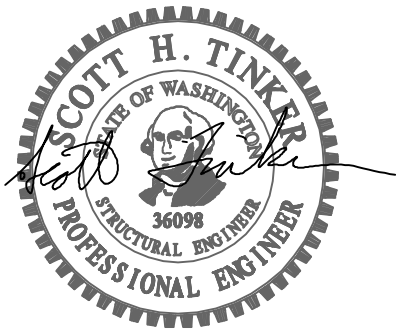
QUANTUM
CONSULTING ENGINEERS

September 26, 2025

SUPPLEMENTAL STRUCTURAL CALCULATIONS
(Permit Corrections)

LIN KICSKA RESIDENCE
5331 Forest Ave SE
Mercer Island, WA 98040

Quantum Job Number: 24429.01



Prepared for:
DIMARCO ARCHITECTURE
7541 Seward Park Ave S
Seattle, WA 98118

Prepared by:
QUANTUM CONSULTING ENGINEERS
1511 Third Avenue, Suite 323
Seattle, WA 98101
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Structural Design Criteria

Building Code: 2021 International Building Code
Building Department: Mercer Island

Seismic Criteria

S_s:	1.46	I_e:	1.00
S_1:	0.51	Seismic Soil Site Class:	D
S_{ds}:	0.97	Seismic Design Category:	D
S_{d1}:	0.60	C_s:	0.15
R:	6.50	Light-Framed Wood Walls Sheathed With Wood Structural Panels	

Wind Criteria

Wind Speed:	98 MPH
Risk Category:	II
Wind Exposure:	C
K_{zt}:	1.0

Geotechnical Criteria

Steel Pipe Piles (3" diameter)	12 K
Frost Depth	18” min.
Soils Consultant	Geotech Consultants Engineer, Inc.
Soils Report Number	#24314
Soils Report Date	October 8, 2024
Active Soil Pressure (Restrained/Unrestrained)	40 PCF
Seismic Surcharge Pressure	9H PSF
Passive Soil Pressure	250 PCF
Coefficient of Friction	0.35

Materials Criteria

Concrete (28 Day Strength):

Foundation/Slab on Grade	F'c= 2,500 PSI
Basement Walls	F'c= 3,000 PSI

Reinforcing Steel:

Grade 60 (#5 bar and larger)	Fy= 60,000 PSI
Grade 40 (#4 bar)	Fy= 40,000 PSI

Wood Framing:

2x, 3x & 4x Framing Members	HF#2 or DF#2
6x Framing Members	DF#1
Glulam Beams	24F-V4 (V8 @ Cont. and Cant. Members)
LSL Members - Beams & Headers	1.55 E LSL
Wood Sheathing	APA RATED

Residential Building Loads

Snow Load	Roof	25 psf
Live Load	Residential	40 psf
	Residential exterior decks / balconies	60 psf

Assembly Loads

Roof Loads		Comments
Standard Roofing	3.0 psf	
1/2” Ply. Sheathing	1.5 psf	
Joists @ 24” o.c.	2.1 psf	
R38 Insulation	1.0 psf	
5/8” GWB	2.8 psf	
Lights, ducts	0.5 psf	
PV Allowance	3.0 psf	INCL W/ MISC
Miscellaneous	1.1 psf	FOR SEISMIC
Total:	**15.0 psf**	SL=25 psf

Typical Floor Loads		Comments
Flooring	3.0 psf	
3/4" Ply. Sheathing	2.3 psf	
Floor Joists @ 16" o.c.	2.5 psf	
5/8” GWB	2.8 psf	
Lights, ducts	0.8 psf	
Miscellaneous	0.6 psf	
Partitons	-	
Total:	**12.0 psf**	LL=40 psf

Interior Wall Framing	
5/8" GWB	2.8 psf
2x4 @ 16" o.c.	0.9 psf
5/8" GWB	2.8 psf
Mech./Elec.	0.5 psf
Misc.	1.0 psf
Total:	**8.0 psf**

Exterior Wood Stud Wall	
Siding	2.3 psf
1/2" Plywood	1.5 psf
2x6 studs @ 16 " o.c.	1.7 psf
Insulation	0.5 psf
1/2" GWB	2.2 psf
Mech./Elec.	0.5 psf
Misc.	1.3 psf
Total:	**10.0 psf**

Deck Loads		Comments
Porcelain Pavers	10.0 psf	
Wood Sleepers	2.5 psf	
2x + Joists @ 16” o.c.	2.6 psf	
Miscellaneous	0.9 psf	
Total:	**16.0 psf**	LL=60 PSF

Deflection Criteria

Roof	Walls			Floor
Live Load: **L/240**		**L/120**	*flexible finishes	Live Load: **L/360**
Total Load: **L/180**		**L/240**	*brittle finish	Total Load: **L/240**
		L/240	*supporting glass	

LATERAL LOADS ON MAIN HOUSE:

SEISMIC SURCHARGE = 9H * 3'-6" TALL WALLS * 22'-0" LONG HOUSE = 2.4K

SOIL LOAD ON HOUSE = 40 PCF * 5'-6" TALL * 5'-6"/2 * 22'-0" = 13.3K

BASE SHEAR OF BUILDING = 5.6K

TOTAL LATERAL FORCE ON FOUNDATION = 2.4K + 5.6K (SEISMIC) + 13.3K (SOIL) = 21.3K

PASSIVE PRESSURE ON BUILDING:

PASSIVE PRESSURE = 250 PCF

GRADE BEAM DEPTH = 1'-6"

GRADE BEAM LENGTH PERPENDICULAR TO UPHILL DIRECTION = 22'+15'+22' = 59'

LATERAL PASSIVE RESISTING LOAD = 250 PCF * 1'-6" * 1'-6"/2 * 59' = 16.5K

SLIDING RESISTANCE FROM DOWELED SLAB:

USE 0.3 FOR FRICTION COEFFICIENT

SLAB AREA = 415 SF

SLAB WEIGHT = 4"/12" * 150 PCF = 50 PSF

FRICTION FORCE = 50 PSF * 415 SF * 0.3 = 6.2K

TOTAL LATERAL RESISTANCE = 16.5K + 6.2K = 22.7 > 21.3K OK

NO BATTERED PILES REQUIRED AT HOUSE

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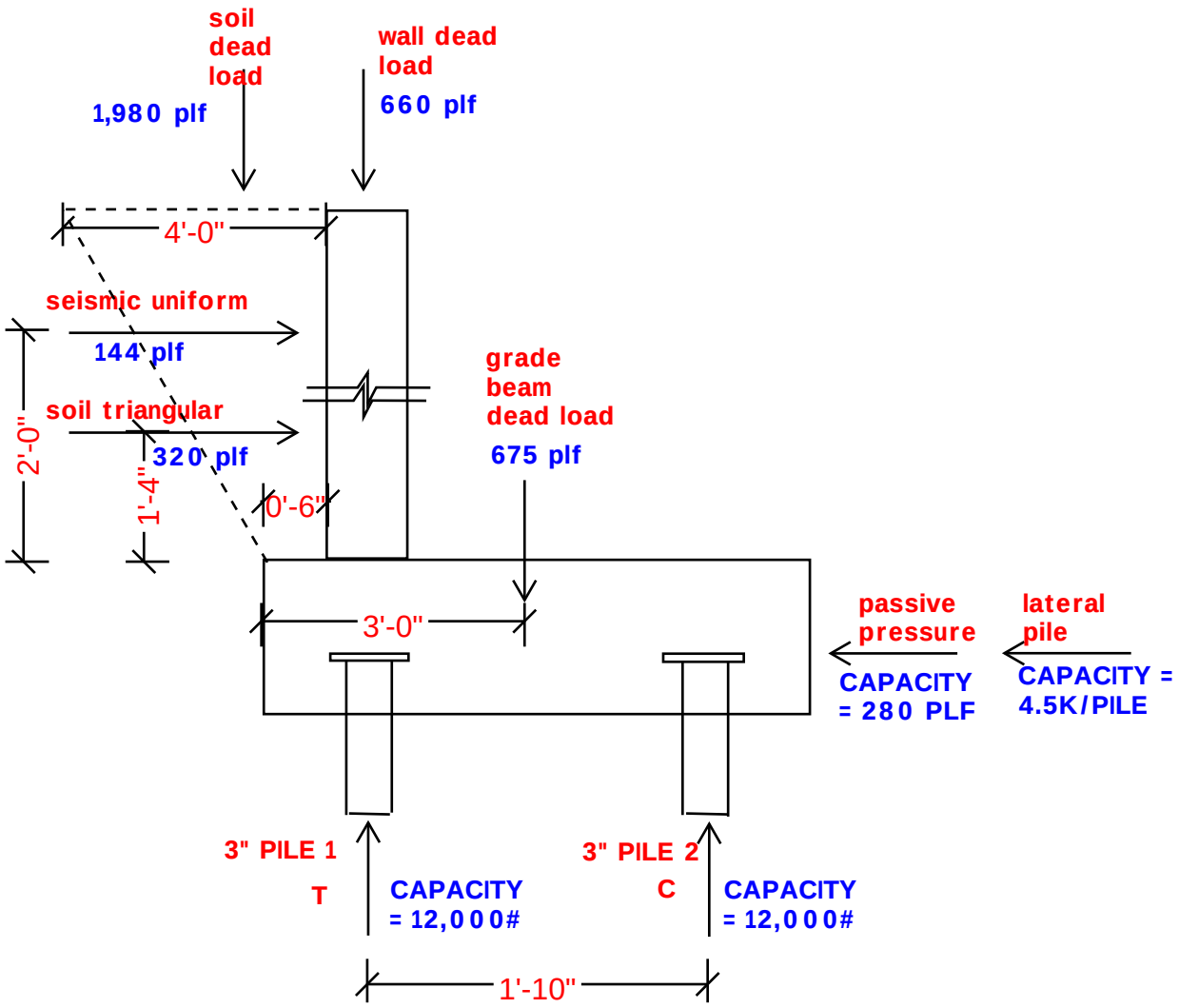
LIN KICSKA RESIDENCE	09/22/2025	24429.01
project	date	job no.
PASSIVE SOIL PRESSURE		
	drawn by:	
DIMARCO	BSD	
client	design by:	sheet no.



MAIN HOUSE PILE VERTICAL FORCES CHECK:

Mu = 144plf * 2' + 320plf * 1'-4" = 715#-FT/FT

T = C = 715#-FT / 1'-10" = 390#/FT

DOWNWARD ON PILE 1 = -390# (tension load) + 660# (wall) + 675#/2 (g.b.) + 1,980# (soil) = 2,925#
∴ PILE 1 NEVER GOES INTO TENSION

PILE 1 SPACING = 12,000#/2,925# = 4'-0" MAX.

DOWNWARD ON PILE 2 = 390# (comp.) + 675#/2 (g.b.) = 730#

PILE 2 SPACING = 12,000# / 730# = 16'-0" MAX

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KIN KICSKA RESIDENCE	09/22/2025	24429.01
project	date	job no.
PIPE PILE & RETAINING WALL DESIGN	drawn by:	
DIMARCO	BSD	
client	design by:	sheet no.

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

DESCRIPTION: Typical Grade Beam - 7'-0" pile spacing

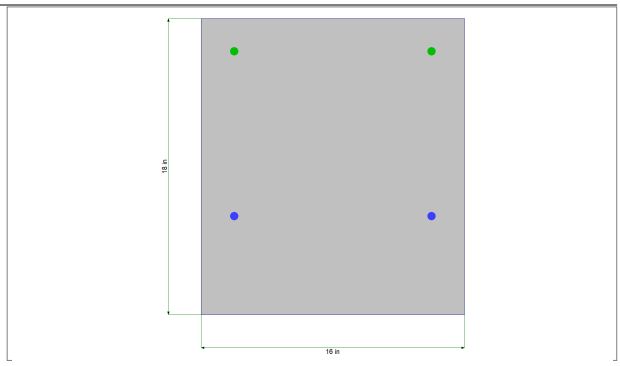
CODE REFERENCES

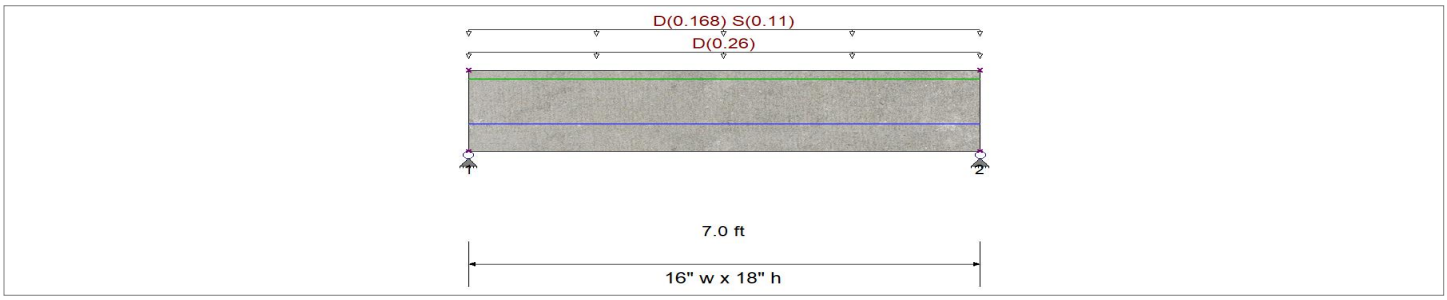
Calculations per ACI 318-19, IBC 2021
Load Combination Set : IBC 2021

General Information

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 *λ * f'c 1/2	=	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		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 16.0 in, Height = 18.0 in
Span #1 Reinforcing....
2-#4 at 6.0 in from Bottom, from 0.0 to 7.0 ft in this span
2-#4 at 2.0 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 = 0.260 k/ft, Tributary Width = 1.0 ft, (retaining wall weight)
Uniform Load : D = 0.1680, S = 0.110 k/ft, Tributary Width = 1.0 ft, (wood wall + roof)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.286** : 1	
Section used for this span	**Typical Section**	
Mu : Applied	6.355	k-ft
Mn * Phi : Allowable	22.221	k-ft
Location of maximum on span	3.506	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <360.0	S Only
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360.0	S Only
Max Downward Total Deflection	0.002 in	Ratio =	45604 >=180.0	Span: 1 : +D+S
Max Upward Total Deflection	0.000 in	Ratio =	0 <180.0	Span: 1 : +D+S

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.898	2.898
Max Upward from Load Combinations	2.898	2.898
Max Upward from Load Cases	2.513	2.513
D Only	2.513	2.513
+D+S	2.898	2.898
+D+0.750S	2.802	2.802

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

LIC# : KW-06016450, Build:20.25.04.16 QUANTUM CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Typical Grade Beam - 7'-0" pile spacing

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+0.60D	1.508	1.508
S Only	0.385	0.385

Shear Stirrup Requirements

Entire Beam Span Length : Ties Not Req'd, Stirrups are not required.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	Φ Vc (k)	Φ Vs (k)	Φ Vn (k)	Vu / Φ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60S	1	0.00	12.00	3.63	No	N/A	7.01	0.00	7.01	0.518	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.08	12.00	3.55	No	N/A	7.01	0.00	7.01	0.506	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.15	12.00	3.47	No	N/A	7.01	0.00	7.01	0.495	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.23	12.00	3.39	No	N/A	7.01	0.00	7.01	0.484	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.31	12.00	3.31	No	N/A	7.01	0.00	7.01	0.472	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.38	12.00	3.23	No	N/A	7.01	0.00	7.01	0.461	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.46	12.00	3.16	No	N/A	7.01	0.00	7.01	0.450	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.54	12.00	3.08	No	N/A	7.01	0.00	7.01	0.439	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.61	12.00	3.00	No	N/A	7.01	0.00	7.01	0.427	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.69	12.00	2.92	No	N/A	7.01	0.00	7.01	0.416	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.77	12.00	2.84	No	N/A	7.01	0.00	7.01	0.405	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.84	12.00	2.76	No	N/A	7.01	0.00	7.01	0.393	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.92	12.00	2.68	No	N/A	7.01	0.00	7.01	0.382	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	0.99	12.00	2.60	No	N/A	7.01	0.00	7.01	0.371	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.07	12.00	2.52	No	N/A	7.01	0.00	7.01	0.359	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.15	12.00	2.44	No	N/A	7.01	0.00	7.01	0.348	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.22	12.00	2.36	No	N/A	7.01	0.00	7.01	0.337	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.30	12.00	2.28	No	N/A	7.01	0.00	7.01	0.325	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.38	12.00	2.20	No	N/A	7.01	0.00	7.01	0.314	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.45	12.00	2.12	No	N/A	7.01	0.00	7.01	0.303	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.53	12.00	2.04	No	N/A	7.01	0.00	7.01	0.291	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.61	12.00	1.96	No	N/A	7.01	0.00	7.01	0.280	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.68	12.00	1.89	No	N/A	7.01	0.00	7.01	0.269	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.76	12.00	1.81	No	N/A	7.01	0.00	7.01	0.257	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.84	12.00	1.73	No	N/A	7.01	0.00	7.01	0.246	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.91	12.00	1.65	No	N/A	7.01	0.00	7.01	0.235	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	1.99	12.00	1.57	No	N/A	7.01	0.00	7.01	0.224	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.07	12.00	1.49	No	N/A	7.01	0.00	7.01	0.212	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.14	12.00	1.41	No	N/A	7.01	0.00	7.01	0.201	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.22	12.00	1.33	No	N/A	7.01	0.00	7.01	0.190	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.30	12.00	1.25	No	N/A	7.01	0.00	7.01	0.178	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.37	12.00	1.17	No	N/A	7.01	0.00	7.01	0.167	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.45	12.00	1.09	No	N/A	7.01	0.00	7.01	0.156	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.52	12.00	1.01	No	N/A	7.01	0.00	7.01	0.144	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.60	12.00	0.93	No	N/A	7.01	0.00	7.01	0.133	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.68	12.00	0.85	No	N/A	7.01	0.00	7.01	0.122	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.75	12.00	0.77	No	N/A	7.01	0.00	7.01	0.110	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.83	12.00	0.69	No	N/A	7.01	0.00	7.01	0.099	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.91	12.00	0.62	No	N/A	7.01	0.00	7.01	0.088	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	2.98	12.00	0.54	No	N/A	7.01	0.00	7.01	0.076	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.06	12.00	0.46	No	N/A	7.01	0.00	7.01	0.065	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.14	12.00	0.38	No	N/A	7.01	0.00	7.01	0.054	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.21	12.00	0.30	No	N/A	7.01	0.00	7.01	0.042	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.29	12.00	0.22	No	N/A	7.01	0.00	7.01	0.031	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.37	12.00	0.14	No	N/A	7.01	0.00	7.01	0.020	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.44	12.00	0.06	No	N/A	7.01	0.00	7.01	0.008	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.52	12.00	-0.02	No	N/A	7.01	0.00	7.01	0.003	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.60	12.00	-0.10	No	N/A	7.01	0.00	7.01	0.014	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.67	12.00	-0.18	No	N/A	7.01	0.00	7.01	0.025	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.75	12.00	-0.26	No	N/A	7.01	0.00	7.01	0.037	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.83	12.00	-0.34	No	N/A	7.01	0.00	7.01	0.048	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.90	12.00	-0.42	No	N/A	7.01	0.00	7.01	0.059	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	3.98	12.00	-0.50	No	N/A	7.01	0.00	7.01	0.071	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.05	12.00	-0.58	No	N/A	7.01	0.00	7.01	0.082	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.13	12.00	-0.65	No	N/A	7.01	0.00	7.01	0.093	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.21	12.00	-0.73	No	N/A	7.01	0.00	7.01	0.105	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.28	12.00	-0.81	No	N/A	7.01	0.00	7.01	0.116	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.36	12.00	-0.89	No	N/A	7.01	0.00	7.01	0.127	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.44	12.00	-0.97	No	N/A	7.01	0.00	7.01	0.139	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.51	12.00	-1.05	No	N/A	7.01	0.00	7.01	0.150	Eqn (c)	Ties Not Req'd

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

DESCRIPTION: Typical Grade Beam - 7'-0" pile spacing

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ϕ Vc (k)	ϕ Vs (k)	ϕ Vn (k)	Vu / ϕ Vn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60S	1	4.59	12.00	-1.13	No	N/A	7.01	0.00	7.01	0.161	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.67	12.00	-1.21	No	N/A	7.01	0.00	7.01	0.173	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.74	12.00	-1.29	No	N/A	7.01	0.00	7.01	0.184	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.82	12.00	-1.37	No	N/A	7.01	0.00	7.01	0.195	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.90	12.00	-1.45	No	N/A	7.01	0.00	7.01	0.207	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	4.97	12.00	-1.53	No	N/A	7.01	0.00	7.01	0.218	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.05	12.00	-1.61	No	N/A	7.01	0.00	7.01	0.229	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.13	12.00	-1.69	No	N/A	7.01	0.00	7.01	0.240	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.20	12.00	-1.77	No	N/A	7.01	0.00	7.01	0.252	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.28	12.00	-1.85	No	N/A	7.01	0.00	7.01	0.263	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.36	12.00	-1.92	No	N/A	7.01	0.00	7.01	0.274	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.43	12.00	-2.00	No	N/A	7.01	0.00	7.01	0.286	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.51	12.00	-2.08	No	N/A	7.01	0.00	7.01	0.297	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.58	12.00	-2.16	No	N/A	7.01	0.00	7.01	0.308	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.66	12.00	-2.24	No	N/A	7.01	0.00	7.01	0.320	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.74	12.00	-2.32	No	N/A	7.01	0.00	7.01	0.331	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.81	12.00	-2.40	No	N/A	7.01	0.00	7.01	0.342	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.89	12.00	-2.48	No	N/A	7.01	0.00	7.01	0.354	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	5.97	12.00	-2.56	No	N/A	7.01	0.00	7.01	0.365	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.04	12.00	-2.64	No	N/A	7.01	0.00	7.01	0.376	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.12	12.00	-2.72	No	N/A	7.01	0.00	7.01	0.388	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.20	12.00	-2.80	No	N/A	7.01	0.00	7.01	0.399	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.27	12.00	-2.88	No	N/A	7.01	0.00	7.01	0.410	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.35	12.00	-2.96	No	N/A	7.01	0.00	7.01	0.422	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.43	12.00	-3.04	No	N/A	7.01	0.00	7.01	0.433	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.50	12.00	-3.12	No	N/A	7.01	0.00	7.01	0.444	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.58	12.00	-3.20	No	N/A	7.01	0.00	7.01	0.456	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.66	12.00	-3.27	No	N/A	7.01	0.00	7.01	0.467	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.73	12.00	-3.35	No	N/A	7.01	0.00	7.01	0.478	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.81	12.00	-3.43	No	N/A	7.01	0.00	7.01	0.489	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.89	12.00	-3.51	No	N/A	7.01	0.00	7.01	0.501	Eqn (c)	Ties Not Req'd
+1.20D+1.60S	1	6.96	12.00	-3.59	No	N/A	7.01	0.00	7.01	0.512	Eqn (c)	Ties Not Req'd

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	6.36	22.22	0.29
+1.40D					
Span # 1	1	7.000	6.16	22.22	0.28
+1.20D					
Span # 1	1	7.000	5.28	22.22	0.24
+1.20D+0.50S					
Span # 1	1	7.000	5.61	22.22	0.25
+1.20D+1.60S					
Span # 1	1	7.000	6.36	22.22	0.29
+1.20D+0.20S					
Span # 1	1	7.000	5.41	22.22	0.24
+0.90D					
Span # 1	1	7.000	3.96	22.22	0.18

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
1	+D+S	0.0018	3.500		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

LIC# : KW-06016450, Build:20.25.04.16 QUANTUM CONSULTING ENGINEERS (c) ENERCALC, LLC 1982-2025

DESCRIPTION: Deck Grade Beam - 11'-0" pile spacing

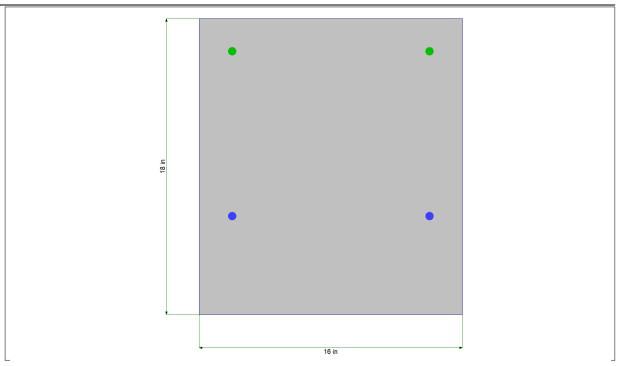
CODE REFERENCES

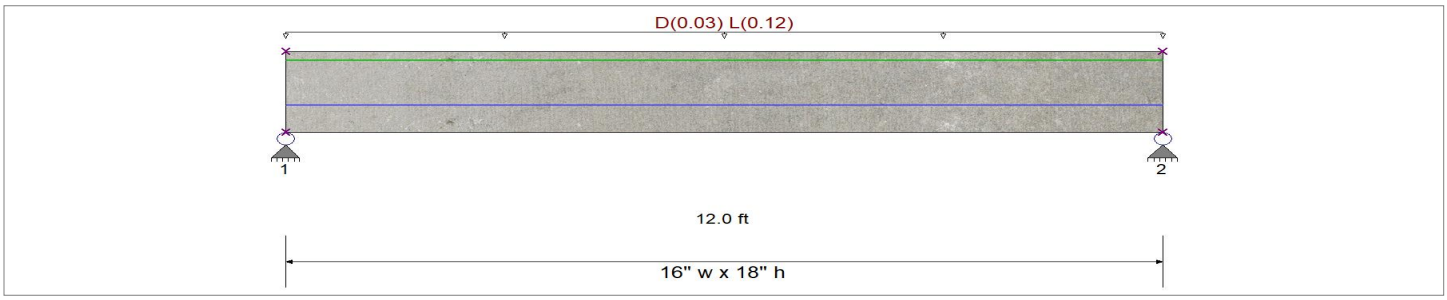
Calculations per ACI 318-19, IBC 2021
Load Combination Set : IBC 2021

General Information

f'c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
fr =7.5 *λ * f'c$^{1/2}$	=	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		40.0 ksi
fy - Main Rebar	=	60.0	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	=	29,000.0 ksi	Stirrup Bar Size #		3
			Number of Resisting Legs Per Stirrup	=	2

Seismic Design Category = A





Cross Section & Reinforcing Details

Rectangular Section, Width = 16.0 in, Height = 18.0 in
Span #1 Reinforcing....
2-#4 at 6.0 in from Bottom, from 0.0 to 12.0 ft in this span
2-#4 at 2.0 in from Top, from 0.0 to 12.0 ft in this span

Beam self weight calculated and added to loads
Load for Span Number 1
Uniform Load : D = 0.030, L = 0.120 k/ft, Tributary Width = 1.0 ft, (deck)

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	**0.467**	: 1
Section used for this span	**Typical Section**	
Mu : Applied	10.368	k-ft
Mn * Phi : Allowable	22.221	k-ft
Location of maximum on span	6.011	ft
Span # where maximum occurs	Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.002 in	Ratio =	62460	>=360.0	L Only
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0	L Only
Max Downward Total Deflection	0.008 in	Ratio =	17034	>=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
Max Upward from all Load Conditions	2.640	2.640
Max Upward from Load Combinations	2.640	2.640
Max Upward from Load Cases	1.920	1.920
D Only	1.920	1.920
+D+L	2.640	2.640
+D+0.750L	2.460	2.460
+0.60D	1.152	1.152

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

DESCRIPTION: Deck Grade Beam - 11'-0" pile spacing

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
L Only	0.720	0.720

Shear Stirrup Requirements

Entire Beam Span Length : Ties Not Req'd, Stirrups are not required.

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦVc (k)	ΦVs (k)	ΦVn (k)	Vu / ΦVn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	0.00	12.00	3.46	No	N/A	7.01	0.00	7.01	0.493	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.13	12.00	3.38	No	N/A	7.01	0.00	7.01	0.482	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.26	12.00	3.30	No	N/A	7.01	0.00	7.01	0.471	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.39	12.00	3.23	No	N/A	7.01	0.00	7.01	0.460	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.52	12.00	3.15	No	N/A	7.01	0.00	7.01	0.450	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.66	12.00	3.08	No	N/A	7.01	0.00	7.01	0.439	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.79	12.00	3.00	No	N/A	7.01	0.00	7.01	0.428	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	0.92	12.00	2.93	No	N/A	7.01	0.00	7.01	0.417	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.05	12.00	2.85	No	N/A	7.01	0.00	7.01	0.407	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.18	12.00	2.78	No	N/A	7.01	0.00	7.01	0.396	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.31	12.00	2.70	No	N/A	7.01	0.00	7.01	0.385	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.44	12.00	2.63	No	N/A	7.01	0.00	7.01	0.374	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.57	12.00	2.55	No	N/A	7.01	0.00	7.01	0.363	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.70	12.00	2.47	No	N/A	7.01	0.00	7.01	0.353	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.84	12.00	2.40	No	N/A	7.01	0.00	7.01	0.342	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	1.97	12.00	2.32	No	N/A	7.01	0.00	7.01	0.331	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.10	12.00	2.25	No	N/A	7.01	0.00	7.01	0.320	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.23	12.00	2.17	No	N/A	7.01	0.00	7.01	0.310	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.36	12.00	2.10	No	N/A	7.01	0.00	7.01	0.299	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.49	12.00	2.02	No	N/A	7.01	0.00	7.01	0.288	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.62	12.00	1.95	No	N/A	7.01	0.00	7.01	0.277	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.75	12.00	1.87	No	N/A	7.01	0.00	7.01	0.267	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	2.89	12.00	1.79	No	N/A	7.01	0.00	7.01	0.256	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.02	12.00	1.72	No	N/A	7.01	0.00	7.01	0.245	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.15	12.00	1.64	No	N/A	7.01	0.00	7.01	0.234	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.28	12.00	1.57	No	N/A	7.01	0.00	7.01	0.223	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.41	12.00	1.49	No	N/A	7.01	0.00	7.01	0.213	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.54	12.00	1.42	No	N/A	7.01	0.00	7.01	0.202	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.67	12.00	1.34	No	N/A	7.01	0.00	7.01	0.191	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.80	12.00	1.27	No	N/A	7.01	0.00	7.01	0.180	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	3.93	12.00	1.19	No	N/A	7.01	0.00	7.01	0.170	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.07	12.00	1.11	No	N/A	7.01	0.00	7.01	0.159	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.20	12.00	1.04	No	N/A	7.01	0.00	7.01	0.148	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.33	12.00	0.96	No	N/A	7.01	0.00	7.01	0.137	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.46	12.00	0.89	No	N/A	7.01	0.00	7.01	0.127	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.59	12.00	0.81	No	N/A	7.01	0.00	7.01	0.116	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.72	12.00	0.74	No	N/A	7.01	0.00	7.01	0.105	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.85	12.00	0.66	No	N/A	7.01	0.00	7.01	0.094	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	4.98	12.00	0.59	No	N/A	7.01	0.00	7.01	0.083	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.11	12.00	0.51	No	N/A	7.01	0.00	7.01	0.073	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.25	12.00	0.43	No	N/A	7.01	0.00	7.01	0.062	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.38	12.00	0.36	No	N/A	7.01	0.00	7.01	0.051	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.51	12.00	0.28	No	N/A	7.01	0.00	7.01	0.040	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.64	12.00	0.21	No	N/A	7.01	0.00	7.01	0.030	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.77	12.00	0.13	No	N/A	7.01	0.00	7.01	0.019	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	5.90	12.00	0.06	No	N/A	7.01	0.00	7.01	0.008	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.03	12.00	-0.02	No	N/A	7.01	0.00	7.01	0.003	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.16	12.00	-0.09	No	N/A	7.01	0.00	7.01	0.013	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.30	12.00	-0.17	No	N/A	7.01	0.00	7.01	0.024	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.43	12.00	-0.25	No	N/A	7.01	0.00	7.01	0.035	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.56	12.00	-0.32	No	N/A	7.01	0.00	7.01	0.046	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.69	12.00	-0.40	No	N/A	7.01	0.00	7.01	0.057	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.82	12.00	-0.47	No	N/A	7.01	0.00	7.01	0.067	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	6.95	12.00	-0.55	No	N/A	7.01	0.00	7.01	0.078	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.08	12.00	-0.62	No	N/A	7.01	0.00	7.01	0.089	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.21	12.00	-0.70	No	N/A	7.01	0.00	7.01	0.100	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.34	12.00	-0.77	No	N/A	7.01	0.00	7.01	0.110	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.48	12.00	-0.85	No	N/A	7.01	0.00	7.01	0.121	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.61	12.00	-0.93	No	N/A	7.01	0.00	7.01	0.132	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.74	12.00	-1.00	No	N/A	7.01	0.00	7.01	0.143	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	7.87	12.00	-1.08	No	N/A	7.01	0.00	7.01	0.153	Eqn (c)	Ties Not Req'd

Project Title:
Engineer:
Project ID:
Project Descr:

Concrete Beam

Project File: Foundations.ec6

DESCRIPTION: Deck Grade Beam - 11'-0" pile spacing

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ΦVc (k)	ΦVs (k)	ΦVn (k)	Vu / ΦVn	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.20D+1.60L	1	8.00	12.00	-1.15	No	N/A	7.01	0.00	7.01	0.164	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.13	12.00	-1.23	No	N/A	7.01	0.00	7.01	0.175	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.26	12.00	-1.30	No	N/A	7.01	0.00	7.01	0.186	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.39	12.00	-1.38	No	N/A	7.01	0.00	7.01	0.197	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.52	12.00	-1.45	No	N/A	7.01	0.00	7.01	0.207	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.66	12.00	-1.53	No	N/A	7.01	0.00	7.01	0.218	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.79	12.00	-1.61	No	N/A	7.01	0.00	7.01	0.229	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	8.92	12.00	-1.68	No	N/A	7.01	0.00	7.01	0.240	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.05	12.00	-1.76	No	N/A	7.01	0.00	7.01	0.250	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.18	12.00	-1.83	No	N/A	7.01	0.00	7.01	0.261	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.31	12.00	-1.91	No	N/A	7.01	0.00	7.01	0.272	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.44	12.00	-1.98	No	N/A	7.01	0.00	7.01	0.283	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.57	12.00	-2.06	No	N/A	7.01	0.00	7.01	0.293	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.70	12.00	-2.13	No	N/A	7.01	0.00	7.01	0.304	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.84	12.00	-2.21	No	N/A	7.01	0.00	7.01	0.315	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	9.97	12.00	-2.29	No	N/A	7.01	0.00	7.01	0.326	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.10	12.00	-2.36	No	N/A	7.01	0.00	7.01	0.337	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.23	12.00	-2.44	No	N/A	7.01	0.00	7.01	0.347	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.36	12.00	-2.51	No	N/A	7.01	0.00	7.01	0.358	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.49	12.00	-2.59	No	N/A	7.01	0.00	7.01	0.369	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.62	12.00	-2.66	No	N/A	7.01	0.00	7.01	0.380	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.75	12.00	-2.74	No	N/A	7.01	0.00	7.01	0.390	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	10.89	12.00	-2.81	No	N/A	7.01	0.00	7.01	0.401	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.02	12.00	-2.89	No	N/A	7.01	0.00	7.01	0.412	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.15	12.00	-2.96	No	N/A	7.01	0.00	7.01	0.423	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.28	12.00	-3.04	No	N/A	7.01	0.00	7.01	0.433	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.41	12.00	-3.12	No	N/A	7.01	0.00	7.01	0.444	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.54	12.00	-3.19	No	N/A	7.01	0.00	7.01	0.455	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.67	12.00	-3.27	No	N/A	7.01	0.00	7.01	0.466	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.80	12.00	-3.34	No	N/A	7.01	0.00	7.01	0.477	Eqn (c)	Ties Not Req'd
+1.20D+1.60L	1	11.93	12.00	-3.42	No	N/A	7.01	0.00	7.01	0.487	Eqn (c)	Ties Not Req'd

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	12.000	10.37	22.22	0.47
+1.40D					
Span # 1	1	12.000	8.06	22.22	0.36
+1.20D+1.60L					
Span # 1	1	12.000	10.37	22.22	0.47
+1.20D+0.50L					
Span # 1	1	12.000	7.99	22.22	0.36
+1.20D					
Span # 1	1	12.000	6.91	22.22	0.31
+0.90D					
Span # 1	1	12.000	5.18	22.22	0.23

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in)	Location in Span (ft)	Load Combination	Max. "+" Defl (in)	Location in Span (ft)
1	+D+L	0.0085	6.000		0.0000	0.000

Project Title:
Engineer:
Project ID:
Project Descr:

Cantilevered Retaining Wall

Project File: Foundations.ec6

DESCRIPTION: Basement L Wall grade beam

Code Reference

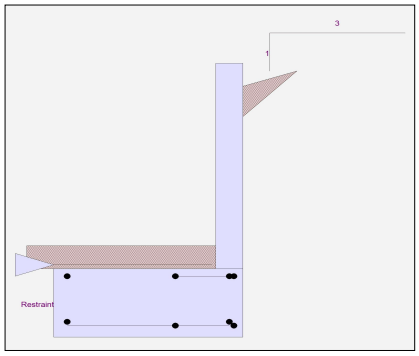
Calculations per IBC 2021, ACI 318-19, TMS 402-16

Criteria

Retained Height	=	4.00 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	3.00
Height of Soil over Toe	=	6.00 in
Water table above bottom of footing	=	0.0 ft

Soil Data

Allow Soil Bearing	=	1,500.0 psf
Equivalent Fluid Pressure Method		
Active Heel Pressure	=	40.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	130.00 pcf
Soil Density, Toe	=	130.00 pcf
Footing||Soil Friction	=	0.400
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	250.0 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	=	9.000
(Multiplier used on soil density)		
Uniform Seismic Force	=	49.500
Total Seismic Force	=	272.250

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Cantilevered Retaining Wall

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DESCRIPTION: Basement L Wall grade beam

Design Summary

Wall Stability Ratios

Overturning	=	2.57	OK
Slab Resists All Sliding !			
Global Stability	=	2.69	
Total Bearing Load	=	1,745 lbs	
...resultant ecc.	=	3.40 in	
Eccentricity within middle third			
Soil Pressure @ Toe	=	741 psf	OK
Soil Pressure @ Heel	=	257 psf	OK
Allowable	=	1,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	933 psf	
ACI Factored @ Heel	=	323 psf	
Footing Shear @ Toe	=	4.1 psi	OK
Footing Shear @ Hee	=	0.0 psi	OK
Allowable	=	82.2 psi	

Sliding Calcs

Lateral Sliding Force	=	795.6 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

		Bottom		
		Stem OK		
Design Height Above Ftg	ft =	0.00		
Wall Material Above "Ht"	=	Concrete		
Design Method	=	SD	SD	SD
Thickness	=	6.00		
Rebar Size	=	# 4		
Rebar Spacing	=	12.00		
Rebar Placed at	=	Center		
Design Data				
fb/FB + fa/Fa	=	**0.427**		
Total Force @ Section				
Service Level	lbs =			
Strength Level	lbs =	710.0		
Moment....Actual				
Service Level	ft-# =			
Strength Level	ft-# =	1,078.7		
Moment.....Allowable	=	2,523.0		
Shear.....Actual				
Service Level	psi =			
Strength Level	psi =	19.7		
Shear.....Allowable	psi =	58.2		
Anet (Masonry)	in2 =			
Wall Weight	psf =	75.0		
Rebar Depth 'd'	in =	3.00		

Masonry Data

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

Concrete Data

f'c	psi =	3,000.0
Fy	psi =	60,000.0

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Cantilevered Retaining Wall

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DESCRIPTION: Basement L Wall grade beam

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0894 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@ 18.52 in	#4@ 37.04 in
Provided Area :	0.2 in2/ft	#5@ 28.70 in	#5@ 57.41 in
Maximum Area :	0.4877 in2/ft	#6@ 40.74 in	#6@ 81.48 in

Footing Data

Toe Width	=	3.00 ft
Heel Width	=	0.50
Total Footing Width	=	3.50
Footing Thickness	=	18.00 in

f'c = 3,000 psi Fy = 40,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel	
Factored Pressure	=	933	323	psf
Mu' : Upward	=	3,414	0	ft-#
Mu' : Downward	=	1,566	0	ft-#
Mu: Design	=	1,848	0	ft-#
φ Mn	=	9,467	OK - Flush	
Actual 1-Way Shear	=	4.15	0.00	psi
Allow 1-Way Shear	=	35.12	38.45	psi

Toe Reinforcing = # 4 @ 11.11 in
Heel Reinforcing = Flush heel condition. No reinforcing required.
Key Reinforcing = None Spec'd
Footing Torsion, Tu = 0.00 ft-lbs
Footing Allow. Torsion, φ Tn = 0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18 in, #8@ 18 in, #9@ 18 in, #10@ 18 in

Heel: Flush heel condition. No reinforcing required.

Key: No key defined

Min footing T&S reinf Area 1.36 in2
Min footing T&S reinf Area per foot 0.39 in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 6.17 in	#4@ 12.35 in
#5@ 9.57 in	#5@ 19.14 in
#6@ 13.58 in	#6@ 27.16 in

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DESCRIPTION: Basement L Wall grade beam

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)		605.0	1.83	1,109.2	Soil Over HL (ab. water tbl)			
HL Act Pres (be water tbl)					Soil Over HL (bel. water tbl)			
Hydrostatic Force					Water Table			
Buoyant Force	=				Sloped Soil Over Hee	=	3.50	
Surcharge over Heel	=				Surcharge Over Heel	=		
Surcharge Over Toe	=				Adjacent Footing Load	=		
Adjacent Footing Load	=				Axial Dead Load on Stem	=	250.0	3.25	812.5
Added Lateral Load	=				* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=				Soil Over Toe	=	195.0	1.50	292.5
Seismic Earth Load	=	190.6	2.75	524.1	Surcharge Over Toe	=			
	=				Stem Weight(s)	=	337.5	3.25	1,096.9
					Earth @ Stem Transitions	=			
					Footing Weight	=	787.5	1.75	1,378.1
					Key Weight	=			
					Vert. Component	=	175.2	3.50	613.1
Total	=	795.6	**O.T.M.** =	1,633.2	**Total =**		1,745.2 lbs	**R.M.=**	4,193.1

Resisting/Overturning Ratio = **2.57**

Vertical Loads used for Soil Pressure = 1,745.2 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.

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)	0.026	in

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

DESCRIPTION: Basement L Wall grade beam

Rebar Lap & Embedment Lengths Information

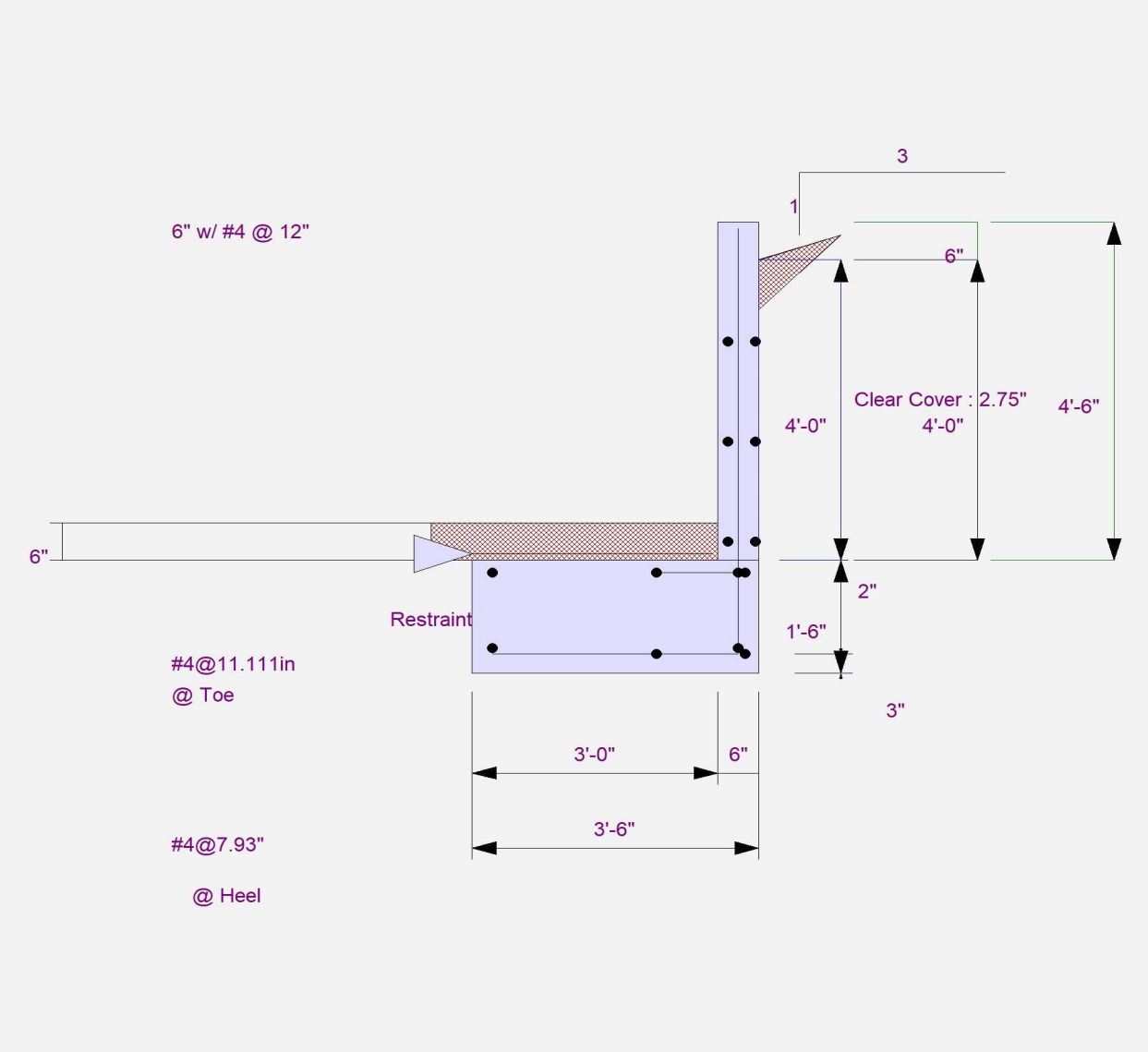
Stem Design Segment: Bottom

Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #4 bar specified in this stem design segment (25.4.2.4a) =	17.09 in
Development length for #4 bar specified in this stem design segment =	13.15 in
Hooked embedment length into footing for #4 bar specified in this stem design segment =	6.00 in
As Provided =	0.2000 in2/ft
As Required =	0.1296 in2/ft

Cantilevered Retaining Wall

DESCRIPTION: Basement L Wall grade beam



Cantilevered Retaining Wall

DESCRIPTION: Basement L Wall grade beam