

MYERS ENGINEERING

BEAM CALCULATIONS



Mark
Myers
2025.07.30
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-07'00'

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Project: Long Residence Addition & Remodel
3424 76th Place SE
Mercer Island, WA

July 30, 2025

2021 INTERNATIONAL BUILDING CODE
100 MPH WIND, EXPOSURE B, $K_{zt} = 1.00$
RISK CATEGORY II - SOIL SITE CLASS D
SEISMIC DESIGN CATEGORY D (IBC)

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Concrete Beam

Project File: Long Addition.ec6

LIC#: KW-06015659, Build:20.25.07.09

MYERS ENGINEERING

(c) ENERCALC, LLC 1982-2025

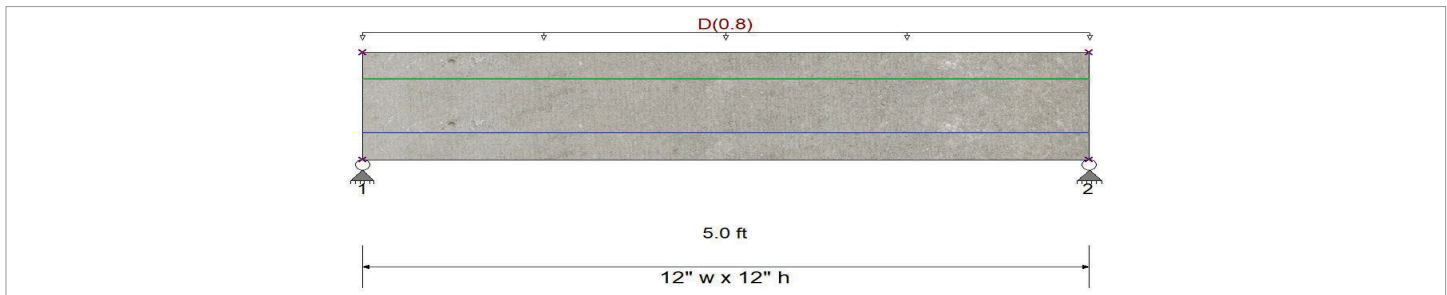
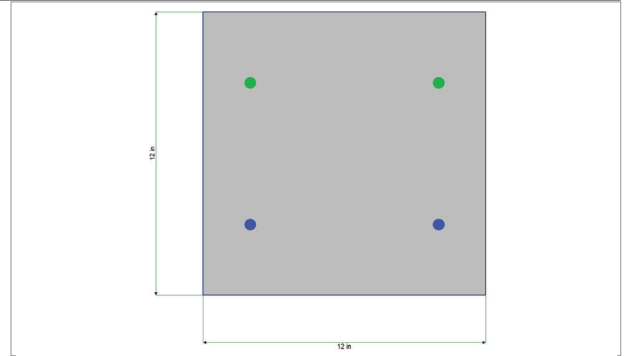
DESCRIPTION: Grade Beam footing

Code References

Governing Code : IBC 2021
 Referenced Design Standard(s) : ACI 318-19
 Load Combination Set : IBC 2021

General Information

f_c	=	2.50 ksi	ϕ Phi Values	Flexure :	0.90
$f_r = 7.5 * \lambda * f_c^{1/2}$	=	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 = 12.0 in, Height = 12.0 in

Span #1 Reinforcing....

2-#4 at 3.0 in from Bottom, from 0.0 to 5.0 ft in this span

2-#4 at 3.0 in from Top, from 0.0 to 5.0 ft in this span

Load for Span Number 1

Uniform Load : D = 0.80 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio	=	0.198	: 1
Section used for this span		Typical Section	
Mu : Applied		3.50	k-ft
Mn * Phi : Allowable		17.704	k-ft
Location of maximum on span		2.495	ft
Span # where maximum occurs		Span # 1	

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0	<360.0
Max Upward Transient Deflection	0.000 in	Ratio =	0	<360.0
Max Downward Total Deflection	0.002 in	Ratio =	28781	>=180.0 Span: 1 : D Only
Max Upward Total Deflection	0.000 in	Ratio =	0	<180.0 Span: 1 : D Only

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Max Upward from all Load Conditions	2.000	2.000
Max Upward from Load Combinations	1.200	1.200
Max Upward from Load Cases	2.000	2.000
D Only	2.000	2.000
+0.60D	1.200	1.200

Shear Stirrup Requirements

Between 0.00 to 0.08 ft, Max spacing per 9.7.6.2.2, use #3 stirrups spaced at 3 in

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DESCRIPTION: Grade Beam footing

Shear Stirrup Requirements

Between 0.09 to 4.91 ft, Ties Not Req'd, Stirrups are not required.
 Between 4.92 to 4.99 ft, Max spacing per 9.7.6.2.2, use #3 stirrups spaced at 3 in

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
+1.40D	1	0.00	6.00	2.80	Yes	3.00	5.40	13.20	18.60	0.151	Eqn (a)	Max spacing per 9.7.6.2
+1.40D	1	0.05	6.00	2.74	Yes	3.00	5.40	13.20	18.60	0.147	Eqn (a)	Max spacing per 9.7.6.2
+1.40D	1	0.11	6.00	2.68	No	N/A	4.82	0.00	4.82	0.556	Eqn (b)	Ties Not Req'd
+1.40D	1	0.16	6.00	2.62	No	N/A	4.82	0.00	4.82	0.543	Eqn (b)	Ties Not Req'd
+1.40D	1	0.22	6.00	2.56	No	N/A	4.82	0.00	4.82	0.530	Eqn (b)	Ties Not Req'd
+1.40D	1	0.27	6.00	2.49	No	N/A	4.82	0.00	4.82	0.517	Eqn (b)	Ties Not Req'd
+1.40D	1	0.33	6.00	2.43	No	N/A	4.82	0.00	4.82	0.505	Eqn (b)	Ties Not Req'd
+1.40D	1	0.38	6.00	2.37	No	N/A	4.82	0.00	4.82	0.492	Eqn (b)	Ties Not Req'd
+1.40D	1	0.44	6.00	2.31	No	N/A	4.82	0.00	4.82	0.479	Eqn (b)	Ties Not Req'd
+1.40D	1	0.49	6.00	2.25	No	N/A	4.82	0.00	4.82	0.467	Eqn (b)	Ties Not Req'd
+1.40D	1	0.55	6.00	2.19	No	N/A	4.82	0.00	4.82	0.454	Eqn (b)	Ties Not Req'd
+1.40D	1	0.60	6.00	2.13	No	N/A	4.82	0.00	4.82	0.441	Eqn (b)	Ties Not Req'd
+1.40D	1	0.66	6.00	2.07	No	N/A	4.82	0.00	4.82	0.429	Eqn (b)	Ties Not Req'd
+1.40D	1	0.71	6.00	2.00	No	N/A	4.82	0.00	4.82	0.416	Eqn (b)	Ties Not Req'd
+1.40D	1	0.77	6.00	1.94	No	N/A	4.82	0.00	4.82	0.403	Eqn (b)	Ties Not Req'd
+1.40D	1	0.82	6.00	1.88	No	N/A	4.82	0.00	4.82	0.390	Eqn (b)	Ties Not Req'd
+1.40D	1	0.87	6.00	1.82	No	N/A	4.82	0.00	4.82	0.378	Eqn (b)	Ties Not Req'd
+1.40D	1	0.93	6.00	1.76	No	N/A	4.82	0.00	4.82	0.365	Eqn (b)	Ties Not Req'd
+1.40D	1	0.98	6.00	1.70	No	N/A	4.82	0.00	4.82	0.352	Eqn (b)	Ties Not Req'd
+1.40D	1	1.04	6.00	1.64	No	N/A	4.82	0.00	4.82	0.340	Eqn (b)	Ties Not Req'd
+1.40D	1	1.09	6.00	1.58	No	N/A	4.82	0.00	4.82	0.327	Eqn (b)	Ties Not Req'd
+1.40D	1	1.15	6.00	1.51	No	N/A	4.82	0.00	4.82	0.314	Eqn (b)	Ties Not Req'd
+1.40D	1	1.20	6.00	1.45	No	N/A	4.82	0.00	4.82	0.302	Eqn (b)	Ties Not Req'd
+1.40D	1	1.26	6.00	1.39	No	N/A	4.82	0.00	4.82	0.289	Eqn (b)	Ties Not Req'd
+1.40D	1	1.31	6.00	1.33	No	N/A	4.82	0.00	4.82	0.276	Eqn (b)	Ties Not Req'd
+1.40D	1	1.37	6.00	1.27	No	N/A	4.82	0.00	4.82	0.263	Eqn (b)	Ties Not Req'd
+1.40D	1	1.42	6.00	1.21	No	N/A	4.82	0.00	4.82	0.251	Eqn (b)	Ties Not Req'd
+1.40D	1	1.48	6.00	1.15	No	N/A	4.82	0.00	4.82	0.238	Eqn (b)	Ties Not Req'd
+1.40D	1	1.53	6.00	1.09	No	N/A	4.82	0.00	4.82	0.225	Eqn (b)	Ties Not Req'd
+1.40D	1	1.58	6.00	1.03	No	N/A	4.82	0.00	4.82	0.213	Eqn (b)	Ties Not Req'd
+1.40D	1	1.64	6.00	0.96	No	N/A	4.82	0.00	4.82	0.200	Eqn (b)	Ties Not Req'd
+1.40D	1	1.69	6.00	0.90	No	N/A	4.82	0.00	4.82	0.187	Eqn (b)	Ties Not Req'd
+1.40D	1	1.75	6.00	0.84	No	N/A	4.82	0.00	4.82	0.175	Eqn (b)	Ties Not Req'd
+1.40D	1	1.80	6.00	0.78	No	N/A	4.82	0.00	4.82	0.162	Eqn (b)	Ties Not Req'd
+1.40D	1	1.86	6.00	0.72	No	N/A	4.82	0.00	4.82	0.149	Eqn (b)	Ties Not Req'd
+1.40D	1	1.91	6.00	0.66	No	N/A	4.82	0.00	4.82	0.137	Eqn (b)	Ties Not Req'd
+1.40D	1	1.97	6.00	0.60	No	N/A	4.82	0.00	4.82	0.124	Eqn (b)	Ties Not Req'd
+1.40D	1	2.02	6.00	0.54	No	N/A	4.82	0.00	4.82	0.111	Eqn (b)	Ties Not Req'd
+1.40D	1	2.08	6.00	0.47	No	N/A	4.82	0.00	4.82	0.098	Eqn (b)	Ties Not Req'd
+1.40D	1	2.13	6.00	0.41	No	N/A	4.82	0.00	4.82	0.086	Eqn (b)	Ties Not Req'd
+1.40D	1	2.19	6.00	0.35	No	N/A	4.82	0.00	4.82	0.073	Eqn (b)	Ties Not Req'd
+1.40D	1	2.24	6.00	0.29	No	N/A	4.82	0.00	4.82	0.060	Eqn (b)	Ties Not Req'd
+1.40D	1	2.30	6.00	0.23	No	N/A	4.82	0.00	4.82	0.048	Eqn (b)	Ties Not Req'd
+1.40D	1	2.35	6.00	0.17	No	N/A	4.82	0.00	4.82	0.035	Eqn (b)	Ties Not Req'd
+1.40D	1	2.40	6.00	0.11	No	N/A	4.82	0.00	4.82	0.022	Eqn (b)	Ties Not Req'd
+1.40D	1	2.46	6.00	0.05	No	N/A	4.82	0.00	4.82	0.010	Eqn (b)	Ties Not Req'd
+1.40D	1	2.51	6.00	-0.02	No	N/A	4.82	0.00	4.82	0.003	Eqn (b)	Ties Not Req'd
+1.40D	1	2.57	6.00	-0.08	No	N/A	4.82	0.00	4.82	0.016	Eqn (b)	Ties Not Req'd
+1.40D	1	2.62	6.00	-0.14	No	N/A	4.82	0.00	4.82	0.029	Eqn (b)	Ties Not Req'd
+1.40D	1	2.68	6.00	-0.20	No	N/A	4.82	0.00	4.82	0.041	Eqn (b)	Ties Not Req'd
+1.40D	1	2.73	6.00	-0.26	No	N/A	4.82	0.00	4.82	0.054	Eqn (b)	Ties Not Req'd
+1.40D	1	2.79	6.00	-0.32	No	N/A	4.82	0.00	4.82	0.067	Eqn (b)	Ties Not Req'd
+1.40D	1	2.84	6.00	-0.38	No	N/A	4.82	0.00	4.82	0.079	Eqn (b)	Ties Not Req'd
+1.40D	1	2.90	6.00	-0.44	No	N/A	4.82	0.00	4.82	0.092	Eqn (b)	Ties Not Req'd
+1.40D	1	2.95	6.00	-0.50	No	N/A	4.82	0.00	4.82	0.105	Eqn (b)	Ties Not Req'd
+1.40D	1	3.01	6.00	-0.57	No	N/A	4.82	0.00	4.82	0.117	Eqn (b)	Ties Not Req'd
+1.40D	1	3.06	6.00	-0.63	No	N/A	4.82	0.00	4.82	0.130	Eqn (b)	Ties Not Req'd
+1.40D	1	3.11	6.00	-0.69	No	N/A	4.82	0.00	4.82	0.143	Eqn (b)	Ties Not Req'd
+1.40D	1	3.17	6.00	-0.75	No	N/A	4.82	0.00	4.82	0.156	Eqn (b)	Ties Not Req'd
+1.40D	1	3.22	6.00	-0.81	No	N/A	4.82	0.00	4.82	0.168	Eqn (b)	Ties Not Req'd
+1.40D	1	3.28	6.00	-0.87	No	N/A	4.82	0.00	4.82	0.181	Eqn (b)	Ties Not Req'd
+1.40D	1	3.33	6.00	-0.93	No	N/A	4.82	0.00	4.82	0.194	Eqn (b)	Ties Not Req'd
+1.40D	1	3.39	6.00	-0.99	No	N/A	4.82	0.00	4.82	0.206	Eqn (b)	Ties Not Req'd
+1.40D	1	3.44	6.00	-1.06	No	N/A	4.82	0.00	4.82	0.219	Eqn (b)	Ties Not Req'd

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Project Title: Long Addition & Remodel
 Engineer: Mark Myers, PE
 Project ID:
 Project Descr: SFR Addition

Printed: 30 JUL 2025, 4:04PM

Concrete Beam

Project File: Long Addition.ec6

LIC# : KW-06015659, Build:20.25.07.09

MYERS ENGINEERING

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DESCRIPTION: Grade Beam footing

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k)	Av, min Req'd?	Spacing Req'd (in)	ϕV_c (k)	ϕV_s (k)	ϕV_n (k)	Vu / ϕV_n	Vc Eqn (T22.5.5.1)	Spacing Provision
+1.40D	1	3.50	6.00	-1.12	No	N/A	4.82	0.00	4.82	0.232	Eqn (b)	Ties Not Req'd
+1.40D	1	3.55	6.00	-1.18	No	N/A	4.82	0.00	4.82	0.244	Eqn (b)	Ties Not Req'd
+1.40D	1	3.61	6.00	-1.24	No	N/A	4.82	0.00	4.82	0.257	Eqn (b)	Ties Not Req'd
+1.40D	1	3.66	6.00	-1.30	No	N/A	4.82	0.00	4.82	0.270	Eqn (b)	Ties Not Req'd
+1.40D	1	3.72	6.00	-1.36	No	N/A	4.82	0.00	4.82	0.283	Eqn (b)	Ties Not Req'd
+1.40D	1	3.77	6.00	-1.42	No	N/A	4.82	0.00	4.82	0.295	Eqn (b)	Ties Not Req'd
+1.40D	1	3.83	6.00	-1.48	No	N/A	4.82	0.00	4.82	0.308	Eqn (b)	Ties Not Req'd
+1.40D	1	3.88	6.00	-1.55	No	N/A	4.82	0.00	4.82	0.321	Eqn (b)	Ties Not Req'd
+1.40D	1	3.93	6.00	-1.61	No	N/A	4.82	0.00	4.82	0.333	Eqn (b)	Ties Not Req'd
+1.40D	1	3.99	6.00	-1.67	No	N/A	4.82	0.00	4.82	0.346	Eqn (b)	Ties Not Req'd
+1.40D	1	4.04	6.00	-1.73	No	N/A	4.82	0.00	4.82	0.359	Eqn (b)	Ties Not Req'd
+1.40D	1	4.10	6.00	-1.79	No	N/A	4.82	0.00	4.82	0.371	Eqn (b)	Ties Not Req'd
+1.40D	1	4.15	6.00	-1.85	No	N/A	4.82	0.00	4.82	0.384	Eqn (b)	Ties Not Req'd
+1.40D	1	4.21	6.00	-1.91	No	N/A	4.82	0.00	4.82	0.397	Eqn (b)	Ties Not Req'd
+1.40D	1	4.26	6.00	-1.97	No	N/A	4.82	0.00	4.82	0.410	Eqn (b)	Ties Not Req'd
+1.40D	1	4.32	6.00	-2.03	No	N/A	4.82	0.00	4.82	0.422	Eqn (b)	Ties Not Req'd
+1.40D	1	4.37	6.00	-2.10	No	N/A	4.82	0.00	4.82	0.435	Eqn (b)	Ties Not Req'd
+1.40D	1	4.43	6.00	-2.16	No	N/A	4.82	0.00	4.82	0.448	Eqn (b)	Ties Not Req'd
+1.40D	1	4.48	6.00	-2.22	No	N/A	4.82	0.00	4.82	0.460	Eqn (b)	Ties Not Req'd
+1.40D	1	4.54	6.00	-2.28	No	N/A	4.82	0.00	4.82	0.473	Eqn (b)	Ties Not Req'd
+1.40D	1	4.59	6.00	-2.34	No	N/A	4.82	0.00	4.82	0.486	Eqn (b)	Ties Not Req'd
+1.40D	1	4.64	6.00	-2.40	No	N/A	4.82	0.00	4.82	0.498	Eqn (b)	Ties Not Req'd
+1.40D	1	4.70	6.00	-2.46	No	N/A	4.82	0.00	4.82	0.511	Eqn (b)	Ties Not Req'd
+1.40D	1	4.75	6.00	-2.52	No	N/A	4.82	0.00	4.82	0.524	Eqn (b)	Ties Not Req'd
+1.40D	1	4.81	6.00	-2.59	No	N/A	4.82	0.00	4.82	0.536	Eqn (b)	Ties Not Req'd
+1.40D	1	4.86	6.00	-2.65	No	N/A	4.82	0.00	4.82	0.549	Eqn (b)	Ties Not Req'd
+1.40D	1	4.92	6.00	-2.71	Yes	3.00	5.40	13.20	18.60	0.146	Eqn (a)	Max spacing per 9.7.6.2
+1.40D	1	4.97	6.00	-2.77	Yes	3.00	5.40	13.20	18.60	0.149	Eqn (a)	Max spacing per 9.7.6.2

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					
+1.40D Span # 1	1	5.000	3.50	17.70	0.20
+1.20D Span # 1	1	5.000	3.00	17.70	0.17
+0.90D Span # 1	1	5.000	2.25	17.70	0.13

Overall Maximum Deflections

Span	Load Combination	Max. "-" Defl (in) in Span	Location in Span (ft)	Load Combination	Max. "+" Defl (in) in Span	Location in Span (ft)
1	D Only	0.0021	2.500		0.0000	0.000