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Structural Calculations

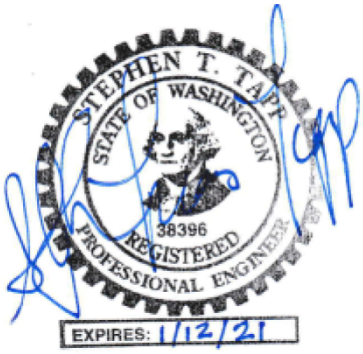
WIND LOAD GOVERNS LATERAL DESIGN

for

Petrie New Residence

2431 60th Avenue SE
Mercer Island, Washington 98040

Date: February 2020
Project: T20B3
Building Code Reference: 2015 IBC



Loading Requirements

ASCE 7-16

Codes

2015 IBC
AISC/ASD Sixteenth Edition
ACI 318-16
NDS 2015
SEAW Rapid Solutions Methodology for Wind Design

Wind Design

Wind Speed = 85 mph
Wind Exposure = 'B'

Soil Loads (assumed)

Passive pressure = 300 psf
Assumed Soil density = 130 pcf
Assumed soil Bearing Pressure = 2500 psf
Friction capacity is a coefficient of .4
Factor of safety = 1.5

Building Loads

Snow Load = 25 psf
Roof (DL) = 15 psf
Exterior Wall (DL) = 15 psf
Interior Wall (DL) = 7.5 psf
Main/Upper Floor(DL) = 12 psf, LL = 40 psf
Main Exterior Deck Load = 60 psf (if less than 100 square feet)
100 psf (if more than 100 square feet)
Corridors, Stairs,Exits (LL) = 100 psf

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JOB _____

SHEET NO. _____ OF _____

CALCULATED BY STT DATE _____

CHECKED BY _____ DATE _____

SCALE _____

SHEAR WALL SCHEDULE - 2015 IBC

WALL SHEATHING TO BE ½" (C-D) STRUCTURAL 1, 24/0

ROOF SHEATHING TO BE ½" (C-D) STRUCTURAL 1, 32/16

USE 10d COMMON NAILS (.148"Ø X 3" LONG)

ALL FRAMING MEMBERS TO BE MAXIMUM 19% MOISTURE CONTENT

PLAN SYMBOL	WALL TYPE	NAIL SIZE	PANEL NAIL SPACING			BLK'G	REQUIRED ANCHORS		ALLOWABLE UNIT SHEAR (PLF)
			PANEL EDGES	FIELD STUDS	TOP/BTM PLATES		PR TR SILL	BTM PLATE	
6	P1-6"	10d	6"	12"	6"	2X6(4)	⅝"Ø @ 48"	16d @ 6"	262(HF), 320(DF)
4	P1-4"	10d	4"	12"	4"	3X6(4)	⅝"Ø @ 32"	(2) 16d @ 8"	348(HF), 425(DF)
3	P1-3"	10d	3"	12"	3"	3X6(4)	⅝"Ø @ 24"	(2) 16d @ 6"	525(HF), 640(DF)
2	P1-2"	10d	2"	12"	2"	3X6(4)	¾"Ø @ 24"	(2) 16d @ 5"	599(HF), 730(DF)
2-3	P2-3"	10d	3'	12"	3"	3X6(4)	¾"Ø @ 16"	(4) 16d @ 6"	1050(HF),1280(DF)

Shear Wall Notes

1. **P-1 INDICATES PLYWOOD ON ONE SIDE OF SHEAR WALL ONLY.**
2. **P-2 INDICATES PLYWOOD ON TWO SIDES OF SHEAR WALL. FRAMING MEMBES SHALL BE 3X. OFFSET PANEL JOINTS TO FALL ON DIFFERENT STUDS.**
3. **PLYWOOD MAY BE INSTALLED EITHER HORIZONTALLY OR VERTICALLY ON HEM-FIR, OR DOUG FIR STUDS.**
4. **FOR NAILING AT 4", 3", 2" ON CENTER, USE 3X FRAMING MEMBERS AT ALL PANEL EDGES. STAGGER FASTENERS AT ALL PANEL JOINTS.**
5. **FOR NAILING AT 4",3",2" ON CENTER USE P.T. 3X SILL AT FOUNDATION.**
6. **SOLID BLOCK ALL PANEL EDGES WITH FULL DEPTH BLOCKING.**
7. **USE 10d. COMMON NAILS FOR SHEAR WALL FASTENERS.**
8. **NAILS MUST BE FLUSH DRIVEN WITH THE DIAPHRAGM SURFACE.**
9. **ANCHOR BOLTS TO HAVE A MINIMUM 3"X3"X1/4" PLATE WASHERS.**
10. **FINGER JOINTED STUDS ARE NOT TO BE USED AT HOLDOWN LOCATIONS.**
11. **NAILS FOR PANEL EDGES SHALL BE 10d COMMON(0.148 X 3" LONG). NAILS FOR PLATES SHALL BE 12d COMMON(0.148X 3 1/4" LONG).**
12. **WHERE BOTTOM PLATE NAILING REQUIRES (4) NAILS AT A SPECIFIC SPACING, BLOCK FLOOR SPACE BELOW THE SOLE PLATE CONSISTING OF A MINIMUM OF TWO FRAMING MEMBERS. NAILING PATTERN SHALL CONSIST OF TWO ROWS IN EACH MEMBER OFFSET 1/2" AND STAGGERED.**
13. **DO NOT INSTALL FLOOR DIAPHRAGM NAILING OVER BOTTOM SILL NAILING.**
14. **ALL STUDS TO BE 2X HEM-FIR OR BETTER.**

Earthquake Design Data for New Expansion Only

1) **Occupancy Category = I** — **ASCE 7-10 Table 1-**
   Occupancy Importance Factor Ie = 1 — **ASCE 7-10 Table 11.5-1**
   Seismic Use Group = I

2) **Mapped Spectoral Response Accelerations** **ASCE 7-10 Fig 22-1, 22-2**
   Latitude = 47.59 deg North
   Longitude = -122.25 deg West
   Location = Mercer Island Wa. 98040
   Maximum Ground Motions, 5% Damping, from USGS Maps
   Ss = 1.378 g, 0.2 sec response
   S_1 = .531 g, 1.0 sec response

3) **Site Classification** — **ASCE 7-10 Table 20-3.1**
   Assumed
   D

4) **Site Coefficients** — **ASCE Table 7-10 11-4.1.**
   F_a = 1 — **Table 11-4.2**
   F_v =1.5

5) **Maximum Considered Earthquake Acceleration** **ASCE 7-10 11.4.3**
   $S_{MS} = F_a * S_s$ = 1.378
   $S_{M1} = F_V * S_1$ = .796

6) **Design Spectral Acceleration** — **ASCE 7-10 11.4.4**
   $S_{DS} = S_{MS} * 2/3$ = .919
   $S_{D1} = S_{M!} * 2/3$ = .531

7) **Seismic Design Category** — **ASCE 7-10 Table11-6.1, Table 11-6.2**
   D

8) **Basic Seismic Force Resisting System** — **ASCE 7-10 Table 12-2.1**
   Bearing Wall Systems
   Light-framed walls sheathed w/wood structural panels rated for shear resistance

Response Modification Factor (R) =6.5

System Over Strength Factor 'Wo" = 3.00

Deflection Amplification factor 'Cd" = 4.00

9) Analysis Procedure — ASCE 7-10 12.6

The Equivalent Lateral Force Procedure — ASCE 7-10 12.8

10) Building Period — ASCE 7-10 12.8.2

Structure Type for Building Period Calculation
All Other Structural Systems

"Ct" value = .02 — ASCE 7-10 Table 12.8-2
"x" value = .75
'h_n' = 21'
"Ta" = Ct*(hn^x) Approx. Fundamental Period — ASCE 7-10 Eq. 12.8-7
.196
"Cu" = 1.4 — ASCE 7-10 Table 12.8-1
Per ASCE 7-05 12.8.2 True Fundamental Period < (1.4)(.196) = .27

11) "Cs" Response Coefficient — ASCE 7-10 12.8.1.1

S_{DS} = .919
S_{D1} = .531
S_1 = .531 g
'R' = 6.5
"I" = 1.00
'TL" = 6 — ASCE 7-10 Figure 22-15

(Eq. 12.8.2) $C_s = S_{DS}/(R/1)$ = .141 Preliminary C_s
(Eq. 12.8-3) $C_s = S_{D1}/T_a(R/1)$ = .30 Need Not Exceed
(Eq. 12.8-5) C_s = .01 Shall no be less than
(Eq. 12.8-6) $C_s = .5\ S_1/(R/1)$ = .0 Shall not be less than

Therefore C_s = .132

12) Building Weight "W" (from hand calculated sheet) = 160.5 K

13) Base Shear — ASCE 7-10 12.8-1

V = C_S *W
(.14) * 160.5K = 22.5 K

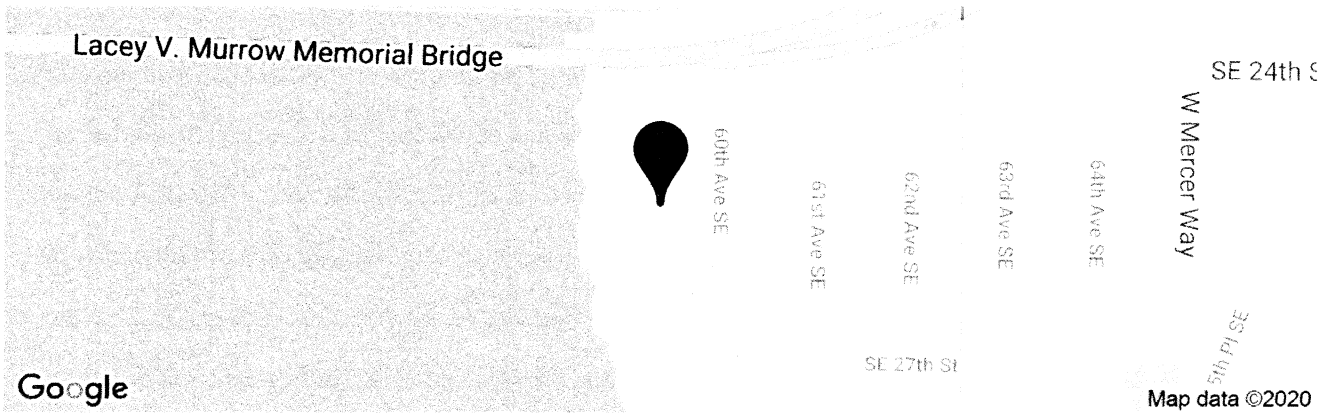
14) Vertical Distribution of Seismic Forces

See Spread Sheet

OSHPD

2431 60th Ave SE, Mercer Island, WA 98040, USA

Latitude, Longitude: 47.5881824, -122.2536294



Date	2/18/2020, 2:55:21 PM
Design Code Reference Document	ASCE7-10
Risk Category	II
Site Class	D - Stiff Soil

Type	Value	Description
S_S	1.378	MCE_R ground motion. (for 0.2 second period)
S_1	0.531	MCE_R ground motion. (for 1.0s period)
S_{MS}	1.378	Site-modified spectral acceleration value
S_{M1}	0.796	Site-modified spectral acceleration value
S_{DS}	0.919	Numeric seismic design value at 0.2 second SA
S_{D1}	0.531	Numeric seismic design value at 1.0 second SA

Type	Value	Description
SDC	D	Seismic design category
F_a	1	Site amplification factor at 0.2 second
F_v	1.5	Site amplification factor at 1.0 second
PGA	0.567	MCE_G peak ground acceleration
F_{PGA}	1	Site amplification factor at PGA
PGA_M	0.567	Site modified peak ground acceleration
T_L	6	Long-period transition period in seconds
SsRT	1.378	Probabilistic risk-targeted ground motion. (0.2 second)
SsUH	1.431	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration
SsD	2.449	Factored deterministic acceleration value. (0.2 second)
S1RT	0.531	Probabilistic risk-targeted ground motion. (1.0 second)
S1UH	0.567	Factored uniform-hazard (2% probability of exceedance in 50 years) spectral acceleration.
S1D	1.004	Factored deterministic acceleration value. (1.0 second)
PGAd	0.933	Factored deterministic acceleration value. (Peak Ground Acceleration)
	0.963	Mapped value of the risk coefficient at short periods

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JOB PETRIE - MAIN HOUSE

SHEET NO. _____ OF _____

CALCULATED BY STT DATE 2/17/20

CHECKED BY _____ DATE _____

SCALE _____

CHECK BUILDING WEIGHTS

UPPER ROOF	(1274)(1.08)(15)	20638
UPPER EXTERIOR WALLS	(181)(9)(15)	24435
UPPER INTERIOR WALLS	[(13.5)(3)+(28)(3)+(25)(2)](1.07)(7.5)(9)	= 12603
UPPER FLOOR	(1274)(15)	19110
UPPER EXTERIOR DECK	= [(67)+(73)](15)	2175
MAIN ROOF	[(98)+(197)+(631)+(57)+(17)]15	= 15000
MAIN INTERIOR WALL	[(7.6)(5)+(12)(3)+(10)(3)](7.75)(9)(.75)	= 5265
MAIN EXTERIOR WALLS	(188)(9)(15)(.75)	= 19035
MAIN FLOOR	(1674)(15)	= 25110
MAIN DECKS	(380)(15)	= 5700
LOWER EXT WALLS	(120)(9)(.5)(15)	= 8100
LOWER INT WALLS	[(127)+(18)+(31)+(36)](7.5)(9)(.5)	= 3297
TOTAL =		160,567 #

Seismic Load Analysis

2015 IBC

Project: Petrie Main House
Architect: Leif Anderson
Job #: T20B3

$V = C_s * (W)$	
V= (W)*	0.14
V =	22479.45
V=E*.7	15735.62
Des. Cat.	D
I =	1
C_s =	0.14
R =	6.5
W =	160567.5 Dead weight of structure

Snow(DL)=	25 psf
Roof (DL)=	15 psf
Ext. Wall(DL)=	15 psf
Int Wall(DL)=	7.5 psf
Floor(DL)=	15 psf
Deck(DL)=	15 psf

	Area	Ln ft	Height	Weight	Total	
Upper Roof =	1376			15	20640	lbs
Upper Floor Exterior Walls (wood)=		181	9	15	24435	
Upper Floor Exterior Walls (mas.)=				80	0	
Upper Floor Interior Walls =		188	9	7.5	12690	
Upper Floor =	1274			15	19110	
Upper Exterior Deck =	145			15	2175	
Upper Green Roof =				0	0	
Main Roof =	1000			15	15000	
Main Exterior Walls (wood) =		188	6.75	15	19035	
Main Exterior Walls (mas.) =					0	
Main Interior Walls =		104	6.75	7.5	5265	
Main Floor =	1674			15	25110	
Main Deck =	380			15	5700	
Lower Floor Exterior Walls (wood) =		120	4.5	15	8100	
Lower Floor Interior Walls =		98	4.5	7.5	3307.5	
W(total) =					160567.5	

Seismic Load Distribution

Level	Weight	Height	Wt*ht	F	F * .7
Upper Roof	39202	31.44	1232511	8539.8	5977.86
Main Roof	67000	21.28	1425760	9878.781	6915.147
Main Floor	54368	10.78	586087	4060.87	2842.609
Total	160570		3244358	22479.45	15735.62

Wind Load Design Data

Design Based on IBC 2015
ASCE 7-10
SEAW Rapid Solutions Methodology (RSM-03)

Basic Wind Speed

$V_{3.5}$ =110 mph
V_{fm} = 85 mph

Exposure

C

Roof Pitch

4:12

Mean Roof Height

32 feet

Least Horizontal Dimension

45 feet

Low Rise Building Criteria (h = 21')

1) **h ≤ 60 feet**

2) **h ≤least horizontal dimension**

Topographic Factors (Figure 3-3A, SEAW RSM)

K_1 = 0

K_2 = 0

K_3 = 0

$K_t = (1+(K_1 * K_2 * K_3))^2$

K_t = 1

Importance Factor

$I_w = 1$

Building Envelope

Enclosed

Design Wind Pressures

$P_{rsm} = q_s * K_{zt} * C_{rsm} * (I_w)$

$q_s = 20.7$ #/sq ft **(Figure 3-1 SEAW RSM)**

$K_{zt} =$ 1.67 **(Wind Load Factors)**

$I_w =$ 1

Crsm Factors See Below

Ballooning Case (Figure 3-5 EB, SEAW RSM)

Roof

Windward Roof = -.08(Up)
Windward Roof (O.H.) = -.8+-.58 = -1.38 (Up)
Leeward Roof = -.6(Up)

Walls

Windward Wall = .42(Inward)
Leeward Wall = -.5(Outward)

Deflating Case (Figure 3-5 ED, SEAW RSM)

Roof

Windward Roof = .48(Up)
Windward Roof (O.H.) = .48+-.58 = -1.06(Up)
Leeward Roof = -.3(Up)

Walls

Windward Wall = .73(Inward)
Leeward Wall) = -.14(Outward)

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

House

Level:	Upper Roof Diaphragm
Direction:	Side - Side
Vseismic @ Level=	5978
Vseismic total=	5978
Vseismic with redundancy=	
Total Load to be resolved (#)=	5978

Grid	2.1	2.7	5					
Span(FT.)	19.9	21.17						
Wind load(#/LF)								
Seismic load(#/LF)	145.5564	145.5564	145.5564	145.5564	145.5564	145.5564	0	0
Load#1(LB)								
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	0	0	0	0	0	0	0	0
P(seismic+L1,L2,L3)=	1448.286	2989	1540.714	0	0	0	0	0
Wall Length(FT.)	10.95	20.5	6.22					
Unit Shear(#/LF)	132.2635	145.8049	247.7032	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-6"					
Area Ab(sq.ft.)	1274	1274	1274					
shear ratio r=	0.22125	0.243902	0.414358	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	-0.532567	-0.29736	0.647711	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	2.78	9.6	3.11					
Panel Height(FT)	7	9	9					
(M)from upper level	0	0	0					
OTM(#')	2573.849	12597.54	6933.214	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	2.78	9.6	3.11					
Panel Wt.(#/LF)	135	135	135					
Wt. on Panel(#/LF)	100	100	100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-544.8522	-6497.28	-681.883	0	0	0	0	0
Resultant(#')	2028.996	6100.261	6529.441	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel Edge(#)	729.8548	635.4439	2099.499	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Simpson' Restraint	cmstc16 strap	cmstc16 strap	cmstc16 strap					

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

House

Level:	Upper Fl'r/Main Roof Diaphragm
Direction:	Side - Side
Vseismic @ Level=	6915
Vseismic total=	12899
Vseismic with redundancy=	
Total Load to be resolved (#)=	12892

Grid	1,2	3	4	6				
Span(FT.)	38	7.17	24.22					
Wind load(#/LF)								
Seismic load(#/LF)	99.65413	99.65413	99.65413	99.65413	99.65413	99.65413	0	0
Load#1(LB)	1448	2989	1540					
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	1448	2989	1540	0	0	0	0	0
P(seismic+L1,L2,L3)=	3341.428	5239.688	3104.072	1206.812	0	0	0	0
Wall Length(FT.)	18.4	22.51	10.89	6				
Unit Shear(#/LF)	181.5994	232.7716	285.0387	201.1353	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-4"	P1-4"	P1-6"				
Area Ab(sq.ft.)	1674	1674	1674	1674				
shear ratio r=	0.140786	0.180457	0.220977	0.155931	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	-1.472114	-0.70881	-0.2121	-1.13487	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	4.39	4.39	10.89	3				
Panel Height(FT)	9	9	9	7				
(M)from upper level	3157	5254	20230	0				
OTM(#')	10331.99	14450.81	48166.64	4223.84	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	4.39	4.39	10.89	3				
Panel Wt.(#/LF)	135	135	135	135				
Wt. on Panel(#/LF)	100	100	100	100				
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-1358.683	-1358.68	-8360.74	-634.5	0	0	0	0
Resultant(#')	8973.308	13092.12	40091.79	3589.34	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	2044.034	2982.26	3681.524	1196.447	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	cmstc16	cmstc16	hdu5 w/	hdu5 w/				
Restraint	strap	strap	4x post	4x post				

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

House

Level:	Main Floor Diaphragm							
Direction:	Side - Side							
Vseismic @ Level=	2842							
Vseismic total=	15735							
Vseismic with redundancy=								
Total Load to be resolved (#)=	7279							
Grid	1.5	3						
Span(FT.)	35.61							
Wind load(#/LF)								
Seismic load(#/LF)	79.80904	79.80904	79.80904	79.80904	79.80904	79.80904	79.80904	79.80904
Load#1(LB)	1448	2989						
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	1448	2989	0	0	0	0	0	0
P(seismic+L1,L2,L3)=	2869	4410	0	0	0	0	0	0
Wall Length(FT.)	22.11	45						
Unit Shear(#/LF)	129.7603	98	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"/ Fnd. Wall	Conc. Ret. Wall						
Area Ab(sq.ft.)	1000	1000						
shear ratio r=	0.082466	0.062282	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	-5.669286	-8.15478	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	3.94							
Panel Height(FT)	9							
(M)from upper level	6701							
OTM(#')	11302.3	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	3.94							
Panel Wt.(#/LF)	135							
Wt. on Panel(#/LF)	100							
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-1094.414	0	0	0	0	0	0	0
Resultant(#')	10207.89	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel Edge(#)	2590.834	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Simpson' Restraint	hdu5 w/ 4x post							

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

House

Level:	Upper Roof Diaphragm
Direction:	Rear - Front
Vseismic @ Level=	5978
Vseismic total=	5978
Vseismic with redundancy=	
Total Load to be resolved (#)=	5978

Grid	A	B	C	C.8,D				
Span(FT.)	14	10	21.28					
Wind load(#/LF)								
Seismic load(#/LF)	132.023	132.023	132.023	132.023	132.023	132.023	0	0
Load#1(LB)								
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	0	0	0	0	0	0	0	0
P(seismic+L1,L2,L3)=	924.1608	1584.276	2064.839	1404.724	0	0	0	0
Wall Length(FT.)	41	12.11	9.4	10.28				
Unit Shear(#/LF)	22.54051	130.8238	219.6637	136.6463	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-6"	P1-6"				
Area Ab(sq.ft.)	1274	1274	1274	1274				
shear ratio r=	0.037706	0.218842	0.367454	0.228582	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	-12.86064	-0.56044	0.475095	-0.45134	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	13.5	3.83	9.4	10.28				
Panel Height(FT)	9	5	9	9				
(M)from upper level	0	0	0	0				
OTM(#')	2738.672	2505.275	18583.55	12642.52	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	13.5	3.83	9.4	10.28				
Panel Wt.(#/LF)	135	135	135	135				
Wt. on Panel(#/LF)	100	100	100	100				
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-12848.63	-1034.16	-6229.38	-7450.33	0	0	0	0
Resultant(#')	-10109.95	1471.117	12638.57	5192.192	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	-748.8854	384.1038	1344.529	505.0771	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson' Restraint	n/a	cmstc16 strap	cmstc16 strap	cmstc16 strap				

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

House

Level:	Upper Fl'r/Main Roof Diaphragm
Direction:	Rear - Front
Vseismic @ Level=	5977
Vseismic total=	12893
Vseismic with redundancy=	
Total Load to be resolved (#)=	11953

Grid	A	C	D					
Span(FT.)	24.17	21.39						
Wind load(#/LF)								
Seismic load(#/LF)	131.1896	131.1896	131.1896	131.1896	131.1896	131.1896	0	0
Load#1(LB)	924	792	1404					
Load#2(LB)	792	2064						
Load#3(LB)								
P(wind+L1,L2,L3)=	1716	2856	1404	0	0	0	0	0
P(seismic+L1,L2,L3)=	3301.427	5844.5	2807.073	0	0	0	0	0
Wall Length(FT.)	62.11	28.16	8.28					
Unit Shear(#/LF)	53.15451	207.5462	339.0185	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-4"					
Area Ab(sq.ft.)	1674	1674	1674					
shear ratio r=	0.041227	0.160976	0.262948	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	-9.856762	-1.03663	0.140985	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	32.83	3.61	3.721					
Panel Height(FT)	10	10	10					
(M)from upper level	-13955	2852	5270					
OTM(#')	3495.627	10344.42	17884.88	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	32.83	3.61	3.72					
Panel Wt.(#/LF)	135	135	135					
Wt. on Panel(#/LF)	100	100	100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-75985.53	-918.763	-975.607	0	0	0	0	0
Resultant(#')	-72489.9	9425.653	17187.99	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	-2208.038	2610.984	4620.428	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	n/a	cmstc16	cmstc16					
Restraint		strap	strap					

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Seismic Loading Only

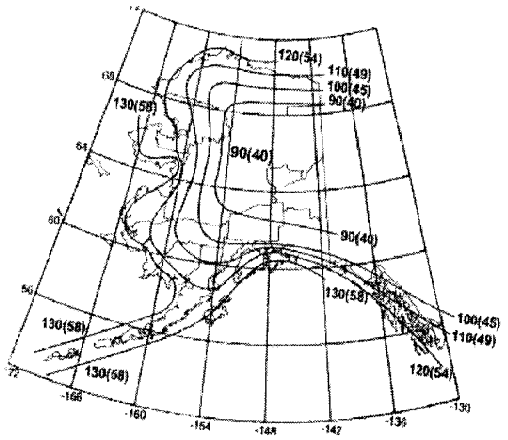
House

Level:	Main Floor Diaphragm
Direction:	Rear - Front
Vseismic @ Level=	2842
Vseismic total=	15735
Vseismic with redundancy=	
Total Load to be resolved (#)=	14794

Grid	A	C	D					
Span(FT.)	24.17	21.39						
Wind load(#/LF)								
Seismic load(#/LF)	62.37928	62.37928	62.37928	62.37928	62.37928	62.37928	0	0
Load#1(LB)	3301	5844	2807					
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	3301	5844	2807	0	0	0	0	0
P(seismic+L1,L2,L3)=	4054.854	7265	3474.146	0	0	0	0	0
Wall Length(FT.)	Conc. Fnd.	Conc. Fnd.	31.44					
Unit Shear(#/LF)	Wall	Wall	110.5008	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type			P1-6"					
Area Ab(sq.ft.)								
shear ratio r=	#VALUE!	#VALUE!	0.070226	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)			8.61					
Panel Height(FT)			9					
(M)from upper level			10476					
OTM(#')	#VALUE!	#VALUE!	19038.71	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)			8.61					
Panel Wt.(#/LF)			135					
Wt. on Panel(#/LF)			100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	0	0	-5226.31	0	0	0	0	0
Resultant(#')	#VALUE!	#VALUE!	14096.01	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	#VALUE!	#VALUE!	1637.167	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'			hdu5 w/					
Restraint			4x post					

Figure 3-1 Basic Wind Speeds, q_s

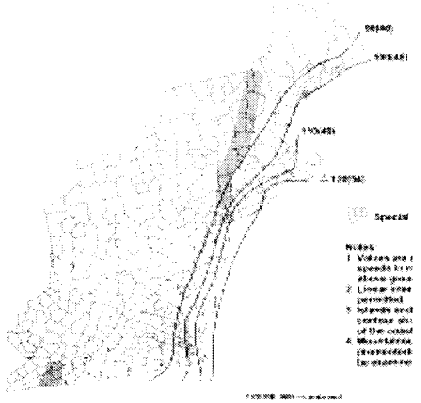
(These notes and excerpts of maps are reprinted with permission by the International Code Council. See IBC Figure 1609 for larger scale maps)



Basic Wind Speeds Are Typically 90 mph, Three Second Gust Wind Speed Everywhere, **Except**:

California, Oregon & Washington	85 mph
Alaska	90 – 130 mph
Hurricane Coastal Areas	90 – 150 mph
Hawaii	105 mph
American Samoa	125 mph
Puerto Rico & Virgin Islands	145 mph
Guam	170 mph

Special Wind Regions in map Shaded Areas



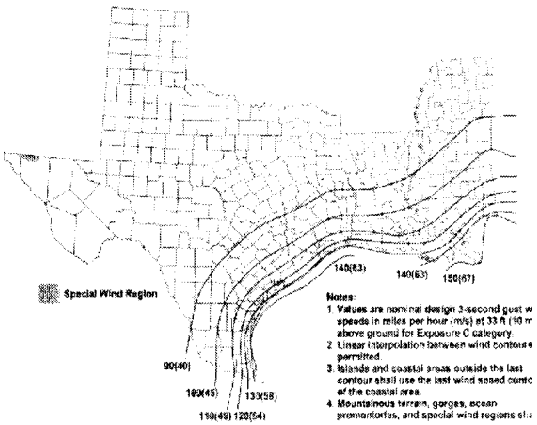
ALASKA

Wind Velocity Pressure (q_s) at Standard Height of 33 Feet

NORTHEAST COAST

Basic Wind Speed , V (mph)	85	90	100	105	110	120	125	130	140	150	160	170
Pressure q_s (psf)	18.5	20.7	25.6	28.2	31.0	36.9	40.0	43.3	50.2	57.6	65.5	74.0

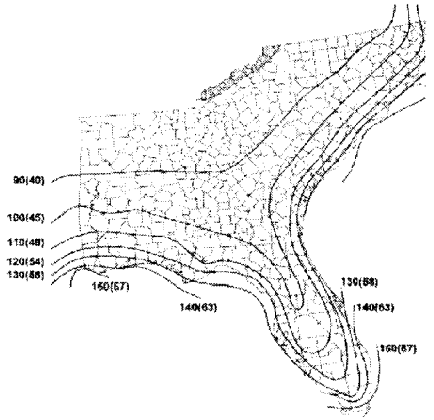
For Wind Speeds, V, not shown, use $q_s = 0.00256\ V^2$



GULF COAST

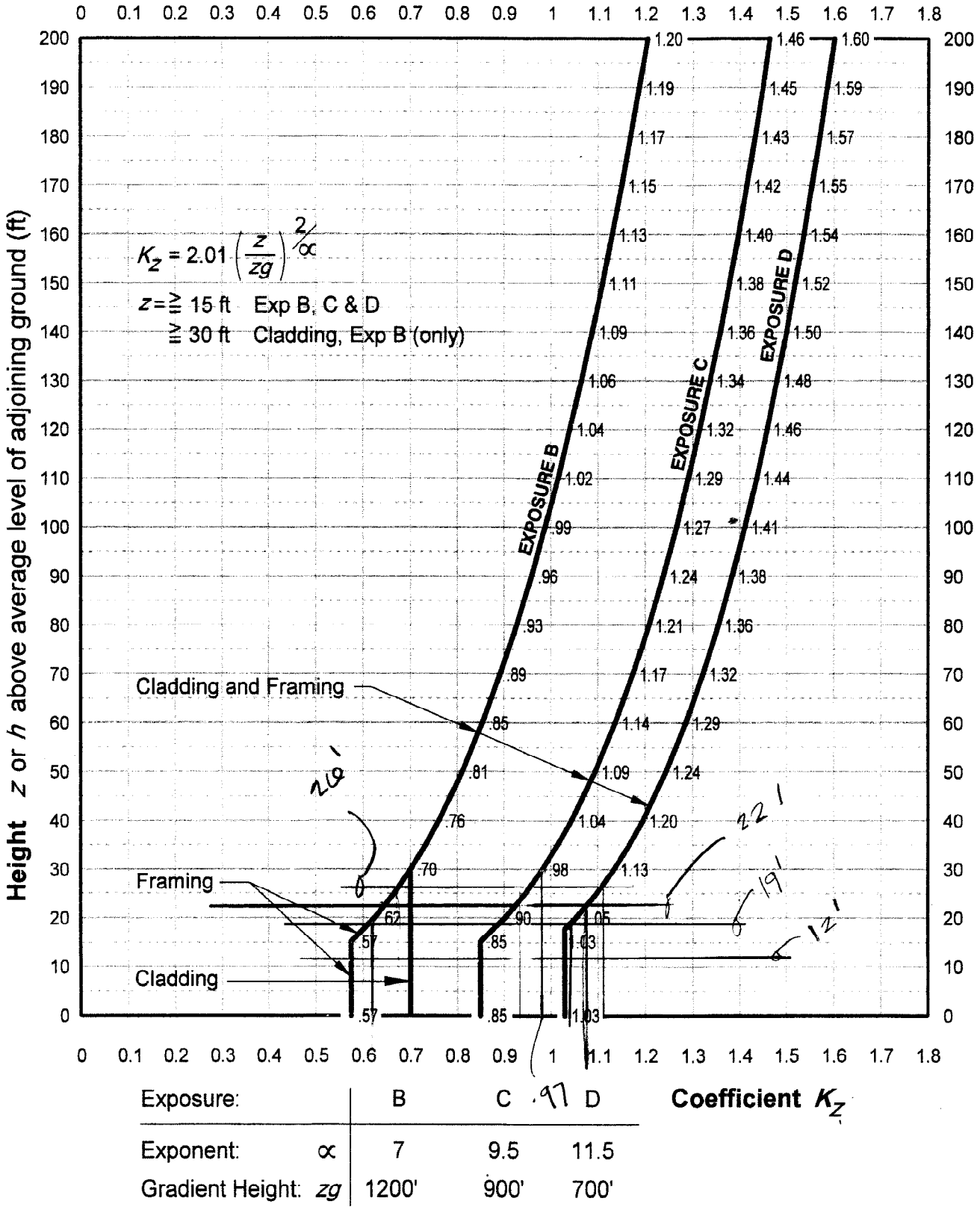
Notes:

1. Values are nominal design 3-second gust wind speeds in miles per hour (m/s) at 33 ft (10 m) above ground for Exposure C category.
2. Linear interpolation between wind contours is permitted.
3. Islands and coastal areas outside the last contour shall use the last wind speed contour of the coastal area.
4. Mountainous terrain, gorges, ocean promontories, and special wind regions shall be examined for unusual wind conditions.



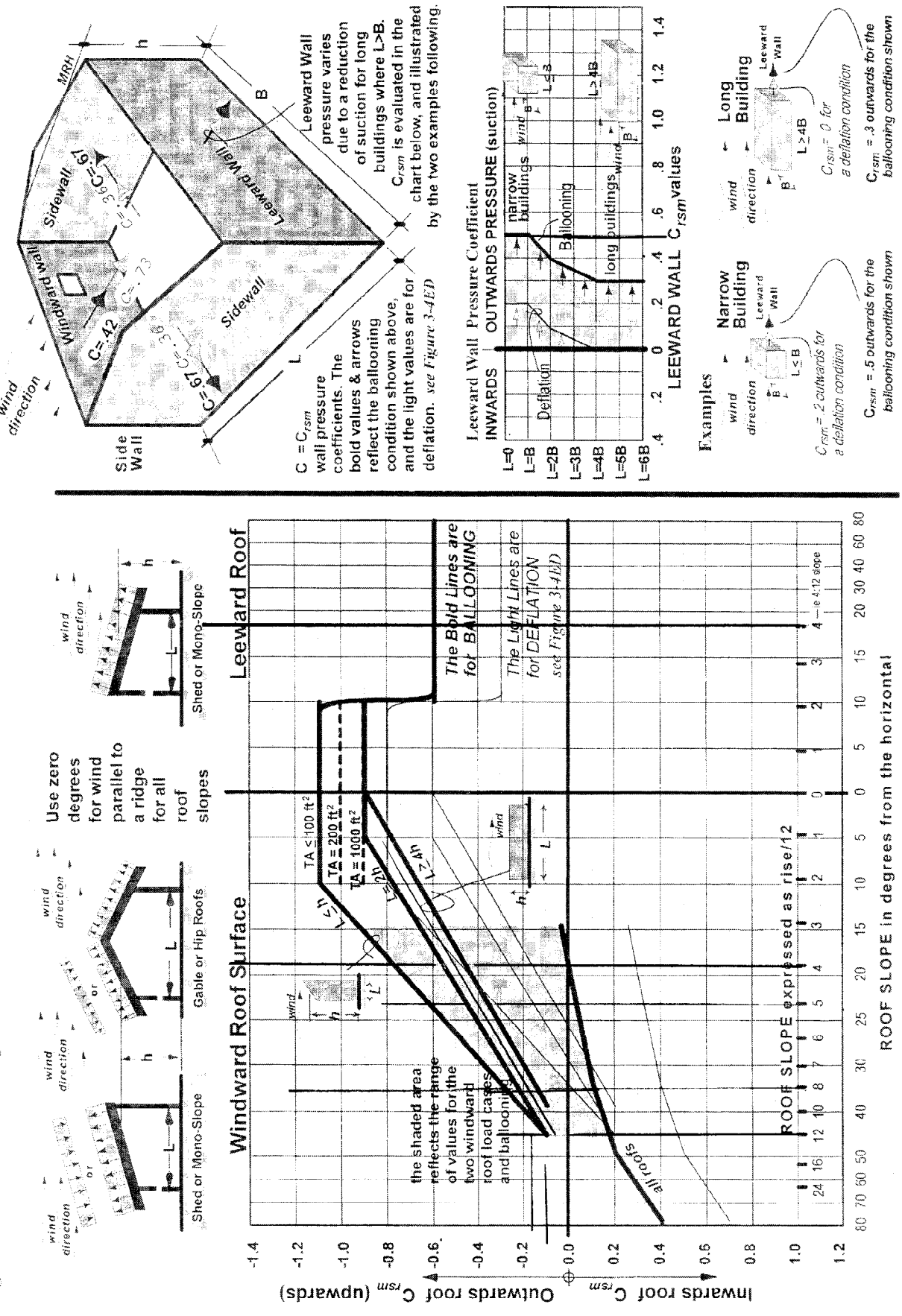
SOUTHEAST COAST

Figure 3-2 Velocity Exposure Coefficient K_z



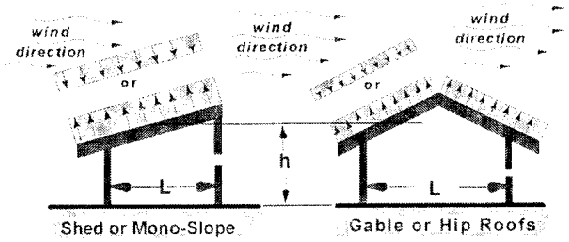
Exposure:		B	C	D
Exponent:	α	7	9.5	11.5
Gradient Height:	zg	1200'	900'	700'

Figure 3-4EB SEAW *Rapid Solution Method*® Pressure Coefficients for LFRS of ENCLOSED BUILDINGS with BALLOONING

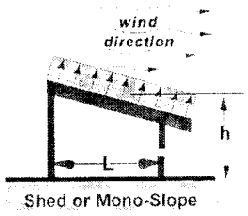


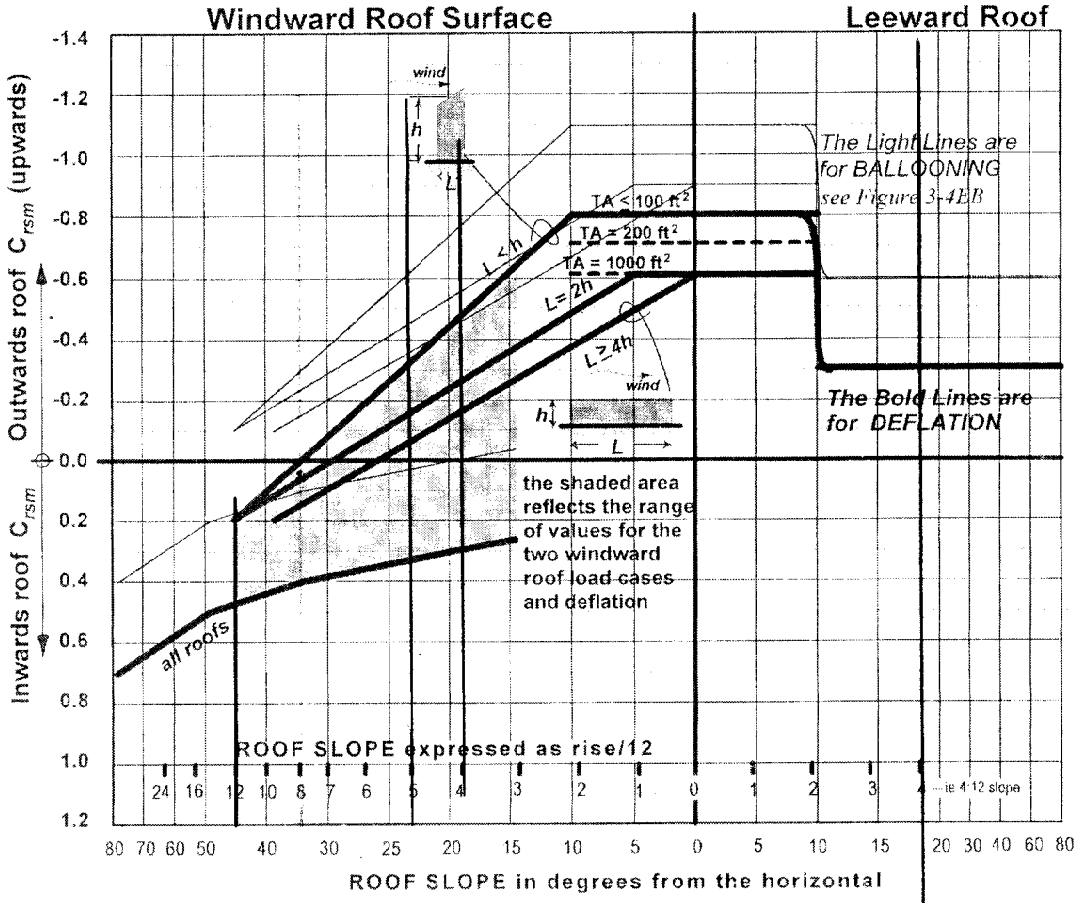
For roof pressure coefficient in the shaded area, where both are inward and outward, C_{rsm} are indicated, both values should be used for assessing load effects

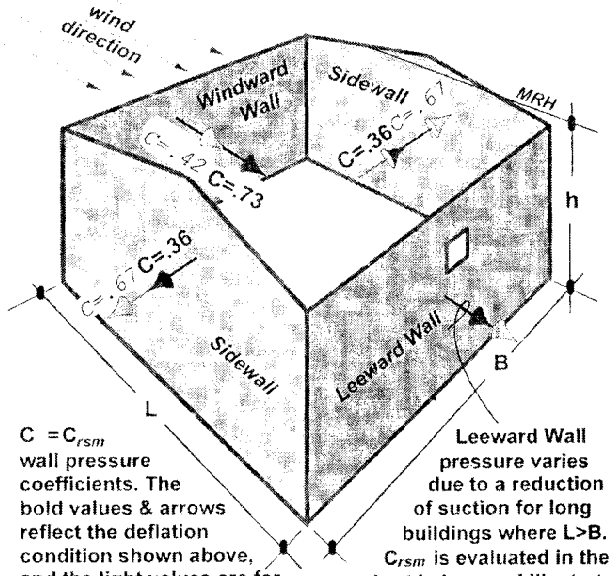
Figure 3-4ED SEAW *Rapid Solution Method*© Pressure Coefficients for LFRS of ENCLOSED BUILDINGS with DEFLATION



Use zero degrees for wind parallel to a ridge for all roof slopes

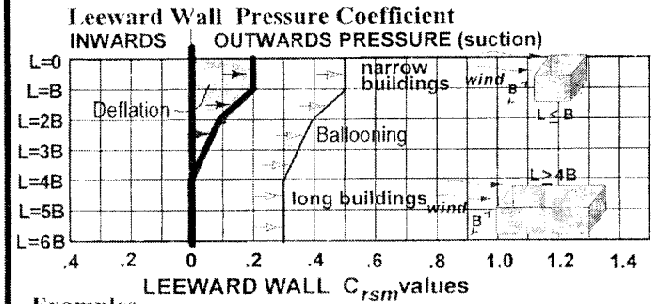




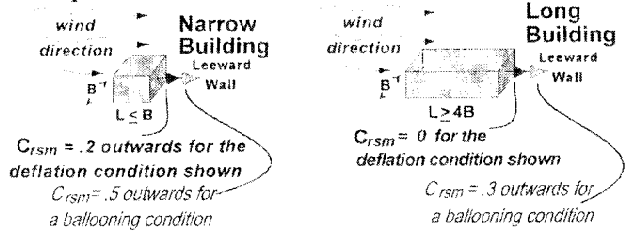


C = C_{rsm} wall pressure coefficients. The bold values & arrows reflect the deflation condition shown above, and the light values are for ballooning. *see Figure 3-4EB*

Leeward Wall pressure varies due to a reduction of suction for long buildings where L>B. C_{rsm} is evaluated in the chart below, and illustrated by the two examples following.



Examples



For roof pressure coefficient in the shaded area, where both are inward and outward, C_{rsm} are indicated, both values should be used for assessing load effects

Factored Wind Pressures P_{rsm} =

Ballooning Case

	h	q_s	K_{zt}	C_{rsm}	I_w	K_t		**P_{rsm}**
Windward Wall =	0'-10'		20.7	1.67	0.42	1	1	14.51898
Leeward Wall	0'-10'		20.7	1.67	-0.5	1	1	-17.2845
Side Wall			20.7	1.67	0.67	1	1	23.16123
Windward Roof			20.7	1.67	-0.67	1	1	-23.1612
Windward Roof Overhang			20.7	1.67	-1.3	1	1	-44.9397
Leeward Roof			20.7	1.67	-1.1	1	1	-38.0259

Deflating Case

Windward Wall =	0'-10'		20.7	1.67	0.73	1	1	25.23537
Leeward Wall	0'-10'		20.7	1.67	-0.2	1	1	-6.9138
Side Wall			20.7	1.67	-0.36	1	1	-12.4448
Windward Roof			20.7	1.67	-0.28	1	1	-9.67932
Windward Roof Overhang			20.7	1.67	-0.86	1	1	-29.7293
Leeward Roof			20.7	1.67	-0.8	1	1	-27.6552

STEPHEN TAPP
ARCHITECT/P.E.
2330 East Madison Street
SEATTLE, WA 98112
(206) 320-0534

Petrie Residence

JOB

SHEET NO. OF

CALCULATED BY STT DATE 2/18/20

CHECKED BY DATE

SCALE

Load	P_{RSM}	Height	Trib Area	V_W
P_1	14.5 psf	12.2'	42.5'	7518#
P_2	14.5 psf	9.3'	66.6'	8900#
P_3	14.5 psf	6.4'	42.2'	3916#
P_4	17.2 psf	6.4'	42.2'	4645#
P_5	17.2 psf	9.3'	66.6'	10653#
TOTAL =				35,632#

STEPHEN TAPP
ARCHITECT/P.E.
2330 East Madison Street
SEATTLE, WA 98112
(206) 320-0534

JOB Petrie Residence

SHEET NO. _____ OF _____

CALCULATED BY STT DATE 2/18/20

CHECKED BY _____ DATE _____

SCALE _____

Load	P_{RSM}	Height	Trib Area	V_W
P_1	14.5 psf	9.3'	45.5'	6136#
P_2	14.5 psf	6.4'	45.5'	4222#
P_3	17.2 psf	6.4'	45.5'	5009#
P_4	17.2 psf	9.3'	45.5'	7278#
P_5	17.2 psf	12.2'	45.5'	9548
TOTAL =				32,193#

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Upper Roof Diaphragm
Direction:	Side - Side
Vseismic @ Level=	
Vseismic total=	
Vseismic with redundancy=	
Total Load to be resolved (#)=	8624.7

Grid	2.1	2.7	5					
Span(FT.)	19.9	21.17						
Wind load(#/LF)	210	210	210					
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)								
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	2089.5	4312.35	2222.85	0	0	0	0	0
P(seismic+L1,L2,L3)=	0	0	0	0	0	0	0	0
Wall Length(FT.)	10.95	20.5	6.22					
Unit Shear(#/LF)	190.8219	210.3585	357.3714	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-4"					
Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	2.78	9.6	3.11					
Panel Height(FT)	7	9	9					
(M)from upper level	0	0	0					
OTM(#')	3713.395	18174.98	10002.83	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	2.78	9.6	3.11					
Panel Wt.(#/LF)	135	135	135					
Wt. on Panel(#/LF)	100	100	100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-544.8522	-6497.28	-681.883	0	0	0	0	0
Resultant(#')	3168.542	11677.7	9599.052	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	1139.763	1216.427	3086.512	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	cmstc16	cmstc16	cmstc16					
Restraint	strap	strap	strap					

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Upper Fl'r/Main Roof Diaphragm
Direction:	Side - Side
Vseismic @ Level=	
Vseismic total=	
Vseismic with redundancy=	
Total Load to be resolved (#)=	28054.2

Grid	1,2	3	4	6				
Span(FT.)	38	7.17	24.22					
Wind load(#/LF)	280	280	280	280				
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)	2090	4312	2223					
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	7410	10635.8	6617.6	3390.8	0	0	0	0
P(seismic+L1,L2,L3)=	2090	4312	2223	0	0	0	0	0
Wall Length(FT.)	18.4	22.51	10.89	6				
Unit Shear(#/LF)	402.7174	472.4922	607.6768	565.1333	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-4"	P1-3"	P1-2"	P1-2"				
Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	4.39	4.39	10.89	3				
Panel Height(FT)	9	9	9	7				
(M)from upper level	2977	4862	19198	0				
OTM(#')	18888.36	23530.17	78756.4	11867.8	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	4.39	4.39	10.89	7				
Panel Wt.(#/LF)	135	135	135	135				
Wt. on Panel(#/LF)	100	100	100	100				
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-1358.683	-1358.68	-8360.74	-3454.5	0	0	0	0
Resultant(#')	17529.68	22171.48	70681.55	8413.3	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	3993.094	5050.452	6490.5	1201.9	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	cmstc16	cmst14	hdu8 w/	hdu5 w/				
Restraint	strap	strap	4x post	4x post				

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Main Floor Diaphragm							
Direction:	Side - Side							
Vseismic @ Level=								
Vseismic total=								
Vseismic with redundancy=								
Total Load to be resolved (#)=		25559.71						
Grid	1.5	3						
Span(FT.)	35.61							
Wind load(#/LF)	211	211						
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)	7410	10636						
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	11166.86	14392.86	0	0	0	0	0	0
P(seismic+L1,L2,L3)=	7410	10636	0	0	0	0	0	0
Wall Length(FT.)	22.11	45						
Unit Shear(#/LF)	505.059	319.8412	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-3"/ Fnd.Wall	Conc.Ret. Wall						
Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	3.94							
Panel Height(FT)	9							
(M)from upper level	10868							
OTM(#')	28777.39	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	3.94							
Panel Wt.(#/LF)	135							
Wt. on Panel(#/LF)	100							
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-1094.414	0	0	0	0	0	0	0
Resultant(#')	27682.98	0	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	7026.137	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson' Restraint	hdu8 w/ 6x post							

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Upper Roof Diaphragm
Direction:	Rear - Front
Vseismic @ Level=	
Vseismic total=	
Vseismic with redundancy=	
Total Load to be resolved (#)=	9735.2

Grid	A	B	C	C.8,D				
Span(FT.)	14	10	21.28					
Wind load(#/LF)	215	215	215	215				
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)								
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	1505	2580	3362.6	2287.6	0	0	0	0
P(seismic+L1,L2,L3)=	0	0	0	0	0	0	0	0
Wall Length(FT.)	41	12.11	9.4	10.28				
Unit Shear(#/LF)	36.70732	213.0471	357.7234	222.5292	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-6"	P1-4"	P1-6"				
Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	13.5	3.83	9.4	10.28				
Panel Height(FT)	9	5	9	9				
(M)from upper level	0	0	0	0				
OTM(#')	4459.939	4079.851	30263.4	20588.4	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	13.5	3.83	9.4	10.28				
Panel Wt.(#/LF)	135	135	135	135				
Wt. on Panel(#/LF)	100	100	100	100				
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-12848.63	-1034.16	-6229.38	-7450.33	0	0	0	0
Resultant(#')	-8388.686	3045.694	24318.42	13138.07	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	-621.3841	795.2203	2587.066	1278.023	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	n/a	cmstc16	cmstc16	cmstc16				
Restraint		strap	strap	strap				

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Upper Fl'r/Main Roof Diaphragm
Direction:	Rear - Front
Vseismic @ Level=	
Vseismic total=	
Vseismic with redundancy=	
Total Load to be resolved (#)=	23311.88

Grid	A	C	D					
Span(FT.)	24.17	21.39						
Wind load(#/LF)	298	298	298					
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)	1505	1290	2288					
Load#2(LB)	1290	3362						
Load#3(LB)								
P(wind+L1,L2,L3)=	6396.33	11440.44	5475.11	0	0	0	0	0
P(seismic+L1,L2,L3)=	2795	4652	2288	0	0	0	0	0
Wall Length(FT.)	62.11	28.16	8.28					
Unit Shear(#/LF)	102.9839	406.2656	661.2452	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type	P1-6"	P1-4"	P1-2"					
Area Ab(sq.ft.)								
shear ratio r=	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)	32.83	3.61	3.72					
Panel Height(FT)	10	10	10					
(M)from upper level	-13489	1234	5902					
OTM(#')	20320.61	15900.19	30500.32	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)	32.83	3.61	3.72					
Panel Wt.(#/LF)	135	135	135					
Wt. on Panel(#/LF)	100	100	100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	-75985.53	-918.763	-975.607	0	0	0	0	0
Resultant(#')	-55664.91	14981.43	29803.43	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	-1695.55	4149.98	8011.676	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson'	n/a	cmstc16	cmst12					
Restraint		strap	strap					

Shear Wall Analysis

Job :	Petrie Residence
Architect:	Leif Anderson
Job #:	T20B3
Date:	Feb-20

Wind Loading Only

House

Level:	Main Floor Diaphragm							
Direction:	Rear - Front							
Vseismic @ Level=								
Vseismic total=								
Vseismic with redundancy=								
Total Load to be resolved (#)=			33562					
Grid	A	C	D					
Span(FT.)	24.17	21.39						
Wind load(#/LF)	225	225	225					
Seismic load(#/LF)	0	0	0	0	0	0	0	0
Load#1(LB)	6396	11440	5475					
Load#2(LB)								
Load#3(LB)								
P(wind+L1,L2,L3)=	9115.125	16565.5	7881.375	0	0	0	0	0
P(seismic+L1,L2,L3)=	6396	11440	5475	0	0	0	0	0
Wall Length(FT.)	Conc.Fnd	Conc. Fnd.	31.44					
Unit Shear(#/LF)	Wall	Wall	250.6799	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Wall Type			P1-6"					
Area Ab(sq.ft.)								
shear ratio r=	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Redundancy factor	#VALUE!	#VALUE!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Section Length(FT)			8.61					
Panel Height(FT)			9					
(M)from upper level			18166					
OTM(#')	#VALUE!	#VALUE!	37591.18	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Panel Length(LF)			8.61					
Panel Wt.(#/LF)			135					
Wt. on Panel(#/LF)			100					
Reduction(%)	40	40	40	40	40	40	40	40
RM(#')	0	0	-5226.31	0	0	0	0	0
Resultant(#')	#VALUE!	#VALUE!	32648.48	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Uplift @ Panel	#VALUE!	#VALUE!	3791.926	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!	#DIV/0!
Edge(#)								
Simpson' Restraint			hdu5 w/ 4x post					

STEPHEN TAPP
ARCHITECT/P.E.
2330 East Madison Street
SEATTLE, WA 98112
(206) 320-0534

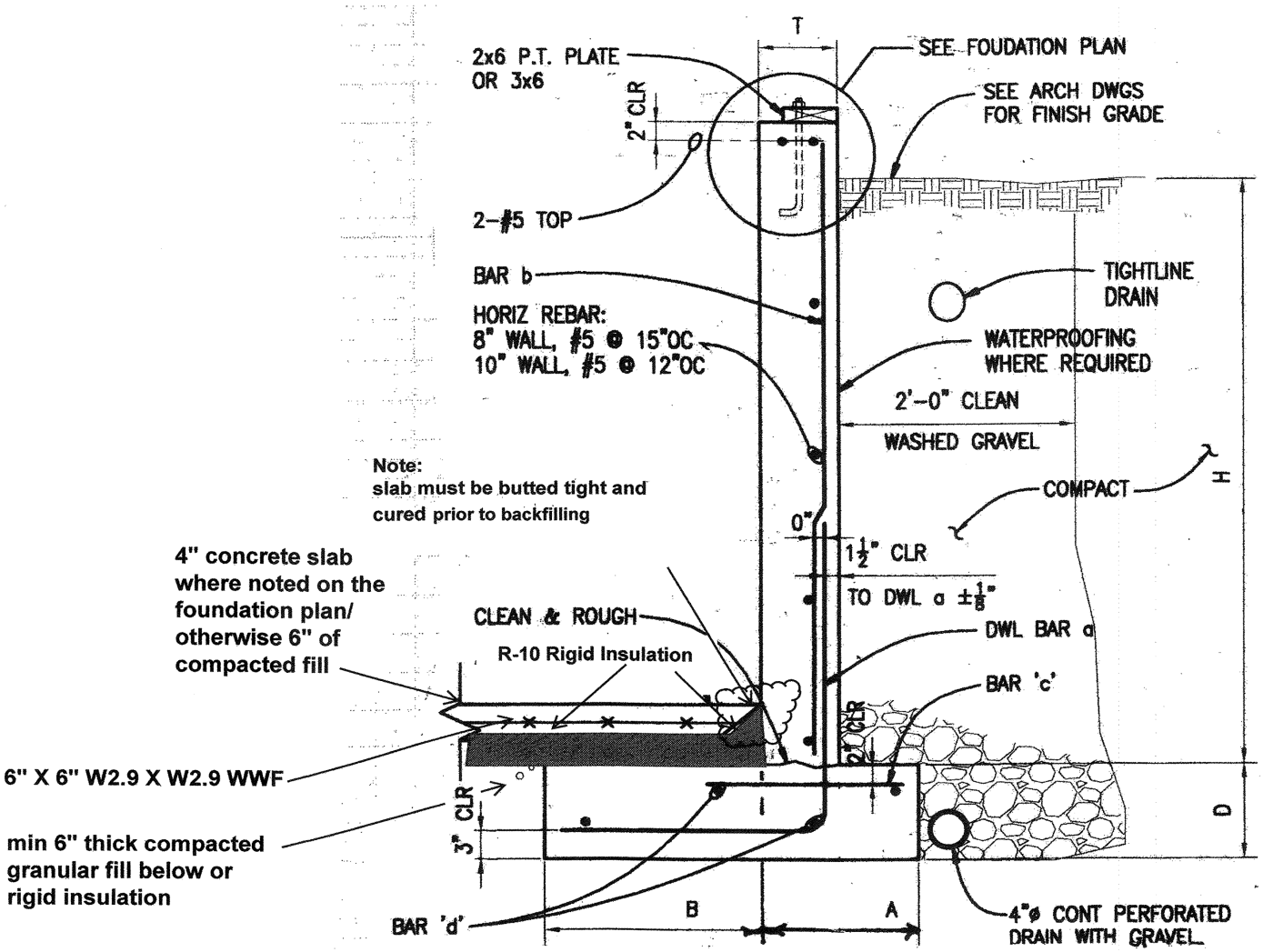
JOB Retaining Wall Typical Section

SHEET NO. _____ OF _____

CALCULATED BY STT DATE 5/5/20

CHECKED BY _____ DATE _____

SCALE _____



Concrete Retaining Wall Section

NTS

STEPHEN TAPP
ARCHITECT/P.E.
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SEATTLE, WA 98112
(206) 320-0534

JOB Retaining Wall Schedule

SHEET NO. _____ OF _____

CALCULATED BY STT DATE 5/4/20

CHECKED BY _____ DATE _____

SCALE _____

Retaining Wall Schedule

T	H	DOWEL'a'	BAR 'b'	BAR 'c'	BAR 'd'	L	D	A	B
8"	4'-0"	#5 $L_{FULL\ HT.}$ @ 16" o.c.	--------	#5 @16" o.c.	#5(T/B) @18" o.c.	3'-3"	12"	1'-3"	2'-0"
8"	6'-0"	#5 $L_{FULL\ HT.}$ @ 12" o.c.	--------	#5 @16" o.c.	#5(T/B) @ 18" o.c.	3'-0"	14"	2'-0"	1'-0"
8"	8'-0"	#5 $L_{2'-10"}$ @6" o.c.	#5 @12" o.c.	#5 @16" o.c.	#5(T/B) @18"o.c.	4'-0"	14"	2-6"	1'-6"
8"	10'-0"	#5$L_{4'-3"}$ @6"o.c.	#5 @12"o.c.	#5 @16" o.c.	#5(T/B) @18" o.c.	4'-3"	14"	2'-0"	2'-3"

STEPHEN TAPP
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JOB Retaining Wall Notes

SHEET NO. _____ OF _____

CALCULATED BY STT DATE 5/4/20

CHECKED BY _____ DATE _____

SCALE _____

Unbraced Retaining Wall Notes

1. **CONCRETE STRENGTH f'c = 2500 psi (If not exposed to weather)**
   3000 psi (if exposed to weather/no special inspection)
2. **REINFORCING TO BE GRADE 60.**
3. **ALL FOOTINGS TO BEAR ON FIRM UNDISTURBED SOIL.**
4. **PROVIDE CORNER BARS TO MATCH HORIZONTAL REINFORCING BARS AT ALL INSIDE AND OUTSIDE CORNERS.**
5. **BACKFILL WALL TO ALLOW FOR DEFLECTION BEFORE ATTACHING HORIZONTAL FLOOR DIAPHRAGM.**
6. **ALLOW SOIL BEAING PRESSURE TO BE 2000 PSF.**
7. **EQUIVALENT FLUID PRESSURE BEHIND WALL TO BE 40 PCF FOR UNBRACED RETAINING WALLS.**
8. **ALLOW 28 DAYS MINIMUM FOR CONCRETE TO CURE BEFORE APPLYING LOADS.**
9. **FRICTION COEFFICIENT TO BE .35.**
10. **SOIL DENSITY TO BE 120 PCF.**
11. **CONTACT ENGINEER OF RECORD FOR ANY MODIFICATIONS OR REVISIONS TO THE ORIGINAL DESIGN.**

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Page : 1
Date: 4 MAY 2020

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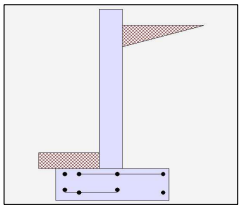
Cantilevered Retaining Wall

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



Criteria

Retained Height	=	4.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

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

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,500.0 psf	Soil Density, Heel	=	120.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	120.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	200.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	250.0 lbs	Axial Load Eccentricity	=	0.0 in
Axial Live Load	=	250.0 lbs			

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

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

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

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Cantilevered Retaining Wall

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

Wall Design Summary

Stability Ratios

Overturning	=	4.29	OK
Sliding	=	1.73	OK

Soil Bearing

Total Bearing Load	=	2,550 lbs	
...resultant ecc.	=	1.75 in	
Soil Pressure @ Toe	=	513 psf	OK
Soil Pressure @ Heel	=	892 psf	OK
Allowable	=	2,500 psf	
Soil Pressure Less Than Allowable			
ACI Factored @ Toe	=	718 psf	
ACI Factored @ Heel	=	1,248 psf	
Footing Shear @ Toe	=	2.6 psi	OK
Footing Shear @ Heel	=	0.1 psi	OK
Allowable	=	75.0 psi	

Sliding

Resisting Forces

Vertical Forces	Force	
Soil Over Heel (above water table, if any)	720.0	lbs
Soil Over Heel (below water table, if any)	0.0	
Water Over Heel	0.0	
Buoyant Force	0.0	
Sloped Soil Over Heel	0.0	
Surcharge Over Heel	0.0	
Adjacent Footing Load	0.0	
Axial Dead Load on Stem	500.0	
Axial Live Load on Stem *	Omit	
Soil Over Toe	75.0	
Surcharge Over Toe	0.0	
Stem Weight(s)	500.0	
Earth @ Stem Transitions	0.0	
Footing Weight	487.5	
Key Weight	0.0	
Vert. Component **	267.4	
Total Vertical Loads	2,299.9	lbs

Sliding Forces

Lateral Forces	Force	
Heel Active Pressure (above water table, if any)	605.0	lbs
Heel Active Pressure (below water table, if any)	0.0	
Hydrostatic Force	0.0	
* Heel Active Pressure	605.0	
Surcharge over Heel	0.0	
Adjacent Footing	0.0	
Surcharge Over Toe	0.0	
Load @ Stem Above Soil	0.0	
Added Lateral Load	0.0	
Seismic Load	0.0	
Seismic-Self-weight	0.0	
Lateral on Key	0.0	
Totals =	605.0	lbs

*Includes water table effect

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

Sliding Calcs

Lateral Sliding Force	=		605.0 lbs	
less 100% Passive Force	=	-	125.0 lbs	
less 100% Friction Force	=	-	920.0 lbs	
Added Force Req'd	=		0.0 lbs	OK
....for 1.5 Stability	=		0.0 lbs	OK

Vertical component of active lateral soil pressure IS considered in the calculation of soil bearing pressures.

This Wall in File:

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment
Soil Over Heel (above water table, if any)	720.0	lbs	2.58	ft	1,860.0 ft-#
Soil Over Heel (below water table, if any)	0.0				
Water Table	0.0				
Soil Over Heel	720.0		2.58		1,860.0
Sloped Soil Over Heel	0.0				
Surcharge Over Heel	0.0				
Adjacent Footing Load	0.0				
Axial Dead Load on Stem	500.0		1.58		395.8
Axial Live Load on Stem *	250.0		1.58		395.8
Soil Over Toe	75.0		0.63		46.9
Surcharge Over Toe	0.0				
Stem Weight(s)	500.0		1.58		791.7
Earth @ Stem Transitions	0.0				
Footing Weight	487.5		1.63		792.2
Key Weight	0.0				
Vert. Component	267.4		3.25		869.0
Total Vertical Loads	2,299.9	lbs			
Resisting Moment					**4,755.6** ft-#
Eccentricity					**-0.5** in

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

Overturning

Overturning Moments

Overturning Moments	Force		Distance		Moment
Heel Active Pressure (above water table, if any)	605.0	lbs	1.83	ft	1,109.2 ft-#
Heel Active Pressure (below water table, if any)	0.0				
Hydrostatic Force	0.0				
Buoyant Force	0.0				
Surcharge over Heel	0.0				
Adjacent Footing	0.0				
Surcharge Over Toe	0.0				
Load @ Stem Above Soil	0.0				
Added Lateral Load	0.0				
Seismic Load	0.0				
Seismic-Self-weight	0.0				
Totals =	605.0	lbs			
Overturning Moment					1,109.2 ft-#

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Stem Design Summary

			Bottom	
			Stem OK	
Design Height Above Ftg	ft	=	0.00	
Wall Material Above "Ht"		=	Concrete	
Design Method		=	LRFD	LRFD
Thickness		=	8.00	
Rebar Size		=	# 5	
Rebar Spacing		=	12.00	
Rebar Placed at		=	Edge	
Design Data				
fb/FB + fa/Fa		=	**0.119**	
Total Force @ Section				
Service Level	lbs	=		
Strength Level	lbs	=	648.0	
Moment....Actual				
Service Level	ft-#	=		
Strength Level	ft-#	=	972.0	
Moment.....Allowable		=	8,121.3	
Shear.....Actual				
Service Level	psi	=		
Strength Level	psi	=	8.7	
Shear.....Allowable	psi	=	75.0	
Anet	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 Weight	
Masonry Design Method		=	ASD	
Concrete Data				
f'c	psi	=	2,500.0	
Fy	psi	=	60,000.0	

Petrie Residence
2431 60th Avenue SE
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Project Name/Number :
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Description....

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Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.0368 in2/ft		
(4/3) * As :	0.0491 in2/ft	Min Stem T&S Reinf Area 0.960 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 :	0.1728 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	=	1.25 ft	f'c	=	2,500	psi
Heel Width	=	2.00	Fy	=	60,000	psi
Total Footing Width	=	3.25 ft	Footing Concrete Density	=	150.00	pcf
Footing Thickness	=	12.00 in	Min. As %	=	0.0018	
Key Width	=	0.00 in	Rebar Cover @ Top	=	2.00	in
Key Depth	=	0.00 in	@ Bottom	=	3.00	in
Key Distance from Toe	=	0.00 ft				

Footing Design Results

		Toe	Heel	
Factored Pressure	=	718	1,248	psf
Mu' : Upward	=	7,371	1,037	ft-#
Mu' : Downward	=	2,363	1,306	ft-#
Mu: Design	=	417	-432	ft-#
Actual 1-Way Shear	=	2.58	0.11	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing	=	# 7 @ 16.00 in
Heel Reinforcing	=	# 6 @ 16.00 in
Key Reinforcing	=	None Spec'd

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	0.84	in2
Min footing T&S reinf Area per fo	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

Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

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)	0.034	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.

Petrie Residence
2431 60th Avenue SE
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Cantilevered Retaining Wall

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

Rebar Lap & Embedment Lengths Information

(Applying TMS 402 provisions) or (Applying IBC modifications to TMS 402 provisions)

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	10.50 in
As Provided =	0.3100 in2/ft
As Required =	0.1728 in2/ft

Petrie Residence
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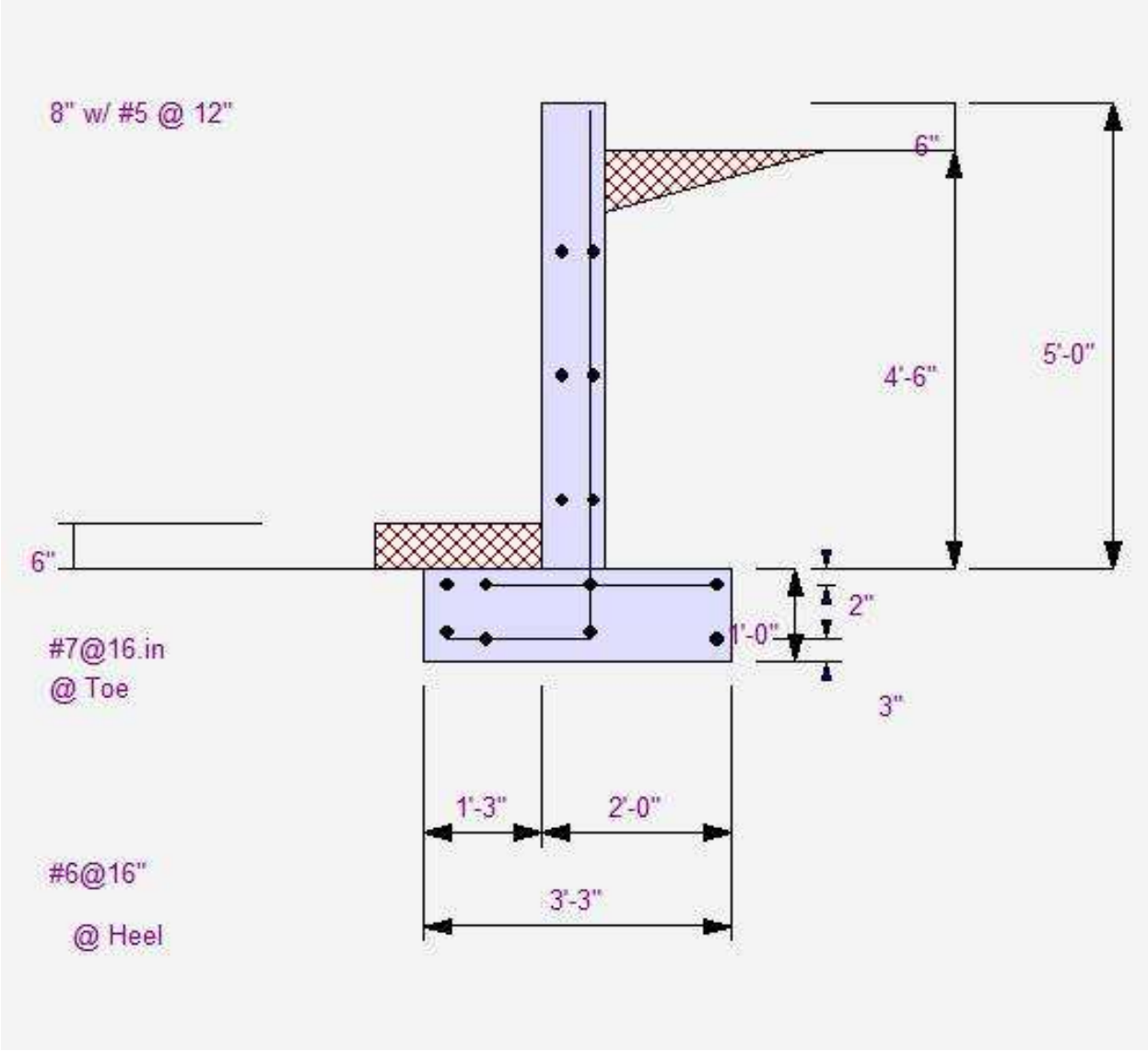

Petrie Residence
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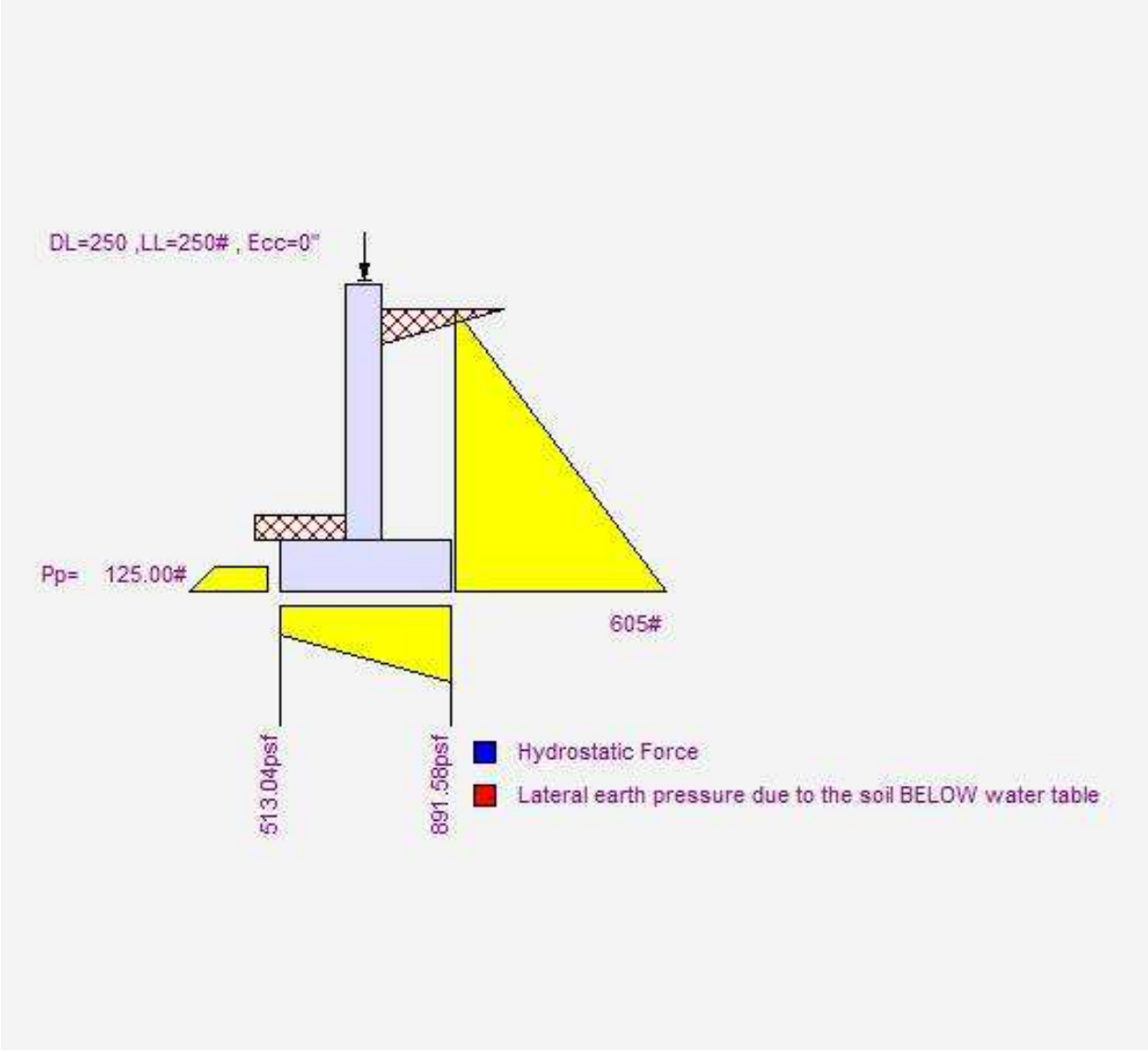

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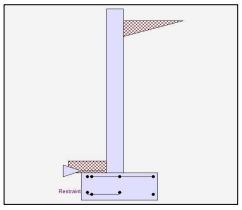
Cantilevered Retaining Wall

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

Criteria



Retained Height	=	6.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

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

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,000.0 psf	Soil Density, Heel	=	120.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	120.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	200.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	250.0 lbs	Axial Load Eccentricity	=	0.0 in
Axial Live Load	=	250.0 lbs			

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

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Wall Design Summary

Stability Ratios

Overturning	=	2.02 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	3,345 lbs
...resultant ecc.	=	3.56 in
Soil Pressure @ Toe	=	1,501 psf OK
Soil Pressure @ Heel	=	382 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,101 psf
ACI Factored @ Heel	=	535 psf
Footing Shear @ Toe	=	1.7 psi OK
Footing Shear @ Heel	=	8.6 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment
Soil Over Heel (above water table, if any)	1,040.0	lbs	2.33	ft	2,426.7ft-#
Soil Over Heel (below water table, if any)	0.0				
Water Table	0.0				
Soil Over Heel	1,040.0		2.33		2,426.7
Sloped Soil Over Heel	0.0				
Surcharge Over Heel	0.0				
Adjacent Footing Load	0.0				
Axial Dead Load on Stem	500.0		1.33		333.3
Axial Live Load on Stem *	250.0		1.33		333.3
Soil Over Toe	60.0		0.50		30.0
Surcharge Over Toe	0.0				
Stem Weight(s)	700.0		1.33		933.3
Earth @ Stem Transitions	0.0				
Footing Weight	525.0		1.50		787.5
Key Weight	0.0				
Vert. Component	519.6		3.00		1,558.7
Total Vertical Loads	3,094.6	lbs			
Resisting Moment					**6,069.5** ft-#
Eccentricity					**-6.1** in

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Overturning

Overturning Moments

Overturning Moments	Force		Distance		Moment	
Heel Active Pressure (above water table, if any)	1,175.6	lbs	2.56	ft	3,004.2	ft-#
Heel Active Pressure (below water table, if any)	0.0					
Hydrostatic Force	0.0					
Buoyant Force	0.0					
Surcharge over Heel	0.0					
Adjacent Footing	0.0					
Surcharge Over Toe	0.0					
Load @ Stem Above Soil	0.0					
Added Lateral Load	0.0					
Seismic Load	0.0					
Seismic-Self-weight	0.0					
Totals =	1,175.6	lbs				
	Overturning Moment				3,004.2	ft-#

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Stem Design Summary

			Bottom	
			Stem OK	
Design Height Above Ftg	ft	=	0.00	
Wall Material Above "Ht"		=	Concrete	
Design Method		=	LRFD	LRFD
Thickness		=	8.00	
Rebar Size		=	# 5	
Rebar Spacing		=	12.00	
Rebar Placed at		=	Edge	
Design Data				
fb/FB + fa/Fa		=	**0.360**	
Total Force @ Section				
Service Level	lbs	=		
Strength Level	lbs	=	1,352.0	
Moment....Actual				
Service Level	ft-#	=		
Strength Level	ft-#	=	2,929.3	
Moment.....Allowable		=	8,121.3	
Shear.....Actual				
Service Level	psi	=		
Strength Level	psi	=	18.2	
Shear.....Allowable	psi	=	75.0	
Anet	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 Weight	
Masonry Design Method		=	ASD	
Concrete Data				
f'c	psi	=	2,500.0	
Fy	psi	=	60,000.0	

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

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Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing
As (based on applied moment) :	0.1109 in2/ft	
(4/3) * As :	0.1479 in2/ft	Min Stem T&S Reinf Area 1.344 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 :	0.1728 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	f'c	=	2,500	psi
Heel Width	=	2.00	Fy	=	60,000	psi
Total Footing Width	=	3.00 ft	Footing Concrete Density	=	150.00	pcf
Footing Thickness	=	14.00 in	Min. As %	=	0.0018	
Key Width	=	0.00 in	Rebar Cover @ Top	=	2.00	in
Key Depth	=	0.00 in	@ Bottom	=	3.00	in
Key Distance from Toe	=	0.00 ft				

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,101	535	psf
Mu' : Upward	=	11,564	682	ft-#
Mu' : Downward	=	1,692	2,127	ft-#
Mu: Design	=	823	-955	ft-#
Actual 1-Way Shear	=	1.75	8.56	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing	=	# 5 @ 12.30 in
Heel Reinforcing	=	# 5 @ 12.30 in
Key Reinforcing	=	None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Key: No key defined

Min footing T&S reinf Area	0.91	in2
Min footing T&S reinf Area per fo	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

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Cantilevered Retaining Wall

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

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)	0.097	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.

Petrie Residence
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Cantilevered Retaining Wall

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

Rebar Lap & Embedment Lengths Information

(Applying TMS 402 provisions) or (Applying IBC modifications to TMS 402 provisions)

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	10.50 in
As Provided =	0.3100 in2/ft
As Required =	0.1728 in2/ft

Petrie Residence
2431 60th Avenue SE
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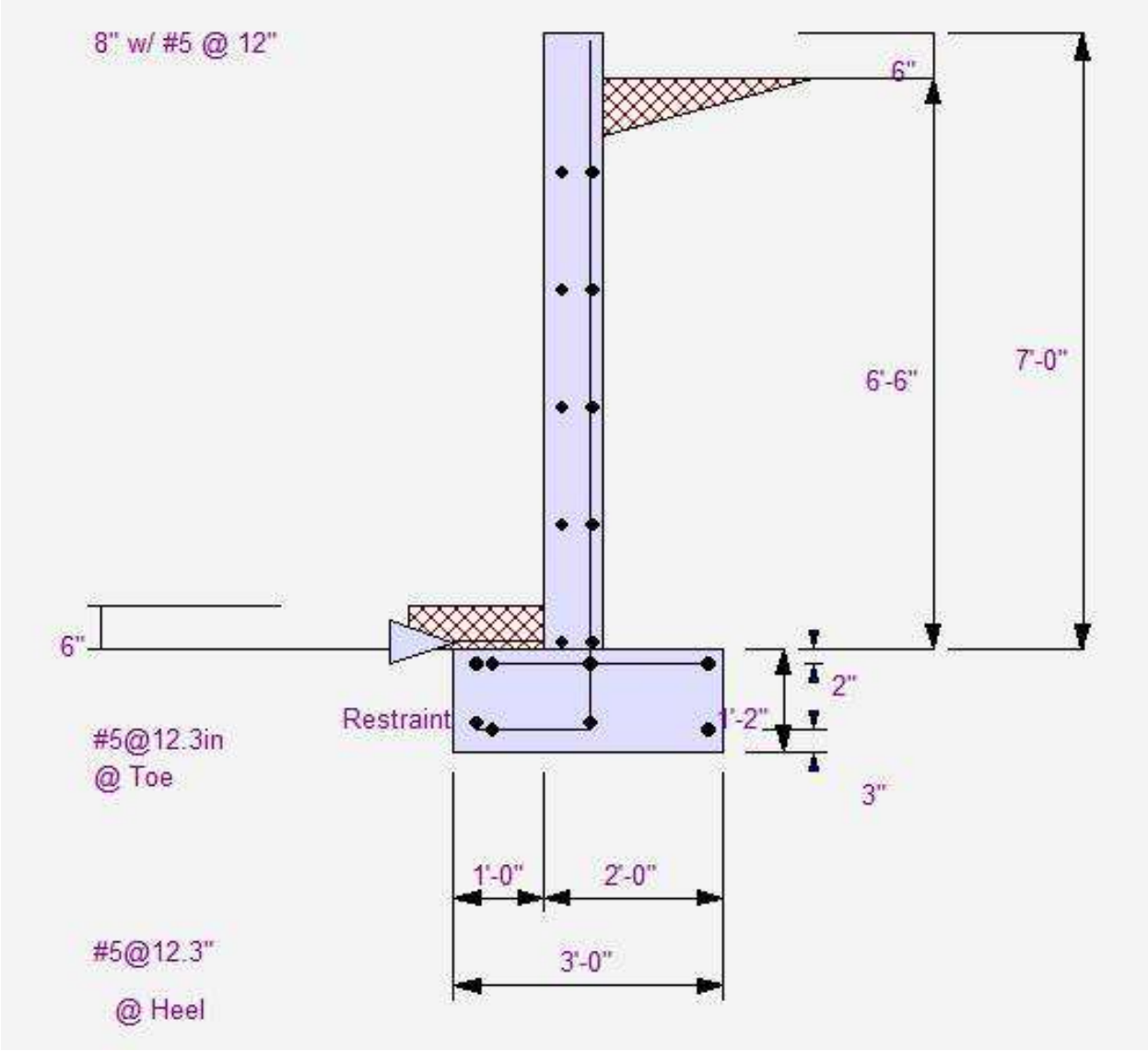
Cantilevered Retaining Wall

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



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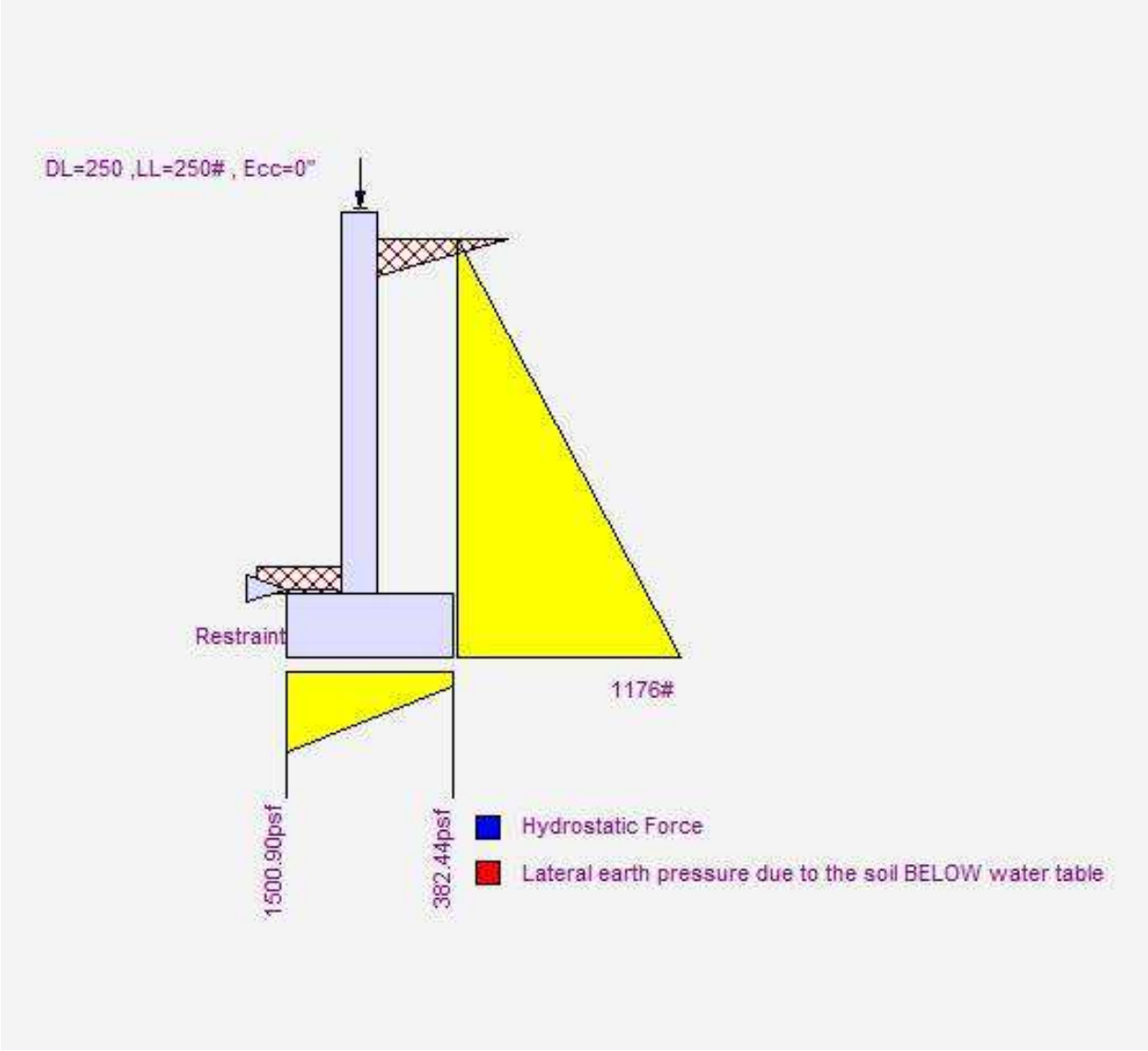
Cantilevered Retaining Wall

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



Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

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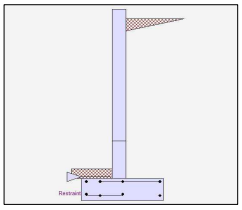
Cantilevered Retaining Wall

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

Criteria



Retained Height	=	8.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

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

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,000.0 psf	Soil Density, Heel	=	120.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	120.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	200.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	350.0 lbs	Axial Load Eccentricity	=	0.0 in
Axial Live Load	=	200.0 lbs			

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

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Wall Design Summary

Stability Ratios

Overturning	=	2.13 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	4,936 lbs
...resultant ecc.	=	3.05 in
Soil Pressure @ Toe	=	1,420 psf OK
Soil Pressure @ Heel	=	635 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	1,988 psf
ACI Factored @ Heel	=	889 psf
Footing Shear @ Toe	=	7.9 psi OK
Footing Shear @ Heel	=	13.5 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment	
Soil Over Heel (above water table, if any)	1,870.0	lbs	3.08	ft	5,765.8	ft-#
Soil Over Heel (below water table, if any)	0.0					
Water Table	0.0					
Soil Over Heel	1,870.0		3.08		5,765.8	
Sloped Soil Over Heel	0.0					
Surcharge Over Heel	0.0					
Adjacent Footing Load	0.0					
Axial Dead Load on Stem	550.0		1.83		641.7	
Axial Live Load on Stem *	200.0		1.83		366.7	
Soil Over Toe	90.0		0.75		67.5	
Surcharge Over Toe	0.0					
Stem Weight(s)	900.0		1.83		1,650.0	
Earth @ Stem Transitions	0.0					
Footing Weight	700.0		2.00		1,400.0	
Key Weight	0.0					
Vert. Component	826.0		4.00		3,304.0	
Total Vertical Loads	4,736.0	lbs				
Resisting Moment					**12,829.0**	ft-#
Eccentricity					**-6.8**	in

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

This Wall in File:

Cantilevered Retaining Wall

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

Overturning

Overturning Moments

Overturning Moments	Force		Distance		Moment
Heel Active Pressure (above water table, if any)	1,868.9	lbs	3.22	ft	6,022.0 ft-#
Heel Active Pressure (below water table, if any)	0.0				
Hydrostatic Force	0.0				
Buoyant Force	0.0				
Surcharge over Heel	0.0				
Adjacent Footing	0.0				
Surcharge Over Toe	0.0				
Load @ Stem Above Soil	0.0				
Added Lateral Load	0.0				
Seismic Load	0.0				
Seismic-Self-weight	0.0				
Totals =	1,868.9	lbs			
	Overturning Moment				6,022.0 ft-#

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
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Cantilevered Retaining Wall

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

Stem Design Summary

			2nd	Bottom
			Stem OK	Stem OK
Design Height Above Ftg	ft	=	2.00	0.00
Wall Material Above "Ht"		=	Concrete	Concrete
Design Method		=	LRFD	LRFD
Thickness		=	8.00	8.00
Rebar Size		=	# 5	# 5
Rebar Spacing		=	12.00	6.00
Rebar Placed at		=	Edge	Edge
Design Data				
fb/FB + fa/Fa		=	**0.360**	**0.430**
Total Force @ Section				
Service Level	lbs	=		
Strength Level	lbs	=	1,352.0	2,312.0
Moment....Actual				
Service Level	ft-#	=		
Strength Level	ft-#	=	2,929.3	6,550.7
Moment.....Allowable	ft-#	=	8,121.3	15,222.0
Shear.....Actual				
Service Level	psi	=		
Strength Level	psi	=	18.2	31.1
Shear.....Allowable	psi	=	75.0	75.0
Anet	in2	=		
Rebar Depth 'd'	in	=	6.19	6.19
Masonry Data				
f'm	psi	=		
Fs	psi	=		
Solid Grouting		=		
Modular Ratio 'n'		=		
Wall Weight	psf	=	100.0	100.0
Short Term Factor		=		
Equiv. Solid Thick.		=		
Masonry Block Type		=	Medium Weight	
Masonry Design Method		=	ASD	
Concrete Data				
f'c	psi	=	2,500.0	2,500.0
Fy	psi	=	60,000.0	60,000.0

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1109 in2/ft		
(4/3) * As :	0.1479 in2/ft	Min Stem T&S Reinf Area 1.344 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 :	0.1728 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

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.248 in2/ft		
(4/3) * As :	0.3307 in2/ft	Min Stem T&S Reinf Area 0.384 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 :	0.248 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.62 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	=	1.50	ft	f'c	=	2,500	psi
Heel Width	=	2.50		Fy	=	60,000	psi
Total Footing Width	=	4.00	ft	Footing Concrete Density	=	150.00	pcf
Footing Thickness	=	14.00	in	Min. As %	=	0.0018	
Key Width	=	0.00	in	Rebar Cover @ Top	=	2.00	in
Key Depth	=	0.00	in	@ Bottom	=	3.00	in
Key Distance from Toe	=	0.00	ft				

Footing Design Results

		Toe	Heel	
Factored Pressure	=	1,988	889	psf
Mu' : Upward	=	24,982	1,776	ft-#
Mu' : Downward	=	3,807	4,833	ft-#
Mu: Design	=	1,765	-2,415	ft-#
Actual 1-Way Shear	=	7.92	13.47	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing	=	# 5 @ 12.30 in
Heel Reinforcing	=	# 5 @ 12.30 in
Key Reinforcing	=	None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Key: No key defined

Min footing T&S reinf Area	1.21	in2
Min footing T&S reinf Area per fo	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

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

Petrie Residence
2431 60th Avenue SE
Mercer Island, Washington

Project Name/Number :
Title :
Dsgnr: **STT**
Description....

Date: 4 MAY 2020

This Wall in File:

Cantilevered Retaining Wall

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

Rebar Lap & Embedment Lengths Information

(Applying TMS 402 provisions) or (Applying IBC modifications to TMS 402 provisions)

Stem Design Segment: 2nd
Stem Design Height: 2.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	10.50 in
As Provided =	0.6200 in2/ft
As Required =	0.2480 in2/ft

Petrie Residence
2431 60th Avenue SE
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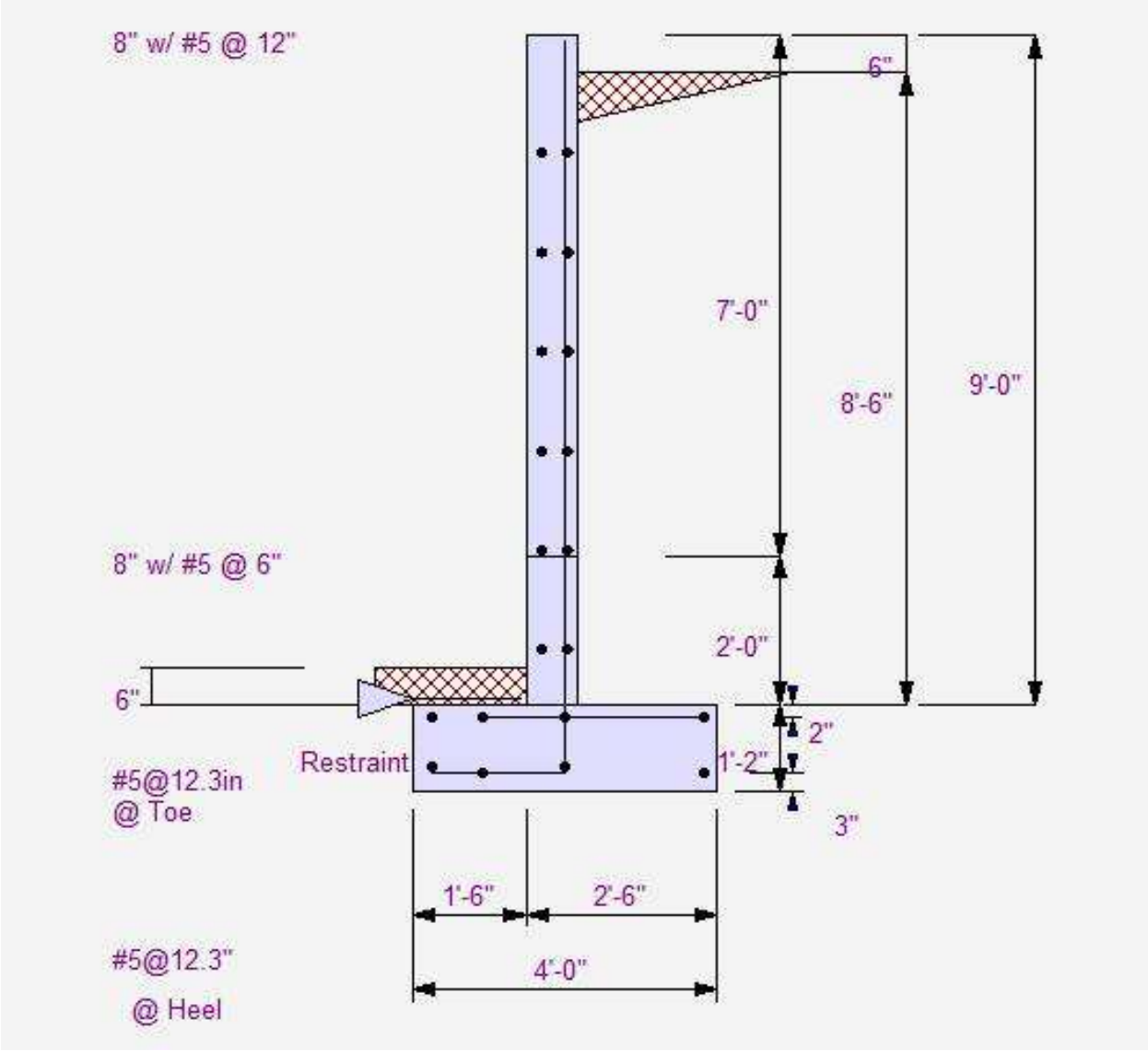

Petrie Residence
2431 60th Avenue SE
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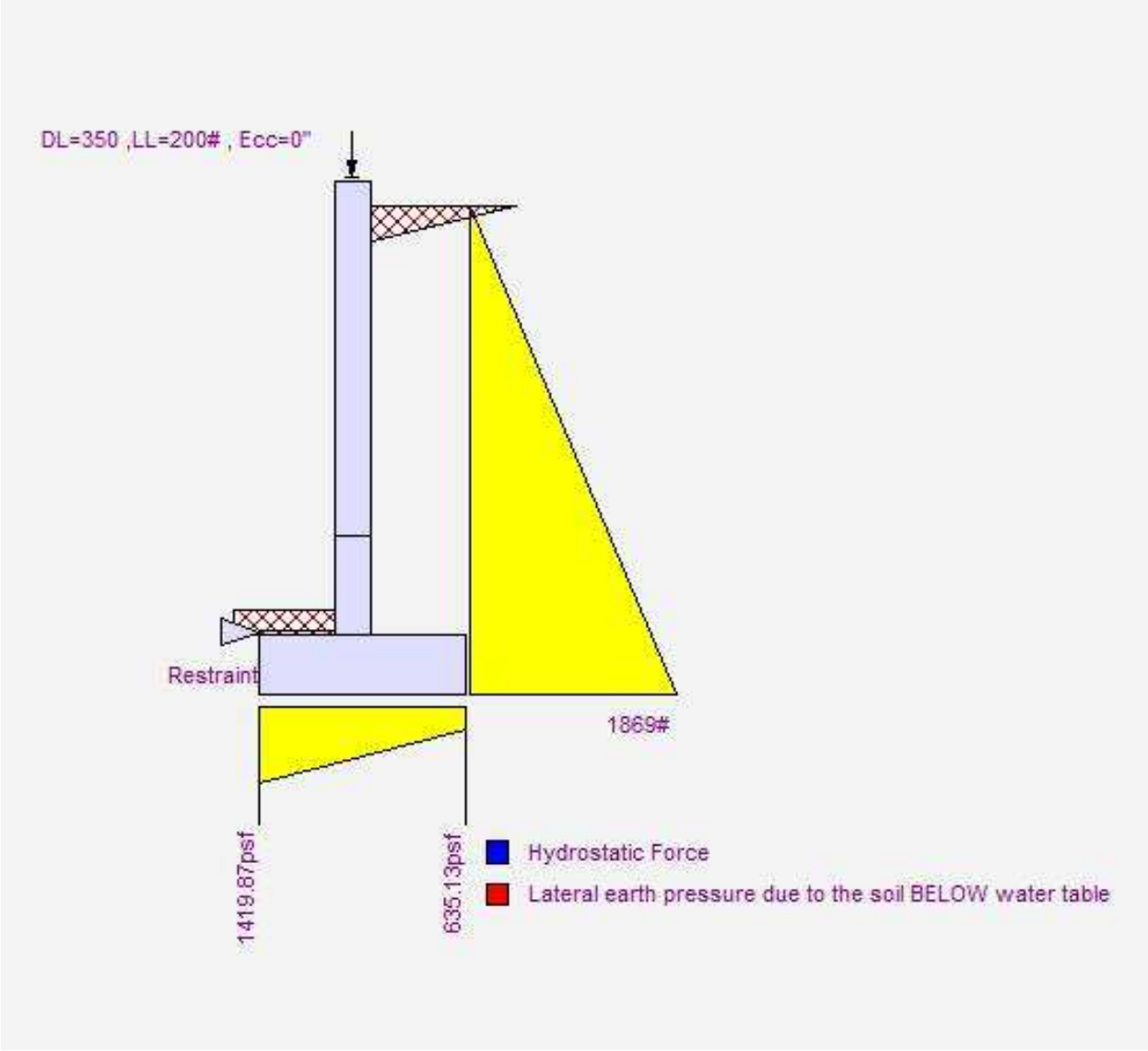

Petrie Residence
Lot 2, 7260 N. Mercer Way
Mercer Island, Washington

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Cantilevered Retaining Wall

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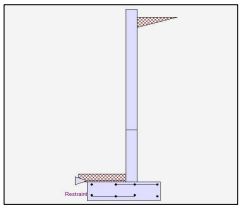

Criteria

Retained Height	=	10.50 ft
Wall height above soil	=	0.50 ft
Slope Behind Wall	=	0.00
Height of Soil over Toe	=	6.00 in
Water height over heel	=	0.0 ft

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

Soil Data and Lateral Earth Pressure

Allow Soil Bearing	=	2,000.0 psf	Soil Density, Heel	=	120.00 pcf
Equivalent Fluid Pressure Method			Soil Density, Toe	=	0.00 pcf
Active Heel Pressure	=	40.0 psf/ft	Footing||Soil Friction	=	0.400
	=		Soil height to ignore for passive pressure	=	12.00 in
Passive Pressure	=	200.0 psf/ft			

Surcharge Loads

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

Axial Load Applied to Stem

Axial Dead Load	=	350.0 lbs	Axial Load Eccentricity	=	0.0 in
Axial Live Load	=	250.0 lbs			

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

Wind on Exposed Stem (Service Level)	=	0.0 psf

Adjacent Footing Load

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

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Cantilevered Retaining Wall

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

Wall Design Summary

Stability Ratios

Overturning	=	1.55 OK
Slab Resists All Sliding !		

Soil Bearing

Total Bearing Load	=	5,327 lbs
...resultant ecc.	=	6.53 in
Soil Pressure @ Toe	=	1,716 psf OK
Soil Pressure @ Heel	=	225 psf OK
Allowable	=	2,000 psf
Soil Pressure Less Than Allowable		
ACI Factored @ Toe	=	2,402 psf
ACI Factored @ Heel	=	315 psf
Footing Shear @ Toe	=	19.2 psi OK
Footing Shear @ Heel	=	24.4 psi OK
Allowable	=	75.0 psi

Overturning

Resisting Moments

Resisting Moments	Force		Distance		Moment	
Soil Over Heel (above water table, if any)	1,680.0	lbs	3.58	ft	6,020.0	ft-#
Soil Over Heel (below water table, if any)	0.0					
Water Table	0.0					
Soil Over Heel	1,680.0		3.58		6,020.0	
Sloped Soil Over Heel	0.0					
Surcharge Over Heel	0.0					
Adjacent Footing Load	0.0					
Axial Dead Load on Stem	600.0		2.58		904.2	
Axial Live Load on Stem *	250.0		2.58		645.8	
Soil Over Toe	0.0		1.13			
Surcharge Over Toe	0.0					
Stem Weight(s)	1,100.0		2.58		2,841.7	
Earth @ Stem Transitions	0.0					
Footing Weight	743.8		2.13		1,580.5	
Key Weight	0.0		0.50			
Vert. Component	1,203.1		4.25		5,113.4	
Total Vertical Loads	5,076.9	lbs				
Resisting Moment					**16,459.7**	ft-#
Eccentricity					**-11.6**	in

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

Petrie Residence
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Cantilevered Retaining Wall

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

Overturning

Overturning Moments

Overturning Moments	Force		Distance		Moment
Heel Active Pressure (above water table, if any)	2,722.2	lbs	3.89	ft	10,586.4 ft-#
Heel Active Pressure (below water table, if any)	0.0				
Hydrostatic Force	0.0				
Buoyant Force	0.0				
Surcharge over Heel	0.0				
Adjacent Footing	0.0				
Surcharge Over Toe	0.0				
Load @ Stem Above Soil	0.0				
Added Lateral Load	0.0				
Seismic Load	0.0				
Seismic-Self-weight	0.0				
Totals =	2,722.2	lbs			
	Overturning Moment				10,586.4 ft-#

Petrie Residence
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Cantilevered Retaining Wall

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

Stem Design Summary

			2nd	Bottom
			Stem OK	Stem OK
Design Height Above Ftg	ft	=	3.33	0.00
Wall Material Above "Ht"		=	Concrete	Concrete
Design Method		=	LRFD	LRFD
Thickness		=	8.00	8.00
Rebar Size		=	# 5	# 5
Rebar Spacing		=	12.00	6.00
Rebar Placed at		=	Edge	Edge
Design Data				
fb/FB + fa/Fa		=	**0.484**	**0.811**
Total Force @ Section				
Service Level	lbs	=		
Strength Level	lbs	=	1,645.1	3,528.0
Moment....Actual				
Service Level	ft-#	=		
Strength Level	ft-#	=	3,931.8	12,348.0
Moment.....Allowable	ft-#	=	8,121.3	15,222.0
Shear.....Actual				
Service Level	psi	=		
Strength Level	psi	=	22.2	47.5
Shear.....Allowable	psi	=	75.0	75.0
Anet	in2	=		
Rebar Depth 'd'	in	=	6.19	6.19
Masonry Data				
f'm	psi	=		
Fs	psi	=		
Solid Grouting		=		
Modular Ratio 'n'		=		
Wall Weight	psf	=	100.0	100.0
Short Term Factor		=		
Equiv. Solid Thick.		=		
Masonry Block Type		=	Medium Weight	
Masonry Design Method		=	ASD	
Concrete Data				
f'c	psi	=	2,500.0	2,500.0
Fy	psi	=	60,000.0	60,000.0

Petrie Residence
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This Wall in File:

Cantilevered Retaining Wall

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

Concrete Stem Rebar Area Details

2nd Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.1489 in2/ft		
(4/3) * As :	0.1985 in2/ft	Min Stem T&S Reinf Area 1.473 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 :	0.1985 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

Bottom Stem	Vertical Reinforcing	Horizontal Reinforcing	
As (based on applied moment) :	0.4676 in2/ft		
(4/3) * As :	0.6234 in2/ft	Min Stem T&S Reinf Area 0.639 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 :	0.4676 in2/ft	#4@ 12.50 in	#4@ 25.00 in
Provided Area :	0.62 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	=	2.25 ft	f'c		=	2,500	psi
Heel Width	=	2.00	Fy		=	60,000	psi
Total Footing Width	=	4.25 ft	Footing Concrete Density		=	150.00	pcf
Footing Thickness	=	14.00 in	Min. As %		=	0.0018	
Key Width	=	12.00 in	Rebar Cover	@ Top	=	2.00	in
Key Depth	=	0.00 in		@ Bottom	=	3.00	in
Key Distance from Toe	=	0.00 ft					

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Cantilevered Retaining Wall

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

Footing Design Results

		Toe	Heel	
Factored Pressure	=	2,402	315	psf
Mu' : Upward	=	61,772	474	ft-#
Mu' : Downward	=	8,566	4,097	ft-#
Mu: Design	=	4,434	-2,890	ft-#
Actual 1-Way Shear	=	19.19	24.38	psi
Allow 1-Way Shear	=	75.00	75.00	psi

Toe Reinforcing	=	# 5 @ 12.30 in
Heel Reinforcing	=	# 5 @ 12.30 in
Key Reinforcing	=	None Spec'd

Other Acceptable Sizes & Spacings

Toe: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Heel: #4@ 7.93 in, #5@ 12.30 in, #6@ 17.46 in, #7@ 23.80 in, #8@ 31.34 in, #9@ 39

Key: No key defined

Min footing T&S reinf Area	1.29	in2
Min footing T&S reinf Area per fo	0.30	in2 /ft

If one layer of horizontal bars:	If two layers of horizontal bars:
#4@ 7.94 in	#4@ 15.87 in
#5@ 12.30 in	#5@ 24.60 in
#6@ 17.46 in	#6@ 34.92 in

Footing Torsion, Tu	=	0.00 ft-lbs
Footing Allow. Torsion, phi Tu	=	0.00 ft-lbs

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

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)	0.123	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.

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

Rebar Lap & Embedment Lengths Information

(Applying TMS 402 provisions) or (Applying IBC modifications to TMS 402 provisions)

Stem Design Segment: 2nd
Stem Design Height: 3.33 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in

---

Stem Design Segment: Bottom
Stem Design Height: 0.00 ft above top of footing

Lap Splice length for #5 bar specified in this stem design segment =	23.40 in
Development length for #5 bar specified in this stem design segment =	18.00 in
Hooked embedment length into footing for #5 bar specified in this stem design segment =	10.50 in
As Provided =	0.6200 in2/ft
As Required =	0.4676 in2/ft

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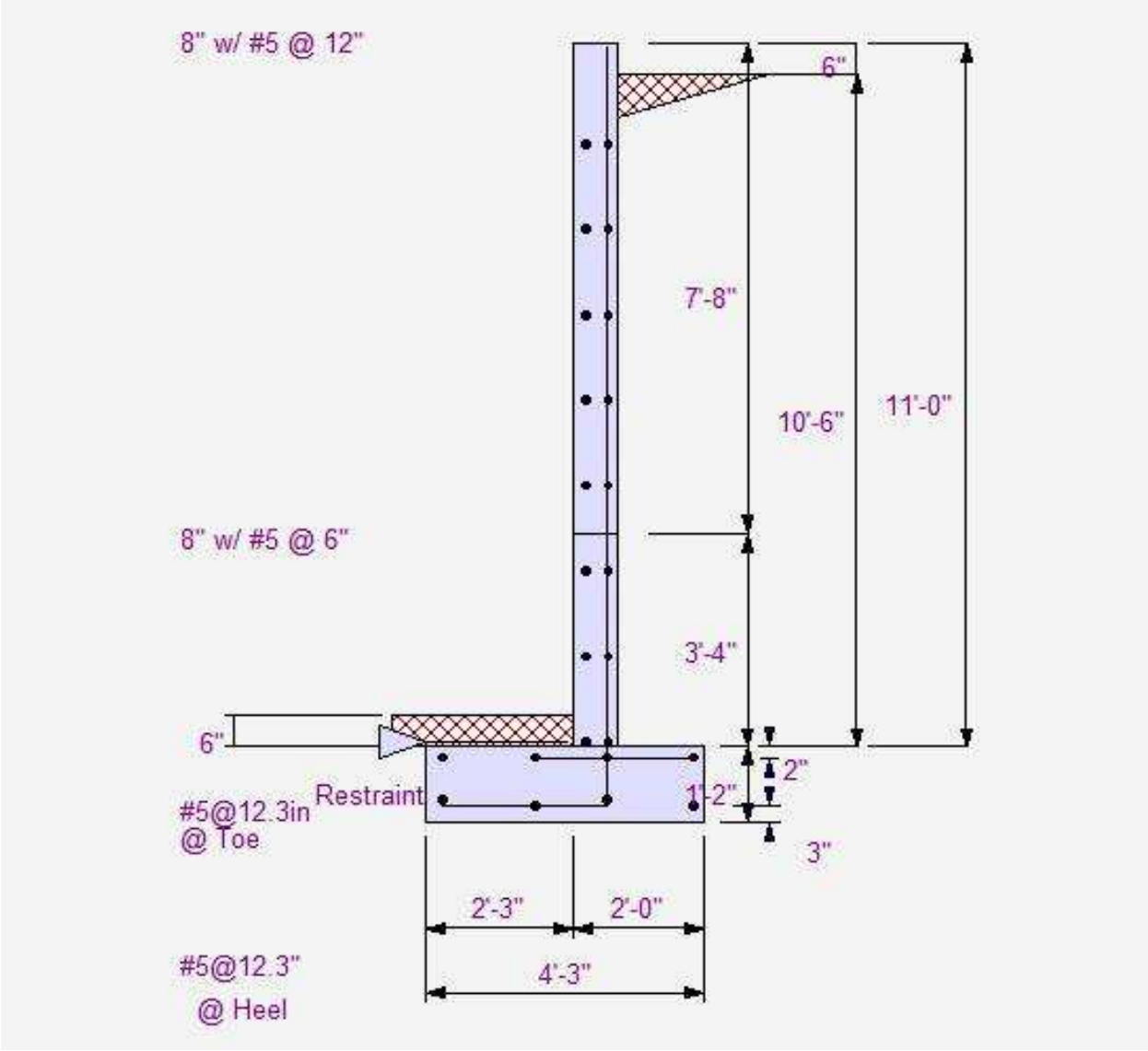

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