Project **1507-166-SUB3-BLDG**
4634 E Mercer Way

Owner **Barcelo Homes**

ORD/STRUCT

Revision 06_2017

General Building resized based on revised architectural drawings
Framing plans adjusted accordingly

Western Grid Basement/Retaining walls redesigned to have L-shaped footings
relabelled Keys 4.10/4.11/4.12

Shear Walls Shear panels in grids B and C at south side (left and right of moment frame), at ist level, added per inspection.
This is conservative, therefore no separate calculation

EOR Roland Heimisch, P. E. Lic # 42479

Date 06/20/17

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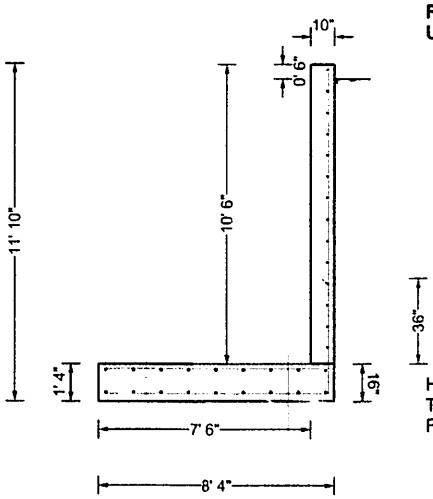
4634 E Mercer Way
Key No. 4.10

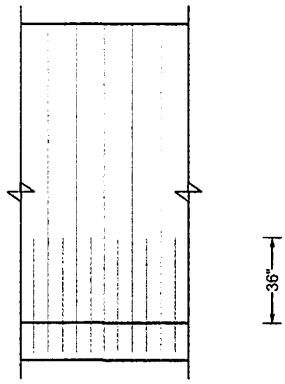
Design Detail

Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



#4 @ 9" (S&T)
#5 @ 6"

Heel Bars: #4 @ 6"
Toe Bars: #5 @ 6"
Footing S/T Bars: #5 @ 12"



Check Summary

Ratio	Check	Provided	Required	Combination
— Stability Checks —				
✓ 0.938	Overturning	1.60	1.50	Stability
✓ 0.369	Bearing Pressure	2500 psf	922 psf	Stability
✓ 0.966	Bearing Eccentricity	24.2"	25"	Stability
— Toe Checks —				
✓ 0.207	Shear	11.42 k/ft	2.37 k/ft	1.4D
✓ 0.432	Moment	33.36 ft·k/ft	14.42 ft·k/ft	1.4D
✓ 0.209	Min Strain	0.0192	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.05 in²	0 in²	1.2D + 1.6H
✓ 0.750	Development	8"	6"	1.2D + 1.6H
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H
✓ 0.557	S&T Min Rho	0.0032	0.0018	1.2D + 1.6H
— Heel Checks —				
✓ 0.000	Shear	12.38 k/ft	0 k/ft	1.2D + 1.6H
✓ 0.000	Moment	23.9 ft·k/ft	0 ft·k/ft	1.2D + 1.6H
✓ 0.117	Min Strain	0.0343	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.03 in²	0 in²	1.2D + 1.6H
✓ 0.122	Development	98"	12"	1.2D + 1.6H
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H
✓ 0.557	S&T Min Rho	0.0032	0.0018	1.2D + 1.6H
— Stem Checks —				
✓ 0.900	Horz Bar Rho	0.0022	0.0020	1.2D + 1.6H
✓ 0.500	Horz Bar Spacing	9"	18"	1.2D + 1.6H
✓ 0.618	Moment	19.41 ft·k/ft	12 ft·k/ft	1.2D + 1.6H
✓ 0.520	Shear	6.92 k/ft	3.6 k/ft	1.2D + 1.6H
✓ 0.168	Max Steel	0.0239	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.05 in²/in	0 in²/in	1.2D + 1.6H
✓ 0.499	Base Development	13"	6.5"	1.2D + 1.6H
✓ 0.259	Bar Cutoff Extension	29.7"	7.7"	1.2D + 1.6H
✓ 0.257	Bar Cutoff Shear	6.92 k/ft	1.78 k/ft	1.2D + 1.6H

Criteria

Building Code	IBC ~~2009~~ 2015
Concrete Load Combs	IBC ~~2009~~ (Strength)
Masonry Load Combs	ASCE ~~7-05~~ (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes 7-10
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.00
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2500 psf
Req'd Bearing Location	Middle half
Wall Friction Angle	25°
Friction Coefficent	0.40
Soil Reaction Modulus	100 lb/in³

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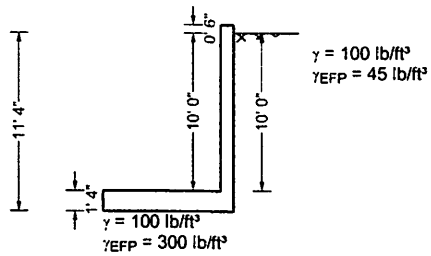
4634 E Mercer Way
Key No. 4.10

Loads

Loading Options/Assumptions
→ Passive pressure neglects top 0' 0" of soil.



Load Combinations

2015
IBC ~~2009~~ (Strength)
1.2D + 1.6H
0.9D + 1.6H
1.4D
1.2D

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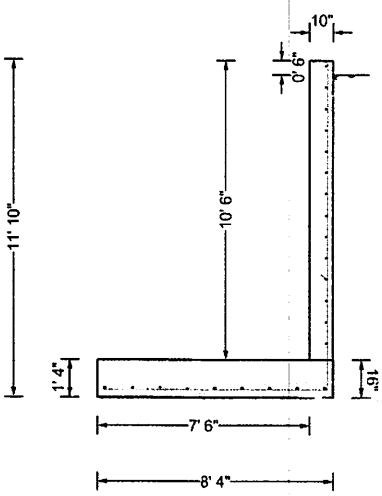
Key No. 4.10a w/ seismic load

Design Detail

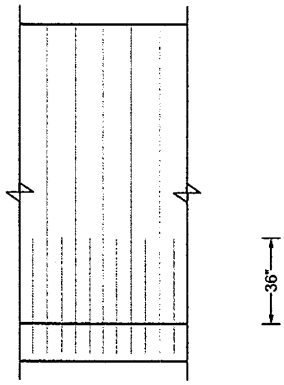
Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



#4 @ 9" (S&T)
#5 @ 6"

36"

Toe Bars: #5 @ 6"
Footing S/T Bars: #5 @ 12"



Check Summary

Ratio	Check	Provided	Required	Combination
— Stability Checks —				
✓ 0.829	Overturning	1.81	1.50	Stability
✓ 0.256	Bearing Pressure	3325 psf	850.6 psf	Stability
✓ 0.282	Bearing Eccentricity	7.1"	25"	Stability
— Toe Checks —				
✓ 0.338	Shear	11.42 k/ft	3.85 k/ft	1.2D + 1.6H + 1.6L
✓ 0.552	Moment	33.36 ft·k/ft	18.41 ft·k/ft	1.2D + 1.6H + 1.6L
✓ 0.209	Min Strain	0.0192	0.0040	1.2D + 1.6H + 1.6L
✓ 0.000	Min Steel	0.05 in²	0 in²	1.2D + 1.6H + 1.6L
✓ 0.750	Development	8"	6"	1.2D + 1.6H + 1.6L
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H + 1.6L
✓ 0.557	S&T Min Rho	0.0032	0.0018	1.2D + 1.6H + 1.6L
— Heel Checks —				
✓ 0.000	Shear	8.4 k/ft	0 k/ft	1.2D + 1.6H + 1.6L
✓ 0.000	Moment	7.35 ft·k/ft	0 ft·k/ft	1.2D + 1.6H + 1.6L
— Stem Checks —				
✓ 0.900	Horz Bar Rho	0.0022	0.0020	1.2D + 1.6H + 1.6L
✓ 0.500	Horz Bar Spacing	9"	18"	1.2D + 1.6H + 1.6L
✓ 0.798	Moment	19.41 ft·k/ft	15.5 ft·k/ft	0.9D + 1.6H + 1.0E
✓ 0.621	Shear	6.92 k/ft	4.3 k/ft	0.9D + 1.6H + 1.0E
✓ 0.168	Max Steel	0.0239	0.0040	1.2D + 1.6H + 1.6L
✓ 0.496	Min Steel	0.05 in²/in	0.03 in²/in	0.9D + 1.6H + 1.0E
✓ 0.645	Base Development	13"	8.4"	0.9D + 1.6H + 1.0E
✓ 0.401	Bar Cutoff Extension	19.2"	7.7"	0.9D + 1.6H + 1.0E
✓ 0.328	Bar Cutoff Shear	6.92 k/ft	2.27 k/ft	0.9D + 1.6H + 1.0E

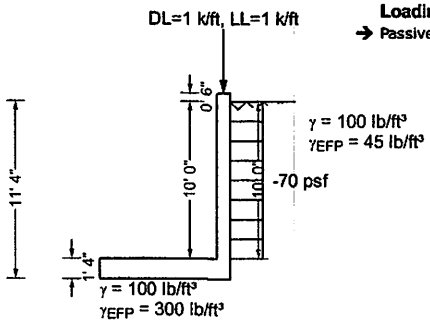
Criteria

2015

Building Code	IBC ~~2009~~
Concrete Load Combs	IBC 2009 (Strength)
Masonry Load Combs	ASCE ~~7-05~~ (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.00
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	3325 psf
Req'd Bearing Location	Middle half
Wall Friction Angle	25°
Friction Coefficent	0.40
Soil Reaction Modulus	100 lb/in³

7-10

Loads



Loading Options/Assumptions

→ Passive pressure neglects top 0' 0" of soil.

Load Combinations

2015

IBC ~~2009~~ (Strength)

1.2D + 1.6H + 1.6L
1.2D + 0.5L
1.2D + 1.0E
1.2D + 0.5L + 1.0E
0.9D + 1.6H + 1.0E
0.9D + 1.6H
1.4D
1.2D

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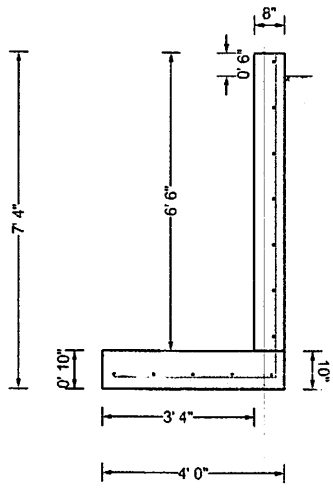
Key 4.11 Ret Wall no seismic

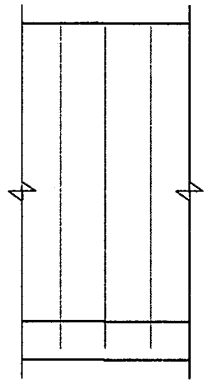
Design Detail

Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



#4 @ 12" (S&T)
#4 @ 12"

Toe Bars: #4 @ 12"
Footing S/T Bars: #4 @ 12"



Check Summary

Ratio	Check	Provided	Required	Combination
— Stability Checks —				
✓ 0.818	Overturning	1.83	1.50	Stability
✓ 0.232	Bearing Pressure	2500 psf	579.3 psf	Stability
✓ 0.676	Bearing Eccentricity	8.1"	12"	Stability
— Toe Checks —				
✓ 0.161	Shear	6.08 k/ft	0.98 k/ft	1.4D
✓ 0.388	Moment	5.86 ft·k/ft	2.27 ft·k/ft	1.4D
✓ 0.119	Min Strain	0.0336	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.2D + 1.6H
✓ 1.000	Development	6"	6"	1.2D + 1.6H
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H
✓ 0.540	S&T Min Rho	0.0033	0.0018	1.2D + 1.6H
— Heel Checks —				
✓ 0.000	Shear	4.8 k/ft	0 k/ft	1.2D + 1.6H
✓ 0.000	Moment	2.4 ft·k/ft	0 ft·k/ft	1.2D + 1.6H
— Stem Checks —				
✓ 0.960	Horz Bar Rho	0.0021	0.0020	1.2D + 1.6H
✓ 0.667	Horz Bar Spacing	12"	18"	1.2D + 1.6H
✓ 0.406	Moment	4.96 ft·k/ft	2.02 ft·k/ft	1.2D + 1.6H
✓ 0.195	Shear	5.17 k/ft	1.01 k/ft	1.2D + 1.6H
✓ 0.142	Max Steel	0.0282	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²/in	0 in²/in	1.2D + 1.6H
✓ 0.857	Base Development	7"	6"	1.2D + 1.6H

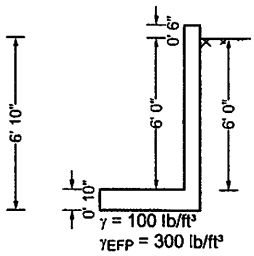
Criteria

Building Code	IBC ~~2009~~ 2015
Concrete Load Combs	IBC 2009 (Strength)
Masonry Load Combs	ASCE ~~7-05~~ 7-10 (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.50
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2500 psf
Req'd Bearing Location	Middle half
Wall Friction Angle	25°
Friction Coefficent	0.35
Soil Reaction Modulus	100 lb/in³

Loads

Loading Options/Assumptions

→ Passive pressure neglects top 0' 0" of soil.



γ = 100 lb/ft³
γEFP = 35 lb/ft³

Load Combinations

IBC ~~2009~~ 2015 (Strength)

1.2D + 1.6H
0.9D + 1.6H
1.4D
1.2D

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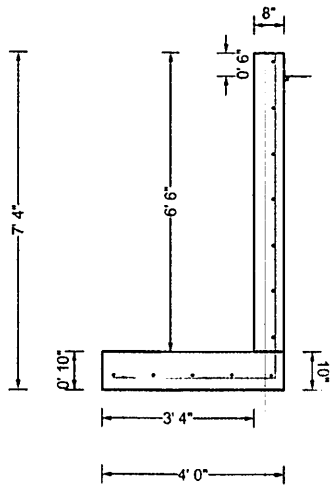
Key 4.11a Retaining Wall 6 ft w/ seismic load

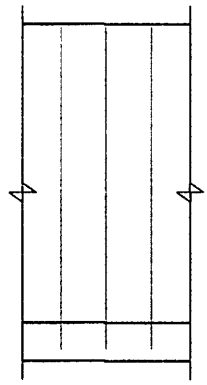
Design Detail

Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



#4 @ 12" (S&T)
#4 @ 12"

Toe Bars: #4 @ 12"
Footing S/T Bars: #4 @ 12"



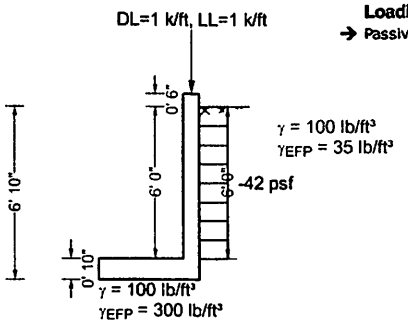
Check Summary

Ratio	Check	Provided	Required	Combination
— Stability Checks —				
✓ 0.538	Overturning	2.79	1.50	Stability
✓ 0.416	Bearing Pressure	3325 psf	1384 psf	Stability
✓ 0.505	Bearing Eccentricity	6.1"	12"	Stability
— Toe Checks —				
✓ 0.295	Shear	6.08 k/ft	1.79 k/ft	1.2D + 1.6H + 1.6L
✓ 0.515	Moment	5.86 ft·k/ft	3.02 ft·k/ft	1.2D + 1.6H + 1.6L
✓ 0.119	Min Strain	0.0336	0.0040	1.2D + 1.6H + 1.6L
✓ 0.000	Min Steel	0.02 in²	0 in²	1.2D + 1.6H + 1.6L
✓ 1.000	Development	6"	6"	1.2D + 1.6H + 1.6L
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H + 1.6L
✓ 0.540	S&T Min Rho	0.0033	0.0018	1.2D + 1.6H + 1.6L
— Heel Checks —				
✓ 0.000	Shear	4.8 k/ft	0 k/ft	1.2D + 1.6H + 1.6L
✓ 0.000	Moment	2.4 ft·k/ft	0 ft·k/ft	1.2D + 1.6H + 1.6L
— Stem Checks —				
✓ 0.960	Horz Bar Rho	0.0021	0.0020	1.2D + 1.6H + 1.6L
✓ 0.667	Horz Bar Spacing	12"	18"	1.2D + 1.6H + 1.6L
✓ 0.559	Moment	4.96 ft·k/ft	2.77 ft·k/ft	0.9D + 1.6H + 1.0E
✓ 0.243	Shear	5.17 k/ft	1.26 k/ft	0.9D + 1.6H + 1.0E
✓ 0.142	Max Steel	0.0282	0.0040	1.2D + 1.6H + 1.6L
✓ 0.000	Min Steel	0.02 in²/in	0 in²/in	1.2D + 1.6H + 1.6L
✓ 0.857	Base Development	7"	6"	1.2D + 1.6H + 1.6L

Criteria

Building Code	IBC ~~2009~~ 2015
Concrete Load Combs	IBC ~~2009~~ (Strength)
Masonry Load Combs	ASCE ~~7-05~~ 7-10 (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.00
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	3325 psf
Req'd Bearing Location	Middle half
Wall Friction Angle	25°
Friction Coefficent	0.40
Soil Reaction Modulus	100 lb/in³

Loads



Loading Options/Assumptions

→ Passive pressure neglects top 0' 0" of soil.

Load Combinations

IBC ~~2009~~ 2015 (Strength)

1.2D + 1.6H + 1.6L
1.2D + 0.5L
1.2D + 1.0E
1.2D + 0.5L + 1.0E
0.9D + 1.6H + 1.0E
0.9D + 1.6H
1.4D
1.2D

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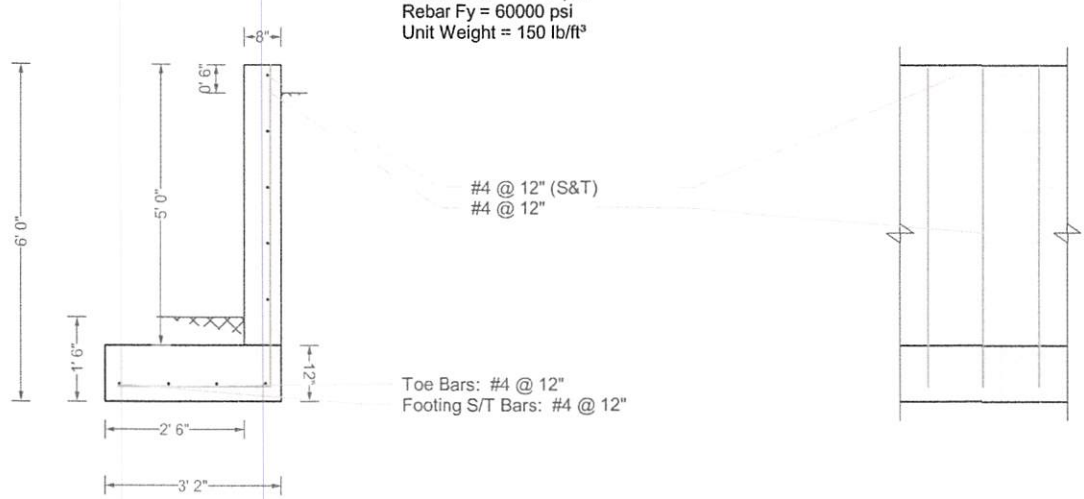
4634 E Mercer Way

Key 4.12 4 ft Retaining Wall no seismic

Design Detail

Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



Check Summary

Ratio	Check	Provided	Required	Combination
---- Stability Checks ----				
✓ 0.584	Overturning	2.57	1.50	Stability
✓ 0.232	Bearing Pressure	2500 psf	579 psf	Stability
✓ 0.445	Bearing Eccentricity	4.2"	9.5"	Stability
---- Toe Checks ----				
✓ 0.078	Shear	7.88 k/ft	0.62 k/ft	1.4D
✓ 0.147	Moment	7.66 ft·k/ft	1.12 ft·k/ft	1.4D
✓ 0.090	Min Strain	0.0444	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.2D + 1.6H
✓ 1.000	Development	6"	6"	1.2D + 1.6H
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H
✓ 0.648	S&T Min Rho	0.0028	0.0018	1.2D + 1.6H
---- Heel Checks ----				
✓ 0.000	Shear	6 k/ft	0 k/ft	1.2D + 1.6H
✓ 0.000	Moment	3.75 ft·k/ft	0 ft·k/ft	1.2D + 1.6H
---- Stem Checks ----				
✓ 0.960	Horz Bar Rho	0.0021	0.0020	1.2D + 1.6H
✓ 0.667	Horz Bar Spacing	12"	18"	1.2D + 1.6H
✓ 0.171	Moment	4.96 ft·k/ft	0.85 ft·k/ft	1.2D + 1.6H
✓ 0.110	Shear	5.17 k/ft	0.57 k/ft	1.2D + 1.6H
✓ 0.142	Max Steel	0.0282	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²/in	0 in²/in	1.2D + 1.6H
✓ 0.667	Base Development	9"	6"	1.2D + 1.6H

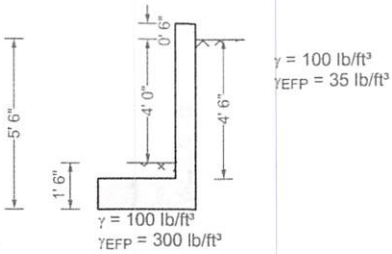
Criteria

Building Code	IBC ~~2009~~ 2015
Concrete Load Combs	IBC 2009 (Strength)
Masonry Load Combs	ASCE 7-~~05~~ 7-10 (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
Neglect Backfill Wt. for Coulomb	No
Factor Soil Weight As Dead	Yes
Use Passive Force for OT	Yes
Assume Pressure To Top	Yes
Extend Backfill Pressure To Key Bottom	No
Use Toe Passive Pressure for Bearing	No
Required F.S. for OT	1.50
Required F.S. for Sliding	1.00
Has Different Safety Factors for Seismic	No
Allowable Bearing Pressure	2500 psf
Req'd Bearing Location	Middle half
Wall Friction Angle	25°
Friction Coefficent	0.40
Soil Reaction Modulus	100 lb/in³

Loads

Loading Options/Assumptions

→ Passive pressure neglects top 0' 0" of soil.



Load Combinations

2015

IBC ~~2009~~ (Strength)

1.2D + 1.6H
0.9D + 1.6H
1.4D
1.2D

Roland Heimisch
tecinstruct LLC
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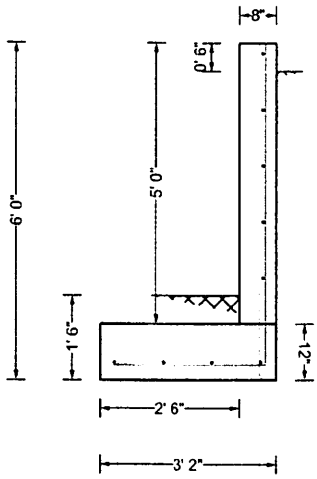
Kenmore, WA 98028
(206) 553-9076

4634 E Mercer Way

Key 4.12a 4 ft Retaining Wall w seismic load

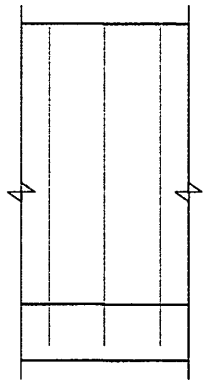
Design Detail

Concrete f'c = 2500 psi
Rebar Fy = 60000 psi
Unit Weight = 150 lb/ft³



#4 @ 12" (S&T)
#4 @ 12"

Toe Bars: #4 @ 12"
Footing S/T Bars: #4 @ 12"



Check Summary

Ratio	Check	Provided	Required	Combination
— Stability Checks —				
✓ 0.749	Overturning	2.00	1.50	Stability
✓ 0.252	Bearing Pressure	3325 psf	838.1 psf	Stability
✓ 0.895	Bearing Eccentricity	8.5"	9.5"	Stability
— Toe Checks —				
✓ 0.112	Shear	7.88 k/ft	0.88 k/ft	1.4D
✓ 0.212	Moment	7.66 ft·k/ft	1.63 ft·k/ft	1.4D
✓ 0.090	Min Strain	0.0444	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²	0 in²	1.2D + 1.6H
✓ 1.000	Development	6"	6"	1.2D + 1.6H
✓ 0.667	S&T Max Spacing	12"	18"	1.2D + 1.6H
✓ 0.648	S&T Min Rho	0.0028	0.0018	1.2D + 1.6H
— Heel Checks —				
✓ 0.000	Shear	6 k/ft	0 k/ft	1.2D + 1.6H
✓ 0.000	Moment	3.75 ft·k/ft	0 ft·k/ft	1.2D + 1.6H
— Stem Checks —				
✓ 0.960	Horz Bar Rho	0.0021	0.0020	1.2D + 1.6H
✓ 0.667	Horz Bar Spacing	12"	18"	1.2D + 1.6H
✓ 0.228	Moment	4.96 ft·k/ft	1.13 ft·k/ft	0.9D + 1.6H + 1.0E
✓ 0.131	Shear	5.17 k/ft	0.68 k/ft	0.9D + 1.6H + 1.0E
✓ 0.142	Max Steel	0.0282	0.0040	1.2D + 1.6H
✓ 0.000	Min Steel	0.02 in²/in	0 in²/in	1.2D + 1.6H
✓ 0.667	Base Development	9"	6"	1.2D + 1.6H

Criteria

Building Code	IBC ~~2009~~ 2015
Concrete Load Combs	IBC ~~2009~~ (Strength)
Masonry Load Combs	ASCE ~~7-05~~ (ASD)
Stability Load Comb	Stability
Restrained Against Sliding	Yes
Neglect Bearing At Heel	Yes
Use Vert. Comp. for OT	No
Use Vert. Comp. for Sliding	No
Use Vert. Comp. for Bearing	Yes
Use Surcharge for Sliding & OT	Yes
Use Surcharge for Bearing	Yes
Neglect Soil Over Toe	No
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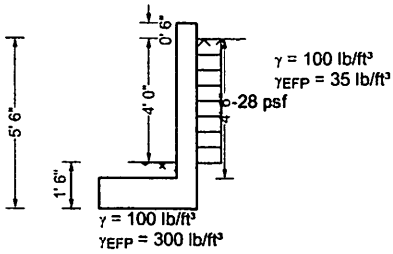

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IBC ~~2009~~ 2015 (Strength)

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1.2D + 1.0E
0.9D + 1.6H + 1.0E
0.9D + 1.6H
1.4D
1.2D