STRUCTURAL CALCULATIONS FOR:

HOUSE 88

88TH AVE SE
MERCER ISLAND, WA 98040

ARCHITECT: STUDIO19 ARCHITECTS

FEBRUARY 5, 2015

MALSAM
TSANG
STRUCTURAL
ENGINEERING

122 S JACKSON ST | SUITE 210 | SEATTLE WA 98104 | 206.789.6038 T | 206.789.6042 F

DESIGN CRITERIA IBC 2012

DEAD LOADS

ROOF		DECK		FLOOR	
Composition	2 psf			Flooring	1 psf
3/4" Plywood	2.4 psf	3/4" Plywood	2.4 psf	3/4" Plywood	2.4 psf
2x @ 24" o.c.	2 psf	2x @ 16" o.c	2.9 psf	TJI @ 16" o.c.	2.3 psf
Insulation	1 psf	Insulation	1 psf	Gyp Board (5/8")	2.75 psf
Mechanical	1 psf	Mechanical	1 psf	Mech/Misc	1 psf
Gyp Board (5/8")	2.75 psf	Gyp Board (5/8")	2.75 psf		
Misc	1 psf	Misc	1 psf		
		Palletized Deck	5 psf		
Total	12 psf	Total	16 psf	Total	9 psf
Use	15 psf	Use	20 psf	Use	10 psf

LIVE LOADS/OCCUPANCY

Occupancy Cat.	II
Roof Deck	No
Common Access	No

ROOF LIVE		FLOOR LIVE	
Occupany =	0 psf	Occupancy =	40 psf
Snow =	25 psf	Stair/Corridor =	40 psf

SEISMIC CRITERIA ASCE 7-10 Ch. 11 & Ch. 12

Imp. Factor =	1.00			
Site Class =	D			
R Value =	6.5	Table 12.2-1		
S_s =	1.43	F_a =	1.000	Table 11.4-1
S_1 =	0.55	F_v =	1.500	Table 11.4-2
S_{ms} =	1.430	x 2/3 = S_{ds} =	**0.953**	Eqn. 11.4-3
S_{m1} =	0.825	x 2/3 = S_{d1} =	**0.550**	Eqn. 11.4-4

C_{SULT} =	**0.147**	Eqn. 12.8-2
C_{SALL} =	**0.103**	

SEISMIC WEIGHT ASCE 7-10 12.7.2

Partitions = 10 psf

***Roof weight = 1/2 Partition + Roof DL**

***Floor weight = Full Partition + Floor DL**

ROOF	20 psf
DECK	25 psf
FLOOR	20 psf

WIND CRITERIA ASCE 7-10 Ch. 27 Directional Procedure

V =	110 mph	K_d =	0.85
Exposure =	B	G =	0.85
h =	44 ft	K_{zt} =	1.37 ***See Kzt Worksheet**

Roof Slope = 2 : 12 = 9.46 °

PRESSUE COEFFICIENTS (Cp)

Windward Wall = 0.8 Windward Roof = N/A

Leeward Wall = -0.5 Leeward Roof = N/A

PRESSURE (PSF) $q = 0.00256K_zK_{zt}K_dV^2$

Ht	K_z	q_z	$0.6xq_z$ [1]	q_h	P_{WW}	P_{LW}	P_{WALL}	P_{ROOF}
0-15	0.57	20.6	12.3		8.4	7.3	**15.7**	
15-20	0.62	22.4	13.4		9.1	7.3	**16.4**	
20-25	0.66	23.8	14.3		9.7	7.3	**17.0**	
25-30	0.70	25.3	15.2		10.3	7.3	**17.6**	
30-35	0.73	26.3	15.8		10.7	7.3	**18.0**	
35-40	0.76	27.4	16.4		11.2	7.3	**18.5**	
40-45	0.79	28.5	17.1	17.1	11.6	7.3	**18.9**	**N/A**
45-50	0.81	29.2	17.5		11.9	7.3	**19.2**	

[1] Per IBC 2012 1605.3.1 Basic Load Combinations

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House 88 — Project

88th Ave SE

Mercer Island, WA 98040

10/30/2014 — Date

0285-2014-01-01 — Proj. No.

SKH — Design

DC1 — Sheet

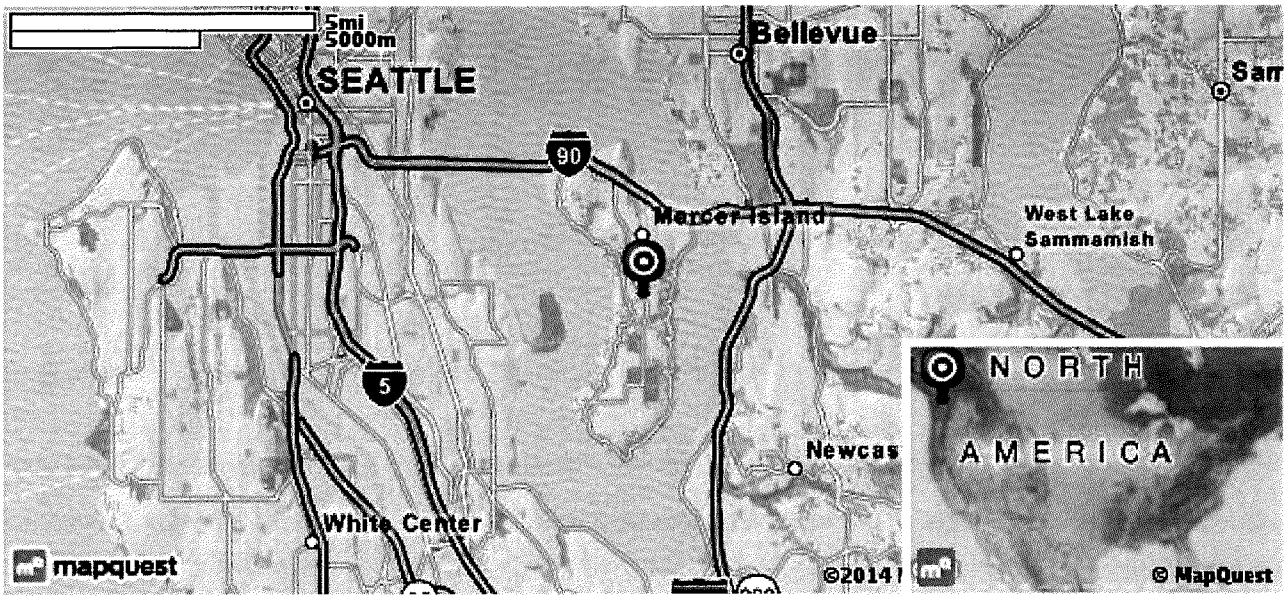

88th Ave SE, Mercer Island, WA 98040
Traffic · Transit · Bicycling · Terrain · Search nearby
Rotary Park
Mercer Island Library
Hollerbach Park
Ellis Pond
Congregational Church of Mercer Island
Mercer Island
Northwest Yeshiva High School
SE 44th St
SE 45th St
SE 46th St
SE 47th St
SE 48th St
SE 50th St
SE 50th Pl
SE 44th Pl
SE 52nd Pl
SE 53rd Pl
Maple Ln
Merrimount Dr
W Mercer Way
Island Crest Way
80th Ave SE
81st Ave SE
84th Ave SE
86th Ave SE
87th Ave SE
88th Ave SE
88th Pl SE
89th Ave SE
90th Ave SE
90th Pl SE
91st Ave SE
92nd Ave SE
Forest Ave SE
Bonney St
E Mercer Way
E Mercer Highlands Dr
Dawn Dr
Fernridge Ln
Map data ©2014 Google 500 ft

DC2

USGS Design Maps Summary Report

User–Specified Input

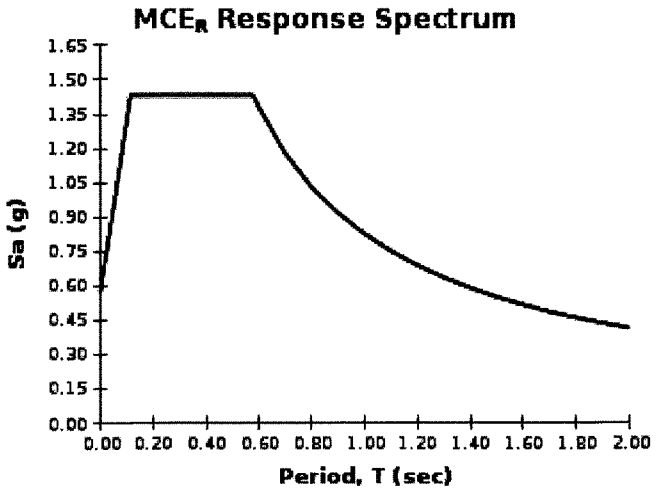
Report Title	House 88 Thu October 30, 2014 15:26:22 UTC
Building Code Reference Document	2012 International Building Code (which utilizes USGS hazard data available in 2008)
Site Coordinates	47.56071°N, 122.22178°W
Site Soil Classification	Site Class D – "Stiff Soil"
Risk Category	I/II/III

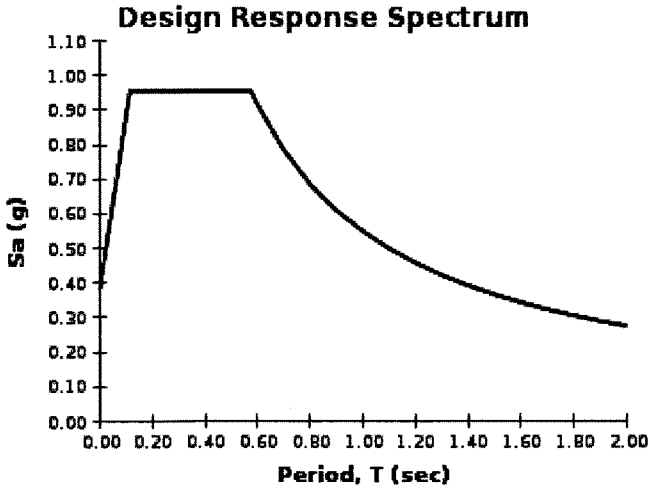


USGS–Provided Output

S_S =	1.430 g	S_{MS} =	1.430 g	S_{DS} =	0.953 g
S_1 =	0.549 g	S_{M1} =	0.824 g	S_{D1} =	0.549 g

For information on how the SS and S1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please return to the application and select the "2009 NEHRP" building code reference document.





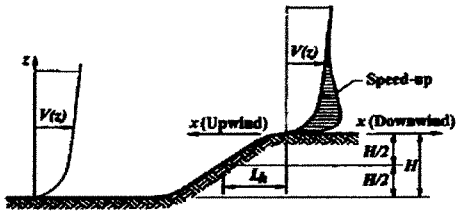
DC3

Kzt WORKSHEET

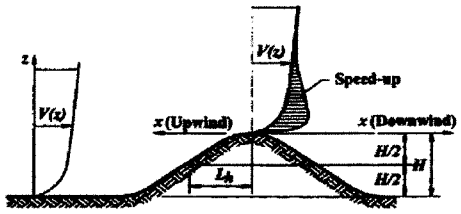
ASCE 7-10 26.8.1

Exposure = B
Bldg Height = 44 ft
Site Elev = 334 ft

Topographic Factor, K_{zt}
Figure 26.8-1



ESCARPMENT



2-D RIDGE OR 3-D AXISYMMETRICAL HILL

PROFILE 1	PROFILE 2	PROFILE 3	-- NOT USED --
Shape = 2-D Ridge	Shape = 2-D Ridge	Shape = 2-D Ridge	
H = 347 ft	H = 347 ft	H = 347 ft	
H/2 = 174 ft	H/2 = 174 ft	H/2 = 174 ft	
L_h = 2059 ft	L_h = 2270 ft	L_h = 2534 ft	
x = 528 ft	x = 1056 ft	x = 898 ft	
z = 44 ft	z = 44 ft	z = 44 ft	
Unobstructed[1] Yes	Unobstructed[1] Yes	Unobstructed[1] Yes	
Above Terrain[2] Yes	Above Terrain[2] Yes	Above Terrain[2] Yes	
Upper Half[3] Yes	Upper Half[3] Yes	Upper Half[3] Yes	
Site to Crest Upwind	Site to Crest Upwind	Site to Crest Upwind	
H/Lh[4] 0.169	H/Lh[4] 0.152837	H/Lh[4] 0.136916	
Calc Kzt ? YES	Calc Kzt ? YES	Calc Kzt ? YES	
K_1: $(K_1/H/L_h)$	K_1: $(K_1/H/L_h)$	K_1: $(K_1/H/L_h)$	
Coefficient = 1.3	Coefficient = 1.3	Coefficient = 1.3	
K_1 = 0.21907	**K_1 = 0.19869**	**K_1 = 0.17799**	
K_2: $(1 - \lvert x\rvert/\mu L_h)$	K_2: $(1 - \lvert x\rvert/\mu L_h)$	K_2: $(1 - \lvert x\rvert/\mu L_h)$	
μ = 1.5 (Figure 26.8-1)	μ = 1.5 (Figure 26.8-1)	μ = 1.5 (Figure 26.8-1)	
K_2 = 0.82906	**K_2 = 0.68992**	**K_2 = 0.76389**	
K_3: $e^{-\gamma z/Lh}$	K_3: $e^{-\gamma z/Lh}$	K_3: $e^{-\gamma z/Lh}$	
γ = 3 (Figure 26.8-1)	γ = 3 (Figure 26.8-1)	γ = 3 (Figure 26.8-1)	
K_3 = 0.93791	**K_3 = 0.94352**	**K_3 = 0.94925**	
$K_{zt} = (1 + K_1 K_2 K_3)^2$	$K_{zt} = (1 + K_1 K_2 K_3)^2$	$K_{zt} = (1 + K_1 K_2 K_3)^2$	
K_{zt} = 1.37	**K_{zt} = 1.28**	**K_{zt} = 1.27**	

1 *Hill, ridge, or escarpment is isolated and unobstructed upwind by other similar topographic features of comparable height for 100H or 2 miles (whichever is less) ASCE 7-10 26.8.1*

2 *The hill, ridge, or escarpment protrudes above the height of the upwind terrain features within a 2-mi radlus in any quadrant by a factor of two or more. ASCE 7-10 26.8.1*

3 *The structure is located as shown in Fig. 26.8-1 in the upper one-half of a hill or ridge or near the crest of an escarpment. ASCE 7-10 26.8.1*

4 *For $H/L_h > 0.5$, assume $H/L_h = 0.5$ for K_1 and $L_h = 2H$ for K_2 and K_3*

Kzt = 1.37

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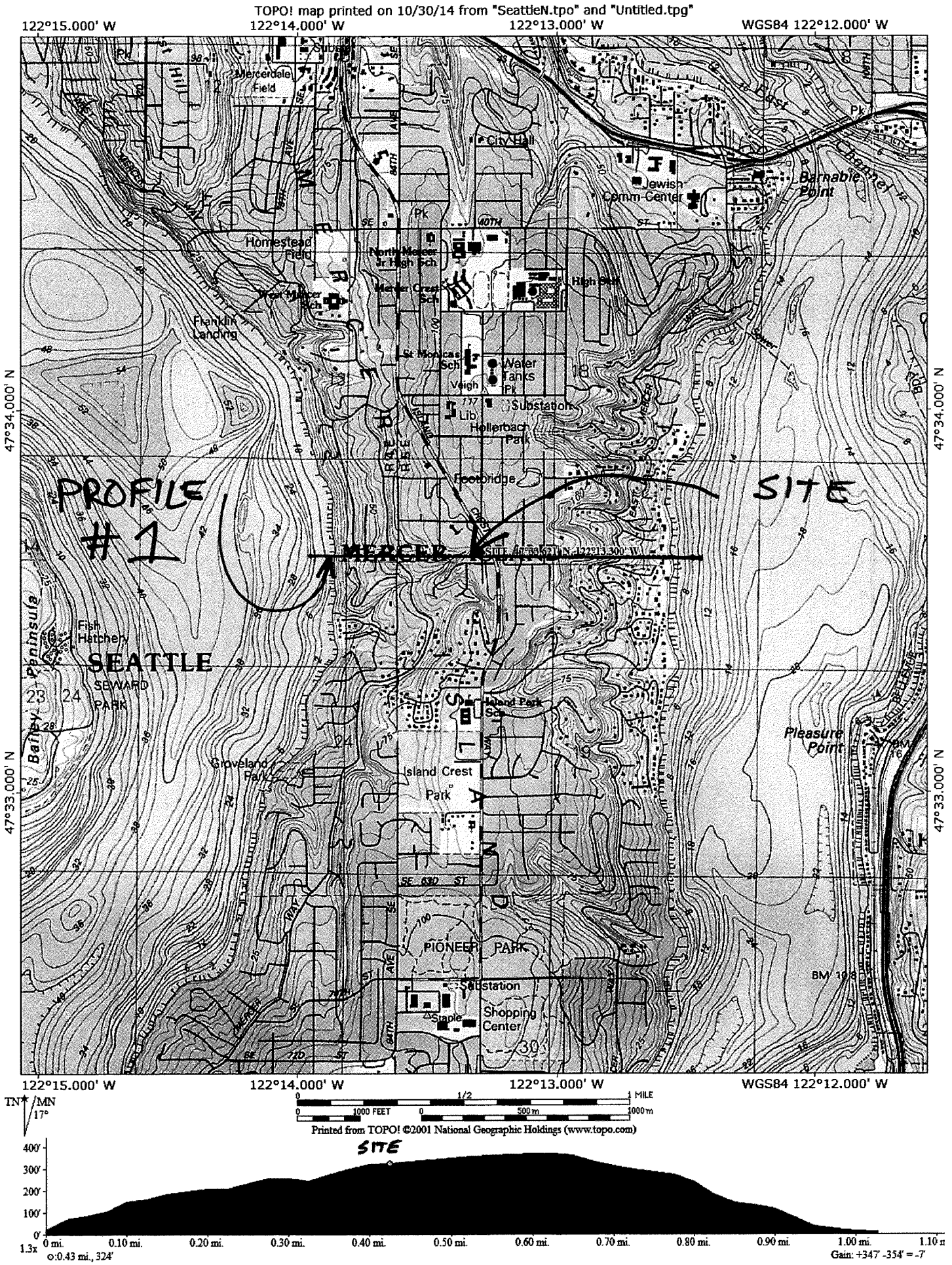
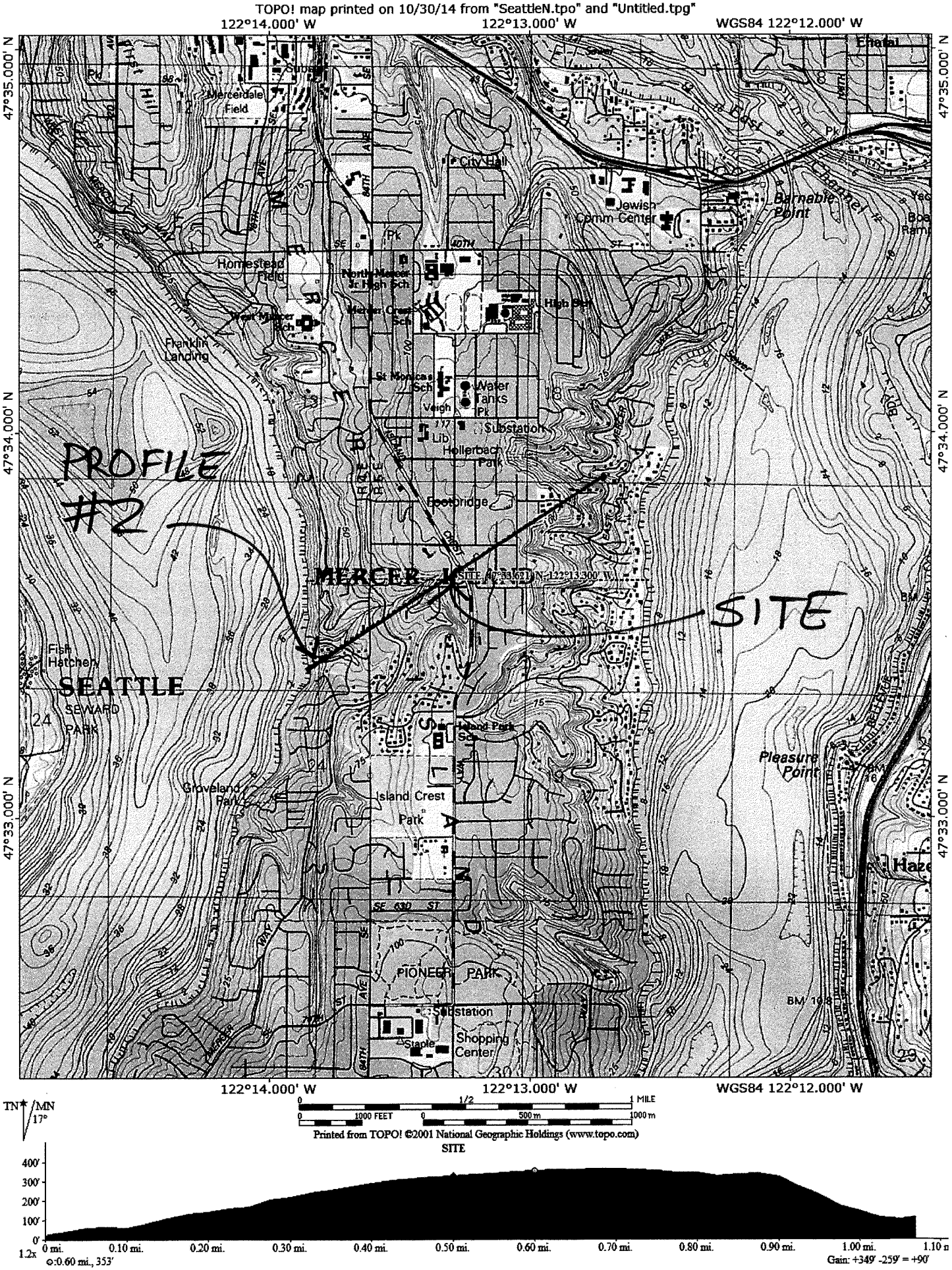
Mercer Island, WA 98040

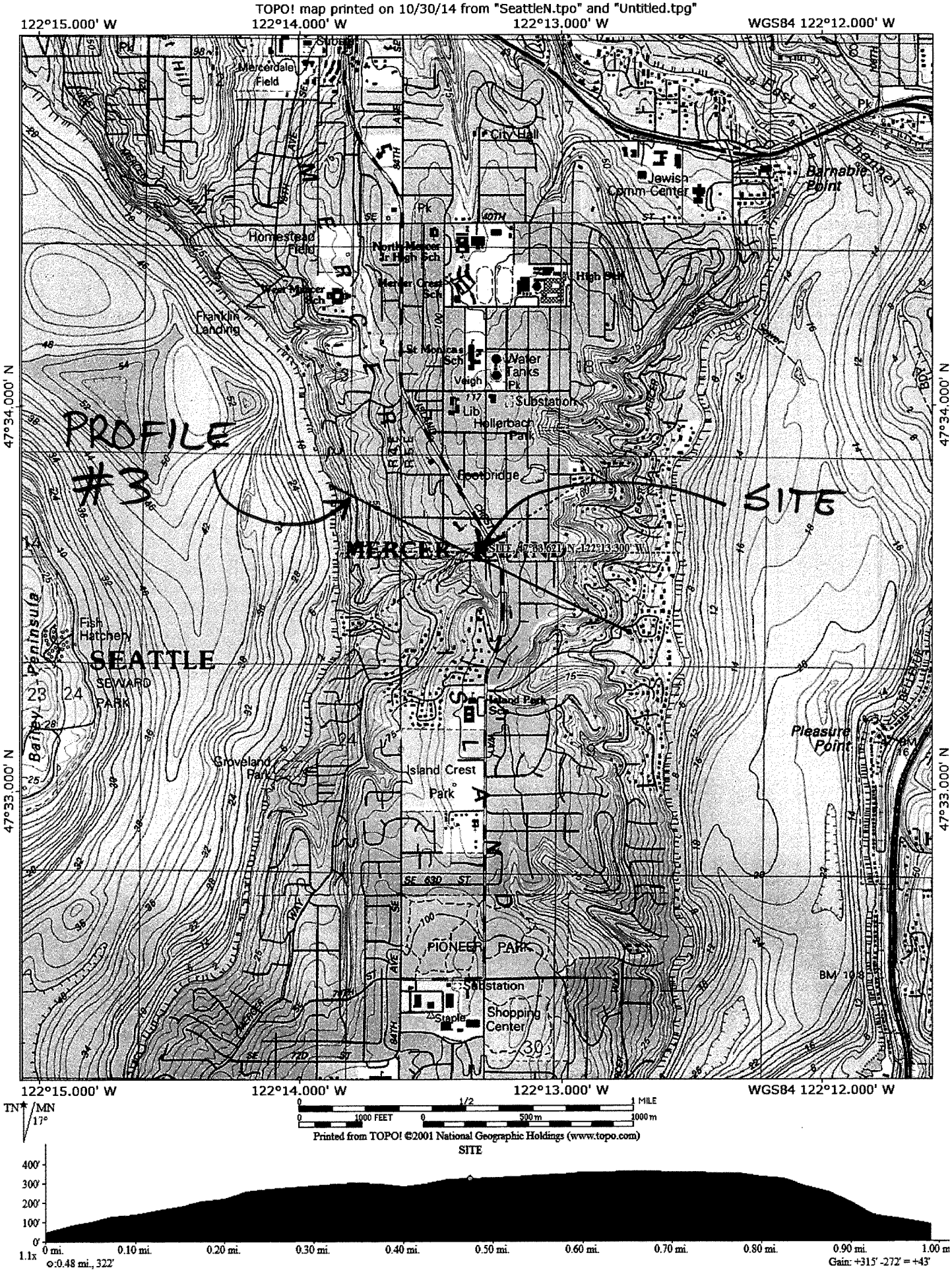
10/30/2014
Date
0285-2014-01-01
Proj. No.
SKH
Design
$K_{ZT}1$
Sheet


TOPO! map printed on 10/30/14 from "SeattleN.tpo" and "Untitled.tpg"
122°15.000' W
122°14.000' W
122°13.000' W
WGS84 122°12.000' W
47°34.000' N
47°33.000' N
PROFILE #1
SITE
MERCER
SEATTLE
Mercerdale Field
City Hall
Jewish Comm Center
Barnabie Point
Homestead Field
North Mercer Jr High Sch
Mercer Crest Sch
West Mercer Sch
High Park
Franklin Landing
St Monicas Sch
Water Tanks
Veigh Pk
Substation
Lib
Hollerbach Park
footbridge
Fish Hatchery
SEWARD PARK
Island Park Sch
Pleasure Point
Groveland Park
Island Crest Park
PIONEER PARK
Substation
Staple
Shopping Center
BM 10.8
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
TN 17° MN
1/2 MILE
1000 FEET
500 m
1000 m
SITE
400'
300'
200'
100'
0'
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi
1.3x
0.43 mi., 324'
Gain: +347' -354' = -7'

KZTZ


TOPO! map printed on 10/30/14 from "SeattleN.tpo" and "Untitled.tpg"
122°14.000' W
122°13.000' W
WGS84 122°12.000' W
47°35.000' N
47°34.000' N
47°33.000' N
PROFILE #2
SITE
MERCER
SEATTLE
Mercerdale Field
City Hall
Jewish Comm Center
Barnable Point
Homestead Field
North Mercer Jr High Sch
Mercer Creek Sch
West Mercer Sch
High Park
Franklin Landing
St Monica's Sch
Water Tanks
Substation
Lib
Hollerbach Park
Footbridge
Fish Hatchery
SEWARD PARK
Island Park
Pleasure Point
Groveland Park
Island Crest Park
PIONEER PARK
Substation
Staple
Shopping Center
BM 16.8
TN
MN
17°
1/2
MILE
1000 FEET
500 m
1000 m
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
SITE
400'
300'
200'
100'
0'
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi.
1.10 mi
1.2x
0.60 mi., 353'
Gain: +349' -259' = +90'

KZT 3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122°15.000' W
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WGS84 122°12.000' W
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PROFILE #3
SITE
MERCER
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Mercerdale Field
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Bailey Peninsula
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Island Crest Park
Island Park Sch
Pleasure Point
Burnable Point
PIONEER PARK
Substation
Staple
Shopping Center
SE 63D ST
SE 72D
84TH AVE
BM 10.8
Printed from TOPO! ©2001 National Geographic Holdings (www.topo.com)
SITE
400'
300'
200'
100'
0'
0 mi.
0.10 mi.
0.20 mi.
0.30 mi.
0.40 mi.
0.50 mi.
0.60 mi.
0.70 mi.
0.80 mi.
0.90 mi.
1.00 mi
1.1x
Gain: +315' -272' = +43'

KZT4

LATERAL ANALYSIS

SEISMIC

LEVEL	AREA	WEIGHT	HT.	$w_i h_i$	C_{vx}	V(k)
ROOF	1475	29.5	30	885	.36	4.4
2ND	2280	47.6	22	1047	.43	5.2
ENTRY	2070	41.4	12	497	.21	2.6
		118.5k		2429		12.2k

$V = 0.147 (118.5k) = 17.4k$

$V = 0.103 (118.5k) = 12.2k$

WIND

NORTH-SOUTH DIRECTION

LEVEL	TRIB HT.	#/'	L(')	V(k)
ROOF	6	106	32	3.4
2ND	9	152	40	6.1
ENTRY	11	174	40	7.0
				16.4k

EAST-WEST DIRECTION

LEVEL	TRIB HT	#/'	L(')	V(k)
ROOF	7	131	52	6.8
2ND	9	161	61	9.8
ENTRY	11	186	61	11.3
				27.9k

$\therefore$ WIND GOVERNS BOTH DIRECTIONS EXCEPT AT ROOF IN N-S DIRECTION

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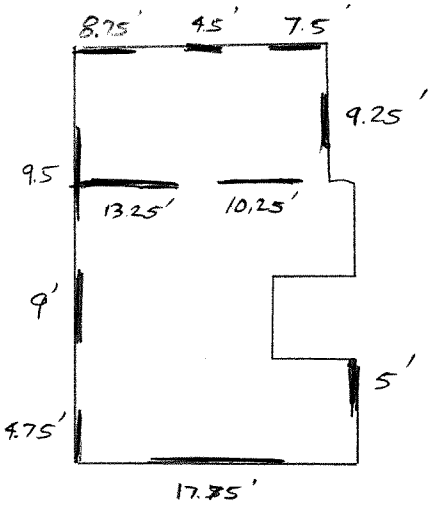
HOUSE 88
PROJECT

11/5/14
DATE

PROJECT NO
SKH
DESIGN
L1
SHEET

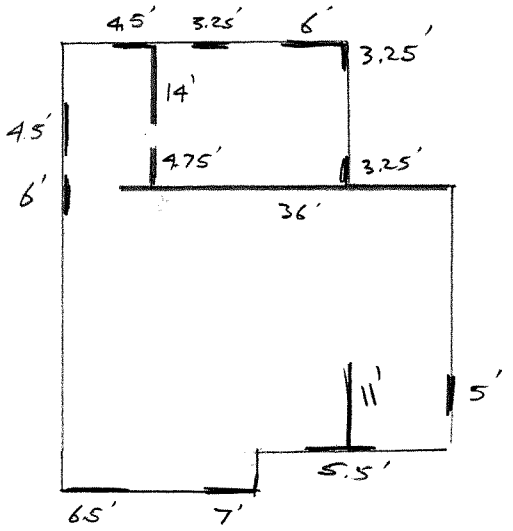
LATERAL KEY PLAN

ROOF

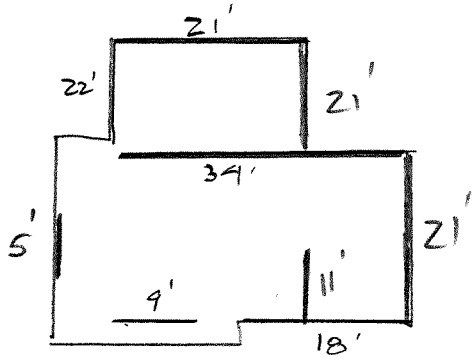


NORTH

2ND



1ST



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HOUSE 98
PROJECT

11/5/14
DATE

PROJECT NO

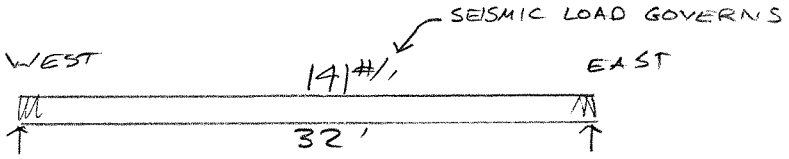
SKH
DESIGN

L2
SHEET

SHEARWALL DESIGN - NORTH - SOUTH

ROOF

8' WALL

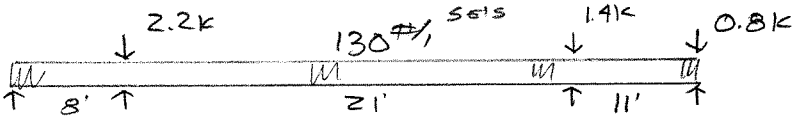


V(k)	2.2	2.2
L(')	23.25	14.25
$2v_u$ (#/')	95	154
SW	SW1	SW1 [1]
T(k)	-	1.2
HD	-	CS16.

[1] DIA. CHECK
$v = 770\#/11'$
$v = 70\#/'$
OK

2ND

9' WALL

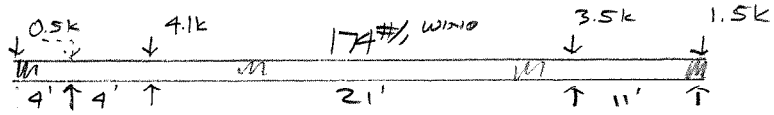


V(k)	0.5	4.1	3.5	1.5
L(')	10.5	18.75	17.5	5
$2v_u$ (#/')	50	220	200	303
SW	SW1	SW1.	SW1/SW2 [2]	SW2.
T(k)	-	2.2	1.8 - DL	2.7+(1.2)
HD	-	(2) CS16.	CS16/LSTHD8.	(3) CS16 or HDU8.

[2] GARAGE H:W RATIO
(2)(3.25)/9
= .72
350#/'(.72)
= 252 ✓

1ST

9' WALL



V(k)	1.5	6.3	6.3	2.5
L(')	5	22	32	21
$2v_u$ (#/')	309	285	197	117
SW	SW2.	SW2.	SW1/CONC	CONC FND OK
T(k)	2.8	2.6+(2.2) @ STACK	1.8+(1.7)	
HD	STHD10/. HDU5	STHD14.	HDU4. @ WOOD WALL	

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HOUSE 88
PROJECT

11/5/14
DATE

PROJECT NO

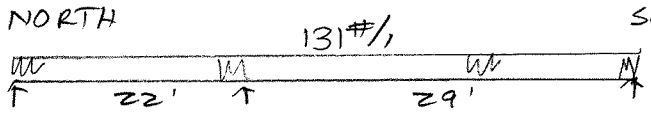
SKH
DESIGN

L3
SHEET

SHEARWALL DESIGN - EAST-WEST

ROOF

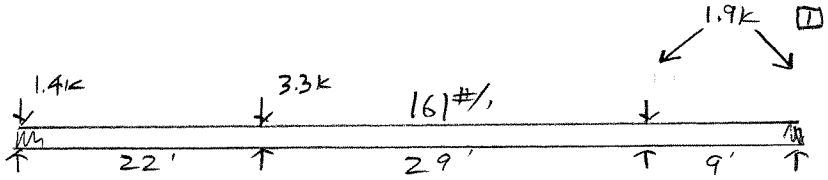
8' WALL



V(k)	1.4	3.3	1.9
L(')	20.75	23.5	17.75
v_u(#/')	69	142	107
SW	SW1.	SW1.	SW1.
T(k)	-	1.1	LONG WALL
HD	-	CS16.	-

2ND

9' WALL



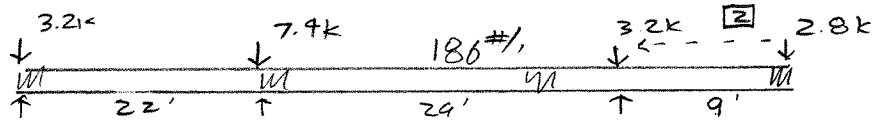
V(k)	3.2	7.4	3.2	2.8
L(')	13.75	36	5.5	13.5
v_u(#/')	233	206	582	207
SW	SW2.	SW1.	SW4.	SW1.
T(k)	2.1	LONG WALL W/DL	5.2	1.9 - DL
HD	(2)CS16/STHD14.	CS16 @ ABOVE. EXCEPT @ RIDGE LOCATION	HDU8.	CS16.

[1] USE DECK DIA. TO TRANSFER LOAD TO SOUTH WALLS

v_u = 2.8k/22' = 127#/' TYP DIA OK

1ST

9' WALL



V(k)	5.2	12.1	10.4
L(')	21	34	27
v_u(#/')	250	355	384
SW	SW2.	SW3.	SW3/CONC FND.
T(k)	2.2/(2.1)	LONG WALL	3.5
HD	STHD10 @ ENDS AND CS16. ABOVE	HDU4 @. CS16 ABV.	STHD14.

[2] DIA. CHECK

v_u = 4.5k/22' = 203#/' BLOCK DIA. W/8d AT 4" OC

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PROJECT

11/10/14
DATE

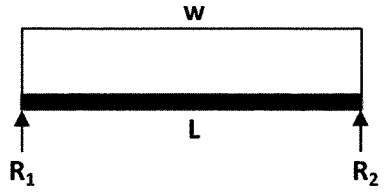
PROJECT NO

SKH
DESIGN

L4
SHEET

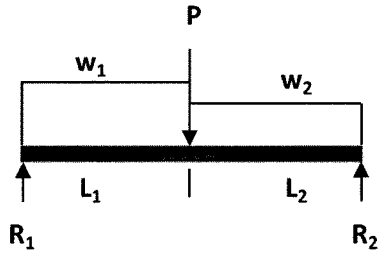
TYPICAL BEAM CASES

CASE #1: (C1)

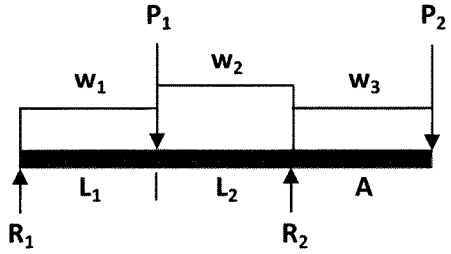


***ASSUME CASE 1 FOR ALL BEAMS U.N.O.**

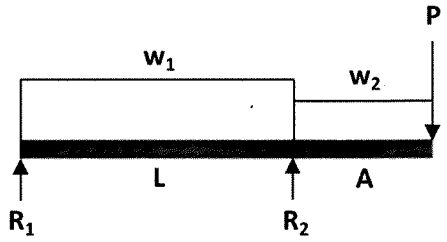
CASE #2: (C2)



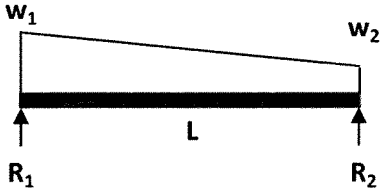
CASE #5: (C5)



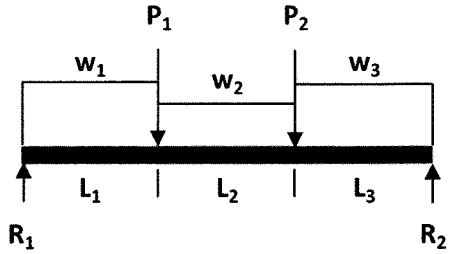
CASE #3: (C3)



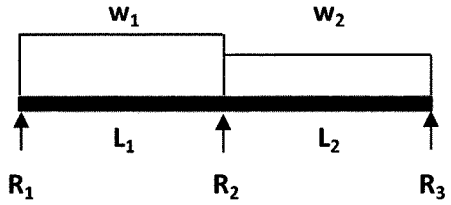
CASE #6: (C6)



CASE #4: (C4)



CASE #7: (C7)



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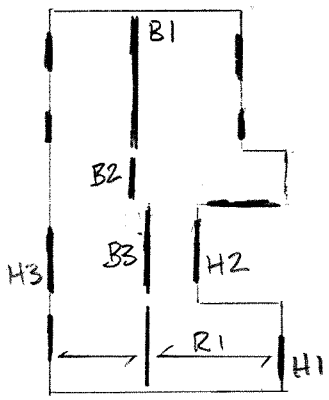
Mercer Island, WA 98040

2/3/2015
Date
0285-2014-01-01
Proj. No.
SKH
Design
B1
Sheet

VERTICAL DESIGN: ROOF

KEY PLAN:



B1:

L = 21.5'
w = 0.52k/'
R1 = 5.6k
M = 30.0k'

f_b = 1.63ksi
F_b' = 2.75ksi
f_v = 104psi
Δ = 0.64"
L/402

GL 3 1/2 × 19 1/2

B2:

L = 7'
w = 0.3k/'
R = 1.1k
M = 1.84k'

f_b = 0.348ksi
F_b' = 0.977ksi
f_v = 34psi
Δ = 0.04"
L/2400

(2) 2×12

B3:

L = 10.5'
w = 0.63k/'
R = 3.3k
M = 8.68k'

f_b = 1.24ksi
F_b' = 2.76ksi
f_v = 96psi
Δ = 0.19"
L/665

GL 3 1/2 × 12

H1:

L = 6'
w = 0.40
R = 1.2k
M = 1.8k'

f_b = 0.822ksi
F_b' = 1.173ksi
f_v = 66psi
Δ = 0.1"

(2) 2×8

H2:

L = 8.25'
w = 0.17k/'
R = 0.7k
M = 1.45k'

f_b = 0.66ksi
F_b' = 1.173ksi
f_v = 41psi
Δ = 0.14"
L/692

(2) 2×8

H3:

L = 10'
w = 0.46
R = 2.3k
M = 5.75k'

f_b = 1.46ksi
F_b' = 2.76ksi
f_v = 93psi
Δ = 0.27"
L/444

GL 3 1/2 × 9

R1:

L = 16'
w = 0.08k/'
R = 0.64k
M = 2.56k'

f_b = 0.971ksi
F_b' = 1.124ksi
f_v = 50psi
Δ = 0.51"
L/376

2×12 @ 24" O.C.

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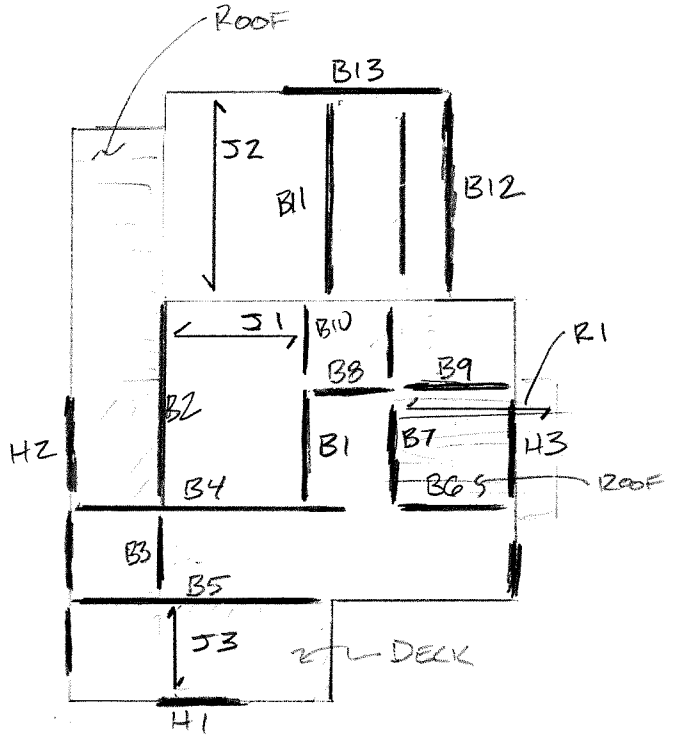
PROJECT: HOUSE 88
DATE: 11/6/14
PROJECT NO: WA1
DESIGN: VC
SHEET

VERTICAL DESIGN: SECOND FLOOR

KEY PLAN:



B1:

L=10' f_b=0.912ksi

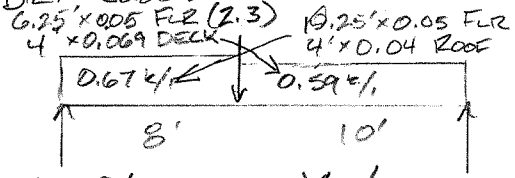
w=0.5k/' F_b'=2.325ksi

R=2.5k F_v=72psi

M=6.25k' Δ=0.15" L/800

LSL 3½×11⅞

B2; Case 2



L_1=8' M_{bx}/Ω_b=137k' OK

L_2=10' Δ=0.27" L/796

w_1=0.67 P=2.3

w_2=0.59

R_1=7.1k

R_2=6.5k

M=35.24k'

W10×45 OR W10×22

B3; Case 2

L_1=0.5'

L_2=10' f_b=1.53ksi

$w_1=w_2$= (0.46) Above, 0.28 Deck, 0.36 Flr = 1.10k/' F_b'=

P=(2.3) Above

R_1=8.0k R_2=5.9k

M=15.7k'

PSL 5¼×11⅞ OR LSL 3½×11⅞

B4; Case 4

L_1=7.75' P_1=14.5k M_{bx}/Ω_b=175k'

L_2=12.25' P_2=2.5k V_{wx}/Ω_v=103k

L_3=2' R_1=11.0k Δ=0.73"

w_1=0.14k/' R_2=8.5k L/360

$w_2=w_3$=0.1k/' M=80.8k'

V=10.8k

W8×67

B5:

D+L: Case 2

L_1=8', L_2=14'

$w_1=w_2$=0.54 ← Deck: .38, Wall: .12, Roof: .08

P=5.9k

R_1=10.1 R_2=8.5

M=62.5k'

W8×67

Δ=0.65"

L/409

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HOUSE 88
PROJECT

11/6/14
DATE

PROJECT NO
W41

DESIGN
VZ

SHEET

VERTICAL DESIGN: SECOND FLOOR CONT'D

B6:

L = 11'
w = 0.08 ROOF
0.123 W/ALL
0.05 FLR
0.253 k/'
R = 1.4k
M = 3.8k'

f_b = 0.56ksi
F_b' = 2.3ksi
f_v = 41psi
Δ = 0.11"

LSL 3½ × 11⅞

B7: CASE 4

L_1 = 1'
L_2 = 8.5'
L_3 = 1'
w_{1-3} = 0.2 FLR
0.22 ROOF
$P_1 = P_2$ = 0.9k
R_1 = 3.1k R_2 = 3.1k
M = 6.7k'

f_b = 0.98ksi
F_b' = 2.6ksi
f_v = 97psi
Δ = 0.18"
L/700

LSL 3½ × 11⅞

B8: CASE 2

L_1 = 2.5'
L_2 = 5'
$w_1 = w_2$ = 0.14 ROOF
0.15 WALL
0.10 FLR
P = 1.1k + 3.3k = 4.4k (FROM ABOVE)
R_1 = 4.6k R_2 = 3.1k
M = 10.1k'

f_b = 1.47ksi
F_b' = 2.6ksi
f_v = 150psi
Δ = 0.12"
L/770

LSL 3½ × 11⅞

B9:

L = 11'
w = 0.116k/'
R = 0.9k
M = 2.42k'

f_b = 0.95ksi
F_b' = 1.2ksi
f_v = 46psi
Δ = 0.3"
L/445

4×8

B10:

L = 7.5'
w = 0.7k/'
R = 2.6k
M = 4.9k'

f_b = 0.72ksi
F_b' = 2.3ksi
f_v = 70psi
Δ = 0.07"

LSL 3½ × 11⅞

B11:

L = 21.5'
w = 0.12 k/'
R = 1.3k
M = 7.1k'

f_b = 1.04ksi
F_b' = 2.3ksi
f_v = 43psi
Δ = 0.78"
L/330

LSL 3½ × 11⅞

B12: (CASE 4)

R_o 1.2 × 2.5 = 3.0k
3.0k
4.5 | 9' | 8'

0.6D = 0.155
D: 0.258
L+S: 0.253
0.511k/'

D+L: $R_1 = R_2$ = 5.5k
M = 29.5k'
Δ = 0.4"
L/643

D+L ± 0.7ER_o:
R_1 = 4.2 (6.7)
R_2 = 6.7 (4.2)
M = 37.6k' ←
FOR GL 5½ × 19½
f_b = 1.29ksi
F_b' = 3.7ksi
f_v = 82psi

0.6D + 0.7ER_o:
R_1 = 0.4 (NO UPLIFT)
R_2 = 2.9k

GL 5½ × 19½

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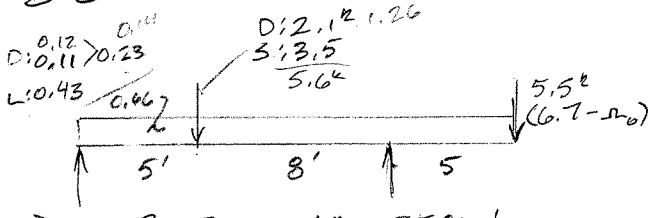
PROJECT: HOUSE 88
DATE: 11/6/14
PROJECT NO: 1401
DESIGN: V3
SHEET

VERTICAL DESIGN: SECOND FLOOR CONT'D

B13:



D+L: (CASE 5) $R_1 = 5.0^k$ $M = -35.8$ kip-ft
$R_2 = 18.0^k$

D ONLY ON BACKSPAN:
$f_b = 1.06$ ksi, $\Delta_c = 0.19''$ OK
$F_b' = 2.3$ ksi

CHECK UPLIFT W/ 0.7E.Mo, ONLY D ON BACKSPAN:
$R_1 = -0.42^k$ $M = -41.8^{k'}$
$R_2 = 15.5^k$ $f_b = 1.24$ ksi
$F_b' = 3.6$ ksi

H1

$L = 9'$ $f_b = 0.884$ ksi
$w = 0.31^k/'$ (Deck) $F_b' = 1.07$ ksi
$R = 1.4$ $f_v = 62$ psi
$M = 3.14$ $\Delta = 0.18''$
(2) 2x10 L/607

H2

$L = 10.5'$ $f_b = 0.588$ ksi
$w = 0.292^k/'$ $F_b' = 2.7$ ksi
$R = 1.5^k$ $f_v = 45$ psi
$M = 4.03^{k'}$ $\Delta = 0.11''$
L/1192
LSL 3 1/2 x 11 7/8

H3:

$L = 10'$ $f_b = 1.08$
$w = 0.36$ $F_b' = 1.242$ ksi
$R = 1.8^k$ $f_v = 71$ psi
$M = 4.5^{k'}$ $\Delta = 0.22''$
4x10 L/547

J1:

$L = 14.25'$ $M_{allow} = 4.2^{k'}$
$w = 0.067^{k/'}$ $\Delta = 0.18''$
$R = 0.48^k$ L/956
$M = 1.7^{k'}$
11 7/8 TJI 230 @ 16" OC

J2:

$L = 21.5'$ $M_{allow} = 6.18^{k'}$
$w = 0.05^{k/'}$ $\Delta = 0.57''$
$R = 0.54^k$ L/449
$M = 2.89^{k'}$
11 7/8 TJI 360 @ 12" OC

J3:

$L = 8.5'$ $f_b = 0.76$ ksi
$w = 0.092^{k/'}$ $F_b' = 1.34$ ksi
$R = 0.391^k$ $F_v = 46$ psi
$M = 0.83$ $\Delta = 0.08''$
L/1300
2x8 @ 16" OC

R1:

$L = 11'$ $f_b = 1.11$ ksi
$w = 0.08$ $F_b' = 1.34$ ksi
$R = 0.44$ $F_v = 54$ psi
$M = 1.21$ $\Delta = 0.43''$
2x8 @ 24" O.C L/310

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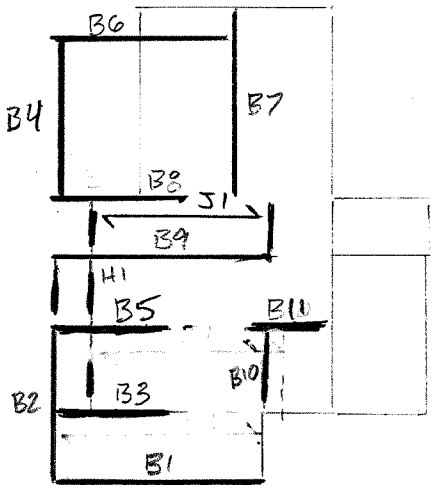
PROJECT: House 88
DATE: 11/6/14
PROJECT NO: 14A1
DESIGN: VY
SHEET

VERTICAL DESIGN: GROUND FLOOR

B1: CASE 4

$L_1 = 6.5'$
$L_2 = 9'$
$L_3 = 7'$
w_1: D: 0.22 (.13) / L: 0.26 (.07) → 0.48
w_2: D: 0.12 / L: 0.04 → 0.16
$w_3 = w_1$ (.35)
P: D: 0.41k / L: 0.99k → 1.4

D+L: $R_1 = 5.4^k$ $M = 26.9^{k'}$
$R_2 = 5.4^k$
$f_b = 0.798$ ksi
$\Delta = 0.34''$
$L/794$



GL 5 1/2 x 21

B2: CASE 3

$L_1 = 11'$
$A = 9'$
w_1: D: 0.14 / L: 0.09 → 0.23
w_2: D: 0.23 / L: 0.44 → 0.67
P: D: 2.4 / L: 3.0 → 5.4

D+L: $R_1 = -5.6^k$ $M = -75.7^{k'}$
$R_2 = 19.6^k$ $\Delta = 0.41''$
D ONLY ON BS: $\Delta_{BS} = -0.05''$
$R_1 = -6.1^k$ $\Delta_c = 0.41''$ 24/527
D ONLY ON CANT. $R_1 = -1.55^k$ $\Delta_{bs} = -0.02''$

W10 x 100
$I = 623.9$

B4:

$L = 18'$
w: 0.18 (.200F) / 0.12 (W/ALL DL) / 0.20 (FLR) → $0.5^{k/'}$
$R = 4.5^k < 2.0^k D + 2.5^k L$
$M = 20.25^{k'}$

$f_b = 1.18$ ksi
$F_b' = 2.68$
$f_v = 70$ psi
$\Delta = 0.42''$
$L/509$

GL 5 1/2 x 15

B3: CASE 3

$L_1 = 8.5'$
$A = 4.25$
$w_1 = w_2 = 0.067^{k/'}$
$P = 31.2^k$
$R_1 = -15.4^k$
$R_2 = 47.4^k$
$M = -133.2^{k'}$

$\Delta_{bs} = -0.06''$
$\Delta_c = 0.23''$ 24/445

W10 x 100
$I = 623.$ in^4

B5: CASE 3

$L = 8.5'$
$A = 4.25$
$w_1 = w_2 = 0.067^{k/'}$
$P = 13.05^k$
$R_1 = -6.3^k$
$R_2 = 20.2^k$
$M = -56.1^{k'}$

$\Delta_{bs} = -0.02''$
$\Delta_c = 0.09''$ $2L/1000$

W10 x 88
$I = 534.$ in^4

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PROJECT: Noorse 88
DATE: 11/7/14
PROJECT NO: W A 1
DESIGN: V5
SHEET

VERTICAL DESIGN: GROUND FLOOR CONT'D

B6: CASE 3

$L = 10.5'$
$A = 8'$
$w_1 = 0$

$w_2 = \begin{matrix} D: 0.14 \\ LS: 0.07 \end{matrix} > 0.21 k/'$
$P = 4.5^k < \begin{matrix} 2.0D \\ 2.5L \end{matrix}$

GL 5 1/2 x 22 1/2

$R_1 = -4.1^k$
$R_2 = 10.3^k$
$M = -42.7^{k'}$
$f_b = 1.10 ksi$
$F_b' = 2.26 ksi$
$f_v = 70 psi$
$\Delta_C = 0.38''$
$\Delta_{DS} = -0.06''$

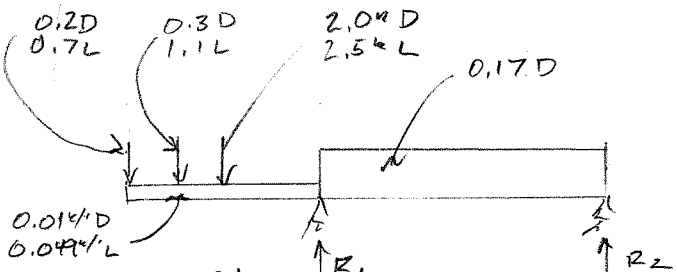
B7: CASE 2

$L_1 = 3'$, $L_2 = 18'$
$w = \begin{matrix} 0.769 \text{ CONC DL} \\ 0.103 DL \\ 0.41 LL \end{matrix} > 1.28 k/'$
$R_1 = 12.6^k$ $R_2 = 13.3^k$
$M = 69.1^{k'}$

GL 5 1/2 x 22 1/2

$f_b = 1.79 ksi$
$F_b' = 2.26 ksi$
$f_v = 132 psi$
$\Delta = 0.58''$
$L/433$

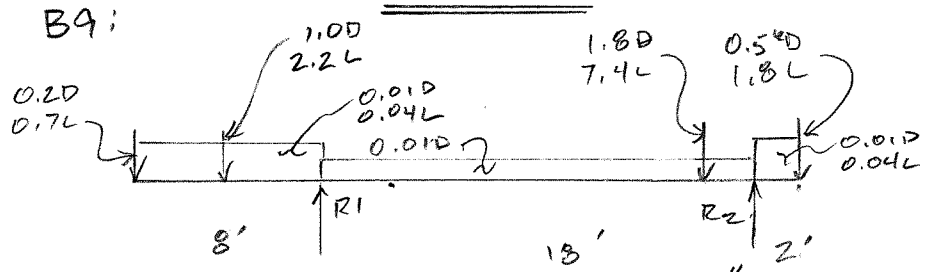
B8:



$R_1 = 12^k$
$R_2 = -1.8^k$
$M_A = -37^{k'}$
$M_{+}/\Omega = 206^{k'}$
$\Delta_C = -0.42''$
$\Delta_{DS} = 0.07''$

W10x45

B9:



$R_1 = 8.0^k$
$R_2 = 10.6^k$
$M_A = -24.10^{k'}$
$M_{+}/\Omega = 280^{k'}$
$\Delta_C = -0.18''$
$\Delta_{DS} = 0.02''$

W10x45

B10:

$L = 10.5'$
$w = 0.71^k$
$R = 3.75^k$
$M = 19.8^{k'}$

PSL 5 1/4 x 11 7/8

$f_b = 0.95 ksi$
$F_b' = 2.91 ksi$
$f_v = 73 psi$
$\Delta = 0.133''$
$L/948$

B11: CASE 4

$L_1 = 2'$
$L_2 = 1.5'$
$L_3 = 4.5'$
$w_{1-3} = 0.05^k/'$
$P_1 = 3.75^k + 8.5^k = 12.3^k$
$P_2 = 8.25$
$R_1 = 14.1^k$
$R_2 = 6.9^k$
$M = 30.5^{k'}$

PSL 5 1/4 x 11 7/8

$f_b = 2.2 ksi$
$F_b' = 2.9 ksi$
$f_v = 252 psi$
$\Delta = 0.16''$
$L/602$

J1:

$L = 19.75$
$w = 0.067^k/'$
$R = 0.662^k$
$M = 3.27^{k'}$

11 7/8 TJI 230 @ 16" oc

$M_A = 4.2^{k'}$
$\Delta = 0.66'$
$L/359$

H1:

$L = 8.25'$
$w = 0.5^k/'$
$R = 2.1^k$
$M = 4.3^{k'}$

4x12

$f_b = 0.69 ksi$
$F_b' = 0.99 ksi$
$f_v = 61 psi$
$\Delta = 0.08''$
$L/1202$

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House 88
PROJECT

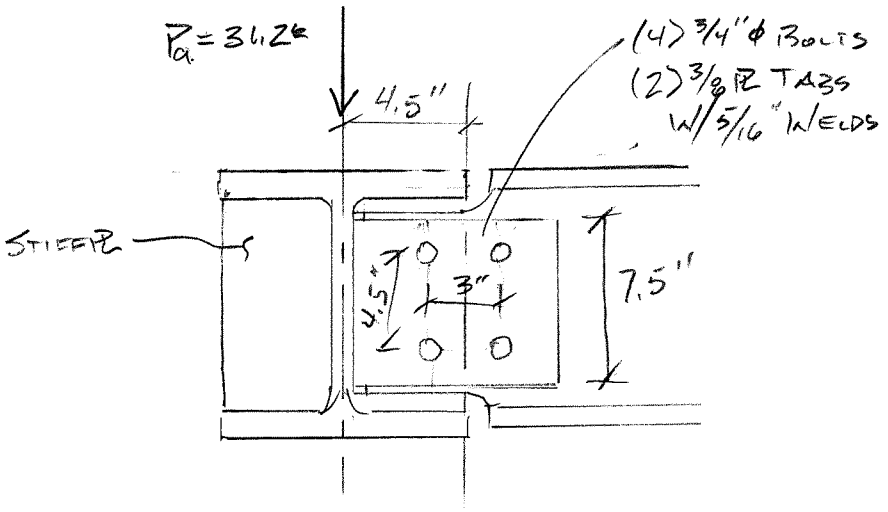
11/7/14
DATE

PROJECT NO
WA1

DESIGN
VC

SHEET

HIGH-CAPCITY STEEL BEAM CONNECTION:



CHECK BOLT GROUP:

TABLE 7-7:

s = 4.5 e_x = 4.5", n = 2 → C = 1.96

SHEAR STRENGTH 3/4" ϕ A325, DBL SH.

TBL 7-1:

r_n/Ω = 23.9k

BRG STRENGTH ON DBL 3/8" PL SHR TABS

TBL 7-5:

r_n/Ω = 29.4k/in × 3/4" = 22.0k

R_n/Ω = 22.0k × 1.96 = 43.2k ✓

CHECK WELD OF SHEAR TABS:

CHECK 3/16" ON ONE SIDE OF EA TAB:

R_n/Ω = 0.928 × 3 × 7.5 × 2

= 41.8k ✓

CHECK SHEAR IN TABS:

$V_n/\Omega_v = \frac{0.6 \times 36 \times 7.5 \times 3/8 \times 2}{1.5} \leq \frac{0.6 \times 58 \times 5.75 \times 3/8 \times 2}{1.5}$

= 100k OK ✓

FLEXURAL YIELDING

M_a = 31.2k × 4.5" = 140k-in M_n/Ω_b = 222k-in OK ✓

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SEATTLE, WA 98104
T 206.789.6038
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PROJECT: House 88

DATE:

PROJECT NO:

DESIGN: V7

SHEET:

VERTICAL DESIGN

STEEL POST DESIGN:

HSS 3x3x1/4 @ W8x67, SECOND FLR B4:
$P_A = 8.5^k$, $L = 12.5'$
$P_n/\Omega_c = 18.6^k$ OK ✓

HSS 5x5x1/4 @ W10x100, GRND FLR B3:
$P_A = 47.4^k$, $L = 10'$
$P_n/\Omega_c = 91.3^k$ OK ✓

HSS 3x3x1/4 @ W10x45, GRND FLR B8
$P_A = 12.0^k$, $L = 10'$
$P_n/\Omega_c = 30.6^k$ OK ✓

HSS 3x3x1/4 @ W10x45, GRND FLR B9
$P_A = 10.6^k$, $L = 10$
$P_n/\Omega_c = 30.6^k$ OK ✓

HSS 3x3x1/4 @ GRND FLR B11
$P_A = 14.1^k$, $L = 12.5'$
$P_n/\Omega_c = 18.6^k$ OK ✓

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PROJECT: HOUSE 88
DATE: 11/14/14
PROJECT NO: 14141
DESIGN: VB
SHEET

Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

Page: 1
Project: HOUSE 88
Sub-Project I Pos. No.:
Date: 11/13/2014

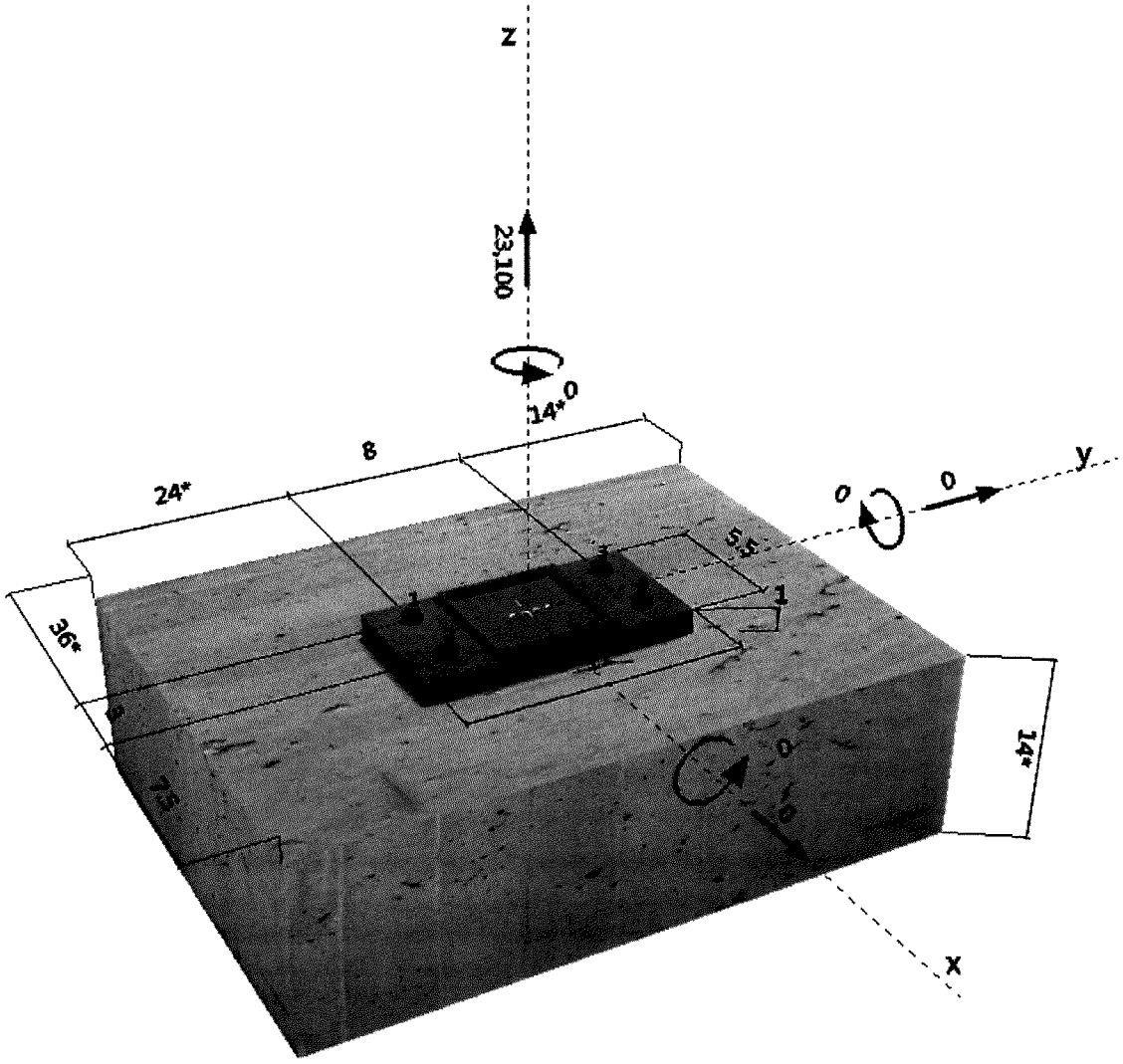
Specifier's comments:

HEAVY UPLIFT BASE PL ~ T_{ALLOW} = 15.4k → T_{ULT} = X1.5 = 23.1k

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 3/4**
Effective embedment depth:	h_{ef} = 10.000 in.
Material:	ASTM F 1554
Proof:	design method ACI 318-08 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 1.000 in.
Anchor plate:	l_x x l_y x t = 5.500 in. x 11.000 in. x 1.000 in.; (Recommended plate thickness: not calculated)
Profile:	Square HSS (AISC); (L x W x T) = 5.000 in. x 5.000 in. x 0.250 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 14.000 in.
Reinforcement:	tension: condition B, shear: condition B; edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

Geometry [in.] & Loading [lb, in.lb]



Company:
Specifier:
Address:
Phone I Fax: |
E-Mail:

Page: 2
Project:
Sub-Project I Pos. No.:
Date: 11/13/2014

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Strength	23100	23670	98 / -	OK
Shear	-	-	-	- / -	-

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	-	-	-	-	-

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

V10

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Specifier:
Address:
Phone I Fax: |
E-Mail:

Page: 1
Project: HOUSE 88
Sub-Project I Pos. No.:
Date: 11/13/2014

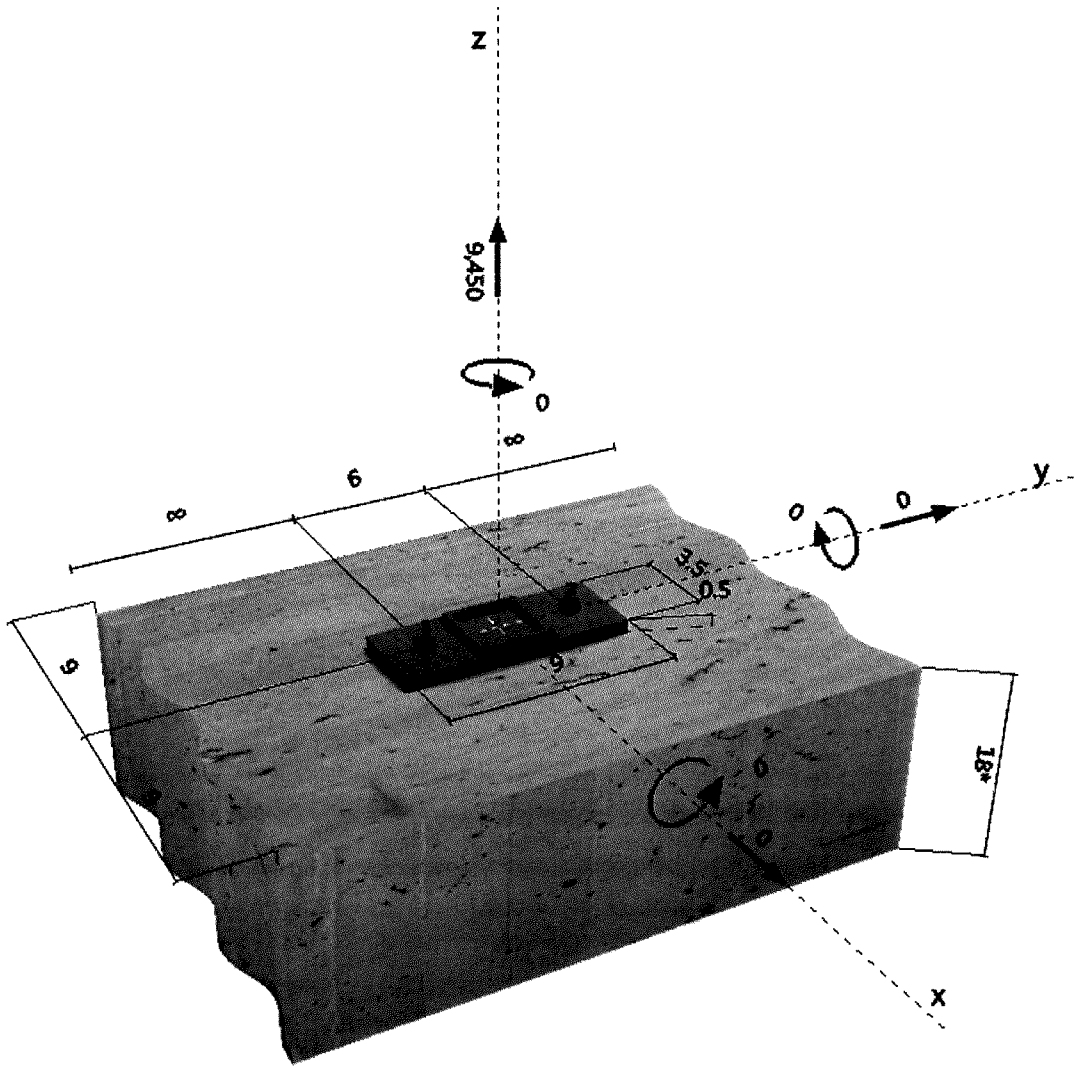
Specifier's comments:

LIGHT UPLIFT BASE PR - T_{ALLOW} = 16.3k → T_{ULT} = x1.5 = 9.45k

1 Input data

Anchor type and diameter:	**Hex Head ASTM F 1554 GR. 36 3/4**
Effective embedment depth:	h_{ef} = 8.000 in.
Material:	ASTM F 1554
Proof:	design method ACI 318-08 / CIP
Stand-off installation:	e_b = 0.000 in. (no stand-off); t = 0.500 in.
Anchor plate:	l_x x l_y x t = 3.500 in. x 9.000 in. x 0.500 in.; (Recommended plate thickness: not calculated)
Profile:	Square HSS (AISC); (L x W x T) = 3.000 in. x 3.000 in. x 0.250 in.
Base material:	cracked concrete, 2500, f_c' = 2500 psi; h = 18.000 in.
Reinforcement:	tension: condition B, shear: condition B; edge reinforcement: none or < No. 4 bar
Seismic loads (cat. C, D, E, or F)	no

Geometry [in.] & Loading [lb, in.lb]



VII

Company:
Specifier:
Address:
Phone I Fax:
E-Mail:

Page: 2
Project:
Sub-Project I Pos. No.:
Date: 11/13/2014

2 Proof I Utilization (Governing Cases)

		Design values [lb]		Utilization	
Loading	**Proof**	**Load**	**Capacity**	**β_N / β_V [%]**	**Status**
Tension	Concrete Breakout Strength	9450	16483	58 / -	OK
Shear	-	-	-	- / -	-

Loading	**β_N**	**β_V**	**ζ**	**Utilization $\beta_{N,V}$ [%]**	**Status**
Combined tension and shear loads	-	-	-	-	-

3 Warnings

- Please consider all details and hints/warnings given in the detailed report!

Fastening meets the design criteria!

4 Remarks; Your Cooperation Duties

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- You must take all necessary and reasonable steps to prevent or limit damage caused by the Software. In particular, you must arrange for the regular backup of programs and data and, if applicable, carry out the updates of the Software offered by Hilti on a regular basis. If you do not use the AutoUpdate function of the Software, you must ensure that you are using the current and thus up-to-date version of the Software in each case by carrying out manual updates via the Hilti Website. Hilti will not be liable for consequences, such as the recovery of lost or damaged data or programs, arising from a culpable breach of duty by you.

V12

PIN PILE FOUNDATION DESIGN:

4"ø PIPE PILES – COMPRESSION CAPACITY = 20k

CHECK WEST WALL LINE LOAD + PT LOAD

$w = (5/8 \times 20') \times 0.05\,ksf$ (Floor) $+ 10' \times 0.01\,ksf$ (Ext Wall) $+ ((10' \times 8/12') + (1' \times 1.5')) \times 0.15\,ksf$ (Stem & Ftg) $= 1.95\,k/'$

PT LOAD FROM STL BM '135', P = 20.2k → 2 PILES (5' MAX TRIB)

$R_{PILE} = 20.2^k/2 + 1.95^{k}/' \times 5' = 19.85^k < 20^k$ OK ✓

PT LOAD FROM STL BM 'B8', P = 12.0k, FROM CORNER WALL: $w = 10 \times 0.01 + 1.33^{k}/'$

$R_{PILE} = 12.0^k + 1.95^{k}/' \times 4.25/2 + 1.33^{k}/' \times 3.7'/2 = 18.6^k < 20^k$ OK ✓

CHECK WALL @ GARAGE W/ PT LOADS

PT LOAD: RIDGE BM @ ROOF: 6.7k
FLOOR BM: 1.3k
GARAGE FLR BM: 13.3k
21.3k → 2 PILES

$w = 22'/2 \times 0.05\,ksf$ (2nd Flr) $+ 30.5' \times 0.01\,ksf$ (Wall) $+ ((5' \times 8/12') + (1' \times 1.5')) \times 0.15\,ksf$ (Stem & Ftg) $= 1.58\,k/'$

MAX TRIB = 4.5'

$R_{PILE} = 21.3^k/2 + 1.58^{k}/' \times 4.5' = 17.8^k < 20^k$ OK ✓

CHECK TYP DECK POST:

PT LOAD: (WORST @ N. END) D+.75L+0.75S: $P = 0.054 \times 5.75 \times 7' = 2.2^k$

$w = (4' \times 8/12 + 1' \times 1.5') 0.15\,ksf = 0.625\,k/'$ (Stem & Ftg) → MAX TRIB = 11.5'

$R_{PILE} = 2.2^k + 0.625^{k}/' \times 11.5 = 9.4^k < 20^k$ OK ✓

CHECK INTERIOR BEARING WALL:

PT LOAD: 14.0k

$w = (18/2 \times 0.05\,ksf) + 1.5' \times 1.5' \times 0.15\,ksf = 0.79\,k/'$

MAX TRIB W/ PT LOAD: 6.5'

$R_{PILE} = 14.0^k + 0.79^{k}/' \times 6.5' = 19.1^k < 20^k$ OK ✓ W/O PT LOAD: 9'

CHECK GARAGE CORNER:

PT LOAD: FROM GARAGE CANT → P = 18.0k → 2 PILES

$w = 22'/2$ (Floor) $\times 0.05\,ksf + 20'$ (Wall) $\times 0.01\,ksf + ((5' \times 8/12') + 1' \times 1.5') \times 0.15\,ksf = 1.48\,k/'$ MAX TRIB = 4.25'

$R_{PILE} = 18.0^k/2 + 1.48^{k}/' \times 4.25' = 15.3^k < 20^k$ OK ✓

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HOUSE 88 — PROJECT
11/12/14 — DATE
PROJECT NO
w/A1
DESIGN
V13
SHEET

SIMPSON Strong-Tie

Anchor Designer™ Software
Version 2.3.5332.0

Company:		Date:	11/17/2014
Engineer:	SKH	Page:	1/4
Project:	House 88		
Address:			
Phone:			
E-mail:			

1.Project information

Customer company:
Customer contact name:
Customer e-mail:
Comment:

Project description:
Location:
Fastening description:

2. Input Data & Anchor Parameters

General
Design method:ACI 318-11
Units: Imperial units

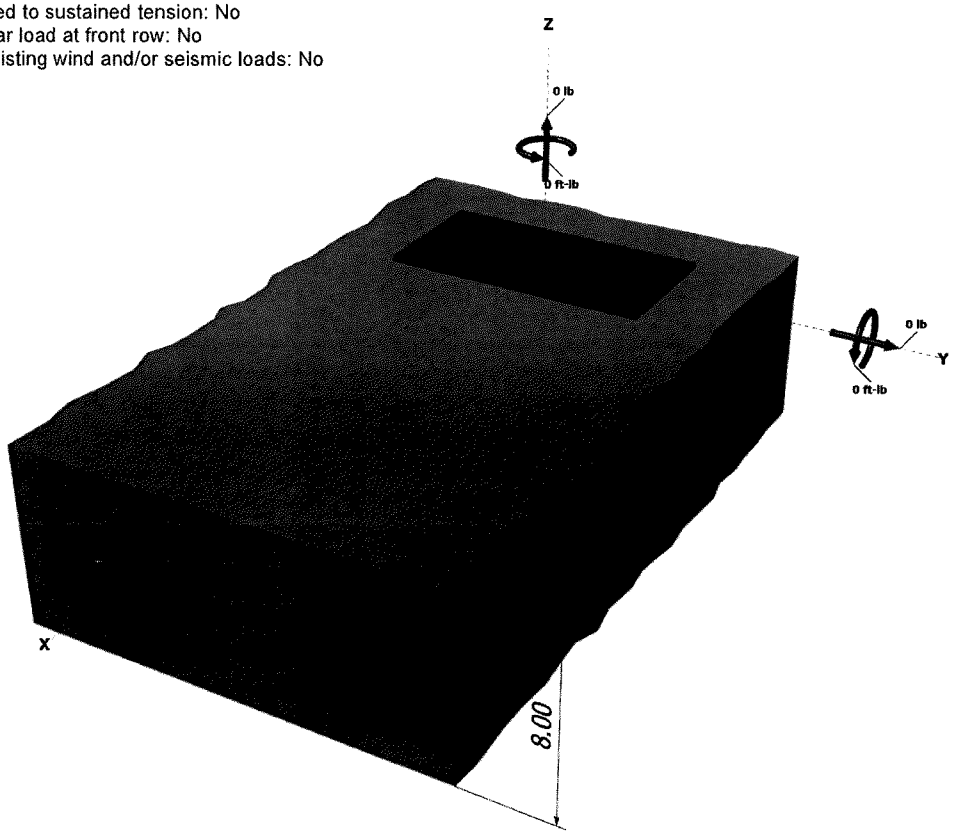
Anchor Information:
Anchor type: Bonded anchor
Material: F1554 Grade 36
Diameter (inch): 0.625
Effective Embedment depth, h_{ef} (inch): 3.125
Code report: IAPMO UES ER-263
Anchor category: -
Anchor ductility: Yes
h_{min} (inch): 6.25
c_{ac} (inch): 4.31
C_{min} (inch): 1.75
S_{min} (inch): 3.00

Load and Geometry
Load factor source: ACI 318 Section 9.2
Load combination: not set
Seismic design: No
Anchors subjected to sustained tension: No
Apply entire shear load at front row: No
Anchors only resisting wind and/or seismic loads: No

<Figure 1>

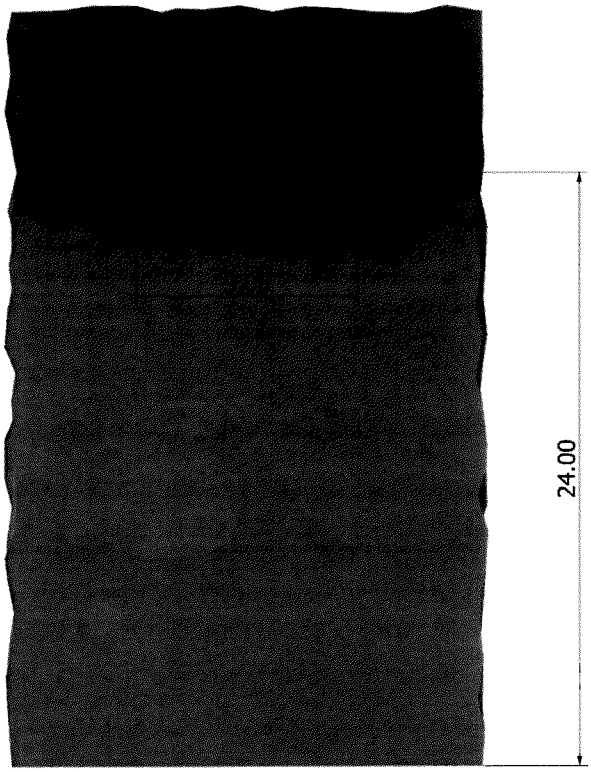
Base Material
Concrete: Normal-weight
Concrete thickness, h (inch): 8.00
State: Cracked
Compressive strength, f'_c (psi): 2500
$\Psi_{c,V}$: 1.0
Reinforcement condition: B tension, B shear
Supplemental reinforcement: Not applicable
Do not evaluate concrete breakout in tension: No
Do not evaluate concrete breakout in shear: No
Hole condition: Dry concrete
Inspection: Continuous
Temperature range: 1
Ignore 6do requirement: Not applicable
Build-up grout pad: No

Base Plate
Length x Width x Thickness (inch): 6.00 x 12.00 x 0.25



V14

<Figure 2>



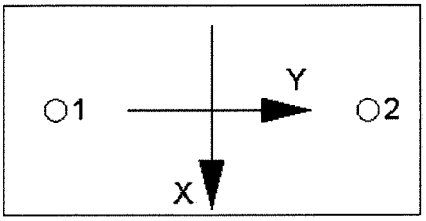
Recommended Anchor
Anchor Name: AT-XP® - AT-XP w/ 5/8"Ø F1554 Gr. 36
Code Report Listing: IAPMO UES ER-263

3. Resulting Anchor Forces

Anchor	Tension load, N_{ua} (lb)	Shear load x, V_{uax} (lb)	Shear load y, V_{uay} (lb)	Shear load combined, $\sqrt{(V_{uax})^2+(V_{uay})^2}$ (lb)
1	0.0	1320.0	0.0	1320.0
2	0.0	1320.0	0.0	1320.0
Sum	0.0	2640.0	0.0	2640.0

Maximum concrete compression strain (‰): 0.00
Maximum concrete compression stress (psi): 0
Resultant tension force (lb): 0
Resultant compression force (lb): 0
Eccentricity of resultant tension forces in x-axis, e'_{Nx} (inch): 0.00
Eccentricity of resultant tension forces in y-axis, e'_{Ny} (inch): 0.00
Eccentricity of resultant shear forces in x-axis, e'_{Vx} (inch): 0.00
Eccentricity of resultant shear forces in y-axis, e'_{Vy} (inch): 0.00

<Figure 3>



8. Steel Strength of Anchor in Shear (Sec. D.6.1)

V_{sa} (lb)	ϕ_{grout}	ϕ	$\phi_{grout}\phi V_{sa}$ (lb)
7865	1.0	0.65	5112

9. Concrete Breakout Strength of Anchor in Shear (Sec. D.6.2)

Shear perpendicular to edge in x-direction:

$V_{bx} = \min|7(l_e / d_a)^{0.2}\sqrt{d_a}\lambda_a\sqrt{f'_c}c_{a1}^{1.5};\ 9\lambda_a\sqrt{f'_c}c_{a1}^{1.5}|$ (Eq. D-33 & Eq. D-34)

l_e (in)	d_a (in)	λ_a	f'_c (psi)	c_{a1} (in)	V_{bx} (lb)
3.13	0.63	1.00	2500	24.00	44887

$\phi V_{cbgx} = \phi\,(A_{Vc} / A_{Vco})\,\Psi_{ec,V}\Psi_{ed,V}\Psi_{c,V}\Psi_{h,V}V_{bx}$ (Sec. D.4.1 & Eq. D-31)

A_{Vc} (in²)	A_{Vco} (in²)	$\Psi_{ec,V}$	$\Psi_{ed,V}$	$\Psi_{c,V}$	$\Psi_{h,V}$	V_{bx} (lb)	ϕ	ϕV_{cbgx} (lb)
648.00	2592.00	1.000	1.000	1.000	2.121	44887	0.70	16663

10. Concrete Pryout Strength of Anchor in Shear (Sec. D.6.3)

$\phi V_{cpg} = \phi\ \min|k_{cp}N_{ag};\ k_{cp}N_{cbg}| = \phi\ \min|k_{cp}(A_{Na} / A_{Na0})\,\Psi_{ec,Na}\Psi_{ed,Na}\Psi_{cp,Na}N_{ba};\ k_{cp}(A_{Nc} / A_{Nco})\,\Psi_{ec,N}\Psi_{ed,N}\Psi_{c,N}\Psi_{cp,N}N_b|$ (Eq. D-41)

k_{cp}	A_{Na} (in²)	A_{Na0} (in²)	$\Psi_{ed,Na}$	$\Psi_{ec,Na}$	$\Psi_{cp,Na}$	N_{ba} (lb)	N_a (lb)
2.0	384.08	243.61	1.000	1.000	1.000	6013	9481

A_{Nc} (in²)	A_{Nco} (in²)	$\Psi_{ec,N}$	$\Psi_{ed,N}$	$\Psi_{c,N}$	$\Psi_{cp,N}$	N_b (lb)	N_{cb} (lb)	ϕ
172.27	87.89	1.000	1.000	1.000	1.000	4696	9203	0.70

ϕV_{cpg} (lb)
12885

11. Results

Interaction of Tensile and Shear Forces (Sec. D.7)

Shear	Factored Load, V_{ua} (lb)	Design Strength, ϕV_n (lb)	Ratio	Status
Steel	**1320**	**5112**	**0.26**	**Pass (Governs)**
T Concrete breakout x+	2640	16663	0.16	Pass

V16

Pryout	2640	12885	0.20	Pass

AT-XP w/ 5/8"Ø F1554 Gr. 36 with hef = 3.125 inch meets the selected design criteria.

12. Warnings

- Designer must exercise own judgement to determine if this design is suitable.

- Refer to manufacturer's product literature for hole cleaning and installation instructions.

Cantilevered Retaining Wall Design

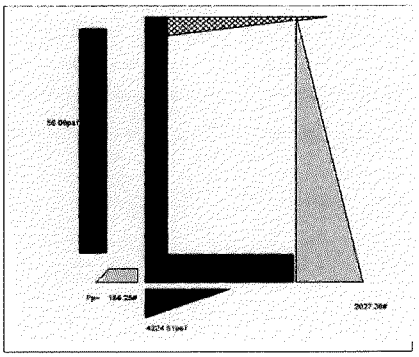
Code: IBC 2009,ACI 318-08,ACI 530-08

Criteria

Retained Height	=	8.50 ft
Wall height above soil	=	0.00 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

Soil Data

Allow Soil Bearing	=	2,666.0 psf
Equivalent Fluid Pressure Method		
Heel Active Pressure	=	35.0 psf/ft
	=	
Passive Pressure	=	250.0 psf/ft
Soil Density, Heel	=	120.00 pcf
Soil Density, Toe	=	120.00 pcf
Footing||Soil Friction	=	0.450
Soil height to ignore for passive pressure	=	12.00 in



Surcharge Loads

Surcharge Over Heel	=	0.0 psf
NOT Used To Resist Sliding & Overturning		
Surcharge Over Toe	=	0.0 psf
NOT 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	=	56.0 #/ft
...Height to Top	=	8.00 ft
...Height to Bottom	=	0.00 ft
The above lateral load has been increased by a factor of		1.00
Wind on Exposed Stem	=	0.0 psf

Adjacent Footing Load

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

Design Summary

Wall Stability Ratios

Overturning	=	1.64 OK
Sliding	=	1.28 Ratio < 1.5!

USING PIN PILES TO RESIST

Total Bearing Load	=	5,435 lbs
...resultant ecc.	=	16.71 in
Soil Pressure @ Toe	=	4,225 psf NG
Soil Pressure @ Heel	=	0 psf OK
Allowable	=	2,666 psf
Soil Pressure Exceeds Allowable!		
ACI Factored @ Toe	=	5,069 psf
ACI Factored @ Heel	=	0 psf
Footing Shear @ Toe	=	0.0 psi OK
Footing Shear @ Heel	=	15.8 psi OK
Allowable	=	75.0 psi

Sliding Calcs (Vertical Component NOT Used)

Lateral Sliding Force	=	2,027.4 lbs
less 100% Passive Force	= -	156.3 lbs
less 100% Friction Force	= -	2,445.8 lbs
Added Force Req'd	=	0.0 lbs OK
....for 1.5 : 1 Stability	=	439.1 lbs NG

Load Factors

Building Code	IBC 2009,ACI
Dead Load	1.200
Live Load	1.600
Earth, H	1.600
Wind, W	1.600
Seismic, E	1.000

Stem Construction

Top Stem

		Stem OK
Design Height Above Ftg	ft =	0.00
Wall Material Above "Ht"	=	Concrete
Thickness	=	8.00
Rebar Size	=	# 4
Rebar Spacing	=	8.00
Rebar Placed at	=	Edge

Design Data

fb/FB + fa/Fa	=	**0.945**
Total Force @ Section	lbs =	2,471.0
Moment....Actual	ft-# =	7,523.8
Moment.....Allowable	=	7,959.6
Shear.....Actual	psi =	32.9
Shear.....Allowable	psi =	75.0
Wall Weight	=	100.0
Rebar Depth 'd'	in =	6.25
LAP SPLICE IF ABOVE	in =	18.72
LAP SPLICE IF BELOW	in =	
HOOK EMBED INTO FTG	in =	7.91

Hook embedment reduced by stress ratio

Masonry Data

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

Concrete Data

f'c	psi =	2,500.0
Fy	psi =	60,000.0

V18

Cantilevered Retaining Wall Design

Code: IBC 2009,ACI 318-08,ACI 530-08

Footing Dimensions & Strengths

Toe Width	=	0.00 ft
Heel Width	=	4.50
Total Footing Width	=	4.50
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 = 60,000 psi
Footing Concrete Density = 150.00 pcf
Min. As % = 0.0018
Cover @ Top 2.00 @ Btm.= 3.00 in

Footing Design Results

		Toe	Heel
Factored Pressure	=	5,069	0 psf
Mu' : Upward	=	0	2,275 ft-#
Mu' : Downward	=	0	10,316 ft-#
Mu: Design	=	0	8,040 ft-#
Actual 1-Way Shear	=	0.00	15.81 psi
Allow 1-Way Shear	=	0.00	75.00 psi

Toe Reinforcing = None Spec'd
Heel Reinforcing = # 4 @ 8.00 in
Key Reinforcing = None Spec'd

Other Acceptable Sizes & Spacings

Toe: Not req'd, Mu < S * Fr
Heel: #4@ 9.26 in, #5@ 14.35 in, #6@ 20.37 in, #7@ 27.78 in, #8@ 36.57 in, #9@ 46
Key: No key defined

Summary of Overturning & Resisting Forces & Moments

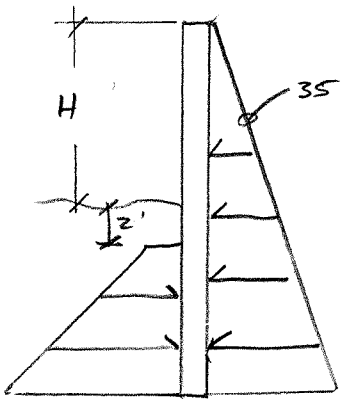
		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#			.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Item									
Heel Active Pressure	=	1,579.4	3.17	5,001.4	Soil Over Heel	=	3,910.0	2.58	10,100.8
Surcharge over Heel	=				Sloped Soil Over Heel	=			
Surcharge Over Toe	=				Surcharge Over Heel	=			
Adjacent Footing Load	=				Adjacent Footing Load	=			
Added Lateral Load	=	448.0	5.00	2,240.0	Axial Dead Load on Stem	=			
Load @ Stem Above Soil	=				* Axial Live Load on Stem	=			
	=				Soil Over Toe	=			
					Surcharge Over Toe	=			
Total		2,027.4	**O.T.M.**	7,241.4	Stem Weight(s)	=	850.0	0.33	283.3
	=		=		Earth @ Stem Transitions	=			
					Footing Weight	=	675.0	2.25	1,518.8
					Key Weight	=			
					Vert. Component	=			
					Total =		5,435.0 lbs	**R.M.=**	11,902.9

Resisting/Overturning Ratio = 1.64
Vertical Loads used for Soil Pressure = 5,435.0 lbs

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

SHORING DESIGN

- EMBEDMENT => MIN OF WALL HEIGHT or 10' BELOW EXCAV.
- NO TRAFFIC SURCHARGE. ROAD IS GREATER THAN 7' AWAY
- NEGLECT TOP 2' OF PASSIVE
- USE PASSIVE OF 400 PCF (INCLUDING F.O.S. OF 1.5) 600 PCF W/NO F.S.
- PASSIVE ACTS OVER 2 PILE DIAMETERS
- USE 50 PCF FOR SLOPING SOIL BACKFILL
- USE 35 PCF FOR LEVEL SOIL BACKFILL



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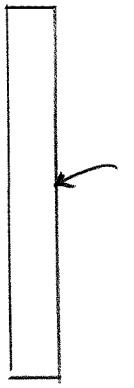

FOS MUST BE 1.2

MAX SPACING = 5'-6" FOR 12'-0" WALL

LAGGING DESIGN

TEMP LAGGING CAN BE DESIGNED FOR 50% OF PRESSURE

-WORST CASE LOADING $w = 0.05(12')(.5) = 300\#/'$

$L = 8.5'$
$w = 225\#/'$
$R = 1.3k$
$M = 2.7k'$

FLAT PT 6x12
$f_b = 537$ PSI
$f_v = 26$ PSI
$\Delta_{TL} = 0.1" = \ell/713$

$L = 6'$
$w = 300\#/'$
$R = 0.9k$
$M = 1.35k$

FLAT 4x12

$f_b = 661$ PSI
$f_v = 29$ PSI
$\Delta_{TL} = 0.1" = \ell/564$

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F 206.789.6042

HOUSE 88
PROJECT

11/11/14
DATE

PROJECT NO

SKH
DESIGN

SH-1
SHEET

PILE DESIGN

P2

TOW = 320'

BOE = 312'

H = 8' W/SLOPING BACKFILL

P4

TOW = 325'

BOE = 313'

H = 12' W/LEVEL BACKFILL

P10

TOW = 325'

BOE = 313'

H = 12' W/SLOPING BACKFILL

P13

TOP = 320'

BOE = 313'

H = 7' W/SLOPING BACKFILL

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HOUSE 88
PROJECT

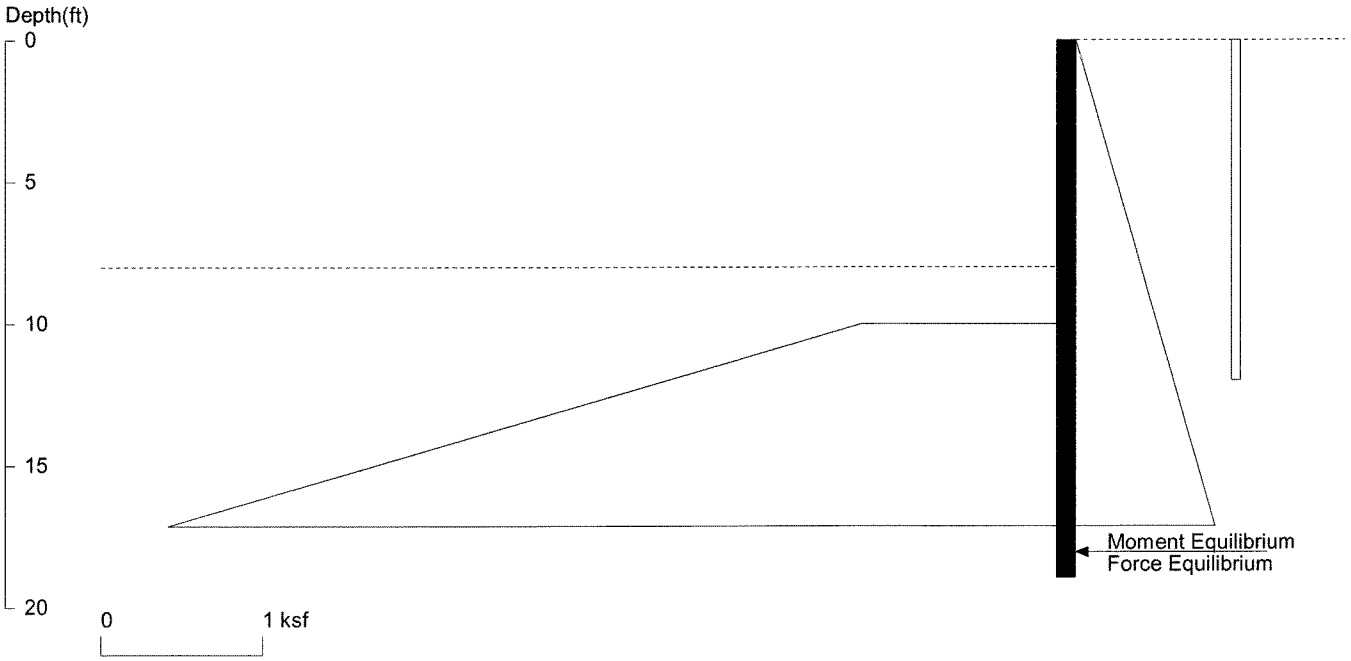
11/12/14
DATE

PROJECT NO

SKH
DESIGN

SH-2
SHEET

House 88
P2 w/seismic



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Wall Height=8.0 Pile Diameter=2.0 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=10.96 Min. Pile Length=18.96 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=100.57 per Pile Spacing=7.0 at Depth=12.89

PILE SELECTION:
Request Min. Section Modulus = 36.6 in3/pile=599.30 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X26 has Section Modulus = 38.4 in3/pile=629.26 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.61(in) based on E (ksi)=29000.00 and I (in4)/pile=301.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05
0	.056	12	0.056	0

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2 ✓

Z1	P1	Z2	P2	Slope
10	1.2	50	25.200	.6

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	7.00
2	8.00	2.00

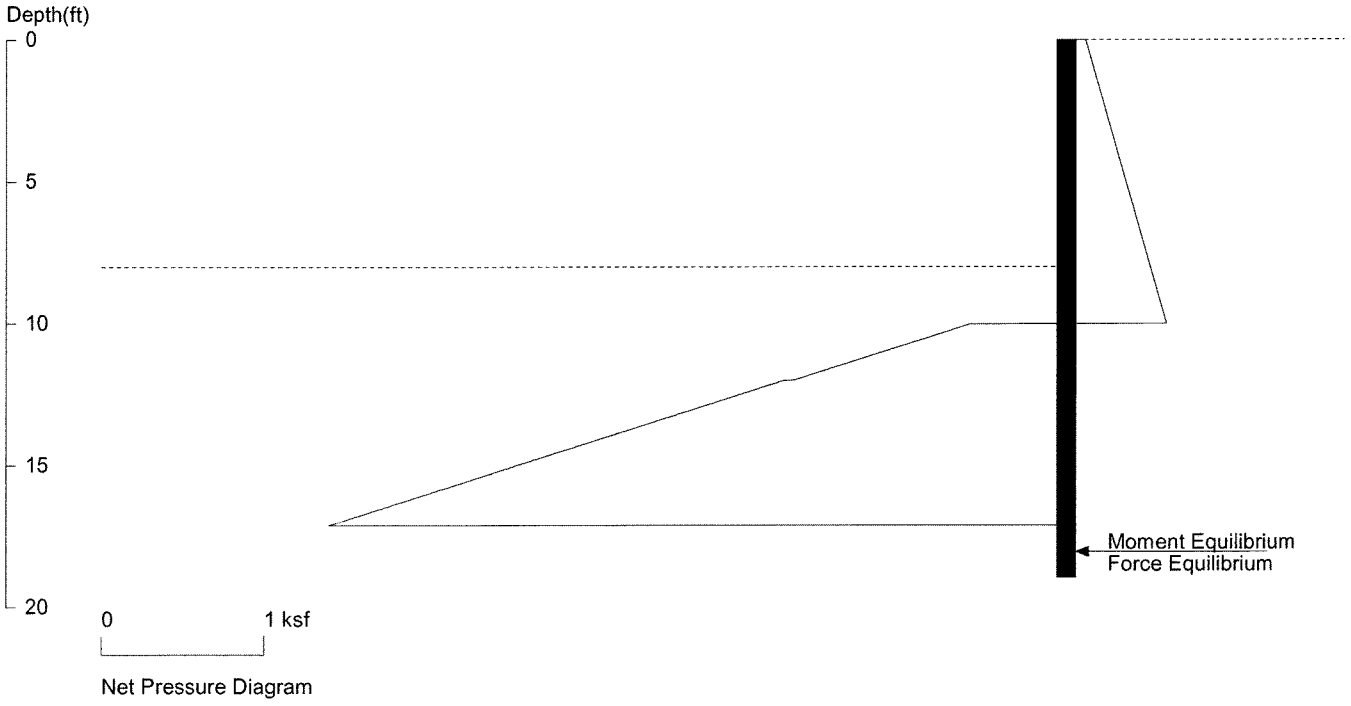
PASSIVE SPACING:

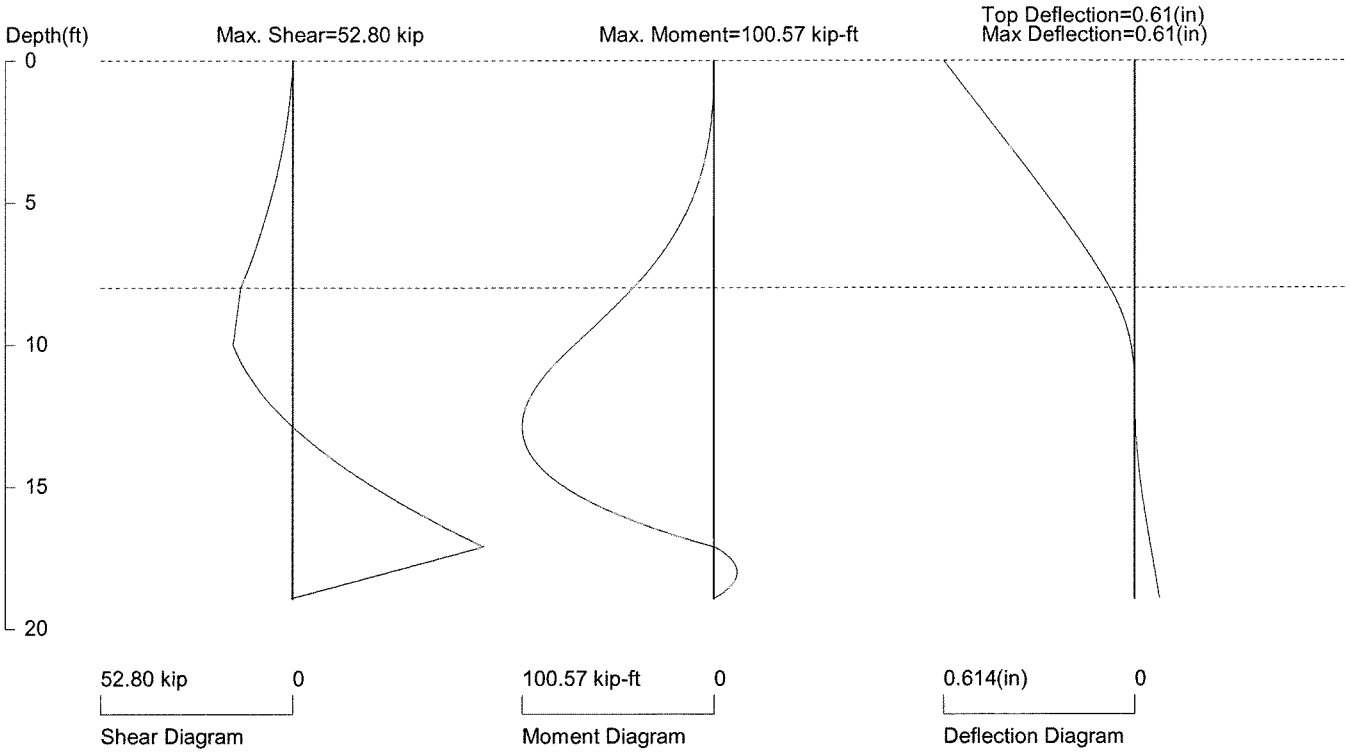
No.	Z depth	Spacing
1	8.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

SH-3

House 88
P2 w/seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in4)/pile=301.0

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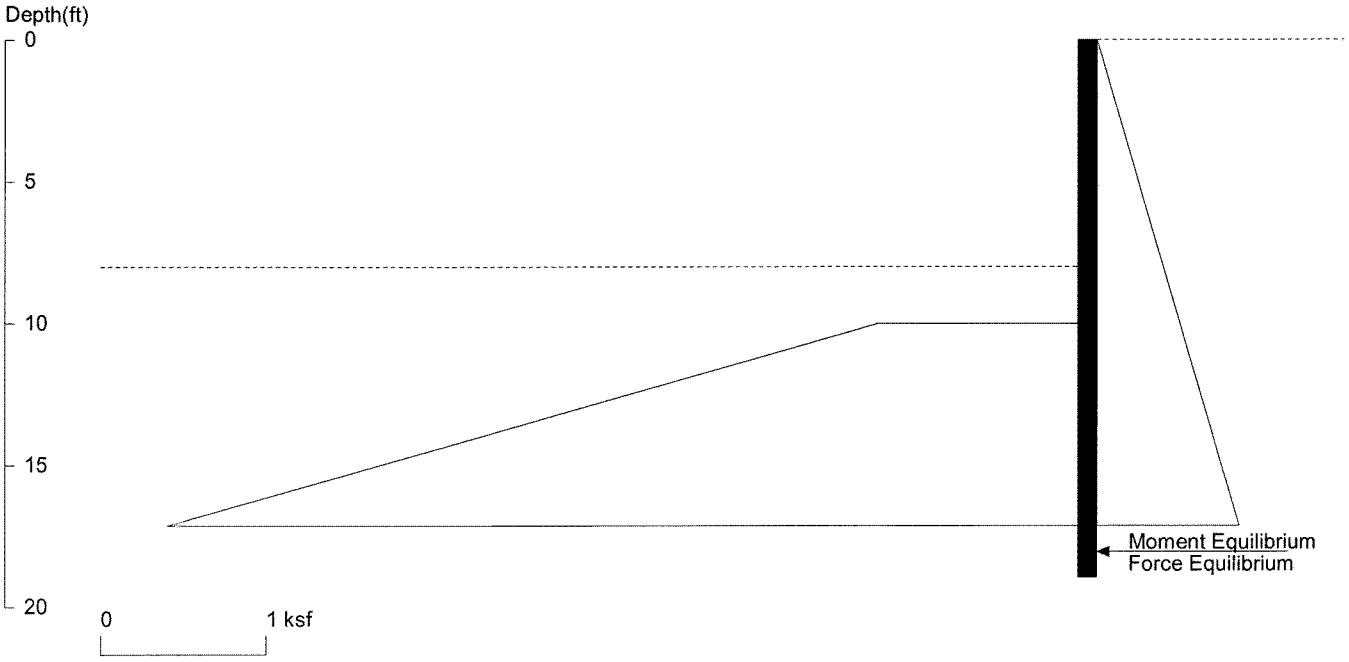
House 88
P2 w/no seismic



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Wall Height=8.0 Pile Diameter=2.0 Pile Spacing=7.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=10.96 Min. Pile Length=18.96 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=76.36 per Pile Spacing=7.0 at Depth=12.94

PILE SELECTION:
Request Min. Section Modulus = 27.8 in3/pile=455.02 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X26 has Section Modulus = 38.4 in3/pile=629.26 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.45(in) based on E (ksi)=29000.00 and I (in4)/pile=301.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5

Z1	P1	Z2	P2	Slope
10	1.2	50	25.200	.6

ACTIVE SPACING:

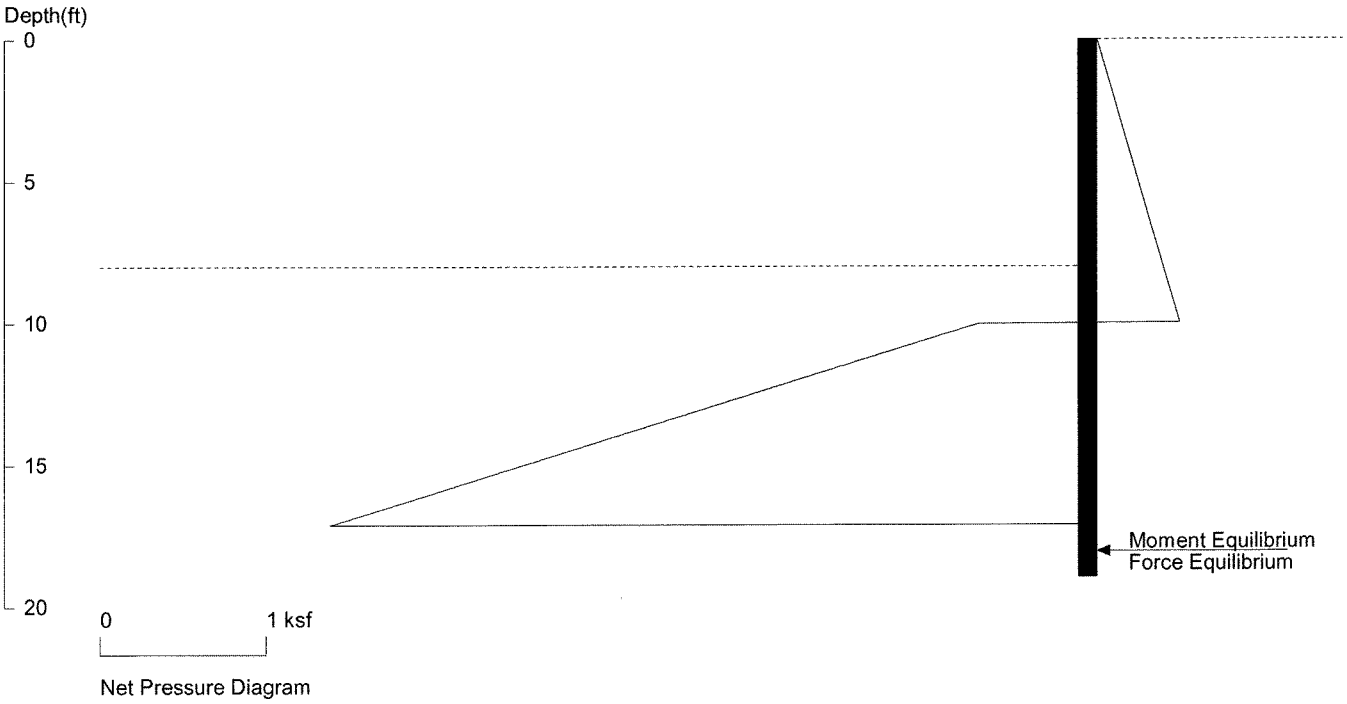
No.	Z depth	Spacing
1	0.00	7.00
2	8.00	2.00

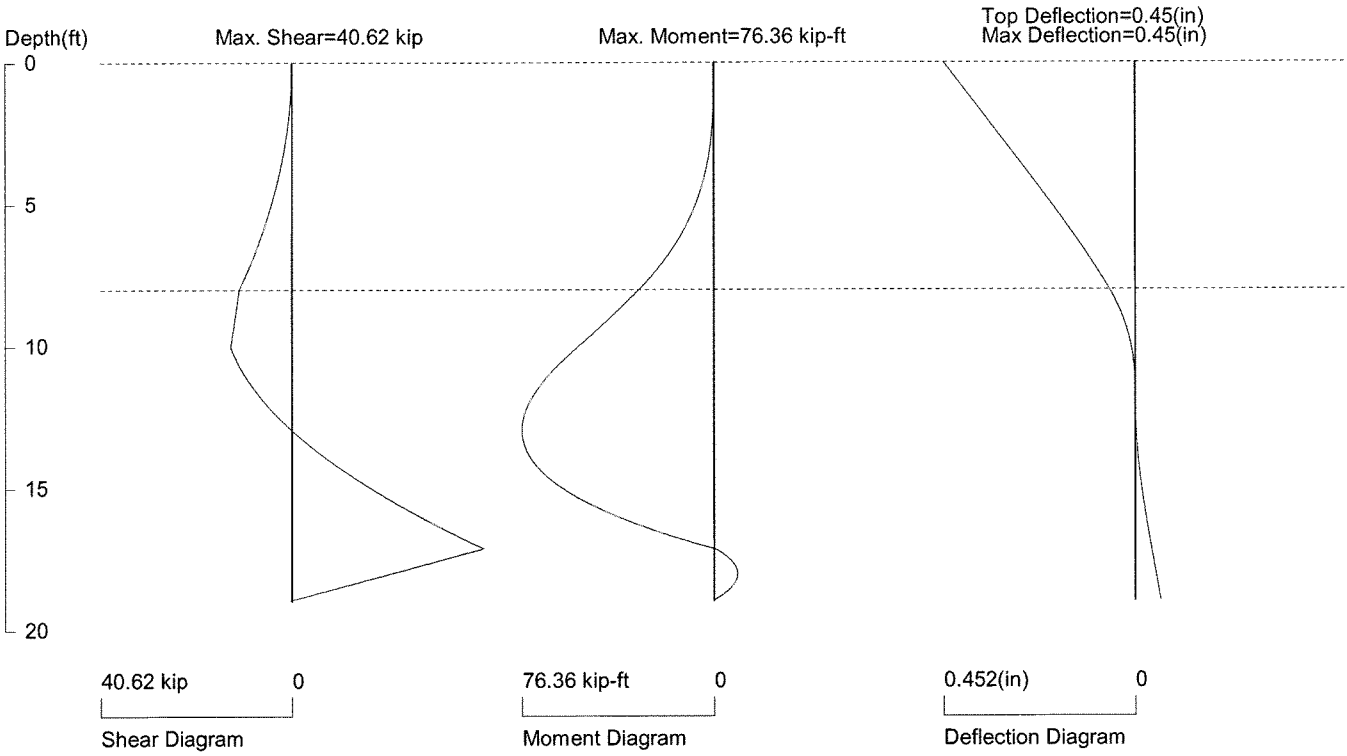
PASSIVE SPACING:

No.	Z depth	Spacing
1	8.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

House 88
P2 w/no seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 7.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in4)/pile=301.0

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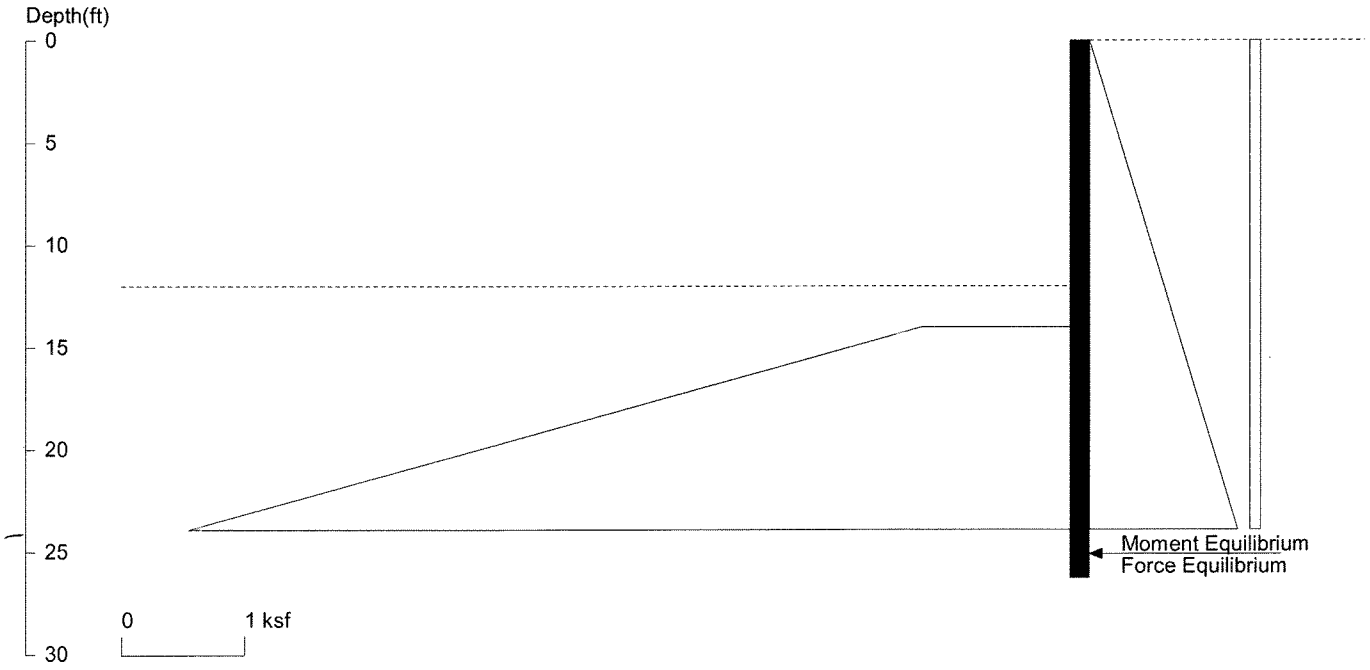
House 88
P4 w/seismic



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Wall Height=12.0 Pile Diameter=2.0 Pile Spacing=5.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.29 Min. Pile Length=26.29 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=227.63 per Pile Spacing=5.3 at Depth=18.22

PILE SELECTION:
Request Min. Section Modulus = 82.8 in3/pile=1356.44 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X57 has Section Modulus = 92.2 in3/pile=1510.88 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 1.15(in) based on E (ksi)=29000.00 and I (in4)/pile=758.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05
0	.084	50	0.084	

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
14	1.2	50	22.800	.6

ACTIVE SPACING:

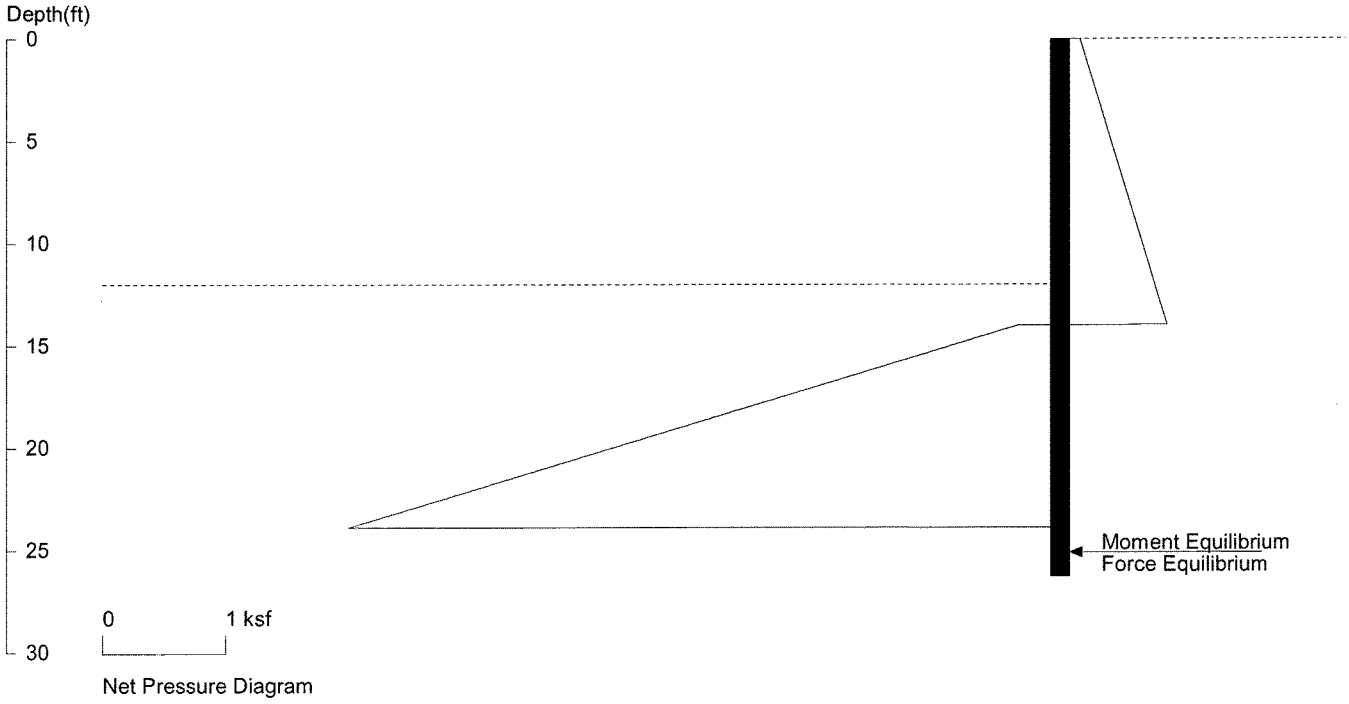
No.	Z depth	Spacing
1	0.00	5.25
2	12.00	2.00

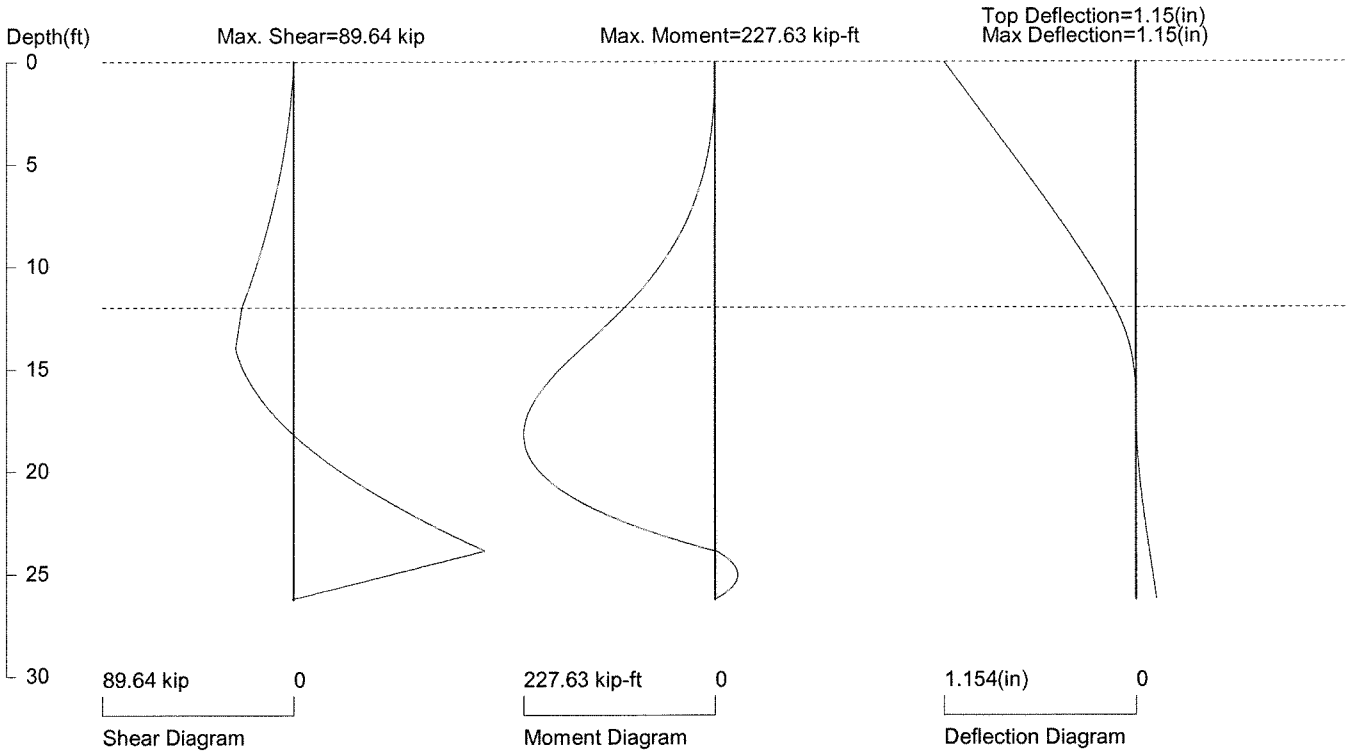
PASSIVE SPACING:

No.	Z depth	Spacing
1	12.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

House 88
P4 w/seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 5.3 foot or meter

User Input Pile, W16X57: E (ksi)=29000.0, I (in4)/pile=758.0

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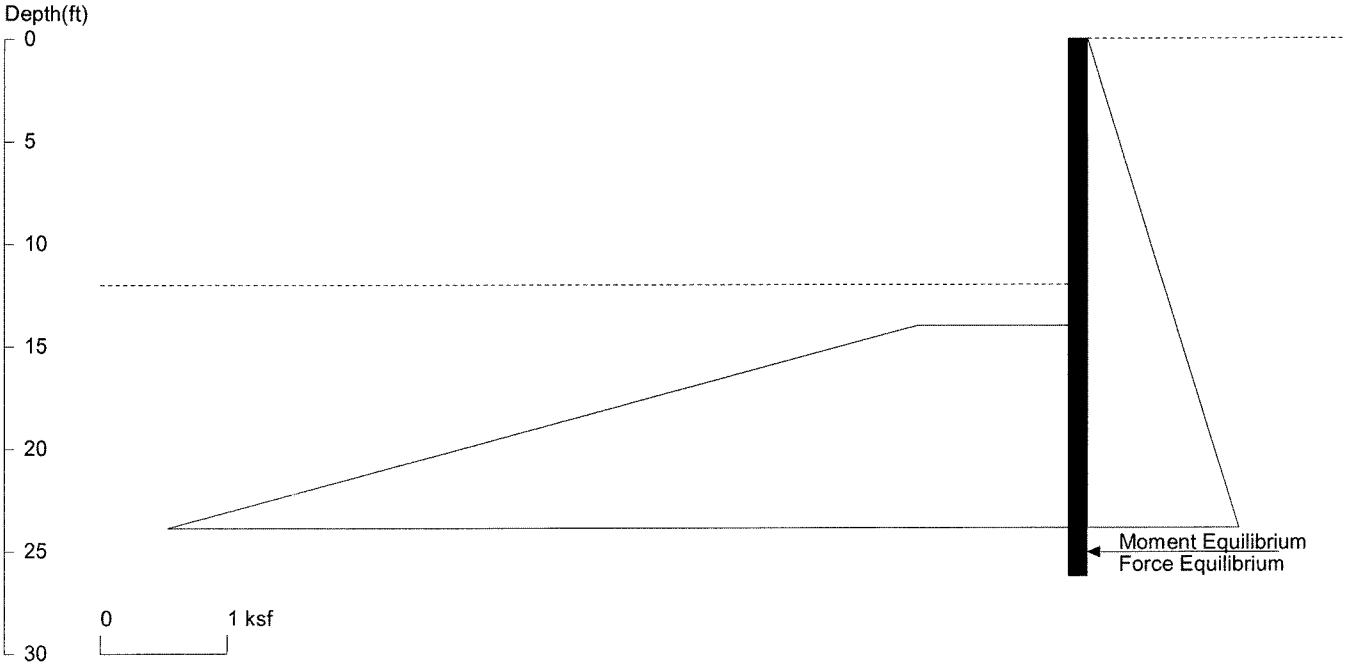
House 88
P4 w/no seismic



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Wall Height=12.0 Pile Diameter=2.0 Pile Spacing=5.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=14.25 Min. Pile Length=26.25 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=171.87 per Pile Spacing=5.3 at Depth=18.29

PILE SELECTION:
Request Min. Section Modulus = 62.5 in3/pile=1024.13 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X57 has Section Modulus = 92.2 in3/pile=1510.88 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.83(in) based on E (ksi)=29000.00 and I (in4)/pile=758.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5 ✓

Z1	P1	Z2	P2	Slope
14	1.2	50	22.80	.6

ACTIVE SPACING:

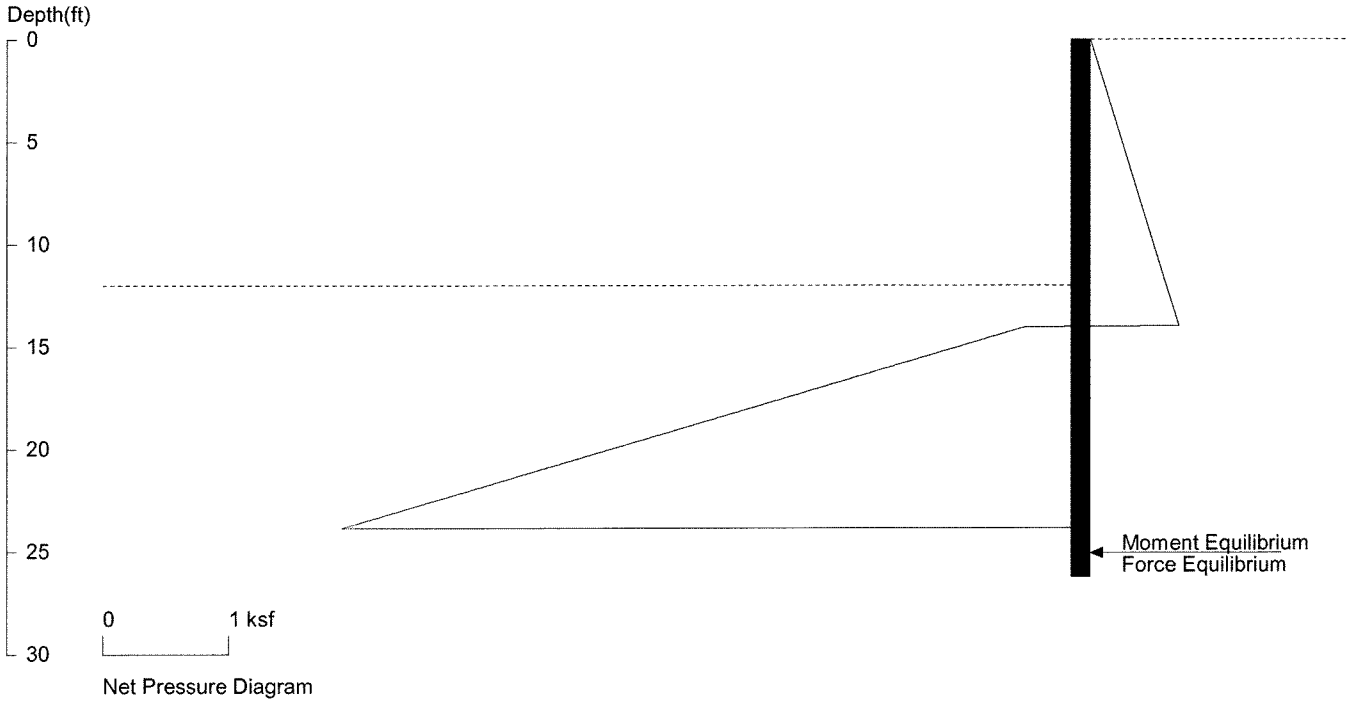
No.	Z depth	Spacing
1	0.00	5.25
2	12.00	2.00

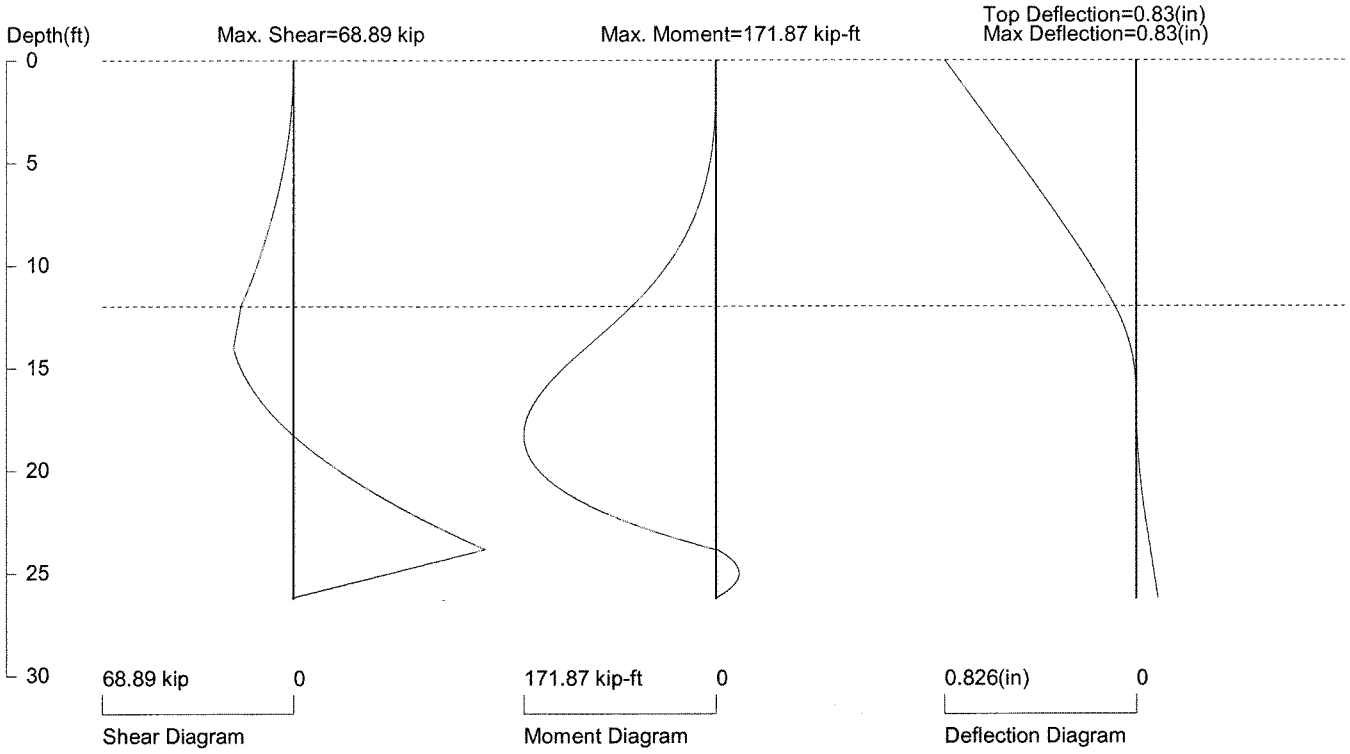
PASSIVE SPACING:

No.	Z depth	Spacing
1	12.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

House 88
P4 w/no seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 5.3 foot or meter

User Input Pile, W16X57: E (ksi)=29000.0, I (in4)/pile=758.0

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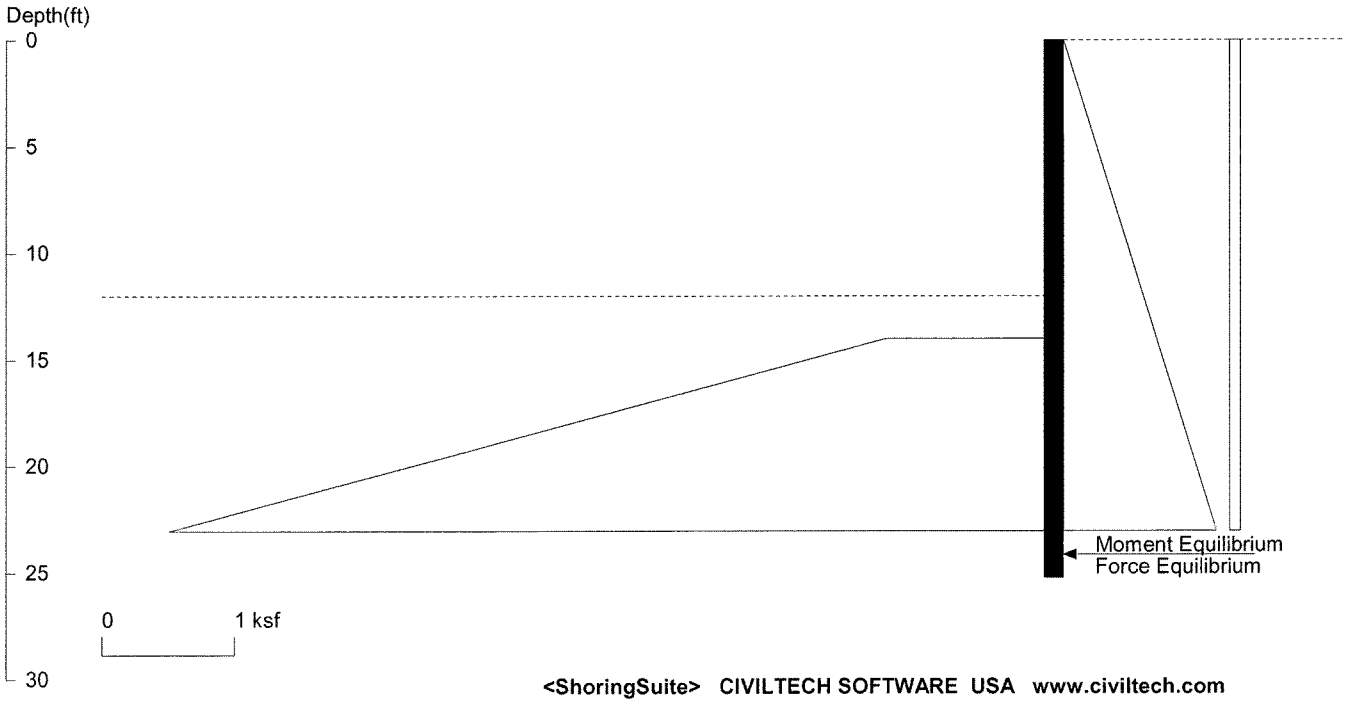
House 88
P10 w/seismic



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Wall Height=12.0 Pile Diameter=2.0 Pile Spacing=4.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=13.24 Min. Pile Length=25.24 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=179.59 per Pile Spacing=4.3 at Depth=17.76

PILE SELECTION:
Request Min. Section Modulus = 65.3 in3/pile=1070.17 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X45 has Section Modulus = 72.7 in3/pile=1191.33 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 1.11(in) based on E (ksi)=29000.00 and I (in4)/pile=586.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05
0	.084	50	0.084	0

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2 ✓

Z1	P1	Z2	P2	Slope
14	1.2	50	22.80	.6

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	4.25
2	12.00	2.00

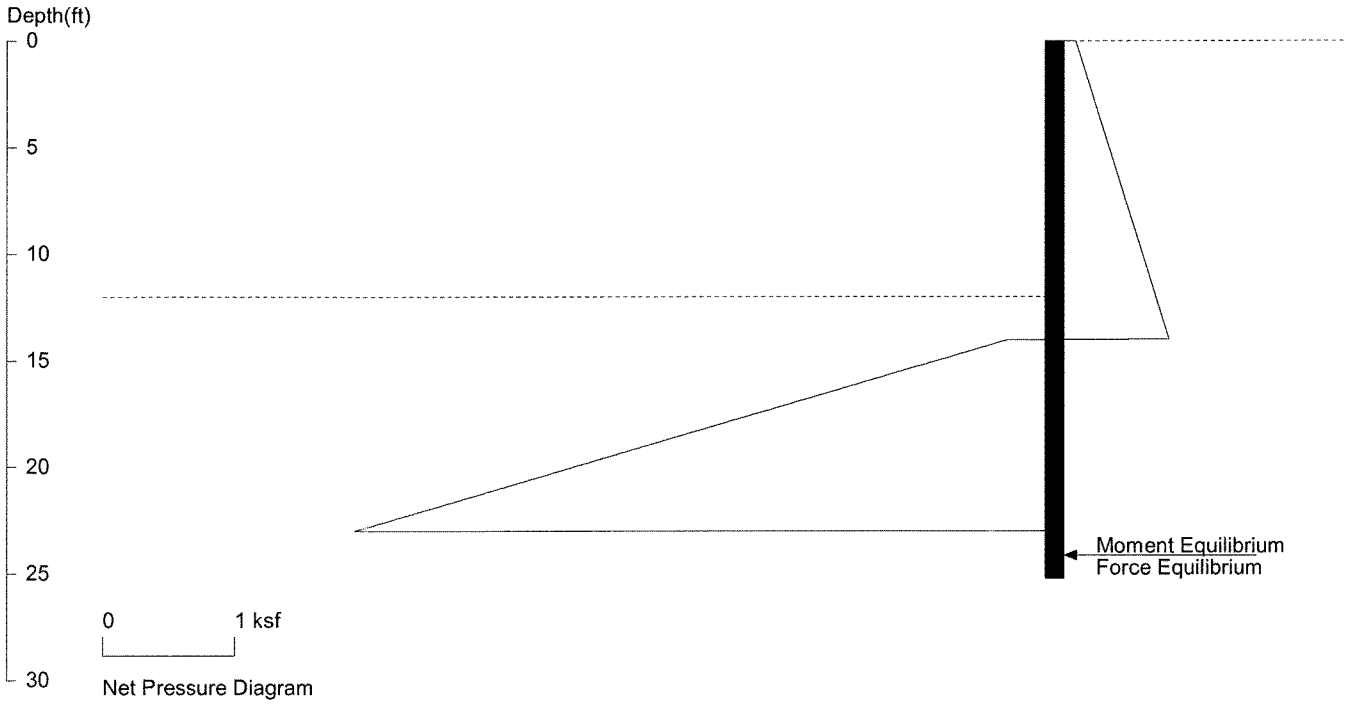
PASSIVE SPACING:

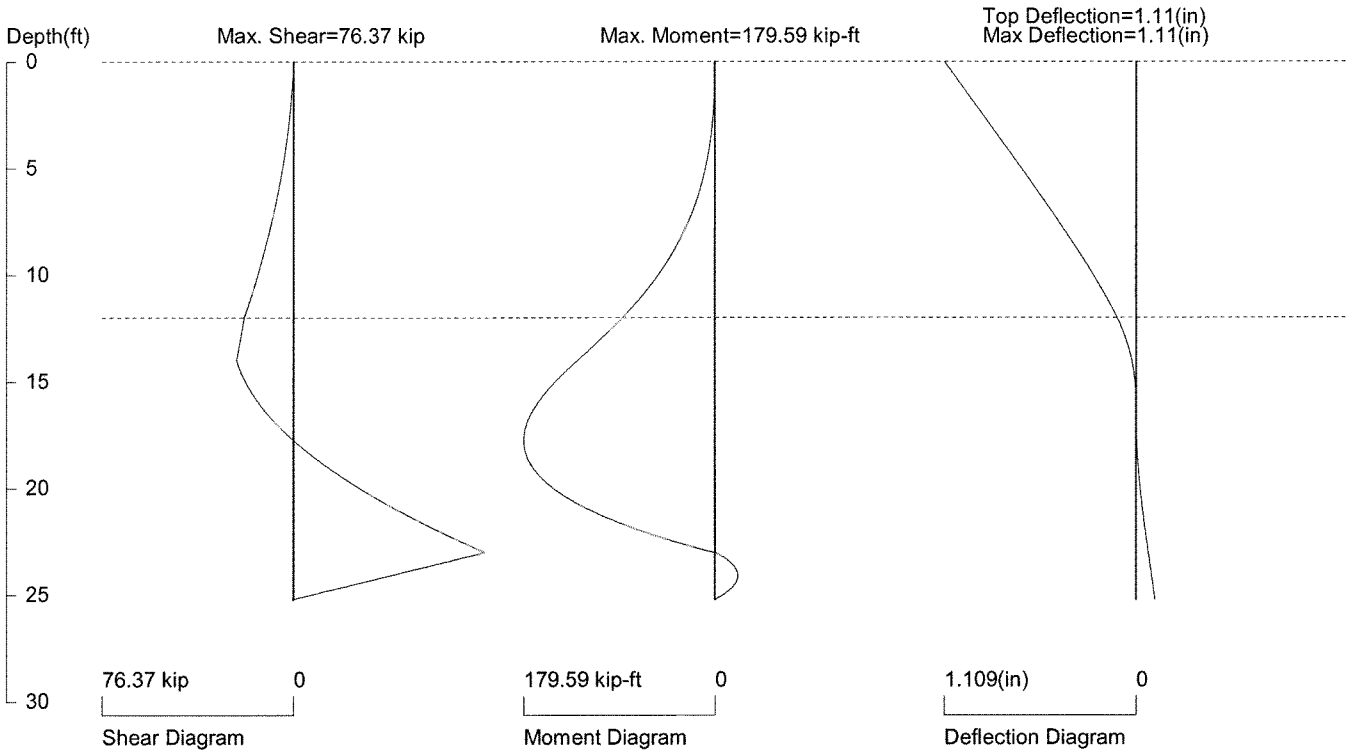
No.	Z depth	Spacing
1	12.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

SH-11

House 88
P10 w/seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.3 foot or meter

User Input Pile, W16X45: E (ksi)=29000.0, I (in4)/pile=586.0

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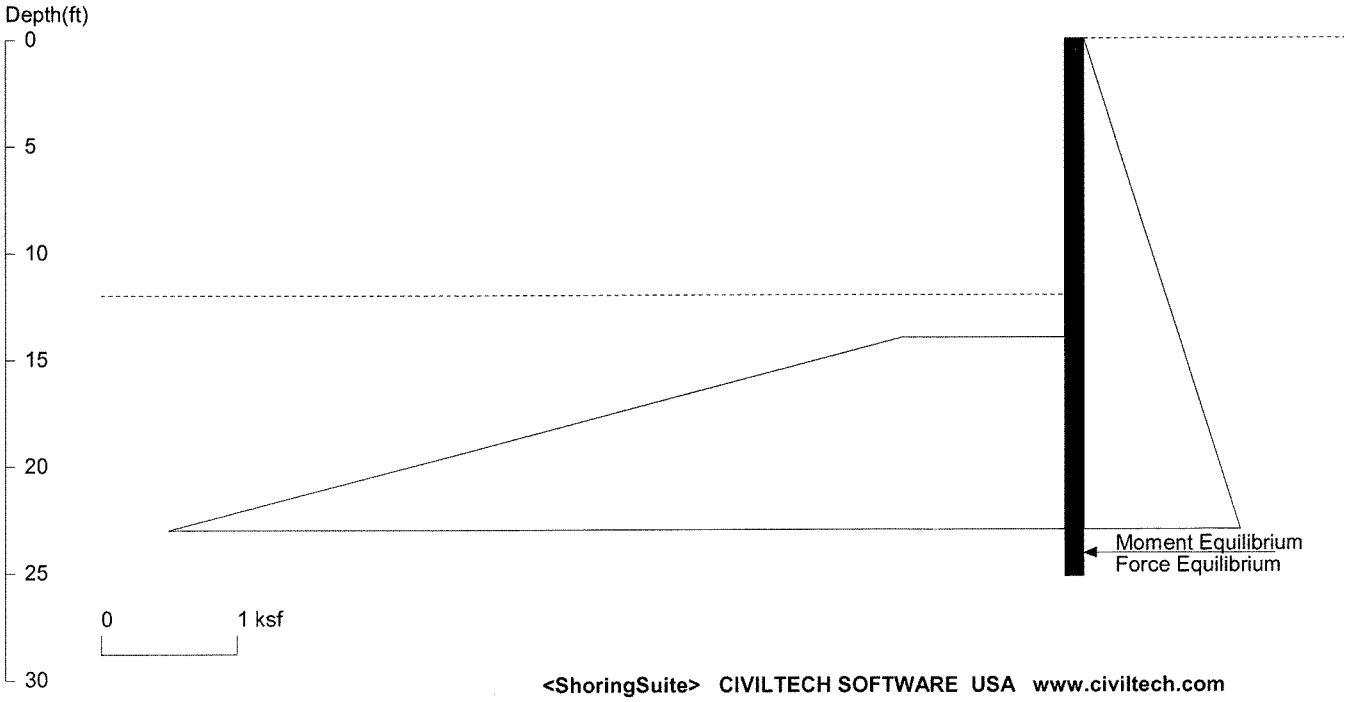
House 88
P10 w/no seismic



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Wall Height=12.0 Pile Diameter=2.0 Pile Spacing=4.3 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=13.21 Min. Pile Length=25.21 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=135.64 per Pile Spacing=4.3 at Depth=17.83

PILE SELECTION:
Request Min. Section Modulus = 49.3 in3/pile=808.28 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X45 has Section Modulus = 72.7 in3/pile=1191.33 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.79(in) based on E (ksi)=29000.00 and I (in4)/pile=586.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5 ✓

Z1	P1	Z2	P2	Slope
14	1.2	50	22.80	.6

ACTIVE SPACING:

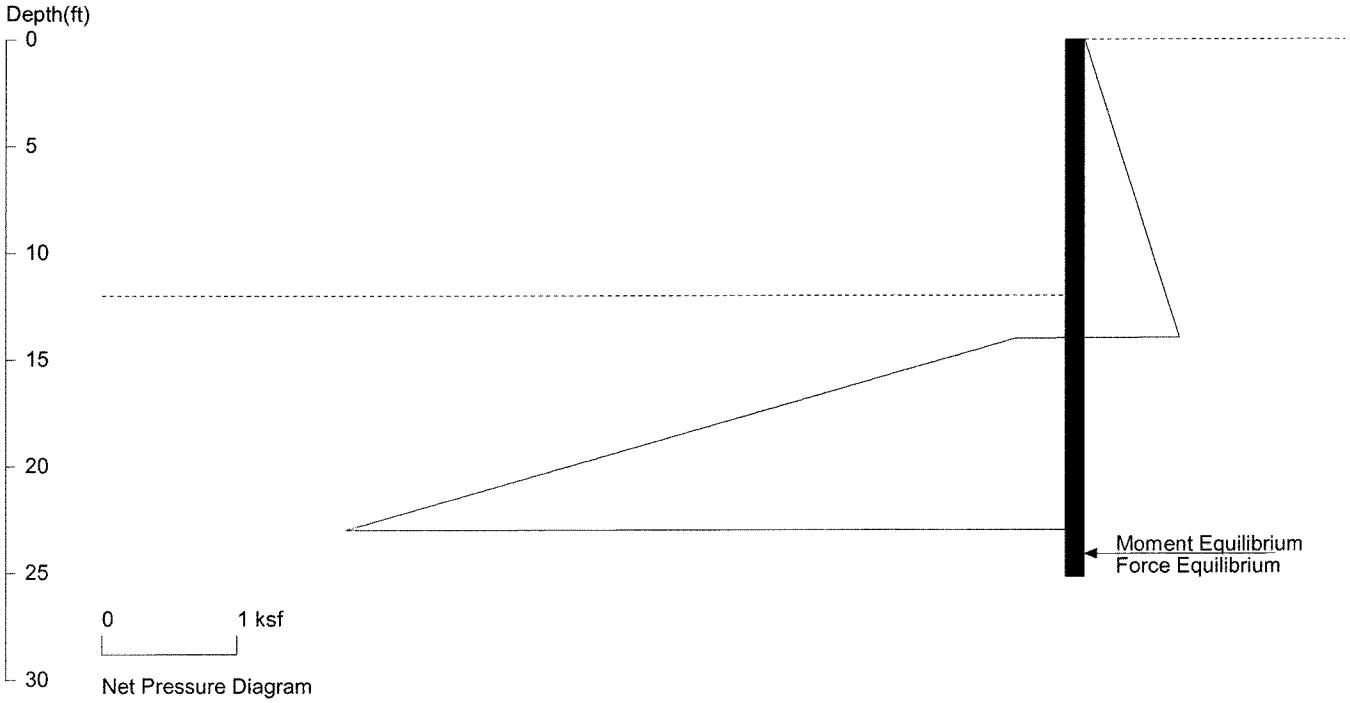
No.	Z depth	Spacing
1	0.00	4.25
2	12.00	2.00

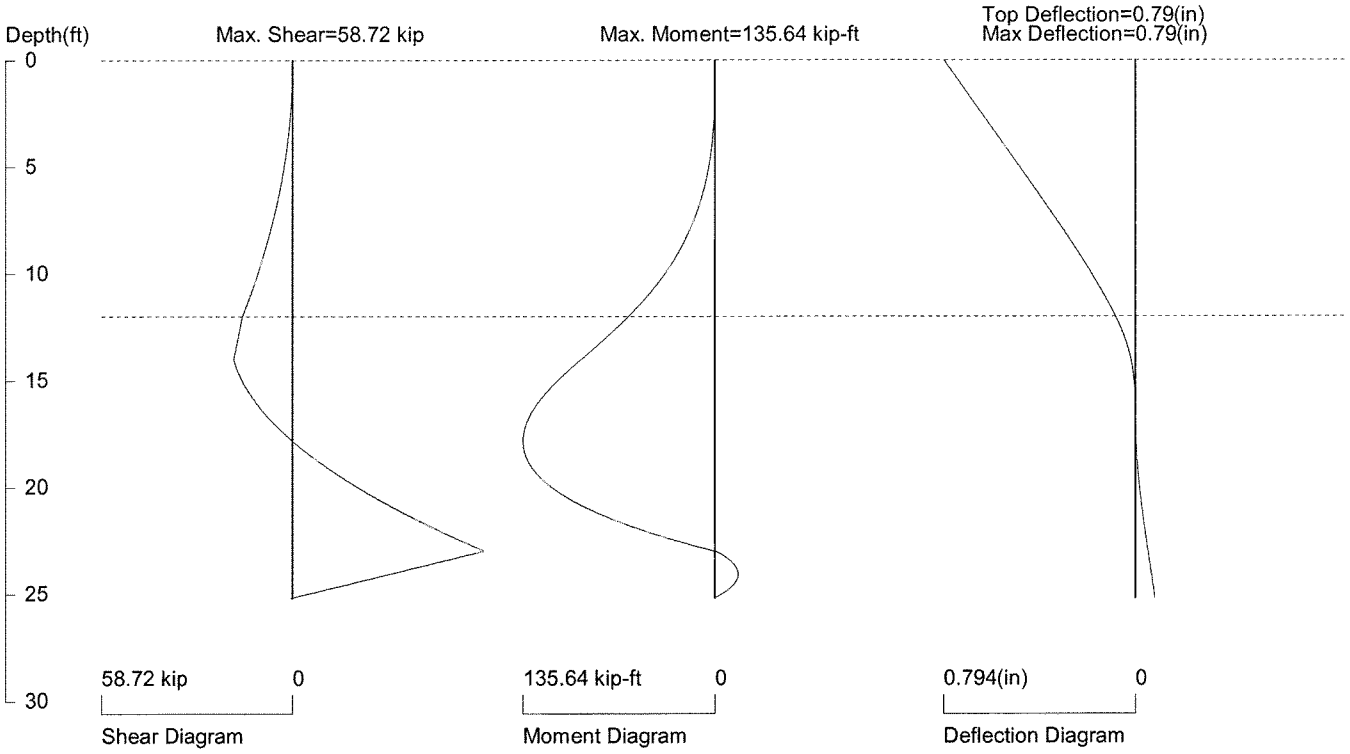
PASSIVE SPACING:

No.	Z depth	Spacing
1	12.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

House 88
P10 w/no seismic





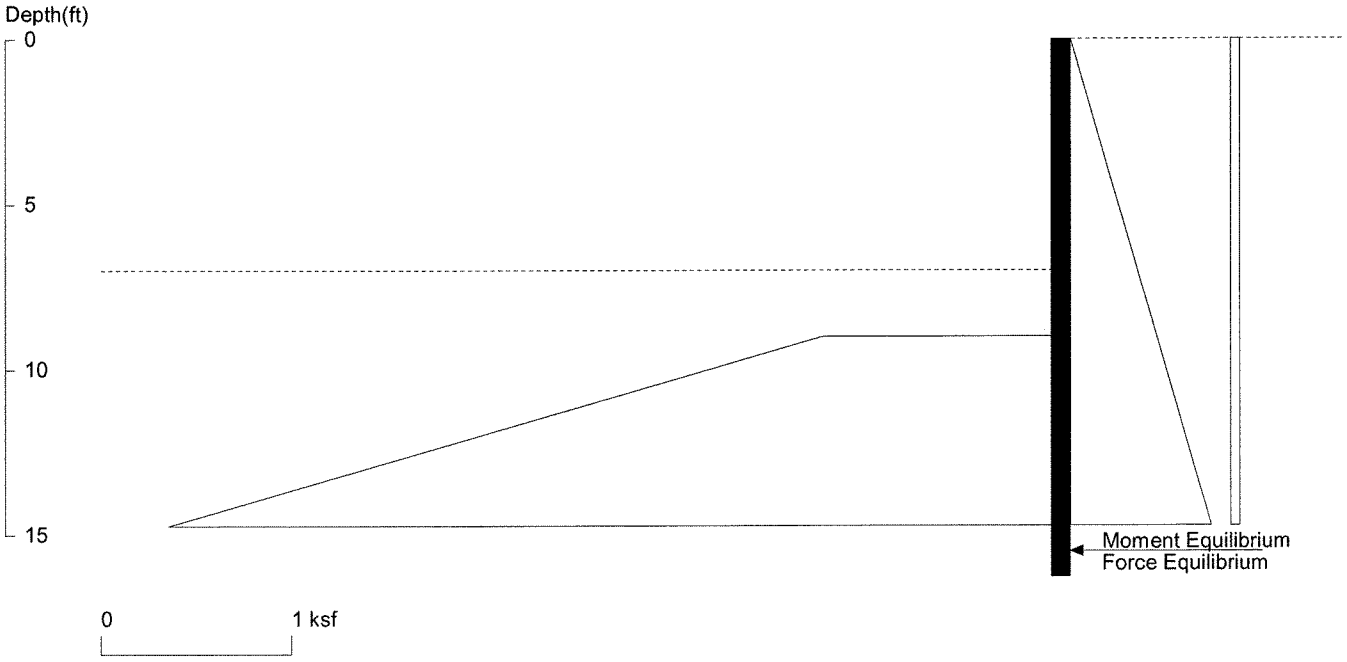
PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 4.3 foot or meter

User Input Pile, W16X45: E (ksi)=29000.0, I (in4)/pile=586.0

File: P:\MT Project Folder\0285-2014-01-01 House 88\Calculations\Shoring\House 88 - P10.sh8

House 88
P13 w/seismic



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Wall Height=7.0 Pile Diameter=2.0 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=9.28 Min. Pile Length=16.28 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=58.91 per Pile Spacing=6.0 at Depth=11.19

PILE SELECTION:
Request Min. Section Modulus = 21.4 in3/pile=351.04 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X26 has Section Modulus = 38.4 in3/pile=629.26 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.27(in) based on E (ksi)=29000.00 and I (in4)/pile=301.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05
0	0.049	50	0.049	0

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.2

Z1	P1	Z2	P2	Slope
9	1.2	50	25.800	.6

ACTIVE SPACING:

No.	Z depth	Spacing
1	0.00	6.00
2	7.00	2.00

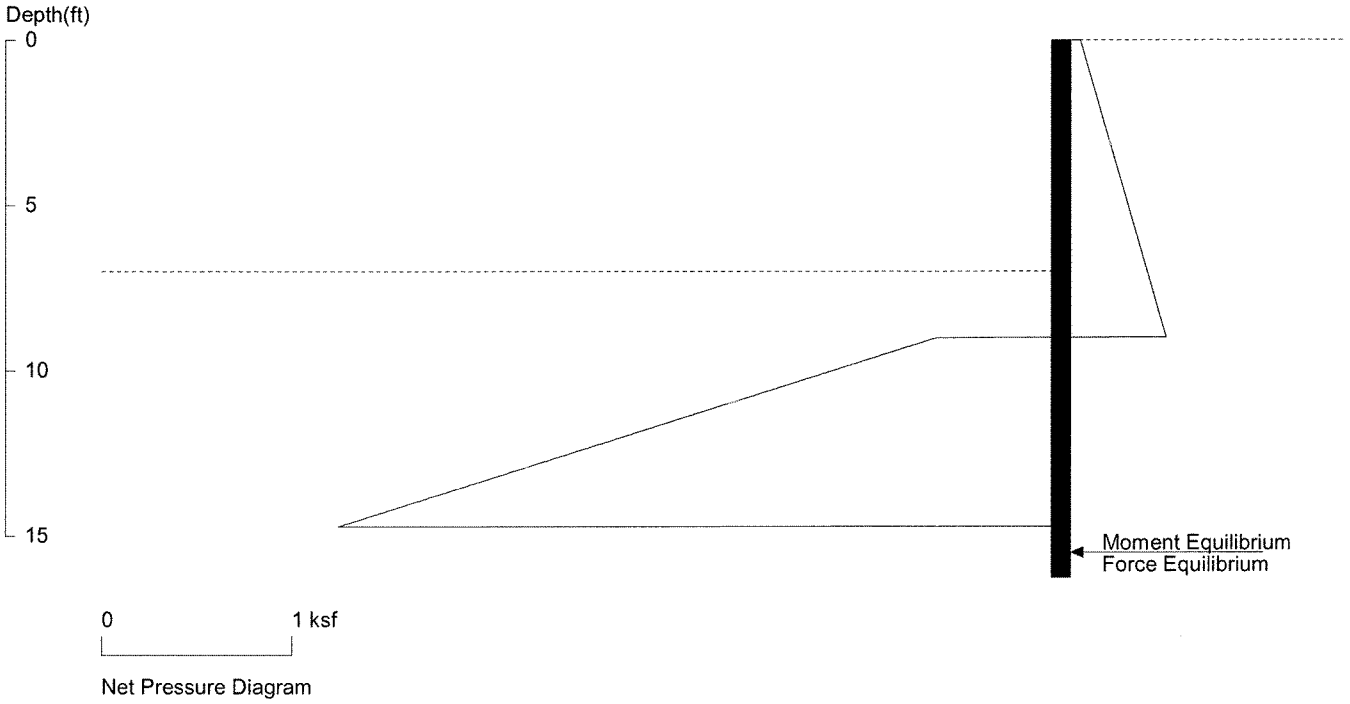
PASSIVE SPACING:

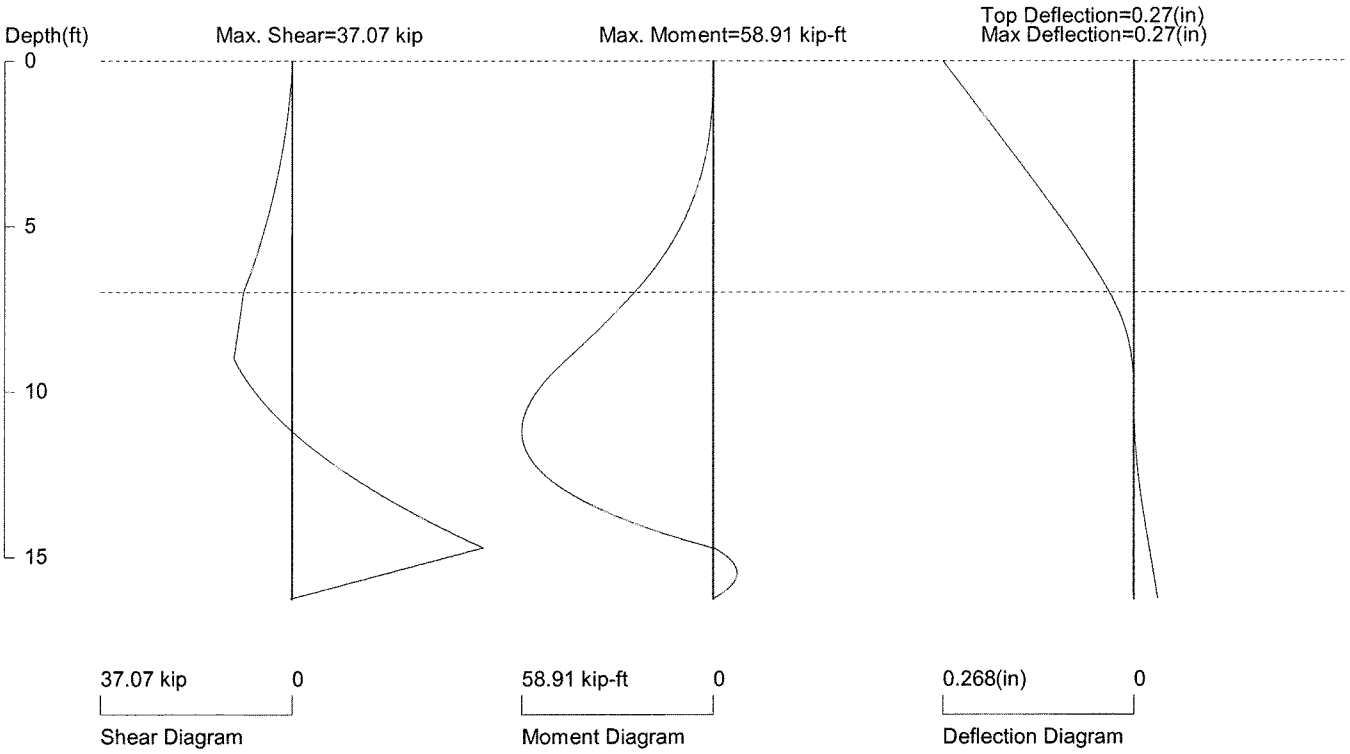
No.	Z depth	Spacing
1	7.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

SH-15

House 88
P13 w/seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in4)/pile=301.0

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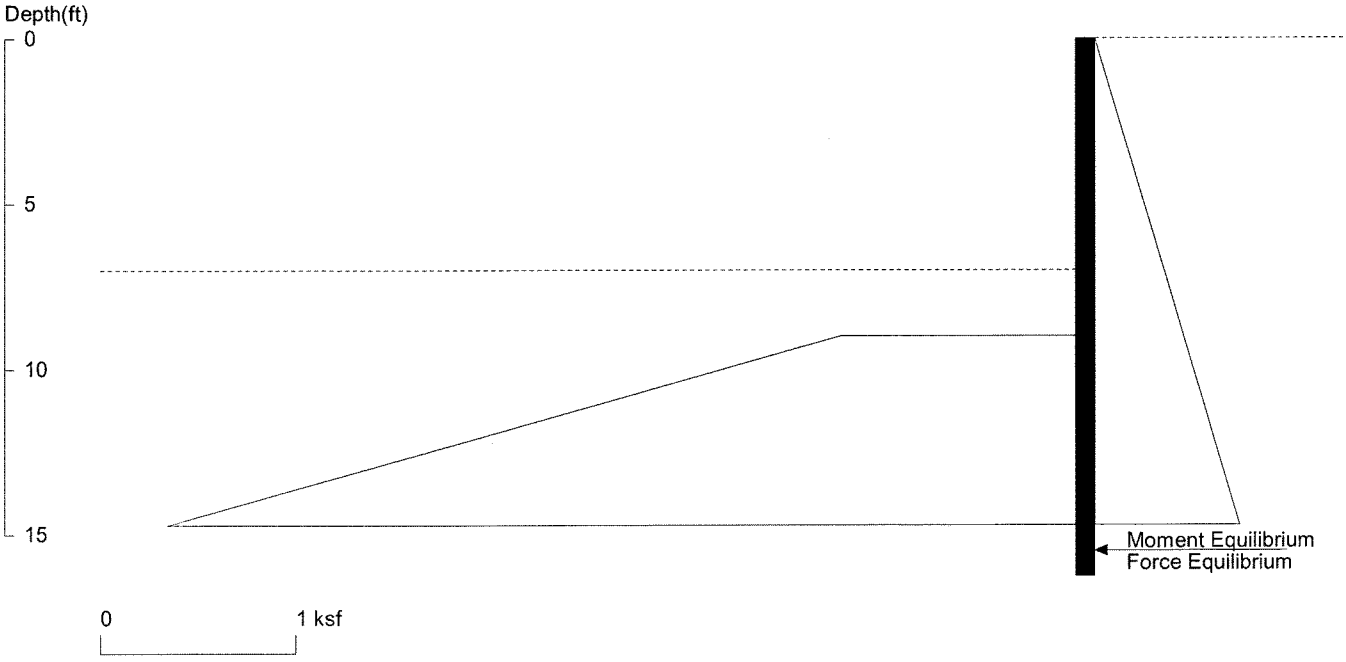
House 88
P13 w/no seismic



<ShoringSuite> CIVILTECH SOFTWARE USA www.civiltech.com

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File: P:\MT Project Folder\0285-2014-01-01 House 88\Calculations\Shoring\House 88 - P13.sh8

Wall Height=7.0 Pile Diameter=2.0 Pile Spacing=6.0 Wall Type: 2. Soldier Pile, Drilled

PILE LENGTH: Min. Embedment=9.27 Min. Pile Length=16.27 (in graphics and analysis)
MOMENT IN PILE: Max. Moment=44.85 per Pile Spacing=6.0 at Depth=11.25

PILE SELECTION:
Request Min. Section Modulus = 16.3 in3/pile=267.27 cm3/pile, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
W16X26 has Section Modulus = 38.4 in3/pile=629.26 cm3/pile. It is greater than Min. Requirements!
Top Deflection = 0.20(in) based on E (ksi)=29000.00 and I (in4)/pile=301.0

DRIVING PRESSURES (ACTIVE, WATER, & SURCHARGE):

Z1	P1	Z2	P2	Slope
0	0	50	2.500	.05

PASSIVE PRESSURES: Pressures below will be divided by a Factor of Safety =1.5 ✓

Z1	P1	Z2	P2	Slope
9	1.2	50	25.800	.6

ACTIVE SPACING:

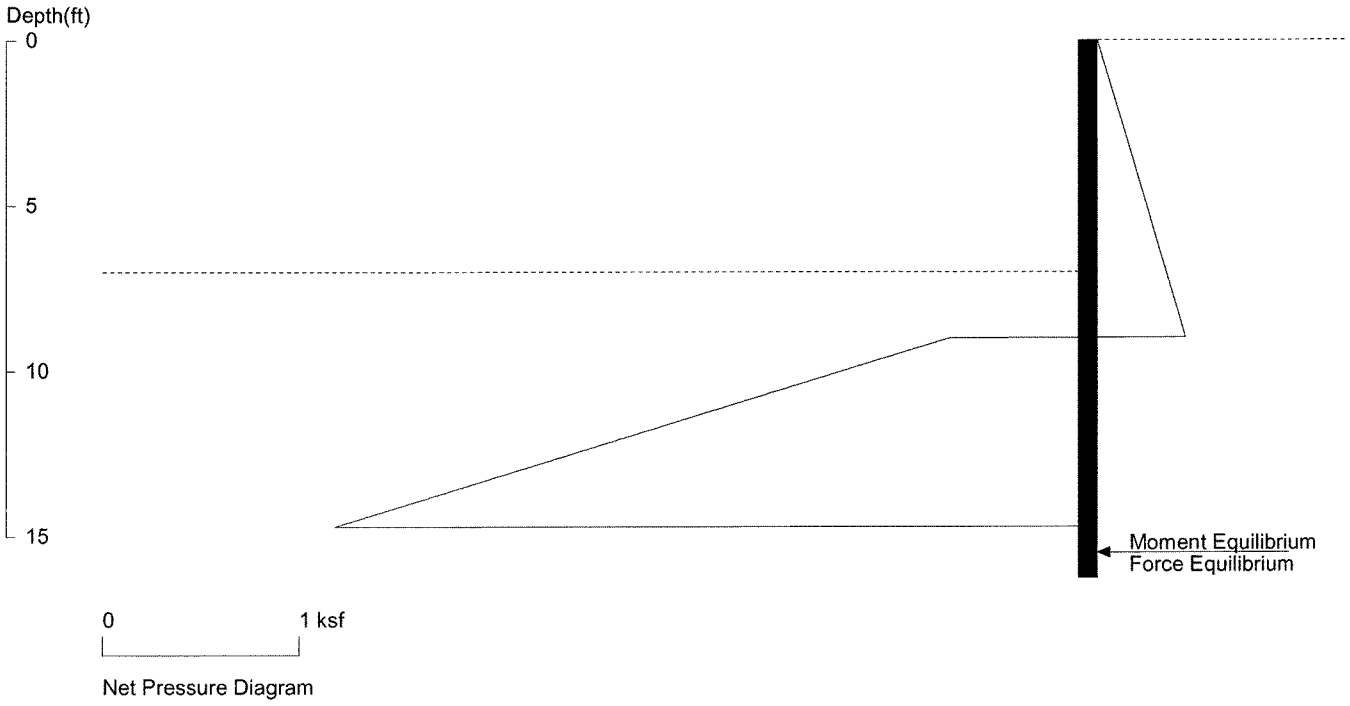
No.	Z depth	Spacing
1	0.00	6.00
2	7.00	2.00

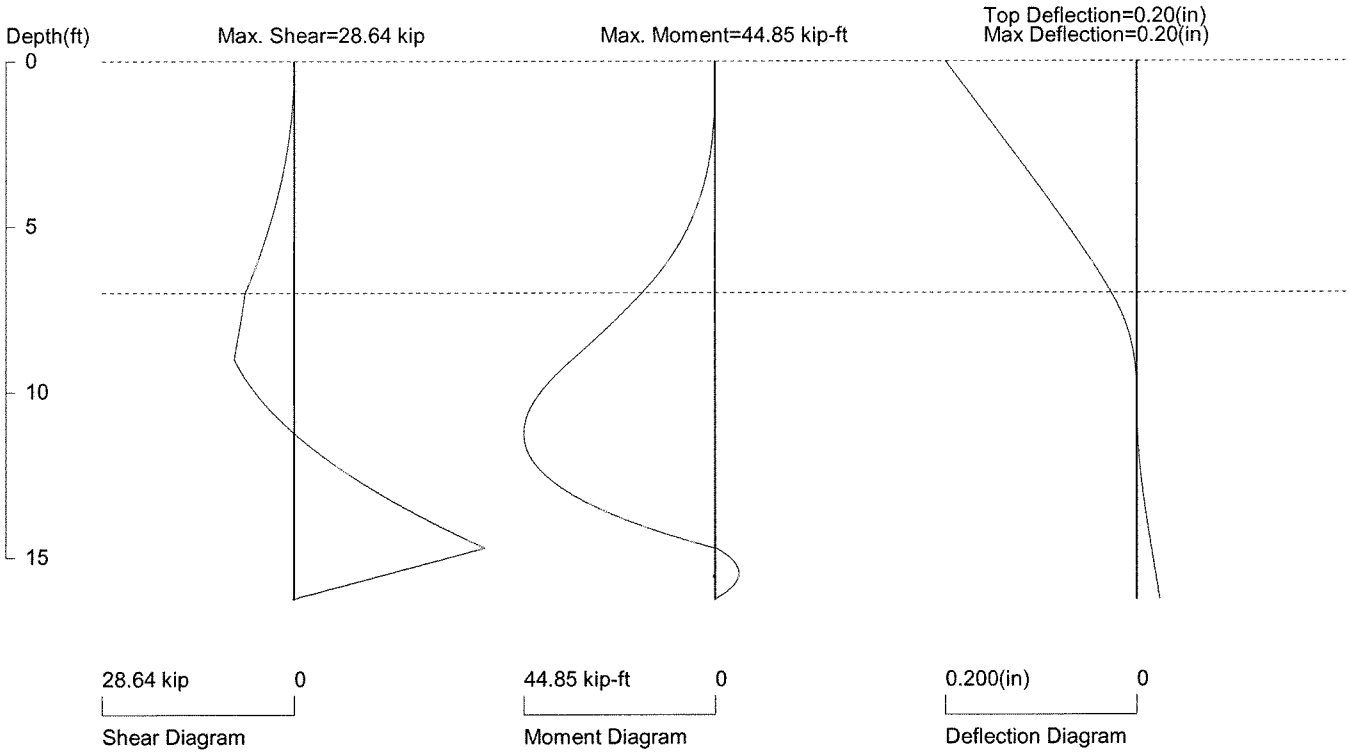
PASSIVE SPACING:

No.	Z depth	Spacing
1	7.00	4.00

UNITS: Width,Spacing,Diameter,Length,and Depth - ft; Force - kip; Moment - kip-ft
Friction,Bearing,and Pressure - ksf; Pres. Slope - kip/ft3; Deflection - in

House 88
P13 w/no seismic





PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on pile spacing: 6.0 foot or meter

User Input Pile, W16X26: E (ksi)=29000.0, I (in4)/pile=301.0

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