C. Christian Fynboe P.E.
CONSULTING ENGINEER

12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT: BOYLE			SHEET NO. 1/30
BY: CCF	DATE: 6/25/17	JOB NO. 17142	

STRUCTURAL CALCULATIONS
FOR THE
BOYLE RESIDENCE
&
GARAGE
(3603 WEST MERCER WAY)

-JAMES GUERRERO ARCHITECTURE

DESIGN PARAMETERS: 2015 IBC
SEE NOTES ON "S1.0"

C. CHRISTIAN FYNBOE
STATE OF WASHINGTON
12148
REGISTERED
PROFESSIONAL ENGINEER

#17147 2/30

USGS Design Maps Summary Report

User–Specified Input

Building Code Reference Document 2009 NEHRP Recommended Seismic Provisions (which utilizes USGS hazard data available in 2008)

Site Coordinates 47.57186°N, 122.23534°W

Site Soil Classification Site Class C – "Very Dense Soil and Soft Rock"

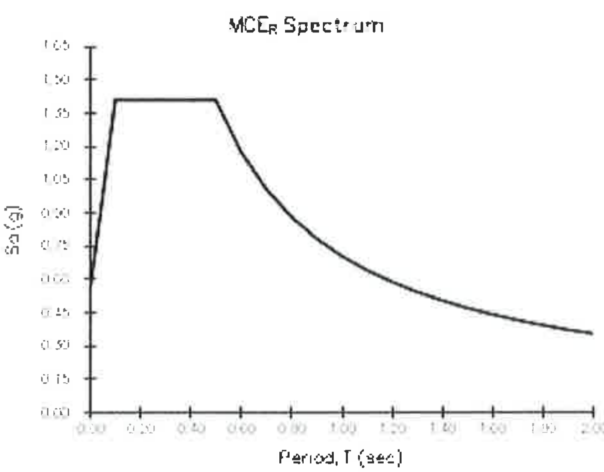
Risk Category I/II/III

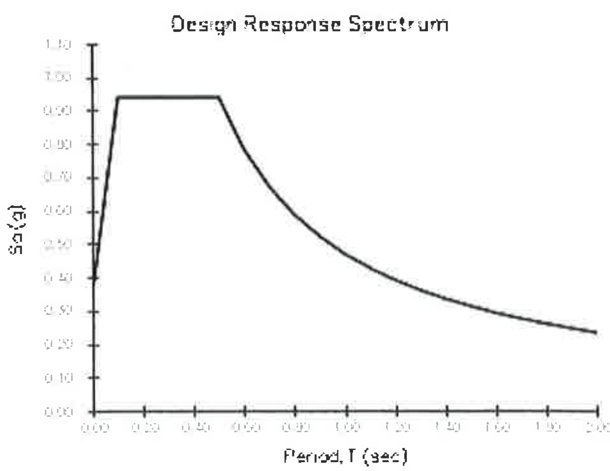
USGS–Provided Output

CS = .94/6.5 = .14

S_S =	1.411 g	S_{MS} =	1.411 g	S_{DS} =	0.941 g
S_1 =	0.543 g	S_{M1} =	0.705 g	S_{D1} =	0.470 g

For information on how the S_S and S_1 values above have been calculated from probabilistic (risk-targeted) and deterministic ground motions in the direction of maximum horizontal response, please view the detailed report.

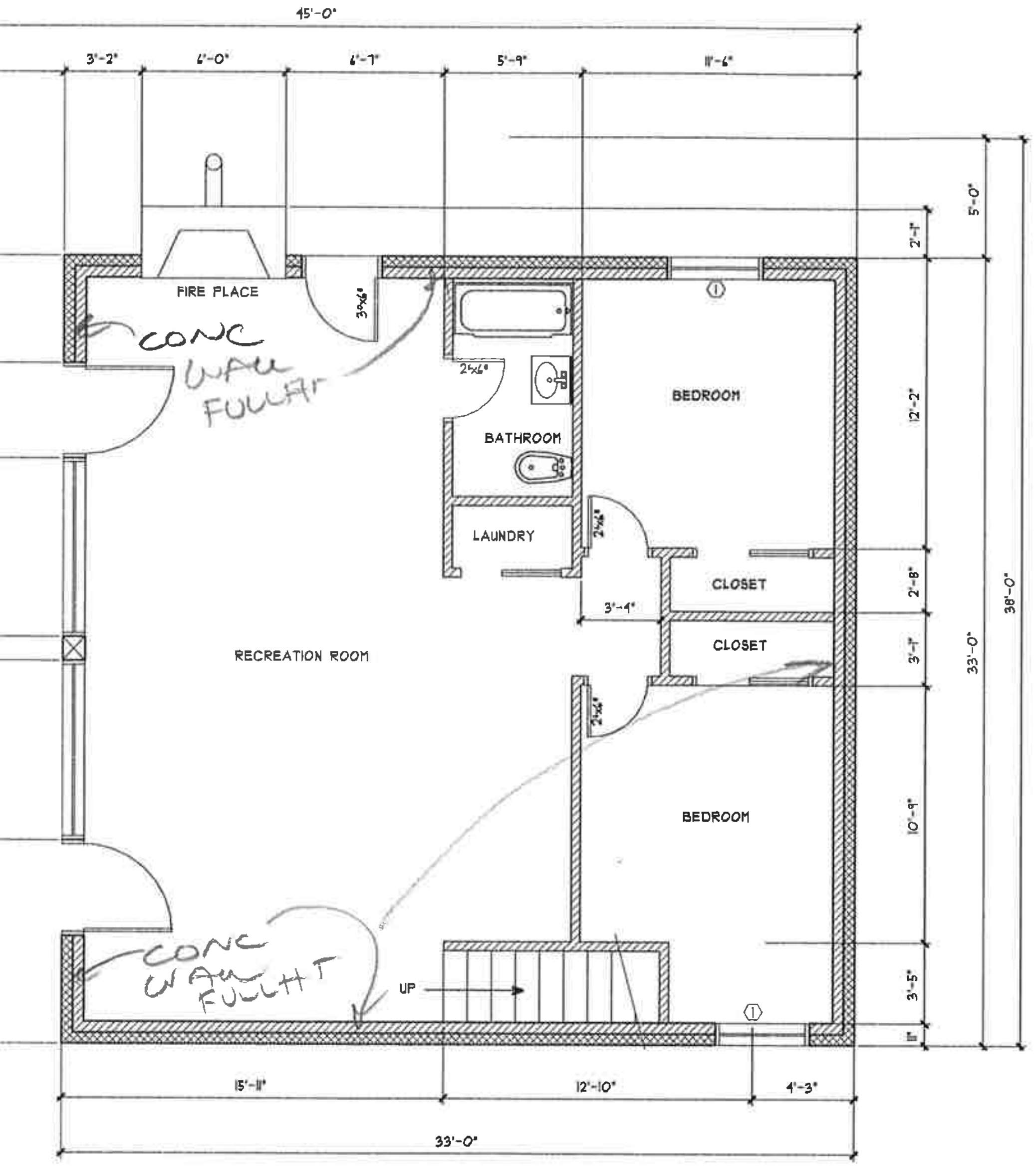




For PGA_M, T_L, C_{RS}, and C_{R1} values, please view the detailed report.

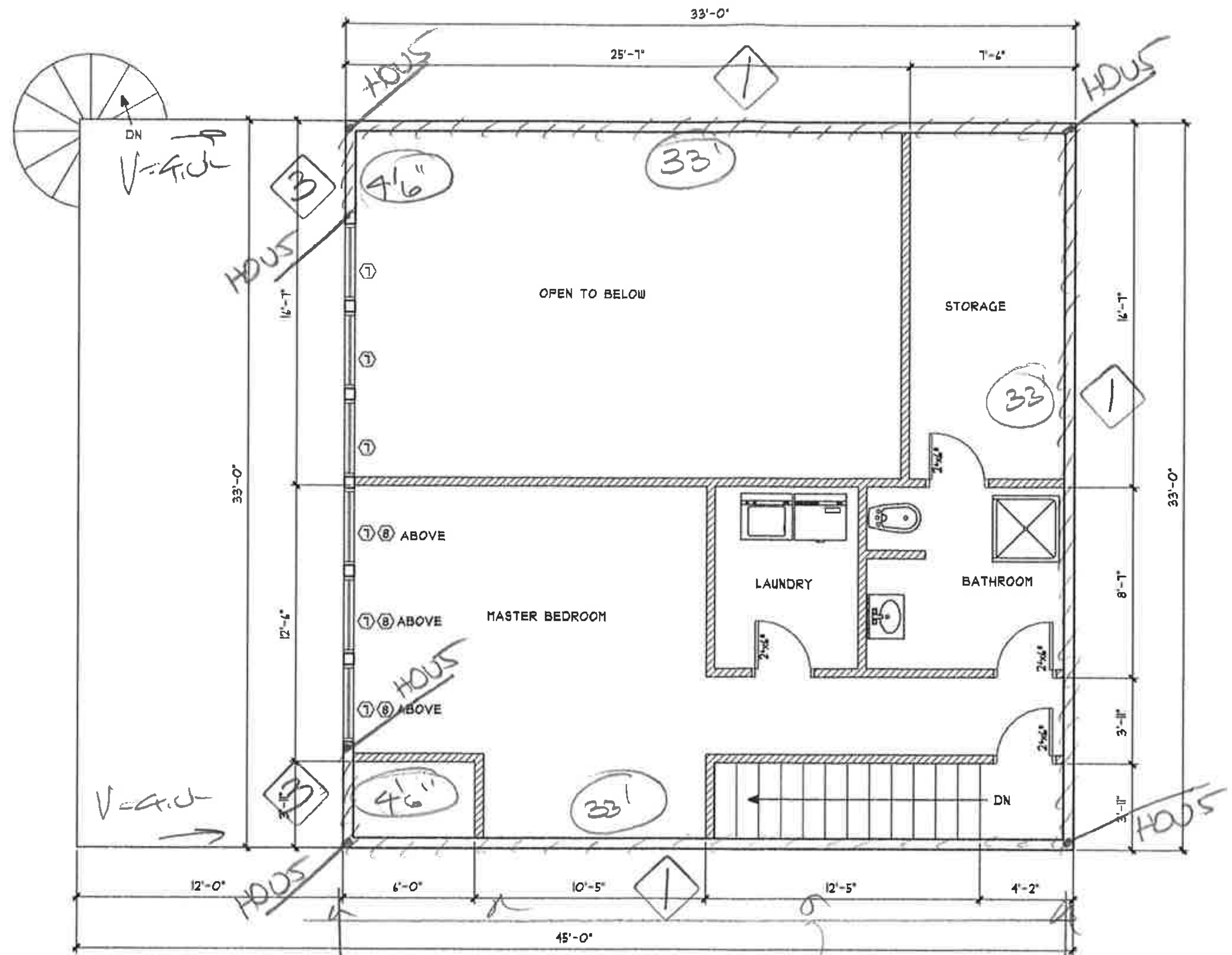
85mph EXP "C"   SEISMIC CAT D   #17147   3/30

P=17.5psf HOUSE   V=14W



NORTH

F3 A1.1 **BASEMENT FLOOR PLAN**



NORTH

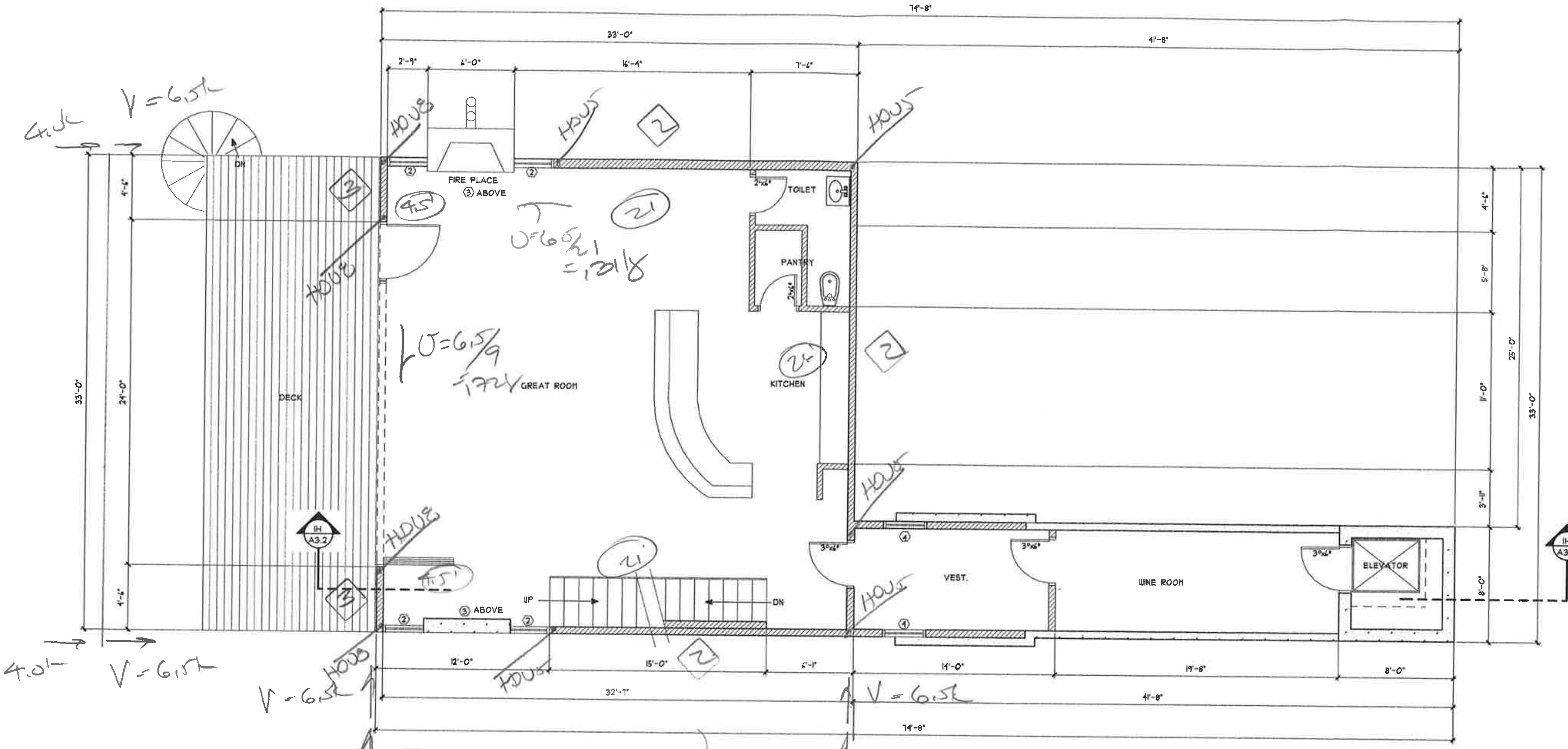
F1 A1.1 **SECOND FLOOR PLAN**

V=4.0k   V=4.0k

11150 Gravelly Lake Drive SW
Lakewood, WA 98499
Phone: 253/581-6000
Website: www.jgarch.net

MERCER ISLAND

#17147 4/30



FIRST FLOOR PLAN

F4 A1.1 SCALE: 1/4" = 1'-0"

W = 8.5(1017.5) = 115 lb

FLOOR DIAPHRAGM
3/4" T&G PLY (48/24)
8d @ 6" PANEL EDGES
& BOUNDARIES
8d @ 10" FIELD
GLUED & NAILED

11150 Gravelly Lake Drive SW
Lakewood, WA 98499
Phone: 253/581-6000
Website: www.jgarch.net

PROJECT: BOYLE MERCER ISLAND

DRAWING TITLE: FIRST LEVEL FLOOR PLAN

PRELIMINARY

DATE: DATE
REVISED

SHEET NO. A1.2

SCALE FACTOR: 48

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PROJECT:			SHEET NO. 5/30
BY:	DATE:	JOB NO. 17147	

SHEARWALL NAILING SCHEDULE				
Mark (shear capacity)	**Wall Type (3)**	**Panel Edge Nailing (1), (2)**	**Intermediate Nailing (2)**	**Bottom Plate Anchor Bolting or Nailing (5)**
1 (200 lb/ft.)	½" CDX Plywood or OSB, one side	8d @ 6" o.c.	8d @ 12" o.c.	½" A.B. @ 4'-0" o.c. or 16d @ 7½" o.c.
2 (350 lb/ft.)	½" CDX Plywood or OSB, one side	8d @ 4" o.c.	8d @ 12" o.c.	5/8" A.B. @ 3'-4" o.c. or 16d @ 4" o.c.
3 (700 lb/ft.)	½" CDX Plywood or OSB, both sides	8d @ 4" o.c. (4)	8d @ 12" o.c.	3/4" A.B. @ 2'-0" o.c. or 16d @ 2" o.c.
11 (200 lb/ft.)	½" GWB, both sides	5d cooler nails @ 7" o.c.	5d cooler nails @ 7" o.c.	½" A.B. @ 4'-0" o.c. or 16d @ 8" o.c.

Notes:

1. Block all panel edges.
2. Common or box nails.
3. 2x studs shall be H.F. #2 or better, kiln-dried.
4. Use 3x studs and plates @ panel edges, wall type 3 only.
5. Anchor bolts shall have minimum 3" by 3" by 1/4" thick plate washers.

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PROJECT:			SHEET NO. 6/30
BY:	DATE:	JOB NO. 17147	

SHEAR WALL (HEM FIR VALUES)

(1) 15/32" STRUCT I 8d @ 6" o/c 280(.82) = 230 lb/ft
1/2" φ AB @ 4'0" o/c 600(1.6/4) = 240 lb/ft
16d @ 7 1/2" o/c 91(1.6)12/7.5 = 233 lb/ft

200 lb/ft

(2) 15/32 STRUCT I 8d @ 4" o/c 430(.82) = 353 lb/ft
5/8" φ AB @ 3'4" 860(1.6)/3.33 = 413 lb/ft
16d @ 4" o/c 91(1.6)12/4 = 437 lb/ft

350 lb/ft

(3) 15/32 STRUCT I 8d @ 4" o/c 353(2) = 706 lb/ft
3/4" φ AB @ 2'0" 1180(1.6)/2 = 944 lb/ft
16d @ 2" o/c 91(1.6)12/2 = 873 lb/ft

700 lb/ft

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PROJECT:			SHEET NO. 7/30
BY:	DATE:	JOB NO. 17147	

ROOF FRAMING

$\ell = 32'$

$W = .045(16) = .72 k/ft$ $R = 11.5^k$

$M = \frac{.72(32)^2}{8} 12 = 1106 k''$

$S_{REQ} = 1106/2.4(1.15) = 401 in^3$

$I_{REQ} = \frac{5}{384} \frac{(.72)(32)^4(1728)}{1800(1.6)} = 5898 in^4$

$5\frac{1}{8}" \times 24"$ GL

2ND FLOOR

$\ell = 32'$

$W = .05(10) = 0.5 k/ft$ $R = 8^k$

$M = \frac{0.5(32)^2}{6} 12 = 768 k''$

$S_{REQ} = 768/2.4 = 320 in^4$

$I_{REQ} = \frac{5}{384} \frac{(.5)(32)^4(1728)}{1800(1.1)} = 5957$

$5\frac{1}{8}" \times 24"$ GL

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PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	8/30

$\ell = 24'$ 14.4

$w = .045(10) = .45^{k/'}$

$P = 8.0^{k}$

$M = \left[\frac{.45(24)^2}{8} + \frac{8.0(24)}{4}\right]12 = 965^{k''}$

$S_{reqd} = 965/2.4(1.15) = 350$

$5\frac{1}{2}" \times 24"$ GL

C. Christian Fynboe p.e.
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO. 9/30
BY:	DATE:	JOB NO. 17147	

1ST FLOOR

l = 12'

W = .065(6) + .105(10) = 1.89 k/f R ~ 5.3k

M = 1.89(12)²/8 (12) ~ 192k"

Sreq ~ 192/2.4 ~ 80.1

5½x12 GL

l = 21' FLOOR

W = .05(16/12) = .0667

M = .0667(21)²/8 = 3.7k'

USE 14" TJI/PRO 360
@16" c

l = 11' DECK

W = .065(6) = .39 k/f

M = .39(11)²/8 (12) ~ 71k"

Sreq ~ 71/.675 ~ 105

TRT 6x12

P = .39(11) ~ 4.3k   L = √(4.3/2.5) ~ 1.3'
3'0" □ x 12" conc FTG

#17147 10/30

Design Properties (100% Load Duration)

Depth	TJI®	Basic Properties: Joist Weight (lbs/ft)	Maximum Resistive Moment(1) (ft-lbs)	Joist Only EI x 10^6 (in.^{2}-lbs)	Maximum Vertical Shear (lbs)	Reaction Properties: 1¾" End Reaction (lbs)	3½" Intermediate Reaction (lbs): No Web Stiffeners	With Web Stiffeners
9½"	110	2.3	2,380	140	1,220	885	1,935	N.A.
	210	2.6	2,860	167	1,330	980	2,145	N.A.
	230	2.7	3,175	183	1,330	1,035	2,410	N.A.
11⅞"	110	2.5	3,015	238	1,560	885	1,935	2,295
	210	2.8	3,620	283	1,655	980	2,145	2,505
	230	3.0	4,015	310	1,655	1,035	2,410	2,765
	360	3.0	6,180	419	1,705	1,080	2,460	2,815
	560	4.0	9,500	636	2,050	1,265	3,000	3,475
14"	110	2.8	3,565	351	1,860	885	1,935	2,295
	210	3.1	4,280	415	1,945	980	2,145	2,505
	230	3.3	4,755	454	1,945	1,035	2,410	2,765
	360	3.3	7,335	612	1,955	1,080	2,460	2,815
	560	4.2	11,275	926	2,390	1,265	3,000	3,475
16"	210	3.3	4,895	566	2,190	980	2,145	2,505
	230	3.5	5,440	618	2,190	1,035	2,410	2,765
	360	3.5	8,405	830	2,190	1,080	2,460	2,815
	560	4.5	12,925	1,252	2,710	1,265	3,000	3,475

*(1) **Caution:** Do **not** increase joist moment design properties by a repetitive member use factor.*

General Notes

TJI® joists are intended for dry-use applications

- Design reaction includes all loads on the joist. Design shear is computed at the inside face of supports and includes loads on the span(s). Allowable shear may sometimes be increased at interior supports in accordance with ICC ES ESR-1153, and these increases are reflected in span tables.
- The following formulas approximate the uniform load deflection of Δ (inches):

For TJI® 110, 210, 230, and 360 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.67\ wL^2}{d \times 10^5}$$

For TJI® 560 Joists

$$\Delta = \frac{22.5\ wL^4}{EI} + \frac{2.29\ wL^2}{d \times 10^5}$$

w = uniform load in pounds per linear foot
L = span in feet
d = out-to-out depth of the joist in inches
EI = value from table above

Material Weights

(Include TJI® weights in dead load calculations—see **Design Properties** table at left for joist weights)

Floor Panels

Southern Pine

- ½" plywood .... 1.7 psf
- ⅝" plywood .... 2.0 psf
- ¾" plywood .... 2.5 psf
- 1⅛" plywood .... 3.8 psf
- ½" OSB .... 1.8 psf
- ⅝" OSB .... 2.2 psf
- ¾" OSB .... 2.7 psf
- ⅞" OSB .... 3.1 psf
- 1⅛" OSB .... 4.1 psf

Based on: Southern pine – 40 pcf for plywood, 44 pcf for OSB

Roofing

- Asphalt shingles .... 2.5 psf
- Wood shingles .... 2.0 psf
- Clay tile .... 9.0 to 14.0 psf
- Slate (⅜" thick) .... 15.0 psf

Roll or Batt Insulation (1" thick):

- Rock wool .... 0.2 psf
- Glass wool .... 0.1 psf

Floor Finishes

- Hardwood (nominal 1") .... 4.0 psf
- Sheet vinyl .... 0.5 psf
- Carpet and pad .... 1.0 psf
- ¾" ceramic or quarry tile .... 10.0 psf

Concrete:

- Regular (1") .... 12.0 psf
- Lightweight (1") .... 8.0 to 10.0 psf
- Gypsum concrete (¾") .... 6.5 psf

Ceilings

- Acoustical fiber tile .... 1.0 psf
- ½" gypsum board .... 2.2 psf
- ⅝" gypsum board .... 2.8 psf
- Plaster (1" thick) .... 8.0 psf

TABLE OF CONTENTS

DTT *Deck Tension Ties*

#17142 11/30

DTT tension ties are safe, cost-effective connectors designed to meet or exceed code requirements for deck construction. These versatile DTT connectors are also load rated as a holdown for light-duty shearwalls and braced wall panel applications.

For new construction or to make an existing current deck code-compliant, the DTT1Z can be used as a tension-tie to satisfy the 2015 IRC provision for a 750 lbs. lateral load connection to the house at four locations per deck. This new code detail permits the lateral connection from the deck joists to be made to top plates, studs, or headers within the supporting structure, which eliminates the need to access to the floor joists inside the home.

The new DTT1Z fastens to the narrow or wide face of a single 2x with Simpson Strong-Tie® Strong-Drive® SD Connector screws or nails and accepts a ⅜" machine bolt, anchor bolt, or lag screw *(washer required)* or can be installed with the new Strong-Drive SDWH Timber-Hex HDG screw with an integral washer. The DTT2 fastens easily to the wide face of a single or double 2x using Simpson Strong-Tie Strong-Drive SDS Heavy-Duty Connector screws (included) and accepts a ½" machine bolt or anchor bolt.

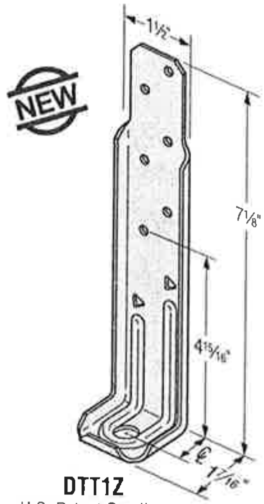
The DTT2 can be used to satisfy the IRC provision for a 1,500 lbs. lateral load connection at two locations per deck. Additionally, the DTT2 has been tested and evaluated in deck guardrail post applications to resist the code-specified lateral forces at the top of railing assemblies. The DTT2 is also available with longer 2½" Strong-Drive SDS Heavy-Duty Connector screws *(model DTT2Z-SDS2.5)* to achieve higher loads when needed.

MATERIAL: 14 gauge

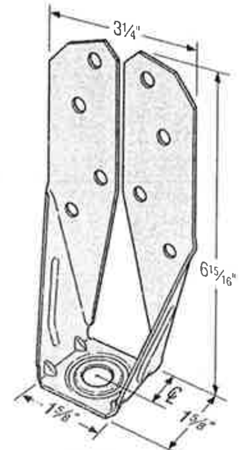
FINISH: DTT1Z/DTT2Z—ZMAX® coating;
DTT2SS—Stainless steel; see Corrosion Information, pages 13-15.

INSTALLATION:
- Use all specified fasteners. See General Notes.
- A standard cut washer *(included)* must be installed between the nut and the seat.
- Simpson Strong-Tie Strong-Drive SDS Heavy-Duty Connector screws install best with a low speed high torque drill with a ⅜" hex head driver.
- Strong-Drive SD Connector screws install with a ¼" hex head driver.
- Strong-Drive SDWH Timber-Hex HDG screws install with a ½" hex head driver.

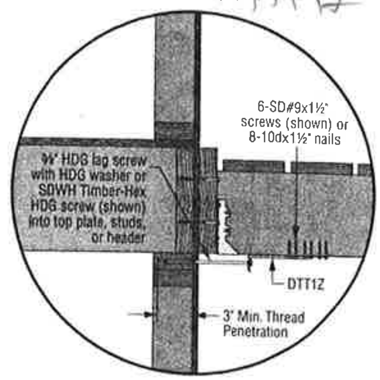
CODES: See page 12 for Code Reference Key Chart.



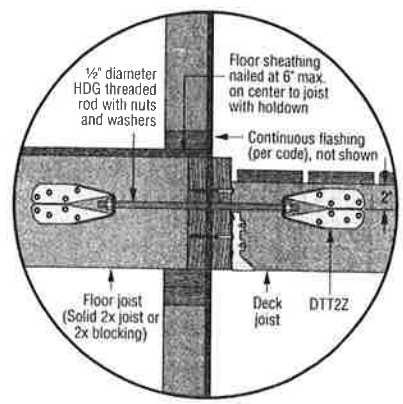
DTT1Z
U.S. Patent Pending



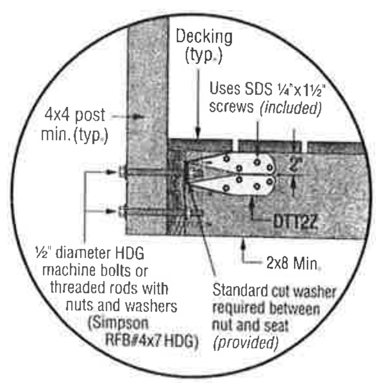
DTT2Z



Typical DTT1Z Deck-to-House Lateral Load Connection
For more information on lateral load connections, see technical bulletin T-DECKLATLOAD



Typical DTT2Z Deck-to-House Lateral Load Connection
For more information on lateral load connections, see technical bulletin T-DECKLATLOAD

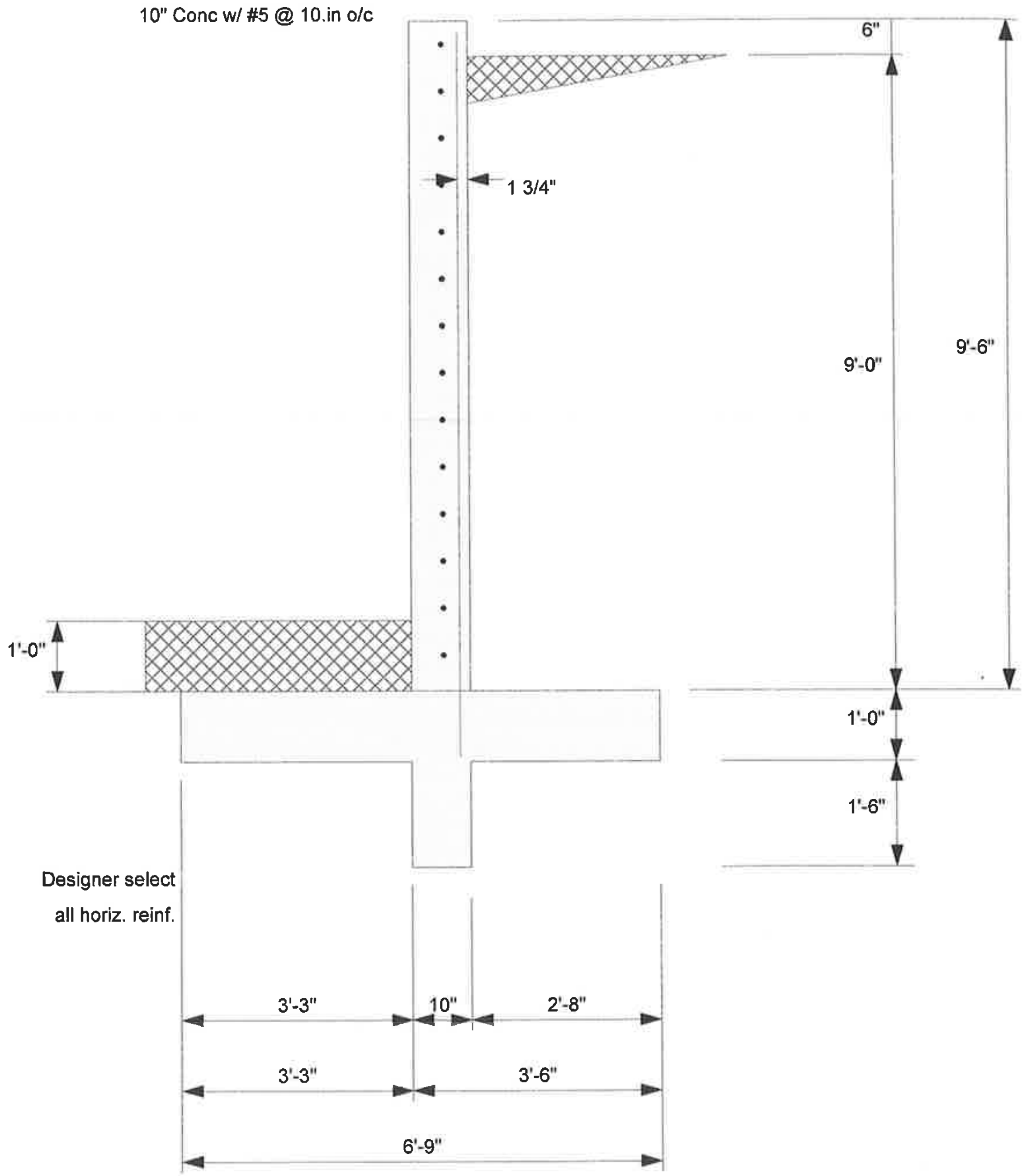


DTT2Z Installed as a Lateral Connector for a Deck Guardrail Post
For more information on guardrail post connections, see technical bulletin T-GRDRLPST

These products are available with additional corrosion protection. Additional products on this page may also be available with this option, check with Simpson Strong-Tie for details.

Model No.	℄	Anchor Dia.	Fasteners	Minimum Wood Member Thickness	Allowable Tension Loads		Code Ref.
					DF/SP	SPF/HF	
NEW DTT1Z	¾	⅜ [6] or SDWH[3]	6-SD #9x1½	1½	840	840	160
			6-10dx1½		910	640[4]	
			8-10dx1½		910	850	
DTT2Z/DTT2SS	1³⁄₁₆	½	8-¼"x1½" SDS	1½	1825	1800	I6, L8, F5
				3	2145	1835	
DTT2Z-SDS2.5	1³⁄₁₆	½	8-¼"x2½" SDS	3	2145	2105	

1. Allowable loads have been increased 60% for wind or earthquake loading with no further increase allowed.
2. DTT1Z installations with allowable loads below 750 lbs. do not satisfy the 2015 IRC requirements for deck-to-house lateral load connections.
3. The Strong-Drive® SDWH Timber-Hex HDG screw with a minimum of 3" of thread penetration into dry lumber has an allowable withdrawal load (160) of 1380 lbs. into SP, 1225 lbs into DF and 1020 lbs. into SPF/HF.
4. Load values are valid if the product is flush with the end of the framing member or installed away from the end.
5. The guardrail post illustration above addresses an outward force on the guardrail. An additional DTT2Z can be added at the lower bolt to address an inward force.
6. A ¾" HDG round washer is required when using a lag screw.


10" Conc w/ #5 @ 10.in o/c
6"
1 3/4"
9'-0"
9'-6"
1'-0"
1'-0"
1'-6"
Designer select
all horiz. reinf.
3'-3"
10"
2'-8"
3'-3"
3'-6"
6'-9"

Title : 9 foot
Job # : 17147 Dsgnr: Date: JUN 18,2017
Description....

#17147 13/30

CANTILEVERED RETAINING WALL DESIGN

GENERAL

Retained Height	=	9.00 ft
Wall height above retained soil	=	0.50 ft
Slope Behind Wall	=	0.00 : 1
Height of Soil over Toe	=	12.00 in
Soil Density	=	120.00 pcf

FOOTING DATA

Toe Width	=	3.25 ft
Heel Width	=	3.50
Total Footing Width	=	6.75
Footing Thickness	=	12.00 in

KEY DATA

Distance from Toe	=	3.25 ft
Width	=	10.00 in
Depth	=	18.00 in

SOIL DATA

Allow Soil Bearing	=	2,500.0 psf
Equivalent Fluid Pressure Method		
Active Soil Pressure - Heel Side	=	55.0 psf
Active Soil Pressure - Toe Side	=	55.0 pcf
Passive Pressure	=	300.0 pcf
Water table height over heel	=	0.0 ft

SLIDING DATA

Friction Factor @ Footing & Soil	=	0.400
...neglect ht. for passive	=	0.00 in
Lateral Sliding Force	=	2,640.0
less Passive Pressure Force	=	- 1,837.5 lbs
less Friction Force	=	- 2,263.0 lbs
Added Restraint Force Required	=	0.0 lbs

FOOTING DESIGN RESULTS

f'c	=	3,000 psi
Fy	=	60,000 psi
Minimum As %	=	0.0018
Rebar Cover @ Top	=	2.00 in
Rebar Cover @ Bottom	=	3.00 in

		Toe	Heel
ACI Factored Soil Pressure	=	1,818	529 psf
Mu' : From Upward Loads	=	8,508	0 ft-#
Mu' : From Downward Loads	=	1,996	6,123 ft-#
Mu: Used For Design	=	6,511	6,123 ft-#
Actual One-Way Shear	=	29.83	40.28 psi
Allowable One-Way Shear	=	93.11	93.11 psi

Minimum Footing Rebar Options......

Toe Side......	Heel Side....
# 4 @ 10.50 in	# 4 @ 11.75 in
# 5 @ 16.25 in	# 5 @ 18.25 in
# 6 @ 23.00 in	# 6 @ 25.75 in
# 7 @ 31.25 in	# 7 @ 35.25 in
# 8 @ 41.25 in	# 8 @ 46.25 in
# 9 @ 48.25 in	# 9 @ 48.25 in
# 10 @ 48.25 in	# 10 @ 48.25 in

Key Reinforcement: Not Req'd = Mu<S*Fr

DESIGN SUMMARY

Total Bearing Load			=	5,657 lbs
...resultant ecc.			=	7.41 in
Soil Pressure @ Toe	=	1,298	<=	2,500 psf
Soil Pressure @ Heel	=	378	<=	2,500 psf
ACI Factored Press @ Toe			=	1,818 psf
ACI Factored Press @ Heel			=	529 psf
Footing Shear @ Toe	=	29.8	<=	93.1 psi
Footing Shear @ Heel	=	40.3	<=	93.1 psi

WALL STABILITY RATIOS

Overturning Stability Ratio	=	2.72
Sliding Ratio Ratio	=	1.55

Summary of Stem Section Designs....
Top: 10 in Conc, #5@10.00 in@Edge, From 9.5 ft to 0.0 ft

Title : 9 foot
Job # : 17147 Dsgnr: Date: JUN 18,2017
Description....

#17147 14/30

CANTILEVERED RETAINING WALL DESIGN

SUMMARY OF OVERTURNING & RESISTING FORCES & MOMENTS

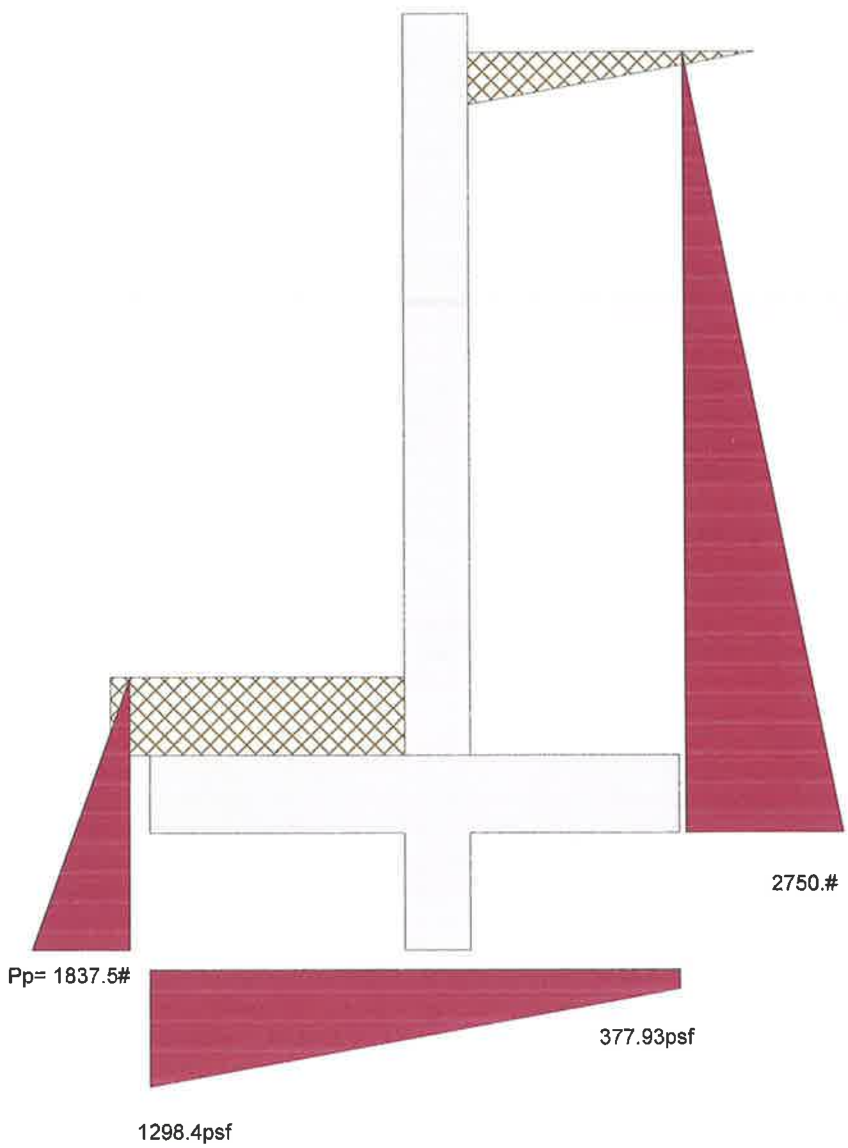
Item		.....OVERTURNING..... Force lbs	Distance ft	Moment ft-#	.....RESISTING..... Force lbs	Distance ft	Moment ft-#
Heel Active Pressure	=	2,750.0	3.33	9,166.7			
Soil Over Heel					2,880.0	5.42	15,600.0
Sloped Soil Over Heel	=						
Surcharge Over Heel	=						
Adjacent Footing Load	=						
Axial Dead Load on Stem	=					0.00	
Toe Active Pressure	=	-110.0	0.67	-73.3			
Soil Over Toe					390.0	1.63	633.8
Surcharge Over Toe	=						
Stem Weight(s)	=				1,187.5	3.67	4,354.2
Earth @ Stem Transitions	=						
Footing Weight	=				1,012.5	3.38	3,417.2
Key Weight	=				187.5	3.67	687.5
Vert. Component	=						
Added Lateral Load	=						
Load @ Stem Above Soil	=						
TOTALS	=	2,640.0	O.T.M. =	9,093.3	5,657.5	R.M. =	24,692.6

Vertical component of active pressure used for soil pressure
Toe Surcharge Not Used To Resist Overturning
Heel Surcharge Not Used To Resist Overturning

Resisting/Overturning Ratio = **2.72**

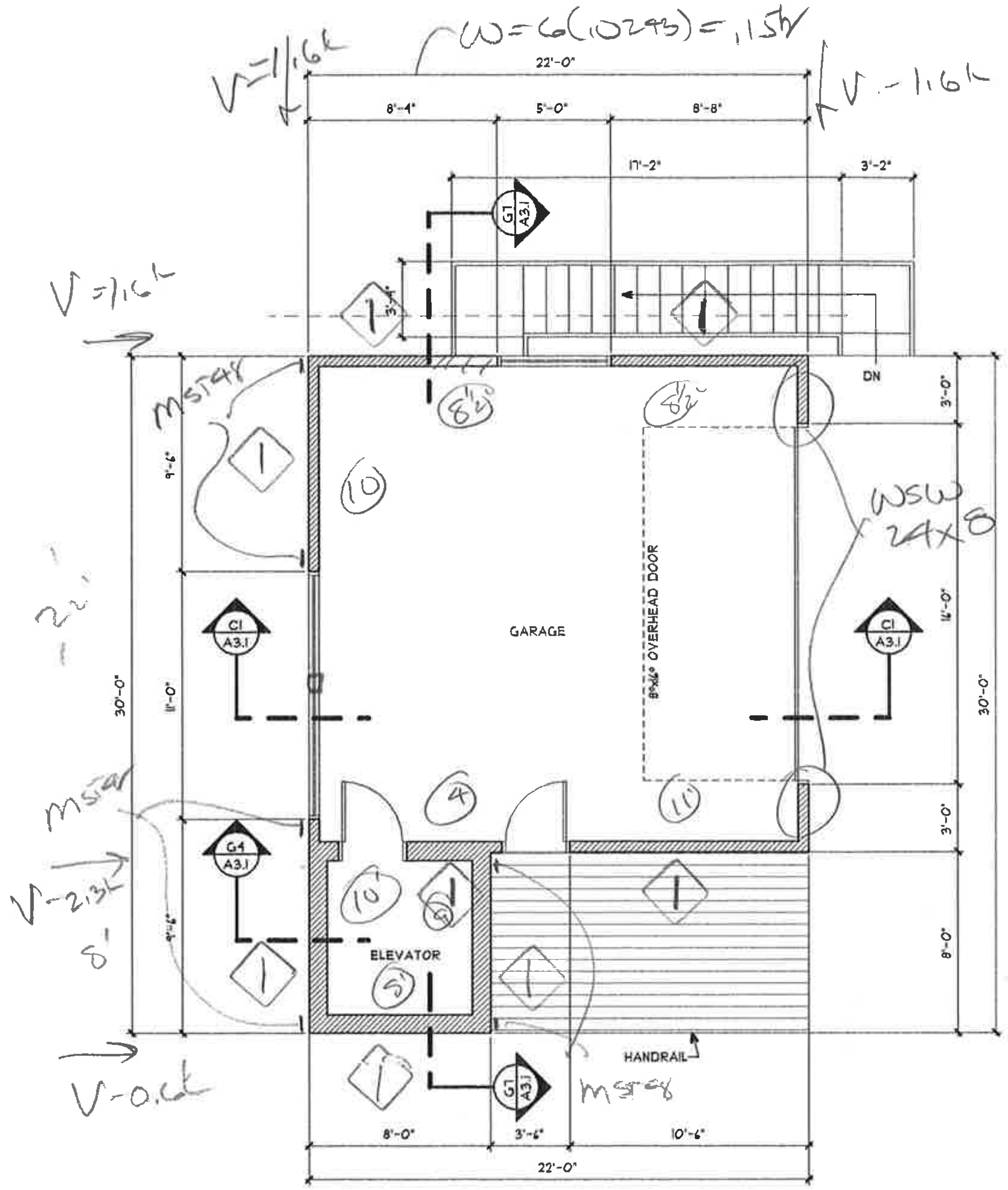
STEM CONSTRUCTION & DESIGN

		Top Stem
		Stem OK
Design at this height above ftg	=	0.00 ft
Wall Material Above "Ht"	=	Concrete
Thickness	=	10.00 in
Rebar Size	=	# 5
Rebar Spacing	=	10.00 in
Rebar Placed at	=	Edge
Design Data		
fb/FB + fa/Fa	=	**0.866**
Total Force @ Section	=	3,740.0 lbs
Moment....Actual	=	11,344.7 ft-#
Moment.....Allowable	=	13,093.5 ft-#
Shear.....Actual	=	38.07 lbs
Shear.....Allowable	=	93.11 psi
Bar Embed ABOVE Ht.	=	14.14 in
Bar Embed BELOW Ht.	=	8.25 in
Wall Weight	=	125.0 psf
Rebar Depth 'd'	=	8.19 in
Masonry Data		
f'm	=	
Fs	=	
Solid Grouting	=	
Special Inspection	=	
Modular Ratio 'n'	=	
Short Term Factor	=	
Equiv. Solid Thick.	=	
Concrete Data		
f'c	=	3,000 psi
Fy	=	60,000 psi


2750.#
Pp= 1837.5#
377.93psf
1298.4psf

#17147

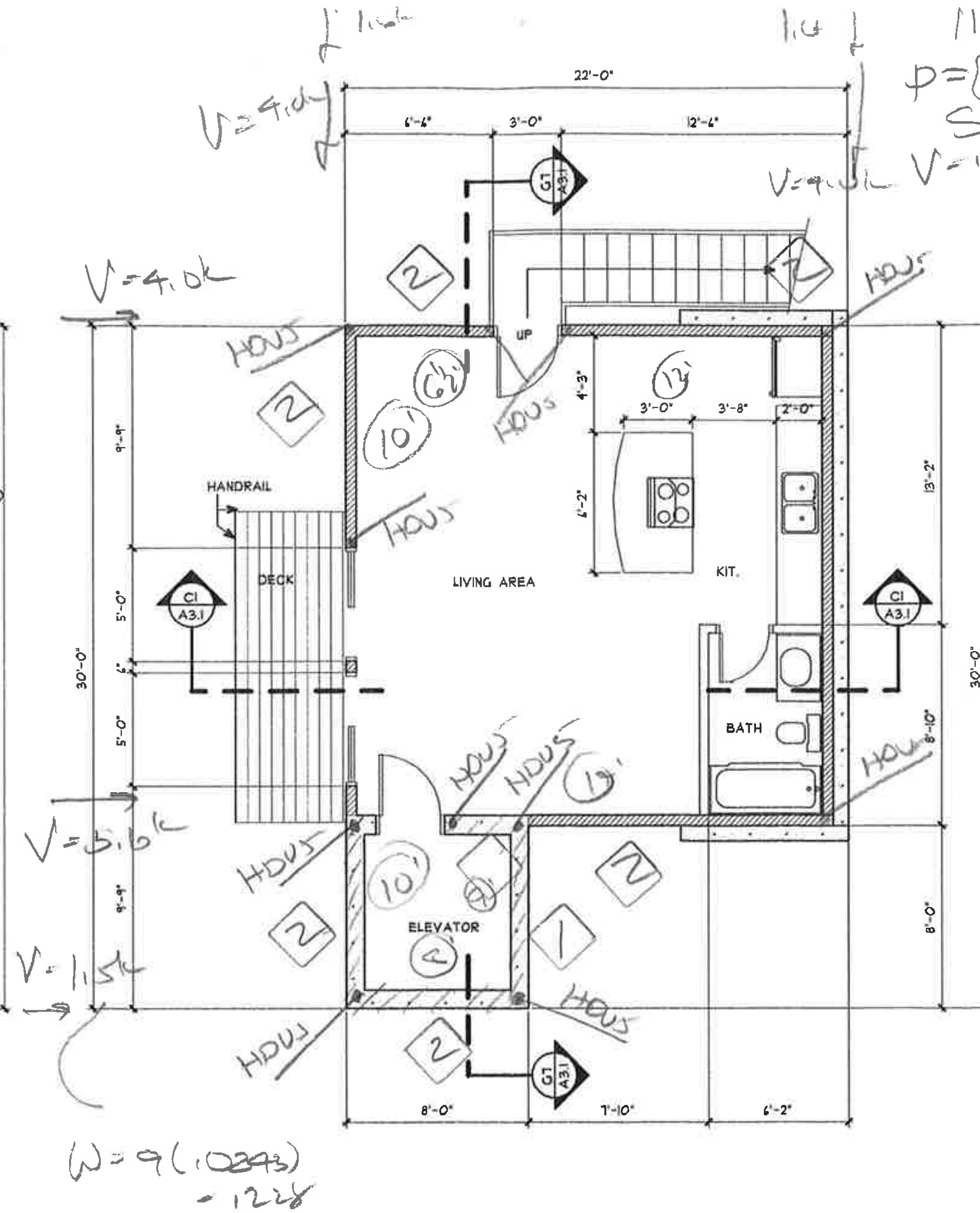
110 mph Exp "C" Kzt=2.0 GARAGE
p=[1.2(35.7)+1.8(23.7)](1.6)(1.55)=243 psf
SEISMIC CAT D



GARAGE FLOOR PLAN

F2 A1.1 SCALE: 1/4" = 1'-0"

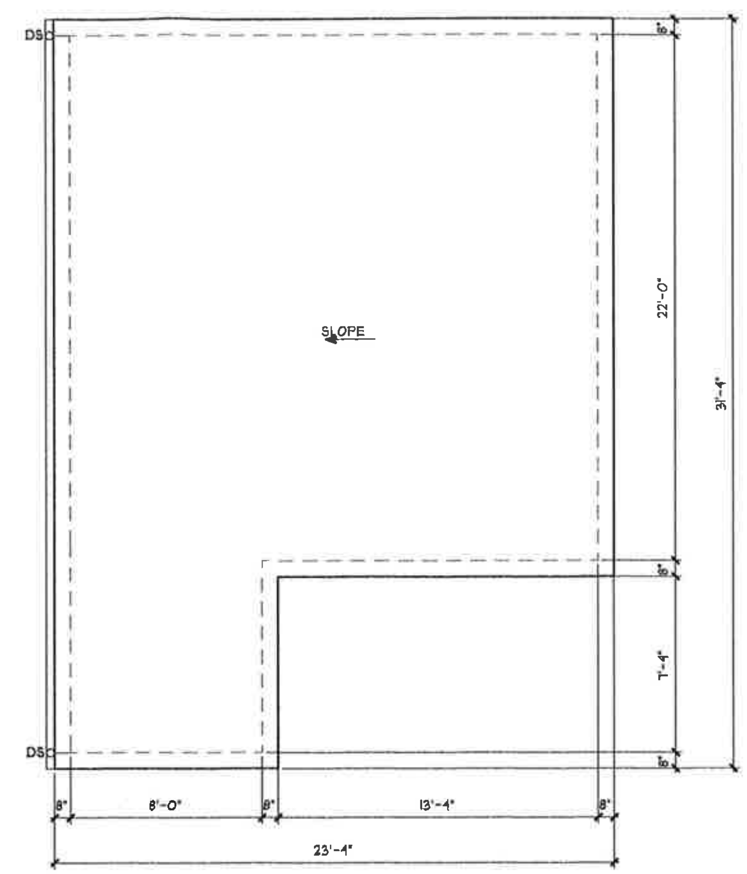
NORTH



APARTMENTS FLOOR PLAN

F5 A1.1 SCALE: 1/4" = 1'-0"

NORTH



ROOF PLAN

F8 A1.1 SCALE: 1/4" = 1'-0"

NORTH

ROOF DIAPHRAGM
1/2" PLY (32/16)
8d @ 6" PANEL EDGES
+ BOUNDARIES
8d @ 12" FIELD

FLOOR DIAPHRAGM
1 1/8" T&G PLY (48/24)
10d @ 6" PANEL EDGE
+ BOUNDARY
10d @ 10" FIELD
GLUED & NAILED

11150 Gravelly Lake Drive SW
Lakewood, WA 98499
Phone: 253/581-6000
Website: www.jgarch.net

PROJECT
BOYLE MERCER ISLAND

DRAWING TITLE
GARAGE FLOOR PLANS

DATE DATE
REVISED

SHEET NO.
A1.1

PRELIMINARY

SCALE FACTOR: 48

Standard and Balloon Framing on Concrete Foundations

SIMPSON Strong-Tie®

Strong-Wall® Wood Shearwall Standard Application on Concrete Foundation

Strong-Wall Wood Shearwall Model[9]	Allowable Vertical Load, P (lb.)[4]	2,500 psi Concrete						3,000 psi Concrete					
		Seismic[3]			Wind			Seismic[3]			Wind		
		Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]	Allowable ASD Shear Load, V (lb.)	Drift at Allowable Shear, Δ (in.)[10]	Anchor Tension at Allowable Shear, T (lb.)[11]
WSW12x7	1,000	1,065	0.31	10,285	1,380	0.43	13,375	1,065	0.31	10,285	1,380	0.43	13,375
	4,000	1,065	0.31	10,285	1,380	0.43	13,375	1,065	0.31	10,285	1,380	0.43	13,375
	7,500	1,065	0.31	10,285	1,380	0.43	13,370	1,065	0.31	10,285	1,380	0.43	13,375
WSW18x7	1,000	2,475	0.31	13,865	2,980	0.4	16,675	2,475	0.31	13,865	3,225	0.43	18,040
	4,000	2,475	0.31	13,865	2,710	0.36	15,160	2,475	0.31	13,865	3,225	0.43	18,040
	7,500	2,475	0.31	13,865	2,395	0.32	13,395	2,475	0.31	13,865	2,910	0.39	16,280
WSW24x7[9]	1,000	5,515	0.29	22,710	5,515	0.32	22,710	5,515	0.29	22,710	5,515	0.32	22,710
	4,000	5,515	0.29	22,710	5,400	0.31	22,240	5,515	0.29	22,710	5,515	0.32	22,710
	7,500	5,515	0.29	22,710	4,950	0.29	20,390	5,515	0.29	22,710	5,515	0.32	22,710
WSW12x8	1,000	960	0.39	11,125	1,245	0.53	14,420	960	0.39	11,125	1,245	0.53	14,420
	4,000	960	0.39	11,125	1,245	0.53	14,420	960	0.39	11,125	1,245	0.53	14,420
	7,500	960	0.39	11,125	1,155	0.49	13,370	960	0.39	11,125	1,245	0.53	14,420
WSW18x8	1,000	2,430	0.39	16,245	2,490	0.42	16,675	2,430	0.39	16,245	2,925	0.50	19,560
	4,000	2,430	0.39	16,245	2,265	0.38	15,160	2,430	0.39	16,245	2,695	0.46	18,045
	7,500	2,430	0.39	16,245	2,000	0.34	13,395	2,430	0.39	16,245	2,435	0.41	16,280
WSW24x8	1,000	4,945	0.37	24,355	4,840	0.40	23,830	4,945	0.37	24,355	5,515	0.45	27,150
	4,000	4,945	0.37	24,355	4,515	0.37	22,240	4,945	0.37	24,355	5,360	0.44	26,395
	7,500	4,945	0.37	24,355	4,140	0.34	20,390	4,945	0.37	24,355	4,985	0.41	24,540
WSW12x9	1,000	790	0.43	10,310	1,020	0.60	13,335	790	0.43	10,310	1,020	0.60	13,335
	4,000	790	0.43	10,310	1,020	0.60	13,335	790	0.43	10,310	1,020	0.60	13,335
	7,500	790	0.43	10,310	1,020	0.60	13,335	790	0.43	10,310	1,020	0.60	13,335
WSW18x9	1,000	1,920	0.43	14,505	2,210	0.53	16,675	1,920	0.43	14,505	2,515	0.60	18,980
	4,000	1,920	0.43	14,505	2,010	0.48	15,160	1,920	0.43	14,505	2,390	0.57	18,045
	7,500	1,920	0.43	14,505	1,775	0.42	13,395	1,920	0.43	14,505	2,155	0.51	16,280
WSW24x9	1,000	4,190	0.43	23,275	4,290	0.46	23,830	4,190	0.43	23,275	5,035	0.54	27,985
	4,000	4,190	0.43	23,275	4,000	0.43	22,240	4,190	0.43	23,275	4,750	0.51	26,395
	7,500	4,190	0.43	23,275	3,670	0.40	20,390	4,190	0.43	23,275	4,415	0.48	24,540
WSW12x10	1,000	630	0.50	9,175	810	0.67	11,810	630	0.50	9,175	810	0.67	11,810
	4,000	630	0.50	9,175	810	0.67	11,810	630	0.50	9,175	810	0.67	11,810
	7,500	630	0.50	9,175	810	0.67	11,810	630	0.50	9,175	810	0.67	11,810
WSW18x10	1,000	1,715	0.49	14,440	1,980	0.59	16,675	1,715	0.49	14,440	2,225	0.67	18,715
	4,000	1,715	0.49	14,440	1,800	0.54	15,160	1,715	0.49	14,440	2,145	0.64	18,045
	7,500	1,715	0.49	14,440	1,590	0.48	13,395	1,715	0.49	14,440	1,935	0.58	16,280
WSW24x10	1,000	3,675	0.48	22,740	3,850	0.54	23,830	3,675	0.48	22,740	4,520	0.63	27,985
	4,000	3,675	0.48	22,740	3,590	0.50	22,240	3,675	0.48	22,740	4,265	0.60	26,395
	7,500	3,675	0.48	22,740	3,295	0.46	20,390	3,675	0.48	22,740	3,965	0.55	24,540
WSW12x11	1,000	575	0.55	9,190	735	0.73	11,810	575	0.55	9,190	735	0.73	11,810
	4,000	575	0.55	9,190	735	0.73	11,810	575	0.55	9,190	735	0.73	11,810
	7,500	575	0.55	9,190	735	0.73	11,810	575	0.55	9,190	735	0.73	11,810
WSW18x11	1,000	1,510	0.53	14,010	1,800	0.67	16,675	1,510	0.53	14,010	1,975	0.73	18,335
	4,000	1,510	0.53	14,010	1,635	0.61	15,160	1,510	0.53	14,010	1,945	0.72	18,045
	7,500	1,510	0.53	14,010	1,445	0.54	13,395	1,510	0.53	14,010	1,755	0.65	16,280
WSW24x11	1,000	3,295	0.53	22,485	3,490	0.58	23,830	3,295	0.53	22,485	4,100	0.69	27,985
	4,000	3,295	0.53	22,485	3,260	0.55	22,240	3,295	0.53	22,485	3,865	0.65	26,395

C. Christian Fynboe p.e.
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE: 12147	JOB NO.	18/30

GARAGE ROOF

$l = 16'$

$w = .045(12) = .54k$

$M = \frac{.54(16)^2}{8} 12 = 207k''$

SHEAR $207/2.4(1.0) = 78.5$

$5\frac{1}{2}'' \times 15''$ Gl

$l = 6'$

$w = .54k$

$M = \frac{.54(6)^2}{8} 12 = 29.2k''$

SHEAR $29.2/2.4(1.0) = 11$

$5\frac{1}{2}'' \times 9''$ Gl

FLOOR

$l = 6'$

$w = (.04 + .01 + .05)11 = 1.1k$

$M = \frac{1.1(6)^2}{8} 12 = 59.4k''$

SHEAR $59.4/2.4 = 25$

$5\frac{1}{2} \times 9''$ Gl

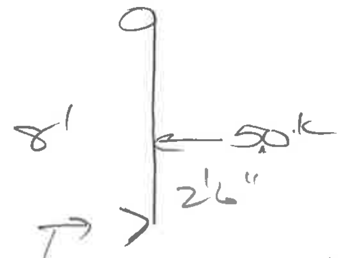
C. Christian Fynboe p.e.
CONSULTING ENGINEER

12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO. 19/30
BY:	DATE:	JOB NO. 17147	

GARAGE

h=8' — 5.0k HORIZ FROM CAR



R = 5(5.5/4) ... 3.4k

M = 3.4(2.5)12 ~ 103k"

Sreq = 103/1.6(1.05) ~ 61.3

(5) 2x6 DF#2

HANGER
HU88 —
2.1(1.6) - 3.4 - OK

USE HSS 8x2x1/4 BUMPER

l=21' GARAGE FLOOR

ω = (.04+.01+.05) = 0.1k

M = 0.1(21)²/8 12 ~ 66.1k"

Sreq ~ 66.1/2.4 = 28.6 in³

P = 3.0k ON 4.5" Φ — THIS WILL SPREAD ONTO (3) JOISTS W/4" conc

M = [(.05+.01)21²/8 + (3.0/3)21/4] 12 ~ 102.7k"

Sreq 102.7/2.4 = 42.8 in³   1 3/4"x14" LVL OK

Christian C. Fynboe p.e.
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	20/30

$l = 12'$

$w = .05(11+5) + 1.1 + .54 = 2.44^k$

$M = \frac{2.4(12)^2}{8} 12 = 518^{k''}$

$S_{NEED} = 518/21.6 = 24^{in^3}$

W 10x33

$P = 2.44(21/2) = 25.6^k$ USE (3) 4" PIPE PILES

$h = 20'$ USE HSS 8x8x1/4

CAP = 132^k – OK

HSS9-HSS8

Table 4-4 (continued)
Available Strength in Axial Compression, kips
Square HSS

F_y = 46 ksi

Shape	HSS9×9×				HSS8×8×							
	3/16[c]		1/8[c]		5/8		1/2		3/8		5/16	
t_{design}, in.	0.174		0.116		0.581		0.465		0.349		0.291	
lb/ft	22.2		15.0		59.3		48.9		37.7		31.8	
Design	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Effective length, KL (ft), with respect to least radius of gyration, r_y												
0	134	201	64.4	96.8	452	679	372	559	286	431	241	363
6	132	198	63.8	95.9	434	653	358	538	276	415	233	350
7	131	197	63.6	95.6	428	644	353	531	273	410	230	346
8	130	196	63.4	95.2	421	633	348	523	269	404	226	340
9	130	195	63.1	94.8	414	622	342	513	264	397	223	335
10	129	193	62.8	94.4	405	609	335	503	259	389	219	329
11	128	192	62.4	93.9	396	596	328	492	254	381	214	322
12	126	190	62.1	93.3	386	581	320	481	248	372	209	315
13	125	188	61.7	92.7	376	565	311	468	242	363	204	307
14	124	186	61.2	92.0	365	549	303	455	235	353	199	299
15	122	184	60.7	91.3	354	532	294	441	228	343	193	290
16	120	181	60.2	90.5	342	514	284	427	221	333	187	282
17	119	178	59.7	89.7	330	496	275	413	214	322	181	273
18	117	176	59.1	88.8	318	478	265	398	207	311	175	263
19	115	173	58.5	87.9	306	459	255	383	199	299	169	254
20	113	170	57.8	86.9	293	440	245	367	191	288	162	244
21	111	166	57.1	85.9	280	421	234	352	184	276	156	234
22	108	163	56.4	84.8	267	402	224	337	176	264	150	225
23	106	159	55.6	83.6	255	383	214	321	168	253	143	215
24	103	155	54.8	82.4	242	364	203	306	160	241	137	205
25	101	151	54.0	81.1	230	345	193	290	153	229	130	195
26	97.7	147	53.1	79.8	217	326	183	275	145	218	124	186
27	94.7	142	52.1	78.3	205	308	173	260	137	206	117	176
28	91.6	138	51.1	76.9	193	290	163	246	130	195	111	167
29	88.4	133	50.1	75.3	182	273	154	231	123	184	105	158
30	84.9	128	49.0	73.7	170	256	145	217	116	174	99.1	149
32	77.3	116	46.7	70.2	149	225	127	191	102	153	87.5	131
34	70.0	105	44.2	66.4	132	199	113	169	90.2	136	77.5	116
36	62.9	94.5	41.4	62.2	118	177	100	151	80.5	121	69.1	104
38	56.5	84.9	38.4	57.7	106	159	90.2	136	72.2	109	62.0	93.2
40	51.0	76.6	35.0	52.6	95.6	144	81.4	122	65.2	98.0	56.0	84.1
Properties												
A_g, in.²	6.06		4.09		16.4		13.5		10.4		8.76	
$I_x = I_y$, in.⁴	78.2		53.5		146		125		100		85.6	
$r_x = r_y$, in.	3.59		3.62		2.99		3.04		3.10		3.13	

ASD	LRFD
$\Omega_c = 1.67$	$\phi_c = 0.90$

[c] Shape is slender for compression with F_y = 46 ksi.

HSS8-HSS7

Table 4-4 (continued)
Available Strength in Axial Compression, kips
Square HSS

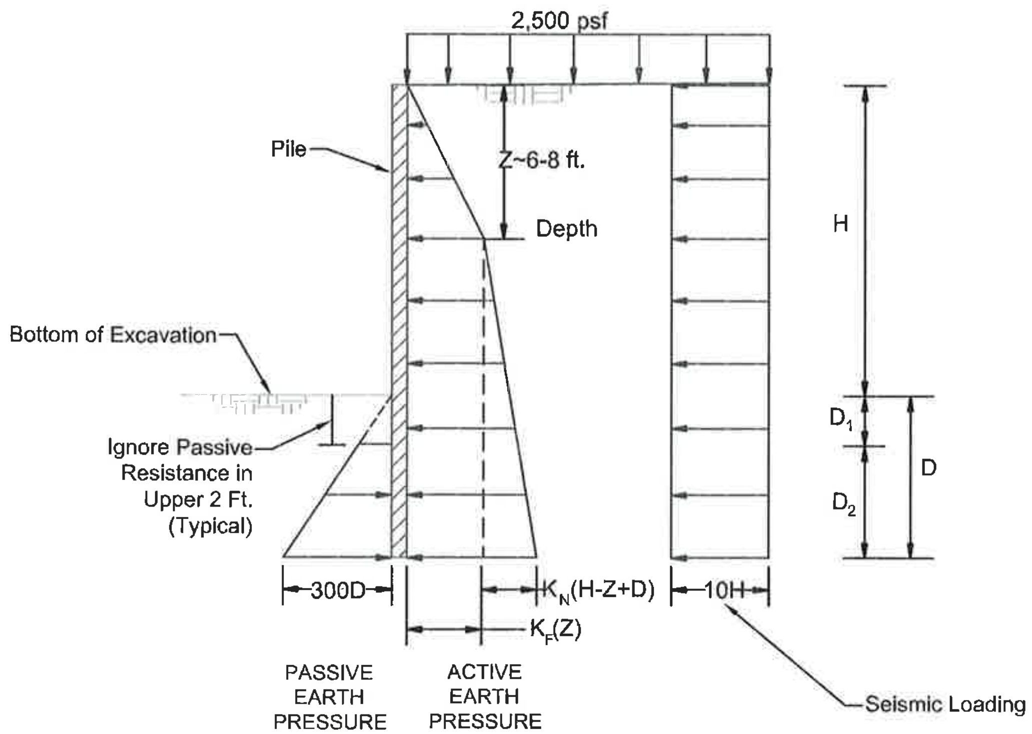
F_y = 46 ksi

Shape	HSS8×8×						HSS7×7×					
	1/4		3/16[c]		1/8[c]		5/8		1/2		3/8	
t_{design}, in.	0.233		0.174		0.116		0.581		0.465		0.349	
lb/ft	25.8		19.6		13.3		50.8		42.1		32.6	
Design	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$	P_n/Ω_c	$\phi_c P_n$
	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD	ASD	LRFD
Effective length, KL (ft), with respect to least radius of gyration, r_y												
0	196	294	130	195	63.0	94.7	386	580	320	480	247	371
6	189	284	127	191	62.2	93.5	366	550	304	457	235	354
7	186	280	126	190	61.9	93.0	359	540	298	448	231	348
8	184	276	125	188	61.6	92.5	351	528	292	439	227	341
9	181	272	124	186	61.2	92.0	343	515	285	429	222	333
10	177	267	122	184	60.8	91.3	333	501	278	417	216	325
11	174	261	121	182	60.3	90.6	323	486	270	405	210	316
12	170	255	119	179	59.7	89.8	313	470	261	393	204	306
13	166	249	117	176	59.2	88.9	302	453	252	379	197	296
14	162	243	115	174	58.5	88.0	290	436	243	365	190	286
15	157	236	113	170	57.9	87.0	278	418	233	350	183	275
16	152	229	111	167	57.2	85.9	266	399	223	336	175	264
17	147	222	109	163	56.4	84.7	253	381	213	320	168	252
18	143	214	106	159	55.6	83.5	241	362	203	305	160	241
19	137	207	103	155	54.7	82.2	228	343	193	290	152	229
20	132	199	100	151	53.7	80.8	215	324	182	274	145	217
21	127	191	97.0	146	52.7	79.3	203	305	172	259	137	206
22	122	183	93.0	140	51.7	77.7	191	287	162	244	129	194
23	117	175	89.1	134	50.6	76.0	179	268	152	229	122	183
24	111	168	85.2	128	49.4	74.3	167	251	143	214	114	172
25	106	160	81.3	122	48.2	72.4	155	233	133	200	107	161
26	101	152	77.4	116	46.9	70.5	144	216	124	186	100	150
27	96.0	144	73.6	111	45.5	68.4	133	201	115	173	92.9	140
28	91.0	137	69.8	105	44.1	66.2	124	186	107	161	86.4	130
29	86.0	129	66.1	99.3	42.6	64.0	116	174	99.6	150	80.6	121
30	81.2	122	62.5	93.9	41.0	61.6	108	162	93.1	140	75.3	113
32	71.8	108	55.4	83.2	37.5	56.4	95.0	143	81.8	123	66.2	99.4
34	63.6	95.6	49.0	73.7	33.7	50.6	84.1	126	72.4	109	58.6	88.1
36	56.7	85.3	43.7	65.7	30.0	45.2	75.1	113	64.6	97.1	52.3	78.6
38	50.9	76.5	39.3	59.0	27.0	40.5	67.4	101	58.0	87.2	46.9	70.5
40	46.0	69.1	35.4	53.2	24.3	36.6	60.8	91.4	52.3	78.7	42.3	63.6
Properties												
A_g, in.²	7.10		5.37		3.62		14.0		11.6		8.97	
$I_x = I_y$, in.⁴	70.7		54.4		37.4		93.4		80.5		65.0	
$r_x = r_y$, in.	3.15		3.18		3.21		2.58		2.63		2.69	

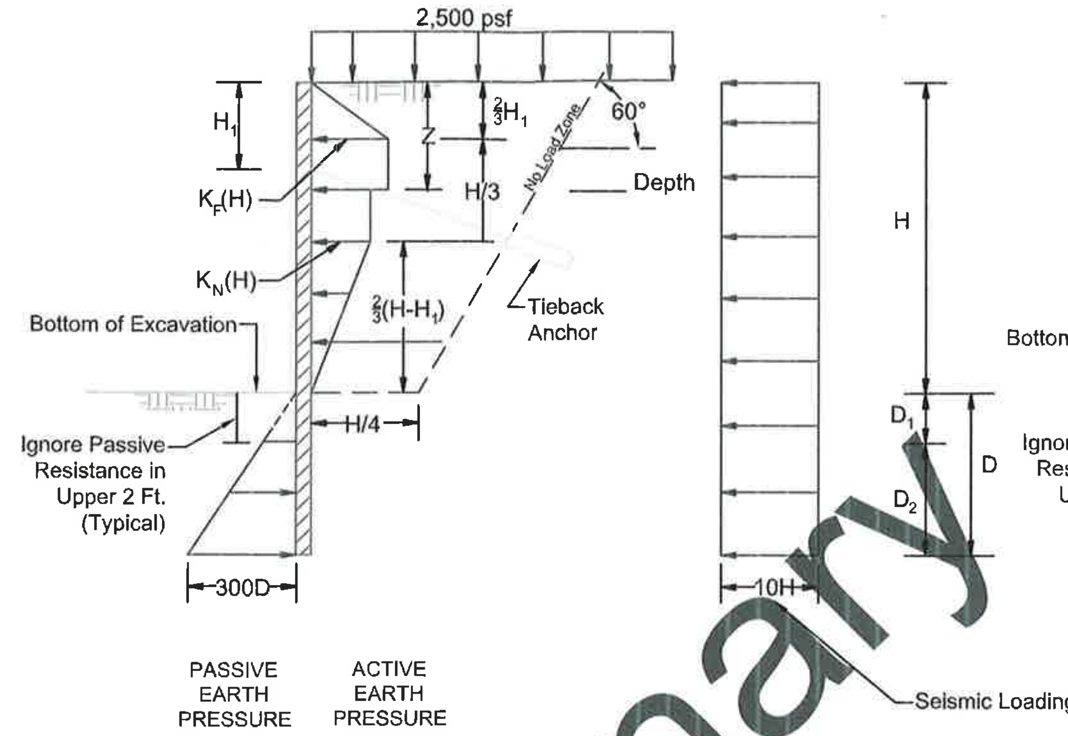
ASD	LRFD
$\Omega_c = 1.67$	$\phi_c = 0.90$

[c] Shape is slender for compression with F_y = 46 ksi.

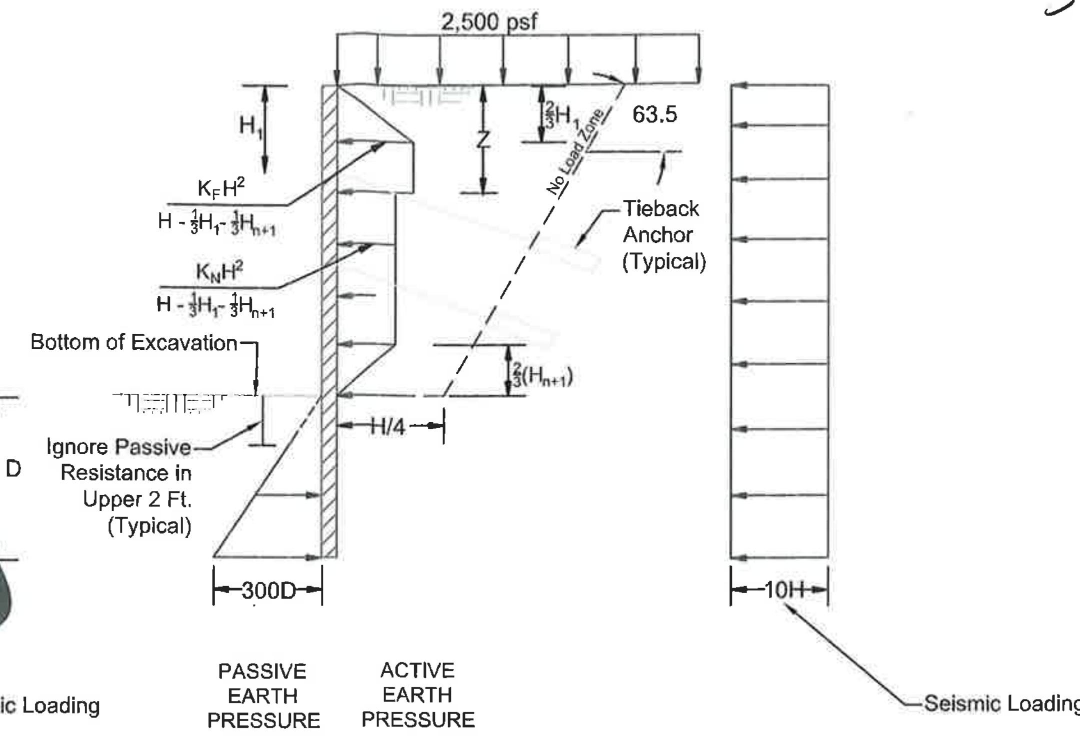
Recommended Earth Pressures for Cantilever Wall



Recommended Earth Pressures for Single Braced Wall



Recommended Earth Pressures for Multiple Braced Wall



NOTES

1. All Earth pressures are in units of pounds per square foot.
2. Wall embedment (D) should consider kickout resistance. Embedment should be determined by satisfying horizontal static equilibrium about the bottom of the pile. Minimum recommended embedment is 5 feet.
3. Passive pressures include FS = 1.5.
4. Surface surcharge of 2,500 psf accounts for the slope above the proposed excavation.
5. The recommended pressure diagrams are based on a continuous wall system. If soldier piles with laggings are used, apply active pressure over the width of the soldier piles below bottom of excavation and apply passive resistance over twice the width of the piles or the spacing of the piles, whichever is smaller.
6. Free drainage assumed behind the wall.
7. Design lagging for 50% of lateral earth pressure if span is 8 ft or less.
8. Allowable vertical soldier pile capacity:
   Skin Friction = 1.0 ksf
   End Bearing = 5 ksf
   (After loose/disturbed soil at bottom of hole is removed and if piles are utilized)
9. Allowable transfer load for a 6-inch diameter soil anchor that is gravity grouted = 2 klf
10. Lateral earth pressure for surcharges due to traffic, construction equipment, and adjacent foundations should be determined based on Figure 5.
11. Seismic surcharge should be applied for permanent structures where required by code.

LEGEND

- H Excavation Height (Ft.)
- H_1 Depth to Uppermost Brace Level (Ft.)
- H_s Equivalent Surcharge Height (Ft.) H_s minimum = 2 Feet
- H_{n+1} Distance from Base of Excavation to Lowermost Brace Level
- D, D_1, D_2 Embedment Depths (Ft.)
- Z Depth of Fill/Weathered Soil, About 6-8 ft.
- K_{FA} Active Earth Pressure - Fill/Weathered Zone
- K_{FO} At-Rest Earth Pressure - Fill/Weathered Zone
- K_{NA} Active Earth Pressure - Native
- K_{NO} At-Rest Earth Pressure - Native

RECOMMENDED EARTH PRESSURES

System	Depth (Ft.)	Above		Below	
		K_{FA}	K_{FO}	K_{NA}	K_{NO}
Cantilever/Single Brace	Z	32	51	30	46
Multiple Brace	Z	22	34	20	31

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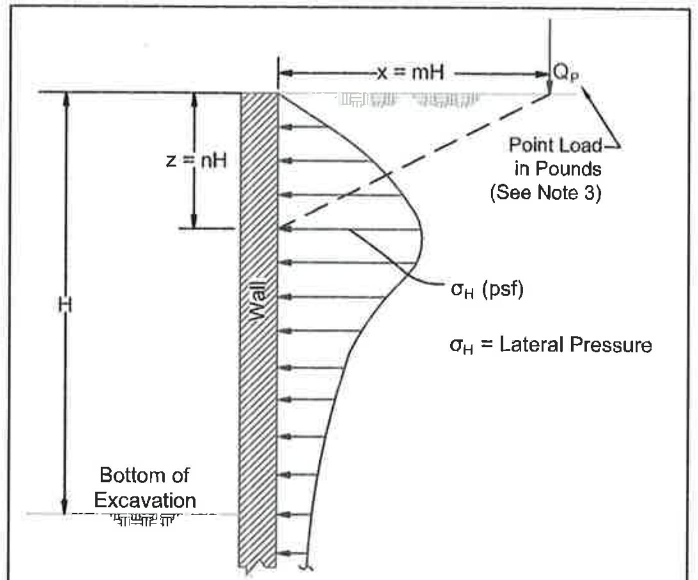
Lateral Earth Pressures

Proposed Single Family Residence
6303 West Mercer Way
Mercer Island, Washington

DocID: FatBoy.MercerWay.LEP | June, 2017 | Figure 1

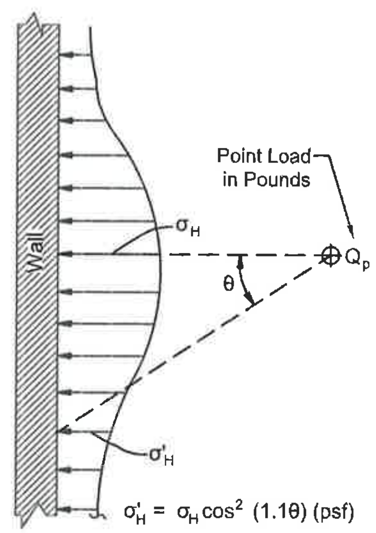
23/30



ELEVATION VIEW

For $m \le 0.4$: $\sigma_H = 0.28 \frac{Q_P}{H^2} \frac{n^2}{(0.16 + n^2)^3}$ (psf) (See Note 3)

For $m > 0.4$: $\sigma_H = 1.77 \frac{Q_P}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3}$ (psf)

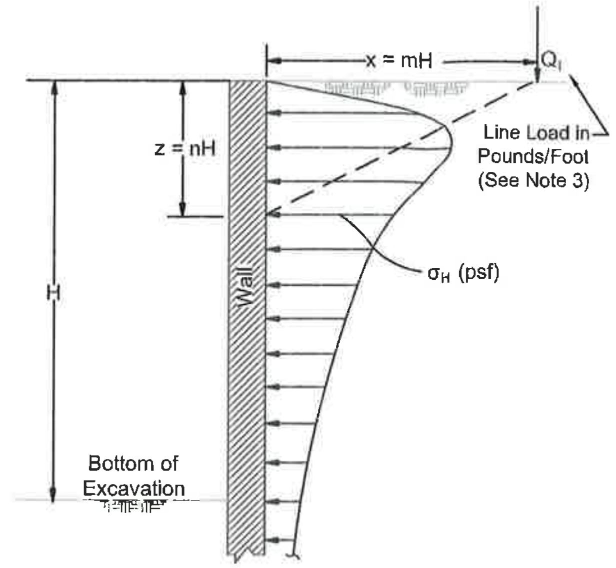


$\sigma'_H = \sigma_H \cos^2(1.1\theta)$ (psf)

PLAN VIEW

A) LATERAL PRESSURE DUE TO POINT LOAD i.e. SMALL ISOLATED FOOTING OR WHEEL LOAD

(NAVFAC DM 7.2, 1986)



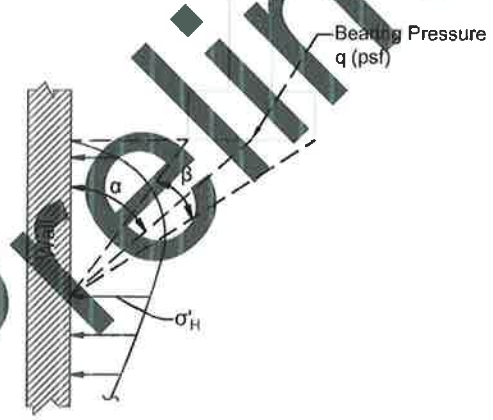
ELEVATION VIEW

For $m \le 0.4$: $\sigma_H = 0.20 \frac{Q_l}{H^2} \frac{n^2}{(0.16 + n^2)^2}$ (psf) (See Note 3)

For $m > 0.4$: $\sigma_H = 1.28 \frac{Q_l}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^2}$ (psf)

B) LATERAL PRESSURE DUE TO LINE LOAD i.e. NARROW CONTINUOUS FOOTING PARALLEL TO WALL

(NAVFAC DM 7.2, 1986)

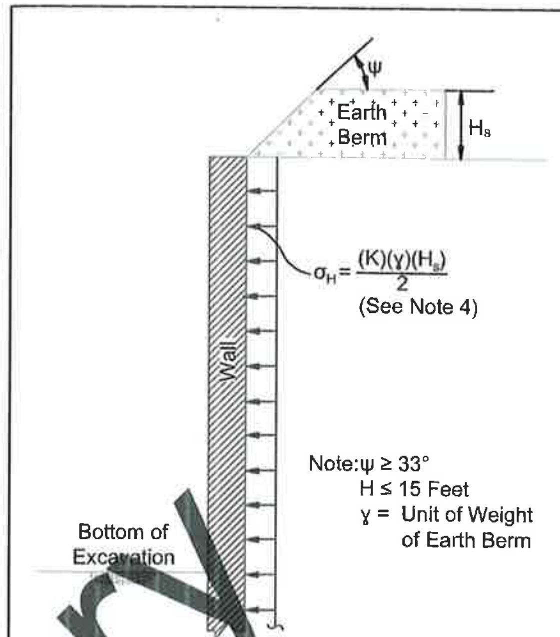


$\sigma_H = \frac{2q}{\pi}(\beta - \sin\beta \cos 2\alpha)$ (psf)

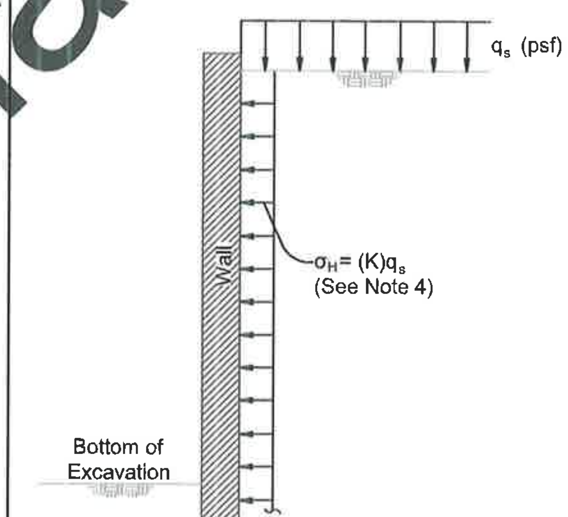
(Where β is in radians)

C) LATERAL PRESSURE DUE TO STRIP LOAD

(DERIVED FROM FANG, *FOUNDATION ENGINEERING HANDBOOK*, 1991)



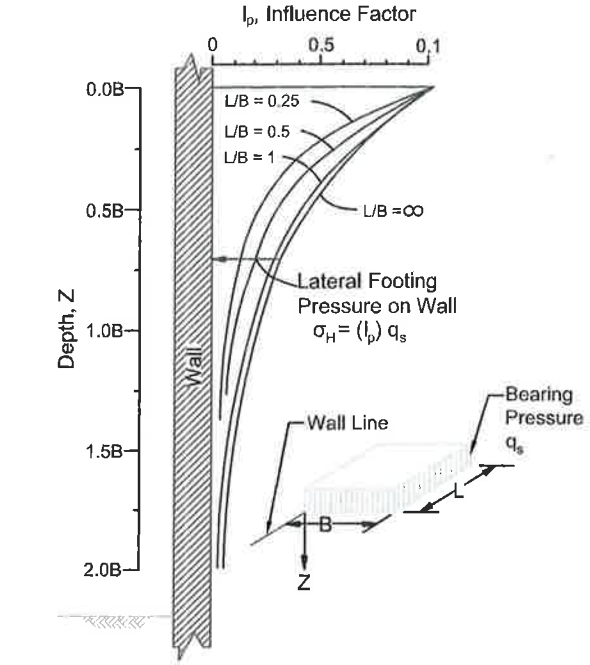
EARTH BERM



UNIFORM SURCHARGE

D) LATERAL PRESSURE DUE TO EARTH BERM OR UNIFORM SURCHARGE

(DERIVED FROM POULOS AND DAVIS, *ELASTIC SOLUTIONS FOR SOIL AND ROCK MECHANICS*, 1974; AND TERZAGHI AND PECK, *SOIL MECHANICS IN ENGINEERING PRACTICE*, 1967)



E) LATERAL PRESSURE DUE TO ADJACENT FOOTING

(DERIVED FROM NAVFAC DM 7.2, 1986; AND SANDHU, *EARTH PRESSURE ON WALLS DUE TO SURCHARGE*, 1974)

NOTES

1. FIGURES ARE NOT DRAWN TO SCALE.
2. APPLICABLE SURCHARGE PRESSURES SHOULD BE ADDED TO THE APPROPRIATE PERMANENT WALL LATERAL EARTH AND WATER PRESSURE.
3. IF POINT OR LINE LOADS ARE CLOSE TO THE BACK OF THE WALL SUCH THAT m ≤ 0.4, IT MAY BE MORE APPROPRIATE TO MODEL THE ACTUAL LOAD DISTRUBUTION (i.e., DETAIL E) OR USE MORE RIGOROUS METHODS.
4. Ka = 0.25, Ko = 0.4

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Lateral Earth Pressure Surcharges

Proposed Single Family Residence
6303 West Mercer Way
Mercer Island, Washington

DocID: FatBoy.MercerWay.LEP	June, 2017	Figure 2

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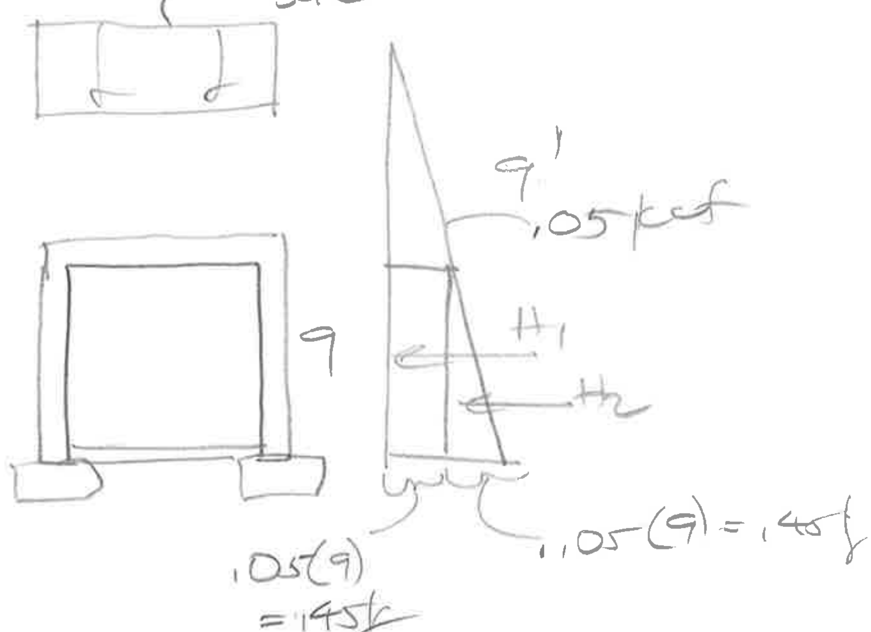
WALKWAY VAULT

$W_{SIL} = 8(.12) = .96 k/ft$



WALLS

$H_1 = .45(9) - 4.1k$

$H_2 = .45(9)/2 - 2.0k$

$M = \left(\frac{.45(9)^2}{8} + .1283(2)(9)\right) 12 = 82.9 k''$

4.6 2.3

$R_U = \frac{82.9(1.6)}{.9(12)(5)^2} = .49 ksi$ $\rho = .0094$

$A_S = .0094(12)5 = .56 in^2/ft = 6½''$

#6 @ 9'' o/c

LID

$M = \frac{.96(8)^2}{8} 12 - 92.2 k''$

$R_U = \frac{92.2(1.6)}{.9(12)(14)^2} = .14 ksi$

$A_S = .00332(12)14 - .46$

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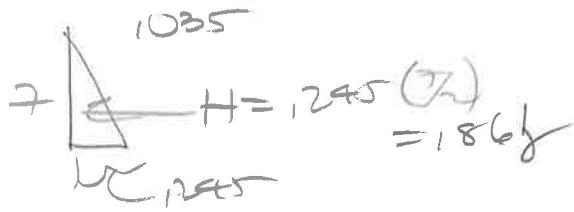
PROJECT:			SHEET NO. 25/30
BY:	DATE:	JOB NO. 17147	



$M = .86(2.33)12$

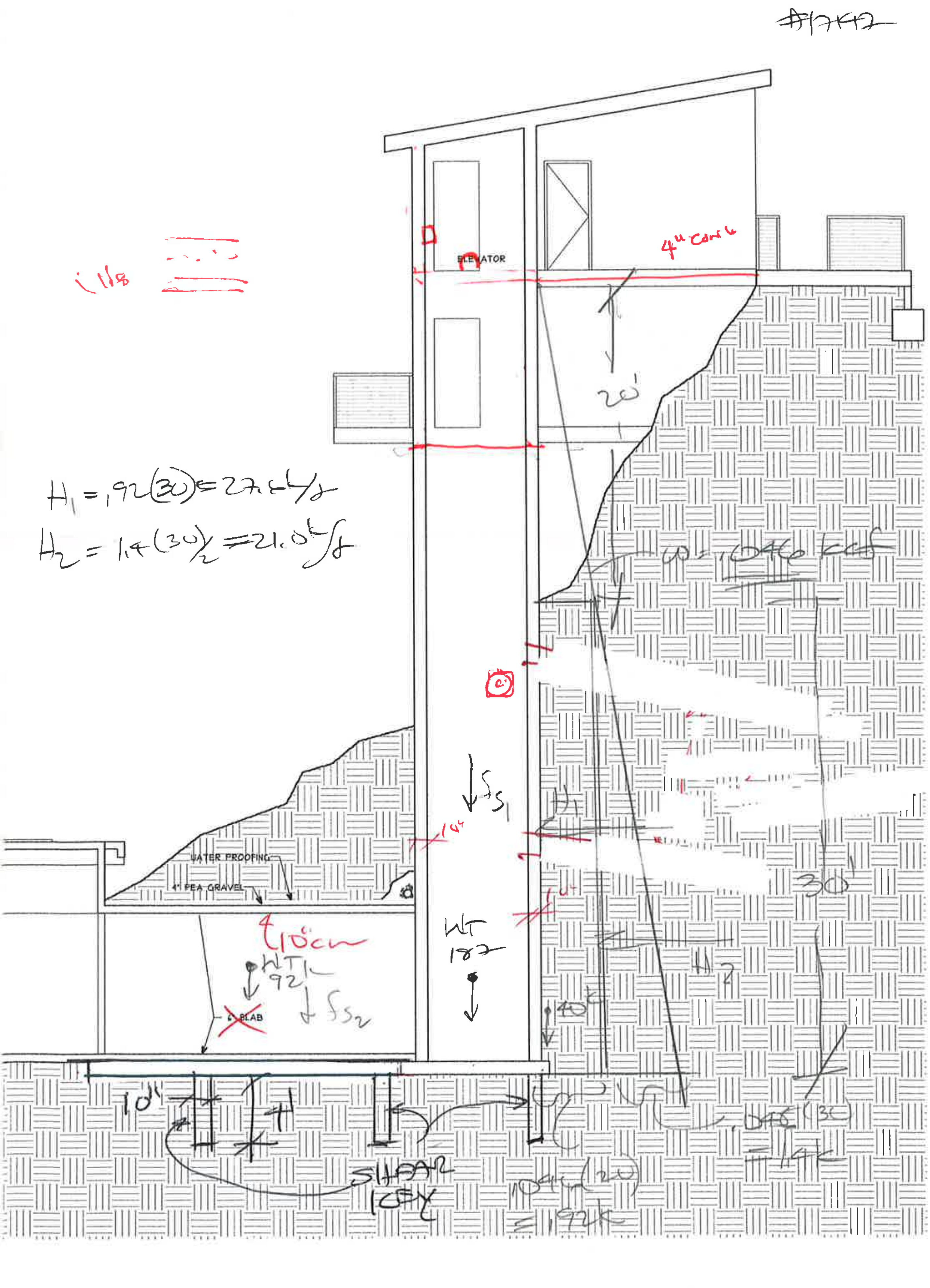
ON RETAINING

$= 24.0k''$

$$R_u = \frac{24(1.6)}{.9(12)10^2} = .035 ksi$$

$$A_s = .00333\left(\frac{35}{200}\right)1.5(12)10 = .10 in^2$$

#5 @ 12"



11150 Gravelly Lake Drive SW
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Phone: 253/581-6000
Website: www.jgarch.net

PROJECT: BOYLE MERCER ISLAND

DRAWING TITLE: BUILDING SECTION

DATE: DATE

REVISED

SHEET NO. A3.2

OF

PRELIMINARY

SCALE FACTOR: 48

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PROJECT:			SHEET NO. 27/30
BY:	DATE:	JOB NO. 17147	

CHECK SHAFT STABILITY

$H_{1\,TOTAL} = 27.6(9) = 248^k$

$H_{2\,TOTAL} = 21(9) = 189^k$

$\Sigma = 437$

$Wt_{SHAFT} = 1.0/12(.15)36(40) + .01(36)20 = 187^k$

$Wt_{VAULT} = 14/12(.15)29(20) + .12(8)20 = 91.7^k$

$Wt_{FTG} = 1.25(.15)11(29) = 59.8^k$

$Wt_{SOIL} = .12(11)30 = 39.6^k$

$\Sigma = 378^k$

$f_{s1} = 233^k$
$f_{s2} = 124^k$
$f_{sk} = 97.2^k$

$\phi = 13(1.5)/ = 1.45$ t_{FS}

14437

→ $378(.45) + 233 + 124 + 97.2 = 624^k$

$OT = 92(10) + 24.5(187) + 59.8(14.5) + 40(26) + 233(24.5) + 124(10)$

$(248)15 + 189(6)$

$= 2.6 < 1.5$

$SLIDING = 624/437 = 1.43 < 1.5$

OK CLOSE (USE 9' OF WALL WIDTH - ONLY 8') SO CONSERVATIVE

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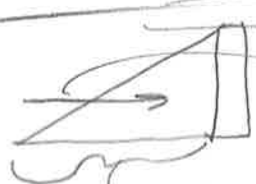
PROJECT:			SHEET NO. 28/30
BY:	DATE:	JOB NO. 17447	

SHEAR KEY

.3(115) = .45 kcf PASSIVE



$W = .45(4) = 1.8^k$

$f_{SK} =$

$W_p = 1.8(4/2)9 = 32.4^k$

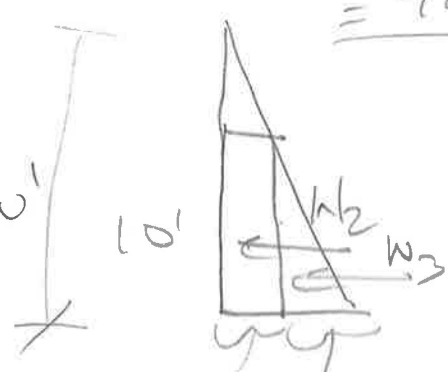
$f_{SK} = 32.4(3) = 97.2^k$ (3 SHEAR KEYS)

SIDEWALL FRICTION

$f_{S2} = 276(.45) = \underline{124^k}$

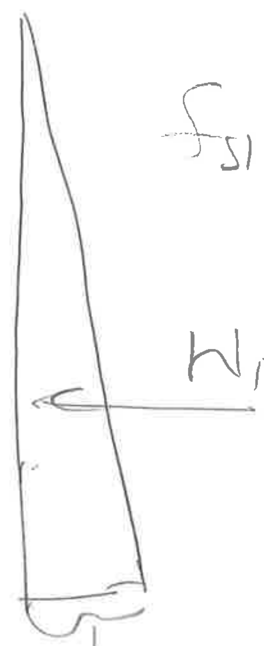
$W_2 = .46(10)20(2) = 184$

$W_3 = .46(10)/2\,(20)2 = 92$



.046(10) = .46

.46(10) = .46



$f_{S1} = 518(.45) = \underline{233^k}$

$W_1 = 1.15(20)9(2) = 518^k$

.046(25) = 1.15

$\Sigma = 518 + 184 + 92 = 794^k(.45) = 357^k$

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PROJECT:			SHEET NO. 29/30
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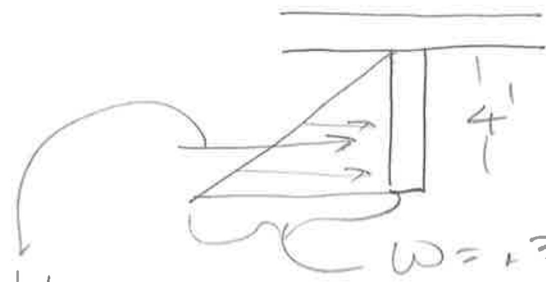
SHEAR KEY



$w = .3(4) = 1.2\ k/ft$

$H = 1.2(4/2) = 2.4^k$

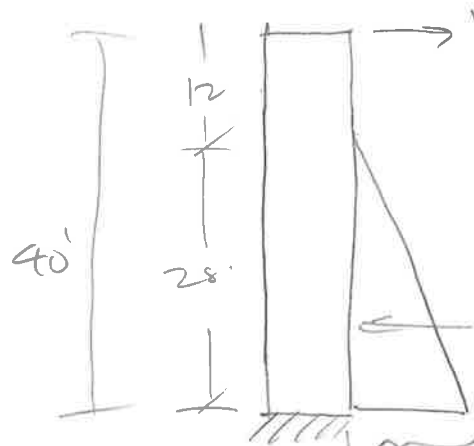
$M_U = 1.6(2.4)4(2/3)12 = 123\ k''$

$S_{REQ} = \frac{123}{.9(12)5^2} = .45\ ksi$

$A_s = .0052(12)5 = .149\ in^2$

#6 @ 10" o.c. CENTERED

SHAFT



$V = 4.0^k$

$M_U = 4(12+6)12 = 864\ k''$

$R_U = \frac{864(1.6)}{.9(10)93^2} = .0177$ LOW

OKAY AS DESIGNED

$H = 8.4(28/2) = 118^k$ OK

$.3(28) = 8.4$

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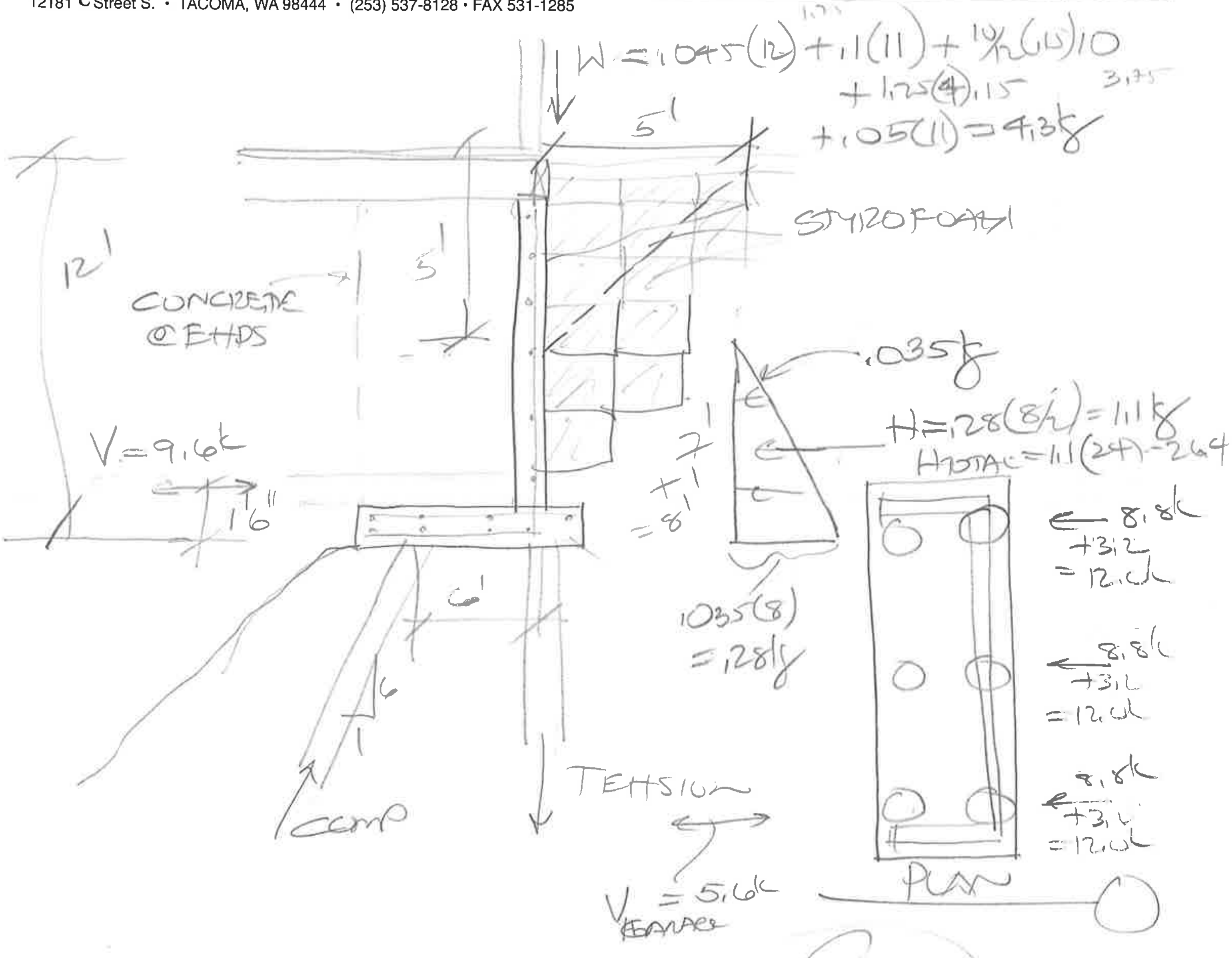

$$T \text{ or } C = \frac{8.8(3)2.3 + 9.6(1.5)}{6} = \frac{12.5k}{3} = 4.2k$$

$$SHEAR = 12.0k$$

6.1 / 6 / 1

$$\text{COMPRESSION IN BATTER PILE} = 4.2 + 12(6.1) = 77.4k$$

$$+ 1.25(4)\frac{24}{3}(1.15) = 6k \quad \text{ADD EXTRA 2 PILES}$$

$$\Sigma = 83.4k \qquad 83.4(3/4) = 62k$$