MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 295, San Diego, CA 92121 ▸ p 619-650-0010 ▸ *mulhernkulp.com*

CALCULATION PACKAGE

May 16, 2023

LNL Builds

2436 74th Ave SE

Mercer Island,
Washington

MULHERN & KULP STRUCTURAL ENGINEERING, INC.

Prepared By:

Lillian G. Heng, P.E. *Project Engineer*

Nicholas J. Martignetti, P.E. *Associate Owner + San Diego Office Director*

Signature, Seal & Date

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

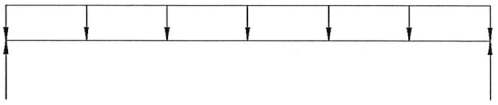
PROJECT NAME: LNL BUILDS
2436 74TH AVE SE
M&K PROJECT #: 01B-22107
ENGINEER: LGH
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: TYP. EXT. HDR @ 2ND FLR — B1

PARAMETERS:

L = 6.0 FT
W = 0.65 KLF
P = N/A K



ANALYSIS:

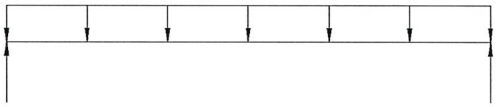
R_{MAX} =	1.95 K	V_D =		K	< V_{ALL} =	3.502 K	✓ ADEQUATE
M_{MAX} =	2.914 K-FT	< M_{ALL} =	3.438 K-FT				✓ ADEQUATE
Δ_{TL} =	0.107 IN.	L/	675	< L/240			✓ ADEQUATE

PF-L NO.2 4X8 HDR

BEAM DESCRIPTION: ROOF FRAMING - FLUSH BTM BM @ BED 2 — B2

PARAMETERS:

L = 3.75 FT
W = 0.294 KLF
P = N/A K



ANALYSIS:

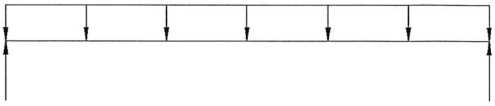
R_{MAX} =	0.55 K	V_D =		K	< V_{ALL} =	4.468 K	✓ ADEQUATE
M_{MAX} =	0.517 K-FT	< M_{ALL} =	5.164 K-FT				✓ ADEQUATE
Δ_{TL} =	0.003 IN.	L/	999F	< L/240			✓ ADEQUATE

PF-L NO.2 4X10

BEAM DESCRIPTION: LOWER ROOF - ROOF RAFTERS — B3

PARAMETERS:

L = 13.83 FT
W = 0.09 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	0.5 K	V_D =		K	< V_{ALL} =	1.94 K	✓ ADEQUATE
M_{MAX} =	1.07 K-FT	< M_{ALL} =	2.96 K-FT				✓ ADEQUATE
Δ_{TL} =	0.25 IN.	L/	667	< L/240			✓ ADEQUATE

HF #2 2X12 R.R. @ 24" O.C.

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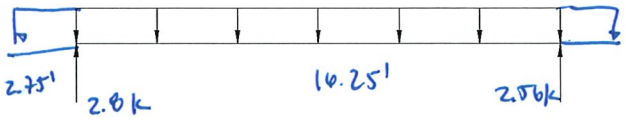
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: COVERED DECK ROOF BEAM — B4

PARAMETERS:

L = VARIES FT
W = 0.256 KLF
P = N/A K



ANALYSIS:

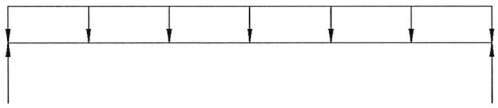
R_{MAX} =	2.8 K	V_D =	K	< V_{ALL} =	8.24 K	✓ ADEQUATE
M_{MAX} =	7.7 K-FT	< M_{ALL} =	10.16 K-FT			✓ ADEQUATE
Δ_{TL} =	0.401 IN.	L/	486	< L/240		✓ ADEQUATE

DF-L NO.2 6X12

BEAM DESCRIPTION: INT. HDR @ GARAGE — B5

PARAMETERS:

L = 3.17 FT
W = 0.24 KLF
P = N/A K



ANALYSIS:

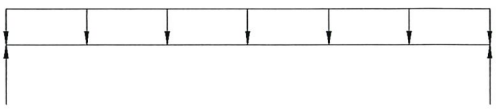
R_{MAX} =	0.377 K	V_D =	K	< V_{ALL} =	3.085 K	✓ ADEQUATE
M_{MAX} =	0.3 K-FT	< M_{ALL} =	4.492 K-FT			✓ ADEQUATE
Δ_{TL} =	0.0015 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4X10

BEAM DESCRIPTION: TYP. EXT. HDR @ 1ST FLR — B6

PARAMETERS:

L = 5.0 FT
W = 0.687 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.72 K	V_D =	K	< V_{ALL} =	4.460 K	✓ ADEQUATE
M_{MAX} =	2.15 K-FT	< M_{ALL} =	5.16 K-FT			✓ ADEQUATE
Δ_{TL} =	0.026 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4X10 HDR

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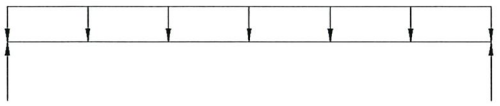
PROJECT NAME: LNL BUILDS
2436 74TH AVE SE
M&K PROJECT #: 01B-22107
ENGINEER: LGH
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: PRIMARY BATH/1 BAR FLOOR JOIST — B7

PARAMETERS:

L = 5.583 FT
W = 0.067 KLF
P = N/A K



ANALYSIS:

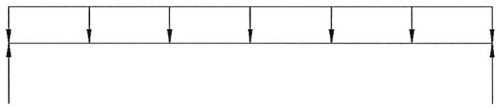
R_{MAX} =	0.19 K	V_D =		K	< V_{ALL} =	K	✓ ADEQUATE
M_{MAX} =	0.26 K-FT	< M_{ALL} =		K-FT			✓ ADEQUATE
Δ_{TL} =	0.04 IN.	L/	999+	< L/240			✓ ADEQUATE

HF #2 2x6 @ 16" O.C.

BEAM DESCRIPTION: PRIMARY BATH FLOOR BEAM — B8

PARAMETERS:

L = 7.583 FT
W = 0.525 KLF
P = N/A K



ANALYSIS:

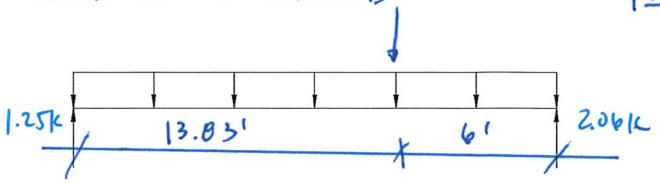
R_{MAX} =	1.99 K	V_D =		K	< V_{ALL} =	7.09 K	✓ ADEQUATE
M_{MAX} =	3.8 K-FT	< M_{ALL} =	17.82	K-FT			✓ ADEQUATE
Δ_{TL} =	0.04 IN.	L/	999+	< L/240			✓ ADEQUATE

TJ MICRO=LAM 2.0E (2) 1 3/4" x 11 7/8" LVL

BEAM DESCRIPTION: 2ND FLR FRMG - FLUSH BM @ GARAGE — B9

PARAMETERS:

L = 19.83 FT
W = 0.067 KLF
P = 1.99 K



ANALYSIS:

R_{MAX} =	2.06 K	V_D =		K	< V_{ALL} =	11.84 K	✓ ADEQUATE
M_{MAX} =	11.55 K-FT	< M_{ALL} =	26.73	K-FT			✓ ADEQUATE
Δ_{TL} =	0.4 IN.	L/	592	< L/240			✓ ADEQUATE

TJ MICRO=LAM 2.0E (3) 1 3/4" x 11 7/8" LVL

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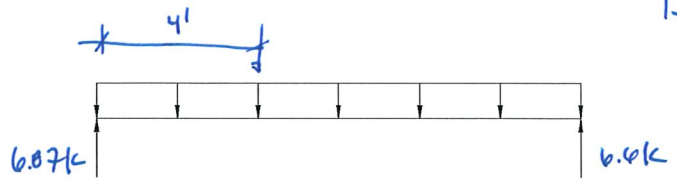
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: GARAGE HDR — B10

PARAMETERS:

L = 16.5 FT
W = 0.703 KLF
P = 0.543 K



ANALYSIS:

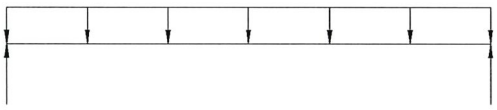
R_{MAX} =	6.07 K	V_D =		K	< V_{ALL} =	16.76 K	✓ ADEQUATE
M_{MAX} =	28.0 K-FT	< M_{ALL} =	47.43	K-FT			✓ ADEQUATE
Δ_{TL} =	0.5 IN.	L/	403	< L/240			✓ ADEQUATE

DF-DF 24F-V4 5½" X 15" GLB

BEAM DESCRIPTION: 2ND FLR FRMG - FLUSH BEAM @ OPENING BELOW — B11

PARAMETERS:

L = 7.5 FT
W = 0.142 KLF
P = N/A K



ANALYSIS:

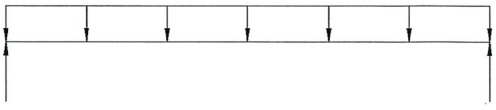
R_{MAX} =	0.53 K	V_D =		K	< V_{ALL} =	11.13 K	✓ ADEQUATE
M_{MAX} =	1.0 K-FT	< M_{ALL} =	37.8	K-FT			✓ ADEQUATE
Δ_{TL} =	0.003 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-DF 24F-V4 3½" X 18" GLB

BEAM DESCRIPTION: 2ND FLR FRMG - FLUSH BTM BEAM @ DINING — B12

PARAMETERS:

L = 4.75 FT
W = 0.777 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.85 K	V_D =		K	< V_{ALL} =	3.885 K	✓ ADEQUATE
M_{MAX} =	2.2 K-FT	< M_{ALL} =	4.492	K-FT			✓ ADEQUATE
Δ_{TL} =	0.02 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-L NO.2 4X10

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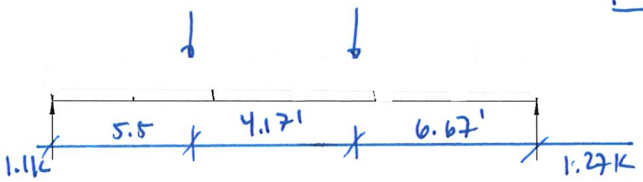
2436 74TH AVE SE
M&K PROJECT #: 01B-22107
ENGINEER: LGH
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: 2ND FLR FRMG - FLUSH BM @ STAIR OPENING — B13

PARAMETERS:

L = 16.33 FT
W = N/A KLF
P = VARIES K



ANALYSIS:

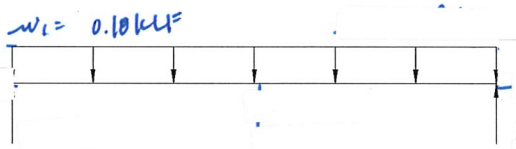
R_{MAX} =	1.27 K	V_D =		K	< V_{ALL} = 7.896 K	✓ ADEQUATE
M_{MAX} =	8.48 K-FT	< M_{ALL} =	17.82 K-FT			✓ ADEQUATE
Δ_{TL} =	0.114 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-DF 24F-V4 3½" x 19" 6 LVB

BEAM DESCRIPTION: PORCH ROOF - ROOF BEAM — B14

PARAMETERS:

L = 11.83 FT
W = 0.10 KLF
P = N/A K



ANALYSIS:

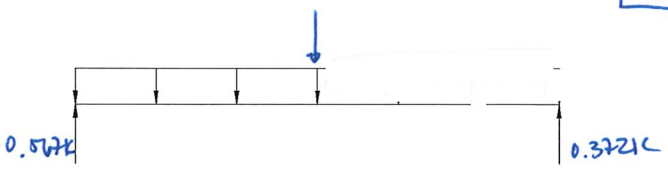
R_{MAX} =	1.1 K	V_D =		K	< V_{ALL} = 5.376 K	✓ ADEQUATE
M_{MAX} =	3.15 K-FT	< M_{ALL} =	4.327 K-FT			✓ ADEQUATE
Δ_{TL} =	0.32 IN.	L/	449	< L/240		✓ ADEQUATE

DF-L NO.2 6 X 8

BEAM DESCRIPTION: INT. HDR @ BED 4 — B15

PARAMETERS:

L = 3.0 FT
W = 0.34 KLF
P = 0.55 K



ANALYSIS:

R_{MAX} =	0.567 K	V_D =		K	< V_{ALL} = 4.468 K	✓ ADEQUATE
M_{MAX} =	0.56 K-FT	< M_{ALL} =	5.168 K-FT			✓ ADEQUATE
Δ_{TL} =	0.002 IN.	L/	999+	< L/240		✓ ADEQUATE

DF-L NO.2 4X10 HDR

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PROJECT NAME: LNL BUILDS
2436 74TH AVE SE
M&K PROJECT #: 018-22107
ENGINEER: LGH
DATE: 25-JAN-23

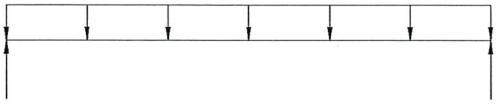
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: FLUSH BTM, BM @ BED 4

B16

PARAMETERS:

L = 4.0 FT
W = 0.84 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.60 K	V_D =		K	< V_{ALL} =	3.085 K	✓ ADEQUATE
M_{MAX} =	1.60 K-FT	< M_{ALL} =	4.492 K-FT				✓ ADEQUATE
Δ_{TL} =	0.013 IN.	L/	9994	< L/240			✓ ADEQUATE

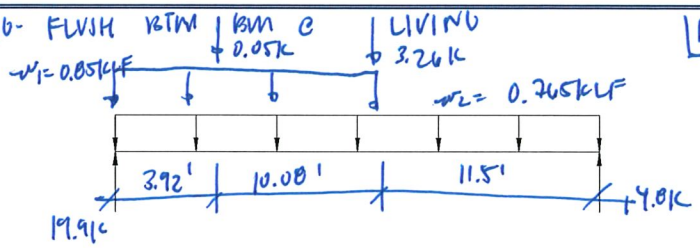
DF-L NO.2 4x10

BEAM DESCRIPTION: 2ND FLR FRMG- FLUSH BTM, BM @ LIVING

B17

PARAMETERS:

L = 25.5 FT
W = VARIES KLF
P = VARIES K



ANALYSIS:

R_{MAX} =	19.9 K	V_D =		K	< V_{ALL} =	145.86 K	ADEQUATE
M_{MAX} =	122.10 K-FT	< M_{ALL} =	346.8 K-FT				ADEQUATE
Δ_{TL} =	0.546 IN.	L/	561	< L/240			ADEQUATE

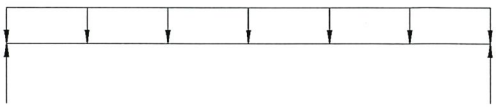
W14X82 STEEL BEAM

BEAM DESCRIPTION: TYP. DECK JOISTS

B19

PARAMETERS:

L = 13.75 FT
W = 0.070 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	0.48 K	V_D =		K	< V_{ALL} =	1.38 K	✓ ADEQUATE
M_{MAX} =	1.65 K-FT	< M_{ALL} =	1.67 K-FT				✓ ADEQUATE
Δ_{TL} =	0.438 IN.	L/	376	< L/240			✓ ADEQUATE

HF #2 2x10 @ 12"O.C.

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DATE: 25-JAN-23

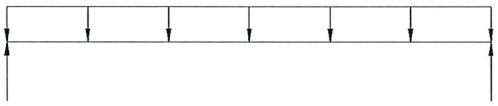
BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: DECK BEAM

B19

PARAMETERS:

L = 16.33 FT
W = 0.478 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	3.9 K	V_D =		K	< V_{ALL} =	11.66 K	✓ ADEQUATE
M_{MAX} =	15.94 K-FT	< M_{ALL} =	26.4	K-FT			✓ ADEQUATE
Δ_{TL} =	0.54 IN.	L/	365	< L/240			✓ ADEQUATE

DF-DF 24F-V4 5½" x 12" GLB

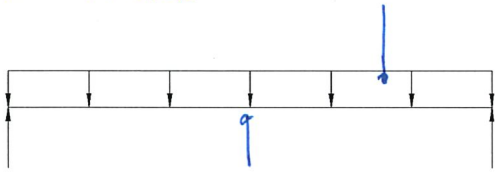
BEAM DESCRIPTION: HEADER @ EXT. STORAGE

B20

PARAMETERS:

L = VARIES FT
W = 1.57 KLF
P = VARIES K

* SEE EVERYCALC OUTPUT FOR HD



ANALYSIS:

R_{MAX} =	12.0 K	V_D =		K	< V_{ALL} =	10.05 K	✓ ADEQUATE
M_{MAX} =	-8.27 K-FT	< M_{ALL} =	17.07	K-FT			✓ ADEQUATE
Δ_{TL} =	0.05 IN.	L/	999+	< L/240			✓ ADEQUATE

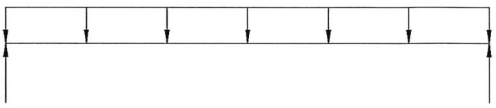
DF-DF 24F-V4 5½" x 9" GLB

BEAM DESCRIPTION: TYP. EXT. HDR @ BASEMENT

B21

PARAMETERS:

L = 5.0 FT
W = 0.504 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.26 K	V_D =		K	< V_{ALL} =	3.045 K	✓ ADEQUATE
M_{MAX} =	1.58 K-FT	< M_{ALL} =	2.989	K-FT			✓ ADEQUATE
Δ_{TL} =	0.04 IN.	L/	999+	< L/240			✓ ADEQUATE

DF-L NO.2 4x8 HDR

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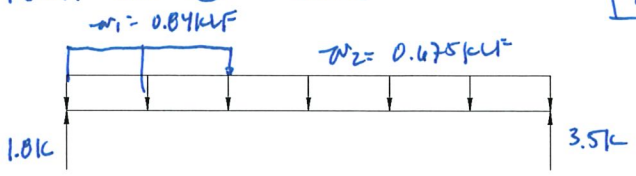
2436 74TH AVE SE
M&K PROJECT #: 01B-22107
ENGINEER: LGH
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: 1ST FLR FRMG - FLUSH BM @ BONUS — B22

PARAMETERS:

L = 11.75 FT
W = VARIES KLF
P = N/A K



ANALYSIS:

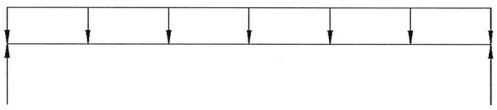
R_{MAX} =	3.5 K	V_D =		K	< V_{ALL} =	7.896 K	✓ ADEQUATE
M_{MAX} =	9.0 K-FT	< M_{ALL} =	17.82 K-FT				✓ ADEQUATE
Δ_{TL} =	0.231 IN.	L/	610	< L/240			✓ ADEQUATE

TJ MICRO LLAM 2.0E (2) 1 3/4" x 11 7/8" LVL

BEAM DESCRIPTION: 1ST FLR FRMG - FLUSH BM @ HALL — B23

PARAMETERS:

L = 3.75 FT
W = 0.54 KLF
P = N/A K



ANALYSIS:

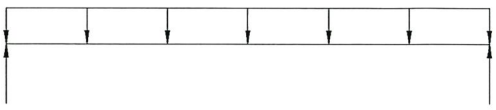
R_{MAX} =	1.04 K	V_D =		K	< V_{ALL} =	7.896 K	✓ ADEQUATE
M_{MAX} =	0.978 K-FT	< M_{ALL} =	1702 K-FT				✓ ADEQUATE
Δ_{TL} =	0.002 IN.	L/	999+	< L/240			✓ ADEQUATE

TJ MICRO LLAM 2.0E (2) 1 3/4" x 11 7/8" LVL

BEAM DESCRIPTION: 1ST FLR FRMG - FLUSH BM @ STAIR OPENING — B24

PARAMETERS:

L = 7.583 FT
W = 0.27 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	1.01 K	V_D =		K	< V_{ALL} =	3.95 K	✓ ADEQUATE
M_{MAX} =	1.92 K-FT	< M_{ALL} =	8.911 K-FT				✓ ADEQUATE
Δ_{TL} =	0.02 IN.	L/	999+	< L/240			✓ ADEQUATE

TJ MICRO LLAM 2.0E (2) 1 3/4" x 11 7/8" LVL

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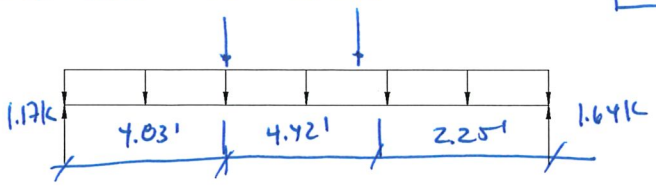
PROJECT NAME: LNL BUILDS
2436 74TH AVE SE
M&K PROJECT #: 01B-22107
ENGINEER: LGH
DATE: 25-JAN-23

BEAM & HEADER CALCULATIONS

BEAM DESCRIPTION: 1ST FLR FRMG - FLUSH BEAM @ STAIRS — B25

PARAMETERS:

L = 11.05 FT
W = 0.067 KLF
P = VARIES K



ANALYSIS:

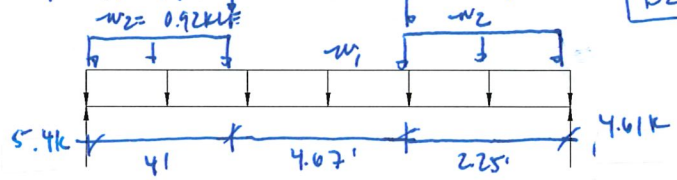
R_{MAX} =	1.64 K	V_D =	K	< V_{ALL} =	7.096 K	✓ ADEQUATE
M_{MAX} =	4.88 K-FT	< M_{ALL} =	17.02 K-FT			✓ ADEQUATE
Δ_{TL} =	0.12 IN.	L/	999+	< L/240		✓ ADEQUATE

TJ MICRO=LAM 2.0E (2) 1¾" x 11⅞" LVL

BEAM DESCRIPTION: 1ST FLR FRMG - FLUSH BM BELOW B.W.A @ CRAWL — B26

PARAMETERS:

L = 10.92 FT
W_1 = 0.067 KLF
P = 1.68 K



ANALYSIS:

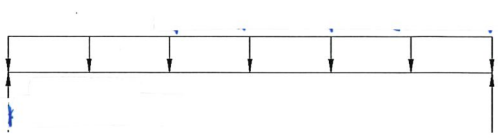
R_{MAX} =	4.61 K	V_D =	K	< V_{ALL} =	7.09 K	✓ ADEQUATE
M_{MAX} =	11.62 K-FT	< M_{ALL} =	10.56 K-FT			✓ ADEQUATE
Δ_{TL} =	0.282 IN.	L/	468	< L/240		✓ ADEQUATE

TJ MICRO=LAM 2.0E (2) 1¾" x 11⅞" LVL

BEAM DESCRIPTION: ROOF BEAM @ STAIRS — B27

PARAMETERS:

L = 7.03 FT
W = 0.606 KLF
P = N/A K



ANALYSIS:

R_{MAX} =	2.37 K	V_D =	K	< V_{ALL} =	5.92 K	✓ ADEQUATE
M_{MAX} =	4.44 K-FT	< M_{ALL} =	6.032 K-FT			✓ ADEQUATE
Δ_{TL} =	0.1 IN.	L/	935	< L/240		✓ ADEQUATE

DF-L NO.2 6x10

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Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ HD

CODE REFERENCES

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

Material Properties

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

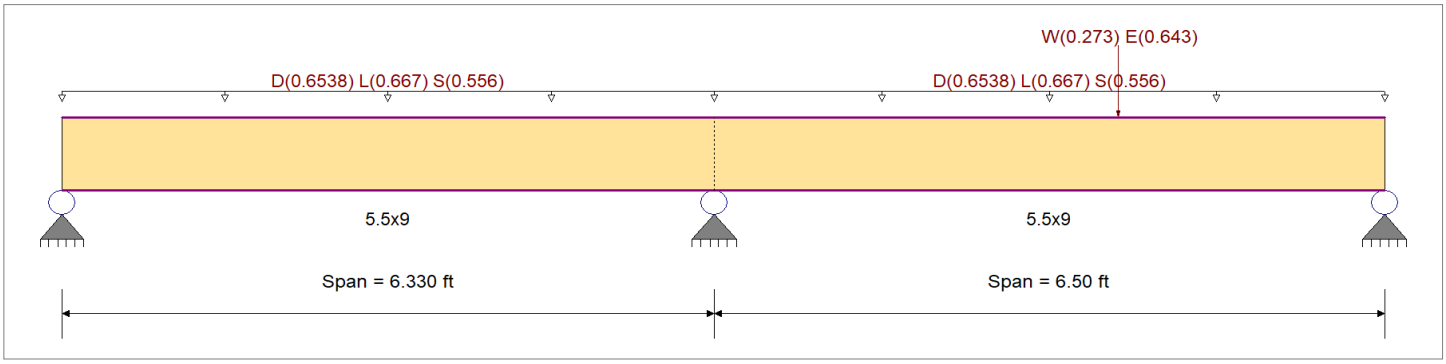
Wood Species : DF/DF
Wood Grade : 24F-V4

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

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

E : Modulus of Elasticity

Ebend- xx	1,800.0 ksi
Eminbend - xx	950.0 ksi
Ebend- yy	1,600.0 ksi
Eminbend - yy	850.0 ksi
Density	31.210 pcf



Applied Loads

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

Beam self weight NOT internally calculated and added
Load for Span Number 1
Uniform Load : D = 0.6538, L = 0.6670, S = 0.5560 , Tributary Width = 1.0 ft
Load for Span Number 2
Uniform Load : D = 0.6538, L = 0.6670, S = 0.5560 , Tributary Width = 1.0 ft
Point Load : W = 0.2730, E = 0.6430 k @ 3.920 ft, (HD)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.614 : 1	Maximum Shear Stress Ratio	=	0.518 : 1
Section used for this span		5.5x9	Section used for this span		5.5x9
fb: Actual	=	1,306.79 psi	fv: Actual	=	157.85 psi
Fb: Allowable	=	2,127.50 psi	Fv: Allowable	=	304.75 psi
Load Combination		+D+0.750L+0.750S	Load Combination		+D+0.750L+0.750S
Location of maximum on span	=	6.330 ft	Location of maximum on span	=	6.330 ft
Span # where maximum occurs	=	Span # 1	Span # where maximum occurs	=	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.019 in	Ratio =	4069 >=360	Span: 2 : L Only
Max Upward Transient Deflection	-0.007 in	Ratio =	10486 >=360	Span: 2 : E Only * -1.0
Max Downward Total Deflection	0.049 in	Ratio =	1590 >=180	Span: 2 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	-0.000 in	Ratio =	409400 >=180	Span: 2 : +0.60D-0.70E

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S-0.5250E	1	0.0395	2.688		0.0000	0.000
+D+0.750L+0.750S+0.5250E	2	0.0490	3.740		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
Overall MAXimum	3.724	12.792	4.037
Overall MINimum	0.056	-0.366	-0.333
D Only	1.538	5.243	1.607
+D+L	3.106	10.593	3.247
+D+S	2.845	9.702	2.974

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Project Title:
Engineer:
Project ID:
Project Descr:

Wood Beam

Project File: Beams.ec6

DESCRIPTION: B20 w/ HD

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2	Support 3
+D+0.750L	2.714	9.255	2.837
+D+0.750L+0.750S	3.695	12.600	3.862
+D+0.60W	1.523	5.337	1.692
+D-0.60W	1.552	5.150	1.522
+D+0.750L+0.450W	2.704	9.325	2.901
+D+0.750L-0.450W	2.725	9.185	2.773
+D+0.750L+0.750S+0.450W	3.684	12.669	3.926
+D+0.750L+0.750S-0.450W	3.706	12.530	3.798
+0.60D+0.60W	0.908	3.239	1.049
+0.60D-0.60W	0.937	3.053	0.879
+D+0.70E	1.499	5.499	1.840
+D-0.70E	1.577	4.987	1.374
+D+0.750L+0.750S+0.5250E	3.666	12.792	4.037
+D+0.750L+0.750S-0.5250E	3.724	12.408	3.687
+0.60D+0.70E	0.883	3.402	1.198
+0.60D-0.70E	0.962	2.890	0.731
L Only	1.569	5.349	1.640
S Only	1.308	4.459	1.367
W Only	-0.024	0.155	0.142
-W	0.024	-0.155	-0.142
E Only	-0.056	0.366	0.333
E Only * -1.0	0.056	-0.366	-0.333

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Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Beams.ec6

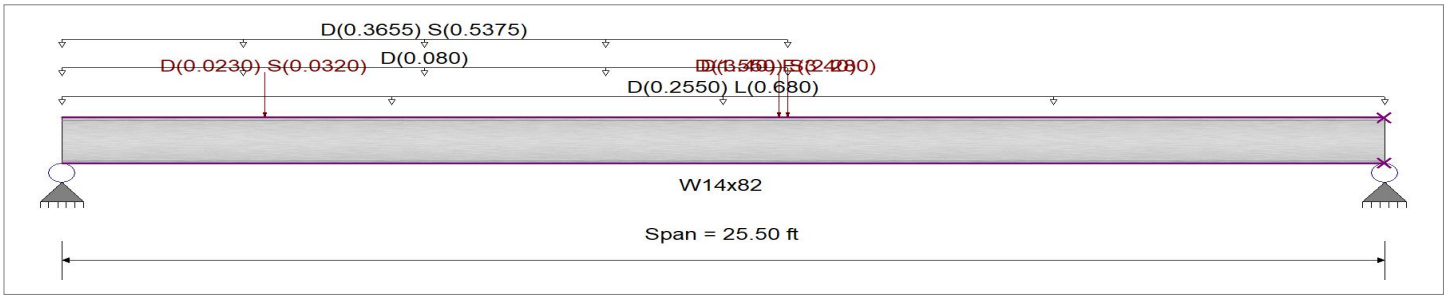
DESCRIPTION: B17 w/ Overstrength

CODE REFERENCES

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

Material Properties

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



Applied Loads

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

Beam self weight NOT internally calculated and added

Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 17.0 ft, (Floor)

Uniform Load : D = 0.010 ksf, Extent = 0.0 -->> 14.0 ft, Tributary Width = 8.0 ft, (Wall)

Uniform Load : D = 0.0170, S = 0.0250 ksf, Extent = 0.0 -->> 14.0 ft, Tributary Width = 21.50 ft, (Roof)

Point Load : D = 0.0230, S = 0.0320 k @ 3.920 ft, (Floor G.T.)

Point Load : D = 1.550, S = 2.280 k @ 14.0 ft, (Roof G.T.)

Point Load : D = 3.40, E = 3.40 k @ 13.830 ft, (SW# 207)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.510 : 1	Maximum Shear Stress Ratio =	0.168 : 1
Section used for this span	W14x82	Section used for this span	W14x82
Ma : Applied	176.885 k-ft	Va : Applied	24.461 k
Mn / Omega : Allowable	346.806 k-ft	Vn/Omega : Allowable	145.860 k
Load Combination	+1.097D+0.750L+0.750S+1.313E	Load Combination	+1.097D+0.750L+0.750S+1.313E
		Location of maximum on span	0.000 ft
Span # where maximum occurs	Span # 1	Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.254 in	Ratio =	1,202	>=360	Span: 1 : E Only * -1.0
Max Upward Transient Deflection	-0.079 in	Ratio =	3,872	>=360	Span: 1 : L Only
Max Downward Total Deflection	0.666 in	Ratio =	459	>=180	Span: 1 : +D+0.750L+0.750S+0.5250E
Max Upward Total Deflection	0.000 in	Ratio =	0	<180	

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
D Only													
Dsgn. L = 25.50 ft	1	0.207	0.069	71.76		71.76	579.17	346.81	1.00	1.00	10.05	218.79	145.86
+D+L													
Dsgn. L = 25.50 ft	1	0.365	0.128	126.71		126.71	579.17	346.81	1.00	1.00	18.72	218.79	145.86
+D+S													
Dsgn. L = 25.50 ft	1	0.318	0.114	110.31		110.31	579.17	346.81	1.00	1.00	16.57	218.79	145.86
+D+0.750L													
Dsgn. L = 25.50 ft	1	0.326	0.113	112.95		112.95	579.17	346.81	1.00	1.00	16.55	218.79	145.86
+D+0.750L+0.750S													

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Project Title:
Engineer:
Project ID:
Project Descr:

Steel Beam

Project File: Beams.ec6

DESCRIPTION: B17 w/ Overstrength

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Max Stress Ratios M	V	Summary of Moment Values Mmax +	Mmax -	Ma Max	Mnx	Mnx/Omega	Cb	Rm	Summary of Shear Values Va Max	Vnx	Vnx/Omega
Dsgn. L = 25.50 ft +0.60D	1	0.409	0.147	141.98		141.98	579.17	346.81	1.00	1.00	21.44	218.79	145.86
Dsgn. L = 25.50 ft +1.130D+1.750E	1	0.124	0.041	43.06		43.06	579.17	346.81	1.00	1.00	6.03	218.79	145.86
Dsgn. L = 25.50 ft +1.130D-1.750E	1	0.342	0.097	118.68		118.68	579.17	346.81	1.00	1.00	14.08	218.79	145.86
Dsgn. L = 25.50 ft +1.097D+0.750L+0.750S+1.313E	1	0.135	0.059	46.90		46.90	579.17	346.81	1.00	1.00	8.63	218.79	145.86
Dsgn. L = 25.50 ft +1.097D+0.750L+0.750S-1.313E	1	0.510	0.168	176.89		176.89	579.17	346.81	1.00	1.00	24.46	218.79	145.86
Dsgn. L = 25.50 ft +0.4701D+1.750E	1	0.355	0.140	123.03		123.03	579.17	346.81	1.00	1.00	20.38	218.79	145.86
Dsgn. L = 25.50 ft +0.4701D-1.750E	1	0.206	0.051	71.34		71.34	579.17	346.81	1.00	1.00	7.45	218.79	145.86
Dsgn. L = 25.50 ft	1	0.017	0.017	6.06	-3.89	6.06	579.17	346.81	1.00	1.00	2.54	218.79	145.86

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
+D+0.750L+0.750S+0.5250E	1	0.6661	12.677		0.0000	0.000

Vertical Reactions

Support notation : Far left is #1 Values in KIPS

Load Combination	Support 1	Support 2
Overall MAXimum	22.256	17.624
Overall MINimum	-1.556	-1.844
D Only	10.051	7.662
+D+L	18.721	16.332
+D+S	16.565	10.984
+D+0.750L	16.553	14.164
+D+0.750L+0.750S	21.439	16.656
+0.60D	6.030	4.597
+D+0.70E	11.140	8.953
+D-0.70E	8.961	6.371
+D+0.750L+0.750S+0.5250E	22.256	17.624
+D+0.750L+0.750S-0.5250E	20.622	15.688
+0.60D+0.70E	7.120	5.888
+0.60D-0.70E	4.941	3.306
L Only	8.670	8.670
S Only	6.515	3.322
E Only	1.556	1.844
E Only * -1.0	-1.556	-1.844

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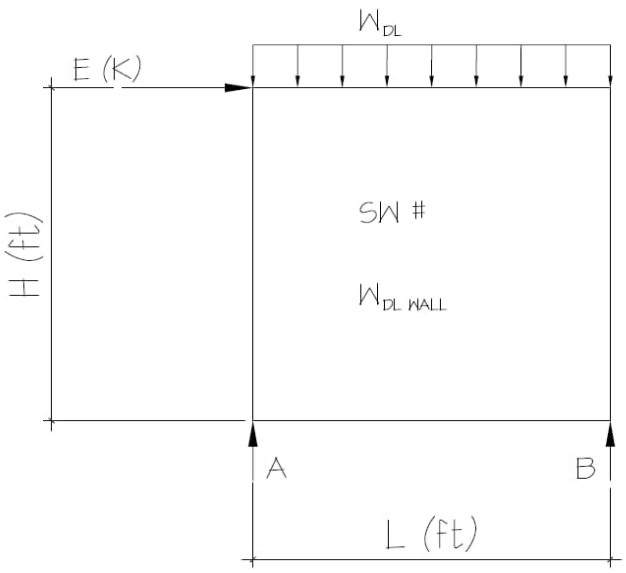
Project Name: LnL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 30-Jan-23

Overstrength Calculations

Wall Description/SW #: 207

Parameters:

L =	14.8	ft
H =	8.0	ft
E =	2.00	k
W_{DLWall} =	0.10	klf
W_{DL} =	0.358	klf
Ω_0 =	2.5	(ASCE TABLE 12.2.1 FOOTNOTE G)
SDS =	0.928	



analysis:

$E_{mh} = \Omega 0 * E$ = 5.00 K

$E_v = 0.2*SDS*DL$ = 1.261 K

$E_m = E_{mh} + E_v$

$E_m = E_{mh} - E_v$

$E_m = E_{mh} + E_v$ = 6.261 K

$E_m = E_{mh} - E_v$ = 3.739 K

E_m (max) $= \sum M_A = 0 =$ 6.26(8.0) + 0.458(14.83)(7.415) - Rb(14.83)

R_B = 3.4DL + 3.4E

Ra = 3.4DL - 3.4E

E_m (min) $= \sum M_A = 0 =$ 3.74(8.0) + 0.458(14.83)(7.415) - Rb(14.83)

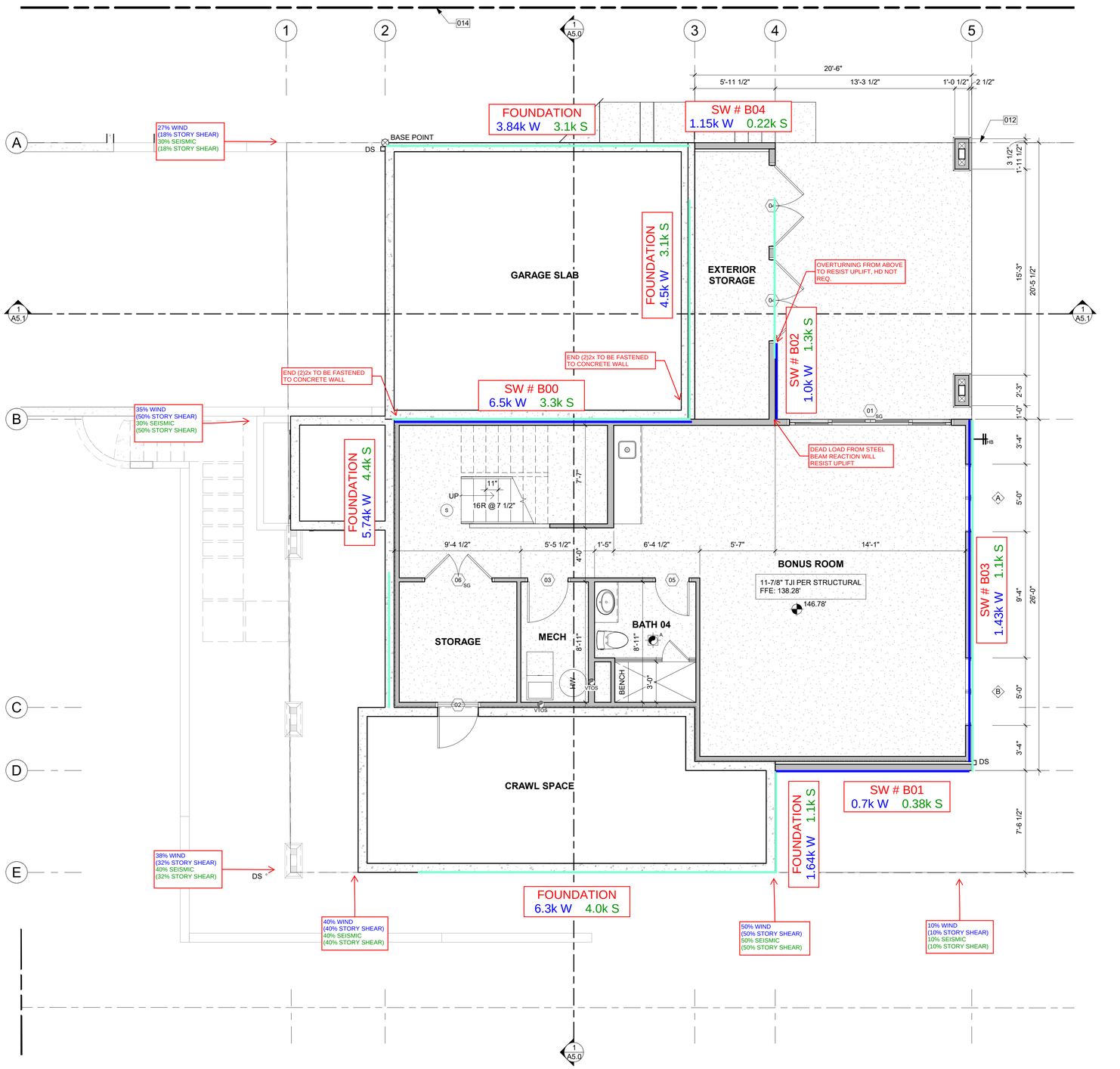
R_B = 3.4DL + 2.0E

Ra = 3.4DL - 2.0E

check beams for axial forces shown using load combos per section 12.4.3.1 (asd)

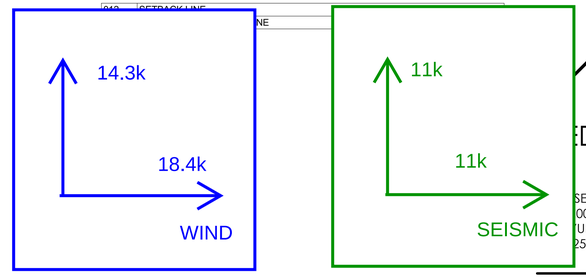
allowable stess permitted to be increased by 1.2

see following beam calcs for load application



BASEMENT PLAN 1
1/4" = 1'-0"

KEY NOTES



HOUSE VENTILATION WITH HRV

BALANCED WHOLE HOUSE VENTILATION REQUIREMENTS TO BE MET WITH A HEAT RECOVERY VENTILATION SYSTEM (HRV) PER M1505.4 AND WSEC ENERGY CREDIT OPTION 2.2/2.3/2.4. HRV TO HAVE MINIMUM SENSIBLE HEAT RECOVERY EFFICIENCY OF 0.65/0.75/0.80. MINIMUM MECHANICAL VENTILATION AIRFLOW RATE TO BE 210 CFM (INTERMITTENT) - (4-5 BEDROOMS 4501-6000 SF) TO OPERATE 50% OF TIME IN EACH 4-HOUR SEGMENT, PER TABLES M1505.4.3(1) AND M1505.4.3(3). UPDATE

SYMBOL	LOCATION	MINIMUM FAN REQUIREMENTS
A	BATH & POWDER	MINIMUM LOCAL EXHAUST RATE TO BE 50 CFM
B	KITCHEN	MINIMUM LOCAL EXHAUST RATE TO BE 100 CFM PROVIDED BY RANGE HOOD OR DOWN DRAFT EXHAUST FAN, PER M1503.2 IF OVER 400 CFM, MAKEUP AIR IS REQUIRED IN THE SAME ROOM PER M1503.6**
C	LAUNDRY ROOM	MINIMUM LOCAL EXHAUST RATE TO BE 50 CFM

** MAKEUP AIR IS NOT REQUIRED IF ALL GAS APPLIANCES IN THE HOUSE HAVE A DIRECT VENT OR MECHANICAL DRAFT VENT SYSTEM, PER MODIFICATION M1503.6.

HOUSE VENTILATION NO HRV

PROVIDE WHOLE HOUSE VENTILATION PER M1505.4 USING LAUNDRY ROOM EXHAUST FAN PER 1505.4.1.2 (WA) AND TABLE 1505.4.3(1) & 1505.4.3(A); PROVIDE CONTROLS PER 1505.4.2. COMPLY WITH WSEC R403.6 UPDATE

SYMBOL	LOCATION	MINIMUM FAN REQUIREMENTS
A	BATH & POWDER	MINIMUM LOCAL EXHAUST RATE TO BE 50 CFM (INTERMITTENT)
B	KITCHEN	MINIMUM LOCAL EXHAUST RATE TO BE 100 CFM (INTERMITTENT) PROVIDED BY RANGE HOOD OR DOWN DRAFT EXHAUST FAN, PER M1503.2 IF OVER 400 CFM, MAKEUP AIR IS REQUIRED IN THE SAME ROOM PER M1503.6** UPDATE
C	LAUNDRY ROOM	MIN. 210 CFM (INTERMITTENT) - TO FUNCTION AND BE LABELED AS WHOLE HOUSE FAN (4-5 BEDROOMS 4501<6000 SF) TO OPERATE 50% OF TIME IN EACH 4-HOUR SEGMENT. UPDATE

** MAKEUP AIR IS NOT REQUIRED IF ALL GAS APPLIANCES IN THE HOUSE HAVE A DIRECT VENT OR MECHANICAL DRAFT VENT SYSTEM, PER MODIFICATION M1503.6.

FLOOR PLAN NOTES

1. CONTRACTOR SHALL VERIFY ALL NOTES, DIMENSIONS & CONDITIONS PRIOR TO CONSTRUCTION.
2. SEE STRUCTURAL DRAWINGS FOR ALL POSTS, BEAMS AND HEADERS.
3. PROVIDE SOLID BLOCKING OVER SUPPORTS.
4. PROVIDE FIRE BLOCKING @ ALL PLUMBING PENETRATIONS.
5. WINDOWS & DOORS ARE SHOWN & NOTED AS NOMINAL SIZES.
6. DOOR JAMB 4.5" FROM CORNER TYP., U.N.O.
7. SEE SHEETS A0.3, A4.0 & A4.1 FOR WINDOW & DOOR HEADER HEIGHTS ABOVE FINISHED FLOOR.
8. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED.
9. EXTERIOR WALLS TO BE 2x6 STUDS @ 16" O.C., U.N.O.
10. INSTALL SIMPSON CONC. TO WOOD HOLDOWNS PER STRUCTURAL DRAWINGS, ALSO SEE MANUFACTURER'S SPECS.
11. SMOKE & CARBON MONOXIDE DETECTORS:
    - SHALL BE 110V INTERCONNECTED W/ BATTERY BACKUP.
    - SHALL SOUND AN ALARM AUDIBLE IN ALL SLEEPING ROOMS.
    - SHALL BE INSTALLED ON EACH FLOOR AND IN ALL BEDROOMS.
    - SHALL BE INSTALLED IN EACH LOCATION WHERE THERE IS A CEILING CHANGE OF GREATER THAN 24"
12. FRESH AIR PROVIDED BY WHOLE-HOUSE EXHAUST FAN WITH FRESH AIR PORT (NET 4 SF IN MIN. OPENING) AT EACH HABITABLE ROOM. A TIMER OPERATES AN EXHAUST FAN WHICH PULLS OUTSIDE AIR THROUGH AIR INLETS LOCATED IN EACH HABITABLE ROOM.
13. LIMITING DEVICE FOR TUBS TO PROVIDE MAX. 120ºF HOT WATER TEMPERATURE.
14. FOOTINGS SHALL BEAR ON SOLID UNDISTURBED EARTH (CONTROLLED, COMPACTED STRUCTURAL FILL OR BOTH). DEPTH OF FOOTINGS TO BE DETERMINED BY STRUCTURAL ENGINEER. FOUNDATION EXCAVATION, BACKFILL AND COMPACTION SHALL CONFORM TO SPECIFICATION REQUIREMENTS. THIS CONSTRUCTION WORK, INCLUDING DRAINAGE, SHORING AND SUCH OTHER RELATED WORK AS REQUIRED, SHALL BE CONDUCTED BY THE CONTRACTOR. STOP WORK IF RECOMMENDED EXCAVATION CUT OR BEARING SOIL CHANGES OCCUR IN EITHER HORIZONTAL OR VERTICAL DIRECTION AND NOTIFY IMMEDIATELY THE GEOTECHNICAL ENGINEER AND STRUCTURAL ENGINEER. AT WHICH POINT THE ENGINEERS SHALL DETERMINE CAUSE OF DISPLACEMENT AND DEVELOP AND IMPLEMENT REMEDIAL MEASURES.

SYMBOL LEGEND

SEE TITLE SHEET A0.0 FOR COMPLETE SYMBOL INDEX.

MEDICI ARCHITECTS

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200 W. RIVER ST.
SUITE 301
KETCHUM, ID 83340
TEL: (208) 726-0194

REGISTRATION:

6926 REGISTERED ARCHITECT NOT FOR CONSTRUCTION STATE OF WASHINGTON

INTAKE DATE: XX/XX/XXXX

REVISIONS: DATE:

PROJECT / CLIENT:

2436 74TH AVE SE - SFR

LNL BUILDS

PROJECT ADDRESS:

2436 74TH AVE SE
MERCER ISLAND, 98040

DRAWING NAME:

BASEMENT PLAN

DRAWN BY: DRA

CHECKED By: JML

PHASE:

CONSTRUCTION DRAWINGS

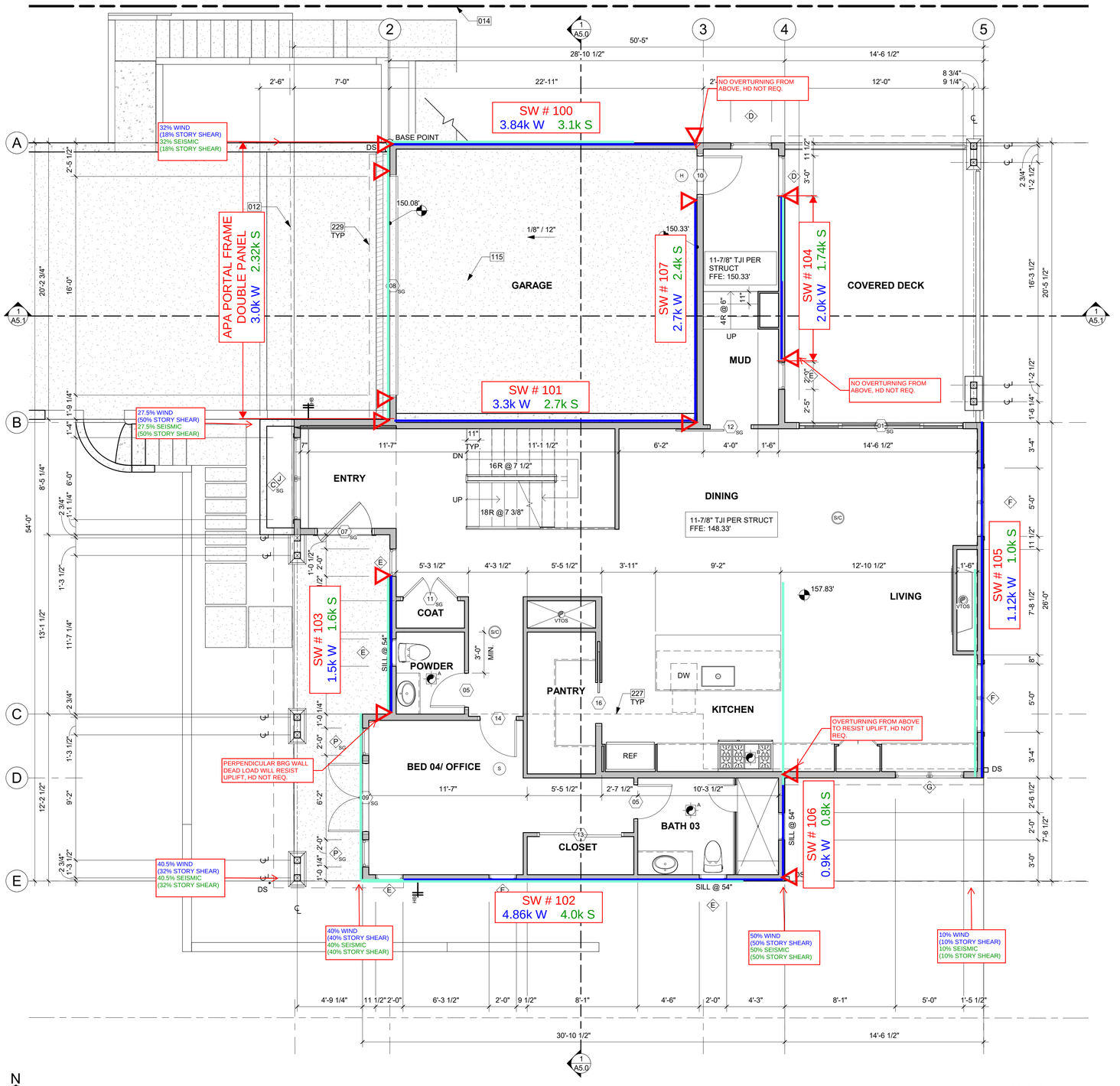
APPROVED FOR CONSTRUCTION:

PROJECT No.: A22 087

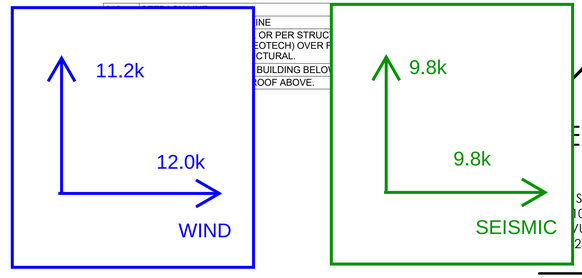
DATE: 1/23/2023
11:19:03 AM

PLOT SCALE: 1:1

A2.0



KEY NOTES



HOUSE VENTILATION WITH HRV

BALANCED WHOLE HOUSE VENTILATION REQUIREMENTS TO BE MET WITH A HEAT RECOVERY VENTILATION SYSTEM (HRV) PER M1505.4 AND WSEC ENERGY CREDIT OPTION 2.2/2.3/2.4. HRV TO HAVE MINIMUM SENSIBLE HEAT RECOVERY EFFICIENCY OF 0.65/0.75/0.80. MINIMUM MECHANICAL VENTILATION AIRFLOW RATE TO BE 210 CFM (INTERMITTENT) - (4-5 BEDROOMS 4501<6000 SF) TO OPERATE 50% OF TIME IN EACH 4-HOUR SEGMENT, PER TABLES M1505.4.3(1) AND M1505.4.3(3). UPDATE

SYMBOL	LOCATION	MINIMUM FAN REQUIREMENTS
A	BATH & POWDER	MINIMUM LOCAL EXHAUST RATE TO BE 50 CFM
B	KITCHEN	MINIMUM LOCAL EXHAUST RATE TO BE 100 CFM PROVIDED BY RANGE HOOD OR DOWN DRAFT EXHAUST FAN, PER M1503.2 IF OVER 400 CFM, MAKEUP AIR IS REQUIRED IN THE SAME ROOM PER M1503.6**
C	LAUNDRY ROOM	MINIMUM LOCAL EXHAUST RATE TO BE 50 CFM

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HOUSE VENTILATION NO HRV

PROVIDE WHOLE HOUSE VENTILATION PER M1505.4 USING LAUNDRY ROOM EXHAUST FAN PER 1505.4.1.2 (WA) AND TABLE 1505.4.3(1) & (3A); PROVIDE CONTROLS PER 1505.4.2. COMPLY WITH WSEC R403.6 UPDATE

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FLOOR PLAN NOTES

1. CONTRACTOR SHALL VERIFY ALL NOTES, DIMENSIONS & CONDITIONS PRIOR TO CONSTRUCTION.
2. SEE STRUCTURAL DRAWINGS FOR ALL POSTS, BEAMS AND HEADERS.
3. PROVIDE SOLID BLOCKING OVER SUPPORTS.
4. PROVIDE FIRE BLOCKING @ ALL PLUMBING PENETRATIONS.
5. WINDOWS & DOORS ARE SHOWN & NOTED AS NOMINAL SIZES.
6. DOOR JAMB 4.5" FROM CORNER TYP., U.N.O.
7. SEE SHEETS A0.3, A4.0 & A4.1 FOR WINDOW & DOOR HEADER HEIGHTS ABOVE FINISHED FLOOR.
8. ALL WOOD IN CONTACT WITH CONCRETE TO BE PRESSURE TREATED.
9. EXTERIOR WALLS TO BE 2x6 STUDS @ 16" O.C., U.N.O.
10. INSTALL SIMPSON CONC. TO WOOD HOLDOWNS PER STRUCTURAL DRAWINGS, ALSO SEE MANUFACTURER'S SPECS.
11. SMOKE & CARBON MONOXIDE DETECTORS:
    - SHALL BE 110V INTERCONNECTED W/ BATTERY BACKUP.
    - SHALL SOUND AN ALARM AUDIBLE IN ALL SLEEPING ROOMS.
    - SHALL BE INSTALLED ON EACH FLOOR AND IN ALL BEDROOMS.
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12. FRESH AIR PROVIDED BY WHOLE-HOUSE EXHAUST FAN WITH FRESH AIR PORT (NET 4 SF IN MIN. OPENING) AT EACH HABITABLE ROOM. A TIMER OPERATES AN EXHAUST FAN WHICH PULLS OUTSIDE AIR THROUGH AIR INLETS LOCATED IN EACH HABITABLE ROOM.
13. LIMITING DEVICE FOR TUBS TO PROVIDE MAX. 120ºF HOT WATER TEMPERATURE.
14. FOOTINGS SHALL BEAR ON SOLID UNDISTURBED EARTH (CONTROLLED, COMPACTED STRUCTURAL FILL OR BOTH). DEPTH OF FOOTINGS TO BE DETERMINED BY STRUCTURAL ENGINEER. FOUNDATION EXCAVATION, BACKFILL AND COMPACTION SHALL CONFORM TO SPECIFICATION REQUIREMENTS. THIS CONSTRUCTION WORK, INCLUDING DRAINAGE, SHORING AND SUCH OTHER RELATED WORK AS REQUIRED, SHALL BE CONDUCTED BY THE CONTRACTOR. STOP WORK IF RECOMMENDED EXCAVATION CUT OR BEARING SOIL CHANGES OCCUR IN EITHER HORIZONTAL OR VERTICAL DIRECTION AND NOTIFY IMMEDIATELY THE GEOTECHNICAL ENGINEER AND STRUCTURAL ENGINEER, AT WHICH POINT THE ENGINEERS SHALL DETERMINE CAUSE OF DISPLACEMENT AND DEVELOP AND IMPLEMENT REMEDIAL MEASURES.

SYMBOL LEGEND

SEE TITLE SHEET A0.0 FOR COMPLETE SYMBOL INDEX.

EDICI ARCHITECTS

SE 8TH STREET
100
VUE, WA 98005
25) 453-9298

200 W. RIVER ST.
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PROJECT / CLIENT:

2436 74TH AVE SE - SFR

LNL BUILDS

PROJECT ADDRESS:

2436 74TH AVE SE
MERCER ISLAND, 98040

DRAWING NAME:

1ST FLOOR PLAN

DRAWN BY: DRA

CHECKED By: JML

PHASE:

CONSTRUCTION DRAWINGS

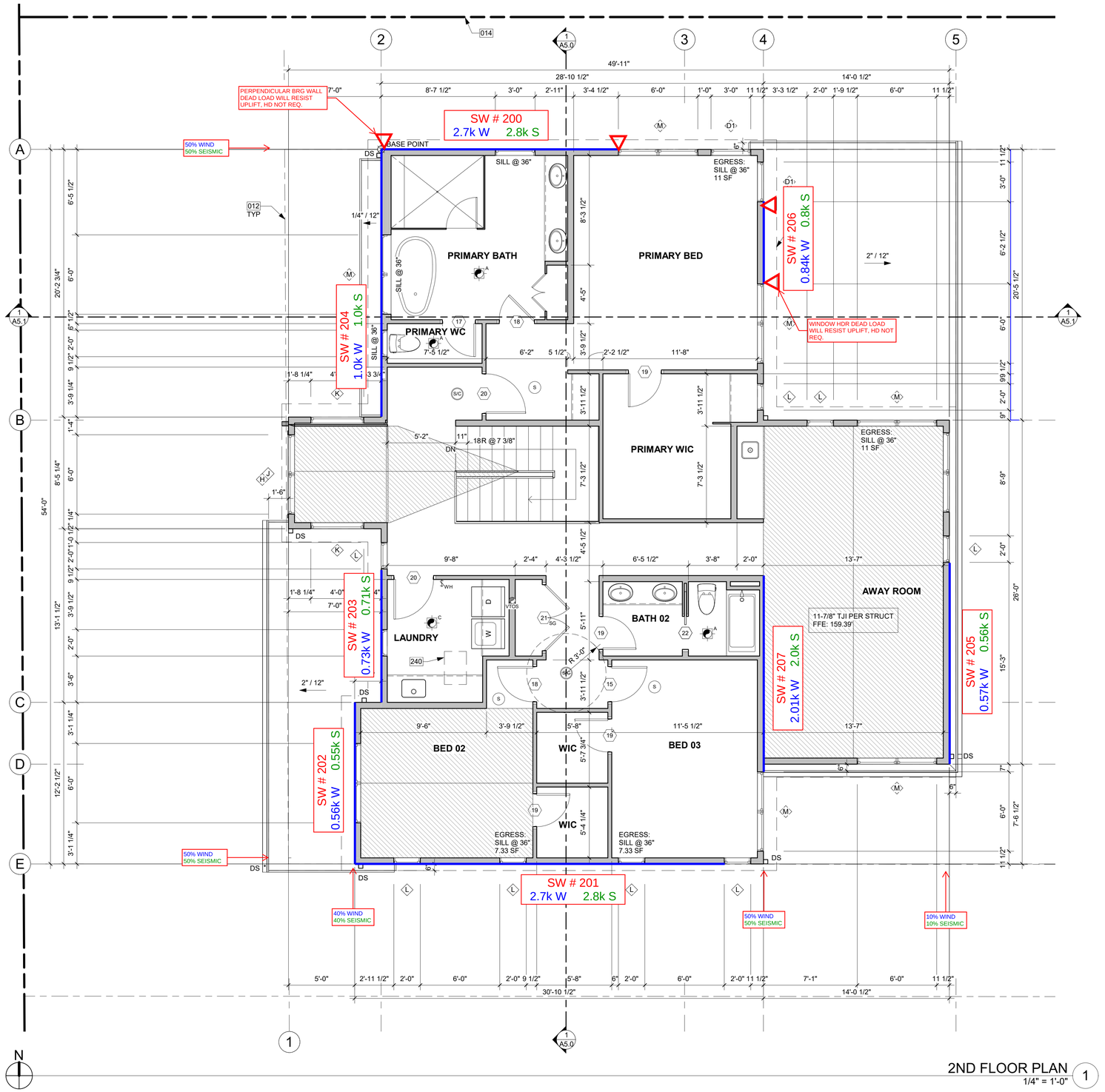
APPROVED FOR CONSTRUCTION:

PROJECT No.: A22 087

DATE: 1/23/2023
11:19:06 AM

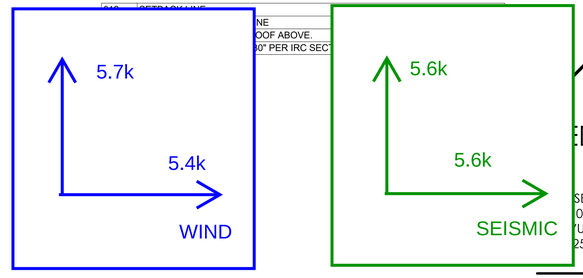
PLOT SCALE: 1:1

A2.1



2ND FLOOR PLAN
1/4" = 1'-0"

KEY NOTES



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MEDICI ARCHITECTS

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PROJECT / CLIENT:

2436 74TH AVE SE - SFR

LNL BUILDS

PROJECT ADDRESS:

2436 74TH AVE SE
MERCER ISLAND, 98040

DRAWING NAME:

2ND FLOOR PLAN

DRAWN BY: DRA

CHECKED By: JML

PHASE:

CONSTRUCTION DRAWINGS

APPROVED FOR CONSTRUCTION:

PROJECT No.: A22 087

DATE: 1/23/2023
11:19:09 AM

PLOT SCALE: 1:1

A2.2

LNL Builds

2436 74th Ave SE

Mercer Island, WA

Seismic Shear Wall Calculations

Reviewed By: NJM

January 24, 2023

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

wind Exposure Category: B

Seismic Design Category: D

Code & Design Standard: 2018 IBC Ch. 1613, ASCE 7-16 Ch. 26-30

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: 2436 74th Ave SE
LNL Builds
M&K Project #: 01B-22107
Engineer: LGH
Date: 17-Jan-23

SEISMIC CALCULATION - ASCE 7-16

Seismic Design Category:

User Inputs:

Site Class	D
Spectral Response Acceleration 0.2 sec, **Ss**	1.392
Spectral Response Acceleration 1.0 sec, **S1**	0.485
Occupancy Category	II

Variables:

Site coefficient, Fa	1.00
Site coefficient, Fv	1.82

Calculated Values:

Maximum spectral response acceleration, S_{ms}	1.392
Maximum spectral response acceleration, S_{m1}	0.880
Design spectral response acceleration, S_{ds}	0.928
Design spectral response acceleration, S_{d1}	0.587
Seismic Design Category (short term)	D
Seismic Design Category (1.0 second term)	D

Building period Determination:

User Inputs:

Building period coefficient, C_t	0.020
Long-Period Trans Period, T_L (sec)	6
Ht. abv base to highest level, h_n	29

Calculated Values:

Approximate Fundamental Period, T_a	0.250
T_0	0.126
T_s	0.632
Spectral Response Acc., S_a (g)	0.928

Site Class Assumption

No — Per ASCE 7-16 Section 11.4.3 the Site Class may be assumed to be D

Equivalent lateral force procedure

Dead Load Calculation:

Level	Story Ht. (ft.)	Area (ft^2)	Dead Load (psf)	DL of ext wall trib. to level (kips)	Total level DL
1	10.0	1850	10	7.6	26 k
2	11.1	2511	13	9.7	42 k
3	8.0	2180	17	4.3	41 k
4	0.0	0	0	0.0	0 k
5	0.0	0	0	0.0	0 k
6	0.0	0	0	0.0	0 k
7	0.0	0	0	0.0	0 k
8	0.0	0	0	0.0	0 k
9	0.0	0	0	0.0	0 k
10	0.0	0	0	0.0	0 k
11	0.0	0	0	0.0	0 k
12	0.0	0	0	0.0	0 k
13	0.0	0	0	0.0	0 k
14	0.0	0	0	0.0	0 k
15	0.0	0	0	0.0	0 k
16	0.0	0	0	0.0	0 k
17	0.0	0	0	0.0	0 k
18	0.0	0	0	0.0	0 k
19	0.0	0	0	0.0	0 k
20	0.0	0	0	0.0	0 k

Total Dead Load Of Structure 110 Kips

Seismic Response Coefficient:

	Transverse	Longitudinal
Response modification factor, **R**	6.5	6.5
Occupancy Importance Factor, I_E	1.00	1.00
Seismic Response Coefficient, C_s	0.143	0.143

Base Shears:

Ultimate Loads				x 0.7 =	Allowable Loads			
Transverse		Longitudinal			Transverse		Longitudinal	
16	k	16	k		11.0	k	11.0	k

Story Shear Calculation:

Distribution exponent, 1.00

Level	Vert. Dist. Factor, C_{vx}	Ultimate Loads: Transverse *Story Shear, F_x*		Ultimate Loads: Longitudinal *Story Shear, F_x*		x 0.7 =	Allowable Loads: Transverse *Story Shear, F_x*		Allowable Loads: Transverse *Σ Story Shear*		Allowable Loads: Longitudinal *Story Shear, F_x*		Allowable Loads: Longitudinal *Σ Story Shear*	
1	0.111	1.7	k	1.7	k		1.2	k	11.0	k	1.2	k	11.0	k
2	0.379	5.9	k	5.9	k		4.2	k	9.8	k	4.2	k	9.8	k
3	0.510	8.0	k	8.0	k		5.6	k	5.6	k	5.6	k	5.6	k
4	0.000	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
5	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
6	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
7	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
8	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
9	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
10	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
11	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
12	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
13	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
14	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
15	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
16	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
17	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
18	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
19	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k
20	0.00	0.0	k	0.0	k		0.0	k	0.0	k	0.0	k	0.0	k

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 200: 2nd - Side Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	17.9	ft.	Qualifying Wall Length, L	14.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2800 lbs	<	3557 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	22.4	k-ft	Hold Down Design Load	600	lbs
DL at ends of wall	400	lbs	Resistive Moment	11.7	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 201: 2nd - Side Ext. Wall @ Bed 2/3

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	27.9	ft.	Qualifying Wall Length, L	21.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2800 lbs	<	5258 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	22.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	180	lbs	Resistive Moment	22.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

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RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 202: 2nd - Front Ext. Wall @ Bed 2

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, H_c	5.2	ft.		
Wall Length, L	12.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
550 lbs	<	1480 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	124	plf	Overturning Moment	5.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	544	lbs	Resistive Moment	7.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 203: 2nd - Front Ext. Wall @ Laundry

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	10.0	ft.	Qualifying Wall Length, L	8.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
710 lbs	<	1919 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	5.7	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	342	lbs	Resistive Moment	9.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

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Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 204: 2nd - Front Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	20.2	ft.	Qualifying Wall Length, L	11.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1000 lbs	<	2638 lbs

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P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	8.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	600	lbs	Resistive Moment	38.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 205: 2nd - Back Ext. Wall @ Away

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	15.3	ft.	Qualifying Wall Length, L	15.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
560 lbs	<	3658 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	212	plf	Overturning Moment	4.5	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	212	lbs	Resistive Moment	13.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 206: 2nd - Back Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
800 lbs	<	1480 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	6.4	k-ft	Hold Down Design Load	300	lbs
DL at ends of wall	513	lbs	Resistive Moment	4.5	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 207: 2nd - Int. Wall @ Away

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	14.8	ft.	Qualifying Wall Length, L	14.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2000 lbs	<	3557 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	458	plf	Overturning Moment	16.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	320	lbs	Resistive Moment	25.9	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 100: 1st - Side Ext. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	22.8	ft.	Qualifying Wall Length, L	22.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3100 lbs	<	5476 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	307	plf	Overturning Moment	53.3	k-ft	Hold Down Design Load	124	lbs
DL at ends of wall	1200	lbs	Resistive Moment	50.5	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall 101: 1st - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	21.9	ft.	Qualifying Wall Length, L	21.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2700 lbs	<	5258 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	182	plf	Overturning Moment	21.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	320	lbs	Resistive Moment	23.9	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 102: 1st - Side Ext. Wall @ Bed 4

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	3.5	ft.		
Wall Length, L	27.9	ft.	Qualifying Wall Length, L	23.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
4000 lbs	<	5716 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	216	plf	Overturning Moment	38.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	215	lbs	Resistive Moment	42.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 103: 1st - Front Ext. Wall @ Powder

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, Hc	3.5	ft.		
Wall Length, L	10.1	ft.	Qualifying Wall Length, L	8.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1600 lbs	<	1919 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	510	plf	Overturning Moment	21.1	k-ft	Hold Down Design Load	641	lbs
DL at ends of wall	510	lbs	Resistive Moment	14.6	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 104: 1st - Back Ext. Wall @ Mud

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	12.1	ft.	Qualifying Wall Length, L	12.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1740 lbs	<	2898 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	555	plf	Overturning Moment	29.2	k-ft	Hold Down Design Load	450	lbs
DL at ends of wall	832	lbs	Resistive Moment	23.8	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 105: 1st - Back Ext. Wall @ Living

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, Hc	7.5	ft.		
Wall Length, L	25.9	ft.	Qualifying Wall Length, L	16.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1000 lbs	<	3787 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	417	plf	Overturning Moment	17.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	383	lbs	Resistive Moment	70.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 106: 1st - Back Ext. Wall @ Bath 3

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	3.5	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
800 lbs	<	1319 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	256	plf	Overturning Moment	7.7	k-ft	Hold Down Design Load	165	lbs
DL at ends of wall	864	lbs	Resistive Moment	6.4	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall 107: 1st - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	16.5	ft.	Qualifying Wall Length, L	16.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2400 lbs	<	3958 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	19.2	k-ft	Hold Down Design Load	659	lbs
DL at ends of wall	165	lbs	Resistive Moment	8.3	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	0.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B00: - Int. Wall @ Stairs

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	22.0	ft.	Qualifying Wall Length, L	22.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3300 lbs	<	5277 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	289	plf	Overturning Moment	51.4	k-ft	Hold Down Design Load	504	lbs
DL at ends of wall	720	lbs	Resistive Moment	40.3	k-ft	Holdown Capacity	3695	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall B01: - Side Ext. Wall @ Bonus

Shearwall Properties:

Wall height, H	2.2	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	14.5	ft.	Qualifying Wall Length, L	14.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
380 lbs	<	3478 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	198	plf	Overturning Moment	0.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	790	lbs	Resistive Moment	15.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B02: - Back Ext. Wall @ Storage

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.6	ft.	Qualifying Wall Length, L	5.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1300 lbs	<	1339 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	744	plf	Overturning Moment	11.7	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	5000	lbs	Resistive Moment	18.6	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall B03: - Back Ext. Wall @ Bonus

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, H_c	5.0	ft.		
Wall Length, L	25.9	ft.	Qualifying Wall Length, L	15.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1100 lbs	<	3737 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	618	plf	Overturning Moment	27.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	790	lbs	Resistive Moment	107.2	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B04: - Side Ext. Wall @ Ext. Storage

Shearwall Properties:

Wall height, H	6.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
220 lbs	<	1439 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	287	plf	Overturning Moment	1.3	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	5.8	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

LNL Builds

2436 74th Ave SE

Mercer Island, WA

Wind Shear Wall Calculations

Reviewed By: NJM

January 24, 2023

Parameters:

Single Family Home

Design Wind Speed: 100 MPH

wind Exposure Category: B

Seismic Design Category: D

Code & Design Standard: 2018 IBC Ch. 1609, ASCE 7-16 Ch. 26-30

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RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: 2436 74TH Ave SE
M&K Project #: 01B-22107
Engineer: LGH
date: 17-Jan-23

Wind Design Summary per ASCE 7-16

Parameters:

Wind Speed	100
Exposure Category	B
Risk Category	II
Wind Directionality Factor, K_d	0.85
Topographic Factor, K_{zt}	1.30
Gust Factor, G	0.85
Ground Elev. Above Sea Level [ft]	0
Design Type	ASD

0.60

Roof Geometry:

Trans. Roof Pitch	4.0	:12
Long. Roof Pitch	4.0	:12
Mean Roof Height, H	35.50	ft

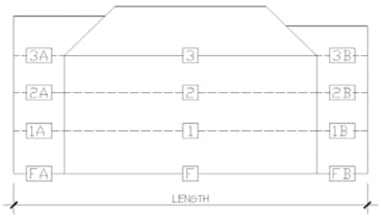
Building Geometry:

length	54	ft
Width	50	ft
Number of stories	3	

Transverse Direction (Perpendicular to Main Ridge Line)

Tributary Design Areas:

Diaphragm Level	Floor-to-Floor Height		Section A	Section O	Section B	
3	8 ft	Roof Surface	0	284	0	sq ft
		Wall surface	0	272	0	sq ft
2	11 ft	Roof Surface	0	50	0	sq ft
		Wall surface	0	500	0	sq ft
1	10 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	540	0	sq ft
FND		Roof Surface	0	0	0	sq ft
		Wall surface	0	0	0	sq ft



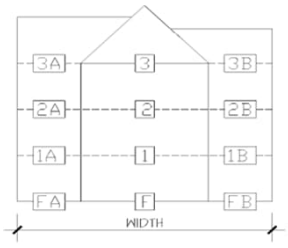
Tributary Design Loads: (0.6W)

	Section A	Section O	Section B	
Story Shear	0.00	5.36	0.00	kips
Total Shear	0.00	5.36	0.00	kips
		5.36		kips
Story Shear	0.00	6.61	0.00	kips
Total Shear	0.00	11.97	0.00	kips
		11.97		kips
Story Shear	0.00	6.45	0.00	kips
Total Shear	0.00	18.41	0.00	kips
		18.41		kips
Story Shear	0.00	0.00	0.00	kips
Total Shear	0.00	18.41	0.00	kips
		18.41		kips

Longitudinal Direction (Parallel to Main Ridge Line)

Tributary Design Areas:

Diaphragm Level	Floor-to-Floor Height		Section A	Section O	Section B	
3	8 ft	Roof Surface	0	65	0	sq ft
		Wall surface	0	400	0	sq ft
2	11 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	444	0	sq ft
1	10 ft	Roof Surface	0	0	0	sq ft
		Wall surface	0	265	0	sq ft
FND		Roof Surface	0	0	0	sq ft
		Wall surface	0	0	0	sq ft



Tributary Design Loads: (0.6W)

	Section A	Section O	Section B	
Story Shear	0.00	5.65	0.00	kips
Total Shear	0.00	5.65	0.00	kips
		5.65		kips
Story Shear	0.00	5.52	0.00	kips
Total Shear	0.00	11.17	0.00	kips
		11.17		kips
Story Shear	0.00	3.12	0.00	kips
Total Shear	0.00	14.29	0.00	kips
		14.29		kips
Story Shear	0.00	0.00	0.00	kips
Total Shear	0.00	14.29	0.00	kips
		14.29		kips

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 200: 2nd - Side Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	17.9	ft.	Qualifying Wall Length, L	14.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2700 lbs	<	4980 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	21.6	k-ft	Hold Down Design Load	375	lbs
DL at ends of wall	400	lbs	Resistive Moment	14.9	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 201: 2nd - Side Ext. Wall @ Bed 2/3

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	27.9	ft.	Qualifying Wall Length, L	21.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2700 lbs	<	7361 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	21.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	100	lbs	Resistive Moment	27.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 202: 2nd - Front Ext. Wall @ Bed 2

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, H_c	5.2	ft.		
Wall Length, L	12.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
560 lbs	<	2072 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	124	plf	Overturning Moment	5.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	544	lbs	Resistive Moment	9.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 203: 2nd - Front Ext. Wall @ Laundry

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	4.0	ft.		
Wall Length, L	10.0	ft.	Qualifying Wall Length, L	8.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
730 lbs	<	2686 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	5.8	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	342	lbs	Resistive Moment	12.3	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 204: 2nd - Front Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	4.0	ft.		
Wall Length, L	20.2	ft.	Qualifying Wall Length, L	11.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1000 lbs	<	3694 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	8.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	600	lbs	Resistive Moment	49.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 205: 2nd - Back Ext. Wall @ Away

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	15.3	ft.	Qualifying Wall Length, L	15.3	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
570 lbs	<	5121 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	212	plf	Overturning Moment	4.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	212	lbs	Resistive Moment	16.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 206: 2nd - Back Ext. Wall @ Primary

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	6.2	ft.	Qualifying Wall Length, L	6.2	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
840 lbs	<	2072 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	342	plf	Overturning Moment	6.7	k-ft	Hold Down Design Load	148	lbs
DL at ends of wall	513	lbs	Resistive Moment	5.8	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 207: 2nd - Int. Wall @ Away

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	14.8	ft.	Qualifying Wall Length, L	14.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2010 lbs	<	4980 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	458	plf	Overturning Moment	16.1	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	320	lbs	Resistive Moment	33.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 100: 1st - Side Ext. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	22.8	ft.	Qualifying Wall Length, L	22.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3840 lbs	<	7666 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	307	plf	Overturning Moment	58.2	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	64.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 101: 1st - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	21.9	ft.	Qualifying Wall Length, L	21.9	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
3300 lbs	<	7361 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	182	plf	Overturning Moment	26.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	320	lbs	Resistive Moment	30.5	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 102: 1st - Side Ext. Wall @ Bed 4

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	3.5	ft.		
Wall Length, L	27.9	ft.	Qualifying Wall Length, L	23.8	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
4860 lbs	<	8002 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	216	plf	Overturning Moment	46.6	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	215	lbs	Resistive Moment	54.1	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall 103: 1st - Front Ext. Wall @ Powder

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, Hc	3.5	ft.		
Wall Length, L	10.1	ft.	Qualifying Wall Length, L	8.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1500 lbs	<	2686 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	510	plf	Overturning Moment	20.3	k-ft	Hold Down Design Load	162	lbs
DL at ends of wall	510	lbs	Resistive Moment	18.6	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 104: 1st - Back Ext. Wall @ Mud

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	12.1	ft.	Qualifying Wall Length, L	12.1	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2000 lbs	<	4057 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	555	plf	Overturning Moment	32.3	k-ft	Hold Down Design Load	164	lbs
DL at ends of wall	832	lbs	Resistive Moment	30.3	k-ft	Holdown Capacity	1705	lbs

Hold-down Specification

SIMPSON CS16 STRAP TIE (14" END LENGTH)

Shearwall 105: 1st - Back Ext. Wall @ Living

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, Hc	7.5	ft.		
Wall Length, L	25.9	ft.	Qualifying Wall Length, L	16.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1120 lbs	<	5302 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	417	plf	Overturning Moment	18.5	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	383	lbs	Resistive Moment	90.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall 106: 1st - Back Ext. Wall @ Bath 3

Shearwall Properties:

Wall height, H	9.6	ft.	Max wall opening ht, H_c	3.5	ft.		
Wall Length, L	7.5	ft.	Qualifying Wall Length, L	5.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
900 lbs	<	1847 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	256	plf	Overturning Moment	8.6	k-ft	Hold Down Design Load	56	lbs
DL at ends of wall	864	lbs	Resistive Moment	8.2	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

Shearwall 107: 1st - Int. Wall @ Garage

Shearwall Properties:

Wall height, H	8.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	16.5	ft.	Qualifying Wall Length, L	16.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
2700 lbs	<	5541 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	110	plf	Overturning Moment	21.6	k-ft	Hold Down Design Load	666	lbs
DL at ends of wall	165	lbs	Resistive Moment	10.6	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall xxx: - Not Used

Shearwall Properties:

Wall height, H	0.0	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	0.0	ft.	Qualifying Wall Length, L	0.0	ft.	Shearwall Assembly	P0

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
0 lbs	####	#DIV/0! lbs

Shearwall Assembly Specification

P0 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - UNBLOCKED
#DIV/0!

Overturning Evaluation:

Resistive DL	0	plf	Overturning Moment	#DIV/0!	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	0	lbs	Resistive Moment	0.0	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B00: - Int. Wall @ Stairs

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	22.0	ft.	Qualifying Wall Length, L	22.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
6500 lbs	<	7388 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	289	plf	Overturning Moment	85.0	k-ft	Hold Down Design Load	1526	lbs
DL at ends of wall	720	lbs	Resistive Moment	51.4	k-ft	Holdown Capacity	4935	lbs

Hold-down Specification

SIMPSON STHD14RJ HOLDOWN

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall B01: - Side Ext. Wall @ Bonus

Shearwall Properties:

Wall height, H	2.2	ft.	Max wall opening ht, H_c	0.0	ft.		
Wall Length, L	14.5	ft.	Qualifying Wall Length, L	14.5	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
700 lbs	<	4869 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	198	plf	Overturning Moment	1.5	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	790	lbs	Resistive Moment	19.3	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B02: - Back Ext. Wall @ Storage

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	5.6	ft.	Qualifying Wall Length, L	5.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1000 lbs	<	1875 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	744	plf	Overturning Moment	9.0	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	5000	lbs	Resistive Moment	23.7	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

Project Name: LNL Builds
2436 74th Ave SE
M&K Project #: 01B-22107
Engineer: LGH
Date: 24-Jan-23

Shearwall Design Summary

Shearwall B03: - Back Ext. Wall @ Bonus

Shearwall Properties:

Wall height, H	9.0	ft.	Max wall opening ht, H_c	5.0	ft.		
Wall Length, L	25.9	ft.	Qualifying Wall Length, L	15.6	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1430 lbs	<	5232 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	618	plf	Overturning Moment	31.4	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	790	lbs	Resistive Moment	136.8	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

Shearwall B04: - Side Ext. Wall @ Ext. Storage

Shearwall Properties:

Wall height, H	6.0	ft.	Max wall opening ht, Hc	0.0	ft.		
Wall Length, L	6.0	ft.	Qualifying Wall Length, L	6.0	ft.	Shearwall Assembly	P1

Capacity Evaluation:

Total Shear load on Wall		Allowable Shearwall Capacity
1150 lbs	<	2015 lbs

Shearwall Assembly Specification

P1 - 1-side 7/16" OSB
fastened w/ 8d nails at 6"o.c. panel edges & 12"o.c. panel field - edges blocked
ADEQUATE

Overturning Evaluation:

Resistive DL	287	plf	Overturning Moment	6.9	k-ft	Hold Down Design Load	0	lbs
DL at ends of wall	1200	lbs	Resistive Moment	7.4	k-ft	Holdown Capacity	0	lbs

Hold-down Specification

No Holdown Required

MULHERN+KULP
RESIDENTIAL STRUCTURAL ENGINEERING

7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
mulhernkulp.com

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Partial Retaining Wall (Detail 2)

Code Reference

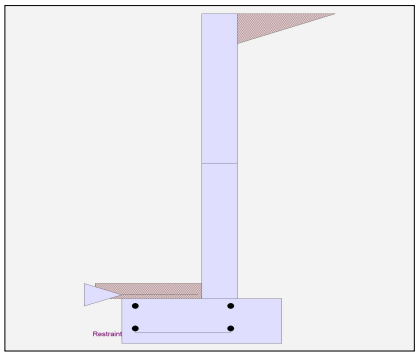
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	6.33 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	300.0 lbs
Axial Live Load	=	420.0 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 : Uniform		
Multiplier Used	=	16.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	117.280
Total Seismic Force	=	859.662

MULHERN+KULP
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7220 Trade Street, Suite 350
San Diego, CA 92121
(619) 650-0010
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Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Partial Retaining Wall (Detail 2)

Design Summary

Wall Stability Ratios

Overturning	=	1.15	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.65	
Total Bearing Load	=	2,853 lbs	
...resultant ecc.	=	10.92 in	
Soil Pressure @ Toe	=	2,756 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	3,859 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	21.4 psi	OK
Footing Shear @ Heel	=	12.6 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,542.0 lbs

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

Load Factors

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

Stem Construction

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	6.33	3.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 5		
Rebar Spacing	=	12.00	12.00	12.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.115**	**0.545**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		701.0	1,864.3		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		994.9	4,716.9		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	8,642.3		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		9.0	23.9		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Partial Retaining Wall (Detail 2)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.0567 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0358 in2/ft		
(4/3) * As :	0.0477 in2/ft	Min Stem T&S Reinf Area 0.639 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1696 in2/ft		
(4/3) * As :	0.2261 in2/ft	Min Stem T&S Reinf Area 0.576 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2261 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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DESCRIPTION: Partial Retaining Wall (Detail 2)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	1.50
Total Footing Width	=	3.00
Footing Thickness	=	12.00 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	=	3,859	0	psf
Mu' : Upward	=	3,114	0	ft-#
Mu' : Downward	=	252	906	ft-#
Mu: Design	=	2,862	906	ft-#
phiMn	=	9,837	2,739	ft-#
Actual 1-Way Shear	=	21.40	12.59	psi
Allow 1-Way Shear	=	82.16	43.82	psi

Toe Reinforcing = # 5 @ 14.35 in
Heel Reinforcing = None Spec'd
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:
Heel:
Key:

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

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

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)		940.3	2.44	2,297.4	Soil Over HL (ab. water tbl)	580.3	2.58	1,499.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		2.58	1,499.0
Hydrostatic Force					Watre 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	=	300.0	1.83	550.0
Added Lateral Load	=				* Axial Live Load on Stem	=	420.0	1.83	770.0
Load @ Stem Above Soil	=				Soil Over Toe	=	55.0	0.75	41.3
Seismic Earth Load	=	601.8	3.67	2,205.5	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	633.0	1.83	1,160.5
					Earth @ Stem Transitions	=			
					Footing Weight	=	450.0	1.50	675.0
					Key Weight	=			
					Vert. Component	=	415.0	3.00	1,245.1
Total	=	1,542.0	**O.T.M.** =	4,502.8	**Total =**		2,433.3 lbs	**R.M.=**	5,170.9

Resisting/Overturning Ratio = **1.15**
Vertical Loads used for Soil Pressure = 2,853.3 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 considered in the calculation of Sliding Resistance.

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

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DESCRIPTION: Partial Retaining Wall (Detail 2)

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)	0.162	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.

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7)

Code Reference

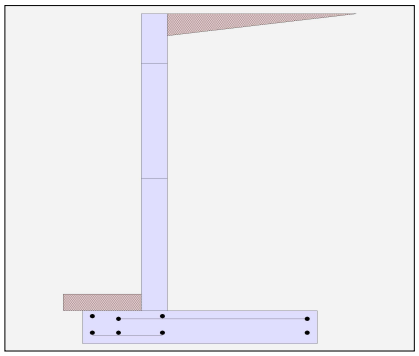
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	9.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	300.0 lbs
Axial Live Load	=	420.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	80.000
Total Seismic Force	=	800.000

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Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7)

Design Summary

Wall Stability Ratios			
Overturning	=	2.91	OK
Sliding	=	1.12	Ratio < 1.5!
Global Stability	=	2.01	
Total Bearing Load	=	7,170 lbs	
...resultant ecc.	=	3.68 in	
Soil Pressure @ Toe	=	1,393 psf	OK
Soil Pressure @ Heel	=	739 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,951 psf	
ACI Factored @ Heel	=	1,035 psf	
Footing Shear @ Toe	=	12.6 psi	OK
Footing Shear @ Heel	=	63.5 psi	OK
Allowable	=	82.2 psi	
Sliding Calcs			
Lateral Sliding Force	=	2,310.0 lbs	
less 100% Passive Force	-	218.8 lbs	
less 100% Friction Force	-	2,362.5 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	883.8 lbs	NG

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	7.50	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 5		
Rebar Spacing	=	12.00	12.00	6.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.014**	**0.250**	**0.611**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =	183.0	1,100.0	2,988.0		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =	121.5	2,166.7	10,044.0		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	16,434.0		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =	2.3	14.1	38.3		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0044 in2/ft		
(4/3) * As :	0.0058 in2/ft	Min Stem T&S Reinf Area 0.288 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0779 in2/ft		
(4/3) * As :	0.1039 in2/ft	Min Stem T&S Reinf Area 0.672 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.3611 in2/ft		
(4/3) * As :	0.4815 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.3611 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.62 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	4.50
Total Footing Width	=	6.00
Footing Thickness	=	12.00 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	=	1,951	1,035	psf
Mu' : Upward	=	2,109	0	ft-#
Mu' : Downward	=	277	14,789	ft-#
Mu: Design	=	1,832	14,789	ft-#
phiMn	=	11,695	22,542	ft-#
Actual 1-Way Shear	=	12.59	63.53	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 12.00 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:
Heel:
Key:

Min footing T&S reinf Area 1.56 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

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

Summary of Overturning & Resisting Forces & Moments

		.....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)	3,795.0	4.08	15,496.3
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.08	15,496.3
Hydrostatic Force					Watre 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	=	300.0	1.83	550.0
Added Lateral Load	=				* Axial Live Load on Stem	=	420.0	1.83	770.0
Load @ Stem Above Soil	=				Soil Over Toe	=	82.5	0.75	61.9
Seismic Earth Load	=	560.0	5.00	2,800.0	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	900.0	1.83	1,650.0
Total	=	2,310.0	**O.T.M.** =	8,633.3	Earth @ Stem Transitions	=			
					Footing Weight	=	900.0	3.00	2,700.0
					Key Weight	=			
					Vert. Component	=	772.5	6.00	4,634.9
					Total =		6,750.0 lbs	**R.M.=**	25,093.0

Resisting/Overturning Ratio = **2.91**
Vertical Loads used for Soil Pressure = 7,170.0 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 considered in the calculation of Sliding Resistance.

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

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7)

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)	0.058	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.

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7A)

Code Reference

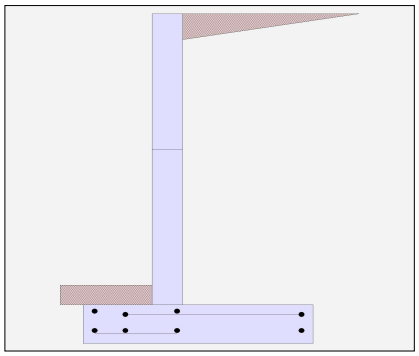
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	7.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	300.0 lbs
Axial Live Load	=	420.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	68.000
Total Seismic Force	=	578.000

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7A)

Design Summary

Wall Stability Ratios

Overturning	=	2.83	OK
Sliding	=	1.13	Ratio < 1.5!
Global Stability	=	2.06	
Total Bearing Load	=	5,198 lbs	
...resultant ecc.	=	2.85 in	
Soil Pressure @ Toe	=	1,193 psf	OK
Soil Pressure @ Heel	=	663 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	1,670 psf	
ACI Factored @ Heel	=	928 psf	
Footing Shear @ Toe	=	10.4 psi	OK
Footing Shear @ Heel	=	41.3 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	1,669.0 lbs	
less 100% Passive Force	-	218.8 lbs	
less 100% Friction Force	-	1,672.3 lbs	
Added Force Req'd	=	0.0 lbs	OK
....for 1.5 Stability	=	612.4 lbs	NG

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	7.50	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 5		
Rebar Spacing	=	12.00	12.00	12.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.094**	**0.676**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		581.0	2,085.0		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		816.7	5,850.0		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	8,642.3		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		7.4	26.7		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7A)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.0567 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0294 in2/ft		
(4/3) * As :	0.0391 in2/ft	Min Stem T&S Reinf Area 0.672 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.2103 in2/ft		
(4/3) * As :	0.2804 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.26 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7A)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	3.50
Total Footing Width	=	5.00
Footing Thickness	=	12.00 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	=	1,670	928	psf
Mu' : Upward	=	1,795	0	ft-#
Mu' : Downward	=	277	7,226	ft-#
Mu: Design	=	1,519	7,226	ft-#
phiMn	=	11,695	9,932	ft-#
Actual 1-Way Shear	=	10.43	41.25	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 14.21 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:
Heel:
Key:

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

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

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)		1,264.4	2.83	3,582.4	Soil Over HL (ab. water tbl)	2,337.5	3.58	8,376.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.58	8,376.0
Hydrostatic Force					Watre 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	=	300.0	1.83	550.0
Added Lateral Load	=				* Axial Live Load on Stem	=	420.0	1.83	770.0
Load @ Stem Above Soil	=				Soil Over Toe	=	82.5	0.75	61.9
Seismic Earth Load	=	404.6	4.25	1,719.6	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	750.0	1.83	1,375.0
					Earth @ Stem Transitions	=			
					Footing Weight	=	750.0	2.50	1,875.0
					Key Weight	=			
					Vert. Component	=	558.1	5.00	2,790.6
Total	=	1,669.0	**O.T.M.** =	5,301.9	**Total =**		4,778.1 lbs	**R.M.=**	15,028.5

Resisting/Overturning Ratio = **2.83**
Vertical Loads used for Soil Pressure = 5,198.1 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 considered in the calculation of Sliding Resistance.

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

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Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7A)

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)	0.050	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.

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7B)

Code Reference

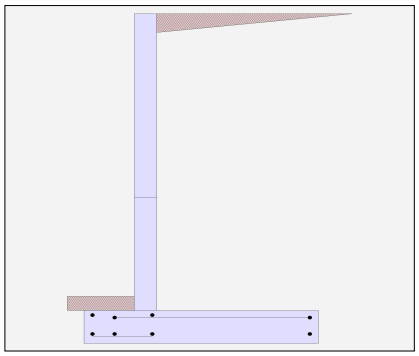
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	10.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	300.0 lbs
Axial Live Load	=	420.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	93.333
Total Seismic Force	=	1,088.889

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7B)

Design Summary

Wall Stability Ratios		
Overturning	=	2.90 OK
Sliding	=	1.13 Ratio < 1.5!
Global Stability	=	2.02
Total Bearing Load	=	9,711 lbs
...resultant ecc.	=	4.82 in
Soil Pressure @ Toe	=	1,663 psf OK
Soil Pressure @ Heel	=	811 psf OK
Allowable	=	5,333 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,328 psf
ACI Factored @ Heel	=	1,136 psf
Footing Shear @ Toe	=	9.8 psi OK
Footing Shear @ Heel	=	74.6 psi OK
Allowable	=	82.2 psi
Sliding Calcs		
Lateral Sliding Force	=	3,144.2 lbs
less 100% Passive Force	-	311.1 lbs
less 100% Friction Force	-	3,252.0 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 Stability	=	1,153.1 lbs NG

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	10.50	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 6		
Rebar Spacing	=	12.00	12.00	6.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.524**	**0.714**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		1,789.7	4,067.0		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		4,534.8	15,949.5		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	22,313.3		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		22.9	52.1		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Garage Reverse Retaining Wall (Detail 7B)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.0567 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.163 in2/ft		
(4/3) * As :	0.2174 in2/ft	Min Stem T&S Reinf Area 1.248 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2174 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.5734 in2/ft		
(4/3) * As :	0.7645 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.5734 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.88 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7B)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	5.50
Total Footing Width	=	7.00
Footing Thickness	=	14.00 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	=	2,328	1,136	psf
Mu' : Upward	=	2,524	0	ft-#
Mu' : Downward	=	311	26,773	ft-#
Mu: Design	=	2,213	26,773	ft-#
phiMn	=	38,659	28,122	ft-#
Actual 1-Way Shear	=	9.81	74.57	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 6 @ 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:
Heel:
Key:

Min footing T&S reinf Area 2.12 in2
Min footing T&S reinf Area per foot 0.30 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Summary of Overturning & Resisting Forces & Moments

Item	.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,381.9	3.89	9,263.1			
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 =	762.2	5.83	4,446.3			
=						
Total =	3,144.2	**O.T.M.** =	13,709.4			
Soil Over HL (ab. water tbl)				5,582.5	4.58	25,586.5
Soil Over HL (bel. water tbl)					4.58	25,586.5
Watre Table						
Sloped Soil Over Heel =						
Surcharge Over Heel =						
Adjacent Footing Load =						
Axial Dead Load on Stem =				300.0	1.83	550.0
* Axial Live Load on Stem =				420.0	1.83	770.0
Soil Over Toe =				82.5	0.75	61.9
Surcharge Over Toe =						
Stem Weight(s) =				1,050.0	1.83	1,925.0
Earth @ Stem Transitions =						
Footing Weight =				1,225.0	3.50	4,287.5
Key Weight =						
Vert. Component =				1,051.4	7.00	7,360.0
				Total = 9,291.4 lbs	**R.M.=**	39,770.9

Resisting/Overturning Ratio = 2.90
Vertical Loads used for Soil Pressure = 9,711.4 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 considered in the calculation of Sliding Resistance.

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

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Cantilevered Retaining Wall

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DESCRIPTION: Garage Reverse Retaining Wall (Detail 7B)

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)	0.069	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.

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DESCRIPTION: Garage Retaining Wall (Detail 9)

Code Reference

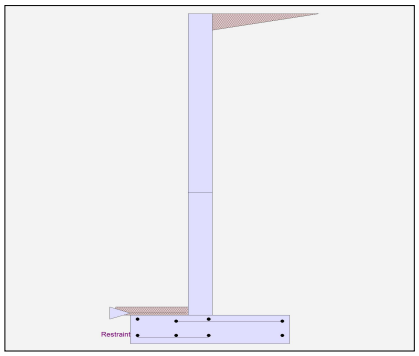
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	12.33 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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 : Uniform

Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	107.973
Total Seismic Force	=	1,457.280

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DESCRIPTION: Garage Retaining Wall (Detail 9)

Design Summary

Wall Stability Ratios

Overturning	=	1.38	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.45	
Total Bearing Load	=	7,601 lbs	
...resultant ecc.	=	17.45 in	
Soil Pressure @ Toe	=	3,186 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	4,460 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	31.7 psi	OK
Footing Shear @ Heel	=	56.8 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	4,207.9 lbs

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	12.33	5.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	10.00	10.00	10.00		
Rebar Size	=	# 5	# 5	# 6		
Rebar Spacing	=	12.00	12.00	6.00		
Rebar Placed at	=	8.5 in	8.5 in	8.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.575**	**0.850**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		2,295.9	5,588.1		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		6,576.4	25,703.0		
Moment.....Allowable	ft-# =	11,432.3	11,432.3	30,233.3		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		22.5	54.8		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	8.50	8.50	8.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	125.0	125.0	125.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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DESCRIPTION: Garage Retaining Wall (Detail 9)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.216 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.3818 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1786 in2/ft		
(4/3) * As :	0.2382 in2/ft	Min Stem T&S Reinf Area 1.759 in2	
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2382 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.31 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.3818 in2/ft	#6@ 22.00 in	#6@ 44.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.6982 in2/ft		
(4/3) * As :	0.9309 in2/ft	Min Stem T&S Reinf Area 1.200 in2	
200bd/fy : 200(12)(8.5)/60000 :	0.34 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.240 in2/ft	
0.0018bh : 0.0018(12)(10) :	0.216 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.6982 in2/ft	#4@ 10.00 in	#4@ 20.00 in
Provided Area :	0.88 in2/ft	#5@ 15.50 in	#5@ 31.00 in
Maximum Area :	1.3818 in2/ft	#6@ 22.00 in	#6@ 44.00 in

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DESCRIPTION: Garage Retaining Wall (Detail 9)

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	3.50
Total Footing Width	=	5.50
Footing Thickness	=	14.00 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	=	4,460	0	psf
Mu' : Upward	=	7,390	0	ft-#
Mu' : Downward	=	508	12,537	ft-#
Mu: Design	=	6,882	12,537	ft-#
phiMn	=	26,931	16,971	ft-#
Actual 1-Way Shear	=	31.66	56.76	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 7 @ 12.00 in
Heel Reinforcing = # 5 @ 10.19 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:
Heel:
Key:

Min footing T&S reinf Area 1.66 in2
Min footing T&S reinf Area per foot 0.30 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

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)		3,187.8	4.50	14,341.6	Soil Over HL (ab. water tbl)	3,616.8	4.17	15,070.0
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		4.17	15,070.0
Hydrostatic Force					Watre 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	=	73.3	1.00	73.3
Seismic Earth Load	=	1,020.1	6.75	6,883.9	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	1,541.3	2.42	3,724.7
					Earth @ Stem Transitions	=			
					Footing Weight	=	962.5	2.75	2,646.9
					Key Weight	=			
					Vert. Component	=	1,407.2	5.50	7,739.3
Total	=	4,207.9	**O.T.M.** =	21,225.5	**Total =**		7,601.0 lbs	**R.M.=**	29,254.2

Resisting/Overturning Ratio = **1.38**
Vertical Loads used for Soil Pressure = 7,601.0 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 considered in the calculation of Sliding Resistance.

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

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DESCRIPTION: Garage Retaining Wall (Detail 9)

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)	0.198	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.

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DESCRIPTION: Garage Retaining Wall (Detail 10)

Code Reference

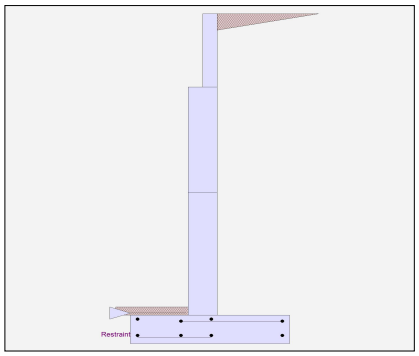
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	12.33 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	4.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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 : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	107.973
Total Seismic Force	=	1,457.280

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DESCRIPTION: Garage Retaining Wall (Detail 10)

Design Summary

Wall Stability Ratios

Overturning	=	1.37	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.45	
Total Bearing Load	=	7,458 lbs	
...resultant ecc.	=	17.61 in	
Soil Pressure @ Toe	=	3,145 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	4,403 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	31.2 psi	OK
Footing Shear @ Heel	=	54.3 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	4,207.9 lbs

Vertical component of active lateral soil pressure IS 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

		4th	3rd	2nd	Bottom	
		Stem OK	Stem OK	Stem OK	Stem OK	
Design Height Above Ftg	ft =	12.33	9.33	5.00	0.00	
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete	Concrete	
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	6.00	6.00	12.00	12.00	
Rebar Size	=	# 5	# 5	# 5	# 6	
Rebar Spacing	=	12.00	12.00	12.00	6.00	
Rebar Placed at	=	4.5 in	4.5 in	10.5 i	Edge	
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.126**	**0.462**	**0.740**	
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		575.9	2,295.9	5,588.1	
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		737.9	6,576.4	25,703.0	
Moment.....Allowable	ft-# =	5,852.3	5,852.3	14,222.3	34,688.3	
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		10.7	18.2	48.4	
Shear.....Allowable	psi =	82.2	82.2	82.2	82.2	
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	4.50	4.50	10.50	9.63	
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	75.0	75.0	150.0	150.0	
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0	3,000.0	
Fy	psi =	60,000.0	60,000.0	60,000.0	60,000.0	

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DESCRIPTION: Garage Retaining Wall (Detail 10)

Concrete Stem Rebar Area Details

4th Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(4.5)/60000 :	0.18 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	0.7315 in2/ft	#6@ 0.00 in	#6@ 0.00 in

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0392 in2/ft		
(4/3) * As :	0.0523 in2/ft	Min Stem T&S Reinf Area 0.432 in2	
200bd/fy : 200(12)(4.5)/60000 :	0.18 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.144 in2/ft	
0.0018bh : 0.0018(12)(6) :	0.1296 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1296 in2/ft	#4@ 16.67 in	#4@ 33.33 in
Provided Area :	0.31 in2/ft	#5@ 25.83 in	#5@ 51.67 in
Maximum Area :	0.7315 in2/ft	#6@ 36.67 in	#6@ 73.33 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1435 in2/ft		
(4/3) * As :	0.1914 in2/ft	Min Stem T&S Reinf Area 1.247 in2	
200bd/fy : 200(12)(10.5)/60000 :	0.42 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2592 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.31 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.7069 in2/ft	#6@ 18.33 in	#6@ 36.67 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.6138 in2/ft		
(4/3) * As :	0.8183 in2/ft	Min Stem T&S Reinf Area 1.440 in2	
200bd/fy : 200(12)(9.625)/60000 :	0.385 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.288 in2/ft	
0.0018bh : 0.0018(12)(12) :	0.2592 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.6138 in2/ft	#4@ 8.33 in	#4@ 16.67 in
Provided Area :	0.88 in2/ft	#5@ 12.92 in	#5@ 25.83 in
Maximum Area :	1.5647 in2/ft	#6@ 18.33 in	#6@ 36.67 in

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DESCRIPTION: Garage Retaining Wall (Detail 10)

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	3.50
Total Footing Width	=	5.50
Footing Thickness	=	14.00 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	=	4,403	0	psf
Mu' : Upward	=	7,280	0	ft-#
Mu' : Downward	=	508	11,371	ft-#
Mu: Design	=	6,772	11,371	ft-#
phiMn	=	50,685	19,434	ft-#
Actual 1-Way Shear	=	31.17	54.33	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 7 @ 6.00 in
Heel Reinforcing = # 5 @ 8.85 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:
Heel:
Key:

Min footing T&S reinf Area 1.66 in2
Min footing T&S reinf Area per foot 0.30 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

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)		3,187.8	4.50	14,341.6		Soil Over HL (ab. water tbl)	3,390.8	4.25	14,410.7
HL Act Pres (be water tbl)						Soil Over HL (bel. water tbl)		4.25	14,410.7
Hydrostatic Force						Watre 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	=	73.3	1.00	73.3
Seismic Earth Load	=	1,020.1	6.75	6,883.9		Surcharge Over Toe	=			
	=					Stem Weight(s)	=	1,624.5	2.53	4,117.5
						Earth @ Stem Transitions	=			
						Footing Weight	=	962.5	2.75	2,646.9
						Key Weight	=			
						Vert. Component	=	1,407.2	5.50	7,739.3
Total	=	4,207.9	**O.T.M.** =	21,225.5		**Total =**		7,458.2 lbs	**R.M.=**	28,987.7

Resisting/Overturning Ratio = **1.37**
Vertical Loads used for Soil Pressure = 7,458.2 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 considered in the calculation of Sliding Resistance.

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

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DESCRIPTION: Garage Retaining Wall (Detail 10)

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)	0.196	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.

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Project File: Beams.ec6

DESCRIPTION: Typ. Basement Wall (Detail 11)

Code Reference

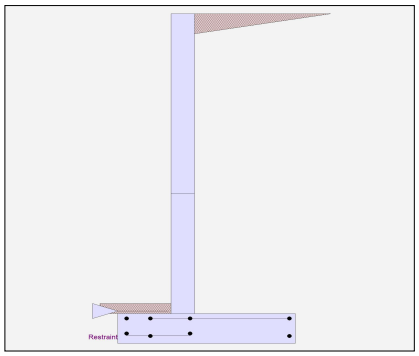
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

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

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
Used for Sliding & Overturning		

Axial Load Applied to Stem

Axial Dead Load	=	390.0 lbs
Axial Live Load	=	270.0 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 : Uniform		
Multiplier Used	=	16.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	176.000
Total Seismic Force	=	1,936.000

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Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Typ. Basement Wall (Detail 11)

Design Summary

Wall Stability Ratios

Overturning	=	1.33	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.63	
Total Bearing Load	=	6,516 lbs	
...resultant ecc.	=	18.00 in	
Soil Pressure @ Toe	=	3,720 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	5,208 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	33.2 psi	OK
Footing Shear @ Heel	=	50.4 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	3,472.7 lbs

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	10.00	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 6		
Rebar Spacing	=	12.00	12.00	6.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.599**	**0.812**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		2,064.0	4,560.0		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		5,184.0	18,133.3		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	22,313.3		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		26.5	58.5		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Project File: Beams.ec6

DESCRIPTION: Typ. Basement Wall (Detail 11)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.0567 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1864 in2/ft		
(4/3) * As :	0.2485 in2/ft	Min Stem T&S Reinf Area 1.152 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.2485 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.6519 in2/ft		
(4/3) * As :	0.8692 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.6519 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.88 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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Project Descr:

Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Typ. Basement Wall (Detail 11)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	3.50
Total Footing Width	=	5.00
Footing Thickness	=	12.00 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	=	5,208	0	psf
Mu' : Upward	=	4,883	0	ft-#
Mu' : Downward	=	252	10,258	ft-#
Mu: Design	=	4,631	10,258	ft-#
phiMn	=	11,695	13,958	ft-#
Actual 1-Way Shear	=	33.24	50.40	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 12.00 in
Heel Reinforcing = # 5 @ 11.23 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:
Heel:
Key:

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

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

Summary of Overturning & Resisting Forces & Moments

Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		2,117.5	3.67	7,764.2	Soil Over HL (ab. water tbl)	3,116.7	3.58	11,168.1
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.58	11,168.1
Hydrostatic Force					Watre 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	=	390.0	1.83	715.0
Added Lateral Load	=				* Axial Live Load on Stem	=	270.0	1.83	495.0
Load @ Stem Above Soil	=				Soil Over Toe	=	55.0	0.75	41.3
Seismic Earth Load	=	1,355.2	5.50	7,453.6	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	1,000.0	1.83	1,833.3
					Earth @ Stem Transitions	=			
					Footing Weight	=	750.0	2.50	1,875.0
					Key Weight	=			
					Vert. Component	=	934.7	5.00	4,673.5
Total	=	3,472.7	**O.T.M.** =	15,217.8	**Total =**		6,246.4 lbs	**R.M.=**	20,306.2

Resisting/Overturning Ratio = **1.33**
Vertical Loads used for Soil Pressure = 6,516.4 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 considered in the calculation of Sliding Resistance.

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

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Typ. Basement Wall (Detail 11)

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)	0.207	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.

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LIC# : KW-06017913, Build:20.22.3.16 MULHERN & KULP STRUCTURAL ENGINEERING INC

DESCRIPTION: Tall Crawlspace Wall (Detail 15)

Code Reference

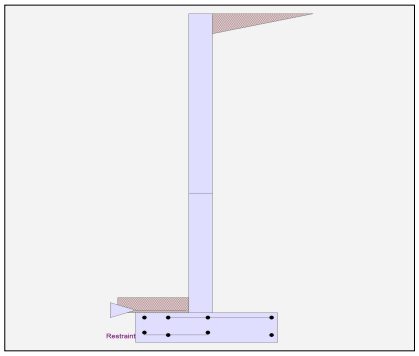
Calculations per IBC 2018 1807.3, CBC 2019, ASCE 7-16

Criteria

Retained Height	=	10.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	5,333.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	350.0 psf/ft
Soil Density, Heel	=	110.00 pcf
Soil Density, Toe	=	110.00 pcf
Footing||Soil Friction	=	0.350
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 psf
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		Spread Footing
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Applied to Stem

Axial Dead Load	=	390.0 lbs
Axial Live Load	=	270.0 lbs
Axial Load Eccentricity	=	0.0 in

Earth Pressure Seismic Load

Method : Uniform		
Multiplier Used	=	8.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	88.000
Total Seismic Force	=	968.000

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Tall Crawlspace Wall (Detail 15)

Design Summary

Wall Stability Ratios

Overturning	=	1.20	Ratio < 1.5!
Slab Resists All Sliding !			
Global Stability	=	1.44	
Total Bearing Load	=	5,294 lbs	
...resultant ecc.	=	16.37 in	
Soil Pressure @ Toe	=	4,572 psf	OK
Soil Pressure @ Heel	=	0 psf	OK
Allowable	=	5,333 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	6,400 psf	
ACI Factored @ Heel	=	0 psf	
Footing Shear @ Toe	=	37.3 psi	OK
Footing Shear @ Heel	=	37.2 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	2,795.1 lbs

Vertical component of active lateral soil pressure IS 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

		3rd	2nd	Bottom		
		Stem OK	Stem OK	Stem OK		
Design Height Above Ftg	ft =	10.00	4.00	0.00		
Wall Material Above "Ht"	=	Concrete	Concrete	Concrete		
Design Method	=	SD	SD	SD	SD	SD
Thickness	=	8.00	8.00	8.00		
Rebar Size	=	# 5	# 5	# 5		
Rebar Spacing	=	12.00	12.00	6.00		
Rebar Placed at	=	6.5 in	6.5 in	6.5 in		
Design Data						
fb/FB + fa/Fa	=	**0.000**	**0.416**	**0.835**		
Total Force @ Section						
Service Level	lbs =					
Strength Level	lbs =		1,536.0	3,680.0		
Moment....Actual						
Service Level	ft-# =					
Strength Level	ft-# =		3,600.0	13,733.3		
Moment.....Allowable	ft-# =	8,642.3	8,642.3	16,434.0		
Shear.....Actual						
Service Level	psi =					
Strength Level	psi =		19.7	47.2		
Shear.....Allowable	psi =	82.2	82.2	82.2		
Anet (Masonry)	in2 =					
Rebar Depth 'd'	in =	6.50	6.50	6.50		
Masonry Data						
f'm	psi =					
Fs	psi =					
Solid Grouting	=					
Modular Ratio 'n'	=					
Wall Weight	psf =	100.0	100.0	100.0		
Short Term Factor	=					
Equiv. Solid Thick.	=					
Masonry Block Type	=					
Masonry Design Method	=	ASD				
Concrete Data						
f'c	psi =	3,000.0	3,000.0	3,000.0		
Fy	psi =	60,000.0	60,000.0	60,000.0		

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Tall Crawlspace Wall (Detail 15)

Concrete Stem Rebar Area Details

3rd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0 in2/ft		
(4/3) * As :	0 in2/ft	Min Stem T&S Reinf Area 0.000 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.000 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 0.00 in	#4@ 0.00 in
Provided Area :	0.31 in2/ft	#5@ 0.00 in	#5@ 0.00 in
Maximum Area :	1.0567 in2/ft	#6@ 0.00 in	#6@ 0.00 in

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1294 in2/ft		
(4/3) * As :	0.1726 in2/ft	Min Stem T&S Reinf Area 1.152 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.1728 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.31 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4937 in2/ft		
(4/3) * As :	0.6583 in2/ft	Min Stem T&S Reinf Area 0.768 in2	
200bd/fy : 200(12)(6.5)/60000 :	0.26 in2/ft	Min Stem T&S Reinf Area per ft of stem Height : 0.192 in2/ft	
0.0018bh : 0.0018(12)(8) :	0.1728 in2/ft	Horizontal Reinforcing Options :	
	==========	One layer of :	Two layers of :
Required Area :	0.4937 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.62 in2/ft	#5@ 19.38 in	#5@ 38.75 in
Maximum Area :	1.0567 in2/ft	#6@ 27.50 in	#6@ 55.00 in

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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Tall Crawlspace Wall (Detail 15)

Footing Data

Toe Width	=	1.50 ft
Heel Width	=	2.50
Total Footing Width	=	4.00
Footing Thickness	=	12.00 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	=	6,400	0	psf
Mu' : Upward	=	5,312	0	ft-#
Mu' : Downward	=	277	5,263	ft-#
Mu: Design	=	5,036	5,263	ft-#
phiMn	=	9,837	11,003	ft-#
Actual 1-Way Shear	=	37.28	37.24	psi
Allow 1-Way Shear	=	82.16	82.16	psi

Toe Reinforcing = # 5 @ 14.35 in
Heel Reinforcing = # 5 @ 14.35 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:
Heel:
Key:

Min footing T&S reinf Area 1.04 in2
Min footing T&S reinf Area per foot 0.26 in2 /ft

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

Summary of Overturning & Resisting Forces & Moments

		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#		.....RESISTING..... Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		2,117.5	3.67	7,764.2	Soil Over HL (ab. water tbl)	2,016.7	3.08	6,218.1
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)		3.08	6,218.1
Hydrostatic Force					Watre 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	=	390.0	1.83	715.0
Added Lateral Load	=				* Axial Live Load on Stem	=	270.0	1.83	495.0
Load @ Stem Above Soil	=				Soil Over Toe	=	82.5	0.75	61.9
Seismic Earth Load	=	677.6	5.50	3,726.8	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	1,000.0	1.83	1,833.3
Total	=	2,795.1	**O.T.M.** =	11,491.0	Earth @ Stem Transitions	=			
					Footing Weight	=	600.0	2.00	1,200.0
					Key Weight	=			
					Vert. Component	=	934.7	4.00	3,738.8
					Total =		5,023.9 lbs	**R.M.=**	13,767.1

Resisting/Overturning Ratio = **1.20**
Vertical Loads used for Soil Pressure = 5,293.9 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 considered in the calculation of Sliding Resistance.

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

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Project Title:
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Cantilevered Retaining Wall

Project File: Beams.ec6

DESCRIPTION: Tall Crawlspace Wall (Detail 15)

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)	0.317	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.

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Project Title:
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Project ID:
Project Descr:

Concrete Beam

Project File: Beams_backup_1.ec6

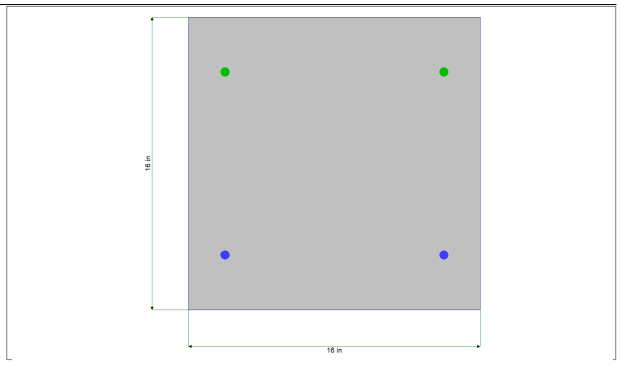
DESCRIPTION: Typical Grade Beam

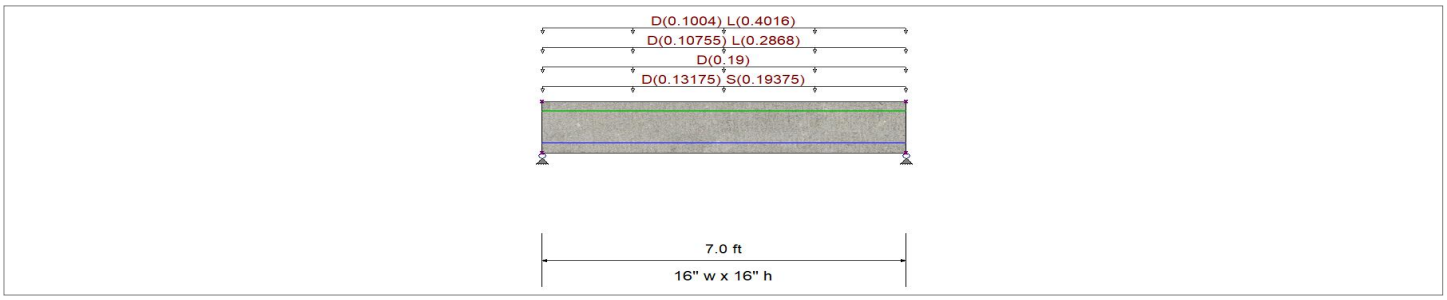
CODE REFERENCES

Calculations per ACI 318-14, IBC 2018, CBC 2019, ASCE 7-16
Load Combination Set : ASCE 7-16

Material Properties

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ *7.50	=	375.0 psi		Shear :	0.750
ψ Density	=	145.0 pcf	β_1	=	0.850
λ LtWt Factor	=	1.0			
Elastic Modulus	=	3,122.0 ksi	Fy - Stirrups		60.0 ksi
fy - Main Rebar	=	60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2





Cross Section & Reinforcing Details

Rectangular Section, Width = 16.0 in, Height = 16.0 in
Span #1 Reinforcing....
2-#4 at 3.0 in from Bottom, from 0.0 to 7.0 ft in this span
2-#4 at 3.0 in from Top, from 0.0 to 7.0 ft in this span

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.0170, S = 0.0250 ksf, Tributary Width = 7.750 ft, (Roof)
Uniform Load : D = 0.010 ksf, Tributary Width = 19.0 ft, (Wall)
Uniform Load : D = 0.0150, L = 0.040 ksf, Tributary Width = 7.170 ft, (Floor)
Uniform Load : D = 0.010, L = 0.040 ksf, Tributary Width = 10.040 ft, (Floor)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.500** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	13.128	k-ft
Mn * Phi : Allowable	26.259	k-ft
Location of maximum on span	3.494	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio =	38524	>=360.0	S Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Downward Total Deflection	0.005 in	Ratio =	17969	>=180.0	Span: 1 : +D+L
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0	Span: 1 : +D+L

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	5.166	5.166
Overall MINimum	0.678	0.678
D Only	2.756	2.756

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Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Beams_backup_1.ec6

DESCRIPTION: Typical Grade Beam

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+L	5.166	5.166
+D+S	3.434	3.434
+D+0.750L	4.563	4.563
+D+0.750L+0.750S	5.072	5.072
+0.60D	1.654	1.654
L Only	2.409	2.409
S Only	0.678	0.678

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Suggest
+1.20D+1.60L+0.50S	1	0.00	13.00	7.50	7.50	0.00	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.08	13.00	7.34	7.34	0.57	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.15	13.00	7.17	7.17	1.12	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.23	13.00	7.01	7.01	1.67	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.31	13.00	6.85	6.85	2.20	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.38	13.00	6.68	6.68	2.71	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.46	13.00	6.52	6.52	3.22	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.54	13.00	6.35	6.35	3.71	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.61	13.00	6.19	6.19	4.19	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.69	13.00	6.03	6.03	4.66	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.77	13.00	5.86	5.86	5.11	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.84	13.00	5.70	5.70	5.55	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.92	13.00	5.53	5.53	5.98	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	0.99	13.00	5.37	5.37	6.40	0.91	15.50	Vu < PhiVc/2	ot Reqd 9.6	15.5	0.0	0.0
+1.20D+1.60L+0.50S	1	1.07	13.00	5.21	5.21	6.81	0.83	15.44	Vu < PhiVc/2	ot Reqd 9.6	15.4	0.0	0.0
+1.20D+1.60L+0.50S	1	1.15	13.00	5.04	5.04	7.20	0.76	15.39	Vu < PhiVc/2	ot Reqd 9.6	15.4	0.0	0.0
+1.20D+1.60L+0.50S	1	1.22	13.00	4.88	4.88	7.58	0.70	15.34	Vu < PhiVc/2	ot Reqd 9.6	15.3	0.0	0.0
+1.20D+1.60L+0.50S	1	1.30	13.00	4.71	4.71	7.94	0.64	15.30	Vu < PhiVc/2	ot Reqd 9.6	15.3	0.0	0.0
+1.20D+1.60L+0.50S	1	1.38	13.00	4.55	4.55	8.30	0.59	15.27	Vu < PhiVc/2	ot Reqd 9.6	15.3	0.0	0.0
+1.20D+1.60L+0.50S	1	1.45	13.00	4.39	4.39	8.64	0.55	15.23	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	1.53	13.00	4.22	4.22	8.97	0.51	15.20	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	1.61	13.00	4.06	4.06	9.29	0.47	15.18	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	1.68	13.00	3.89	3.89	9.59	0.44	15.15	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	1.76	13.00	3.73	3.73	9.88	0.41	15.13	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	1.84	13.00	3.57	3.57	10.16	0.38	15.11	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	1.91	13.00	3.40	3.40	10.43	0.35	15.09	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	1.99	13.00	3.24	3.24	10.68	0.33	15.07	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	2.07	13.00	3.07	3.07	10.92	0.30	15.05	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.14	13.00	2.91	2.91	11.15	0.28	15.03	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.22	13.00	2.75	2.75	11.37	0.26	15.02	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.30	13.00	2.58	2.58	11.57	0.24	15.00	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.37	13.00	2.42	2.42	11.76	0.22	14.99	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.45	13.00	2.25	2.25	11.94	0.20	14.97	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.52	13.00	2.09	2.09	12.11	0.19	14.96	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	2.60	13.00	1.93	1.93	12.26	0.17	14.95	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	2.68	13.00	1.76	1.76	12.40	0.15	14.94	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	2.75	13.00	1.60	1.60	12.53	0.14	14.92	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	2.83	13.00	1.43	1.43	12.65	0.12	14.91	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	2.91	13.00	1.27	1.27	12.75	0.11	14.90	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	2.98	13.00	1.11	1.11	12.84	0.09	14.89	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.06	13.00	0.94	0.94	12.92	0.08	14.88	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.14	13.00	0.78	0.78	12.99	0.06	14.87	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.21	13.00	0.61	0.61	13.04	0.05	14.86	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.29	13.00	0.45	0.45	13.08	0.04	14.85	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0
+1.20D+1.60L+0.50S	1	3.37	13.00	0.29	0.29	13.11	0.02	14.84	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0
+1.20D+1.60L+0.50S	1	3.44	13.00	0.12	0.12	13.12	0.01	14.83	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0
+1.20D+1.60L+0.50S	1	3.52	13.00	-0.04	0.04	13.13	0.00	14.82	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0
+1.20D+1.60L+0.50S	1	3.60	13.00	-0.20	0.20	13.12	0.02	14.83	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0

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Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Beams_backup_1.ec6

DESCRIPTION: Typical Grade Beam

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu Actual	(k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Suggest
+1.20D+1.60L+0.50S	1	3.67	13.00	-0.37	0.37	13.10	0.03	14.84	Vu < PhiVc/2	ot Reqd 9.6	14.8	0.0	0.0
+1.20D+1.60L+0.50S	1	3.75	13.00	-0.53	0.53	13.06	0.04	14.85	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.83	13.00	-0.70	0.70	13.01	0.06	14.86	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.90	13.00	-0.86	0.86	12.95	0.07	14.87	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	3.98	13.00	-1.02	1.02	12.88	0.09	14.88	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.05	13.00	-1.19	1.19	12.80	0.10	14.90	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.13	13.00	-1.35	1.35	12.70	0.12	14.91	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.21	13.00	-1.52	1.52	12.59	0.13	14.92	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.28	13.00	-1.68	1.68	12.47	0.15	14.93	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.36	13.00	-1.84	1.84	12.33	0.16	14.94	Vu < PhiVc/2	ot Reqd 9.6	14.9	0.0	0.0
+1.20D+1.60L+0.50S	1	4.44	13.00	-2.01	2.01	12.19	0.18	14.95	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.51	13.00	-2.17	2.17	12.03	0.20	14.97	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.59	13.00	-2.34	2.34	11.85	0.21	14.98	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.67	13.00	-2.50	2.50	11.67	0.23	14.99	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.74	13.00	-2.66	2.66	11.47	0.25	15.01	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.82	13.00	-2.83	2.83	11.26	0.27	15.02	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.90	13.00	-2.99	2.99	11.04	0.29	15.04	Vu < PhiVc/2	ot Reqd 9.6	15.0	0.0	0.0
+1.20D+1.60L+0.50S	1	4.97	13.00	-3.16	3.16	10.80	0.32	15.06	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	5.05	13.00	-3.32	3.32	10.56	0.34	15.08	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	5.13	13.00	-3.48	3.48	10.30	0.37	15.09	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	5.20	13.00	-3.65	3.65	10.02	0.39	15.12	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	5.28	13.00	-3.81	3.81	9.74	0.42	15.14	Vu < PhiVc/2	ot Reqd 9.6	15.1	0.0	0.0
+1.20D+1.60L+0.50S	1	5.36	13.00	-3.98	3.98	9.44	0.46	15.16	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	5.43	13.00	-4.14	4.14	9.13	0.49	15.19	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	5.51	13.00	-4.30	4.30	8.81	0.53	15.22	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	5.58	13.00	-4.47	4.47	8.47	0.57	15.25	Vu < PhiVc/2	ot Reqd 9.6	15.2	0.0	0.0
+1.20D+1.60L+0.50S	1	5.66	13.00	-4.63	4.63	8.12	0.62	15.28	Vu < PhiVc/2	ot Reqd 9.6	15.3	0.0	0.0
+1.20D+1.60L+0.50S	1	5.74	13.00	-4.80	4.80	7.76	0.67	15.32	Vu < PhiVc/2	ot Reqd 9.6	15.3	0.0	0.0
+1.20D+1.60L+0.50S	1	5.81	13.00	-4.96	4.96	7.39	0.73	15.37	Vu < PhiVc/2	ot Reqd 9.6	15.4	0.0	0.0
+1.20D+1.60L+0.50S	1	5.89	13.00	-5.12	5.12	7.00	0.79	15.41	Vu < PhiVc/2	ot Reqd 9.6	15.4	0.0	0.0
+1.20D+1.60L+0.50S	1	5.97	13.00	-5.29	5.29	6.60	0.87	15.47	Vu < PhiVc/2	ot Reqd 9.6	15.5	0.0	0.0
+1.20D+1.60L+0.50S	1	6.04	13.00	-5.45	5.45	6.19	0.95	15.54	Vu < PhiVc/2	ot Reqd 9.6	15.5	0.0	0.0
+1.20D+1.60L+0.50S	1	6.12	13.00	-5.62	5.62	5.77	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.20	13.00	-5.78	5.78	5.33	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.27	13.00	-5.94	5.94	4.89	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.35	13.00	-6.11	6.11	4.42	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.43	13.00	-6.27	6.27	3.95	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.50	13.00	-6.44	6.44	3.47	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.58	13.00	-6.60	6.60	2.97	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.66	13.00	-6.76	6.76	2.46	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.73	13.00	-6.93	6.93	1.93	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.81	13.00	-7.09	7.09	1.40	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.89	13.00	-7.26	7.26	0.85	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0
+1.20D+1.60L+0.50S	1	6.96	13.00	-7.42	7.42	0.29	1.00	15.57	Vu < PhiVc/2	ot Reqd 9.6	15.6	0.0	0.0

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	7.000	13.13	26.26	0.50
+1.40D					
Span # 1	1	7.000	6.75	26.26	0.26
+1.20D+1.60L					
Span # 1	1	7.000	12.53	26.26	0.48
+1.20D+1.60L+0.50S					
Span # 1	1	7.000	13.13	26.26	0.50
+1.20D+L					
Span # 1	1	7.000	10.00	26.26	0.38
+1.20D					

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Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Beams_backup_1.ec6

DESCRIPTION: Typical Grade Beam

Load Combination Segment	Span #	Location (ft) along Beam	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
Span # 1 +1.20D+L+1.60S	1	7.000	5.79	26.26	0.22
Span # 1 +1.20D+1.60S	1	7.000	11.90	26.26	0.45
Span # 1 +1.20D+L+0.50S	1	7.000	7.69	26.26	0.29
Span # 1 +0.90D	1	7.000	10.60	26.26	0.40
Span # 1 +1.20D+L+0.20S	1	7.000	4.34	26.26	0.17
Span # 1	1	7.000	10.24	26.26	0.39

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
+D+L	1	0.0047	3.500		0.0000	0.000