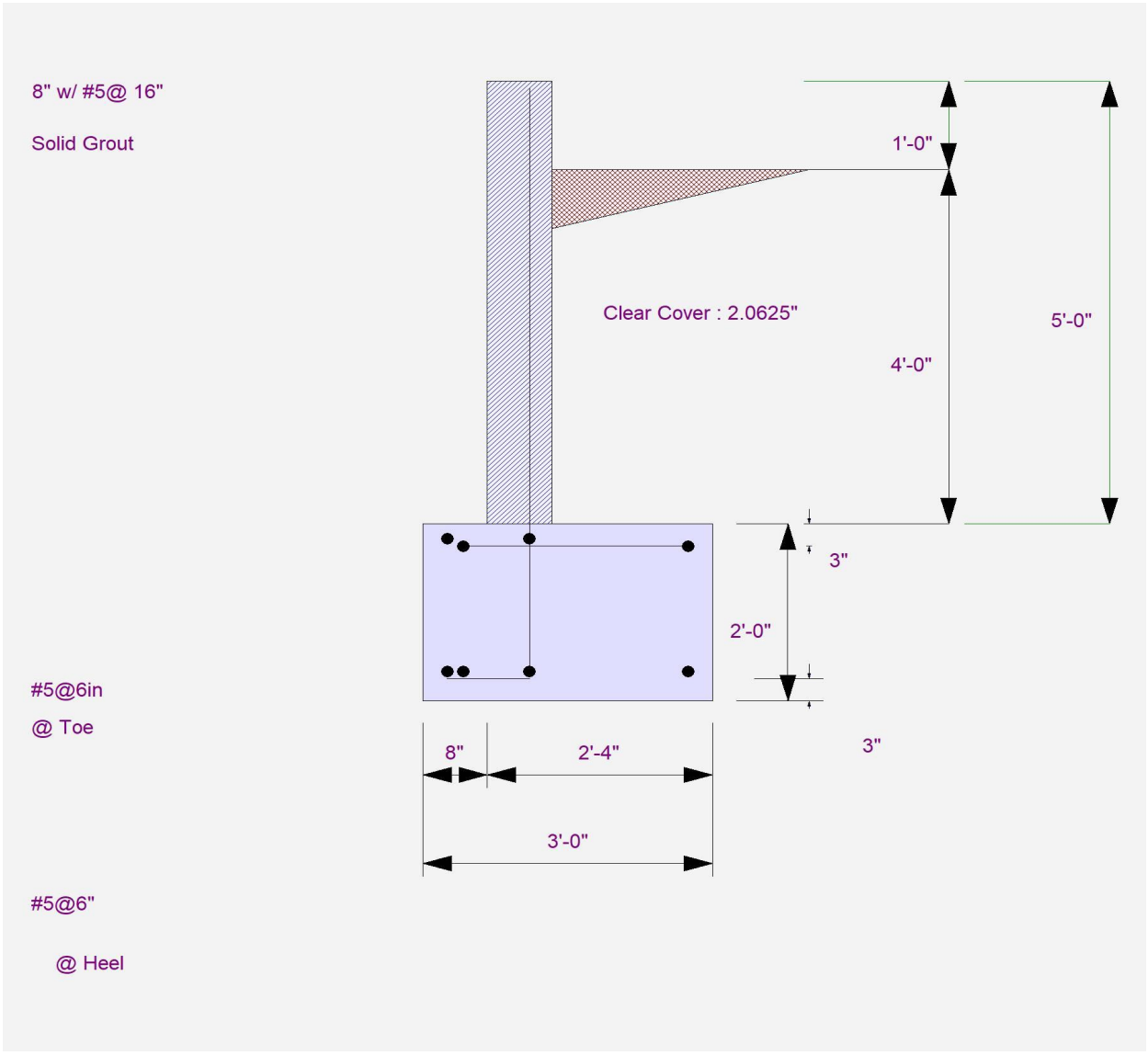
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 4077.26 psi

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	25.00 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 =	7.87 in
As Provided =	0.2325 in2/ft
As Required =	0.0298 in2/ft

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

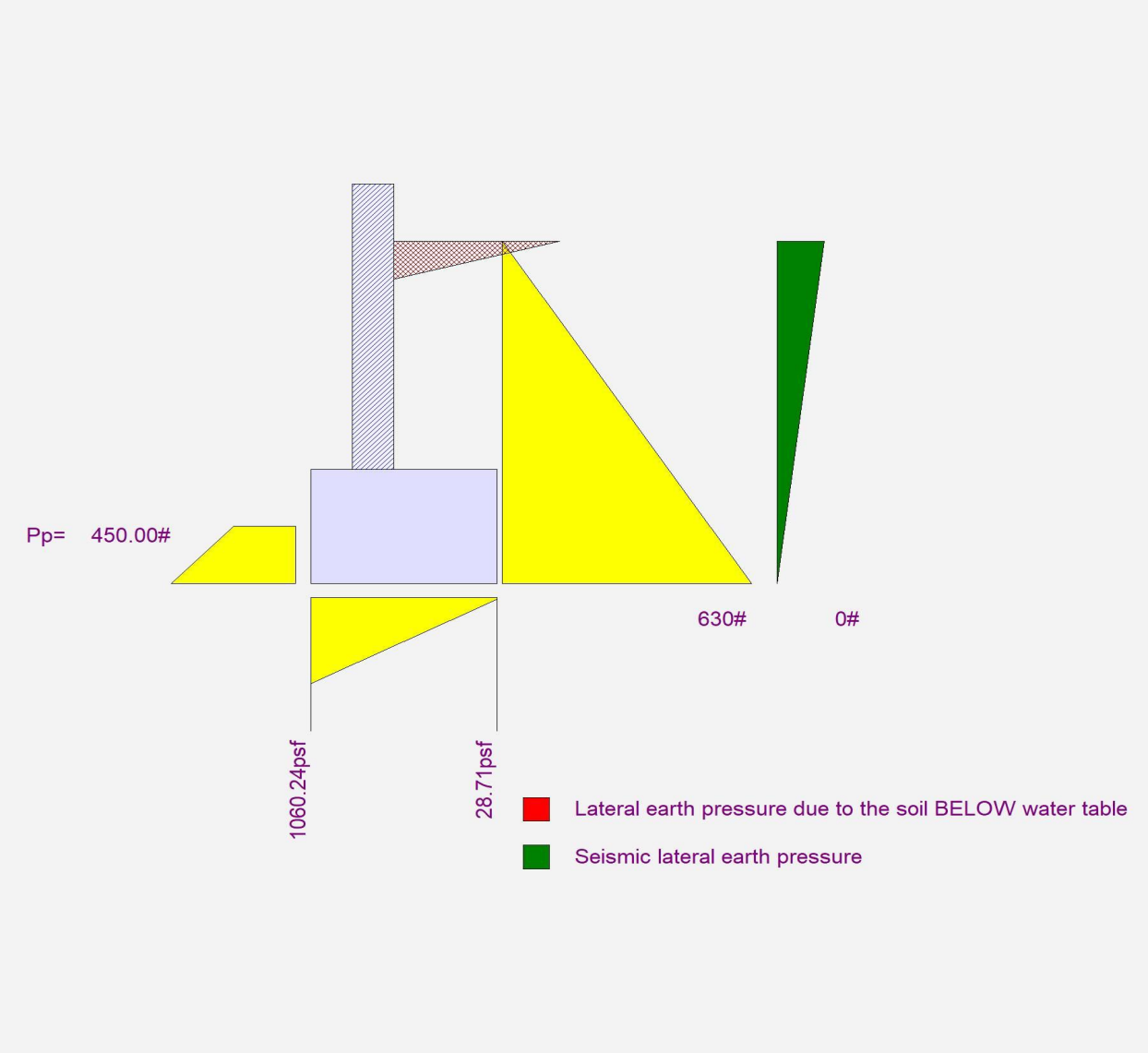
DESCRIPTION: Site Retaining Walls 0-4' Retained



Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained



Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC (c) ENERCALC INC 1983-2023

DESCRIPTION: Site Retaining Walls 6' Retained

Code Reference

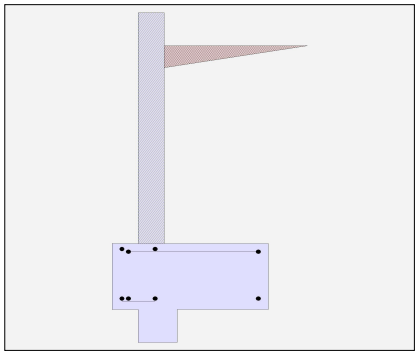
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Inverted Triangular

Load at top of Inverted Triangular Distribution . . . . . = 0.200 psf (Strength)

Total Strength-Level Seismic Load. . . . . = 0.800 lbs

Total Service-Level Seismic Load. . . . . = 0.560 lbs

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained

Design Summary

Wall Stability Ratios

Overturning	=	2.43	OK
Sliding	=	2.18	OK
Global Stability	=	2.70	

Total Bearing Load	=	3,109 lbs	
...resultant ecc.	=	7.49 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	1,506 psf	OK
Soil Pressure @ Heel	=	49 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	2,109 psf	
ACI Factored @ Heel	=	68 psf	
Footing Shear @ Toe	=	4.3 psi	OK
Footing Shear @ Heel	=	4.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,120.6 lbs	
less 100% Passive Force	-	1,200.0 lbs	
less 100% Friction Force	-	1,243.8 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	16.00		
Rebar Placed at	=	Edge		

Design Data

fb/FB + fa/Fa	=	**0.529**
Total Force @ Section		
Service Level	lbs =	630.8
Strength Level	lbs =	
Moment....Actual		
Service Level	ft-# =	1,262.7
Strength Level	ft-# =	
Moment.....Allowable	=	2,386.2
Shear.....Actual		
Service Level	psi =	6.9
Strength Level	psi =	
Shear.....Allowable	psi =	50.3
Anet (Masonry)	in2 =	91.50
Wall Weight	psf =	0.0
Rebar Depth 'd'	in =	5.25

Masonry Data

f'm	psi =	2,000
Fs	psi =	32,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	16.11
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =
Fy	psi =

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained

Footing Data

Toe Width	=	0.67 ft
Heel Width	=	3.33
Total Footing Width	=	4.00
Footing Thickness	=	24.00 in
Key Width	=	12.00 in
Key Depth	=	12.00 in
Key Distance from Toe	=	0.67 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 3.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	2,109		68	psf
Mu' : Upward	=	443		1,855	ft-#
Mu' : Downward	=	120		4,607	ft-#
Mu: Design	=	323	OK	2,752	ft-# OK
phiMn	=	56,022		56,022	ft-#
Actual 1-Way Shear	=	4.27		4.37	psi
Allow 1-Way Shear	=	82.16		82.16	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, phi Tu	=			0.00	ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Heel: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Key: phiMn = phi*5*lambda*sqrt(fc)*Sm

Min footing T&S reinf Area	2.07	in2
Min footing T&S reinf Area per foot	0.52	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained

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 =						
Seismic Earth Load =	0.6	5.33	3.0			
=						
Total =	1,120.6	**O.T.M.** =	2,989.7			
Soil Over HL (ab. water tbl)				1,759.8	2.67	4,691.3
Soil Over HL (bel. water tbl)					2.67	4,691.3
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 =						
Surcharge Over Toe =						
Stem Weight(s) =						
Earth @ Stem Transitions =						
Footing Weight =				1,199.7	2.00	2,398.8
Key Weight =				150.0	1.17	174.9
Vert. Component =						
Total =				3,109.5 lbs	**R.M.=**	7,265.0

Resisting/Overturning Ratio = **2.43**

Vertical Loads used for Soil Pressure = 3,109.5 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.073	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 Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained

Rebar Lap & Embedment Lengths Information

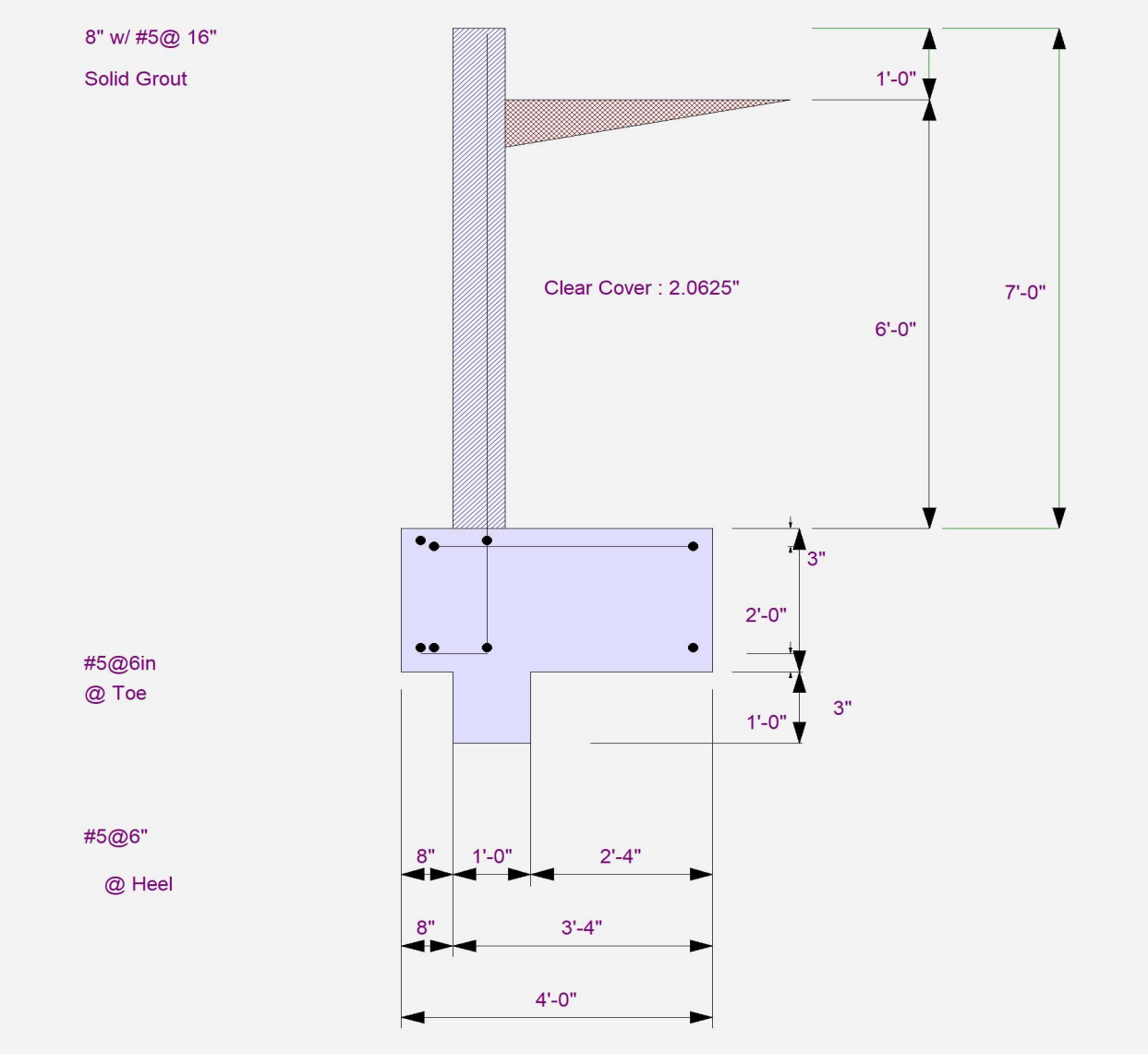
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 13744.43 psi

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	25.00 in
Development length for #5 bar specified in this stem design segment =	17.18 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	7.87 in
As Provided =	0.2325 in2/ft
As Required =	0.1012 in2/ft

Cantilevered Retaining Wall

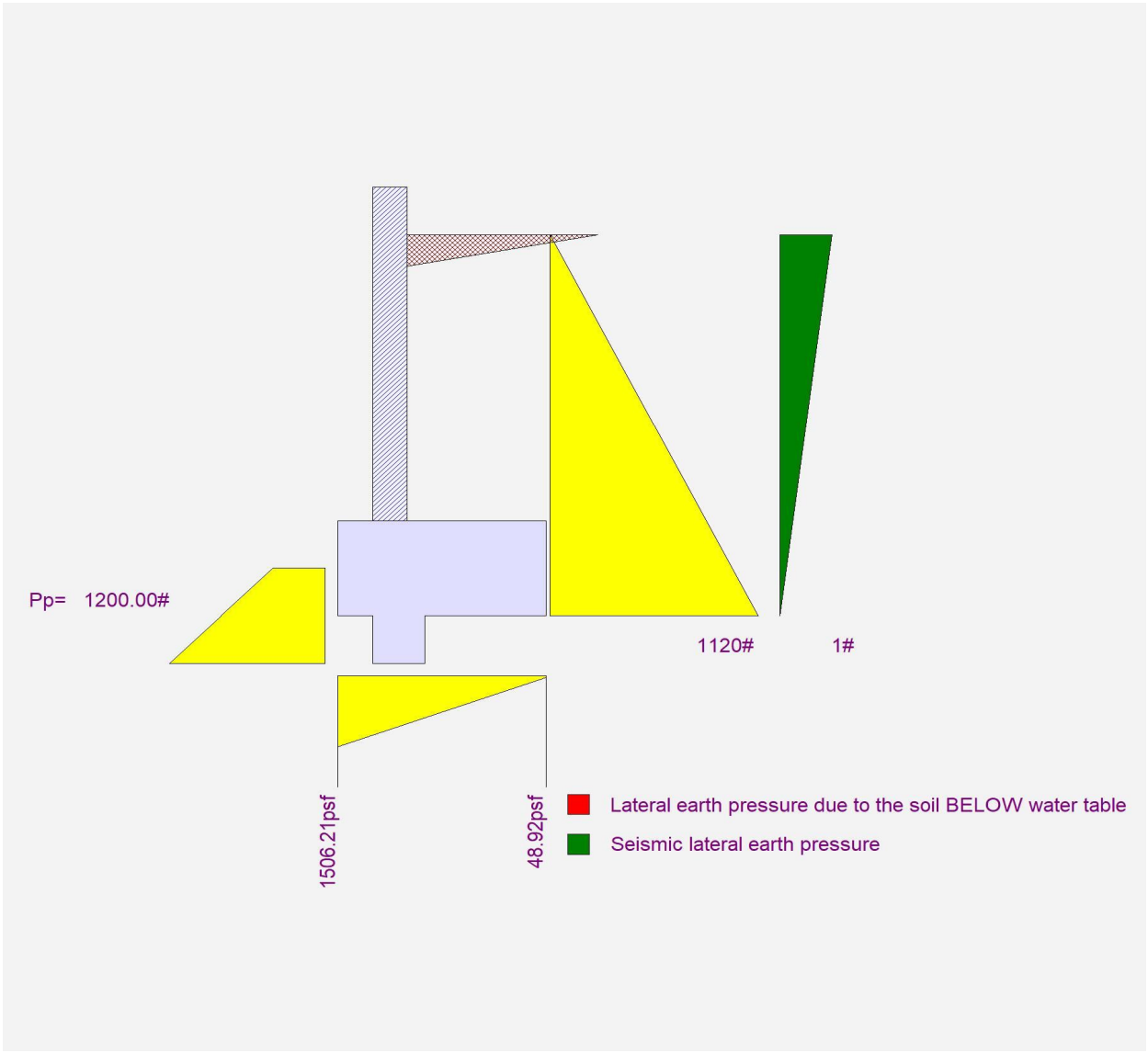
Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained



Cantilevered Retaining Wall

DESCRIPTION: Site Retaining Walls 6' Retained



Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained

Code Reference

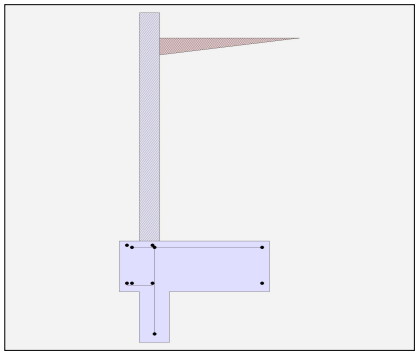
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	8.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.250
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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Inverted Triangular

Load at top of Inverted Triangular Distribution . . . . . = 0.200 psf (Strength)

Total Strength-Level Seismic Load. . . . . = 1.000 lbs

Total Service-Level Seismic Load. . . . . = 0.700 lbs

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained

Design Summary

Wall Stability Ratios

Overturning	=	2.45	OK
Sliding	=	2.00	OK
Global Stability	=	2.38	

Total Bearing Load	=	5,026	lbs
...resultant ecc.	=	9.76	in

Eccentricity within middle third

Soil Pressure @ Toe	=	1,987 psf	OK
Soil Pressure @ Heel	=	24 psf	OK
Allowable	=	2,000 psf	

Soil Pressure Less Than Allowable

ACI Factored @ Toe	=	2,782 psf	
ACI Factored @ Heel	=	33 psf	
Footing Shear @ Toe	=	6.1 psi	OK
Footing Shear @ Heel	=	5.6 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,750.7 lbs	
less 100% Passive Force	-	2,250.0 lbs	
less 100% Friction Force	-	1,256.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	8.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.984**		
Total Force @ Section				
Service Level	lbs =	1,121.0		
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	2,991.4		
Strength Level	ft-# =			
Moment.....Allowable	=	3,039.2		
Shear.....Actual				
Service Level	psi =	12.3		
Strength Level	psi =			
Shear.....Allowable	psi =	50.3		
Anet (Masonry)	in2 =	91.50		
Wall Weight	psf =	0.0		
Rebar Depth 'd'	in =	5.25		

Masonry Data

f'm	psi =	2,000
Fs	psi =	32,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	16.11
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =
Fy	psi =

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained

Footing Data

Toe Width	=	0.67 ft
Heel Width	=	4.33
Total Footing Width	=	5.00
Footing Thickness	=	24.00 in
Key Width	=	12.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	0.67 ft

f'c = 3,000 psi Fy = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 3.00 @ Btm.= 3.00 in

Footing Design Results

		Toe		Heel	
Factored Pressure	=	2,782		33 psf	
Mu' : Upward	=	590		4,740 ft-#	
Mu' : Downward	=	120		10,382 ft-#	
Mu: Design	=	470	OK	5,642 ft-#	OK
phiMn	=	56,022		56,022 ft-#	
Actual 1-Way Shear	=	6.06		5.59 psi	
Allow 1-Way Shear	=	82.16		82.16 psi	
Toe Reinforcing	=	# 5 @ 6.00 in			
Heel Reinforcing	=	# 5 @ 6.00 in			
Key Reinforcing	=	# 5 @ 8.00 in			
Footing Torsion, Tu	=	0.00 ft-lbs			
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs			

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

Other Acceptable Sizes & Spacings

Toe: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Heel: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Key: #4@ 9.25 in, #5@ 14.35 in, #6@ 18 in, #7@ 18

Min footing T&S reinf Area 2.59 in2
Min footing T&S reinf Area per foot 0.52 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained

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)	3,226.4	3.17	10,214.2
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.17	10,214.2
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	=		
Seismic Earth Load	=	0.7	6.67	4.7	Surcharge Over Toe	=		
	=				Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
Total	=	1,750.7	**O.T.M.** =	5,838.0	Footing Weight	=	1,499.7	2.50	3,748.5
					Key Weight	=	300.0	1.17	349.8
					Vert. Component	=			
					Total =		5,026.1 lbs	**R.M.=**	14,312.5

Resisting/Overturning Ratio = **2.45**

Vertical Loads used for Soil Pressure = 5,026.1 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.099	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 Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained

Rebar Lap & Embedment Lengths Information

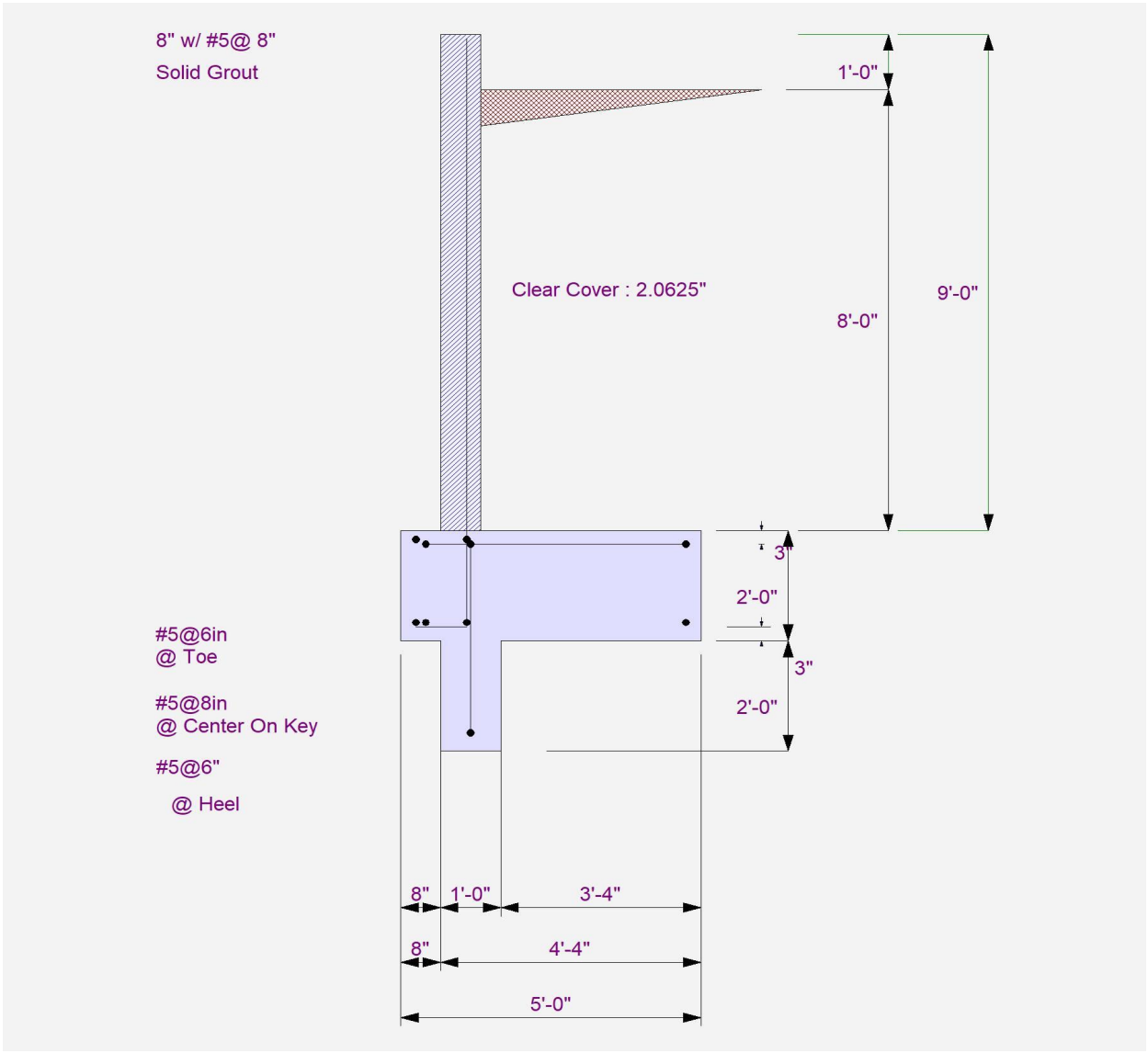
Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 16856.36 psi

Lap Splice length for #5 bar specified in this stem design segment (25.4.2.4a) =	25.00 in
Development length for #5 bar specified in this stem design segment =	21.07 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	7.87 in
As Provided =	0.4650 in2/ft
As Required =	0.2433 in2/ft

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

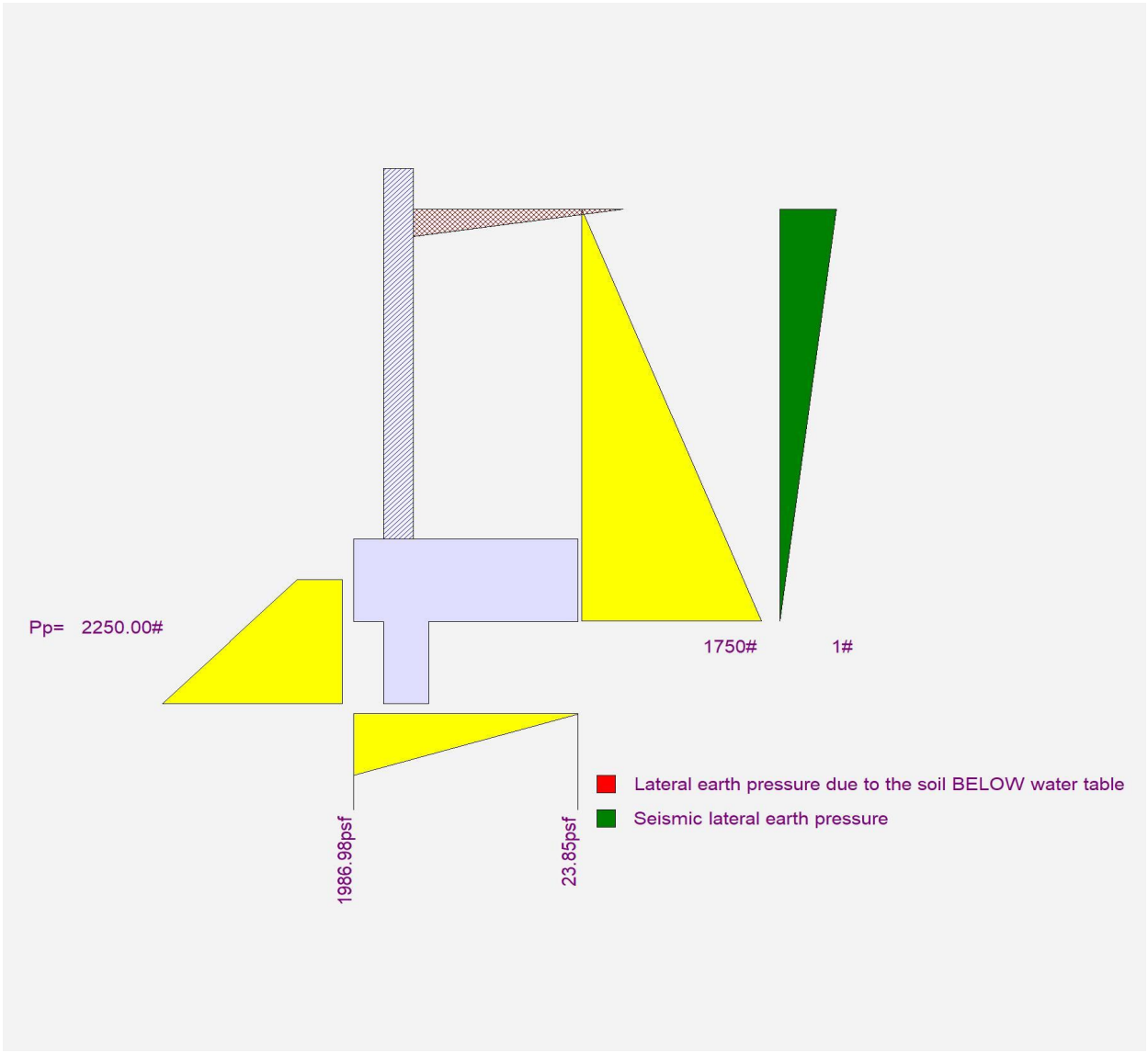
DESCRIPTION: Site Retaining Walls 6'-8' Retained



Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6'-8' Retained



Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

LIC# : KW-06014768, Build:20.23.08.30 WYNN ENGINEERING, INC

DESCRIPTION: Copy of Garage Retaining Walls

Code Reference

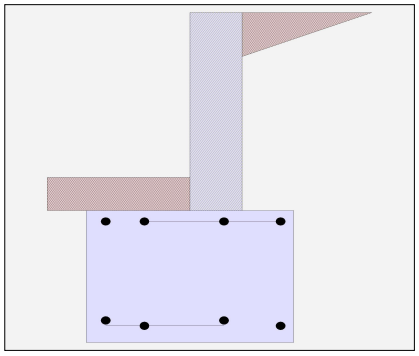
Calculations per IBC 2021 1807.3, ASCE 7-16

Criteria

Retained Height	=	3.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,000.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 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	=	370.0 lbs
Axial Live Load	=	240.0 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 (Strength 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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Copy of Garage Retaining Walls

Design Summary

Wall Stability Ratios

Overturning	=	3.07	OK
Sliding	=	3.13	OK
Global Stability	=	4.52	

Total Bearing Load	=	1,700 lbs	
...resultant ecc.	=	2.51 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	941 psf	OK
Soil Pressure @ Heel	=	337 psf	OK
Allowable	=	2,000 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,317 psf	
ACI Factored @ Heel	=	472 psf	
Footing Shear @ Toe	=	3.6 psi	OK
Footing Shear @ Heel	=	0.5 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	437.5 lbs	
less 100% Passive Force	-	787.5 lbs	
less 100% Friction Force	-	584.0 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	0.0 lbs	OK

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 4		
Rebar Spacing	=	16.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.102**		
Total Force @ Section				
Service Level	lbs =	157.5		
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	157.5		
Strength Level	ft-# =			
Moment.....Allowable	=	1,931.1		
Shear.....Actual				
Service Level	psi =	1.7		
Strength Level	psi =			
Shear.....Allowable	psi =	52.6		
Anet (Masonry)	in2 =	91.50		
Wall Weight	psf =	0.0		
Rebar Depth 'd'	in =	5.25		

Masonry Data

f'm	psi =	2,000
Fs	psi =	32,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	16.11
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD

Concrete Data

f'c	psi =
Fy	psi =

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Copy of Garage Retaining Walls

Footing Data

Toe Width	=	1.33 ft
Heel Width	=	1.33
Total Footing Width	=	2.66
Footing Thickness	=	24.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft

f'c = 3,000 psi Fy = 60,000 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	=	1,317	472 psf	
Mu' : Upward	=	1,041	119 ft-#	
Mu' : Downward	=	471	250 ft-#	
Mu: Design	=	569 OK	131 ft-#	OK
phiMn	=	56,022	58,812 ft-#	
Actual 1-Way Shear	=	3.56	0.46 psi	
Allow 1-Way Shear	=	82.16	82.16 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, phi Tu	=	0.00 ft-lbs		

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

Other Acceptable Sizes & Spacings

Toe: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Heel: #4@ 4.62 in, #5@ 7.17 in, #6@ 10.18 in, #7@ 13.88 in, #8@ 18.28 in, #9@ 23.14 in, #10@ 29.39 in

Key: No key defined

Min footing T&S reinf Area 1.38 in2
Min footing T&S reinf Area per foot 0.52 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 4.63 in	#4@ 9.26 in
#5@ 7.18 in	#5@ 14.35 in
#6@ 10.19 in	#6@ 20.37 in

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Copy of Garage Retaining Walls

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			
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)	218.9	2.33	509.7
				Soil Over HL (bel. water tbl)		2.33	509.7
				Water Table			
				Sloped Soil Over Heel =			
				Surcharge Over Heel =			
				Adjacent Footing Load =			
				Axial Dead Load on Stem =	370.0	1.66	615.4
				* Axial Live Load on Stem =	240.0	1.66	399.2
				Soil Over Toe =	73.2	0.67	48.6
				Surcharge Over Toe =			
				Stem Weight(s) =			
				Earth @ Stem Transitions =			
				Footing Weight =	798.0	1.33	1,061.3
				Key Weight =			
				Vert. Component =			
Total =	437.5	**O.T.M.** =	729.2	**Total =**	1,460.1 lbs	**R.M.=**	2,235.1

Resisting/Overturning Ratio = **3.07**

Vertical Loads used for Soil Pressure = 1,700.1 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 NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.029	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: Copy of Garage Retaining Walls

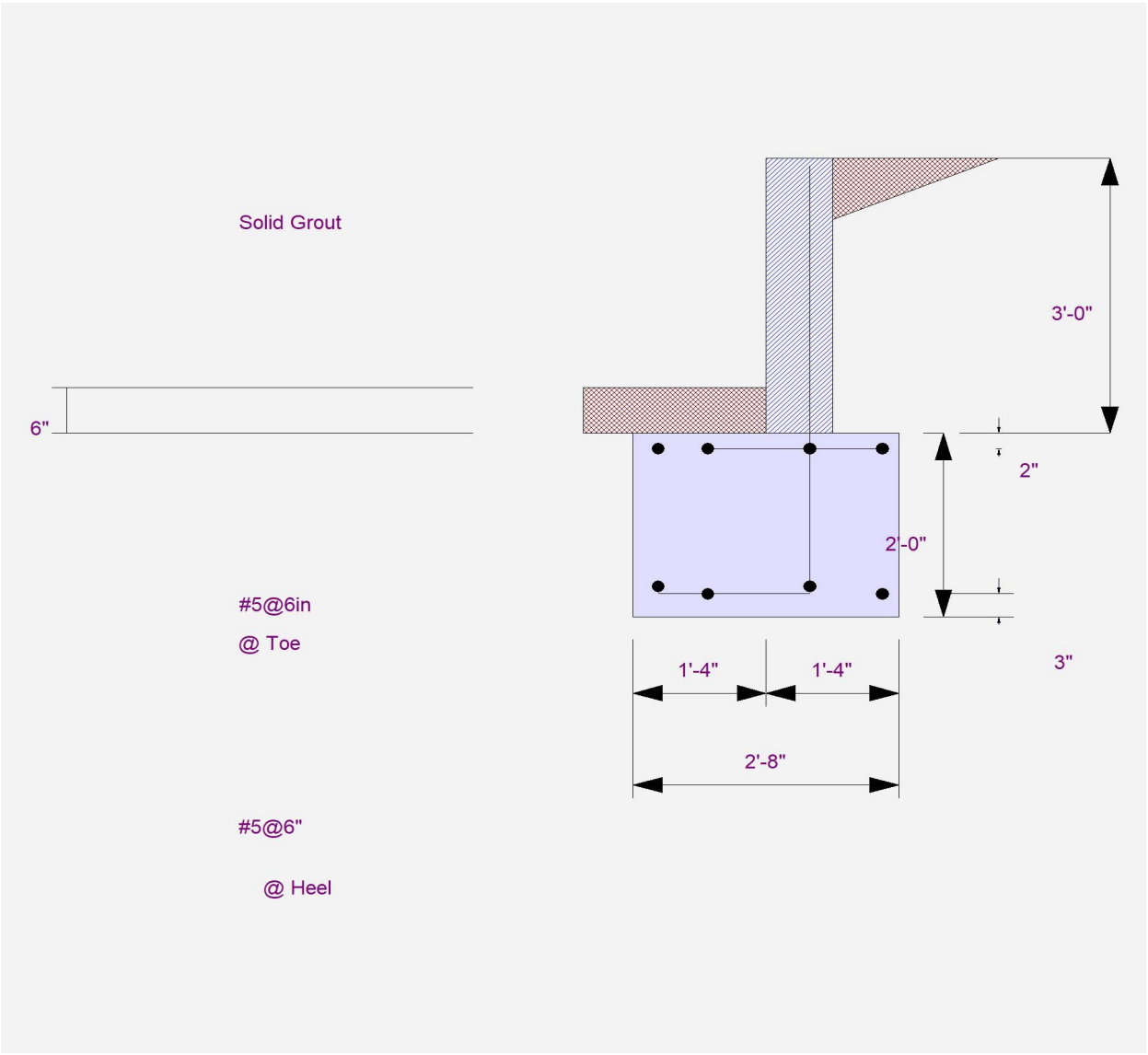
Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 2609.89 psi

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	20.00 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 =	5.63 in
As Provided =	0.1500 in2/ft
As Required =	0.0125 in2/ft

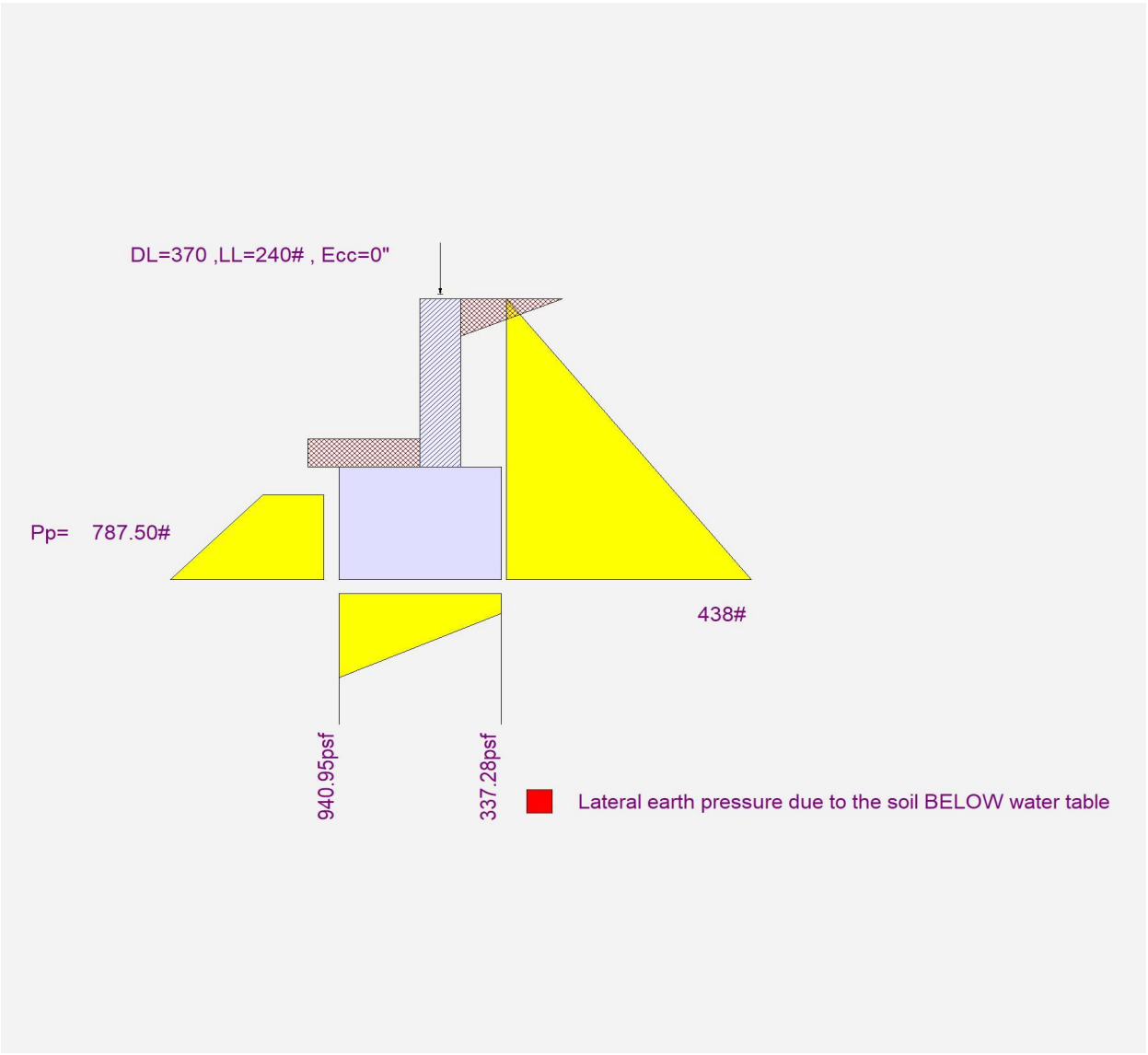
Cantilevered Retaining Wall

DESCRIPTION: Copy of Garage Retaining Walls



Cantilevered Retaining Wall

DESCRIPTION: Copy of Garage Retaining Walls



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL

Code References

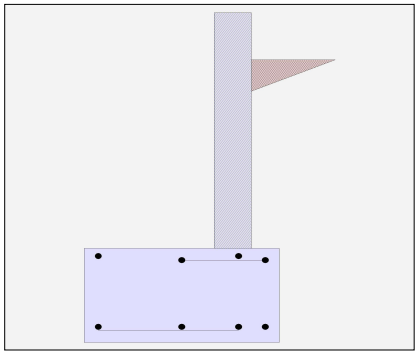
Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19 , TMS 402-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 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 (Strength 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	=	0.000 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Inverted Triangular

Load at top of Inverted Triangular Distribution . . . . . = 0.200 psf (Strength)

Total Strength-Level Seismic Load. . . . . = 0.600 lbs

Total Service-Level Seismic Load. . . . . = 0.420 lbs

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL

Design Summary

Wall Stability Ratios

Overturning	=	2.02	OK
Sliding	=	1.52	OK
Global Stability	=	2.98	

Total Bearing Load	=	1,269 lbs	
...resultant ecc.	=	8.81 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	834 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,168 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	3.4 psi	OK
Footing Shear @ Heel	=	1.8 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	630.4 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	16.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.127**		
Total Force @ Section				
Service Level	lbs =	280.5		
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	374.6		
Strength Level	ft-# =			
Moment.....Allowable	=	2,939.8		
Shear.....Actual				
Service Level	psi =	3.1		
Strength Level	psi =			
Shear.....Allowable	psi =	50.3		
Anet (Masonry)	in2 =	91.50		
Wall Weight	psf =	0.0		
Rebar Depth 'd'	in =	5.25		
Masonry Data				
f'm	psi =	2,000		
Fs	psi =	32,000		
Solid Grouting	=	Yes		
Modular Ratio 'n'	=	16.11		
Equiv. Solid Thick.	in =	7.63		
Masonry Block Type	=			
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =			
Fy	psi =			

Summary of Sliding Forces

	FS = 1.0	FS = 1.5
Lateral Force @ Base of Footing	630.42 lbs	945.63 lbs
less 100% Passive Force	- 450.0 lbs	- 450.0 lbs
less 100% Friction Force	- 507.70 lbs	- 507.70 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 1.519: 1.00

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL

Footing Data

Toe Width	=	2.33 ft
Heel Width	=	1.17
Total Footing Width	=	3.50
Footing Thickness	=	24.00 in

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

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,168	0	psf
Mu' : Upward	=	2,361	0	ft-#
Mu' : Downward	=	1,117	185	ft-#
Mu: Design	=	1,244	185	ft-#

Toe Reinforcing = # 5 @ 6.00 in
Heel Reinforcing = # 5 @ 6.00 in

Mu:Design @ Toe	1,244.04 ft-#	OK
phiMn Toe	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Heel	185.19 ft-#	OK
phiMn Heel	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL

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	Soil Over HL (ab. water tbl)	220.1	3.25	714.8
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.25	
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	=		
Seismic Earth Load	=	0.4	4.00	1.7	Surcharge Over Toe	=		
	=				Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
Total	=	630.4	**O.T.M.** =	1,261.7	Footing Weight	=	1,049.1	1.75	1,834.4
					Key Weight	=		
					Vert. Component	=		
					Total =		1,269.2 lbs	**R.M.=**	2,549.1

Resisting/Overturning Ratio = **2.02**

Vertical Loads used for Soil Pressure = 1,269.2 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.033	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: Site Retaining Walls 0-4' Retained PL

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 4077.26 psi

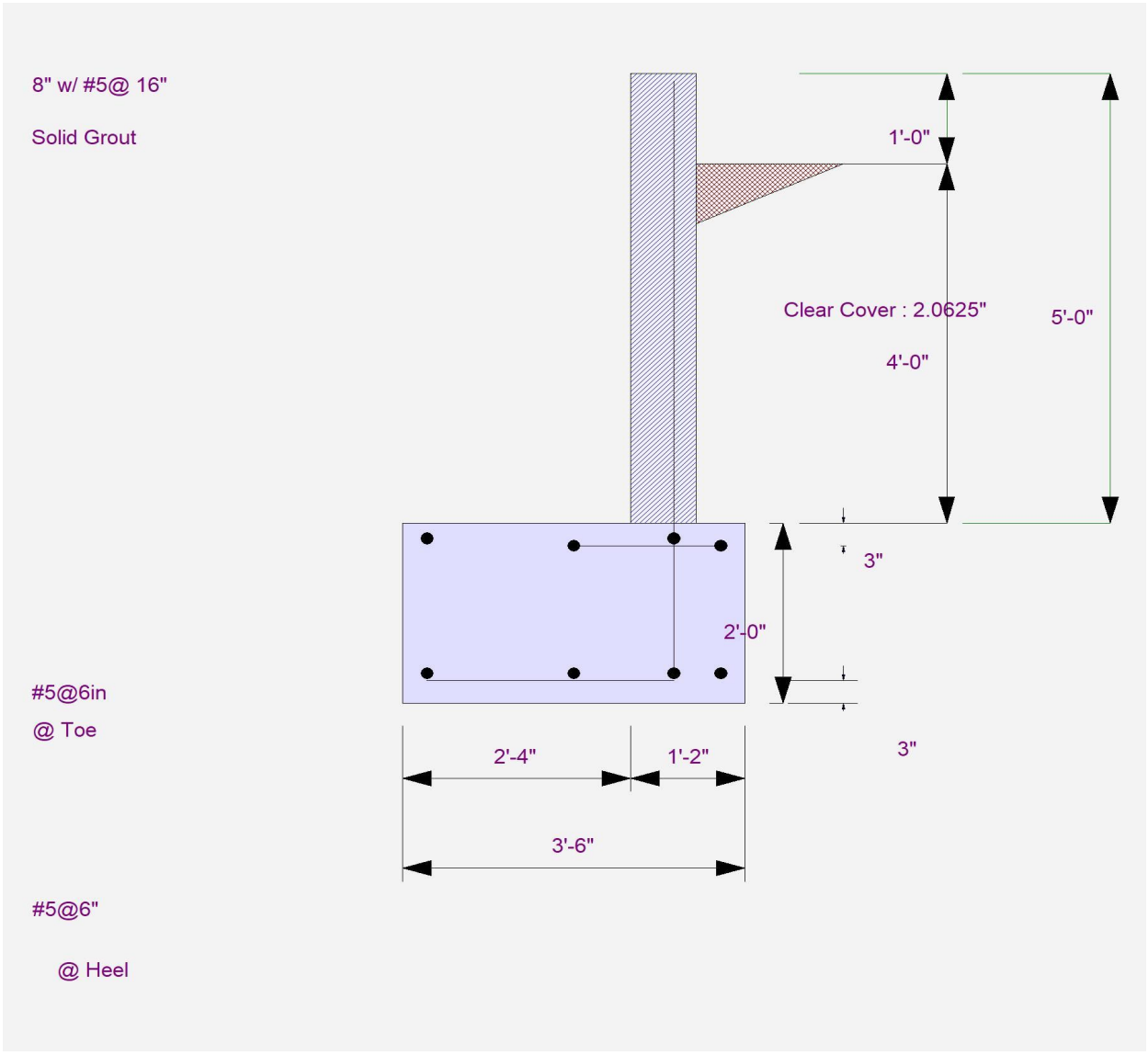
Lap Splice length for #5 bar specified in this stem design segment (IBC Eq. 21-1) =	40.00 in
Development length for #5 bar specified in this stem design segment =	40.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	8.27 in
As Provided =	0.2325 in2/ft
As Required =	0.0298 in2/ft
Ψ r: Confining Reinforcement Factor =	1.00
Ψ o: Location Factor =	1.00
Ψ c: Concrete Strength Factor =	0.77

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL

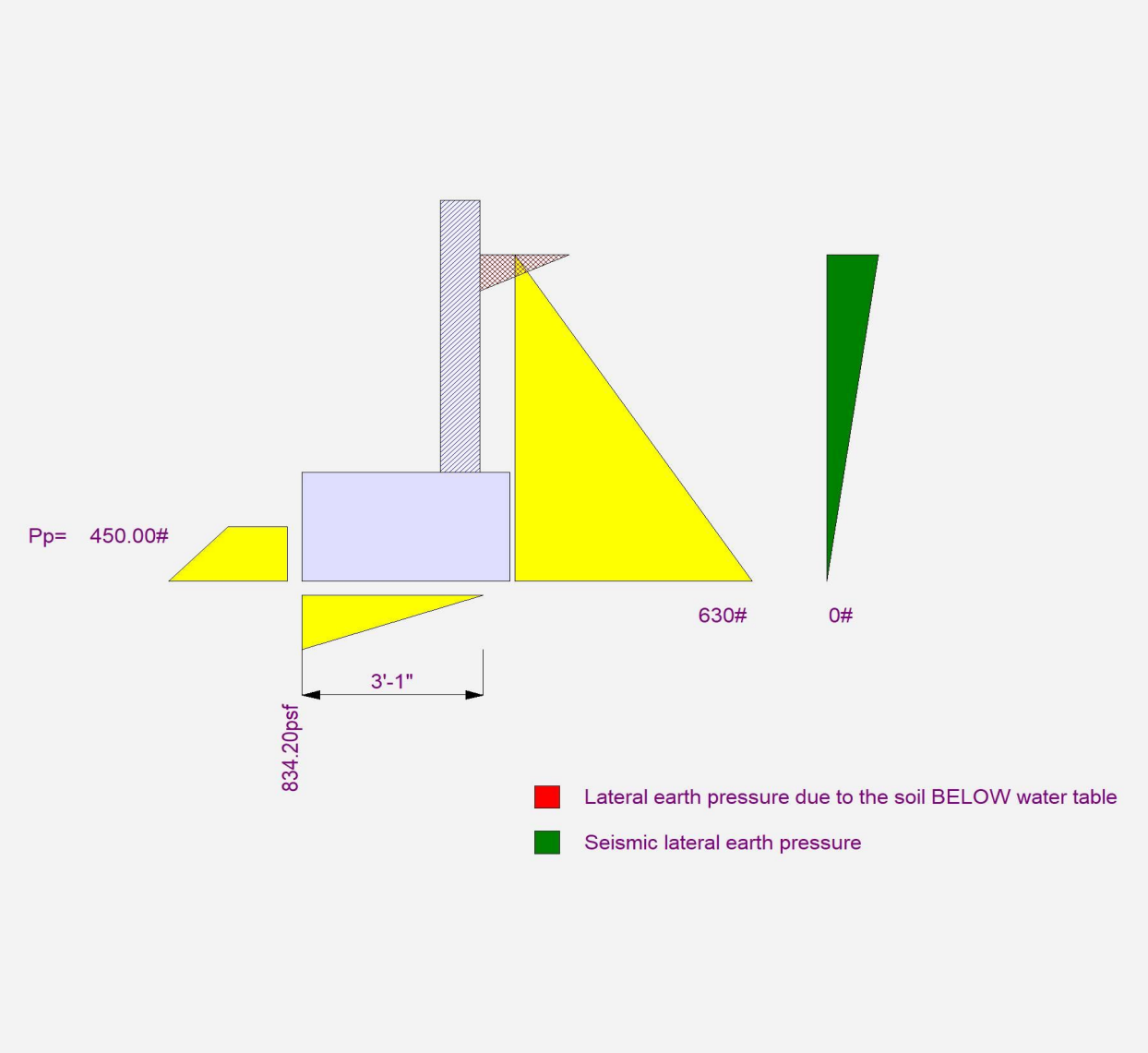


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 0-4' Retained PL



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL

Code References

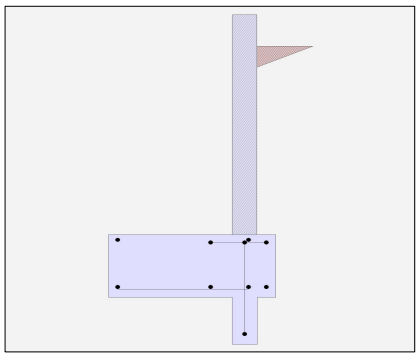
Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19 , TMS 402-16

Criteria

Retained Height	=	6.00 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,400.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 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		

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 (Strength 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	=	0.000 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	1.67	OK
Sliding	=	2.16	OK
Global Stability	=	2.09	

Total Bearing Load	=	1,829 lbs	
...resultant ecc.	=	13.87 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,116 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,400 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,563 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	5.5 psi	OK
Footing Shear @ Heel	=	2.3 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,120.0 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom
		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Masonry
Design Method	=	ASD SD SD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	16.00
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.428**
Total Force @ Section		
Service Level	lbs =	630.0
Strength Level	lbs =	
Moment....Actual		
Service Level	ft-# =	1,260.0
Strength Level	ft-# =	
Moment.....Allowable	=	2,939.8
Shear.....Actual		
Service Level	psi =	6.9
Strength Level	psi =	
Shear.....Allowable	psi =	50.3
Anet (Masonry)	in2 =	91.50
Wall Weight	psf =	0.0
Rebar Depth 'd'	in =	5.25
Masonry Data		
f'm	psi =	2,000
Fs	psi =	32,000
Solid Grouting	=	Yes
Modular Ratio 'n'	=	16.11
Equiv. Solid Thick.	in =	7.63
Masonry Block Type	=	
Masonry Design Method	=	ASD
Concrete Data		
f'c	psi =	
Fy	psi =	

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL

Summary of Sliding Forces

	FS = 1.0	FS = 1.5
Lateral Force @ Base of Footing	1,120.00 lbs	1,680.00 lbs
less 100% Passive Force	- 1,687.50 lbs	- 1,687.50 lbs
less 100% Friction Force	- 731.73 lbs	- 731.73 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 2.160: 1.00

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL

Footing Data

Toe Width	=	3.33 ft
Heel Width	=	1.17
Total Footing Width	=	4.50
Footing Thickness	=	24.00 in
Key Width	=	8.00 in
Key Depth	=	18.00 in
Key Distance from Toe	=	3.33 ft

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

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	1,563	0		psf
Mu' : Upward	=	5,730	0		ft-#
Mu' : Downward	=	2,196	240		ft-#
Mu: Design	=	3,534	240	1,745	ft-#
Toe Reinforcing	=	# 5 @ 6.00 in			
Heel Reinforcing	=	# 5 @ 6.00 in			
Key Reinforcing	=	# 5 @ 8.00 in			

Mu:Design @ Toe	3,534.34 ft-#	OK
phiMn Toe	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Heel	240.26 ft-#	OK
phiMn Heel	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Key	1,745.34 ft-#	OK
phiMn Key	5,071 ft-#	
As min req'd 0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	OK
As provided #5@8.0 in o.c.	0.465 in2/ft	
As Max :	0.8128 in2/ft	OK

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL

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	Soil Over HL (ab. water tbl)	330.2	4.25	1,402.4
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.25	
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	=		
	=				Surcharge Over Toe	=		
					Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
Total	=	1,120.0	**O.T.M.** =	2,986.7	Footing Weight	=	1,349.1	2.25	3,033.5
					Key Weight	=	150.0	3.66	549.5
					Vert. Component	=			
					Total =		1,829.3 lbs	**R.M.=**	4,985.3

Resisting/Overturning Ratio = **1.67**

Vertical Loads used for Soil Pressure = 1,829.3 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 NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.048	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: Site Retaining Walls 6' Retained PL

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 13715.04 psi

Lap Splice length for #5 bar specified in this stem design segment (IBC Eq. 21-1) =	40.00 in
Development length for #5 bar specified in this stem design segment =	40.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	8.27 in
As Provided =	0.2325 in2/ft
As Required =	0.1010 in2/ft
Ψ r: Confining Reinforcement Factor =	1.00
Ψ o: Location Factor =	1.00
Ψ c: Concrete Strength Factor =	0.77

Project Title:
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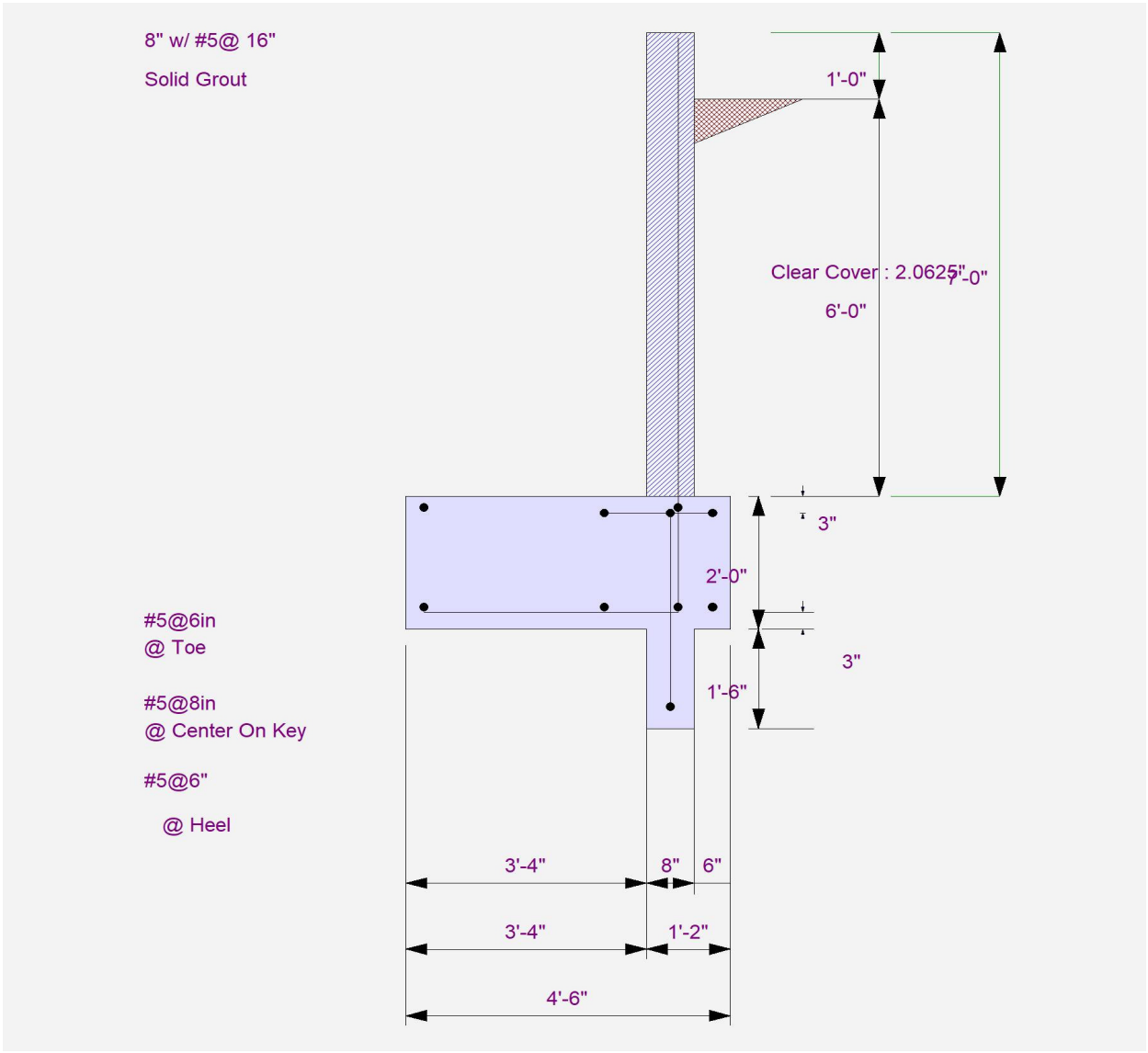
Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL



Project Title:
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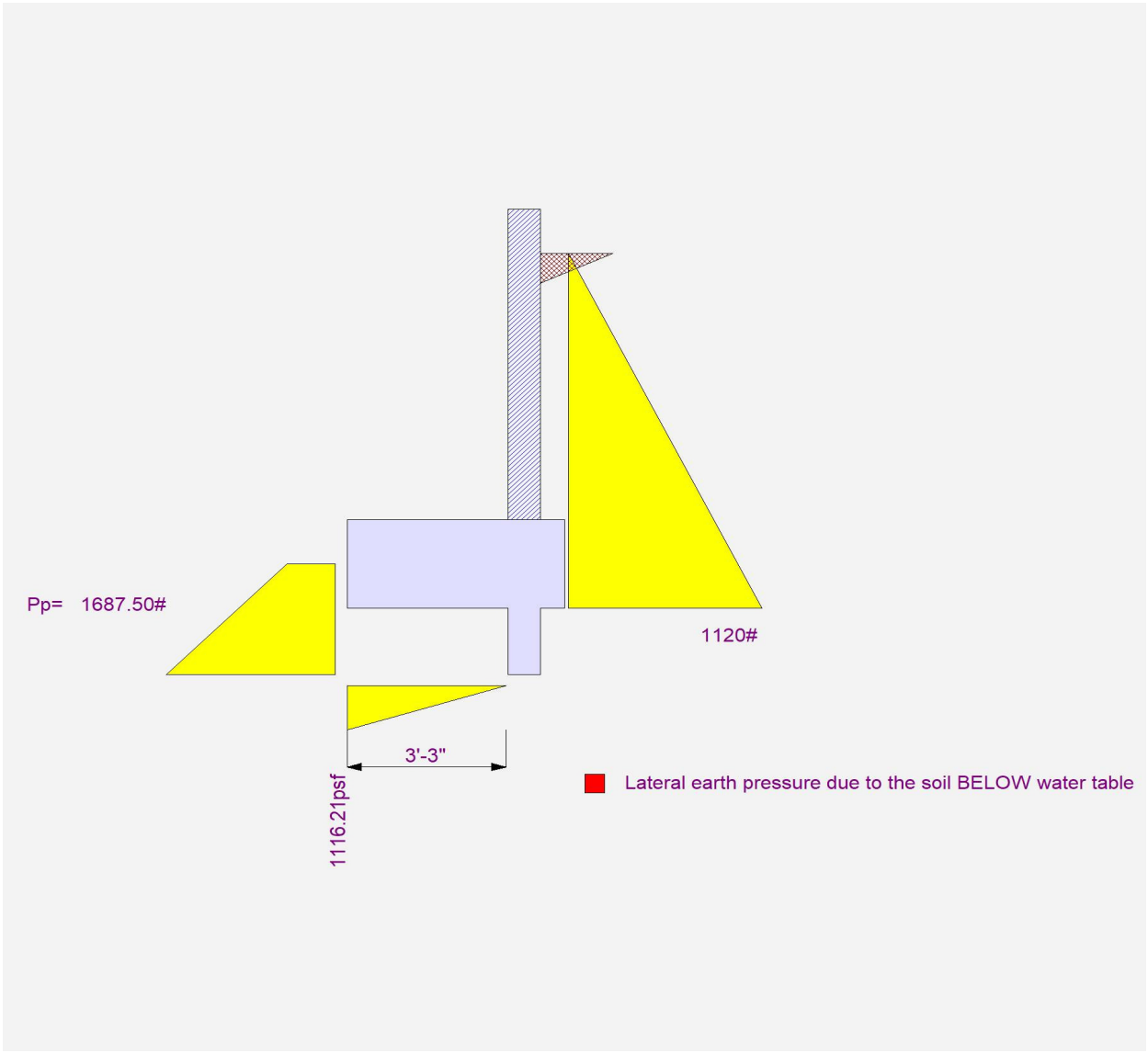
Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 6' Retained PL



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

Code References

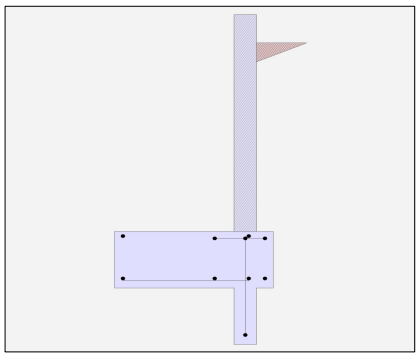
Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19 , TMS 402-16

Criteria

Retained Height	=	6.67 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,800.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.250
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		

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 (Strength 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	=	0.000 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

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

Design Summary

Wall Stability Ratios

Overturning	=	1.53	OK
Sliding	=	2.09	OK
Global Stability	=	1.88	

Total Bearing Load	=	1,991 lbs	
...resultant ecc.	=	16.36 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,314 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,800 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,839 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	6.1 psi	OK
Footing Shear @ Heel	=	2.5 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,315.5 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	8.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.417**		
Total Force @ Section				
Service Level	lbs =	778.6		
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	1,731.0		
Strength Level	ft-# =			
Moment.....Allowable	=	4,144.4		
Shear.....Actual				
Service Level	psi =	8.5		
Strength Level	psi =			
Shear.....Allowable	psi =	50.3		
Anet (Masonry)	in2 =	91.50		
Wall Weight	psf =	0.0		
Rebar Depth 'd'	in =	5.25		
Masonry Data				
f'm	psi =	2,000		
Fs	psi =	32,000		
Solid Grouting	=	Yes		
Modular Ratio 'n'	=	16.11		
Equiv. Solid Thick.	in =	7.63		
Masonry Block Type	=			
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =			
Fy	psi =			

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

Summary of Sliding Forces

	FS = 1.0		FS = 1.5	
Lateral Force @ Base of Footing	1,315.46	lbs	1,973.18	lbs
less 100% Passive Force	- 2,250.0	lbs	- 2,250.0	lbs
less 100% Friction Force	- 497.80	lbs	- 497.80	lbs
Added Resisting Force Required	0.0	lbs		
Added Resisting Force Required for 1.5 Factor of Safety			0.00	lbs

Sliding Factor of Safety = 2.089: 1.00

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

Footing Data

Toe Width	=	3.58 ft
Heel Width	=	1.17
Total Footing Width	=	4.75
Footing Thickness	=	24.00 in
Key Width	=	8.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	3.58 ft

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

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	1,839	0		psf
Mu' : Upward	=	7,163	0		ft-#
Mu' : Downward	=	2,522	259		ft-#
Mu: Design	=	4,642	259	3,104	ft-#
Toe Reinforcing	=	# 5 @ 6.00 in			
Heel Reinforcing	=	# 5 @ 6.00 in			
Key Reinforcing	=	# 5 @ 8.00 in			

Mu:Design @ Toe	4,641.51 ft-#	OK
phiMn Toe	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Heel	258.70 ft-#	OK
phiMn Heel	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Key	3,103.71 ft-#	OK
phiMn Key	5,071 ft-#	
As min req'd 0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	OK
As provided #5@8.0 in o.c.	0.465 in2/ft	
As Max :	0.8128 in2/ft	OK

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

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)	1,315.5	2.89	3,801.7	Soil Over HL (ab. water tbl)	367.1	4.50	1,650.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl)		4.50	
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 =			
=				Surcharge Over Toe =			
				Stem Weight(s) =			
				Earth @ Stem Transitions =			
Total =	1,315.5	**O.T.M.** =	3,801.7	Footing Weight =	1,424.1	2.37	3,380.1
				Key Weight =	200.0	3.91	782.7
				Vert. Component =			
				Total =	1,991.2 lbs	**R.M.=**	5,813.5

Resisting/Overturning Ratio = **1.53**

Vertical Loads used for Soil Pressure = 1,991.2 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 NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.059	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.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 9754.15 psi

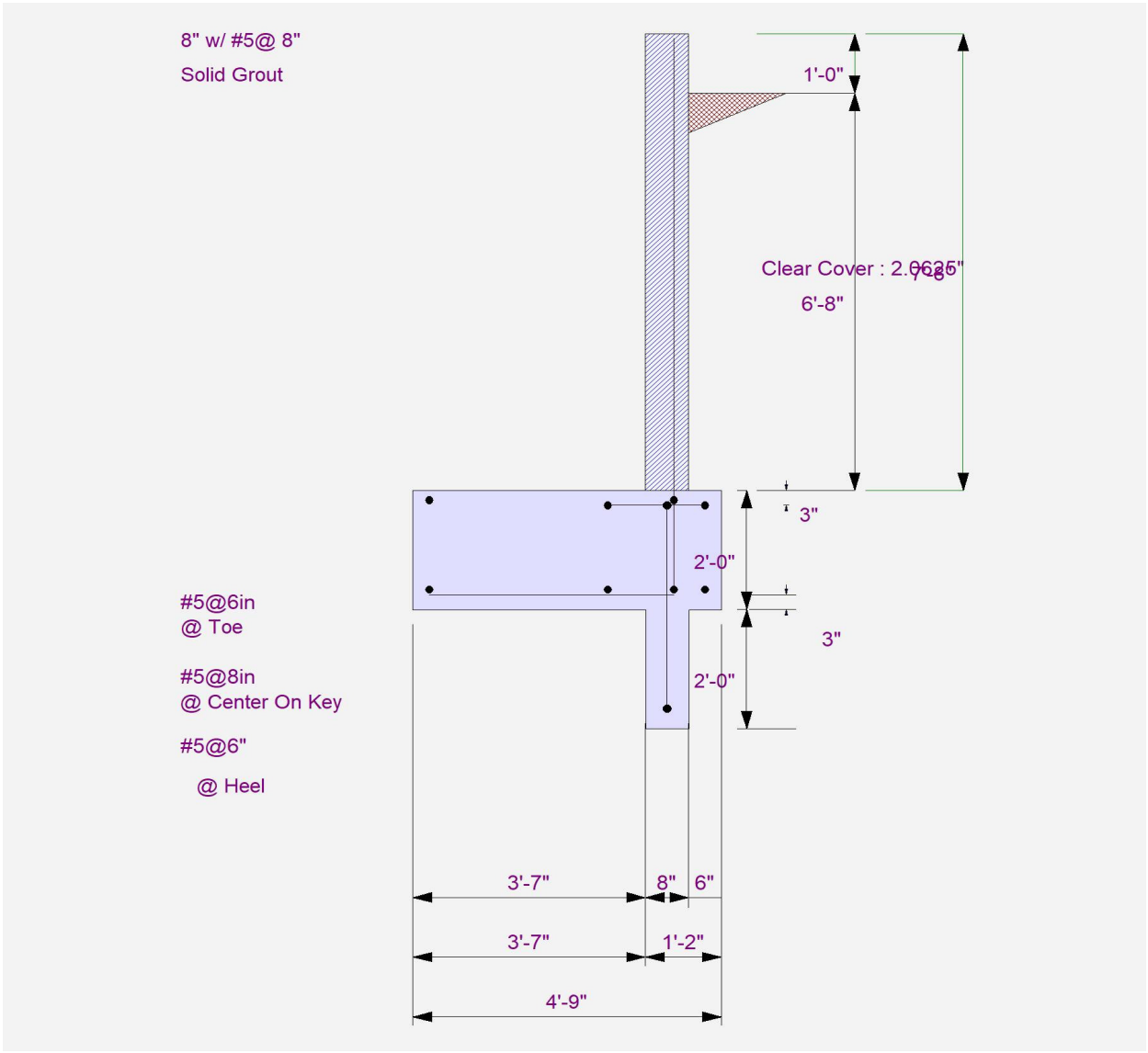
Lap Splice length for #5 bar specified in this stem design segment (IBC Eq. 21-1) =	40.00 in
Development length for #5 bar specified in this stem design segment =	40.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	8.27 in
As Provided =	0.4650 in2/ft
As Required =	0.1393 in2/ft
Ψ r: Confining Reinforcement Factor =	1.00
Ψ o: Location Factor =	1.00
Ψ c: Concrete Strength Factor =	0.77

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage

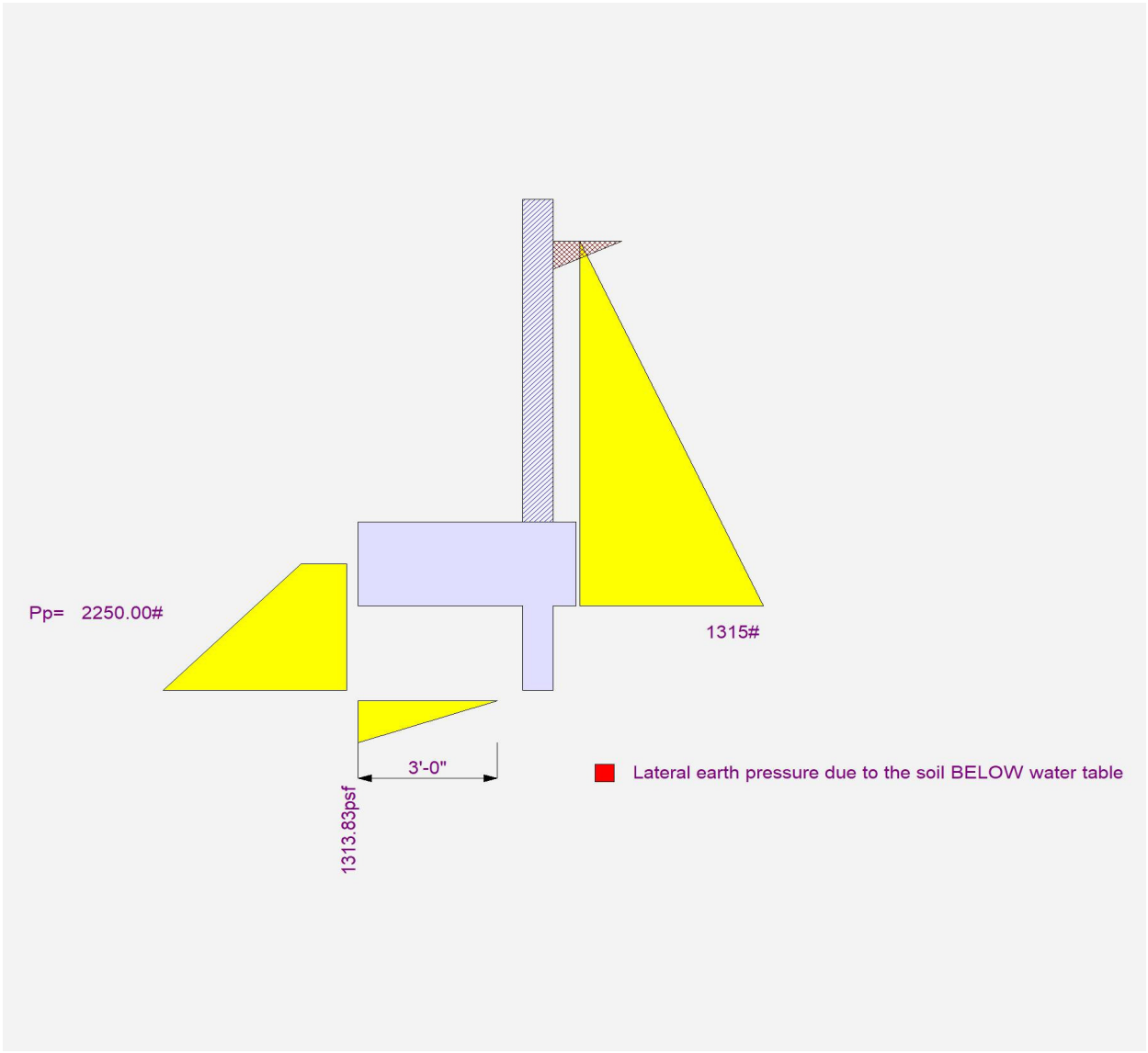


Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: 6'-8" Retaining Near Garage



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL

Code References

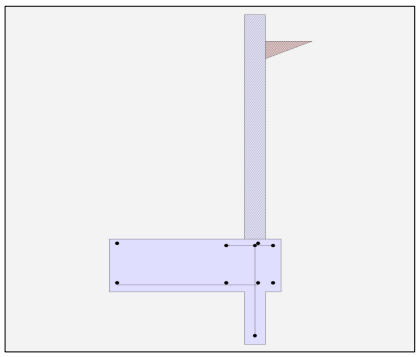
Governing Code : IBC 2021
Referenced Design Standard(s) : ACI 318-19 , TMS 402-16

Criteria

Retained Height	=	7.50 ft
Wall height above soil	=	1.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	0.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,600.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.250
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 (Strength 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	=	0.000 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Method : Inverted Triangular

Load at top of Inverted Triangular Distribution . . . . . = 0.200 psf (Strength)

Total Strength-Level Seismic Load. . . . . = 0.950 lbs

Total Service-Level Seismic Load. . . . . = 0.665 lbs

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL

Design Summary

Wall Stability Ratios

Overturning	=	1.52	OK
Sliding	=	1.78	OK
Global Stability	=	1.67	

Total Bearing Load	=	2,262 lbs	
...resultant ecc.	=	19.05 in	
Eccentricity outside middle third			
Soil Pressure @ Toe	=	1,299 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	2,600 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,819 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	6.5 psi	OK
Footing Shear @ Heel	=	2.7 psi	OK
Allowable	=	75.0 psi	

Sliding Calcs

Lateral Sliding Force	=	1,580.0 lbs

Vertical component of active lateral soil pressure IS NOT considered in the calculation of soil bearing pressures.

Load Factors

Building Code	
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Masonry		
Design Method	=	ASD	SD	SD
Thickness	=	8.00		
Rebar Size	=	# 5		
Rebar Spacing	=	8.00		
Rebar Placed at	=	Edge		
Design Data				
fb/FB + fa/Fa	=	**0.594**		
Total Force @ Section				
Service Level	lbs =	985.3		
Strength Level	lbs =			
Moment....Actual				
Service Level	ft-# =	2,465.1		
Strength Level	ft-# =			
Moment.....Allowable	=	4,144.4		
Shear.....Actual				
Service Level	psi =	10.8		
Strength Level	psi =			
Shear.....Allowable	psi =	50.3		
Anet (Masonry)	in2 =	91.50		
Wall Weight	psf =	0.0		
Rebar Depth 'd'	in =	5.25		
Masonry Data				
f'm	psi =	2,000		
Fs	psi =	32,000		
Solid Grouting	=	Yes		
Modular Ratio 'n'	=	16.11		
Equiv. Solid Thick.	in =	7.63		
Masonry Block Type	=			
Masonry Design Method	=	ASD		
Concrete Data				
f'c	psi =			
Fy	psi =			

Summary of Sliding Forces

	FS = 1.0	FS = 1.5
Lateral Force @ Base of Footing	1,580.04 lbs	2,370.06 lbs
less 100% Passive Force	- 2,250.0 lbs	- 2,250.0 lbs
less 100% Friction Force	- 565.47 lbs	- 565.47 lbs
Added Resisting Force Required	0.0 lbs	
Added Resisting Force Required for 1.5 Factor of Safety		0.00 lbs

Sliding Factor of Safety = 1.782: 1.00

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL

Footing Data

Toe Width	=	4.33 ft
Heel Width	=	1.17
Total Footing Width	=	5.50
Footing Thickness	=	24.00 in
Key Width	=	8.00 in
Key Depth	=	24.00 in
Key Distance from Toe	=	4.33 ft

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

Footing Design Results

		Toe	Heel	Key	
Factored Pressure	=	1,819	0		psf
Mu' : Upward	=	10,036	0		ft-#
Mu' : Downward	=	3,635	282		ft-#
Mu: Design	=	6,401	282	3,099	ft-#
Toe Reinforcing	=	# 5 @ 6.00 in			
Heel Reinforcing	=	# 5 @ 6.00 in			
Key Reinforcing	=	# 5 @ 8.00 in			

Mu:Design @ Toe	6,401.30 ft-#	OK
phiMn Toe	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Heel	281.55 ft-#	OK
phiMn Heel	37,574 ft-#	
As min req'd 0.0018bh : 0.0018(12)(24) :	0.5184 in2/ft	OK
As provided #5@6.0 in o.c.	0.62 in2/ft	
As Max :	4.1657 in2/ft	OK
Mu:Design @ Key	3,099.45 ft-#	OK
phiMn Key	5,071 ft-#	
As min req'd 0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	OK
As provided #5@8.0 in o.c.	0.465 in2/ft	
As Max :	0.8128 in2/ft	OK

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL

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)		1,579.4	3.17	5,001.4	Soil Over HL (ab. water tbl)	412.8	5.25	2,165.8
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		5.25	
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	=		
Seismic Earth Load	=	0.7	6.33	4.2	Surcharge Over Toe	=		
	=				Stem Weight(s)	=		
					Earth @ Stem Transitions	=		
Total	=	1,580.0	**O.T.M.** =	5,005.6	Footing Weight	=	1,649.1	2.75	4,532.6
					Key Weight	=	200.0	4.66	932.7
					Vert. Component	=			
					Total =		2,261.9 lbs	**R.M.=**	7,631.0

Resisting/Overturning Ratio = **1.52**

Vertical Loads used for Soil Pressure = 2,261.9 lbs

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

If seismic is included, the OTM and sliding ratios may be 1.1 per section 1807.2.3 of IBC.

Vertical component of active lateral soil pressure IS NOT considered in the calculation of Sliding Resistance.

Vertical component of active lateral soil pressure IS NOT 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)	0.056	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.

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL

Rebar Lap & Embedment Lengths Information

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing
Calculated Rebar Stress, fs = 13890.78 psi

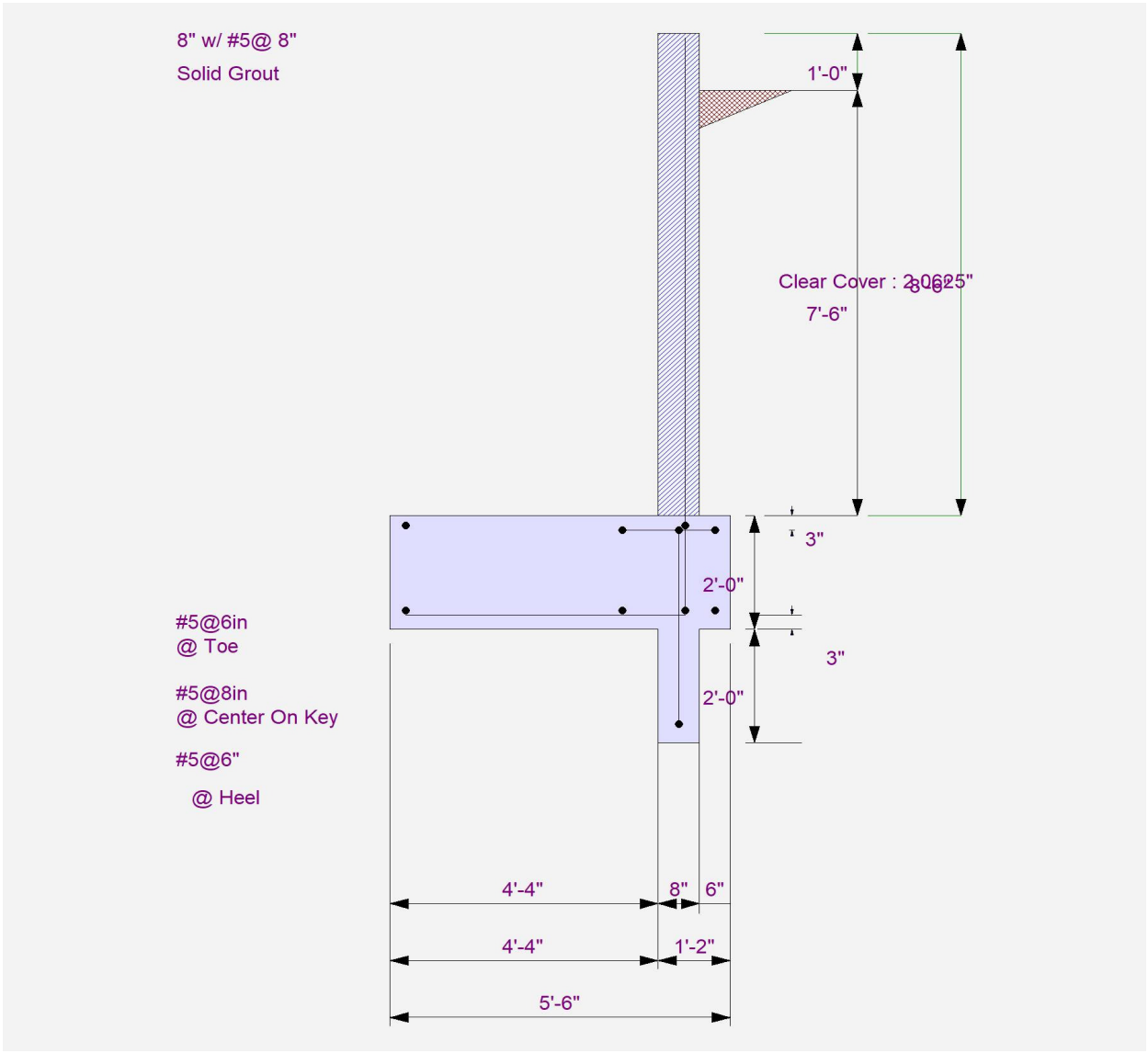
Lap Splice length for #5 bar specified in this stem design segment (IBC Eq. 21-1) =	40.00 in
Development length for #5 bar specified in this stem design segment =	40.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	8.27 in
As Provided =	0.4650 in2/ft
As Required =	0.1996 in2/ft
Ψ r: Confining Reinforcement Factor =	1.00
Ψ o: Location Factor =	1.00
Ψ c: Concrete Strength Factor =	0.77

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL



Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: 26-501 vertical design.ec6

DESCRIPTION: Site Retaining Walls 7.5' Retained PL