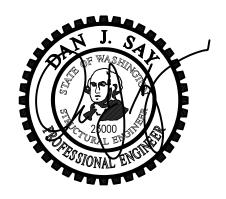


Structural Calculations:

Huber Residence

9611 SE 72nd St Mercer Island, WA 98040



Prepared for: **Brandt Design Group**

Job #: 01519-2021-06

Date: September 10, 2021



2124 Third Ave, Suite 100, Seattle, WA 98121 934 Broadway, Suite 100, Tacoma, WA 98402

O 206.443.6200 ⊕ ssfengineers.comO 253.284.9470

Criteria Sheet

Codes Project Location

Structural IBC 2018 Loading ASCE 7-16

Wood: NDS 2018 Steel: AISC 360-16

Steel: AISC 360-16

Concrete: ACI 318-14

Masonry: TMS 402/602-16

Street & Number 9611 SE 72nd St

City: Mercer Island

Island State: WA

ZIP: 98040

Latitude: 47.5380 N Longitude: -122.2114 W Ground Elevation 48 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure

Lateral System: Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Story Information

Stories Above Grade (Including Mezzanine Levels) 2



Horizontal and Vertical Irregularities:

Is the building a "Regular Structure"? (No horizontal or vertical irregularities)

Yes

Wind Load Summary:

V= 98 K_{ZT}= 1.00

Exposure = C

Dead Loads:

Roof			Floor		
KOOI			FIUUI		
Roofing	2.5	psf	Finish Floor	1	psf
1/2" Sheathing	1.8	psf	1.5" Gypcrete	18.75	psf
Trusses @ 24" oc	2.5	psf	3/4" Sheathing	2.7	psf
Misc./Mech.	1.5	psf	Joists @ 16" oc	2.2	psf
Ceiling Finish	2.8	psf	Misc./Mech.	2	psf
Solar Panels	4		Ceiling Finish	2.8	
	15	psf		29.45	psf
Use	15	psf	Use	30	psf

Live Loads:

Snow	25	psf
Floor	40	psf

Soils:	Soils Repo	ort Provided?		No	To be approved by the authority having jurisdiction, per 11.8.2 exception.				
	Allowable Bearing	3000	psf		Active		55/35	pcf (Restrained/Unrestrained)	
	Sliding, μ	0.5			Seismic Surcharge		6H		



Huber Residence
Criteria

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Seismic Design ASCE 7-16 Seismic Analysis

Equivalent Lateral Force Procedure

Seismic Force Resisting System Per Table 12.2-1	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D
Risk Category	II
Site Class	D (Default)
Diaphragm Flexibility	Flexible

I, II, or III, or IV per Table 1.5-1 Assumed default soil properties, per 11.4.3.

		-	
S _S	1.451 g		& Longitude lookup
S ₁	0.501 g	2% in 50 yr, Latitude	& Longitude lookup
R	6.50		
C _d	4.0		
Ω_{o}	2.5		
l _e	1.00	Table 1.5-2	
h _n	33.0 ft	1	
Ct	0.02	Table 12.8-2	
х	0.75	Table 12.8-2	Building Period Per
Ta	0.28 sec]	Alternate Analysis
Т	0.28 sec	Eq. 12.8-7	T (sec)
T ₀	0.10 sec		
T _S	0.49 sec		
T _L	6.00 sec	1	Per Geotech Report
Fa	1.20	Table 11.4-1	Fa
F _v	1.70	Table 11.4-2	F _v
S _{MS}	1.74 g	Eq. 11.4-1	
S _{M1}	0.85 g	Eq. 11.4-2	
S _{DS}	1.161 g	Eq. 11.4-3	
S _{D1}	0.568 g	Eq. 11.4-4	
		_	
	0.179 Controls	Eq. 12.8-2	
C _s	0.317	Eq. 12.8-3 need not	exceed, T < T _L
	0.010	Eq. 12.8-5 or 12.8-6	minimum
C _s , design	0.179	Section 11.4.8 Exce	ption 2 Applied
]	
Bldg. Weight	151.8 k	1	
$V = C_S W$	27.1 k	Eq. 12.8-1, Strength	
$V = C_{Sasd}W$	19.0 k	Eq. 12.8-1 ASD Bas	e Shear

Section 12.8.1.3 Exceptions

Regular Structure	Yes
≤ 5 Stories above grade	Yes
T ≤ 0.5s	Yes
ρ = 1.0	No
Not Site Class E or F	Yes
Risk Category I or II	Yes

If all exceptions are met, S_{DS} may be taken as 1, but not less than 0.7*(Calculated $\ensuremath{S_{DS}}\xspace)$

$T_a = C_t h_n^x$	Eq. 12.8.7
$S_{MS} = F_a S_S$ $S_{M1} = F_v S_1$ $S_{DS} = \frac{2}{3} S_{MS}$ $S_{D1} = \frac{2}{3} S_{M1}$	Eq. 11.4-1 Eq. 11.4-2 Eq. 11.4-3 Eq. 11.4-4
$C_S = \frac{S_{DS}}{(R/I_e)}$	Eq. 12.8-2
$C_S = \frac{S_{D1}}{T(R/I_e)}$	Eq. 12.8-3
$C_S = \frac{S_{D1}T_L}{T^2(R/I_e)}$	Eq. 12.8-4
$C_S \ge 0.044 S_{DS} I_e$	Eq. 12.8-5
$C_S \geq 0.01$	Eq. 12.8-5
$C_S \ge 0.5 \frac{S_1}{(R/I_e)}$	Eq. 12.8-6

$C_{VX} = w_x h_x^k / \sum_{i=1}^n w_x h_i^k$	Eq. 12.8-12
$F_{px} = \frac{\sum_{i=x}^{n} F_i}{\sum_{i=x}^{n} w_i} w_{px}$	Eq. 12.10-1
$F_{px} \ge 0.2 S_{DS} I_e w_{px}$	Eq. 12.10-2
$F_{px} \le 0.4 S_{DS} I_e w_{px}$	Eq. 12.10-3

Vertical Distrib	oution	ASD	ρ=	1.3	k=	1.000						
Level	h _x (ft)	W _x (k)	h _x ^k (ft)	$W_x h_x^{\ k}$	\$	Story Shea ASD	ır		Diaphragm Force (ρ not included)			
					C _{vx} (%)	$F_{x}(k)$	SV (k)	F _{px,calc}	$F_{px,min}$	F _{px,max}	F _{px,design}	$\gamma = F_{px}/F_x$
Roof	33.0	26.40	33.0	871	0.281	6.9	6.9	5.3	4.3	8.6	5.3	0.77
Upper	24.0	60.43	24.0	1450	0.468	11.5	18.5	9.9	9.8	19.6	9.9	0.86
Main	12.0	64.95	12.0	779	0.251	6.2	24.7	8.1	10.6	21.1	10.6	1.70
Σ		151.8		3101		24.7						



Huber Residence			
Seismic Criteria			

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Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD
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Wind Coefficients

Exposure	С	
V=	98	mph
K _d =	0.85	Table 26.6-1
K _h =	1.02	Table 26.10-1
K _e =	1.00	Table 26.9-1
G=	0.85	26.9.4

$\frac{\text{Transverse Wind Pressures}}{\text{L/B} = 1.00} \quad \text{h/L} = 0.73$

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-1.08 / -0.18
Leeward Roof	-0.59

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.00	
Roof Type	Gable	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	26.6	degrees
Ground to top of roof	40	ft
Bot of roof to top of roof	7	ft
Mean Roof Height, h	36.5	ft
Short Plan Dimension	50	ft
Long Plan Dimension	50	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	15	ft

Velocity Pressure at Mean	04.4	
Roof Height, q _h =	21.4	psf

Wall Pressures (Unfactored):

Train Freeduces (emacionea).					
Ht	K _z	q_z	P _{ww walls}	P _{lwwalls}	P _{walls} (psf)
0-15	0.85	17.73	12.06	9.08	12.7
15-20	0.9	18.78	12.77	9.08	13.1
20-25	0.94	19.61	13.33	9.08	13.4
25-30	0.98	20.44	13.90	9.08	13.8
30-40	1.04	21.70	14.75	9.08	14.3
41-50	1.09	22.74	15.46	9.08	14.7
51-60	1.13	23.57	16.03	9.08	15.1
61-70	1.17	24.41	16.60	9.08	15.4
71-80	1.21	25.24	17.16	9.08	15.7
81-90	1.24	25.87	17.59	9.08	16.0
91-100	1.26	26.29	17.87	9.08	16.2

Roof Pressures (Unfactored)

	9	

	Windward		Laguend	Horiz Proj
	Max	Min	Leeward	(psf)
ı	-3.3	-19.7	-10.7	4.80

Longitudinal Wind Pressures

L/B = 1.00 h/L = 0.73

Pressure Coefficients from Figure 27.4-1:

Bldg Face	C_p		
Windward Wall	0.8		
Leeward Wall	-0.50		
Windward Roof	-0.35 / 0.14		
Leeward Roof	-0.60		

Wall Pressures (Unfactored):

ASD

Ht	K _z	q _z	P _{ww walls}	P _{lwwalls}	P _{walls} (psf)
0-15	0.85	17.73	12.06	9.08	12.68
15-20	0.9	18.78	12.77	9.08	13.11
20-25	0.94	19.61	13.33	9.08	13.45
25-30	0.98	20.44	13.90	9.08	13.79
30-40	1.04	21.70	14.75	9.08	14.30
41-50	1.09	22.74	15.46	9.08	14.72
51-60	1.13	23.57	16.03	9.08	15.06
61-70	1.17	24.41	16.60	9.08	15.40
71-80	1.21	25.24	17.16	9.08	15.74
81-90	1.24	25.87	17.59	9.08	16.00
91-100	1.26	26.29	17.87	9.08	16.17

Roof Pressures (Unfactored)

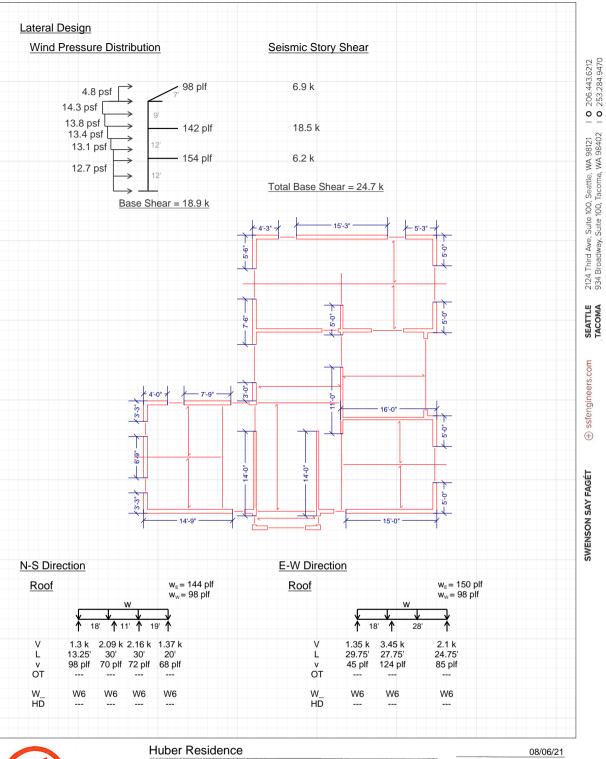
Λ	CI
м	0

Wind	lward	Leeward	Horiz Proj
Max	Min	Leewalu	(psf)
2.5	-6.3	-10.9	4.80



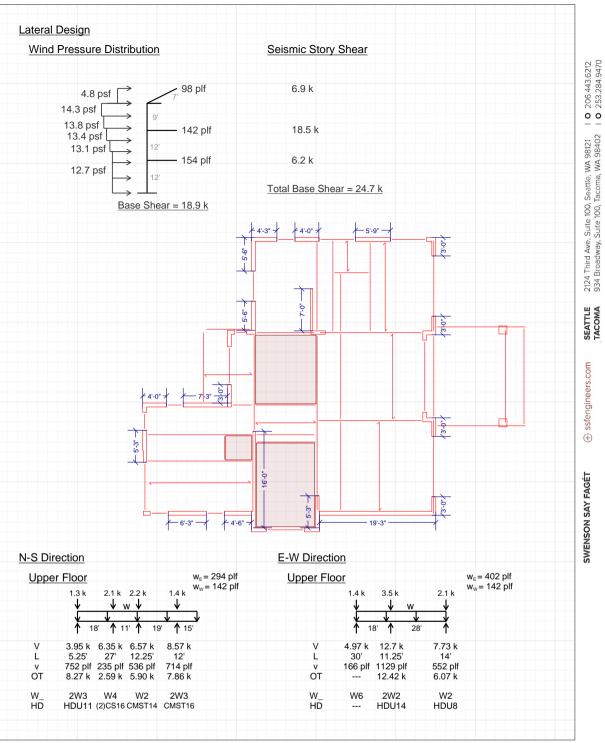
Huber Residence	
Wind Criteria	

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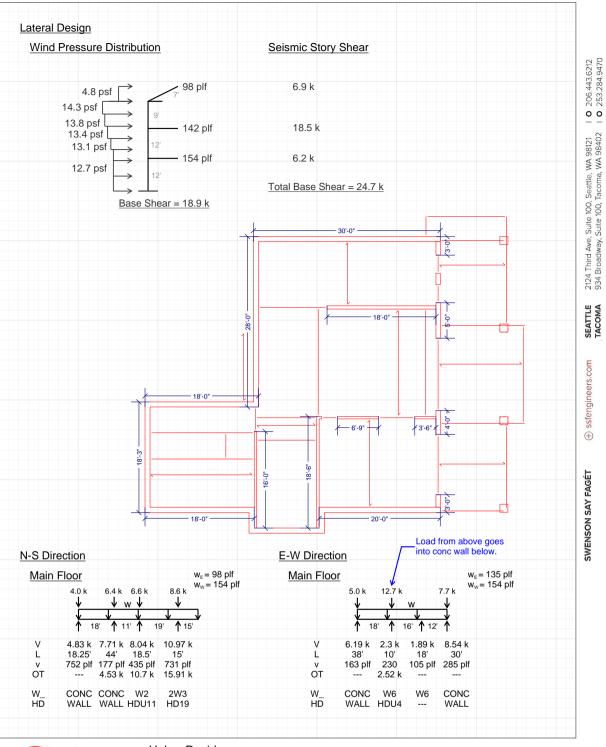


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Huber Residence	08/06/21
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Criteria Sheet

Codes **Project Location**

Structural IBC 2018 Loading ASCE 7-16

> Wood: NDS 2018 Steel: AISC 360-16

Concrete: ACI 318-14 Masonry: TMS 402/602-16 Street & Number 9611 SE 72nd St

City: Mercer Island

State: WA

ZIP: 98040

Latitude: 47.5380 N -122.2114 W Longitude: Ground Elevation 48 ft

Occupancy Category

Risk Category: II ASCE 7 Table 1.5-1

Seismic Load Summary:

Analysis Procedure: Equivalent Lateral Force Procedure

Lateral System: Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

 $C_d = 4$ R: 6.50 Base Shear V = 2 kips $\Omega_{\rm o}$ = 2.5 S_S= 1.451 $S_1 = 0.501$ S_{DS}= 1.16 $S_{D1} = 0.57$ $C_s = 0.179$ I_E= 1.0

Story Information



Horizontal and Vertical Irregularities:

Stories Above Grade (Including Mezzanine Levels)

Is the building a "Regular Structure"? (No horizontal or vertical irregularities)

Wind Load Summary:

V= 98 $K_{ZT} = 1.00$

Exposure = C

Dead Loads:

Roof			Floor		
Roofing	2.5	psf	Finish Floor	1	psf
1/2" Sheathing	1.8	psf	1.5" Gypcrete	18.75	psf
Trusses @ 24" oc	2.5	psf	3/4" Sheathing	2.7	psf
Misc./Mech.	1.5	psf	Joists @ 16" oc	2.2	psf
Ceiling Finish	2.8	psf	Misc./Mech.	2	psf
Solar Panels	4		Ceiling Finish	2.8	
	15	psf		29.45	psf
Use	15	psf	Use	30	psf

Live Loads:

Snow	25	psf
Floor	40	psf

Soils:	Soils Repo	rt Provided?		No	To be approved by the auth	be approved by the authority having jurisdiction, per 11.8.2 exception.		
	Allowable Bearing	3000	psf		Active		55/35	pcf (Restrained/Unrestrained)
	Sliding, μ	0.5			Seismic Surcharge		6H	



Huber Garage			
Cuitauia			
Criteria			

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Seismic Design ASCE 7-16 Seismic Analysis

Equivalent Lateral Force Procedure

Seismic Force Resisting System Per Table 12.2-1	System	Bearing Wall Systems
	Type:	Light-frame (wood) Walls Sheathed with Wood Structural Panels Rated for Shear Resistance

Seismic Design Cat.	D
Risk Category	Ш
Site Class	D (Default)
Diaphragm Flexibility	Flexible

I, II, or III, or IV per Table 1.5-1 Assumed default soil properties, per 11.4.3.

		-	
S _S	1.451 g	1 '	e & Longitude lookup
S ₁	0.501 g	2% in 50 yr, Latitude	e & Longitude lookup
R	6.50		
C _d	4.0		
$\Omega_{ m o}$	2.5		
l _e	1.00	Table 1.5-2	
h _n	12.0 ft		
Ct	0.02	Table 12.8-2	
х	0.75	Table 12.8-2	Building Period Per
Ta	0.13 sec	1	Alternate Analysis
Т	0.13 sec	Eq. 12.8-7	T (sec)
T ₀	0.10 sec		
T _S	0.49 sec		
T _L	6.00 sec		Per Geotech Report
Fa	1.20	Table 11.4-1	Fa
F _v	1.70	Table 11.4-2	F _v
S _{MS}	1.74 g	Eq. 11.4-1	
S _{M1}	0.85 g	Eq. 11.4-2	
S _{DS}	1.161 g	Eq. 11.4-3	
S _{D1}	0.568 g	Eq. 11.4-4	
	0.179 Controls	Eq. 12.8-2	
C_s	0.677	Eq. 12.8-3 need not	t exceed, T < T _L
	0.010	Eq. 12.8-5 or 12.8-6	6 minimum
C _s , design	0.179	Section 11.4.8 Exce	eption 2 Applied
		1	
Bldg. Weight	12.5 k	1	
		1	
$V = C_S W$	2.2 k	Eq. 12.8-1, Strength	Level Base Shear
$V = C_{Sasd}W$	1.6 k	Eq. 12.8-1 ASD Bas	se Shear
•			

Section 12.8.1.3 Exceptions

Regular Structure	Yes
≤ 5 Stories above grade	Yes
T ≤ 0.5s	Yes
$\rho = 1.0$	No
Not Site Class E or F	Yes
Risk Category I or II	Yes

If all exceptions are met, S_{DS} may be taken as 1, but not less than 0.7*(Calculated $\ensuremath{S_{DS}}\xspace)$

$T_a = C_t h_n^x$	Eq. 12.8.7
$S_{MS} = F_{\alpha}S_{S}$ $S_{M1} = F_{\nu}S_{1}$ $S_{DS} = \frac{2}{3}S_{MS}$ $S_{D1} = \frac{2}{3}S_{M1}$	Eq. 11.4-1 Eq. 11.4-2 Eq. 11.4-3 Eq. 11.4-4
$C_S = \frac{S_{DS}}{(R/I_e)}$	Eq. 12.8-2
$C_S = \frac{S_{D1}}{T(R/I_e)}$	Eq. 12.8-3
$C_S = \frac{S_{D1}T_L}{T^2(R/I_e)}$	Eq. 12.8-4
$C_S \ge 0.044 S_{DS} I_e$	Eq. 12.8-5
$C_S \geq 0.01$	Eq. 12.8-5
$C_S \ge 0.5 \frac{S_1}{(R/I_e)}$	Eq. 12.8-6

$C_{VX} = w_x h_x^k / \sum_{i=1}^n w_x h_i^k$	Eq. 12.8-12
$F_{px} = \frac{\sum_{i=x}^{n} F_i}{\sum_{i=x}^{n} w_i} w_{px}$ $F_{px} \ge 0.2 S_{DS} I_e w_{px}$ $F_{px} \le 0.4 S_{DS} I_e w_{px}$	Eq. 12.10-1 Eq. 12.10-2 Eq. 12.10-3

Vertical Distri	bution	ASD	ρ=	1.3	k=	1.000						
Level	h _x (ft)	W _x (k)	h _x ^k (ft)	Story Shear Diaphragm								
					C _{vx} (%)	F _x (k)	SV (k)	$F_{px,calc}$	$F_{px,min}$	F _{px,max}	F _{px,design}	$\gamma = F_{px}/F_x$
Roof	12.0	12.54	12.0	150	1.000	2.0	2.0	1.6	2.0	4.1	2.0	1.00
Σ		12.5		150		2.0						



Seismic Criteria

9/10/2021 DATE PROJ. # 01519-2021-06 DMR DESIGN SHEET

Wind Design - MWFRS

ASCE 7 Chapter 27 - Directional Procedure

Design Method	ASD

Wind Coefficients

Exposure	С	
V=	98	mph
K _d =	0.85	Table 26.6-1
	0.85	Table 26.10-1
K _e =	1.00	Table 26.9-1
G=	0.85	26.9.4

$\frac{\textbf{Transverse Wind Pressures}}{\text{L/B} = 0.59} \quad \text{h/L} = 0.69$

Pressure Coefficients from Figure 27.3-1:

Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.50
Windward Roof	-1.05 / -0.18
Leeward Roof	-0.58

Location and Building Dimensions

Calculate Kzt?	No	
Kzt	1.00	
Roof Type	Gable	
Roof Angle - Transverse Dir	0	degrees
Roof Angle - Long Dir	26.6	degrees
Ground to top of roof	19	ft
Bot of roof to top of roof	7	ft
Mean Roof Height, h	15.5	ft
Short Plan Dimension	22.5	ft
Long Plan Dimension	38	ft
Parapet ?	No	
Ground to top of parapet		ft
Average Parapet Height		ft
Ht of 2nd Level Above Grade	12	ft

Velocity Pressure at Mean	47.0	
Roof Height, q _h =	17.8	psf

Wall Pressures (Unfactored):

	(
Ht	K _z	q_z	P _{ww walls}	P _{lwwalls}	P _{walls} (psf)
0-15	0.85	17.73	12.06	7.58	11.8
15-20	0.9	18.78	12.77	7.58	12.2
20-25	0.94	19.61	13.33	7.58	12.5
25-30	0.98	20.44	13.90	7.58	12.9
30-40	1.04	21.70	14.75	7.58	13.4
41-50	1.09	22.74	15.46	7.58	13.8
51-60	1.13	23.57	16.03	7.58	14.2
61-70	1.17	24.41	16.60	7.58	14.5
71-80	1.21	25.24	17.16	7.58	14.8
81-90	1.24	25.87	17.59	7.58	15.1
91-100	1.26	26.29	17.87	7.58	15.3

Roof Pressures (Unfactored)

Windward		1	Horiz Proj
Max	Min	Leeward	(psf)
-2.7	-15.9	-8.7	4.80

Longitudinal Wind Pressures

L/B = 1.69 h/L = 0.41

Pressure Coefficients from Figure 27.4-1:

3	-
Bldg Face	C _p
Windward Wall	0.8
Leeward Wall	-0.36
Windward Roof	-0.24 / 0.24
Leeward Roof	-0.60

Wall Pressures (Unfactored):

۸C	г
AS	L

Ht	K _z	q _z	P _{ww walls}	P _{lwwalls}	P _{walls} (psf)
0-15	0.85	17.73	12.06	5.49	10.53
15-20	0.9	18.78	12.77	5.49	10.95
20-25	0.94	19.61	13.33	5.49	11.30
25-30	0.98	20.44	13.90	5.49	11.64
30-40	1.04	21.70	14.75	5.49	12.15
41-50	1.09	22.74	15.46	5.49	12.57
51-60	1.13	23.57	16.03	5.49	12.91
61-70	1.17	24.41	16.60	5.49	13.25
71-80	1.21	25.24	17.16	5.49	13.59
81-90	1.24	25.87	17.59	5.49	13.85
91-100	1.26	26.29	17.87	5.49	14.02

Roof Pressures (Unfactored)

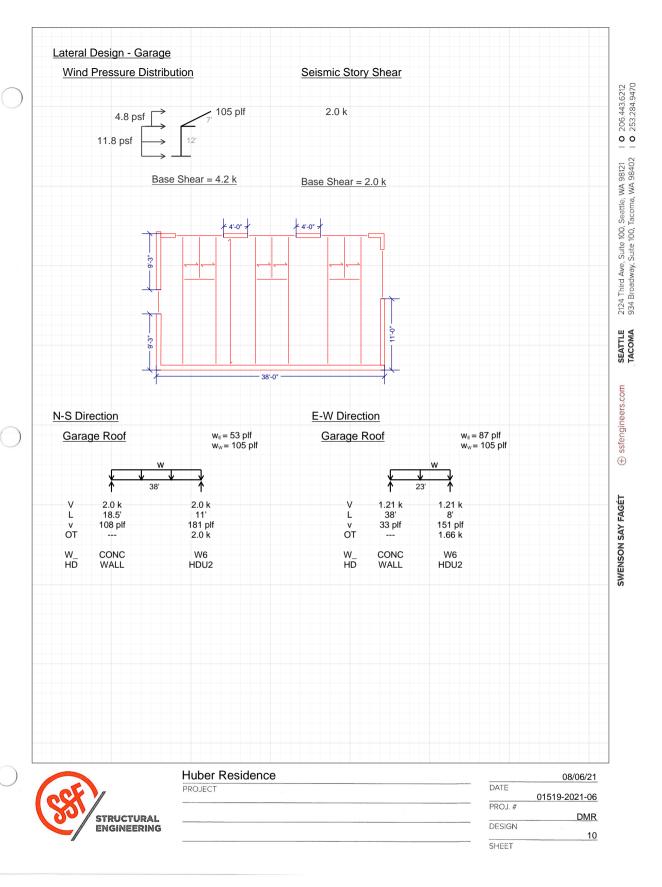
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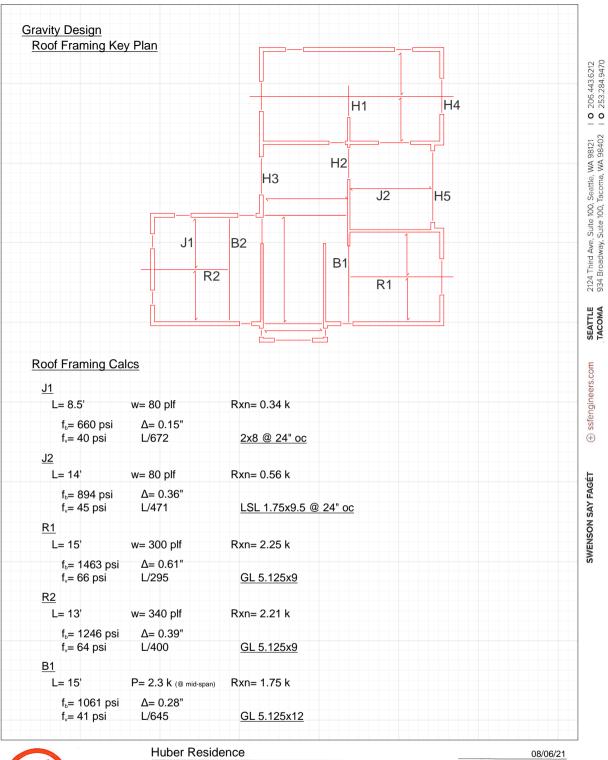
Windward		Leeward	Horiz Proj
Max	Min	Leewalu	(psf)
3.6	-3.7	-9.1	4.80



Huber Garage	
Wind Criteria	

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	Ilcs (cont)		
<u>B2</u> L= 17'	P= 2.3 k (@ mid-span)	Rxn= 1.83 k	
	$\Delta = 0.42$ "	1.00 K	
$f_b = 1236 \text{ psi}$ $f_v = 43 \text{ psi}$	Δ= 0.42" L/486	GL 5.125x12	
		<u> </u>	
<u>H1</u> L= 6'	P= 4.5 k (@ 3.5')	Rxn= 2.63 k	
f _b = 1138 psi	Δ= 0.06"	100 K	
$f_{v} = 85 \text{ psi}$	L/1200	GL 5.125x9	
<u>H2</u>			
L= 6'	w= 600 plf	Rxn= 1.8 k	
f _b = 757 psi	Δ= 0.07"		
$f_v = 737 \text{ psi}$	L/1060	(2)2x10	
<u>H3</u>			
L= 6.5'	w= 280 plf	Rxn= 0.56 k	
f _b = 675 psi	Δ= 0.09"		
f _v = 51 psi	L/859	<u>(2)2x8</u>	
<u>H4</u>			
L= 6'	P= 2.3 k (@ mid-span)	Rxn= 1.15 k	
f _b = 829 psi	Δ= 0.05"		
f _v = 53 psi	L/1394	4x10	
<u>H5</u>			
L= 12'	w= 300 plf	Rxn= 1.8 k	
DCR _м : 0.04	Δ= 0.09"		
DCR _v : 0.11	L/1600	<u>W6x25</u>	

01519-2021-06

DMR

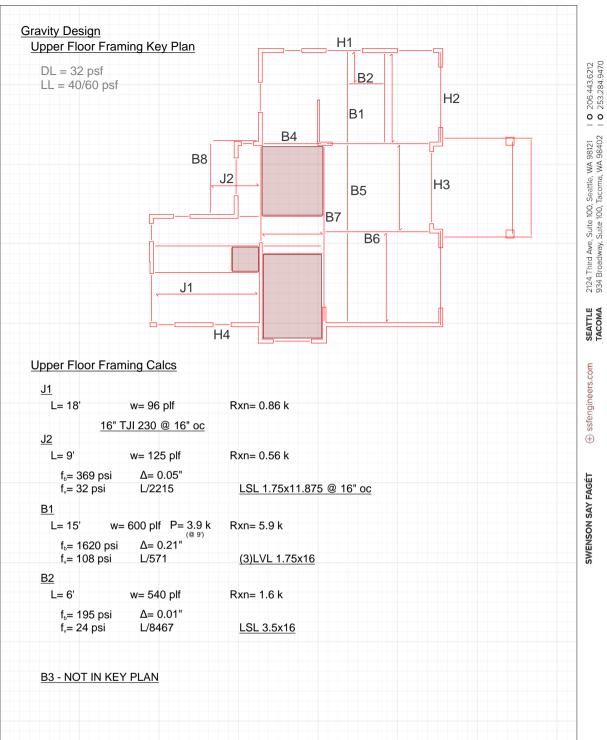
12

PROJ. #

DESIGN

SHEET

STRUCTURAL ENGINEERING





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        Huber Residence
        08/06/21

        PROJECT
        DATE

        01519-2021-06
        PROJ. #

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        DESIGN

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        SHEET
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B1 L= 18' f_b= 893 psi $f_v = 50 \text{ psi}$ B2 L= 20' f₀= 765 psi f_v= 15 psi <u>B3</u> L= 13' $W_1 = 80$ $f_b = 720 \text{ psi}$ $f_v = 50 \text{ psi}$ B4 $\begin{array}{ccc} L=15' & w \\ {}^{(+1'\; cant.)} \\ f_b=330 \; psi \end{array}$ w = 80

 $f_v = 94 \text{ psi}$

	ning Calcs (cont)		
<u>B4</u>			
L= 9'	w= 700 plf	Rxn= 3.15 k	
$f_b = 570 \text{ psi}$ $f_v = 59 \text{ psi}$	Δ= 0.04" L/2497	LSL 3.5x16	
<u>B5</u>			
	700 plf P= 1.8 k	Rxn= 6.0 k	
f _b = 1364 psi	Δ= 0.28"		
f _v = 96 psi	L/644	(3) LVL 1.75x16	
B <u>6</u>			
L= 18' w=	1.38 klf P= 9.8 k	Rxn= 20.3 k	
DCR _M : 0.08 DCR _V : 0.18	Δ= 0.21" L/1029	W14x68	
	L/ 1023	<u> </u>	
B7	450 If D 0001	D 00 74 l	
	150 plf P= 20.3 k	Rxn= 20.74 k	
DCR _M : 0.14	Δ= 0.09"	VA/4 41/CQ	
DCR _v : 0.18	L/2519	W14x68	
<u> </u>			
L= 12'	w= 420 plf	Rxn= 2.52 k	
f _b = 1103 psi	Δ= 0.26"		
f _v = 76 psi	L/556	LSL 3.5x11.875	
H1			
L= 6' w=	700 plf P= 4.5 k	Rxn= 5.1 k	
f _b = 707 psi	Δ= 0.03"		
f _v = 112 psi	L/2725	LSL 3.5x16	
H2			
L= 10' w=	150 plf P= 1.2 k (@ 1.5/8.5')	Rxn= 1.9 k	
f _b = 613 psi	Δ= 0.06"		
f _v = 46 psi	L/1907	LSL 3.5x16	
<u>H3</u>			
L= 12'	w= 400 plf	Rxn= 2.4 k	
f _b = 579 psi	Δ= 0.10"		
f _v = 50 psi	L/1429	LSL 3.5x16	
H <u>4</u>			
L= 4.5'	w= 700 plf	Rxn= 1.58 k	
f _b = 809 psi	Δ= 0.05"		
f _v = 79 psi	L/1036	(2) 2x8	

STRUCTURAL ENGINEERING

Huber Residence	08/06/21
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<u>H1</u> w= 700 $f_b = 707 \text{ psi}$ $f_v = 112 \text{ psi}$ <u>H2</u> L= 10' w= 150 f_b= 613 psi f_v= 46 psi <u>H3</u> L= 12'

<u>B7</u> L= 17'

<u>B8</u> L= 12' w= 150

Δ

Δ

Δ

Δ

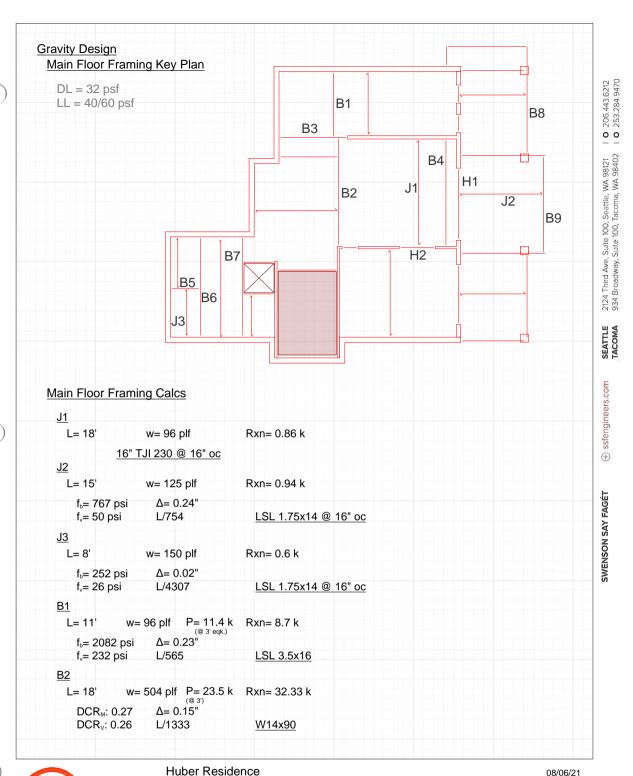
w= Δ: L/

DCR_M: 0.14 DCR_V: 0.18

 $f_b = 1103 \text{ psi}$ $f_v = 76 \text{ psi}$

f_b= 579 psi $f_v = 50 \text{ psi}$ <u>H4</u> L=4.5'

 $f_b = 809 \text{ psi}$ $f_v = 79 \text{ psi}$





PROJECT

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L= 18' f_b= 893 psi $f_v = 50 \text{ psi}$ B2 L= 20' f₀= 765 psi f_v= 15 psi <u>B3</u> L= 13' $W_1 = 80$ $f_b = 720 \text{ psi}$ $f_v = 50 \text{ psi}$ B4 $\begin{array}{ccc} L=15' & w \\ {}^{(+1'\; cant.)} \\ f_b=330 \; psi \end{array}$ w = 80 $f_v = 94 \text{ psi}$

B1

lain Floor Frami	ing Calos (COIII)		
<u>B3</u>			
L= 18' w=	504 plf P= 23.5 k	Rxn= 36.5 k	
DCR _M : 0.19	Δ= 0.05"		
DCR _v : 0.30	L/2769	W14x90	
<u>B4</u>			
L= 18' w=	96 plf P= 16.7 k	Rxn= 12.93 k	
DCR _M : 0.36	Δ= 0.14"		
DCR _v : 0.11	L/1565	W14x68	
<u>B5</u>			
L= 5'	w= 764 plf	Rxn= 1.9 k	
f _b = 192 psi	Δ= 0.01"		
f _v = 24 psi	L/10000+	LSL 3.5x16	
<u>B6</u>			
L= 17' w=	150 plf P= 1.9 k	Rxn= 2.3 k	
f _b = 1081 psi	Δ= 0.33"		
f _v = 56 psi	L/613	LSL 3.5x16	
<u>B7</u>			
L= 17' w=	576 plf P= 1.1 k (@ 0'-5') (@ 9.5')	Rxn= 3.4 k	
f₀= 940 psi	Δ= 0.31"		
f _v = 69 psi	L/666	(3) LVL 1.75x16	
<u>B8</u>			
L= 14' (+4' cant.)	w= 552 plf	Rxn= 6.4 k	
f _b = 798 psi	Δ= 0.16"		
f _v = 72 psi	L/876	(3) LVL 1.75x13	
<u>B9</u>			
L= 17'	w= 690 plf	Rxn= 5.86 k	
f _b = 1308 psi	Δ= 0.41"		
f _v = 77 psi	L/504	LSL 3.5x11.875	
<u>H1</u>			
L= 12'	w= 690 plf	Rxn= 4.2 k	
f₀= 652 psi	Δ= 0.10"		
f _v = 51 psi	L/1432	(3) LVL 5.25x14	
<u>H2</u>			
L= 6'	w= 1188 plf	Rxn= 3.56 k	
f _b = 430 psi	Δ= 0.02"		
f _v = 53 psi	L/3850	LSL 3.5x16	



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	DMR
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	SHEET

Project Name/Number: Typical Detai

Bottom

Typ. Retaining Wall (8/S3.1) Title Dsgnr: DMR

Description...

3'-0" Retaining Wall w/ Slab

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0.0 ft

Reta

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Lice

Criteria

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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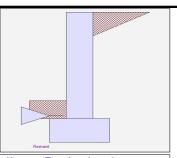
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Officia		
Retained Height	=	3.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over To	e =	6.00 in

Soil Data				
Allow Soil Bearing		3,000.0	psf	
Equivalent Fluid Pressure Method				
Active Heel Pressure	=	35.0	psf/f	

Cantilevered Retaining Wall

35.0 psf/ft Passive Pressure 300.0 psf/ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.450 Soil height to ignore for passive pressure 12.00 in



Surcharge Loads

Water height over heel

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load 0.0 #/ft 0.00 ft ...Height to Top ...Height to Bottom 0.00 ft Load Type Wind (W) (Service Level)

Wind on Exposed Stem = 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratio	os		
Overturning	=	1.87	OK
Slah I	Resists All Slidi	na I	

Total Bearing Loadresultant ecc.	=	605 lbs 4.01 in
Soil Pressure @ Toe Soil Pressure @ Heel	=	971 psf OK 0 psf OK
Allowable Soil Pressure Less	= Tha	3,000 psf n Allowable
ACI Factored @ Toe ACI Factored @ Heel	=	1,359 psf 0 psf
Footing Shear @ Toe	=	0.7 psi OK
Footing Shear @ Heel	=	3.1 psi OK
Allowable	=	75.0 psi
Sliding Calcs		
Lateral Sliding Force		235.3 lbe

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction Stem Ok Design Height Above Ftg 0.00 Wall Material Above "Ht" Concrete Design Method LRFD Thickness

8.00 Rebar Size Rebar Spacing 18.00 Rebar Placed at Edge **Design Data** fb/FB + fa/Fa 0.068

Total Force @ Section Service Level lbs = Strength Level 252.0 Moment....Actual Service Level ft-# =

Strength Level

Moment.....Allowable 3,655.6 Shear.....Actual Service Level psi = Strenath Level psi = 3.4 Shear.....Allowable psi = 75.0

ft-# =

252.0

Anet (Masonry) in2 = Rebar Depth 'd' in = 6.25 Masonry Data f'm psi =

psi = Solid Grouting Modular Ratio 'n' Wall Weight 100.0 psf = Short Term Factor

Equiv. Solid Thick. Masonry Block Type = Medium Weight Masonry Design Method ASD

Concrete Data f'c

2,500.0 Fy 60,000.0 psi =

Project Name/Number: Typical Detai

Min Stem T&S Reinf Area 0.576 in2

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

3'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0094 in2/ft

(4/3) * As: 0.0126 in2/ft

200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft Horizontal Reinforcing Options :

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft

One layer of : Two layers of : #4@ 12.50 in #4@ 25.00 in 0.1152 in2/ft Required Area: Provided Area: 0.1333 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	= 0.42 ft
Heel Width	= 1.08
Total Footing Width	= 1.50
Footing Thickness	= 8.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from T	oe = 0.00 ft
f'c = 2,500 psi	
Footing Concrete De	ensity = 150.00 pcf
Min. As %	= 0.0018
Cover @ Top 2.	.00 @ Btm.= 3.00 in

Footing Design Results

			_
		<u>Toe</u>	Heel
Factored Pressure	=	1,359	0 psf
Mu' : Upward	=	1,277	1 ft-#
Mu' : Downward	=	206	49 ft-#
Mu: Design	=	89	48 ft-#
Actual 1-Way Shear	=	0.70	3.08 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	•
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow, Torsio	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.26 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

3'-0" Retaining Wall w/ Slab

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING	i		RE	SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	235.3	1.22	287.6	Soil Over HL (ab. water tbl)	155.0	1.29	200.5
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		1.29	200.5
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 =		0.21	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	300.0	0.75	226.0
				Earth @ Stem Transitions =			
Total =	235.3	O.T.M. =	287.6	Footing Weight =	150.0	0.75	112.5
				Key Weight =			
Resisting/Overturning Ra		=	1.87	Vert. Component =			
Vertical Loads used for Se	oil Pressure	= 605.0	0 lbs	Total =	605.0 I	bs R.M.=	539.0

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.054 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Project Name/Number : Typical Detai

Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR
Description....
3'-0" Retaining Wall w/ Slab, w/ Seismic

Page: 1 9 SEP 2021

Date:

		sidence\Calcs\Typical Detail Co-0)4-07.R	RPX		
RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.20.03.31 AY FAGET	Cantilevered Retain	ng V	Vall	Code: IBC 2015,	ACI 318-14,ACI 530-13
Criteria		Soil Data				
Wall height above soil Slope Behind Wall Height of Soil over Toe	= 3.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure =	35.0	psf/ft psf/ft pcf		
Surcharge Loads		Lateral Load Applied to	Stem	7	Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load Axial Live Load Axial Load Eccentricity	= 0.0 turning to Stem = 0.0 lbs = 0.0 lbs	Height to Bottom = Load Type = Win	0.0 #/ 0.00 ft 0.00 ft d (W) rvice Le 0.0 ps	F E V evel) F sf	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft = 0.300
Earth Pressure Se Method: Uniform Multiplier Used (Multiplier used on soil december)	= 6.000		2.000 0.667			
Design Summary		Stem Construction		Bottom Stem OK		
Wall Stability Ratios Overturning Slab Resis Total Bearing Loadresultant ecc.	= 1.38 Ratio < ts All Sliding! = 605 lbs = 6.07 in	Thickness Rebar Size Rebar Spacing	= = =	0.00 Concrete LRFD 8.00 # 4 18.00		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 1,650 psf Ok = 0 psf Ok = 4,000 psf		= = Ibs =	0.096		
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= 2,310 psf = 0 psf = 1.3 psi OK	Strength Level	lbs = ft-# = ft-# =	318.0 351.0		
Footing Shear @ Heel Allowable Sliding Calcs Lateral Sliding Force	= 3.3 psi OK = 75.0 psi = 291.7 lbs	MomentAllowable ShearActual Service Level Strength Level	= psi = psi =	3,655.6 4.2		
		ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = in2 = in =	75.0 6.25		
Vertical component of activ NOT considered in the calc		Modular Ratio 'n' Wall Weight	psi = psi = = = psf =	100.0		
Load Factors Building Code Dead Load Live Load Earth, H	IBC 2015,ACI 1.200 1.600 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data		Medium W ASD	eight	
Wind, W Seismic, E	1.000 1.000	f'c Fy	psi = psi =	2,500.0 60,000.0		

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

Horizontal Reinforcing

3'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0132 in2/ft

(4/3) * As: 0.0175 in2/ft Min Stem T&S Reinf Area 0.576 in2

200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft Horizontal Reinforcing Options :

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft

One layer of : Two layers of : #4@ 25.00 in 0.1152 in2/ft #4@ 12.50 in 0.1333 in2/ft #5@ 19.38 in #5@ 38.75 in 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Maximum Area: **Footing Data**

Required Area: Provided Area:

Toe Width		=	0	.42 ft
Heel Width		=	1	.08
Total Footing Wi	dth	=	1	.50
Footing Thickness	SS	=	8	.00 in
Key Width		=	0.	.00 in
Key Depth		=	0	.00 in
Key Distance fro	m Toe	=	0	.00 ft
f'c = 2,500		Fy =		000 psi
Footing Concrete Min. As %	Density		0.00	.00 pcf
	2.00	=		3.00 in
Cover @ Top	2.00	w	DIIII.=	3.00 111

Footing Design Results

	_		
		<u>Toe</u>	Heel
Factored Pressure	=	2,310	0 psf
Mu' : Upward	=	1,978	0 ft-#
Mu' : Downward	=	206	49 ft-#
Mu: Design	=	148	49 ft-#
Actual 1-Way Shear	=	1.26	3.27 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	•
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	ohi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.26 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

3'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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		OV	ERTURNIN	۱G				R	ESISTING	
Item		Force lbs	Distance ft		ft-#			Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tb	1)	235.3	1.22		287.6	Soil Over HL (ab. wa	ater tbl)	155.0	1.29	200.5
HL Act Pres (be water tb	,					Soil Over HL (bel. w	ater tbl)		1.29	200.5
Hydrostatic Force	•					Watre Table				
Buoyant Force	=					Sloped Soil Over Hee	el =			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	=					Adjacent Footing Loa	nd =			
Adjacent Footing Load	=					Axial Dead Load on	Stem =			
Added Lateral Load	=					* Axial Live Load on S	tem =			
Load @ Stem Above So	l =					Soil Over Toe	=		0.21	
Seismic Earth Load	=	56.5	1.83		103.5	Surcharge Over Toe	=			
	=					Stem Weight(s)	=	300.0	0.75	226.0
Total		201.7	O.T.M. :		391.1	Earth @ Stem Trans	tions=			
I Olai	=	291.7	O. I . IVI.	=	391.1	Footing Weight	=	150.0	0.75	112.5
						Key Weight	=			
Resisting/Overturnin	_		=	1.3		Vert. Component	=			
Vertical Loads used f	or So	il Pressure	= 60)5.0 I	bs	•	Total =	605.0	lbs R.M.=	539.0

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.092 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

4'-0" Retaining Wall w/ Slab

12.00 in

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Criteria

Retained Height	=	4.00 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

Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning

Surcharge Over Toe = Used for Sliding & Overturning

Axial Load Applied to Stem

0.0 psf

0.0 lbs

0.0 lbs 0.0 in

381.1 lbs

0.0

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Soil Data

Allow Soil Bearing		3,000.0 psf
Equivalent Fluid Pressure	Meth	od
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
• • • • • • • • • • • • • • • • • • • •		
Footing Soil Friction	=	0.450

Lateral Load Applied to Stem

Soil height to ignore for passive pressure

Lateral LoadHeight to TopHeight to Bottom	=	0.0 #/ft 0.00 ft 0.00 ft
Load Type	=	Wind (W) (Service Level)

Wind on Exposed Stem = 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Eccentricity **Design Summary**

Lateral Sliding Force

Axial Dead Load

Axial Live Load

Surcharge Loads

Wall Stability	/ Ratios		
Overturning	=	1.92	OK
	Slab Resists Al	Sliding!	

Total Bearing Loadresultant ecc.	=	815 lbs 4.47 in
Soil Pressure @ Toe	=	813 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	3,000 psf
Soil Pressure Less	Thai	n Allowable
ACI Factored @ Toe	=	1,139 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	6.4 psi OK
Footing Shear @ Heel	=	3.7 psi OK
Allowable	=	75.0 psi
Sliding Calcs		

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Ste

Fy

em Construction		Bottom	
Design Usinht Above Fte		Stem OK	
Design Height Above Ftg Wall Material Above "Ht"	ft =	0.00	
	=	Concrete	
Design Method Thickness	=	LRFD 8.00	
Rebar Size	=	# 4	
Rebar Spacing	_	18.00	
Rebar Placed at	_	Edge	
Design Data		Luge	
fb/FB + fa/Fa	=	0.163	
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	448.0	
MomentActual			
Service Level	ft-# =		
Strength Level	ft-# =	597.3	
MomentAllowable	=	3,655.6	
ShearActual			
Service Level	psi =		
Strength Level	psi =	6.0	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in=	6.25	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =	100.0	
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	=	Medium W	eight
Masonry Design Method	=	ASD	
Concrete Data		0.500.0	
f'c	psi =	2,500.0	

psi = 60,000.0

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

4'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 2

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0224 in2/ft

(4/3) * As: 0.0298 in2/ft

Min Stem T&S Reinf Area 0.768 in2 200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft Horizontal Reinforcing Options :

One layer of : Two layers of : #4@ 12.50 in #4@ 25.00 in 0.1152 in2/ft Required Area: Provided Area: 0.1333 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	1.	.00 ft
Heel Width	=	1.	.08
Total Footing Width	= -	2.	.08
Footing Thickness	=	8.	00 in
Key Width	=	0.	00 in
Key Depth	=	0.	00 in
Key Distance from Toe	=	0.	00 ft
f'c = 2,500 psi	Fy =		00 psi
Footing Concrete Densit	ty =	150	.00 pcf
Min. As %	=	0.00	18
Cover @ Top 2.00	@ E	3tm.=	3.00 in

Footing Design Results

	,		_
		Toe	Heel
Factored Pressure	=	1,139	0 psf
Mu' : Upward	=	5,695	4 ft-#
Mu' : Downward	=	1,170	62 ft-#
Mu: Design	=	377	58 ft-#
Actual 1-Way Shear	=	6.43	3.69 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	•
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi/5'lambda'sqrt(fc)'Sm Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.36 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description....

4'-0" Retaining Wall w/ Slab

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

OVERTURNING				RESISTING			
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	381.1	1.56	592.8	Soil Over HL (ab. water tbl)	206.7	1.87	387.2
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		1.87	387.2
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 =		0.50	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	400.0	1.33	533.3
				Earth @ Stem Transitions =			
Total =	381.1	O.T.M. =	592.8	Footing Weight =	208.0	1.04	216.3
				Key Weight =			
Resisting/Overturning Ra	itio	=	1.92	Vert. Component =			
Vertical Loads used for S	oil Pressure	= 814.	7 lbs	Total = * Avial live load NOT included in		bs R.M.=	1,136.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.043 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

4'-0" Retaining Wall w/ Slab, w/ Seismic

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Criteria	Soil Data	

-"	cense	10.	SVVE	NOON	JAI	FA
	Crite	ria				
_						

Retained Height	=	4.00 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

Allow Soil Bearing	=	4,000.0 psf
Equivalent Fluid Pressure	e Meth	
Active Heel Pressure	=	35.0 psf/ft
	_	
	_	



Lateral Load Applied to Stem

Lateral Load Height to Top	=	0.0 #/ft 0.00 ft
Height to Bottom	=	0.00 ft
Load Type	=	Wind (W)
		(Service Level)

Wind on Exposed Stem = 0.0 psf (Service Level)

Adjacent Footing Load

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Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil		0.04
at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Earth Pressure Seismic Load

Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning

Surcharge Over Toe = Used for Sliding & Overturning

Axial Load Applied to Stem

0.0 psf

0.0 lbs

0.0 lbs

0.0 in

0.0

Method : Uniform Multiplier Used 7.000

(Multiplier used on soil density) **Design Summary**

Surcharge Loads

Axial Dead Load

Axial Live Load

Axial Load Eccentricity

Wall Stability Ratios Overturning 1.35 Ratio < 1.5 Slab Resists All Sliding!

Total Bearing Loadresultant ecc.	=	815 lbs 8.14 in
Soil Pressure @ Toe	=	1,500 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	4,000 psf
Soil Pressure Less	s Thai	n Allowable
ACI Factored @ Toe	=	2,100 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	11.1 psi OK
Footing Shear @ Heel	=	4.1 psi OK
Allowable	=	75.0 psi
Sliding Calcs		
Lateral Sliding Force	=	487.8 lbs

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Uniform Seismic Force = 32.667 Total Seismic Force = 152.444

St	em Construction		Bottom	
	Design Height Above Ftg	- (Stem OK	
	Wall Material Above "Ht"	ft = =	0.00 Concrete	
5!	Design Method	=	LRFD	
٠.	Thickness	_	8.00	
	Rebar Size	=	# 4	
	Rebar Spacing	=	18.00	
	Rebar Placed at	=	Edge	
	Design Data ————— fb/FB + fa/Fa	=	0.234	
	Total Force @ Section			
	Service Level	lbs =		
	Strength Level	lbs =	578.7	
	MomentActual			
	Service Level	ft-# =		
	Strength Level	ft-# =	858.7	
	MomentAllowable	=	3,655.6	
	ShearActual			
	Service Level	psi =		
	Strength Level	psi =	7.7	
	ShearAllowable	psi =	75.0	
	Anet (Masonry)	in2 =		
	Rebar Depth 'd'	in =	6.25	
	Masonry Data —			
	f'm	psi =		
	Fs	psi =		
	Solid Grouting	=		
	Modular Ratio 'n'	_=	400.0	
	Wall Weight	psf =	100.0	
	Short Term Factor	=		
	Equiv. Solid Thick. Masonry Block Type	=	Medium W	oight
	Masonry Design Method		ASD	eigni
	Concrete Data		אסט	
	f'c	psi =	2,500.0	
	Fy	psi =	60,000.0	

Project Name/Number : Typical Detai
Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR

Horizontal Reinforcing

Description....
4'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete Stem Rebar Area Details

Bottom Stem Vertical Reinforcing

As (based on applied moment): 0.0322 in2/ft

(4/3) * As : 0.0429 in2/ft Min Stem T&S Reinf Area 0.768 in2

 $200 b d/fy: 200 (12) (6.25)/60000: \qquad \qquad 0.25 \ in 2/ft \qquad \qquad \\ Min \ Stem \ T\&S \ Reinf \ Area \ per \ ft \ of \ stem \ Height: 0.192 \ in 2/ft \qquad \qquad \\$

 Required Area :
 0.1152 in2/ft
 #4@ 12.50 in
 #4@ 25.00 in

 Provided Area :
 0.1333 in2/ft
 #5@ 19.38 in
 #5@ 38.75 in

 Maximum Area :
 0.8467 in2/ft
 #6@ 27.50 in
 #6@ 55.00 in

Footing Data

Toe Width	=	1.00 ft
Heel Width	=	1.08
Total Footing Width	= -	2.08
Footing Thickness	=	8.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi	Fy =	60,000 psi
Footing Concrete Density	/ =	150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@ E	3.00 in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	2,100	0 psf
Mu' : Upward	=	8,733	0 ft-#
Mu' : Downward	=	1,170	62 ft-#
Mu: Design	=	630	62 ft-#
Actual 1-Way Shear	=	11.07	4.13 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	•
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow, Torsio	n. p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

Min footing T&S reinf Area 0.36 in2
Min footing T&S reinf Area per foot 0.17 in2 /ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 21.53 in #5@ 43.06 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

4'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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		OV	ERTURNI	NG		<u> </u>		R	ESISTING	
Item		Force lbs	Distance ft	•	Moment ft-#	_		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		381.1	1.56		592.8	Soil Over HL (ab. water	er tbl)	206.7	1.87	387.2
HL Act Pres (be water tbl)						Soil Over HL (bel. wat	er tbl)		1.87	387.2
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 St	em =			
Added Lateral Load	=					* Axial Live Load on Ste	m =			
Load @ Stem Above Soil	=					Soil Over Toe	=		0.50	
Seismic Earth Load	=	106.7	2.33		249.0	Surcharge Over Toe	=			
	=					Stem Weight(s)	=	400.0	1.33	533.3
T-1-1		407.0	- O T M		0.44.0	Earth @ Stem Transiti	ons=			
Total	=	487.8	O.T.M.	=	841.8	Footing Weight	=	208.0	1.04	216.3
						Key Weight	=			
Resisting/Overturning			=		.35	Vert. Component	=			
Vertical Loads used fo	r Soil	Pressure :	= 8	14.7	lbs	To	otal =	814.7	lbs R.M.=	1,136.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.080 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Project Name/Number: Typical Detai

Typ. Retaining Wall (8/S3.1) Title

Dsgnr: DMR Description..

6'-0" Retaining Wall w/ Slab

12.00 in

Bottom

8,121.3

6.19

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		4.4	-					

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Criteria			

Retained Height 6.00 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

Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning

Used for Sliding & Overturning

Axial Load Applied to Stem

0.0 psf

0.0 lbs

0.0 lbs

817.2 lbs

0.0 in

0.0

Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 1

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Soil Data

Soil height to ignore for passive pressure

Allow Soil Bearing = 3,000.0 psf Equivalent Fluid Pressure Method Active Heel Pressure 35.0 psf/ft Passive Pressure 300.0 psf/ft 125.00 pcf Soil Density, Heel Soil Density, Toe 0.00 pcf Footing||Soil Friction 0.450

Lateral Load Applied to Stem

Lateral Load 0.0 #/ft 0.00 ft ...Height to Top ...Height to Bottom 0.00 ft Wind (W) Load Type (Service Level)

Wind on Exposed Stem _ 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load 0.0 lbs Footing Width 0.00 ft Eccentricity 0.00 in Wall to Ftg CL Dist 0.00 ft Footing Type Line Load Base Above/Below Soil 0.0 ft at Back of Wall Poisson's Ratio 0.300

Axial Load Eccentricity **Design Summary**

Lateral Sliding Force

Surcharge Loads

Surcharge Over Toe

Axial Dead Load

Axial Live Load

Wall Stability Ratios Overturning 1.55 OK Slab Resists All Sliding!

Total Bearing Load 9.01 in ...resultant ecc Soil Pressure @ Toe 1,094 psf OK Soil Pressure @ Heel 0 psf OK 3,000 psf Allowable Soil Pressure Less Than Allowable 1,531 psf ACI Factored @ Toe ACI Factored @ Heel 0 psf Footing Shear @ Toe 15.1 psi OK Footing Shear @ Heel 4.5 psi OK Allowable 75.0 psi Sliding Calcs

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Stem Construction

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Design Method	=	LRFD
Thickness	=	8.00
Rebar Size	=	# 5
Rebar Spacing	=	12.00
Rebar Placed at	=	Edge
Design Data ————		
fb/FB + fa/Fa	=	0.248

Total Force @ Section Service Level lbs = Strength Level 1,008.0 lbs = Moment....Actual Service Level ft-# = Strenath Level ft-# = 2.016.0

Shear.....Actual Service Level psi = Strenath Level psi = 13.6 Shear.....Allowable psi = 75.0

Anet (Masonry) in2 = Rebar Depth 'd' in = Masonry Data f'm psi = psi =

Moment.....Allowable

Solid Grouting Modular Ratio 'n' Wall Weight 100.0 psf = Short Term Factor Equiv. Solid Thick. Masonry Block Type = Medium Weight

Concrete Data 2,500.0 Fy 60,000.0 psi =

Masonry Design Method

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

6'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.0763 in2/ft

(4/3) * As: 0 1018 in 2/ft

Min Stem T&S Reinf Area 1.152 in2 200bd/fy: 200(12)(6.1875)/60000: 0.2475 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0018bh: 0.0018(12)(8): Horizontal Reinforcing Options : 0.1728 in2/ft One layer of :

Two layers of : #4@ 25.00 in 0.1728 in2/ft #4@ 12.50 in Required Area: Provided Area: 0.31 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8382 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width		=	2	.00 ft
Heel Width		=	1	.08
Total Footing Wid	dth	=	3	.08
Footing Thicknes	s :	=	10.	00 in
Key Width		=	0.	.00 in
Key Depth		=	0.	.00 in
Key Distance from	m Toe	=	0.	.00 ft
f'c = 2,500		/ =		00 psi
Footing Concrete	Density	=	150	.00 pcf
Min. As %		=	0.00	18
Cover @ Top	2.00	@	Btm.=	3.00 in

Footing Design Results

Į					
			<u>Toe</u>	Heel	
	Factored Pressure	=	1,531	0 psf	
	Mu' : Upward	=	26,401	0 ft-#	
	Mu' : Downward	=	5,400	90 ft-#	
	Mu: Design	=	1,750	90 ft-#	
	Actual 1-Way Shear	=	15.14	4.52 psi	
	Allow 1-Way Shear	=	75.00	40.00 psi	
	Toe Reinforcing	=	#5@12.00 in		
	Heel Reinforcing	=	None Spec'd		
	Key Reinforcing	=	None Spec'd		
	Footing Torsion, Tu		=	0.00 ft-lb	s
	Footing Allow. Torsion	ո, p	hi Tu =	0.00 ft-lb	s

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

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.67 in2 in2 /ft 0.22

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in #5@ 17.22 in #5@ 34.44 in #6@ 24.44 in #6@ 48.89 in

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description....

6'-0" Retaining Wall w/ Slab

Page: 3 Date: 9 SEP 2021

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RE	SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	310.0	2.87	890.7
HL Act Pres (be water tbl) Hydrostatic Force			,	Soil Over HL (bel. water tbl) Watre Table		2.87	890.7
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 =		1.00	
=				Surcharge Over Toe =			
				Stem Weight(s) =	600.0	2.33	1,400.0
		—		Earth @ Stem Transitions =			
Total =	817.2	O.T.M. =	1,861.3	Footing Weight =	385.0	1.54	592.9
				Key Weight =			
Resisting/Overturning Ra	itio	=	1.55	Vert. Component =			
Vertical Loads used for S	oil Pressure	= 1,295.0	0 lbs	Total =	1.295.0 I	bs R.M.=	2,883.6

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.059 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Live Load

Earth, H

Wind, W

Seismic, E

1.600

1.600

1.000

1.000

Project Name/Number: Typical Detai

Typ. Retaining Wall (8/S3.1) Title Dsgnr: DMR

Description.

6'-0" Retaining Wall w/ Slab, w/ Seismic

Page: 1

Date:

9 SEP 2021

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-07.RPX

RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 530-13 License: KW-06052576 License To: SWENSON SAY FAGET Soil Data Criteria Allow Soil Bearing = 4,000.0 psf Retained Height 6.00 ft Equivalent Fluid Pressure Method Wall height above soil 0.00 ft Active Heel Pressure 35.0 psf/ft Slope Behind Wall 0.00 Height of Soil over Toe 6.00 in Passive Pressure 300.0 psf/ft Water height over heel 0.0 ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.450 Soil height to ignore for passive pressure 12.00 in Surcharge Loads **Lateral Load Applied to Stem** Adjacent Footing Load Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning 0.0 psf Adjacent Footing Load 0.0 lbs 0.0 #/ft 0.00 ft Lateral Load Footing Width 0.00 ft ...Height to Top Surcharge Over Toe 0.0 ...Height to Bottom 0.00 ft Eccentricity = 0.00 in Used for Sliding & Overturning Wall to Ftg CL Dist 0.00 ft Wind (W) Load Type Footing Type Line Load **Axial Load Applied to Stem** (Service Level) Base Above/Below Soil 0.0 ft Axial Dead Load 0.0 lbs Wind on Exposed Stem _ 0.0 psf at Back of Wall Axial Live Load 0.0 lbs (Service Level) Poisson's Ratio 0.300 Axial Load Eccentricity 0.0 in **Earth Pressure Seismic Load** Method: Uniform Uniform Seismic Force = 41.000 Total Seismic Force Multiplier Used 6.000 280.167 (Multiplier used on soil density) **Design Summary Stem Construction Bottom** Stem OK Design Height Above Ftg 0.00 Wall Stability Ratios Wall Material Above "Ht" Concrete Overturning 1.14 Ratio < 1.5! Design Method LRFD Slab Resists All Sliding! Thickness 8.00 Rebar Size **Total Bearing Load** 1,295 lbs Rebar Spacing 12.00 resultant ecc 15 22 in Rebar Placed at = Edge Design Data Soil Pressure @ Toe 3,174 psf OK 0.339 fb/FB + fa/Fa = Soil Pressure @ Heel 0 psf OK Total Force @ Section 4,000 psf Allowable Service Level lbs = Soil Pressure Less Than Allowable Strength Level lbs = 1,254.0 ACI Factored @ Toe 4,443 psf Moment....Actual 0 psf ACI Factored @ Heel Service Level ft-# = Footing Shear @ Toe 18.6 psi OK Strength Level ft-# = 2,754.0 Footing Shear @ Heel 4.5 psi OK Moment.....Allowable 8,121.3 Allowable 75.0 psi Shear Actual Sliding Calcs Service Level psi = Lateral Sliding Force 1.013.3 lbs Strength Level psi = 16.9 Shear.....Allowable psi = 75.0 Anet (Masonry) in2 =Rebar Depth 'd' in= 6.19 Masonry Data f'm psi = Fs psi = Vertical component of active lateral soil pressure IS Solid Grouting NOT considered in the calculation of soil bearing Modular Ratio 'n' Wall Weight 100.0 psf = Load Factors Short Term Factor IBC 2015,ACI **Building Code** Equiv. Solid Thick. 1.200 Dead Load Masonry Block Type Medium Weight

Masonry Design Method

Concrete Data

f'c

Fy

ASD =

2,500.0

60,000.0

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Horizontal Reinforcing

Description...

6'-0" Retaining Wall w/ Slab, w/ Seismic

Min Stem T&S Reinf Area 1.152 in2

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 2

9 SEP 2021

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.1043 in2/ft

(4/3) * As: 0.139 in2/ft

200bd/fy: 200(12)(6.1875)/60000: 0.2475 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft Horizontal Reinforcing Options : 0.1728 in2/ft

0.0018bh: 0.0018(12)(8):

One layer of : Two layers of : #4@ 25.00 in 0.1728 in2/ft #4@ 12.50 in #5@ 19.38 in #5@ 38.75 in

Maximum Area:

Required Area: Provided Area: 0.31 in2/ft 0.8382 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	2.00 ft
Heel Width	=	1.08
Total Footing Width	= -	3.08
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi Footing Concrete Density		60,000 psi 150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@ E	3.00 in

Footing Design Results

ı					
			<u>Toe</u>	Heel	
	Factored Pressure	=	4,443	0 psf	
	Mu' : Upward	=	37,594	0 ft-#	
	Mu' : Downward	=	5,400	90 ft-#	
	Mu: Design	=	2,683	90 ft-#	
	Actual 1-Way Shear	=	18.57	4.52 psi	
	Allow 1-Way Shear	=	75.00	40.00 psi	
	Toe Reinforcing	=	#5@12.00 in	-	
	Heel Reinforcing	=	None Spec'd		
	Key Reinforcing	=	None Spec'd		
	Footing Torsion, Tu		=	0.00 ft-lbs	ŝ
	Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs	ŝ

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

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.67 in2 in2 /ft 0.22

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in #5@ 17.22 in #5@ 34.44 in #6@ 24.44 in #6@ 48.89 in

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

6'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 3

9 SEP 2021

· ·		OV	ERTURNIN	۱G				RESISTING	
Item		Force lbs	Distance ft		Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	817.2	2.28		1,861.3	Soil Over HL (ab. water to	l) 310.0	2.87	890.7
HL Act Pres (be water tbl					,	Soil Over HL (bel. water the	ol)	2.87	890.7
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	=	1.00	
Seismic Earth Load	=	196.1	3.42		670.1	Surcharge Over Toe =	=		
	=					Stem Weight(s) =	= 600.0	2.33	1,400.0
		4.040.0			0.504.4	Earth @ Stem Transitions =	=		
Total	=	1,013.3	O.T.M.	=	2,531.4	Footing Weight =	= 385.0	1.54	592.9
						Key Weight =	=		
Resisting/Overturning	•		=	-	.14	Vert. Component	=	_	
Vertical Loads used for	or So	l Pressure	= 1,29	5.0	lbs	Total	= 1.295.0	lbs R.M.=	2.883.6

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

250.0 pci Soil Spring Reaction Modulus Horizontal Defl @ Top of Wall (approximate only) 0.172 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

8'-0" Retaining Wall w/ Slab

12.00 in

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 1

9 SEP 2021

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Retained Height	=	8.00 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

Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning

Surcharge Over Toe = Used for Sliding & Overturning

Axial Load Applied to Stem

0.0 psf

0.0 lbs

0.0 lbs 0.0 in

1,417.5 lbs

0.0

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Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure	Meth	od
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing Soil Friction	=	0.450

Lateral Load Applied to Stem

Soil height to ignore for passive pressure

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 = 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Axial Load Eccentricity **Design Summary**

Lateral Sliding Force

Axial Dead Load

Axial Live Load

Surcharge Loads

Wall Stability	Ratios			
Overturning		=	1.84	OK
	Slab Resists	All Slidir	ng!	

Total Bearing Loadresultant ecc.	=	2,455 lbs 9.06 in
Soil Pressure @ Toe	=	1,128 psf OK
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	3,000 psf
Soil Pressure Less	Thar	n Allowable
ACI Factored @ Toe	=	1,580 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	18.6 psi OK
Footing Shear @ Heel	=	10.6 psi OK
Allowable	=	75.0 psi
Sliding Calcs		

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

St

Fy

tem Construction		Bottom	
		Stem OK	
Design Height Above Ftg		0.00	
Wall Material Above "Ht"	=	Concrete	
Design Method	=	LRFD	
Thickness Rebar Size	=	8.00 # 5	
	=	# 5 12.00	
Rebar Spacing Rebar Placed at	=		
Design Data	=	Edge	
fb/FB + fa/Fa	=	0.588	
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	1,792.0	
MomentActual			
Service Level	ft-#=		
Strength Level	ft-# =	4,778.7	
MomentAllowable	=	8,121.3	
ShearActual			
Service Level	psi =		
Strength Level	psi =	24.1	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	6.19	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =	100.0	
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type		Medium W	eight
Masonry Design Method	=	ASD	
Concrete Data		2 500 2	
f'c	psi =	2,500.0	

psi = 60,000.0

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1)

8'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

Dsgnr: DMR 9 SEP 2021 Description...

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 2

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.1809 in2/ft

(4/3) * As: 0 2413 in2/ft

200bd/fy: 200(12)(6.1875)/60000: 0.2475 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

Min Stem T&S Reinf Area 1.536 in2

Horizontal Reinforcing Options : One layer of : Two layers of :

#4@ 25.00 in 0.2413 in2/ft #4@ 12.50 in Required Area: Provided Area: 0.31 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8382 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	2.	.75 ft
Heel Width	=	1.	.66
Total Footing Width	=	4.	.41
Footing Thickness	=	12.	00 in
Key Width	=	0.	.00 in
Key Depth	=	0.	.00 in
Key Distance from Toe	=	0.	.00 ft
f'c = 2,500 psi	Fy =	60,0	00 psi
Footing Concrete Densit	ty =	150	.00 pcf
Min. As %	_	0.00	18
Cover @ Top 2.00	@	Btm.=	3.00 in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	1,580	0 psf
Mu' : Upward	=	56,583	49 ft-#
Mu' : Downward	=	11,571	681 ft-#
Mu: Design	=	3,751	632 ft-#
Actual 1-Way Shear	=	18.60	10.64 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#5@12.00 in	
Heel Reinforcing	=	#5@12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow, Torsion	n. p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 1.14 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

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description....

8'-0" Retaining Wall w/ Slab

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RE	SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	993.3	3.91	3,887.2
HL Act Pres (be water tbl) Hydrostatic Force	, -		,	Soil Over HL (bel. water tbl) Watre Table		3.91	3,887.2
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 =		1.38	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	800.0	3.08	2,466.7
				Earth @ Stem Transitions =			
Total =	1,417.5	O.T.M. =	4,252.5	Footing Weight =	661.5	2.21	1,458.6
				Key Weight =			
Resisting/Overturning Ra	tio	=	1.84	Vert. Component =			
Vertical Loads used for Se	oil Pressure	= 2,454.8	8 lbs	Total =	2 454 8 I	bs R.M.=	7.812.5

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.057 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number : Typical Detai

Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR
Description....
8'-0" Retaining Wall w/ Slab, w/ Seismic

Page: 1 9 SEP 2021

Date:

This Wall in File: K:\2021\01519-2 RetainPro (c) 1987-2019, Build 11.2					
License : KW-06052576 License To : SWENSON SAY FA		Cantilevered Retaini	ng V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-1
Criteria	S	Soil Data			
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	0.00 ft Ad 0.00 6.00 in 0.0 ft Sc	quivalent Fluid Pressure Methor ctive Heel Pressure = = assive Pressure =	35.0 300.0 125.00	psf/ft psf/ft pcf pcf	
	30		12.00	in	Rostrain
Surcharge Loads		ateral Load Applied to	Stem	1	Adjacent Footing Load
Surcharge Over Heel = Used To Resist Sliding & Ove Surcharge Over Toe = Used for Sliding & Overturnin Axial Load Applied to S Axial Dead Load =	erturning 0.0 ig Lo	.Height to Bottom = oad Type = Wind (Ser	vice L	evel)	Adjacent Footing Load
Axial Dead Load = Axial Live Load = Axial Load Eccentricity =		Wind on Exposed Stem = (Service Level)	0.0 p	51	at Back of Wall Poisson's Ratio = 0.300
Earth Pressure Seism	ic Load				
Method: Uniform Multiplier Used = (Multiplier used on soil density	6.000 T		.000		
Design Summary		Stem Construction		Bottom Stem OK	
Wall Stability Ratios Overturning = Slab Resists All Total Bearing Load =	2,466 lbs	Design Height Above Ftg Wall Material Above "Ht" .5! Design Method Thickness Rebar Size Rebar Spacing	ft = = = = = =	0.00 Concrete LRFD 8.00 # 5 12.00	
resultant ecc. = Soil Pressure @ Toe = Soil Pressure @ Heel =	16.40 in 1,950 psf OK 0 psf OK	Rebar Placed at Design Data fb/FB + fa/Fa	=	0.801	
Allowable = Soil Pressure Less That ACI Factored @ Toe =	4,000 psf	Total Force @ Section Service Level Strength Level	lbs = lbs =	2,224.0	
ACI Factored @ Heel = Footing Shear @ Toe = Footing Shear @ Heel =	0 psf 27.0 psi OK 12.1 psi OK	MomentActual Service Level Strength Level	ft-# = ft-# =	6,506.7	,
Allowable = Sliding Calcs Lateral Sliding Force =	75.0 psi 1,757.7 lbs	MomentAllowable ShearActual Service Level Strength Level	psi =	8,121.3	
		ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = in2 = in =	30.0 75.0 6.19	
Vertical component of active late NOT considered in the calculation		Masonry Data f'm Fs Solid Grouting Modular Ratio 'n'	psi = psi = = =		
Load Factors Building Code IE Dead Load Live Load	3C 2015,ACI 1.200 1.600	Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	psf = = = =	Medium V	
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Concrete Data f'c Fy	psi =	2,500.0 60,000.0	

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR
Description....

Horizontal Reinforcing

8'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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Concrete Stem Rebar Area Details

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.2464 in2/ft

(4/3) * As : 0.3285 in2/ft Min Stem T&S Reinf Area 1.536 in2

200bd/fy: 200(12)(6.1875)/60000: 0.2475 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 :
 0.2475 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 :
 0.8382 in2/ft
 #6@ 27.50 in
 #6@ 55.00 in

Footing Data

Toe Width	=	2.75 ft	
Heel Width	= _	1.67	
Total Footing Width	=	4.42	
Footing Thickness	=	12.00 in	
Key Width	=	0.00 in	
Key Depth	=	0.00 in	
Key Distance from Toe	=	0.00 ft	
	Fy =	60,000 ps	
Footing Concrete Densi	ty =	150.00 pc	f
Min. As %	=	0.0018	
Cover @ Top 2.00	@ E	3.00 stm.=	in

Footing Design Results

1				
			Toe	Heel
	Factored Pressure	=	2,730	0 psf
	Mu': Upward	=	79,002	0 ft-#
	Mu': Downward	=	11,571	695 ft-#
	Mu: Design	=	5,619	695 ft-#
	Actual 1-Way Shear	=	26.99	12.15 psi
	Allow 1-Way Shear	=	75.00	75.00 psi
	Toe Reinforcing	=	#5@12.00 in	· ·
	Heel Reinforcing	=	#5@12.00 in	
	Key Reinforcing	=	None Spec'd	
	Footing Torsion, Tu		=	0.00 ft-lbs
	Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area 1.15 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@ 28.70 in #6@ 20.37 in #6@ 40.74 in

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

8'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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		OV	ERTURNIN	IG		·	Б	RESISTING	
Item		Force lbs	Distance ft		Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl))	1,417.5	3.00		4,252.5	Soil Over HL (ab. water tbl)	1,003.3	3.92	3,931.4
HL Act Pres (be water tbl		, -			,	Soil Over HL (bel. water tbl)		3.92	3,931.4
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 =		1.38	
Seismic Earth Load	=	340.2	4.50		1,530.9	Surcharge Over Toe =			
	=				•	Stem Weight(s) =	800.0	3.08	2,466.7
T-1-1		4 757 7	- 0 T M		5 700 4	Earth @ Stem Transitions=			
Total	=	1,/5/./	O.T.M.	=	5,783.4	Footing Weight =	663.0	2.21	1,465.2
						Key Weight =			
Resisting/Overturning			=		36	Vert. Component =			
Vertical Loads used for	or Soi	I Pressure	= 2,46	6.3	lbs	Total =	2.466.3	lbs R.M.=	7,863.3

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.098 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Live Load

Earth, H

Wind, W

Seismic, E

1.600

1.000

1.000

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR

Page: 1 9 SEP 2021

Date:

Description....
10'-0" Retaining Wall w/ Slab

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RetainPro (c) 1987-2019, Buil License : KW-06052576 License To : SWENSON S	d 11.20.03.31 AY FAGET	Cantilevered Retaini	ng W	/all	Code: IBC 2015,A	CI 318-14,ACI 530-13
Criteria		Soil Data				
rioigni oi con ovoi roo	= 10.00 ft = 0.00 ft = 0.00 = 6.00 in = 0.0 ft	Equivalent Fluid Pressure Method Active Heel Pressure = Passive Pressure =		psf/ft psf/ft pcf	r = = = = = = = = = = = = = = = = = = =	
			12.00	in	Restraint	
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing I	_oad
Surcharge Over Heel Used To Resist Sliding Surcharge Over Toe Used for Sliding & Over Axial Load Applied Axial Dead Load	= 0.0 turning	Height to Bottom = Under the Bottom = Wind	0.0 #/f 0.00 ft 0.00 ft d (W) vice Le 0.0 ps	evel)	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil at Back of Wall	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft
Axial Live Load Axial Load Eccentricity	= 0.0 lbs = 0.0 in	(Service Level)	0.0 po		Poisson's Ratio	= 0.300
Design Summary		Stem Construction		Bottom Stem OK		
Wall Stability Ratios Overturning Slab Resis	= 1.65 OK sts All Sliding!	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness	ft = = = =	0.00 Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= 3,786 lbs = 14.21 in	Rebar Size Rebar Spacing Rebar Placed at Design Data	= =	# 7 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Les ACI Factored @ Toe	= 1,655 psf Ok = 0 psf Ok = 3,000 psf s Than Allowable = 2,316 psf	fb/FB + fa/Fa Total Force @ Section Service Level Strength Level	= lbs = lbs =	0.712 2,800.0		
ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable	= 0 psf = 18.0 psi OK = 11.7 psi OK = 75.0 psi		ft-# = ft-# = =	9,333.3 13,107.2		
Sliding Calcs Lateral Sliding Force	= 75.0 psi = 2,314.4 lbs	ShearActual Service Level Strength Level ShearAllowable	psi = psi = psi =	41.9 75.0		
		Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs	in2 = in = psi =	5.56		
Vertical component of activ		S Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type		Medium W	/eight	

Masonry Design Method

psi = 2,500.0

psi = 60,000.0

Concrete Data f'c Fy

Project Name/Number : Typical Detai

Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR

Description....

10'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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9 SEP 2021

Concrete Stem Rebar Area Details	
----------------------------------	--

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.3955 in2/ft

(4/3) * As : 0.5274 in2/ft

200bd/fy : 200(12)(5.5625)/60000 : 0.2225 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 : #4@ 12.50 in #4@ 25.00 in

Min Stem T&S Reinf Area 1.920 in2

 Required Area :
 0.3955 in2/ft
 #4@ 12.50 in
 #4@ 25.00 in

 Provided Area :
 0.6 in2/ft
 #5@ 19.38 in
 #5@ 38.75 in

 Maximum Area :
 0.7535 in2/ft
 #6@ 27.50 in
 #6@ 55.00 in

Footing Data

Toe Width	=	3.50 ft
Heel Width	=	1.92
Total Footing Width	=	5.42
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 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

1					
			<u>Toe</u>	Heel	
	Factored Pressure	=	2,316	0 psf	
	Mu' : Upward	=	126,854	6 ft-#	
	Mu' : Downward	=	25,358	1,390 ft-#	
	Mu: Design	=	8,458	1,384 ft-#	
	Actual 1-Way Shear	=	18.00	11.70 psi	
	Allow 1-Way Shear	=	75.00	75.00 psi	
	Toe Reinforcing	=	#6@13.58 in	-	
	Heel Reinforcing	=	#6@13.58 in		
	Key Reinforcing	=	None Spec'd		
	Footing Torsion, Tu		=	0.00 ft-lbs	6
	Footing Allow. Torsion	n, p	hi Tu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area 2.11 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

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR

Description....

10'-0" Retaining Wall w/ Slab

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RESISTING		
ltem	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2,314.4	3.83	8,871.8	Soil Over HL (ab. water tbl)	1,566.7	4.79	7,509.6
HL Act Pres (be water tbl) Hydrostatic Force	,-		-,-	Soil Over HL (bel. water tbl) Watre Table		4.79	7,509.6
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 =		1.75	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	1,000.0	3.83	3,833.3
				Earth @ Stem Transitions =			
Total =	2,314.4	O.T.M. =	8,871.8	Footing Weight =	1,219.5	2.71	3,304.8
				Key Weight =			
Resisting/Overturning Ra	itio	=	1.65	Vert. Component =			
Vertical Loads used for Se	oil Pressure	= 3,786.2	2 lbs	Total =	3.786.2 I	bs R.M.=	14.647.7

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.085 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Project Name/Number : Typical Detai
Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR
Description....
10'-0" Retaining Wall w/ Slab, w/ Seismic

Page: 1
Date: 9 SEP 2021

		Residence\Calcs\Typical Detail Co	0-04-07.K	PX		
stainPro (c) 1987-2019, Build cense : KW-06052576 cense To : SWENSON SA	I 11.20.03.31 AY FAGET	Cantilevered Retai	ning W	all	Code: IBC 2015,A	CI 318-14,ACI 530
Criteria		Soil Data				
Wall height above soil	= 10.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Metl Active Heel Pressure =		psf psf/ft		
	= 6.00 in = 0.0 ft	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	300.0 125.00 0.00 0.450 12.00	pcf pcf	Restand	
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing I	_oad
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt	= 0.0 turning		0.0 #/t 0.00 ft 0.00 ft lind (W)		Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Load Applied Axial Dead Load	= 0.0 lbs	(S Wind on Exposed Stem _	ervice Le 0.0 ps	vei)	Base Above/Below Soil	= 0.0 ft
	= 0.0 lbs	(Service Level)	0.0 ps		at Back of Wall Poisson's Ratio	= 0.300
Earth Pressure Sei		I				
Method: Uniform Multiplier Used: (Multiplier used on soil de	= 6.000 ensity)		69.000 93.500			
Design Summary		Stem Construction		Bottom Stem OK		
Wall Stability Ratios Overturning Slab Resist Total Bearing Loadresultant ecc. Soil Pressure @ Toe	= 1.21 Rations to All Sliding! = 3,786 lbs = 24.34 in = 3,701 psf (1)	Thickness Rebar Size Rebar Spacing Rebar Placed at Design Data	_	0.00 Concrete LRFD 8.00 # 7 12.00 Edge		
Soil Pressure @ Heel Allowable	= 0 psf 0 = 4,000 psf	OK Total Force @ Section		0.975		
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	Than Allowable = 5,182 psf = 0 psf	Service Level Strength Level MomentActual Service Level	lbs = lbs = ft-# =	3,490.0		
Footing Shear @ Toe Footing Shear @ Heel	= 25.6 psi (= 11.9 psi (OK Strength Level	ft-# =	12,783.3		
i ootiing oneai 🐷 neei						
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual Service Level	= psi =	13,107.2		
Allowable		ShearActual Service Level Strength Level	psi = psi =	52.3		
Allowable Sliding Calcs	= 75.0 psi	ShearActual Service Level Strength Level ShearAllowable	psi =			
Allowable Sliding Calcs	= 75.0 psi	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd'	psi = psi = psi =	52.3		
Allowable Sliding Calcs Lateral Sliding Force	= 75.0 psi = 2,869.8 lbs	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data fm Fs	psi = psi = psi = in = psi = psi =	52.3 75.0		
Allowable Sliding Calcs Lateral Sliding Force ertical component of active	= 75.0 psi = 2,869.8 lbs	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n'	psi = psi = psi = in2 = in = psi = psi = psi =	52.3 75.0 5.56		
Allowable Sliding Calcs Lateral Sliding Force ertical component of active DT considered in the calcu-	= 75.0 psi = 2,869.8 lbs = lateral soil pressure	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor	psi = psi = psi = in2 = in = psi = psi = psi =	52.3 75.0		
Allowable Sliding Calcs Lateral Sliding Force ertical component of active OT considered in the calcu	= 75.0 psi = 2,869.8 lbs	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data fm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick.	psi = psi = psi = in2 = in = psi = psi = psi = psi = = psf = = = = psf = = = = = = = = = = = = = psf = = = = = = = = = = = = = = = = = = =	52.3 75.0 5.56	/eight	
Allowable Sliding Calcs Lateral Sliding Force entical component of active DT considered in the calculation. Load Factors Building Code Dead Load Live Load	= 75.0 psi = 2,869.8 lbs e lateral soil pressure ulation of soil bearing IBC 2015,ACI 1.200 1.600	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor	psi = psi = psi = in2 = in = psi = psi = psi = psf = = = = = = = = = = = = = = = = = = =	52.3 75.0 5.56	/eight	
Allowable Sliding Calcs Lateral Sliding Force ertical component of active OT considered in the calcu- coad Factors Building Code Dead Load	= 75.0 psi = 2,869.8 lbs e lateral soil pressure ulation of soil bearing IBC 2015,ACI 1.200	ShearActual Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type	psi = psi = psi = in2 = in = psi = psi = psi = psf = = = = = = = = = = = = = = = = = = =	52.3 75.0 5.56 100.0 Medium V	/eight	

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Horizontal Reinforcing

Description...

10'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete S	tem Rebar	Area Details
------------	-----------	--------------

Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.5417 in2/ft

(4/3) * As: 0.7223 in2/ft

Min Stem T&S Reinf Area 1.920 in2 200bd/fy: 200(12)(5.5625)/60000: 0.2225 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0018bh: 0.0018(12)(8): Horizontal Reinforcing Options : 0.1728 in2/ft One layer of : Two layers of :

0.5417 in2/ft #4@ 12.50 in #4@ 25.00 in Required Area: Provided Area: 0.6 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.7535 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	3.50 ft
Heel Width	=	1.92
Total Footing Width	= '	5.42
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi		60,000 psi
Footing Concrete Densi	ty =	150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@	Btm.= 3.00 in

Footing Design Results

			_	
		<u>Toe</u>	Heel	
Factored Pressure	=	5,182	0 psf	
Mu' : Upward	=	179,247	0 ft-#	
Mu' : Downward	=	25,358	1,390 ft-#	
Mu: Design	=	12,824	1,390 ft-#	
Actual 1-Way Shear	=	25.59	11.93 psi	
Allow 1-Way Shear	=	75.00	75.00 psi	
Toe Reinforcing	=	#6@13.58 in	•	
Heel Reinforcing	=	#6@13.58 in		
Key Reinforcing	=	None Spec'd		
Footing Torsion, Tu		=	0.00 ft-lbs	
Footing Allow. Torsion	n, p	hi Tu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 2.11 in2 /ft 0.39

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

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

10'-0" Retaining Wall w/ Slab, w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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		OV	ERTURN	IING		·		R	ESISTING	
Item		bs	Distanc ft	е	Moment ft-#			Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	2	,314.4	3.83	3	8,871.8	Soil Over HL (ab. wat	er tbl)	1,566.7	4.79	7,509.6
HL Act Pres (be water tbl)		, -			-,-	Soil Over HL (bel. wa	ter tbl)		4.79	7,509.6
Hydrostatic Force						Watre Table				
Buoyant Force	=					Sloped Soil Over Hee	=			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	_					Adjacent Footing Load	d =			
Adjacent Footing Load	=					Axial Dead Load on S	tem =			
Added Lateral Load	=					* Axial Live Load on Sto	em =			
Load @ Stem Above Soil	=					Soil Over Toe	=		1.75	
Seismic Earth Load	=	555.5	5.75	5	3,193.8	Surcharge Over Toe	=			
	=				.,	Stem Weight(s)	=	1,000.0	3.83	3,833.3
T-1-1		000.0	- O T M	_	40.005.0	Earth @ Stem Transit	ions=			
Total	= 2	,869.8	O.T.M.	=	12,065.6	Footing Weight	=	1,219.5	2.71	3,304.8
						Key Weight	=			
Resisting/Overturning			=		1.21	Vert. Component	=			
Vertical Loads used fo	r Soil Pre	essure :	= 3,7	786.2	2 lbs	Т	otal =	3,786.2	lbs R.M.=	14.647.7

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

250.0 pci Soil Spring Reaction Modulus Horizontal Defl @ Top of Wall (approximate only) 0.190 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

12'-0" Retaining Wall w/ Slab

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•		

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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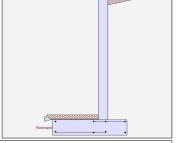
C	ш	He

Retained Height	=	12.00 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	=	3,000.0	psf
Equivalent Fluid Pressure	Meth	nod	
Active Heel Pressure	=	35.0	psf/ft
	=		
Passive Pressure	=	300.0	psf/ft
Soil Density, Heel	=	125.00	pcf

0.00 pcf Soil Density, Toe Footing||Soil Friction 0.450 Soil height to ignore for passive pressure 12.00 in



Surcharge Loads

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load	=	0.0 #/ft
Height to Top	=	0.00 ft
Height to Bottom	=	0.00 ft
Load Type	=	Wind (W)
		(Service Level)

Wind on Exposed Stem = 0.0 psf (Service Level)

Concrete Data

f'c

Fy

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Sliding Calcs Lateral Sliding Force

Wind, W

Seismic, E

Wall Stability	Ratios			
Overturning		=	1.78	Ok
	Slab Resists	All Slidir	ng!	

Total Bearing Loadresultant ecc.	= =	5,463 lbs 14.41 in
Soil Pressure @ Toe Soil Pressure @ Heel	=	1,777 psf OK 0 psf OK
Allowable Soil Pressure Less	= Than	3,000 psf
ACI Factored @ Toe ACI Factored @ Heel	=	2,488 psf 0 psf
Footing Shear @ Toe	=	24.9 psi OK
Footing Shear @ Heel Allowable	=	16.7 psi OK 75.0 psi

3,189.4 lbs

1.000

1.000

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600

Stem Construction	\mathbb{T}_{-}	Bottom	
B : 11:1:44		Stem OK	
Design Height Above Ftg		0.00	
Wall Material Above "Ht"	=	Concrete	
Design Method	=	LRFD	
Thickness	=	10.00	
Rebar Size	=	# 7 8.00	
Rebar Spacing	=		
Rebar Placed at Design Data	=	Edge	
fb/FB + fa/Fa	=	0.612	
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	4,032.0	
MomentActual			
Service Level	ft-# =		
Strength Level	ft-# =	16,128.0	
MomentAllowable	=	26,327.0	
ShearActual			
Service Level	psi =		
Strength Level	psi =	44.4	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	7.56	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =	125.0	
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type	=	Medium Wei	ight
Masonry Design Method	=	ASD	

2,500.0

psi = 60,000.0

Project Name/Number: Typical Detai

Title Typ. Retaining Wall (8/S3.1) Dsgnr: DMR

Description...

12'-0" Retaining Wall w/ Slab

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.4948 in2/ft

(4/3) * As: 0.6597 in2/ft

Min Stem T&S Reinf Area 2.880 in2 200bd/fy: 200(12)(7.5625)/60000: 0.3025 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.240 in2/ft

0.0018bh: 0.0018(12)(10): Horizontal Reinforcing Options : 0.216 in2/ft One layer of : Two layers of :

0.4948 in2/ft #4@ 10.00 in #4@ 20.00 in Required Area: Provided Area: 0.9 in2/ft #5@ 15.50 in #5@ 31.00 in Maximum Area: 1.0245 in2/ft #6@ 22.00 in #6@ 44.00 in

Footing Data

Toe Width	=	4.00 ft
Heel Width	=	2.50
Total Footing Width	= -	6.50
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi Footing Concrete Densit		60,000 psi 150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@ E	3.00 in

Footing Design Results

	_		
		<u>Toe</u>	Heel
Factored Pressure	=	2,488	0 psf
Mu' : Upward	=	187,056	153 ft-#
Mu' : Downward	=	33,120	2,875 ft-#
Mu: Design	=	12,828	2,722 ft-#
Actual 1-Way Shear	=	24.92	16.67 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#6@12.00 in	
Heel Reinforcing	=	#6@12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow, Torsio	n, p	hi Tu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 2.53 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

Project Name/Number : Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description....

12'-0" Retaining Wall w/ Slab

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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	OV	ERTURNING			RESISTING		
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,189.4	4.50	14,352.2	Soil Over HL (ab. water tbl)	2,500.0	5.67	14,166.7
HL Act Pres (be water tbl)	,		,	Soil Over HL (bel. water tbl)		5.67	14,166.7
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 =		2.00	
=				Surcharge Over Toe =			
				Stem Weight(s) =	1,500.0	4.42	6,625.0
—	0.400.4		110500	Earth @ Stem Transitions =			
Total =	3,189.4	O.T.M. =	14,352.2	Footing Weight =	1,462.5	3.25	4,753.1
				Key Weight =			
Resisting/Overturning Ra		=	1.78	Vert. Component =			
Vertical Loads used for So	oil Pressure	= 5,462.5	5 lbs	Total =	5,462.5 I	bs R.M.=	25,544.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.091 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number : Typical Detai

Title Typ. Retaining Wall (8/S3.1)
Dsgnr: DMR
Description....
12'-0" Retaining Wall w/ Slab w/ Seismic

Page: 1 9 SEP 2021

Date:

is Wall in File: K:\2021\015	19-2021-06 Huber P	esidence\Calcs\Typical Detail Co-	14-07 P	PX		
tainPro (c) 1987-2019, Build cense : KW-06052576 cense To : SWENSON SA	11.20.03.31	Cantilevered Retain			Code: IBC 2015,ACI 3	18-14,ACI 530-
Criteria		Soil Data				
Retained Height = Wall height above soil = Slope Behind Wall =	12.00 ft 0.00 ft 0.00	Allow Soil Bearing = Equivalent Fluid Pressure Metho Active Heel Pressure =		psf psf/ft		
Height of Soil over Toe = Water height over heel =	6.00 in 0.0 ft	Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	300.0 125.00 0.00 0.450 12.00	pcf pcf	Gentrale	
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing Load	
Surcharge Over Heel = Used To Resist Sliding & Surcharge Over Toe = Used for Sliding & Overtu	0.0 rning	Lateral Load =Height to Top =Height to Bottom = Load Type = Wir	0.0 #/ 0.00 ft 0.00 ft ad (W)		Adjacent Footing Load = Footing Width = Eccentricity = Wall to Ftg CL Dist = Footing Type	0.0 lbs 0.00 ft 0.00 in 0.00 ft Line Load
Axial Load Applied t Axial Dead Load =		,	rvice Le 0.0 ps	evei)	Base Above/Below Soil	0.0 ft
Axial Live Load = Axial Load Eccentricity =	0.0 lbs	Wind on Exposed Stem = (Service Level)	υ.υ ρε		at Back of Wall Poisson's Ratio =	0.300
Earth Pressure Seis						
Method: Uniform Multiplier Used = (Multiplier used on soil der	6.000 nsity)	Total Seismic Force = 1,09		Bottom		
Design Summary		Stem Construction Design Height Above Ft		Stem OK		
Wall Stability Ratios Overturning Slab Resists Total Bearing Loadresultant ecc.	= 1.31 Ratio All Sliding! = 5,463 lbs = 25.76 in	Wall Material Above "Ht		0.00 Concrete LRFD 10.00 # 7 8.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel	= 3,301 psf C = 0 psf C	Design Data K fb/FB + fa/Fa	=	0.834		
Allowable Soil Pressure Less	= 4,000 psf	Total Force @ Section Service Level	lbs=			
ACI Factored @ Toe ACI Factored @ Heel	= 4,622 psf = 0 psf	Strength Level MomentActual Service Level	lbs =	5,004.0		
Footing Shear @ Toe Footing Shear @ Heel	= 36.9 psi O = 18.5 psi O	N Strength Level	ft-# =	21,960.0		
Allowable Sliding Calcs	= 75.0 psi	MomentAllowable ShearActual	=	26,327.0		
•						
Lateral Sliding Force	= 3,954.8 lbs	Service Level Strength Level	psi = psi =	55.1		
-	= 3,954.8 lbs	Service Level Strength Level ShearAllowable	psi = psi =	55.1 75.0		
-	= 3,954.8 lbs	Service Level Strength Level ShearAllowable Anet (Masonry)	psi =	75.0		
-	= 3,954.8 lbs	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data	psi = psi = in2 = in =			
-	= 3,954.8 lbs	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs	psi = psi = in2 =	75.0		
Lateral Sliding Force	lateral soil pressure	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n'	psi = psi = in2 = in = psi = psi = = = = = = =	75.0 7.56		
Lateral Sliding Force ertical component of active OT considered in the calcul	lateral soil pressure ation of soil bearing	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor	psi = psi = in2 = in = psi = psi = psf = = = = = = = = = = = = psf	75.0		
Lateral Sliding Force ertical component of active OT considered in the calcul	lateral soil pressure	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs IS Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick.	psi = psi = in2 = in = psi = psi = psf = = = = = = = = = = = = = = = = = = =	75.0 7.56	/eiaht	
ertical component of active OT considered in the calcul Load Factors Building Code Dead Load Live Load	lateral soil pressure ation of soil bearing IBC 2015,ACI 1.200 1.600	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs IS Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	psi = psi = in2 = in = psi = psi = psi = psf = = = = = = = = = = = = = = = = = = =	75.0 7.56	/eight	
ertical component of active OT considered in the calcul Load Factors Building Code Dead Load	lateral soil pressure ation of soil bearing IBC 2015,ACI 1.200	Service Level Strength Level ShearAllowable Anet (Masonry) Rebar Depth 'd' Masonry Data f'm Fs IS Solid Grouting Modular Ratio 'n' Wall Weight Short Term Factor Equiv. Solid Thick. Masonry Block Type	psi = psi = in2 = in = psi = psi = psi = psf = = = = = = = = = = = = = = = = = = =	75.0 7.56 125.0 Medium V	/eight	

Project Name/Number : Typical Detai

Title Typ. Retaining Wall (8/S3.1)

Horizontal Reinforcing

Dsgnr: DMR Description....

12'-0" Retaining Wall w/ Slab w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete	Stem	Rebar	Area	Details
----------	------	-------	------	---------

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.6737 in2/ft

(4/3) * As : 0.8982 in2/ft Min Stem T&S Reinf Area 2.880 in2

200bd/fy: 200(12)(7.5625)/60000: 0.3025 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 :
 0.6737 in2/ft
 #4@ 10.00 in
 #4@ 20.00 in

 Provided Area :
 0.9 in2/ft
 #5@ 15.50 in
 #5@ 31.00 in

 Maximum Area :
 1.0245 in2/ft
 #6@ 22.00 in
 #6@ 44.00 in

Footing Data

Toe Width	=	4	.00 ft
Heel Width	=	2	.50
Total Footing Width	= -	6	.50
Footing Thickness	=	18.	00 in
Key Width	=	0.	.00 in
Key Depth	=	0.	.00 in
Key Distance from Toe	=	0.	.00 ft
f'c = 2,500 psi	Fy =		00 psi
Footing Concrete Densit	ty =	150	.00 pcf
Min. As %	=	0.00	18
Cover @ Top 2.00	@	3tm.=	3.00 in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	4,622	0 psf
Mu': Upward	=	265,846	0 ft-#
Mu': Downward	=	33,120	2,875 ft-#
Mu: Design	=	19,394	2,875 ft-#
Actual 1-Way Shear	=	36.94	18.55 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#6@12.00 in	
Heel Reinforcing	=	#6@12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 5.92 in, #5@ 9.18 in, #6@ 13.03 in, #7@ 17.76 in, #8@ 23.39 in, #9@ 29. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area 2.53 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

Project Name/Number: Typical Detai Title Typ. Retaining Wall (8/S3.1)

Dsgnr: DMR Description...

12'-0" Retaining Wall w/ Slab w/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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9 SEP 2021

		OV	ERTURN	NG		·		R	ESISTING	
Item	F	orce lbs	Distance ft	•	Moment ft-#			Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		3,189.4	4.50		14,352.2	Soil Over HL (ab. wa	ter tbl)	2,500.0	5.67	14,166.7
HL Act Pres (be water tbl)		-,			,	Soil Over HL (bel. wa	ater tbl)		5.67	14,166.7
Hydrostatic Force						Watre Table				
Buoyant Force	=					Sloped Soil Over Hee	el =			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	=					Adjacent Footing Loa	d =			
Adjacent Footing Load	=					Axial Dead Load on S	Stem =			
Added Lateral Load	=					* Axial Live Load on St	em =			
Load @ Stem Above Soil	=					Soil Over Toe	=		2.00	
Seismic Earth Load	=	765.5	6.75		5,166.8	Surcharge Over Toe	=			
	=				-,	Stem Weight(s)	=	1,500.0	4.42	6,625.0
T-1-1		0.054.0	- O T M	_	40.540.0	Earth @ Stem Transi	tions=			
Total	=	3,954.8	O.T.M.	=	19,519.0	Footing Weight	=	1,462.5	3.25	4,753.1
						Key Weight	=			
Resisting/Overturning			=		.31	Vert. Component	=			
Vertical Loads used fo	r Soil P	ressure :	= 5,4	62.5	lbs	-	Γotal =	5.462.5	lbs R.M.=	25,544.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

250.0 pci Soil Spring Reaction Modulus Horizontal Defl @ Top of Wall (approximate only) 0.169 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Description... 3'-0" Retaining Wall

Page: 1 Dsgnr: DMR Date: 9 SEP 2021

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0.14	-

Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

u	I	П	Œ	:1	lė	1

Retained Height	=	3.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0 0 ft

Soil Data

Allow Soil Bearing	=	3,000.0 psf
Equivalent Fluid Pressure	Meth	od
Active Heel Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	300.0 psf/ft
Soil Density, Heel	=	125.00 pcf
Soil Density, Toe	=	0.00 pcf
Footing Soil Friction	=	0.500
Soil height to ignore		
for passive pressure	=	12.00 in

Surcharge Loads

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

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 = 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios Overturning Sliding	=		1.87 1.52		
Total Bearing Loadresultant ecc.	=		605 4.03		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe Footing Shear @ Heel Allowable	= = = =	an Al	3,000 lowable 1,370 0	psf psf e psf psf psi psi	OK OK
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'dfor 1.5 Stability		-	235.3 54.2 302.3 0.0	lbs lbs lbs lbs	OK OK

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

Ste

Fy

em Construction		Bottom	
		Stem OK	
Design Height Above Ftg	ft =	0.00	
Wall Material Above "Ht"	=	Concrete	
Design Method	=	LRFD	
Thickness	=	8.00	
Rebar Size	=	# 4	
Rebar Spacing	=	18.00	
Rebar Placed at Design Data	=	Edge	
fb/FB + fa/Fa	_	0.068	
Total Force @ Section	_	0.000	
Service Level	lbs =		
Strength Level	lbs =	252.0	
MomentActual	103 –	232.0	
Service Level	ft-# =		
Strength Level	ft-# =	252.0	
MomentAllowable	=	3.655.6	
ShearActual	=	3,055.0	
Service Level	psi =		
Strength Level	psi =	3.4	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	6.25	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	_=	400.0	
Wall Weight	psf =	100.0	
Short Term Factor	=		
Equiv. Solid Thick.	=	Madium 14/	alada
Masonry Block Type		Medium W	eignt
Masonry Design Method	=	ASD	
Concrete Data f'c	psi =	2,500.0	
1 C	psi =	2,500.0	

psi = 60,000.0

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Two layers of :

Dsgnr: DMR Description... 3'-0" Retaining Wall

Horizontal Reinforcing

Page: 2 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0094 in2/ft

(4/3) * As: 0.0126 in2/ft

Min Stem T&S Reinf Area 0.576 in2 200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft

Horizontal Reinforcing Options : One layer of : 0.1152 in2/ft

#4@ 25.00 in #4@ 12.50 in Required Area: Provided Area: 0.1333 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	= 0.42 ft
Heel Width	= 1.08
Total Footing Width	= 1.50
Footing Thickness	= 8.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from T	oe = 0.00 ft
f'c = 2,500 psi	
Footing Concrete De	ensity = 150.00 pcf
Min. As %	= 0.0018
Cover @ Top 2.	.00 @ Btm.= 3.00 in

Footing Design Results

	_		
		<u>Toe</u>	Heel
Factored Pressure	=	1,370	0 psf
Mu' : Upward	=	1,263	1 ft-#
Mu' : Downward	=	202	49 ft-#
Mu: Design	=	88	48 ft-#
Actual 1-Way Shear	=	0.64	3.09 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	•
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi/5'lambda'sqrt(fc)'Sm Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.26 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
3'-0" Retaining Wall

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RE	SISTING	
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	235.3	1.22	287.6	Soil Over HL (ab. water tbl)	155.0	1.29	199.8
HL Act Pres (be water tbl)				Soil Over HL (bel. water tbl) Watre Table		1.29	199.8
Hydrostatic Force 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 =		0.21	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	300.0	0.75	224.8
				Earth @ Stem Transitions =			
Total =	235.3	O.T.M. =	287.6	Footing Weight =	149.6	0.75	111.9
				Key Weight =			
Resisting/Overturning Ra	itio	=	1.87	Vert. Component =			
Vertical Loads used for Se	oil Pressure	= 604.6	6 lbs	Total =	604.6	bs R.M.=	536.5

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.055 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number : Typical Detai Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR
Description....
3'-0" Retaining Wall W/Seismic

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Date: 9 SEP 2021

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		esidence\Calcs\Typical Detail Co-0	4-06.R	PX		
RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON SA	111.20.03.31 AY FAGET	Cantilevered Retaini	ng W	/all	Code: IBC 2015,AC	CI 318-14,ACI 530-13
Criteria		Soil Data				
Retained Height = Wall height above soil = Slope Behind Wall = Height of Soil over Toe = Water height over heel =	= 0.00 ft = 0.00 = 6.00 in	Equivalent Fluid Pressure Metho Active Heel Pressure = Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction =		psf/ft psf/ft pcf		
		Soil height to ignore for passive pressure =	12.00	in _		
Surcharge Loads		Lateral Load Applied to	Stem	Α	djacent Footing Lo	oad
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overtte Axial Load Applied	= 0.0 urning	Height to Bottom = Load Type = Win	0.0 #/f 0.00 ft 0.00 ft d (W) vice Le	FC Ec W evel) FC	ooting Width ccentricity all to Ftg CL Dist ooting Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind on Exposed Stem = (Service Level)	0.0 ps	sf	at Back of Wall	= 0.0 ft = 0.300
Earth Pressure Sei	ismic Load					
Method: Uniform Multiplier Used (Multiplier used on soil de	= 6.000 ensity)		2.000 0.667			
Design Summary		Stem Construction		Bottom		
Wall Stability Ratios Overturning Sliding	= 1.37 Ratio = 1.22 Ratio		ft = = = =	Stem OK 0.00 Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= 605 lbs = 6.09 in	Rebar Size Rebar Spacing Rebar Placed at Design Data	= =	# 4 18.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 1,675 psf C = 0 psf C = 4,000 psf Than Allowable	fb/FB + fa/Fa Total Force @ Section Service Level	= lbs =	0.096		
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= 2,345 psf = 0 psf = 1.2 psi C	Strength Level MomentActual Service Level	lbs = ft-# =	318.0		
Footing Shear @ Heel Allowable Sliding Calcs	= 3.3 psi C = 75.0 psi	Strength Level	ft-# = =	351.0 3,655.6		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force	e = - 302.3 lbs	Service Level Strength Level ShearAllowable	psi = psi = psi =	4.2 75.0		
Added Force Req'dfor 1.5 Stability	= 0.0 lbs C = 81.2 lbs N		in2 = in = psi =	6.25		
Vertical component of active NOT considered in the calculation		Fs IS Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = = psf =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	· = = =	Medium We ASD	ight	
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Concrete Data f'c Fy	psi = psi =	2,500.0 60,000.0		

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Min Stem T&S Reinf Area 0.576 in2

Two layers of :

Dsgnr: DMR Description...

3'-0" Retaining Wall W/Seismic

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

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Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0132 in2/ft

(4/3) * As: 0.0175 in2/ft

200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft Horizontal Reinforcing Options : One layer of :

#4@ 25.00 in 0.1152 in2/ft #4@ 12.50 in Required Area: Provided Area: 0.1333 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	0.42 ft
Heel Width	=	1.08
Total Footing Wid	Jth =	1.50
Footing Thicknes	S =	8.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from	m Toe =	0.00 ft
f'c = 2,500 Footing Concrete Min. As % Cover @ Top	Density = =	60,000 psi 150.00 pcf 0.0018 Btm.= 3.00 in

Footing Design Results

		10000	
		Toe	Heel
Factored Pressure	=	2,345	0 psf
Mu' : Upward	=	1,967	0 ft-#
Mu' : Downward	=	202	49 ft-#
Mu: Design	=	147	49 ft-#
Actual 1-Way Shear	=	1.17	3.27 psi
Allow 1-Way Shear	=	40.00	40.00 psi
Toe Reinforcing	=	None Spec'd	
Heel Reinforcing	=	None Spec'd	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: phiMn = phi'5'lambda'sqrt(fc)'Sm Heel: phiMn = phi'5'lambda'sqrt(fc)'Sm

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.26 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

3'-0" Retaining Wall W/Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

		ov	ERTURNI	NG		<u> </u>		RESISTING		
Item		Force lbs	Distance ft	•	Moment ft-#	_		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)		235.3	1.22		287.6	Soil Over HL (ab. water	er tbl)	155.0	1.29	199.8
HL Act Pres (be water tbl)						Soil Over HL (bel. wat	er tbl)		1.29	199.8
Hydrostatic Force						Watre Table				
, -	=					Sloped Soil Over Heel	=			
Surcharge over Heel	=					Surcharge Over Heel	=			
Surcharge Over Toe	=					Adjacent Footing Load	=			
	=					Axial Dead Load on St	iem =			
Added Lateral Load	=					* Axial Live Load on Ste	m =			
Load @ Stem Above Soil	=					Soil Over Toe	=		0.21	
Seismic Earth Load	=	56.5	1.83		103.5	Surcharge Over Toe	=			
	=					Stem Weight(s)	=	300.0	0.75	224.8
-				_		Earth @ Stem Transiti	ons=			
Total	=	291.7	O.T.M.	=	391.1	Footing Weight	=	149.6	0.75	111.9
						Key Weight	=			
Resisting/Overturning			=	-	.37	Vert. Component	=			
Vertical Loads used for	r Soil	Pressure :	= 6	04.6	lbs	Te	otal =	604.6	lbs R.M.=	536.5

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.093 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Building Code

Dead Load

Live Load

Earth. H

Wind, W

Seismic, E

IBC 2012,ACI

1.200

1.600

1.600

1.000

1.000

Project Name/Number : Typical Detai Title Site Retaining Wall (12/S3.3)

Page: 1

Date:

9 SEP 2021

Dsgnr: DMR
Description....
4'-0" Retaining Wall

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Equiv. Solid Thick.

Concrete Data

f'c

Fy

Masonry Block Type

Masonry Design Method

= Medium Weight

2,500.0

60,000.0

psi =

Project Name/Number: Typical Detai

Min Stem T&S Reinf Area 0.768 in2

Horizontal Reinforcing Options :

Dsgnr: DMR Description... 4'-0" Retaining Wall

Horizontal Reinforcing

Title Site Retaining Wall (12/S3.3) Page: 2 9 SEP 2021

Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

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Cantilevered Retaining Wall

Code: IBC 2012,ACI 318-11,ACI 530-11

Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.0224 in2/ft

0.0298 in2/ft

(4/3) * As: 200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft

0.0012bh: 0.0012(12)(8): 0.1152 in2/ft

0.1152 in2/ft Required Area: Provided Area: 0.1333 in2/ft Maximum Area:

One layer of : Two layers of : #4@ 12.50 in #4@ 25.00 in #5@ 19.38 in #5@ 38.75 in 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	0.42 ft
Heel Width	=	1.67
Total Footing Width	= -	2.09
Footing Thickness	=	8.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi Footing Concrete Densit Min. As % Cover @ Top 2.00	y = =	60,000 psi 150.00 pcf 0.0018 8tm.= 3.00 in

Footing Design Results

. coming book	,	1000	_
		<u>Toe</u>	Heel
Factored Pressure	=	1,600	0 psf
Mu': Upward	=	1,542	88 ft-#
Mu': Downward	=	202	362 ft-#
Mu: Design	=	112	275 ft-#
Actual 1-Way Shear	=	1.03	6.32 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 4 @ 12.00 in	
Heel Reinforcing	=	# 4 @ 12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6 Heel: #4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.36 0.17 in2 /ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
4'-0" Retaining Wall

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2012,ACI 318-11,ACI 530-11

	0\	ERTURNING			RE	SISTING	
ltem	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	381.1	1.56	592.8	Soil Over HL (ab. water tbl)	501.7	1.58	794.8
HL Act Pres (be water tbl) Hydrostatic Force				Soil Over HL (bel. water tbl) Watre Table		1.58	794.8
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 =		0.21	
=				Surcharge Over Toe =			
				Stem Weight(s) =	400.0	0.75	299.7
				Earth @ Stem Transitions =			
Total =	381.1	O.T.M. =	592.8	Footing Weight =	208.6	1.04	217.6
				Key Weight =			
Resisting/Overturning Ra	itio	=	2.21	Vert. Component =			
Vertical Loads used for S	oil Pressure	= 1,110.3	3 lbs	Total =	1.110.3 I	bs R.M.=	1.312.1

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.061 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Project Name/Number : Typical Detai

Page: 1 9 SEP 2021

Date:

Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR
Description....
4'-0" Retaining Wall W/ Seismic

		sidence\Calcs\Typical Detail Co-0	4-06.R	PX		
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Criteria		Soil Data				
Wall height above soil	= 0.00 = 6.00 in	Allow Soil Bearing = 4 Equivalent Fluid Pressure Methor Active Heel Pressure = Passive Pressure =		psf/ft		
Trace Hought over Hoos	- 0.011	Soil Density, Toe = Footing Soil Friction = Soil height to ignore	125.00 0.00 0.500 12.00	pcf	:	•
Surcharge Loads		Lateral Load Applied to	Stem		Adjacent Footing	_oad
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overt Axial Load Applied	= 0.0 urning	Height to Bottom = Load Type = Wine	0.0 #/ 0.00 ft 0.00 ft d (W)	 [\	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
Axial Dead Load	= 0.0 lbs = 0.0 lbs	Wind on Exposed Stem = (Service Level)	0.0 ps	sf I	Base Above/Below Soil at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Earth Pressure Sei Method : Uniform Multiplier Used (Multiplier used on soil de	= 6.000		3.000).667			
Design Summary		Stem Construction	<u> </u>	Stem OK		
Wall Stability Ratios Overturning Sliding	= 1.63 OK = 1.29 Ratio <	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size	= =	0.00 Concrete LRFD 8.00 # 4		
Total Bearing Loadresultant ecc.	= 1,110 lbs = 7.05 in	Rebai Size Rebar Spacing Rebar Placed at Design Data	= =	18.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 1,625 psf Oh = 0 psf Oh = 4,000 psf Than Allowable	fh/FB + fa/Fa	= lbs =	0.224		
ACI Factored @ Toe ACI Factored @ Heel	= 2,274 psf = 0 psf	Strength Level MomentActual Service Level	lbs = ft-# =	560.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 1.5 psi Ok = 9.9 psi Ok = 75.0 psi	Strength Level	ft-# = =	821.3 3,655.6		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= - 555.1 lbs	Service Level Strength Level ShearAllowable	psi = psi = psi =	7.5 75.0		
Added Force Req'dfor 1.5 Stability	= 0.0 lbs Ok = 99.6 lbs NC	- (),	in2 = in = psi =	6.25		
Vertical component of active NOT considered in the calculation		Fs	psi = = = = = = = = = = = = = = = = = = =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	· = = =	Medium W	eight // eight	
Earth, H Wind, W Seismic, E	1.600 1.000 1.000	Concrete Data f'c Fy	psi = psi =	2,500.0 60,000.0		

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR

Description...

4'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.0308 in2/ft

(4/3) * As: 0.041 in2/ft

200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft

0.0012bh: 0.0012(12)(8):

0.1152 in2/ft

0.1152 in2/ft

0.1333 in2/ft

0.8467 in2/ft

Min Stem T&S Reinf Area 0.768 in2

Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

Horizontal Reinforcing Options : One layer of : Two layers of :

#4@ 12.50 in #4@ 25.00 in #5@ 19.38 in #5@ 38.75 in #6@ 27.50 in #6@ 55.00 in

Horizontal Reinforcing

Maximum Area: **Footing Data**

Required Area: Provided Area:

Toe Width		=	0	.42 ft	
Heel Width		=	1	.67	
Total Footing	Width	=	2	.09	
Footing Thick	ness	=	8.	.00 in	
Key Width		=	0.	.00 in	
Key Depth		=	0.	.00 in	
Key Distance	from Toe	=	0.	.00 ft	
	500 psi	Fy =		00 psi	
Footing Conc	rete Densit	y =	150	.00 pcf	
Min. As %		=	0.00	18	
Cover @ Top	2.00	@	Btm.=	3.00 i	in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	2,274	0 psf
Mu' : Upward	=	2,122	6 ft-#
Mu' : Downward	=	202	362 ft-#
Mu: Design	=	160	356 ft-#
Actual 1-Way Shear	=	1.53	9.93 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#4@12.00 in	
Heel Reinforcing	=	# 4 @ 12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsion	ո, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6 Heel: #4@ 13.88 in, #5@ 21.52 in, #6@ 30.55 in, #7@ 41.66 in, #8@ 54.86 in, #9@ 6

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.36 in2 in2 /ft 0.17

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 13.89 in #4@ 27.78 in #5@ 43.06 in #5@ 21.53 in #6@ 30.56 in #6@ 61.11 in

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

4'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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	OVERTURNING				RESISTING			
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water th	ol)	381.1	1.56	592.8	Soil Over HL (ab. water tbl)	501.7	1.58	794.8
HL Act Pres (be water th	,				Soil Over HL (bel. water tbl)		1.58	794.8
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 So	il =				Soil Over Toe =		0.21	
Seismic Earth Load	=	91.5	2.33	213.4	Surcharge Over Toe =			
	=				Stem Weight(s) =	400.0	0.75	299.7
		470.0	-		Earth @ Stem Transitions =			
Total	=	472.6	O.T.M. =	806.3	Footing Weight =	208.6	1.04	217.6
					Key Weight =			
Resisting/Overturning	•		=	1.63	Vert. Component =			
Vertical Loads used	or So	il Pressure	= 1,110	.3 lbs	Total =	1,110.3	bs R.M.=	1,312.1

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.087 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Live Load

Earth, H

Wind, W

Seismic, E

1.600

1.600

1.000

1.000

Project Name/Number : Typical Detai Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR

Page: 1 9 SEP 2021

Date:

Description....
6'-0" Retaining Wall

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Criteria		Soil Data				
Retained Height = Wall height above soil = Slope Behind Wall =	= 0.00	Allow Soil Bearing Equivalent Fluid Pressi Active Heel Pressure	= 35.0) psf) psf/ft		
Height of Soil over Toe = Water height over heel =		Passive Pressure Soil Density, Heel Soil Density, Toe Footing Soil Friction Soil height to ignore for passive pressure	= 125.00 = 0.00 = 0.500	pcf		
Surcharge Loads		Lateral Load App	olied to Stem	1	Adjacent Footing	Load
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overtt Axial Load Applied	= 0.0 urning	Lateral LoadHeight to TopHeight to Bottom Load Type	= 0.0 # = 0.00 ft = 0.00 ft = Wind (W) (Service Lo	evel)	Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type Base Above/Below Soil	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
	= 0.0 lbs = 0.0 lbs = 0.0 in	Wind on Exposed Ste (Service Level)	em ₌ 0.0 p	sf	at Back of Wall Poisson's Ratio	= 0.0 ft = 0.300
Design Summary		Stem Construct	ion _	Bottom Stem OK		
Wall Stability Ratios Overturning Sliding	= 2.63 OK = 1.80 OK	Design Height A Wall Material A Design Method Thickness Rebar Size	Above "Ht" =	0.00 Concrete LRFD 8.00 # 4		
Total Bearing Loadresultant ecc.	= 2,708 lbs = 6.62 in	Rebar Spacing Rebar Placed a Design Data —		12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable	= 1,614 psf = 8 psf = 3,000 psf	OK fb/FB + fa/Fa		0.367		
Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= 2,259 psf = 11 psf	Strength Lev MomentAct Service Lev	ual	1,008.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 0.4 psi (= 7.0 psi (= 94.9 psi	Strongth La	owable =	2,016.0 5,492.3		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force		Service Lev Strength Le ShearAllow	vel psi=	13.4 94.9		
Added Force Req'dfor 1.5 Stability	= 0.0 lbs = 0.0 lbs	,	*	6.25		
Vertical component of active NOT considered in the calculation		e IS Solid Grouting	. =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factorial Short Term Factorial Short	ctor = nick. = Type =	Medium W	/eight	

Masonry Design Method

4,000.0

psi = 60,000.0

Concrete Data f'c Fy

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
6'-0" Retaining Wall

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 2

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Concrete Stem Rebar Area Details

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.0755 in2/ft

(4/3) * As : 0.1007 in2/ft Min Stem T&S Reinf Area 1.152 in2

 $\begin{array}{lll} \text{0.0018bh}: \text{0.0018(12)(8)}: & \text{0.1728 in2/ft} & \text{Horizontal Reinforcing Options}: \\ & ========= & \text{One layer of}: & \text{Two layers of}: \end{array}$

 Required Area :
 0.1728 in2/ft
 #4@ 12.50 in
 #4@ 25.00 in

 Provided Area :
 0.2 in2/ft
 #5@ 19.38 in
 #5@ 38.75 in

 Maximum Area :
 1.3547 in2/ft
 #6@ 27.50 in
 #6@ 55.00 in

Footing Data

Toe Width	= 0.42 ft
Heel Width	= 2.92
Total Footing Width	= 3.34
Footing Thickness	= 10.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from Toe	e = 0.00 ft
	Fy = 60,000 psi
Footing Concrete Dens	sity = 150.00 pcf
Min. As %	= 0.0018
Cover @ Top 2.00	@ Btm.= 3.00 in

Footing Design Results

		<u>Toe</u>	Heel		
Factored Pressure	=	2,259	11 psf		
Mu' : Upward	=	2,291	1,311 ft-#		
Mu' : Downward	=	238	2,666 ft-#		
Mu: Design	=	171	1,355 ft-#		
Actual 1-Way Shear	=	0.39	7.03 psi		
Allow 1-Way Shear	=	94.87	94.87 psi		
Toe Reinforcing	=	# 4 @ 12.00 in			
Heel Reinforcing	=	# 4 @ 12.00 in			
Key Reinforcing	=	None Spec'd			
Footing Torsion, Tu		=	0.00 ft-lbs		
Footing Allow. Torsion, phi Tu = 0.00 ft-lb					

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

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Key: No key defined

Min footing T&S reinf Area 0.72 in2
Min footing T&S reinf Area per foot 0.22 in2 /ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in #5@ 17.22 in #5@ 34.44 in #6@ 24.44 in #6@ 48.89 in

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
6'-0" Retaining Wall

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RESISTING		
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	1,690.0	2.21	3,740.5
HL Act Pres (be water tbl) Hydrostatic Force			,	Soil Over HL (bel. water tbl) Watre Table		2.21	3,740.5
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 =		0.21	
=				Surcharge Over Toe =			
_				Stem Weight(s) =	600.0	0.75	452.0
				Earth @ Stem Transitions =			
Total =	817.2	O.T.M. =	1,861.3	Footing Weight =	417.5	1.67	697.2
				Key Weight =			
Resisting/Overturning Ra	itio	=	2.63	Vert. Component =			
Vertical Loads used for Se	oil Pressure	= 2,707.5	5 lbs	Total =	2 707 5	bs R.M.=	4.889.8

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.081 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Vertical component of active lateral soil pressure IS

IBC 2015,ACI

1.200

1.600

1.600

1.000

1.000

NOT considered in the calculation of soil bearing

Load Factors

Dead Load

Live Load

Earth, H

Wind, W

Seismic, E

Building Code

Project Name/Number : Typical Detai Title Site Retaining Wall (12/S3.3)

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Title Site Retain Dsgnr: DMR Description....

6'-0" Retaining Wall W/ Seismic

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RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 530-13 License: KW-06052576 License To: SWENSON SAY FAGET Soil Data Criteria Allow Soil Bearing = 4,000.0 psf Retained Height 6.00 ft Equivalent Fluid Pressure Method Wall height above soil 0.00 ft Active Heel Pressure 35.0 psf/ft Slope Behind Wall 0.00 Height of Soil over Toe 6.00 in Passive Pressure 300.0 psf/ft Water height over heel 0.0 ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.500 Soil height to ignore for passive pressure 12.00 in Surcharge Loads **Lateral Load Applied to Stem** Adjacent Footing Load Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning 0.0 psf Adjacent Footing Load 0.0 lbs 0.0 #/ft 0.00 ft Lateral Load Footing Width 0.00 ft ...Height to Top Surcharge Over Toe 0.0 ...Height to Bottom 0.00 ft Eccentricity = 0.00 in Used for Sliding & Overturning Wall to Ftg CL Dist 0.00 ft Load Type Wind (W) Footing Type Line Load **Axial Load Applied to Stem** (Service Level) Base Above/Below Soil 0.0 ft Axial Dead Load Wind on Exposed Stem _ 0.0 psf 0.0 lbs at Back of Wall Axial Live Load 0.0 lbs (Service Level) Poisson's Ratio 0.300 Axial Load Eccentricity 0.0 in **Earth Pressure Seismic Load** Method: Uniform Uniform Seismic Force = 41.000 Total Seismic Force Multiplier Used 6.000 280.167 (Multiplier used on soil density) **Design Summary Stem Construction Bottom** Stem OK Design Height Above Ftg 0.00 Wall Stability Ratios Wall Material Above "Ht" Concrete Overturning 1.93 OK 1.45 Ratio < 1.5! Design Method LRFD Sliding Thickness 8.00 Rebar Size **Total Bearing Load** 2,707 lbs Rebar Spacing 12.00 = resultant ecc 9 61 in Rebar Placed at = Edge Design Data Soil Pressure @ Toe 2,081 psf OK 0.508 fb/FB + fa/Fa = Soil Pressure @ Heel 0 psf OK Total Force @ Section 4,000 psf Allowable Service Level lbs = Soil Pressure Less Than Allowable Strength Level lbs = 1,254.0 ACI Factored @ Toe 2,913 psf Moment....Actual 0 psf ACI Factored @ Heel Service Level ft-# = Footing Shear @ Toe 0.4 psi OK Strength Level ft-# = 2.754.0 Footing Shear @ Heel 11.9 psi OK Moment.....Allowable 5,412.6 Allowable 75.0 psi Sliding Calcs Shear Actual Service Level psi = Lateral Sliding Force 1.013.3 lbs less 100% Passive Force = -Strength Level 116.7 lbs psi = 16.7 less 100% Friction Force = -1.353.5 lbs Shear.....Allowable psi = 75.0 0.0 lbs OK Anet (Masonry) Added Force Reg'd in2 =....for 1.5 Stability 49.7 lbs NG Rebar Depth 'd' in= 6.25 **Masonry Data** f'm psi = Fs psi =

Solid Grouting

Modular Ratio 'n' Wall Weight

Short Term Factor

Equiv. Solid Thick.

Concrete Data

f'c

Fy

Masonry Block Type

Masonry Design Method

100.0

Medium Weight

2,500.0

60,000.0

= ASD

psf =

psi =

Project Name/Number: Typical Detai

Min Stem T&S Reinf Area 1.152 in2

Two layers of :

Title Site Retaining Wall (12/S3.3) Dsgnr: DMR

Description...

6'-0" Retaining Wall W/ Seismic

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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9 SEP 2021

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.1032 in2/ft

(4/3) * As: 0.1376 in2/ft

200bd/fy: 200(12)(6.25)/60000: 0.25 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft Horizontal Reinforcing Options :

0.0018bh: 0.0018(12)(8): 0.1728 in2/ft One layer of :

#4@ 25.00 in 0.1728 in2/ft #4@ 12.50 in Required Area: Provided Area: 0.2 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8467 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	0.42 ft
Heel Width	=	2.92
Total Footing Widtl	n =	3.34
Footing Thickness	=	10.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from	Toe =	0.00 ft
f'c = 2,500 p Footing Concrete D Min. As % Cover @ Top	Density = =	60,000 psi 150.00 pcf 0.0018 Btm.= 3.00 in

Footing Design Results

. coming 2 congili recounts						
		<u>Toe</u>	Heel			
Factored Pressure	=	2,913	0 psf			
Mu' : Upward	=	2,864	654 ft-#			
Mu' : Downward	=	234	2,666 ft-#			
Mu: Design	=	219	2,012 ft-#			
Actual 1-Way Shear	=	0.40	11.93 psi			
Allow 1-Way Shear	=	75.00	75.00 psi			
Toe Reinforcing	=	# 4 @ 12.00 in				
Heel Reinforcing	=	# 4 @ 12.00 in				
Key Reinforcing	=	None Spec'd				
Footing Torsion, Tu		=	0.00 ft-lbs			
Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs			

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

Other Acceptable Sizes & Spacings

Toe: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5 Heel: #4@ 11.11 in, #5@ 17.22 in, #6@ 24.44 in, #7@ 33.33 in, #8@ 43.88 in, #9@ 5

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 0.72 0.22 in2 /ft

If one layer of horizontal bars: If two layers of horizontal bars:

#4@ 11.11 in #4@ 22.22 in #5@ 17.22 in #5@ 34.44 in #6@ 24.44 in #6@ 48.89 in

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

6'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

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		OV	ERTURNING)		R	ESISTING	
Item	_	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water th	1)	817.2	2.28	1,861.3	Soil Over HL (ab. water tbl)	1,690.0	2.21	3,733.8
HL Act Pres (be water th	,			,	Soil Over HL (bel. water tbl)		2.21	3,733.8
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 So	il =				Soil Over Toe =		0.21	
Seismic Earth Load	=	196.1	3.42	670.1	Surcharge Over Toe =			
	=				Stem Weight(s) =	600.0	0.75	449.6
T-1-1		4 040 0		0.504.4	Earth @ Stem Transitions =			
Total	=	1,013.3	O.T.M. =	2,531.4	Footing Weight =	417.0	1.67	695.6
					Key Weight =			
Resisting/Overturnin	_		=	1.93	Vert. Component =			
Vertical Loads used t	or So	il Pressure	= 2,707.	0 lbs	Total =	2,707.0	lbs R.M.=	4,878.9

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.104 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

Project Name/Number: Typical Detai Site Retaining Wall (12/S3.3) Title

Dsgnr: DMR 8'-0" Retaining Wall

Date: 9 SEP 2021 Description... for your program.

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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0.0 ft

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Criteria

Retained Height 8.00 ft Wall height above soil 0.00 ft Slope Behind Wall 0.00 Height of Soil over Toe 6.00 in

Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 1

Soil Data

Allow Soil Bearing = 3,1 Equivalent Fluid Pressure Method Active Heel Pressure = = 3,000.0 psf 35.0 psf/ft Passive Pressure 300.0 psf/ft Soil Density, Heel 125.00 pcf

0.00 pcf Soil Density, Toe Footing||Soil Friction 0.500 Soil height to ignore for passive pressure 12.00 in

Surcharge Loads

Water height over heel

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

Axial Load Applied to Stem

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

Lateral Load Applied to Stem

Lateral Load ...Height to Top ...Height to Bottom 0.0 #/ft 0.00 ft 0.00 ft Load Type Wind (W) (Service Level)

Wind on Exposed Stem = 0.0 psf (Service Level)

Adjacent Footing Load

Adjacent Footing Load 0.0 lbs Footing Width 0.00 ft Eccentricity = 0.00 in Wall to Ftg CL Dist 0.00 ft Footing Type Line Load Base Above/Below Soil 0.0 ft at Back of Wall Poisson's Ratio 0.300

Design Summary

Wall Stability Ratios Overturning Sliding	=		2.56 1.62		
Total Bearing Loadresultant ecc.	=		4,212 7.58		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less ACI Factored @ Toe ACI Factored @ Heel	= = Th: = =	an .	3,000	psf psf e psf	OK OK
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =		6.1 11.5 75.0		
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Req'dfor 1.5 Stability			0.0	lbs lbs lbs	OK OK

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

St

Fy

tem Construction		Bottom	
		Stem OK	
Design Height Above Ftg		0.00	
Wall Material Above "Ht"	=	Concrete	
Design Method	=	LRFD	
Thickness Rebar Size	=	8.00 # 5	
Rebar Spacing	=	12.00	
Rebar Placed at	=	Edge	
Design Data		Euge	
fb/FB + fa/Fa	=	0.588	
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	1,792.0	
MomentActual			
Service Level	ft-# =		
Strength Level	ft-# =	4,778.7	
MomentAllowable	=	8,121.3	
ShearActual			
Service Level	psi =		
Strength Level	psi =	24.1	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	6.19	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	=		
Modular Ratio 'n'	=		
Wall Weight	psf =	100.0	
Short Term Factor	=		
Equiv. Solid Thick.	=		
Masonry Block Type		Medium W	eight
Masonry Design Method	=	ASD	
Concrete Data		2 500 2	
f'c	psi =	2,500.0	

psi = 60,000.0

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Description... 8'-0" Retaining Wall

Horizontal Reinforcing

Horizontal Reinforcing Options :

Page: 2 Dsgnr: DMR 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.1809 in2/ft

(4/3) * As: 0.2413 in2/ft

Min Stem T&S Reinf Area 1.536 in2 200bd/fy: 200(12)(6.1875)/60000: 0.2475 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

One layer of : Two layers of : #4@ 25.00 in 0.2413 in2/ft #4@ 12.50 in Required Area: Provided Area: 0.31 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.8382 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	= 1.00 ft
Heel Width	= 3.42
Total Footing Width	= 4.42
Footing Thickness	= 12.00 in
Key Width	= 0.00 in
Key Depth	= 0.00 in
Key Distance from Toe	= 0.00 ft
f'c = 2,500 psi Footing Concrete Dens Min. As % Cover @ Top 2.00	= 0.0018

Footing Design Results

_ total			_
		<u>Toe</u>	Heel
Factored Pressure	=	2,482	189 psf
Mu' : Upward	=	13,851	2,512 ft-#
Mu' : Downward	=	1,530	5,216 ft-#
Mu: Design	=	1,027	2,703 ft-#
Actual 1-Way Shear	=	6.08	11.51 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	# 5 @ 12.00 in	
Heel Reinforcing	=	# 5 @ 12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 1.14 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

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
8'-0" Retaining Wall

Page: 3 Date: 9 SEP 2021

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING	i		RE	SISTING	
ltem	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	2,749.3	3.04	8,361.6
HL Act Pres (be water tbl) Hydrostatic Force	, -		,	Soil Over HL (bel. water tbl) Watre Table		3.04	8,361.6
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 =		0.50	
=				Surcharge Over Toe =			
				Stem Weight(s) =	800.0	1.33	1,066.7
				Earth @ Stem Transitions =			
Total =	1,417.5	O.T.M. =	4,252.5	Footing Weight =	662.4	2.21	1,462.6
				Key Weight =			
Resisting/Overturning Ra		=	2.56	Vert. Component =			
Vertical Loads used for S	oil Pressure	= 4,211.7	7 lbs	Total =	4.211.7 I	bs R.M.=	10.890.9

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.089 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

 $\underline{\text{because the wall would then tend to rotate into the retained soil.}}$

Wind, W

Seismic, E

1.000

1.000

f'c

Fy

2,500.0

60,000.0

psi =

Project Name/Number: Typical Detai Site Retaining Wall (12/S3.3) Title

Page: 1

9 SEP 2021

Dsgnr: DMR Description.

8'-0" Retaining Wall W/ Seismic

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RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 530-13 License: KW-06052576 License To: SWENSON SAY FAGET Soil Data Criteria Allow Soil Bearing = 4,000.0 psf Retained Height 8.00 ft Equivalent Fluid Pressure Method Wall height above soil 0.00 ft Active Heel Pressure 35.0 psf/ft Slope Behind Wall 0.00 Height of Soil over Toe 6.00 in Passive Pressure 300.0 psf/ft Water height over heel 0.0 ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.500 Soil height to ignore for passive pressure 12.00 in Surcharge Loads **Lateral Load Applied to Stem** Adjacent Footing Load Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning 0.0 psf Adjacent Footing Load 0.0 lbs 0.0 #/ft 0.00 ft Lateral Load Footing Width 0.00 ft ...Height to Top Surcharge Over Toe 0.0 ...Height to Bottom 0.00 ft Eccentricity = 0.00 in Used for Sliding & Overturning Wall to Ftg CL Dist 0.00 ft Load Type Wind (W) Footing Type Line Load **Axial Load Applied to Stem** (Service Level) Base Above/Below Soil 0.0 ft Axial Dead Load Wind on Exposed Stem _ 0.0 psf 0.0 lbs at Back of Wall Axial Live Load 0.0 lbs (Service Level) Poisson's Ratio 0.300 Axial Load Eccentricity 0.0 in **Earth Pressure Seismic Load** Method: Uniform Uniform Seismic Force = 54.000 Multiplier Used 6.000 Total Seismic Force 486.000 (Multiplier used on soil density) **Design Summary Stem Construction Bottom** Stem OK Design Height Above Ftg 0.00 Wall Stability Ratios Wall Material Above "Ht" Concrete Overturning 1.88 OK 1.30 Ratio < 1.5! Design Method LRFD Sliding Thickness 8.00 Rebar Size **Total Bearing Load** 4,212 lbs Rebar Spacing 12.00 = resultant ecc 11 94 in Rebar Placed at = Edge Design Data Soil Pressure @ Toe 2,315 psf OK 0.801 fb/FB + fa/Fa = Soil Pressure @ Heel 0 psf OK Total Force @ Section 4,000 psf Allowable Service Level lbs = Soil Pressure Less Than Allowable Strength Level lbs = 2,224.0 ACI Factored @ Toe 3,242 psf Moment....Actual ACI Factored @ Heel 0 psf Service Level ft-# = Footing Shear @ Toe 8.1 psi OK Strength Level 6.506.7 ft-# = Footing Shear @ Heel 18.1 psi OK Moment.....Allowable 8,121.3 Allowable 75.0 psi Sliding Calcs Shear Actual Service Level psi = Lateral Sliding Force 1.757.7 lbs less 100% Passive Force = -Strength Level 187.5 lbs psi = 30.0 less 100% Friction Force = -2.105.9 lbs Shear.....Allowable psi = 75.0 0.0 lbs OK Anet (Masonry) Added Force Reg'd in2 =....for 1.5 Stability 343.2 lbs NG Rebar Depth 'd' in= 6.19 **Masonry Data** f'm psi = Fs psi = Vertical component of active lateral soil pressure IS Solid Grouting NOT considered in the calculation of soil bearing Modular Ratio 'n' Wall Weight 100.0 psf = Load Factors Short Term Factor IBC 2015,ACI **Building Code** Equiv. Solid Thick. Dead Load 1.200 Masonry Block Type Medium Weight Live Load 1.600 Masonry Design Method ASD = Earth, H 1.600 Concrete Data

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Min Stem T&S Reinf Area 1.536 in2

Dsgnr: DMR
Description....

Horizontal Reinforcing

8'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 2

9 SEP 2021

Concrete Stem Rebar Area Details

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.2464 in2/ft

(4/3) * As: 0.3285 in2/ft

200bd/fy: 200(12)(6.1875)/60000: 0.2475 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0018bh : 0.0018(12)(8) :

 Required Area :
 0.2475 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 :
 0.8382 in2/ft
 #6@ 27.50 in
 #6@ 55.00 in

Footing Data

Toe Width		1.00 ft
	=	
Heel Width	=	3.42
Total Footing Width	= '	4.42
Footing Thickness	=	12.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
	Fy =	60,000 psi
Footing Concrete Density	v =	150.00 pcf
Min. As %	_	0.0018
Cover @ Top 2.00	@	Btm.= 3.00 in

Footing Design Results

Į	<u></u>			
			<u>Toe</u>	Heel
	Factored Pressure	=	3,242	0 psf
	Mu': Upward	=	17,667	1,138 ft-#
	Mu' : Downward	=	1,530	5,216 ft-#
	Mu: Design	=	1,345	4,078 ft-#
	Actual 1-Way Shear	=	8.10	18.09 psi
	Allow 1-Way Shear	=	75.00	75.00 psi
	Toe Reinforcing	=	# 5 @ 12.00 in	
	Heel Reinforcing	=	# 5 @ 12.00 in	
	Key Reinforcing	=	None Spec'd	
	Footing Torsion, Tu		=	0.00 ft-lbs
	Footing Allow. Torsion	n, p	hi Tu =	0.00 ft-lbs

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

Other Acceptable Sizes & Spacings

Toe: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46 Heel: #4@ 9.25 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.77 in, #8@ 36.57 in, #9@ 46

Key: No key defined

Min footing T&S reinf Area 1.14 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@ 28.70 in #6@ 20.37 in #6@ 40.74 in

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

8'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 3

9 SEP 2021

•		OV	ERTURNING	i		RI	ESISTING	
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water th	ol)	1,417.5	3.00	4,252.5	Soil Over HL (ab. water tbl)	2,749.3	3.04	8,361.6
HL Act Pres (be water th	,	, -		,	Soil Over HL (bel. water tbl)		3.04	8,361.6
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 So	il =				Soil Over Toe =		0.50	
Seismic Earth Load	=	340.2	4.50	1,530.9	Surcharge Over Toe =			
	=			,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	Stem Weight(s) =	800.0	1.33	1,066.7
		4		5.700.4	Earth @ Stem Transitions =			
Total	=	1,757.7	O.T.M. =	5,783.4	Footing Weight =	662.4	2.21	1,462.6
					Key Weight =			
Resisting/Overturning	•		=	1.88	Vert. Component =			
Vertical Loads used	for So	il Pressure	= 4,211.	7 lbs	Total =	4,211.7	lbs R.M.=	10,890.9

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

250.0 pci Soil Spring Reaction Modulus Horizontal Defl @ Top of Wall (approximate only) 0.117 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.

Wind, W

Seismic, E

1.000

1.000

Concrete Data f'c Fy

psi = 2,500.0

psi = 60,000.0

Project Name/Number : Typical Detai

Description....
10'-0" Retaining Wall

Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR Page: 1 9 SEP 2021 Date:

etainPro (c) 1987-2019, Build cense : KW-06052576 cense To : SWENSON SA	1 11.20.03.31 AY FAGET	Cantilevered Retain	ing V	Vall	Code: IBC 2015,A	CI 318-14,ACI 530-
Criteria		Soil Data				
Retained Height = Wall height above soil = Slope Behind Wall =	= 0.00 ft	Allow Soil Bearing = 3 Equivalent Fluid Pressure Metho Active Heel Pressure =) psf) psf/ft		
Height of Soil over Toe = Water height over heel =		Passive Pressure = Soil Density, Heel = Soil Density, Toe = Footing Soil Friction = Soil height to ignore for passive pressure =	125.00	pcf		
Surcharge Loads		Lateral Load Applied to	Stem	1	Adjacent Footing I	_oad
Surcharge Over Heel Used To Resist Sliding & Surcharge Over Toe Used for Sliding & Overto Axial Load Applied	= 0.0 urning	* *	0.0 # 0.00 ft 0.00 ft d (W)		Adjacent Footing Load Footing Width Eccentricity Wall to Ftg CL Dist Footing Type	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load
	= 0.0 lbs	Wind on Exposed Stem _	rvice L 0.0 p	,	Base Above/Below Soil	= 0.0 ft
	= 0.0 lbs	(Service Level)	υ.υ ρ	31	at Back of Wall Poisson's Ratio	= 0.300
Design Summary		Stem Construction		Bottom Stem Ok		
Wall Stability Ratios Overturning Sliding	= 2.98 OK = 1.72 OK	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness		0.00 Concrete LRFD 8.00		
Total Bearing Loadresultant ecc.	= 7,074 lbs = 7.14 in	Rebar Size Rebar Spacing Rebar Placed at Design Data	=	# 7 12.00 Edge		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= 1,811 psf (= 483 psf (= 3,000 psf Than Allowable	fb/FB + fa/Fa Total Force @ Section Service Level	= lbs =	0.71		
ACI Factored @ Toe ACI Factored @ Heel	= 2,536 psf = 676 psf	Strength Level MomentActual Service Level	lbs =	2,800.0		
Footing Shear @ Toe Footing Shear @ Heel Allowable Sliding Calcs	= 6.5 psi (= 10.6 psi (= 75.0 psi	JK Strength Level	ft-# =	9,333.3 13,107.2		
Lateral Sliding Force less 100% Passive Force less 100% Friction Force	= - 3,537.0 lbs	Service Level Strength Level ShearAllowable	psi = psi = psi =	41.9 75.0		
Added Force Req'dfor 1.5 Stability	= 0.0 lbs (= 0.0 lbs (3,	in2 = in = psi =	5.56		
ertical component of active OT considered in the calcu		Fs IS Solid Grouting	psi = = = psf =	100.0		
Load Factors Building Code Dead Load Live Load	IBC 2015,ACI 1.200 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method	· =	Medium \	Veight	

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Min Stem T&S Reinf Area 1.920 in2

10'-0" Retaining Wall

Horizontal Reinforcing

Dsgnr: DMR 9 SEP 2021 Description...

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 2

Concrete Stem Rebar Area Details

Vertical Reinforcing **Bottom Stem**

As (based on applied moment): 0.3955 in2/ft

(4/3) * As: 0.5274 in2/ft

200bd/fy: 200(12)(5.5625)/60000: 0.2225 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.192 in2/ft

0.0018bh: 0.0018(12)(8):

Horizontal Reinforcing Options : 0.1728 in2/ft One layer of : Two layers of : #4@ 12.50 in #4@ 25.00 in

0.3955 in2/ft Required Area: Provided Area: 0.6 in2/ft #5@ 19.38 in #5@ 38.75 in Maximum Area: 0.7535 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Width	=	1.75 ft
Heel Width	=	4.42
Total Footing Width	= '	6.17
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
	Fy =	60,000 psi
Footing Concrete Density	y =	150.00 pcf
Min. As %	=	0.0018
Cover @ Top 2.00	@	Btm.= 3.00 in

Footing Design Results

		<u>Toe</u>	Heel	
Factored Pressure	=	2,536	676	psf
Mu' : Upward	=	43,366	7,403	ft-#
Mu': Downward	=	6,339	12,441	ft-#
Mu: Design	=	3,086	5,038	ft-#
Actual 1-Way Shear	=	6.49	10.65	psi
Allow 1-Way Shear	=	75.00	75.00	psi
Toe Reinforcing	=	#7@12.00 in		
Heel Reinforcing	=	#6@12.00 in		
Key Reinforcing	=	None Spec'd		
Footing Torsion, Tu		=	0.00	0 ft-lbs
Footing Allow. Torsio	n, p	ohi Tu =	0.00	0 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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 2.40 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

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....
10'-0" Retaining Wall

taining Wall (12/S3.3) Page : 3
Date: 9 SEP 2021

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

	0\	ERTURNING			RESISTING			
Item	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#	
HL Act Pres (ab water tbl)	2,314.4	3.83	8,871.8	Soil Over HL (ab. water tbl)	4,686.7	4.29	20,112.0	
HL Act Pres (be water tbl) Hydrostatic Force	,-		-,-	Soil Over HL (bel. water tbl) Watre Table		4.29	20,112.0	
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 =		0.88		
=				Surcharge Over Toe =				
				Stem Weight(s) =	1,000.0	2.08	2,083.3	
				Earth @ Stem Transitions=				
Total =	2,314.4	O.T.M. =	8,871.8	Footing Weight =	1,387.4	3.08	4,277.2	
				Key Weight =				
Resisting/Overturning Ra	atio	=	2.98	Vert. Component =				
Vertical Loads used for S	oil Pressure	= 7,074.0) lbs	Total =	7 074 0	bs R.M.=	26,472.6	

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.082 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.

Seismic, E

1.000

Project Name/Number : Typical Detai Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR
Description....
10'-0" Retaining Wall W/ Seismic

Page: 1 9 SEP 2021

Date:

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

This Wall in File: K:\2021\01	519-2021-06 Huber Re	sidence\Calcs\Typical Detail Co-0	4-06.F	RPX			
RetainPro (c) 1987-2019, Build License : KW-06052576 License To : SWENSON S	d 11.20.03.31 AY FAGET	Cantilevered Retaini	ng V	Vall	Code: IBC 2015,ACI 318-14,ACI 530-13		
Criteria		Soil Data					
Wall height above soil	= 10.00 ft = 0.00 ft = 0.00	Allow Soil Bearing = 4 Equivalent Fluid Pressure Method Active Heel Pressure =) psf) psf/ft			
Height of Soil over Toe Water height over heel	= 6.00 in = 0.0 ft	Soil Density, Toe = Footing Soil Friction = Soil height to ignore	125.00	pcf			
Surcharge Loads		Lateral Load Applied to	Stem	1 A	djacent Footing	Load	
Used for Sliding & Overl Axial Load Applied Axial Dead Load	= 0.0 turning to Stem = 0.0 lbs = 0.0 lbs	Height to Bottom = Under the Bottom = Wind	0.0 #. 0.00 ft 0.00 ft d (W) vice L 0.0 p	t Fo t Ec W evel) Fo esf	djacent Footing Load poting Width ccentricity 'all to Ftg CL Dist poting Type ase Above/Below Soil at Back of Wall pisson's Ratio	= 0.0 lbs = 0.00 ft = 0.00 in = 0.00 ft Line Load = 0.0 ft = 0.300	
Method: Uniform Multiplier Used (Multiplier used on soil de	= 6.000		0.000 3.500				
Design Summary		Stem Construction]-	Bottom Stem OK			
Wall Stability Ratios Overturning Sliding Total Bearing Load	= 2.19 OK = 1.39 Ratio < = 7,074 lbs	Design Height Above Ftg Wall Material Above "Ht" Design Method Thickness Rebar Size Rebar Spacing	ft = = = = = =	0.00 Concrete LRFD 8.00			
resultant ecc. Soil Pressure @ Toe	= 12.56 in = 2,316 psf Ok	Rebar Placed at Design Data	=	Edge			
Soil Pressure @ Heel Allowable Soil Pressure Less	= 0 psf Ok = 4,000 psf Than Allowable		= lbs = lbs =	0.975 3,490.0			
ACI Factored @ Toe ACI Factored @ Heel Footing Shear @ Toe	= 3,242 psf = 0 psf = 8.5 psi Ok	MomentActual	ft-# =	3,430.0			
Footing Shear @ Heel Allowable Sliding Calcs	= 16.2 psi Ok = 75.0 psi	MomentAllowable ShearActual	ft-# = =				
Lateral Sliding Force less 100% Passive Force less 100% Friction Force Added Force Reg'd		Service Level Strength Level ShearAllowable Anet (Masonry)	psi = psi = psi = in2 =	52.3 75.0			
for 1.5 Stability	= 317.7 lbs NC		in =	5.56			
Vertical component of active NOT considered in the calculation		Fs Solid Grouting Modular Ratio 'n' Wall Weight	psi = = = psf =				
Load Factors Building Code Dead Load Live Load Earth, H	IBC 2015,ACI 1.200 1.600 1.600	Short Term Factor Equiv. Solid Thick. Masonry Block Type Masonry Design Method Concrete Data			ight		
Wind, W Seismic, E	1.000	f'c Fv	psi =	2,500.0 60,000.0			

psi = 60,000.0

Project Name/Number : Typical Detai

Title Site Retaining Wall (12/S3.3)
Dsgnr: DMR

Description....

10'-0" Retaining Wall W/ Seismic

Min Stem T&S Reinf Area 1.920 in2

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 2

9 SEP 2021

Concrete Stem Rebar Area De	tails
-----------------------------	-------

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.5417 in2/ft

(4/3) * As: 0.7223 in2/ft

200bd/fy: 200(12)(5.5625)/60000: 0.2225 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 :
0.5417 in2/ft #4@ 12.50 in #4@ 25.00 in

Required Area : Provided Area : Maximum Area :

0.6 in2/ft #5@ 19.38 in #5@ 38.75 in 0.7535 in2/ft #6@ 27.50 in #6@ 55.00 in

Footing Data

Toe Wid	th		=	1	.75 ft
Heel Wid	lth		=	4	.42
Total Fo	oting Wid	lth	=	6	.17
Footing 7	Thickness	3	=	18.	.00 in
Key Wid	th		=	0.	.00 in
Key Dep	th		=	0.	.00 in
Key Dist	ance fron	n Toe	=	0.	.00 ft
f'c =	2,500		-y =		000 psi
Footing (Concrete	Density	=	150	.00 pcf
Min. As 9	6		=	0.00	18
Cover @	Top	2.00	@	Btm.=	3.00 in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	3,242	0 psf
Mu' : Upward	=	53,882	4,455 ft-#
Mu' : Downward	=	6,339	12,441 ft-#
Mu: Design	=	3,962	7,986 ft-#
Actual 1-Way Shear	=	8.49	16.22 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#7 @ 12.00 ii	า
Heel Reinforcing	=	# 6 @ 12.00 ii	า
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hiTu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area 2.40 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

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

10'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 3

9 SEP 2021

OVERTURNING							RESISTING			
Item		Force lbs	Distance ft		Moment ft-#	_		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl))	2,314.4	3.83		8,871.8	Soil Over HL (ab. water	tbl)	4,686.7	4.29	20,112.0
HL Act Pres (be water tbl		,-			-,-	Soil Over HL (bel. water	tbl)		4.29	20,112.0
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 Ster	n =			
Added Lateral Load	=					* Axial Live Load on Stem	=			
Load @ Stem Above Soil	=					Soil Over Toe	=		0.88	
Seismic Earth Load	=	555.5	5.75		3,193.8	Surcharge Over Toe	=			
	=				-,	Stem Weight(s)	=	1,000.0	2.08	2,083.3
T-1-1		0.000.0	- O T M		40.005.0	Earth @ Stem Transition	s=			
Total	=	2,869.8	O.T.M. =	=	12,065.6	Footing Weight	=	1,387.4	3.08	4,277.2
						Key Weight	=			
Resisting/Overturning	•		=		.19	Vert. Component	=			
Vertical Loads used for	or Soil	Pressure :	= 7,07	4.0	lbs	Tot	al =	7,074.0	bs R.M.=	26.472.6

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.104 in

The above calculation is not valid if the heel soil bearing pressure exceeds that of the toe,

because the wall would then tend to rotate into the retained soil.

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

12'-0" Retaining Wall

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

Cantilevered Retaining Wall

Criteria		
Retained Height	=	12.00 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in

0.0 ft

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Soil Data = 3,000.0 psf

Allow Soil Bearing = 3,1 Equivalent Fluid Pressure Method Active Heel Pressure = 35.0 psf/ft Passive Pressure 300.0 psf/ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.500 Soil height to ignore for passive pressure 12.00 in

Page: 1

9 SEP 2021

Date:

Code: IBC 2015,ACI 318-14,ACI 530-13

Surcharge Loads

Water height over heel =

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

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 _ 0.0 psf (Service Level)

> **Concrete Data** f'c

Fy

Adjacent Footing Load

Adjacent Footing Load	=	0.0 lbs
Footing Width	=	0.00 ft
Eccentricity	=	0.00 in
Wall to Ftg CL Dist	=	0.00 ft
Footing Type		Line Load
Base Above/Below Soil at Back of Wall	=	0.0 ft
Poisson's Ratio	=	0.300

Design Summary

Wall Stability Ratios Overturning Sliding	=	2.35 1.50		
Total Bearing Loadresultant ecc.	= =	8,693 11.72		
Soil Pressure @ Toe Soil Pressure @ Heel Allowable Soil Pressure Less	= = = Then	2,592 118 3,000	psf psf	
ACI Factored @ Toe ACI Factored @ Heel	= = =	3,629 165	psf	
Footing Shear @ Toe Footing Shear @ Heel Allowable	= = =	9.7 17.9 75.0	psi	
Sliding Calcs Lateral Sliding Force less 100% Passive Force less 100% Friction Force		3,189.4 450.0 4,346.3	bs	
Added Force Req'dfor 1.5 Stability	=	0.0		

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

Load Factors	
Building Code	IBC 2015,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.000
Seismic, E	1.000

01011	_	Bottom	
Stem Construction		Stem OK	
Design Height Above Ftg	ft =	0.00	
Wall Material Above "Ht"	=	Concrete	
Design Method	=	LRFD	
Thickness	=	10.00	
Rebar Size	=	# 7	
Rebar Spacing	=	9.00	
Rebar Placed at	=	Edge	
Design Data ————			
fb/FB + fa/Fa	=	0.676	
Total Force @ Section			
Service Level	lbs =		
Strength Level	lbs =	4,032.0	
MomentActual			
Service Level	ft-# =		
Strength Level	ft-# =	16,128.0	
MomentAllowable	=	23,826.6	
ShearActual			
Service Level	psi =		
Strength Level	psi =	44.4	
ShearAllowable	psi =	75.0	
Anet (Masonry)	in2 =		
Rebar Depth 'd'	in =	7.56	
Masonry Data			
f'm	psi =		
Fs	psi =		
Solid Grouting	· =		
Modular Ratio 'n'	=		
Wall Weight	psf =	125.0	
Short Term Factor	· =		
Equiv. Solid Thick.	=		
Masonry Block Type	=	Medium Wei	ight
Masonry Design Method	=	ASD	
• • • • • • • • • • • • • • • • • • • •			

2,500.0

60,000.0

psi =

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Min Stem T&S Reinf Area 2.880 in2

Dsgnr: DMR

Description... 12'-0" Retaining Wall

Horizontal Reinforcing

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 2

9 SEP 2021

Concrete S	tem Rebar	Area Details
------------	-----------	--------------

Vertical Reinforcing Bottom Stem

As (based on applied moment): 0.4948 in2/ft

(4/3) * As: 0.6597 in2/ft

200bd/fy: 200(12)(7.5625)/60000: 0.3025 in2/ft Min Stem T&S Reinf Area per ft of stem Height: 0.240 in2/ft Horizontal Reinforcing Options :

0.0018bh: 0.0018(12)(10): 0.216 in2/ft

0.0018

@ Btm.= 3.00 in

One layer of : Two layers of : #4@ 10.00 in #4@ 20.00 in 0.4948 in2/ft 0.8 in2/ft #5@ 15.50 in #5@ 31.00 in 1.0245 in2/ft #6@ 22.00 in #6@ 44.00 in

Maximum Area: **Footing Data**

Required Area: Provided Area:

Toe Width 1.75 ft Heel Width 4.67 Total Footing Width 6.42 Footing Thickness 18.00 in Key Width 0.00 in Key Depth 0.00 in Key Distance from Toe 0.00 ft 2,500 psi 60,000 psi Footing Concrete Density = 150.00 pcf Min. As % Cover @ Top

2.00

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	3,629	165 psf
Mu' : Upward	=	60,893	6,276 ft-#
Mu' : Downward	=	6,339	15,203 ft-#
Mu: Design	=	4,546	8,928 ft-#
Actual 1-Way Shear	=	9.69	17.94 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#7@12.00 in	
Heel Reinforcing	=	#6@12.00 in	
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hiTu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area Min footing T&S reinf Area per foot 2.49 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

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

12'-0" Retaining Wall

Dsgnr: DMR 9 SEP 2021 Description...

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Page: 3

	0\	/ERTURNING	ì		RE	SISTING	
ltem	Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl)	3,189.4	4.50	14,352.2	Soil Over HL (ab. water tbl)	5,749.0	4.50	25,868.6
HL Act Pres (be water tbl)	•		,	Soil Over HL (bel. water tbl)		4.50	25,868.6
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 =		0.88	
=				Surcharge Over Toe =			
				Stem Weight(s) =	1,500.0	2.17	3,250.0
				Earth @ Stem Transitions =			
Total =	3,189.4	O.T.M. =	14,352.2	Footing Weight =	1,443.6	3.21	4,631.1
				Key Weight =			
Resisting/Overturning R		=	2.35	Vert. Component =			
Vertical Loads used for S	oil Pressure	= 8,692.	6 lbs	Total =	8,692.6 I	bs R.M.=	33,749.7

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

(Deflection due to wall bending not considered)

Soil Spring Reaction Modulus 250.0 pci Horizontal Defl @ Top of Wall (approximate only) 0.135 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.

Earth, H

Wind, W

Seismic, E

1.600

1.000

1.000

Concrete Data

2,500.0

60,000.0

psi =

f'c

Fy

Project Name/Number: Typical Detai Site Retaining Wall (12/S3.3) Title

Page: 1

Date:

9 SEP 2021

Dsgnr: DMR

12'-0" Retaining Wall W/ Seismic

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

RetainPro (c) 1987-2019, Build 11.20.03.31 Cantilevered Retaining Wall Code: IBC 2015,ACI 318-14,ACI 530-13 License: KW-06052576 License To: SWENSON SAY FAGET Soil Data Criteria Allow Soil Bearing = 4,000.0 psf Retained Height 12.00 ft Equivalent Fluid Pressure Method Wall height above soil 0.00 ft Active Heel Pressure 35.0 psf/ft Slope Behind Wall 0.00 Height of Soil over Toe 6.00 in Passive Pressure 300.0 psf/ft Water height over heel 0.0 ft Soil Density, Heel 125.00 pcf 0.00 pcf Soil Density, Toe Footing||Soil Friction 0.500 Soil height to ignore for passive pressure 12.00 in Surcharge Loads **Lateral Load Applied to Stem** Adjacent Footing Load Surcharge Over Heel = 0.0 ps Used To Resist Sliding & Overturning 0.0 psf Adjacent Footing Load 0.0 lbs 0.0 #/ft 0.00 ft Lateral Load Footing Width 0.00 ft ...Height to Top Surcharge Over Toe 0.0 ...Height to Bottom 0.00 ft Eccentricity = 0.00 in Used for Sliding & Overturning Wall to Ftg CL Dist 0.00 ft Wind (W) Load Type Footing Type Line Load **Axial Load Applied to Stem** (Service Level) Base Above/Below Soil 0.0 ft Wind on Exposed Stem _ 0.0 psf Axial Dead Load 0.0 lbs at Back of Wall Axial Live Load 0.0 lbs (Service Level) Poisson's Ratio 0.300 Axial Load Eccentricity 0.0 in **Earth Pressure Seismic Load** Method: Uniform Uniform Seismic Force = 81.000 Total Seismic Force Multiplier Used 6.000 = 1.093.500(Multiplier used on soil density) **Design Summary Stem Construction Bottom** Stem OK Design Height Above Ftg 0.00 Wall Stability Ratios Wall Material Above "Ht" Concrete Overturning 1.73 OK 1.21 Ratio < 1.5! Design Method LRFD Sliding Thickness 10.00 Rebar Size **Total Bearing Load** 8,693 lbs Rebar Spacing 9.00 resultant ecc 18 85 in Rebar Placed at Edge = Design Data Soil Pressure @ Toe 3,540 psf OK 0.921 fb/FB + fa/Fa Soil Pressure @ Heel 0 psf OK Total Force @ Section 4,000 psf Allowable Service Level lbs = Soil Pressure Less Than Allowable Strength Level lbs = 5,004.0 ACI Factored @ Toe 4,956 psf Moment....Actual ACI Factored @ Heel Service Level ft-# = Footing Shear @ Toe 13.4 psi OK Strength Level ft-# = 21,960.0 Footing Shear @ Heel 28.0 psi OK Moment.....Allowable 23,826.6 Allowable 75.0 psi Sliding Calcs Shear Actual Service Level psi = Lateral Sliding Force 3.954.8 lbs less 100% Passive Force = Strength Level 450 0 lbs psi = 55.1 less 100% Friction Force = 4.346.3 lbs Shear.....Allowable psi = 75.0 0.0 lbs OK Anet (Masonry) Added Force Reg'd in2 =....for 1.5 Stability 1 135 9 lbs NG Rebar Depth 'd' in= 7.56 **Masonry Data** f'm psi = Fs psi = Vertical component of active lateral soil pressure IS Solid Grouting NOT considered in the calculation of soil bearing Modular Ratio 'n' Wall Weight 125.0 psf = Load Factors Short Term Factor IBC 2015,ACI **Building Code** Equiv. Solid Thick. Dead Load 1.200 Masonry Block Type Medium Weight Live Load 1.600 Masonry Design Method ASD =

Project Name/Number : Typical Detai
Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR
Description....

Horizontal Reinforcing

12'-0" Retaining Wall W/ Seismic

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Cantilevered Retaining Wall

Code: IBC 2015,ACI 318-14,ACI 530-13

Date:

Page: 2

9 SEP 2021

Concrete Stem Rebar Area Details

Bottom Stem Vertical Reinforcing

As (based on applied moment) : 0.6737 in2/ft

(4/3) * As : 0.8982 in2/ft

200bd/fy: 200(12)(7.5625)/60000: 0.3025 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

Min Stem T&S Reinf Area 2.880 in2 Min Stem T&S Reinf Area per ft of ste

Horizontal Reinforcing Options :

One layer of : Two layers of :

 Required Area :
 0.6737 in2/ft
 #4@ 10.00 in
 #4@ 20.00 in

 Provided Area :
 0.8 in2/ft
 #5@ 15.50 in
 #5@ 31.00 in

 Maximum Area :
 1.0245 in2/ft
 #6@ 22.00 in
 #6@ 44.00 in

Footing Data

Toe Width	=	1.75 ft
Heel Width	=	4.67
Total Footing Width	= -	6.42
Footing Thickness	=	18.00 in
Key Width	=	0.00 in
Key Depth	=	0.00 in
Key Distance from Toe	=	0.00 ft
f'c = 2,500 psi Footing Concrete Densit		60,000 psi 150.00 pcf
Min. As %	, – –	0.0018
Cover @ Top 2.00	@ E	3.00 in

Footing Design Results

		<u>Toe</u>	Heel
Factored Pressure	=	4,956	0 psf
Mu' : Upward	=	80,246	2,122 ft-#
Mu' : Downward	=	6,339	15,203 ft-#
Mu: Design	=	6,159	13,082 ft-#
Actual 1-Way Shear	=	13.42	27.95 psi
Allow 1-Way Shear	=	75.00	75.00 psi
Toe Reinforcing	=	#7@12.00	in
Heel Reinforcing	=	#6@12.00	in
Key Reinforcing	=	None Spec'd	
Footing Torsion, Tu		=	0.00 ft-lbs
Footing Allow. Torsio	n, p	hi Tu =	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@ 18.51 in, #8@ 24.38 in, #9@ 30. Heel: #4@ 6.17 in, #5@ 9.56 in, #6@ 13.58 in, #7@ 18.51 in, #8@ 24.38 in, #9@ 30.

Key: No key defined

Min footing T&S reinf Area 2.49 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

Project Name/Number: Typical Detai Title Site Retaining Wall (12/S3.3)

Dsgnr: DMR Description...

12'-0" Retaining Wall W/ Seismic

This Wall in File: K:\2021\01519-2021-06 Huber Residence\Calcs\Typical Detail Co-04-06.RPX

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Cantilevered Retaining Wall

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9 SEP 2021

		0V	ERTURNIN	G	·	Б	ESISTING	
Item		Force lbs	Distance ft	Moment ft-#		Force lbs	Distance ft	Moment ft-#
HL Act Pres (ab water tbl))	3,189.4	4.50	14,352.2	Soil Over HL (ab. water tbl)	5,749.0	4.50	25,868.6
HL Act Pres (be water tbl)		-,		,	Soil Over HL (bel. water tbl)	4.50	25,868.6
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 =		0.88	
Seismic Earth Load	=	765.5	6.75	5,166.8	Surcharge Over Toe =			
	=			-,	Stem Weight(s) =	1,500.0	2.17	3,250.0
T-1-1		0.054.0		40.540.0	Earth @ Stem Transitions =			
Total	=	3,954.8	O.T.M. =	19,519.0	Footing Weight =	1,443.6	3.21	4,631.1
					Key Weight =			
Resisting/Overturning	•		=	1.73	Vert. Component =			
Vertical Loads used for	or Soil	Pressure :	= 8,692	.6 lbs	Total =	8.692.6	lbs R.M.=	33.749.7

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

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

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

Tilt

Horizontal Deflection at Top of Wall due to settlement of soil

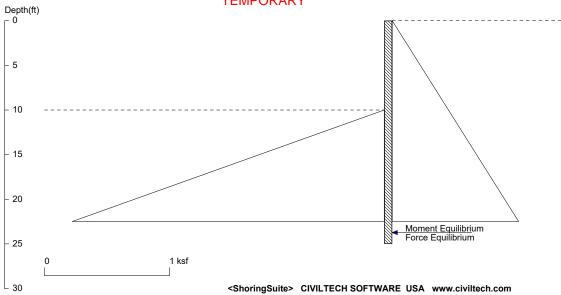
(Deflection due to wall bending not considered)

250.0 pci Soil Spring Reaction Modulus Horizontal Defl @ Top of Wall (approximate only) 0.184 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.

P1-P6 TEMPORARY



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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_temp.sh8

Wall Height=10.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.98 Min. Pile Length=24.98

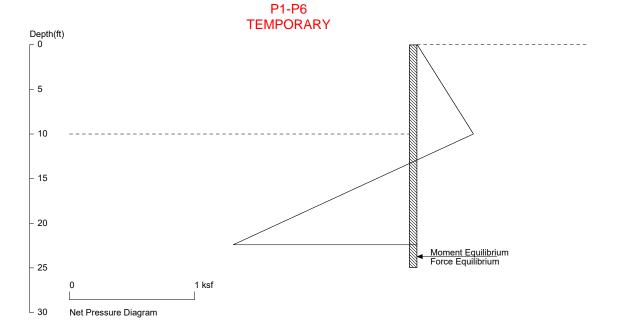
MOMENT IN PILE: Max. Moment=110.86 per Pile Spacing=7.0 at Depth=16.63

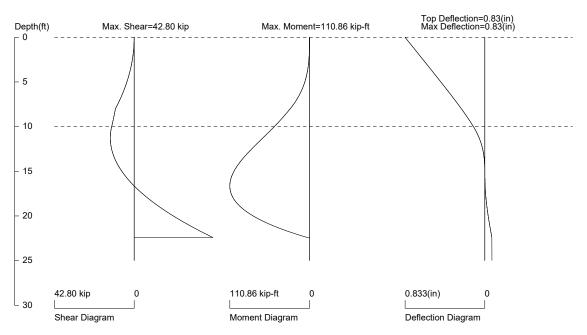
PILE SELECTION:

Request Min. Section Modulus = 56.0 in3/pile=917.54 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W14X43 has Section Modulus = 62.6 in3/pile=1025.83 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.83(in) based on E (ksi)=29000.00 and I (in4)/pile=428.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope	
0	0	100	4.500	.045	
PASSIVE PRESSURES:					
Z 1	P1	Z2	P2	Slope	
10	0	100	18.00	.2	
ACTIVE SPACING:					
No.		Z depth		Spacing	
1		0.00		7.00	
2		8.00		2.50	
PASSIVE SPACING:					
No.		Z depth		Spacing	
1		8.00		5.00	





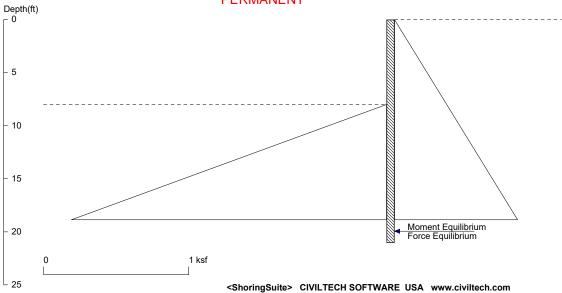
Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_temp.sh8

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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\garage wall_perm.sh8

Wall Height=8.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=13.03 Min. Pile Length=21.03

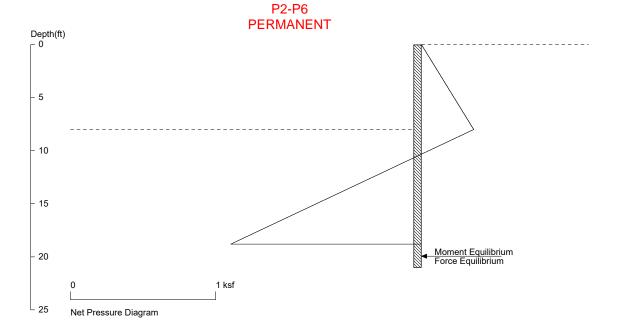
MOMENT IN PILE: Max. Moment=71.64 per Pile Spacing=7.0 at Depth=13.89

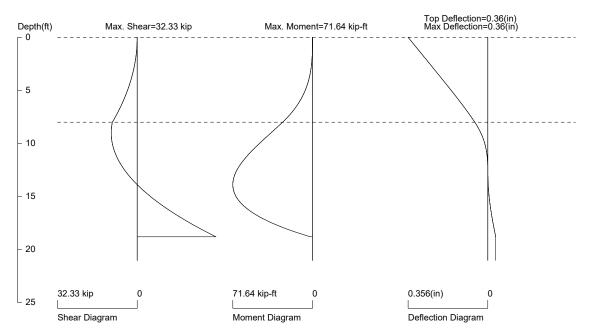
PILE SELECTION:

Request Min. Section Modulus = 36.2 in3/pile=592.89 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W14X43 has Section Modulus = 62.6 in3/pile=1025.83 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.36(in) based on E (ksi)=29000.00 and I (in4)/pile=428.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	P1	Z2	P2	Slope	
	0	0	100	4.500	.045	
PASSIVE PR	ESSURES:					
	Z1	P1	Z2	P2	Slope	
	8	0	100	18.40	.2	
ACTIVE SPA	CING:					
	No.		Z depth		Spacing	
	1		0.00		7.00	
	2		8.00		2.50	
PASSIVE SPA	ACING:					
	No.		Z depth		Spacing	
	1		8.00		5.00	



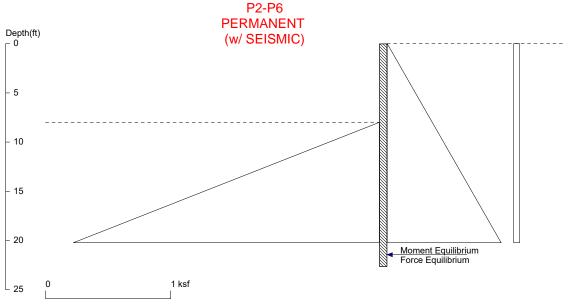


Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

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Wall Height=8.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.66 Min. Pile Length=22.66

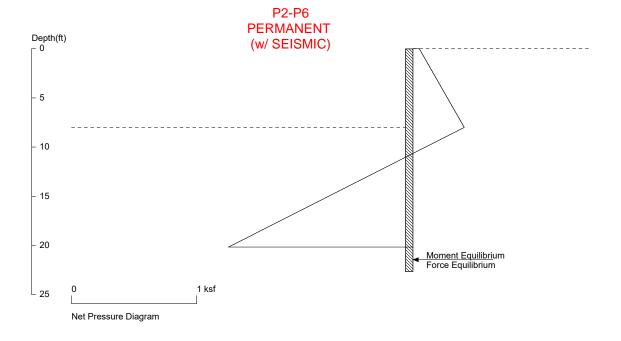
MOMENT IN PILE: Max. Moment=101.59 per Pile Spacing=7.0 at Depth=14.64

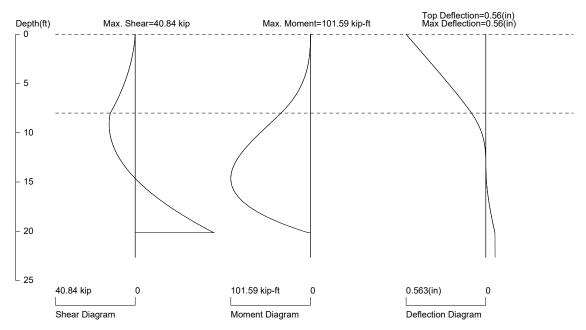
PILE SELECTION:

Request Min. Section Modulus = 51.3 in3/pile=840.82 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W14X43 has Section Modulus = 62.6 in3/pile=1025.83 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.56(in) based on E (ksi)=29000.00 and I (in4)/pile=428.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	. P1	Z2	P2 [′]	Slope	
	0	0	100	4.500	.045	
	*	eqk				
	0	.048	100	0.048		
PASSIVE PRES	SURES	S:				
	Z1	P1	Z2	P2	Slope	
	8	0	100	18.40	.2	
ACTIVE SPACIN	NG:					
	No.		Z depth		Spacing	
	1		0.00		7.00	
	2		8.00		2.50	
PASSIVE SPAC	ING:					
	No.		Z depth		Spacing	
	1		8.00		5.00	





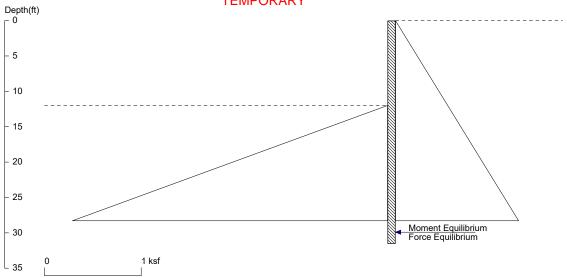
Based on pile spacing: 7.0 foot or meter

User Input Pile, W14X43: E (ksi)=29000.0, I (in4)/pile=428.0

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P7-P9, P14-P16 TEMPORARY



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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall temp.sh8

Wall Height=12.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=19.55 Min. Pile Length=31.55

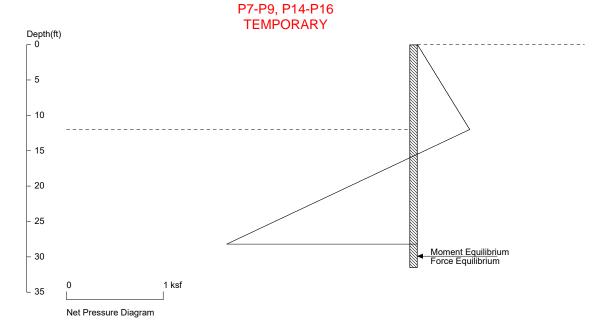
MOMENT IN PILE: Max. Moment=241.78 per Pile Spacing=7.0 at Depth=20.83

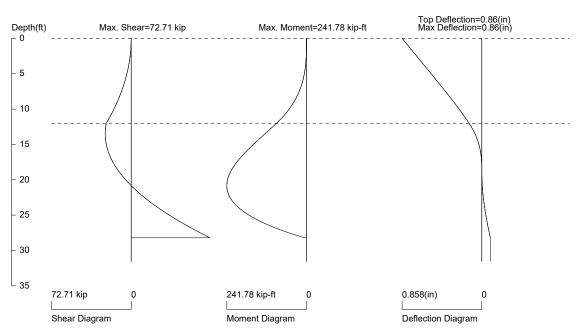
PILE SELECTION:

Request Min. Section Modulus = 122.1 in3/pile = 2001.02 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W16X89 has Section Modulus = 155.0 in3/pile = 2539.99 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.86(in) based on E (ksi)=29000.00 and 1 (in4)/pile = 1300.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	P1	Z2	P2	Slope	
	0	0	100	4.500	.045	
PASSIVE PRE	ESSURES	:				
	Z1	P1	Z2	P2	Slope	
	12	0	100	17.60	.2	
ACTIVE SPACE	CING:					
	No.		Z depth		Spacing	
	1		0.00		7.00	
	2		12.00		2.50	
PASSIVE SPA	ACING:					
	No.		Z depth		Spacing	
	1		12.00		5.00	





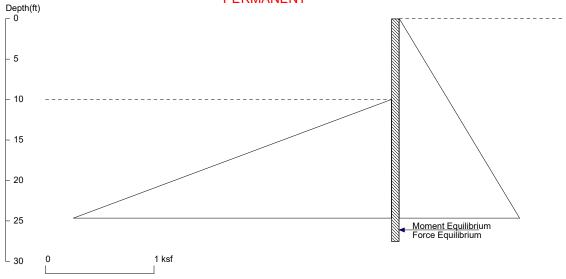
Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall temp.sh8

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P7-P9, P14-P16 PERMANENT



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Wall Height=10.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=17.57 Min. Pile Length=27.57

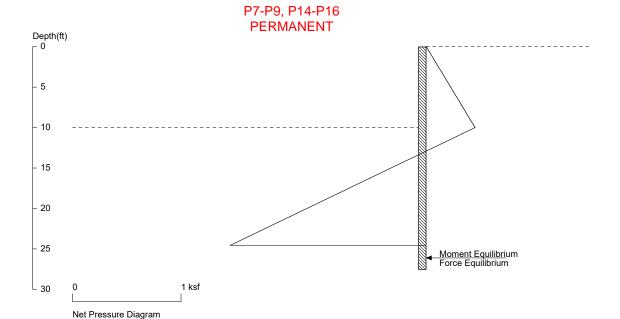
MOMENT IN PILE: Max. Moment=169.87 per Pile Spacing=7.0 at Depth=18.12

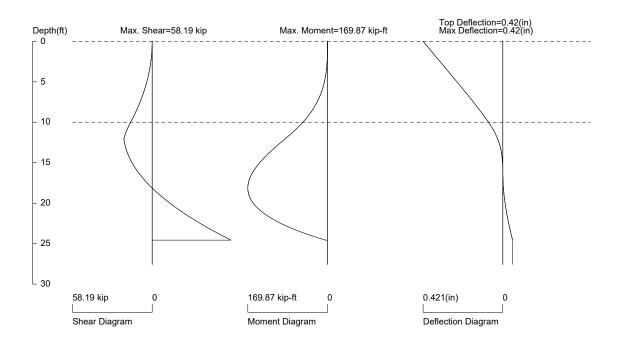
PILE SELECTION:

Request Min. Section Modulus = 85.8 in3/pile=1405.89 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W16X89 has Section Modulus = 155.0 in3/pile=2539.99 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.42(in) based on E (ksi)=29000.00 and I (in4)/pile=1300.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z	'1 F	P1 Z	Z2 P2	Slope	
	0	0 1	00 4.500	.045	
PASSIVE PRESS	URES:				
Z	'1 F	P1 Z	Z2 P2	Slope	
1	0	0 1	00 18.00	.2	
ACTIVE SPACING	3 :				
N	0.	Ζd	epth	Spacing	
•	1	0.	00	7.00	
:	2	12	00	2.50	
PASSIVE SPACIN	NG:				
N	0.	Ζd	epth	Spacing	
-	1	10	.00	5.00	



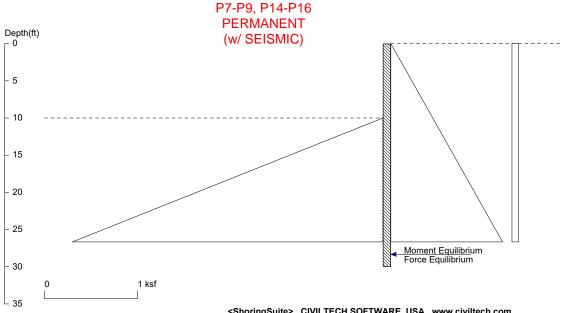


Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\trash wall perm.sh8

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Wall Height=10.0 Pile Spacing=7.0 Pile Diameter=2.5 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=20.01 Min. Pile Length=30.01

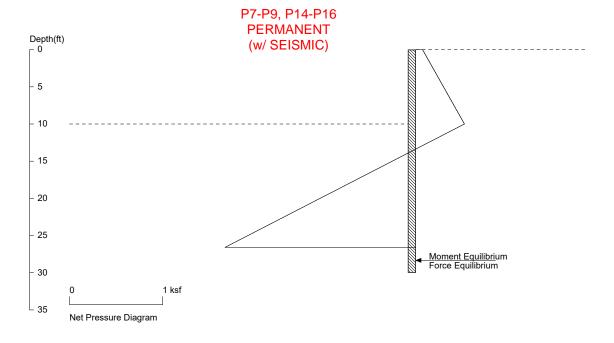
MOMENT IN PILE: Max. Moment=250.73 per Pile Spacing=7.0 at Depth=19.26

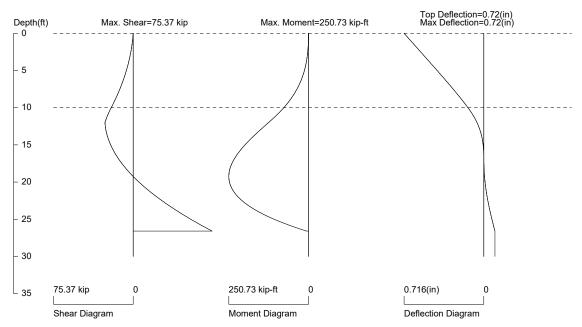
PILE SELECTION:

Request Min. Section Modulus = 126.6 in3/pile=2075.13 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W16X89 has Section Modulus = 155.0 in3/pile=2539.99 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.72(in) based on E (ksi)=29000.00 and I (in4)/pile=1300.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z	'. '1	P1	Z2	P2 [′]	Slope	
	0	0	100	4.500	.045	
	*	eqk				
(0	.072	100	0.072	0	
PASSIVE PRESS	URES:					
Z	<u>'</u> 1	P1	Z2	P2	Slope	
1	0	0	100	18.00	.2	
ACTIVE SPACING	Э:					
N	lo.		Z depth		Spacing	
	1		0.00		7.00	
:	2		12.00		2.50	
PASSIVE SPACIN	NG:					
N	lo.		Z depth		Spacing	
	1		10.00		5.00	





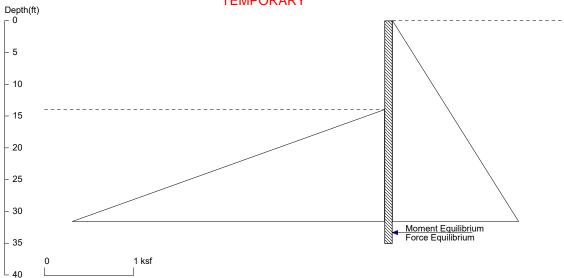
Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X89: E (ksi)=29000.0, I (in4)/pile=1300.0

 $File: K: \label{lem:condition} \textbf{K: L2021-01519-2021-06 Huber Residence-Calcs-Lambda} wall \ perm \ \textbf{EQK.sh8}$

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P10-P13 TEMPORARY



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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\turnaround temp.sh8

Wall Height=14.0 Pile Diameter=2.5 Pile Spacing=5.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=21.09 Min. Pile Length=35.09

MOMENT IN PILE: Max. Moment=274.13 per Pile Spacing=5.0 at Depth=23.64

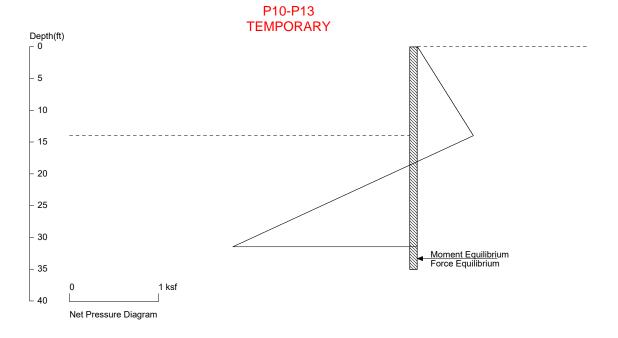
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

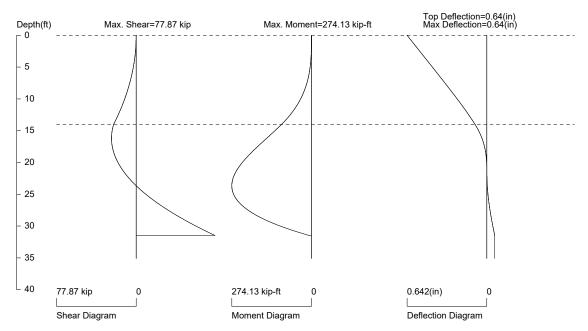
PILE SELECTION:

Request Min. Section Modulus = 138.4 in3/pile=2268.77 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X130 has Section Modulus = 256.0 in3/pile=4195.07 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.64(in) based on E (ksi)=29000.00 and I (in4)/pile=2460.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	. P1	Z2	P2	Slope	
0	0	100	4.500	.045	
*	eq				
PASSIVE PRESSUF	RES:				
Z1	P1	Z2	P2	Slope	
14	0	100	17.20	.2	
ACTIVE SPACING:					
No.		Z depth		Spacing	
1		0.00		5.00	
2		14.00		3.00	
PASSIVE SPACING	:				
No.		Z depth		Spacing	
1		14.00		5.00	



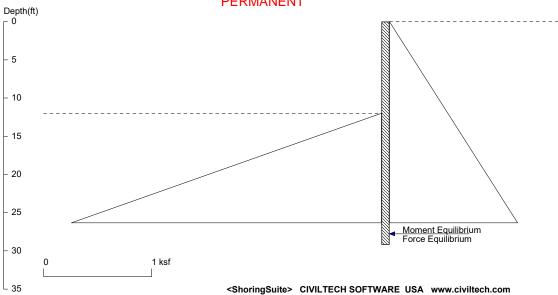


Based on pile spacing: 5.0 foot or meter

User Input Pile, W18X130: E (ksi)=29000.0, I (in4)/pile=2460.0

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P10-P13 PERMANENT



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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\turnaround perm.sh8

Wall Height=12.0 Pile Diameter=2.5 Pile Spacing=5.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=17.20 Min. Pile Length=29.20

MOMENT IN PILE: Max. Moment=162.04 per Pile Spacing=5.0 at Depth=19.75

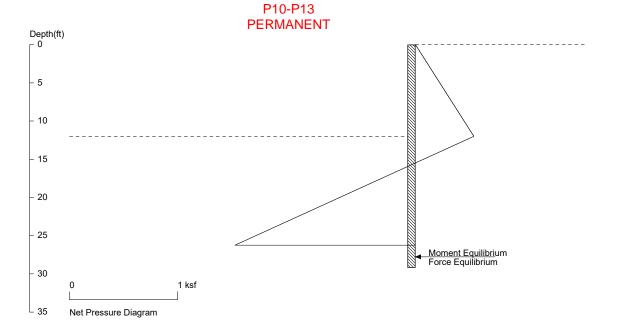
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

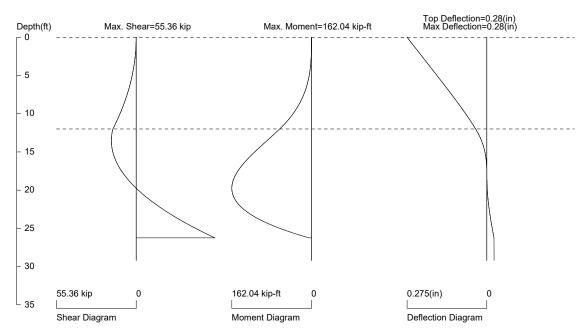
PILE SELECTION:

Request Min. Section Modulus = 81.8 in3/pile=1341.08 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X130 has Section Modulus = 256.0 in3/pile=4195.07 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.28(in) based on E (ksi)=29000.00 and I (in4)/pile=2460.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	` P1	Z2	P2	Slope	
0	0	100	4.500	.045	
PASSIVE PRESSU	RES:				
Z1	P1	Z2	P2	Slope	
12	0	100	17.60	.2	
ACTIVE SPACING:					
No		Z depth		Spacing	
1		0.00		5.00	
2		12.00		2.50	
PASSIVE SPACING	3 :				
No	-	Z depth		Spacing	
1		12.00		5.00	



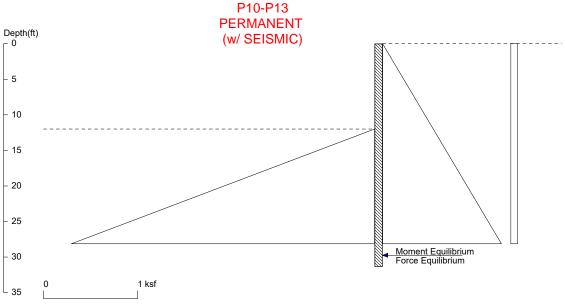


Based on pile spacing: 5.0 foot or meter

User Input Pile, W18X130: E (ksi)=29000.0, I (in4)/pile=2460.0

 $File: K: \label{lem:cond_perm.sh8} File: K: \label{lem:cond_perm.sh8} Identify the lemma of th$

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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\turnaround perm EQK.sh8

Wall Height=12.0 Pile Diameter=2.5 Pile Spacing=5.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=19.36 Min. Pile Length=31.36

MOMENT IN PILE: Max. Moment=229.75 per Pile Spacing=5.0 at Depth=20.75

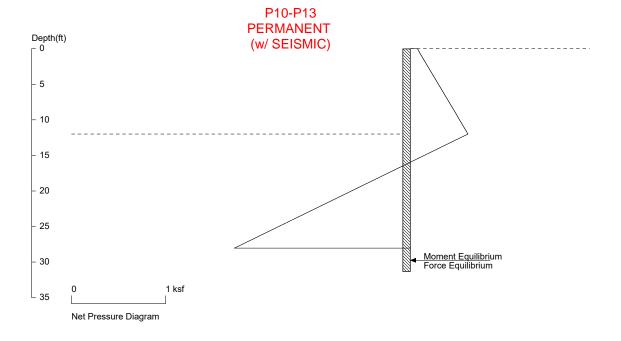
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

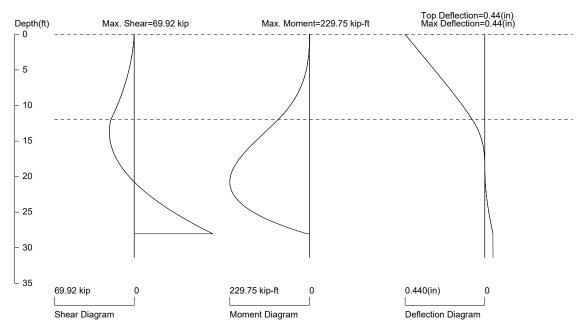
PILE SELECTION:

Request Min. Section Modulus = 116.0 in3/pile = 1901.45 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X130 has Section Modulus = 256.0 in3/pile = 4195.07 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.44(in) based on E (ksi)=29000.00 and I (in4)/pile = 2460.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	P1	Z2	P2	Slope	
	0	0	100	4.500	.045	
	*	eqk				
	0	.072	100	0.072	0	
PASSIVE PRES	SURES	: :				
	Z1	P1	Z2	P2	Slope	
	12	0	100	17.60	.2	
ACTIVE SPACIN	NG:					
	No.		Z depth		Spacing	
	1		0.00		5.00	
	2		12.00		2.50	
PASSIVE SPAC	ING:					
	No.		Z depth		Spacing	
	1		12.00		5.00	



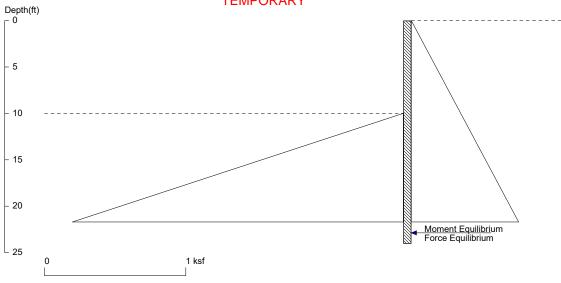


Based on pile spacing: 5.0 foot or meter

User Input Pile, W18X130: E (ksi)=29000.0, I (in4)/pile=2460.0

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P17-P19 TEMPORARY



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Date: 9/10/2021

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\Temporary basement shoring.sh8

Wall Height=10.0

Pile Diameter=2.5

Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.05 Min. Pile Length=24.05

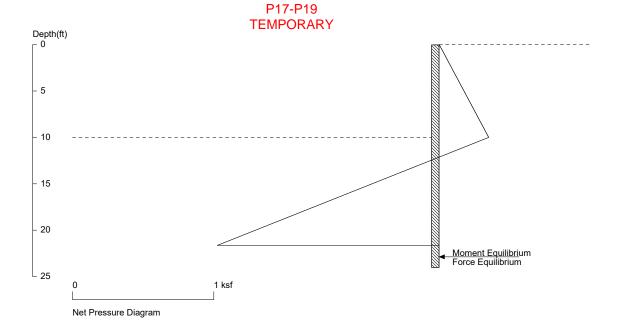
MOMENT IN PILE: Max. Moment=97.36 per Pile Spacing=7.0 at Depth=16.23

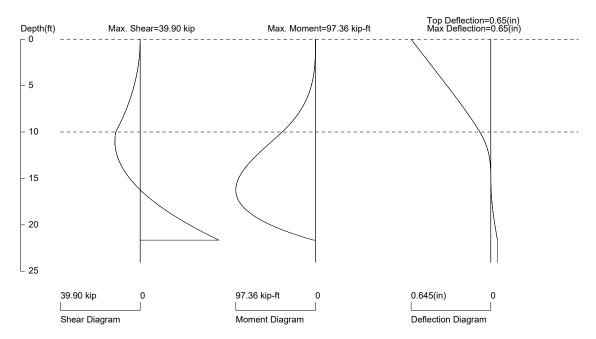
PILE SELECTION:

Request Min. Section Modulus = 49.2 in3/pile=805.75 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W16X36 has Section Modulus = 56.5 in3/pile=925.87 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.65(in) based on E (ksi)=29000.00 and I (in4)/pile=448.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

	Z1	P1	Z2	P2	Slope	
	0	0	100	3.500	0.035	
PASSIVE PRES	SSURES:					
	Z1	P1	Z2	P2	Slope	
	10	0	100	18.00	.2	
ACTIVE SPACI	NG:					
	No.		Z depth		Spacing	
	1		0.00		7.00	
	2		10.00		2.50	
PASSIVE SPAC	CING:					
	No.		Z depth		Spacing	
	1		10.00		5.00	





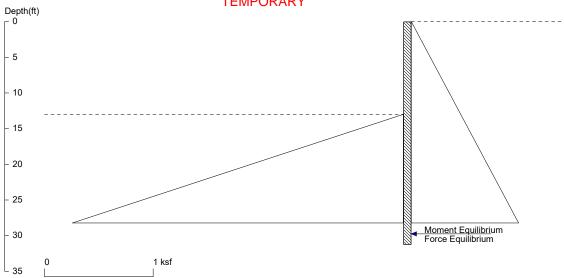
Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X36: E (ksi)=29000.0, I (in4)/pile=448.0

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P20-P24 TEMPORARY



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File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\north basement wall temp.sh8

Wall Height=13.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=18.27 Min. Pile Length=31.27

MOMENT IN PILE: Max. Moment=213.89 per Pile Spacing=7.0 at Depth=21.10

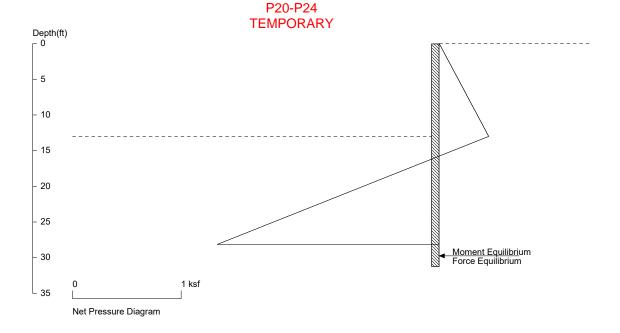
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=292.7, Vertical Factor of Safety=999.00

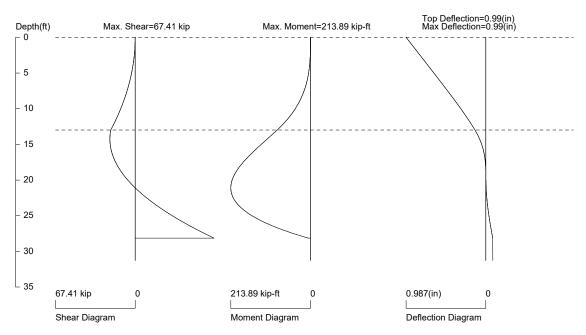
PILE SELECTION:

Request Min. Section Modulus = 108.0 in3/pile = 1770.24 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X65 has Section Modulus = 117.0 in3/pile = 1917.28 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.99(in) based on E (ksi)=29000.00 and I (in4)/pile=1070.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

DI WINTO I INCOO	,	,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,	O: // (: \O/.		
Z1	` P1	Z2	P2	Slope	
0	0	100	3.500	.035	
PASSIVE PRESSU	RES:				
Z1	P1	Z2	P2	Slope	
13	0	100	17.40	.2	
ACTIVE SPACING:	:				
No		Z depth		Spacing	
1		0.00		7.00	
2		13.00		2.50	
PASSIVE SPACING	3 :				
No		Z depth		Spacing	
1		13.00		5.00	



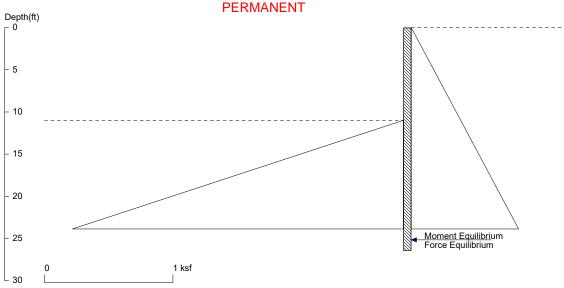


Based on pile spacing: 7.0 foot or meter

User Input Pile, W18X65: E (ksi)=29000.0, I (in4)/pile=1070.0

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P20-P24



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Wall Height=11.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=15.46 Min. Pile Length=26.46

MOMENT IN PILE: Max. Moment=129.58 per Pile Spacing=7.0 at Depth=17.86

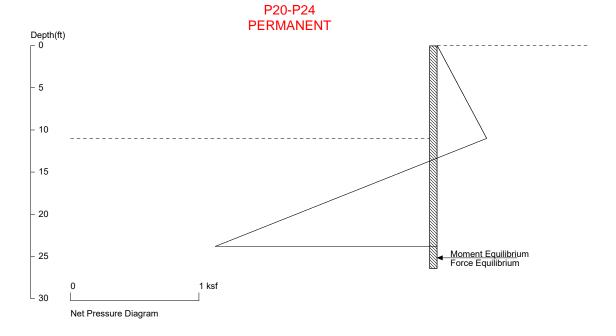
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

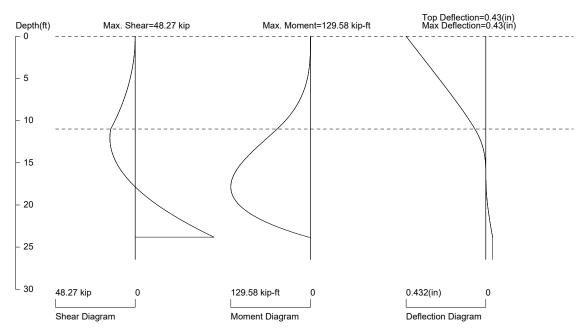
PILE SELECTION:

Request Min. Section Modulus = 65.4 in3/pile=1072.46 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X65 has Section Modulus = 117.0 in3/pile=1917.28 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.43(in) based on E (ksi)=29000.00 and I (in4)/pile=1070.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1		Z2	P2	Slope	
0	0	100	3.500	.035	
PASSIVE PRESSU	RES:				
Z1		Z2	P2	Slope	
11	0	100	17.80	.2	
ACTIVE SPACING:					
No		Z depth		Spacing	
1		0.00		7.00	
2		11.00		2.50	
PASSIVE SPACING	G :				
No		Z depth		Spacing	
1		11.00		5.00	



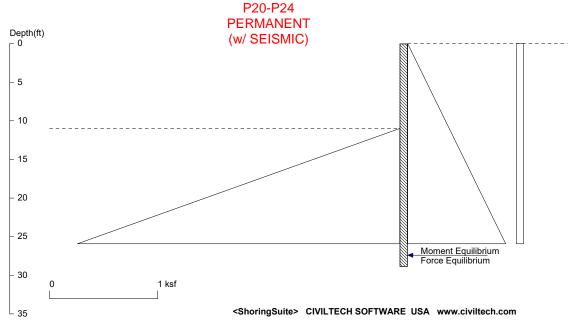


Based on pile spacing: 7.0 foot or meter

User Input Pile, W18X65: E (ksi)=29000.0, I (in4)/pile=1070.0

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Wall Height=11.0 Pile Diameter=2.5 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=17.90 Min. Pile Length=28.90

MOMENT IN PILE: Max. Moment=199.76 per Pile Spacing=7.0 at Depth=18.94

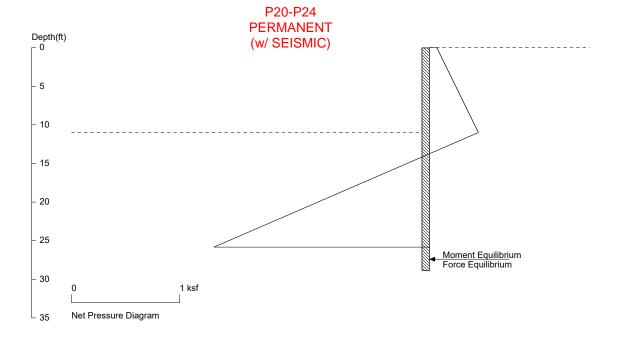
VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=0.2, Vertical Factor of Safety=999.00

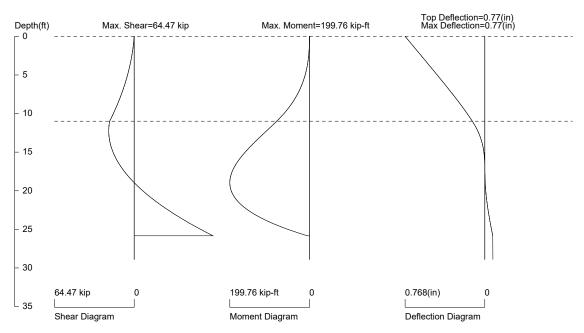
PILE SELECTION:

Request Min. Section Modulus = 100.9 in3/pile=1653.23 cm3/pile, Fy= 36 ksi = 248 MPa, Fb/Fy=0.66 W18X65 has Section Modulus = 117.0 in3/pile=1917.28 cm3/pile. It is greater than Min. Requirements! Top Deflection = 0.77(in) based on E (ksi)=29000.00 and I (in4)/pile=1070.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope	
0	0	100	3.500	0.035	
*	eq				
0	.066	100	0.066	0	
RESSURES	:				
Z1	P1	Z2	P2	Slope	
11	0	100	17.80	.2	
ACING:					
No.		Z depth		Spacing	
1		0.00		7.00	
2		11.00		2.50	
PACING:					
No.		Z depth		Spacing	
1		11.00		5.00	
	0 * 0 RESSURES Z1 11 ACING: No. 1 2 PACING: No.	0 0 * eq 0 .066 RESSURES: Z1 P1 11 0 ACING: No. 1 2 PACING: No.	0 0 100 * eq 0 .066 100 RESSURES: Z1 P1 Z2 11 0 100 ACING: No. Z depth 1 0.00 2 11.00 PACING: No. Z depth	0 0 100 3.500 * eq 0 .066 100 0.066 RESSURES: Z1 P1 Z2 P2 11 0 100 17.80 ACING: No. Z depth 1 0.00 2 11.00 PACING: No. Z depth	0 0 100 3.500 0.035 * eq 0 .066 100 0.066 0 RESSURES: Z1 P1 Z2 P2 Slope 11 0 100 17.80 .2 ACING: No. Z depth Spacing PACING: No. Z depth Spacing





Based on pile spacing: 7.0 foot or meter

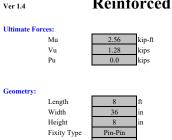
User Input Pile, w18x65: E (ksi)=29000.0, I (in4)/pile=1070.0

File: K:\2021\01519-2021-06 Huber Residence\Calcs\shoring\north basement wall_perm EQK.sh8

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Reinforced Concrete Beams (ACI 318-2005)

Project:



Member Type

T-Beam Slab B,flange b,eff

Lagging Huber Shoring 09/10/21 DMR Date: Engineer: 1 LAYER OF (4) #4 TENSION

Concrete:

F'c	3000 psi
β_1	0.850
Ec	3122 ksi

Beam

36.0 in

Steel:

Fy	60	ks
Es	29000	k
Inter-Layer Clearance	1	in
Bottom Cover	1.0	in
Side Cover	1	in
Consider p'	No	
As' Location	Web	



Spacing Check

(OK)

(OK)

Bar Number Depth to bar Count As / bar As / Layer Diameter Horiz Clr Extreme-most Layer 0.20 0.80 1.25 0.500 10.66 2nd Layer 0.00 0.00 0.00 0.000

Tension REINF

4th Layer	0	0	auto	0.00	0.00	0.00	0	n/a
3rd Layer	0	0	auto	0.00	0.00	0.00	0	n/a
2nd Layer	0	0	auto	0.00	0.00	0.00	0	n/a
Extreme-most Layer	4	4	auto	0.20	0.80	6.75	0.5	10.66
			in or auto	in ²	in ²	in	in	in

Global:

d	6.75 in		d'	1.25 in
As	0.80 in ²		As'	0.80 in^2
As min	0.81 in ²	N/A	ρ (rho)	0.33 %

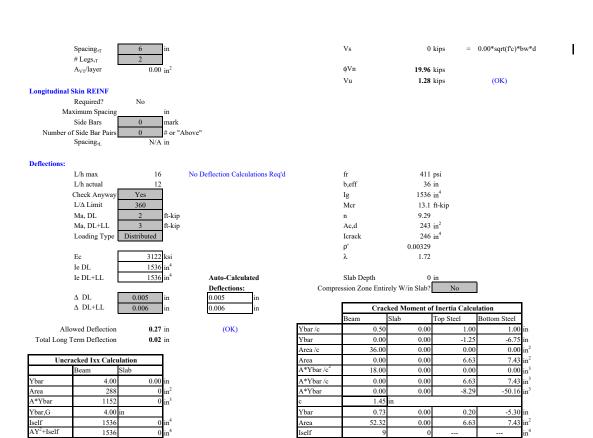
Internal A	Axial Fo	rces:
------------	----------	-------

	Sec	tion	
L	Ma		
s,max	11.94	in	(OK
c	0.62	in	
Extreme Fiber Es	0.0299		
φ	0.90	Tension Controll	ed
Mn	26	kip-ft	
φMn	23.36	kip-ft	
Mn	2.56	kin-ft	(OK

Strain Compatibility - Axial Force Equilibrium - Moment Capacity										
Layer	depth (in)	strain	stress (ksi)	Area (in ²)	Force (kips)	Moment (k-in)				
Comp Web	0.26	0.00300	2.55	18.82	48					
Comp Flange										
As'1 As'2										
As'3 As'4										
As4										
As3										
As2										
As1	6.75	-0.02992	-60.00	0.8	-48	311				
				Σ	0.00	311				

Transverse Shear REINF Shear Reinf is not required per 11.5.6.1

Fy	60	ksi	Vn,max	133 kips	= 10.00*sqrt(f'c)*bw*d
Transverse Bar Mark	0		Vc	27 kips	= 2.00*sqrt(f'c)*bw*d



208 in⁴

Icrack/Igross 16%