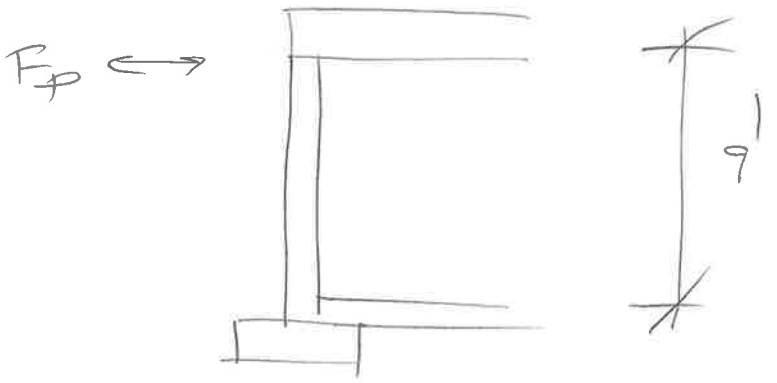
christian fynboe pc
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

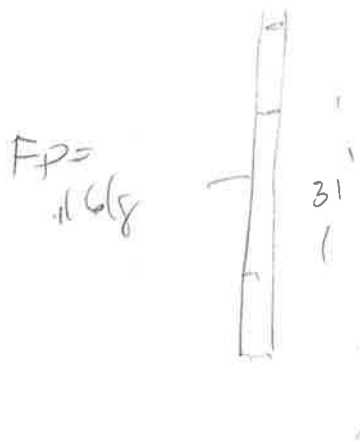
PROJECT: BOYE			SHEET NO. 12
BY: CF	DATE: 9/19/19	JOB NO. 17147	

P29 S2.1



$F_p = \frac{(0.4)1.94}{1.4}\left(1+\frac{32}{100}\right)(19/12).15(4.5)0.8 = .166\,k_{ip}(12.11-1)$

DIST ⊥ TO WALL



$w = .166(31)/2/4 = .128$ OK

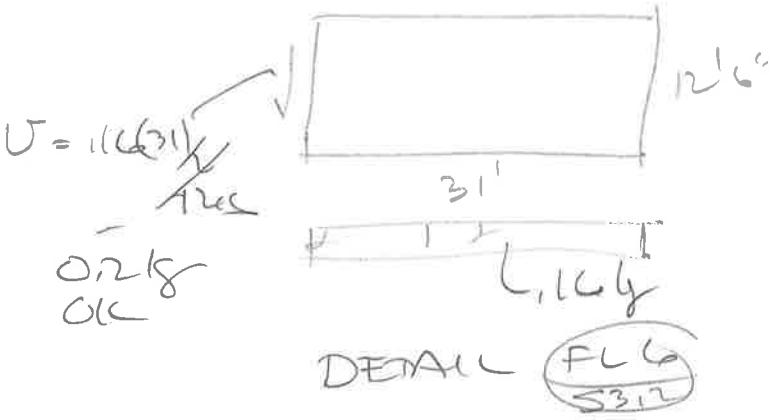
DETAIL FL7 / S3.2 ADD (3) 1/4"x4 1/2" SDS

CAP = 352(3).6 = 1680lb > .166(24) = 3201b OK

christian fynboe pe
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	22

ODIST II TOWAL



$U = \frac{1.16(31)}{Area}$

0.21g OK

WORST CASE

$F_p = 1.16(10) = 1.16k$

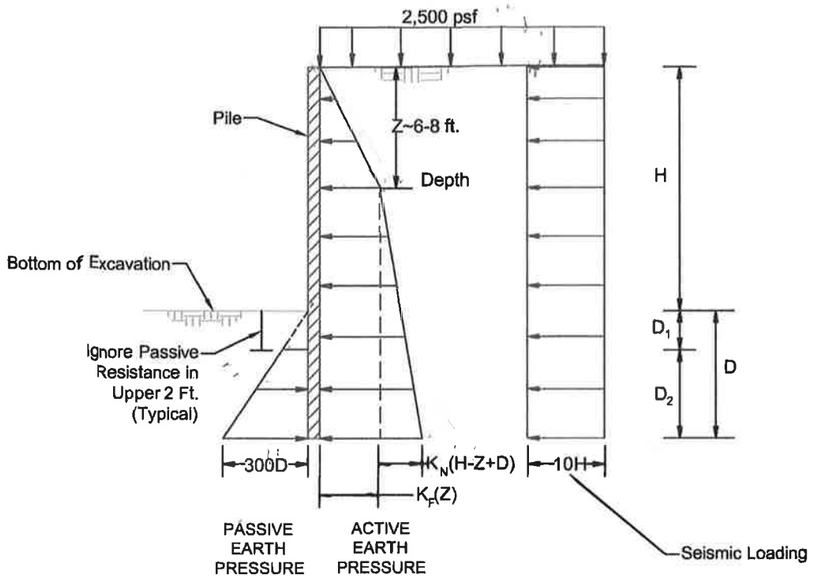
CAP HEAD + (3) 1/4" ϕ x 4 1/2" STDS

$= 940 + 3(320)1.6$

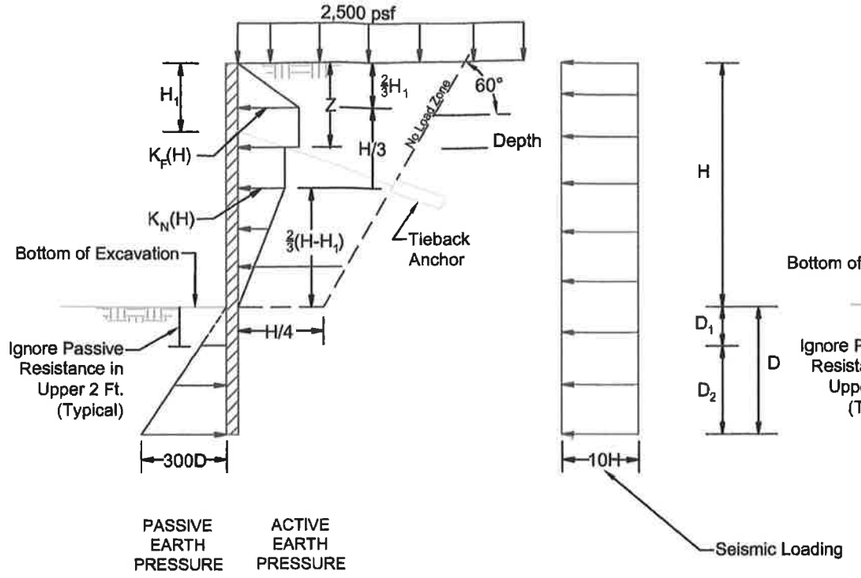
$= 2620lb > 1600lb$ OK

#17447 3R

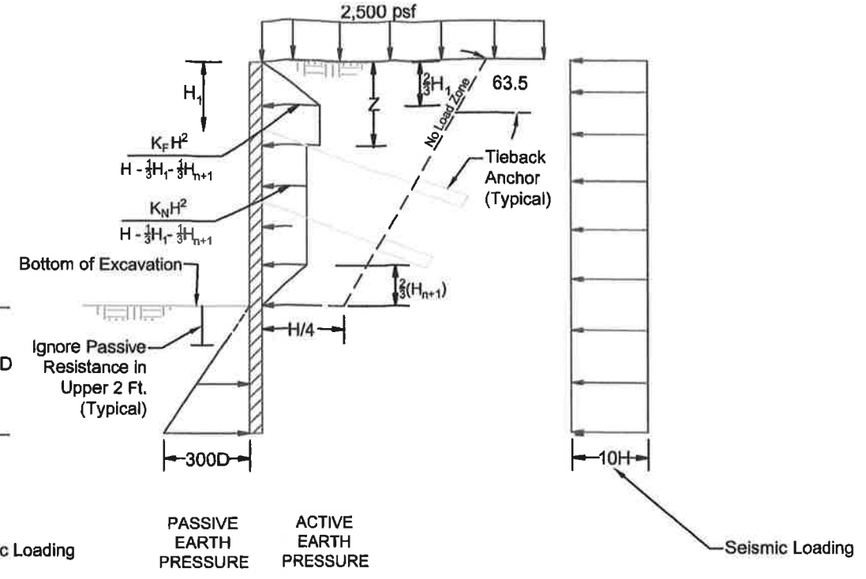
Recommended Earth Pressures for Cantilever Wall



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 pressute 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 30% 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

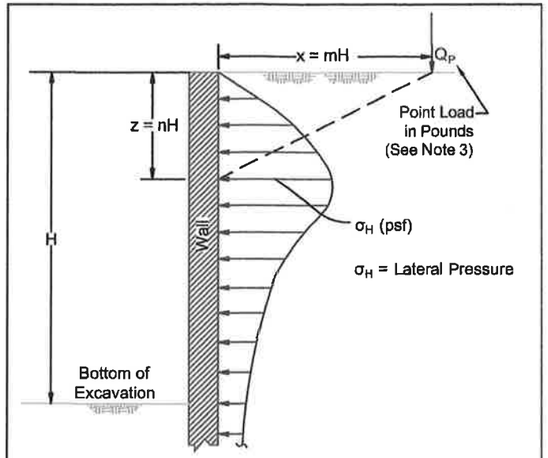
GEORESOURCES
earth science & geotechnical engineering
5007 Pacific Hwy E., Suite 16 | Fife, WA 98424 | 253.896.1011 | www.georesources.rocks

Lateral Earth Pressures

Proposed Single Family Residence
3603 West Mercer Way
Mercer Island, Washington

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

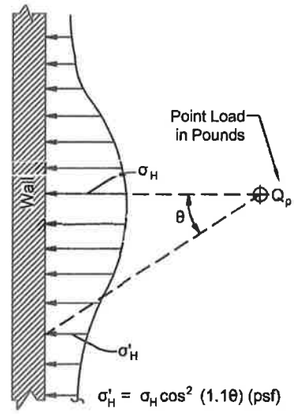
#17197 4R



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)

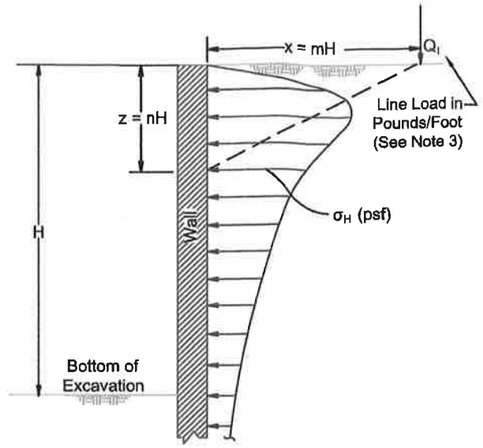
For $m > 0.4$: $\sigma_H = 1.77 \frac{Q_P}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3}$ (psf)



PLAN VIEW

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

(NAVFAC DM 7.2, 1986)



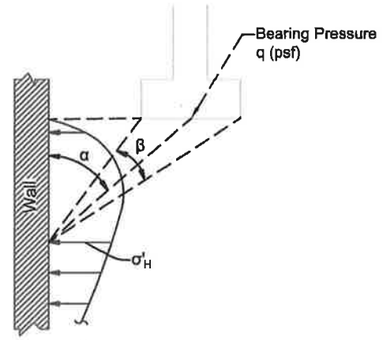
ELEVATION VIEW

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)

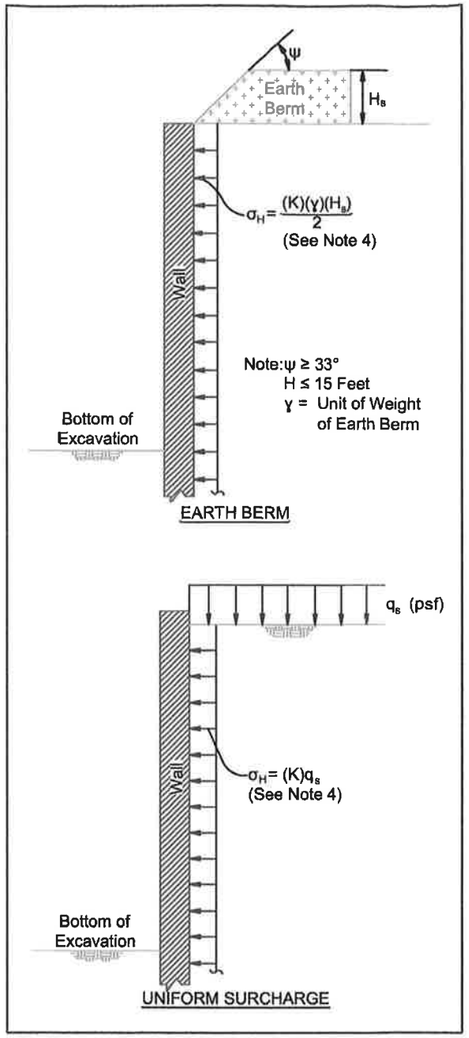


$\sigma_H = \frac{2q}{\pi}(\beta - \sin\beta \cos 2\alpha)$ (psf)

(Where β is in radians)

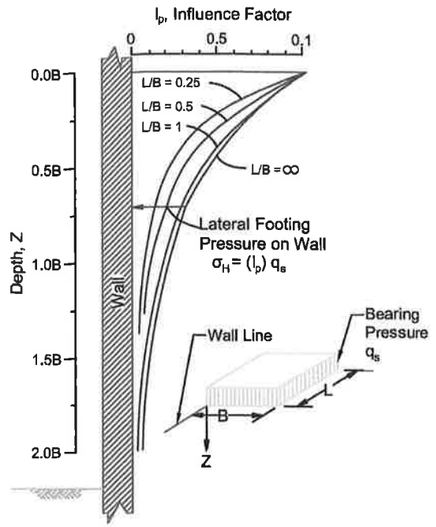
C) LATERAL PRESSURE DUE TO STRIP LOAD

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



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

GEORESOURCES
earth science & geotechnical engineering
5007 Pacific Hwy E., Suite 16 | Fife, WA 98424 | 253.896.1011 | www.georesources.rocks

Lateral Earth Pressure Surcharges

Proposed Single Family Residence
3603 West Mercer Way
Mercer Island, Washington

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

$\phi = 1$

PLATE 98.0'

8'-0"

GARAGE F.F. 90.0'

9'-1"

ADU F.F. 80.5'

28'-0 1/2"

SECOND FLOOR F.F. 52.44'

10'-2 3/4"

FIRST FLOOR F.F. 42.23'

10'-3 3/4"

ABE = 31.0'

BASEMENT F.F. 32.0'

SIDE INSULATION

$H = .36(1\%) \cdot 20 = 43.2$

$h = .18(27/48 = 87.5$

27

$.10(27) = .18$

$.10(12) = .12$

33'-0"
33.5 X 33 = 1,106

HEIGHT LIMIT 67.0'

ENERGY CREDIT OPTION 6 SOLAR PANELS

HEAT RECOVERY VENTILATOR, TYP.

3 12

12 12

TRIM PER OWNER, TYP.

DECK

3'-0"

PATIO

FINISH PER OWNER TO REPLICATE CONCRETE APPEARANCE HARDIBOARD OR EQUAL

EL = 30.83'
EL = 30.0'

MID POINT= 33.5'

23'-0"
43 x 23 = 989

RIDGE SKYLIGHT

SCREENED AIR VENT AT LOWER END OF UNCONDITIONED SPACE

14.73'

14.73'

12.23'

MID POINT 13.0'

WINE ROOM PARTIALLY BURIED

FLOOR = 12.23'

B.O. FTG. 31.5'

B.O. FTG. 35.0'

B.O. FTG. 32.5'

SHORING TO EXISTING GRADE HEIGHT

B.O. FTG. 30.5'

BSMT = 32.0'

40'

50'

60'

W_2

S_{S2}

W_3

W_1

S_{S1}

H_1

H_2

H_3

30

ELEVATOR SHAFT UNDERGROUND

EXISTING GRADE PER CIVIL = 62.67' AT CORNER

SOIL NAILS PER STRUCTURAL

VERIFY FOOTING DEPTH COORDINATE WITH ELEVATOR MANUFACTURER FOR HOISTWAY RECESS REQUIREMENT

EL = 41.54'
EL = 40.31'

BASED ON 8" ELEVATOR PIT

.30k SEISMIC

0.50k

$.03(30) = 0.9k$

=

REVEGETATE THE SLOPE WITH PLANTS IN KIND WITH THE REST OF THE DISTURBED SOILS

ABE = 74.0'

8'-0"
48 X 8 = 544

14'-0"
18.5 X 14 = 1,099

1.75 12

PROPERTY LINE

DECK

DRIVEWAY

3'-0"

GRADE SLOPES UP TO DRIVEWAY

STEP FLASHING

39'-11"

40'-0" MAX.

3'-0"

80'

EL = 78.25'
EL = 77.0'

OPEN BELOW

MID POINT = 79.5'

P.T. BEAM AND TRIM

STEEL BEAM PER STRUCTURAL

70'

MID POINT = 68'

2H A2.1 SOUTH ELEVATION

SCALE: 1/4" = 1'-0"

FS = 1.2 or 1.1 for SRS

FS = 1.5

5R

#17147

REGISTERED ARCHITECT JAMES GUERRERO

2 2ND SUBMI 05-31-18

3 3RD SUBMI 12-11-18

4 4TH SUBMI 04-05-19

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

PROJECT: BOYLE MERCER ISLAND

DRAWING TITLE: EXTERIOR ELEVATIONS

PERMIT REVIEW SET

DATE 10-18-17
REVISED 5-30-18
12-11-18
04-05-19

SHEET NO A2.1 OF

SCALE FACTOR: 48

christian fynboe pe
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 7147	6R

$H_1 = 0.9(30)8 = 108^k$

$H_2 = 0.5(30)8 = 120^k$ $\quad \Sigma = 228^k$

H_3 SEISMIC $= .43(30)8 = 72^k$ $\quad \Sigma = 300^k$

$W_1 = 1/2(.15)30(40) + .015(30)20 = 159^k$

$W_2 = 1/2(.15)(20)\frac{20}{3} + .12(11)(1\frac{1}{2})8 = 123^k$

$W_3 = 1.25(.15)29(10) + 1(.15)20(6) = 73^k$

W_{TSOIL} (SIDES) $= .12(30)16(2) = 115^k$ $\quad \Sigma = 470^k$

$\phi = 0.3$ (SOIL FRICTION)

f_{S1} SIDE FRICTION $= 82.5(2).3(1.5) = 79^k$

f_{S2} SIDE FRICTION $= 43.2(2).3(1.5) = 39^k$

$$FS_{OT} = \frac{(159)29.5 + 123(11) + 73(15) + 115(15) + 79(29.5) + 39(11)}{108(10) + 120(15)}$$

10433 / 2880

$= 3.6^k - OK$

christian fynboe pc
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 1747	7R

$FS_{OT} = \frac{10433}{2880+300(15)} = 3.1$ — OK

$FS_{SLIDING} = \frac{470(.3)1.5 + 79 + 39}{329.5} / 228 = 1.145 < 1.5$

ADD SHEARKEYS

$FS_{SLIDING\ SEISMIC} = \frac{329.5}{300} = 1.1$ CLOSE

ADD SHEARKEYS

$W = .6(2/2)10 = 6.0k$

$.3(2) = .6k$

(3) SHEARKEYS

$(6)3 = 18k$

$FS_{SLIDING} = \frac{329.5+18}{228} = 1.5$ OK

$FS_{SLIDING\ SEISMIC} = \frac{329.5+18}{300} = 1.2$

OK

christian C. fynboe PE
CONSULTING ENGINEER

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

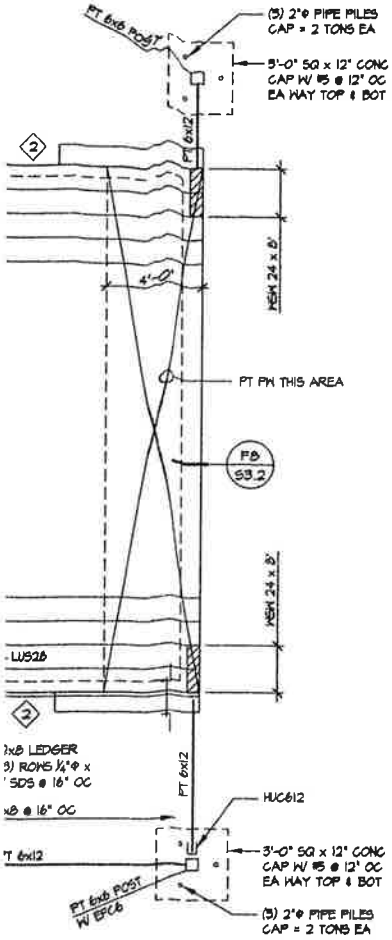
PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	ER

THE (2) SHEARWALL @ THE UPPER FLOOR IS TRANSFERRING THE FLOOR DIAPHRAGM LOAD FROM THE 5 1/2" x 24" GLULAM INTO THE ROOF DIAPHRAGM.

#17197

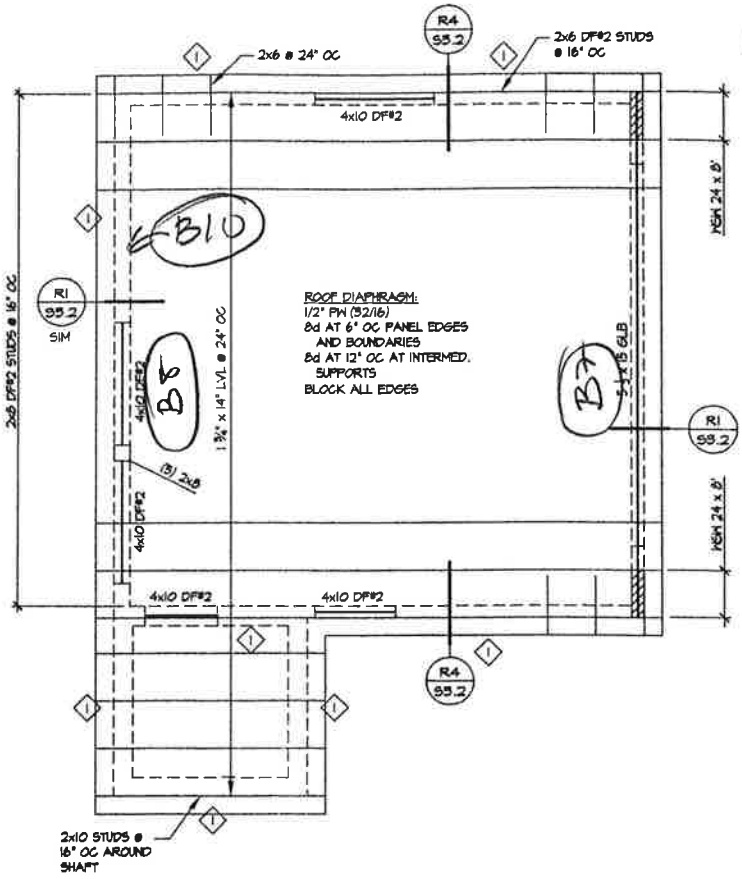
189/30

9R



ING PLAN

1/4" = 1'-0"



GARAGE ROOF FRAMING PLAN

1/4" = 1'-0"

CONSULTING

12181 'C' ST
TACOMA, W
(253) 53
ccfynboe

7520 Bridgeport Way W.
Lakewood, WA 98499
Phone: 253/581-6000

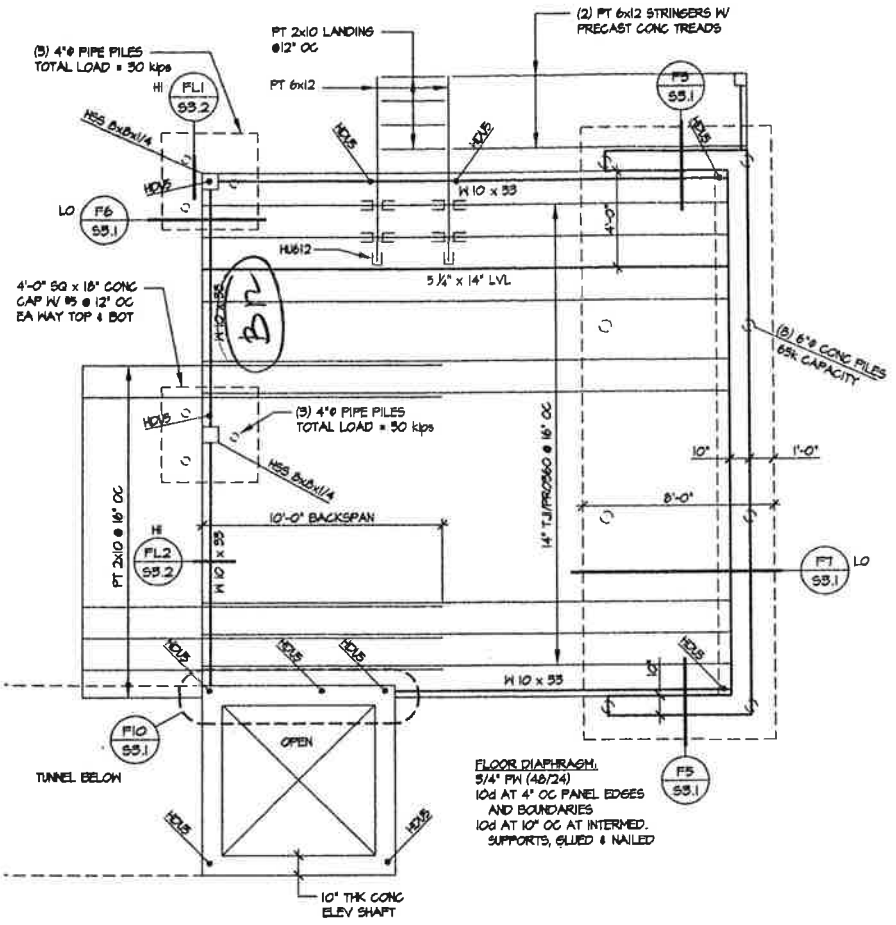
PROJECT
BOYLE RESIDENCE
MERCER ISLAND, WA

DATE 08/
REVISED

PERMIT SET

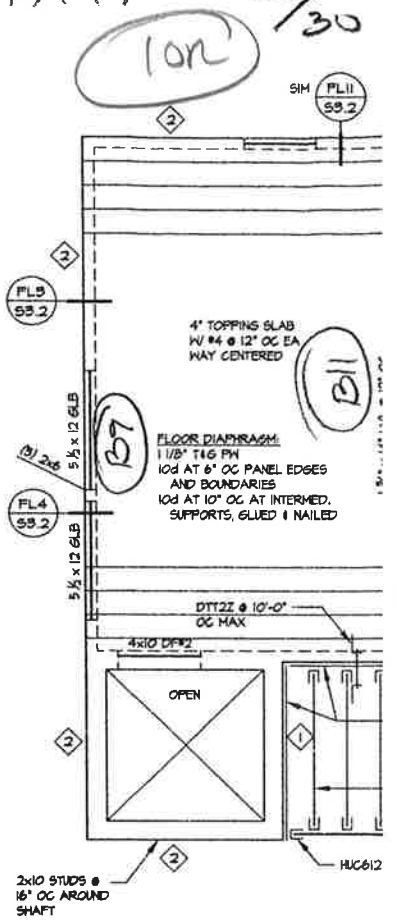
SHEET NO.
S2

#17147 18b/30



GARAGE FOUNDATION PLAN (ADU LEVEL)

1/4" = 1'-0"



GARAGE FLOOR FR

christian fynboe pe
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE: 1747	JOB NO.	18/30

112

GMACC ROOF

L = 16' "B7"

W = .045(12) = .54k

M = .54(16)²/8 12 = 207k"

Shear 207/2.4(1.1) = 785 lbs

5½" x 15" 6ply

L = 6' "B8"

W = .54k

M = .54(6)²/8 12 = 29.2k"

Shear 29.2/1.05(1.1) = 24.0 lbs

FLOOR

L = 6' "B9"

W(.04+.01+.05))11 = 1.1k

M = 1.1(6)²/8 12 = 59.4k"

Shear = 59.4/2.4 = 25

5½" x 12" 4ply

christian fynboe pe
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

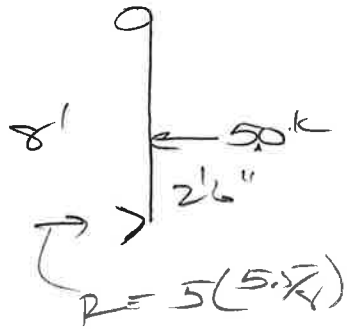
PROJECT:			SHEET NO. 19/30
BY:	DATE:	JOB NO. 1747	

12R

GARAGE

h=8' — 5.0K HORIZ FROM CAR

"B10"



R = 5(5.1/4) = 3.4k

M = 3.4(2.5)12 = 103k"

Sreqd = 103/1.6(1.05) = 61.3

(5) 2x6 DF#2

HANGER HU88 — 2.1(1.60) = 3.4 OK

USE HSS 8x2x1/4 BUMPER

L=21' GARAGE FLOOR "B11"

W = (.104 + .01 + .05) = 0.1k

M = 0.1(21)²/8 R = 66.1k"

Sreqd = 66.1/2.4 = 28.6in³

P = 3.0K ON 4.5"Φ — THIS WILL SUPPORT ONE (3) JOISTS W/4' CANT

M = [(.105+.01)/8 (21)² + (3.0/3)/4 (21)] R = 102.7k"

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

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

BL

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

L-12'11"B12"

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

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

$S_{REQD} = 518/21.6 = 24 \rightarrow$
W10X33

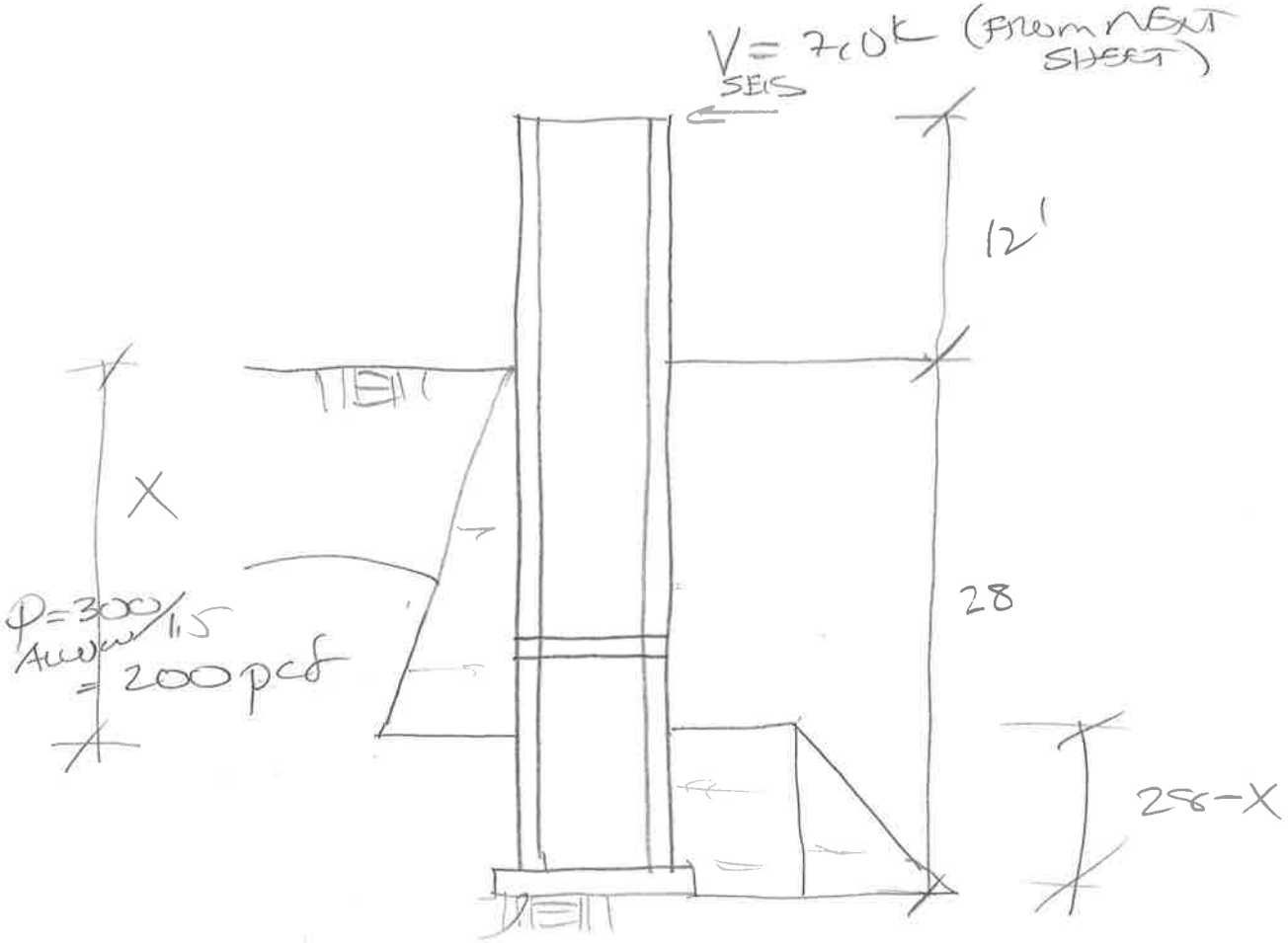
$P = 2.44(21/2) = 25.6^k$ USE (3) 4" ϕ PIPE PLUGS

$h = 20'$ USE HSS 8x8x1/4
$C_{AP} = 132^k - OK$

christian fynboe pc
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17197	14R

N-S DIRECTION



$$V_{MAX} = V = 0 = 7.0 - .200\frac{(x)}{2}^2 8 = 0$$

$$x^2 = \frac{7(2)}{.200(8)} = 3'$$

∴ MAX MOMENT @ 15' FROM TOP
– CONVENTIONAL ANALYSIS
@ 26'

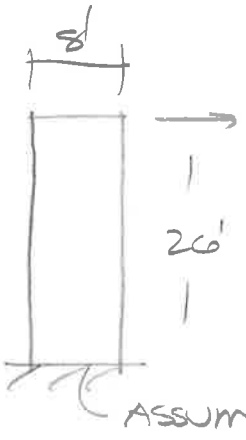
christian C. fynboe p.e.
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	152

$h = 26'$

WT GARAGE $= (.015+.015+.015)\,11(22)$
$= 10.9^k$

WT OF SHAFT $= (10/12)\,16(26/2)\,.15 = 26^k$



V_{SEIS} @ BASE $= .94/5\,W = .19W$
$= .19(26+10.9)$
$= 7.0^k$ (USD)

$2A_{cv}\sqrt{f'_c}$ — 21.9.2.2 ACI
$2(10)96\sqrt{3000} = 105^k$

SINGLE CURTAIN OF REBAR — OK
#5 @ 10" o.c.

21.9.4.1 ACI

$V_N = A_{cv}(\alpha_c\sqrt{f'_c} + \rho_n f_y)$

$V_N = 10(96)\left(2\sqrt{3000} + \underbrace{.31(12)/10(96)}_{.23}(60)\right) = 127^k$
OK

$M_u = 7(26)12 = 2184^{k'}$

$R_u = \dfrac{2184}{.9(10)(92)^2} = .1029\ ksi$

$A_s = \dfrac{29}{200}(.00373)(11.5)\,10(92) = .666\ in^2$
#6 @ 9" EWEW — OK

christian fynboe pc
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	16R

INTERCONNECTED STRUCTURES

12.1.3

$F_p = .133(.94/1.4)W = .087W$ ← CONTROLS

$F_p = .05W$

@ TUTHILL

$F_p = .087(.015)(14)(1\frac{1}{2}) = 0.1k$

SEE (4) LOCATIONS MS748 & CS20" STRAPPLATES ON S2.2

@ ELEVATOR

E-W

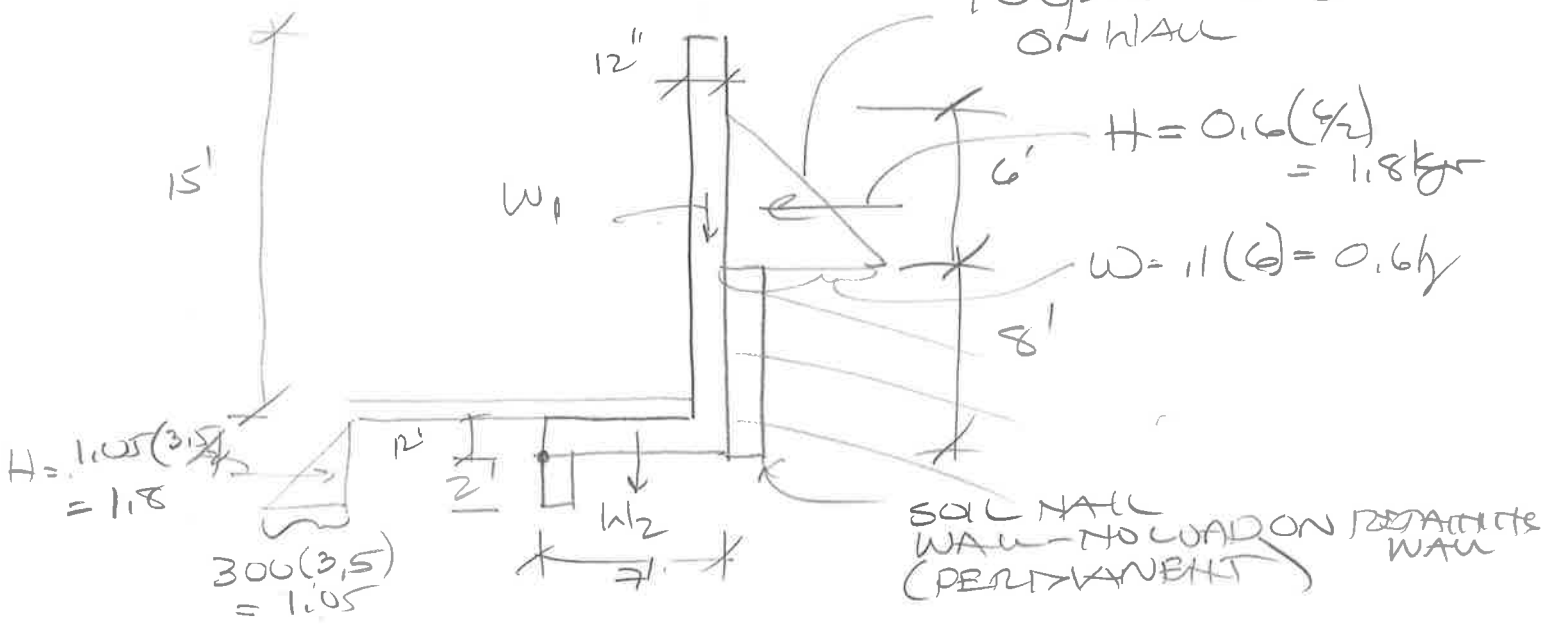
$f_p = 10/12(.15)16(13)(.087) = 2.3k$

SEE DETAIL F10 / S3.1 (circled) THIS DIAGS FORCE INTO W10X33

christian fynboe PE
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 1747	171

CATCHMENT WALL



$W_1 = 1(15).15 + .015(6) + .015(10) + .01(6) = 2.5$ k

$W_2 = 1.25(7).15 = 1.31$ k

$\frac{OT}{FS} = \frac{2.5(6.5) + 1.31(3.5)}{1.8(10)} = 1.16$ — OK IMPACT LOAD

$\text{SLIDE}_{FS} = \frac{(2.5 + 1.31).3(1.5) + 1.8}{1.8} = 1.95$ OK

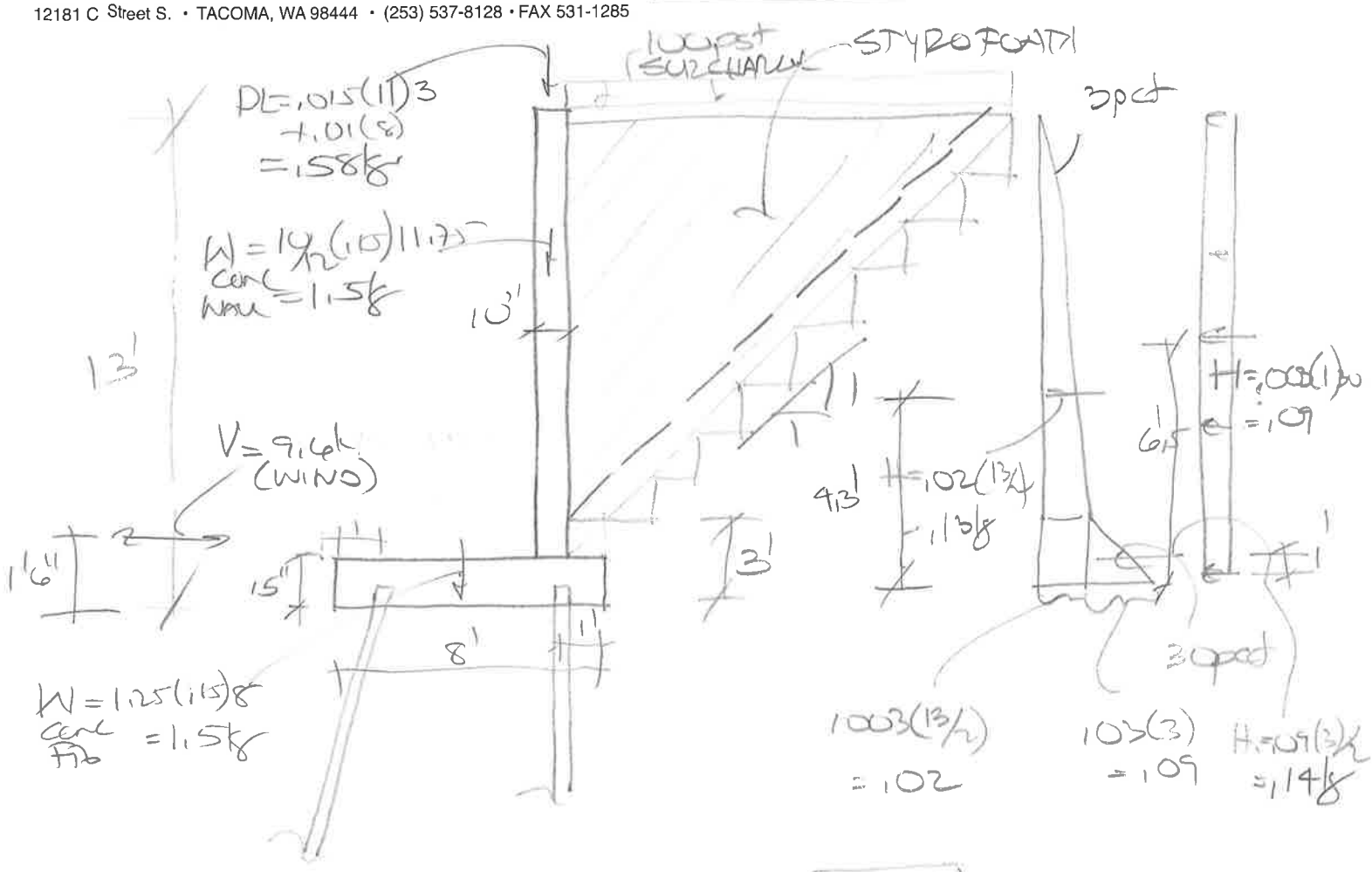
$M_U = 1.8(1.6)\,9(12) = 311$ k'

$R_U = \frac{311}{.9(12)(9)^2} = .136$ ksi

$A_S = .0065(12)9 = .7$ in²/ft #7 @ 10" c/c

C. christian fynboe PE
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17-147	181

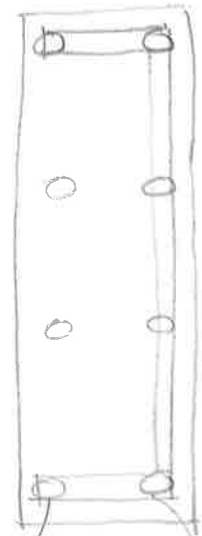


$\Sigma M_{WALL} = .109(6.5) + .13(4.13) + .09(1)$
$= 1.23(24) = 29.6k'$

$M_{GARAGE} = 9.6(1.5) = 14.4k'$

$\Sigma = 44k'/6.$
$= 7.3k/4\text{ rows}$
$= 1.83k$

SHEAR $= 9.6t(.09+.13+.09)24$
$= 17k/4_{Bolts} = 4.3k$



TENSION IN PILE
$= 4.3(6.1) - 1.5(24/4)$
$- 1.5(24/4)$
$- .58(24/4)$
$= 4.7k$

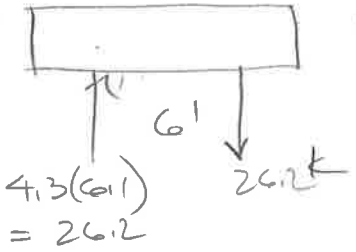
6.1 / 1 C

COMP IN PILE $= 4.3(6.1) + 1.5(24/4) = 35k$

christian fynboe PE
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17197	KR

M_u GRADE BEAM $= 26.2(1.6)\frac{1}{6}(6)12 = 503^{k'}$



$R_u = \frac{503}{.9(12)12^2} = .132^{ksi}$

$A_s = .0056(12)12 = .81 in^2/ft$

#7 @ 9" o/c

PUNCHING SHEAR OKAY – SEE PREVIOUS CALC

christian fynboe pc
CONSULTING ENGINEER
12181 C Street S. • TACOMA, WA 98444 • (253) 537-8128 • FAX 531-1285

PROJECT:			SHEET NO.
BY:	DATE:	JOB NO. 17147	202

13.5 / 12

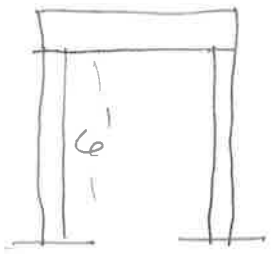
WT - GRATING - 6.3 lb/ft²

WT - HSS 12x4x1/4 - 25.8 lb/ft

$WT = \left(.0258(19)2 + .0063(3)16\right)/3.5(19) = .019$ ksf

$WT_{LANDING} = \left\{3.5(12) + 3.5(2)\right\}.019 = .93^{k}$

$V = .94/3.25(1.4)\,W = .21W = .21(.93) = 0.2^{k}$-Low



← V = 0.2k

$M = 12(6)12 = 14.4^{k''}$

Sreq'd $14.4/4.6(.6) = 1.5^{in^3}$

HSS 4x4x1/4

OK

$l = 16'6''$

$w = (.06 + .025 + .01)1.5 = .14^{klf}$

$M = .14(16.5)^2/8 \cdot 12 = 57.2^{k'}$

Sreq'd $57.2/4.6(.6) = 2.1^{in^3}$

HSS 12x4x1/4