Engineering West, L.L.C.

3785 North 1100 West
Pleasant View, UT 84414
(801) 643-5710

4 June 2013

MEMO:

RE: The Retreat Entry Walls
        Review Comments

Gentlemen,

This memo addresses changes made to the calculations based on the review comments.

Comments on S1:

1)   The shear resistance of the re-enforcing was adequate without a key; However, a key has been shown in the calculation sketches if one is desired. This can be accomplished using a 2 x 4 as a form in the top of the footing.

2)   Detail F4 showing an intersection or corner would occur where the dead men tie into the stem. This would put this detail in compression and the embedment isn't to critical.

Comments on Sheet 8

3)   The soils report specifies an active lateral pressure coefficient of 0.35 for walls that can rotate over 0.4%. Our value of 0.4 is therefore slightly conservative. This is based on native soils being used as backfill.

4)   Calculations have been added to check soil bearing pressure.

5)   Calculations have been added to check sliding stability.

I was informed that the maximum height of the retaining wall is going to be 9'-0. I have added a sheet showing this option.

We have received word from Earthtec Engineering, Inc. that the 1,500 psf assumption on soil bearing is adequate.

Respectfully;

Steven J. Carlson, P.E.

Engineering West, L.L.C.

Steven J. Carlson, P.E.
380 North 200 West, Suite 110
Bountiful, UT   84010

Design Calculations

23 May 2013

Project
The Retreat Entry Walls
Wolf Creek
Lewis Homes

Design Codes

International Building Code 2009
ASCE 7-10   (Minimum Design Loads for Buildings and Other Structures)
ACI 318-08   (Building Code Requirements for Structural Concrete)
ACI 530-08   (Building Code Requirements for Masonry Structures)
AISC ASD 13th Ed.   (Structural Steel)
ANSI / AF&PA   NDS 05 (National Design Specification for Wood Construction)

Design Criteria

Concrete
    Compressive Strength Slabs on Grade / Footings   2,500 PSI
    Foundations   3,000 PSI
    Suspended Slabs   4,000 PSI

Reinforcement
    Grade 60, Yield Strength   60,000 PSI
    Tensile Strength   90,000 PSI

General Notes

These calculations, and accompanying plans, are for one project, at one location only. All plans and calculations should be wet stamped.

Engineering West's scope covers structural design of concrete only. Specifically excluded is geotechnical design.: Even if this information is included on a stamped drawings.
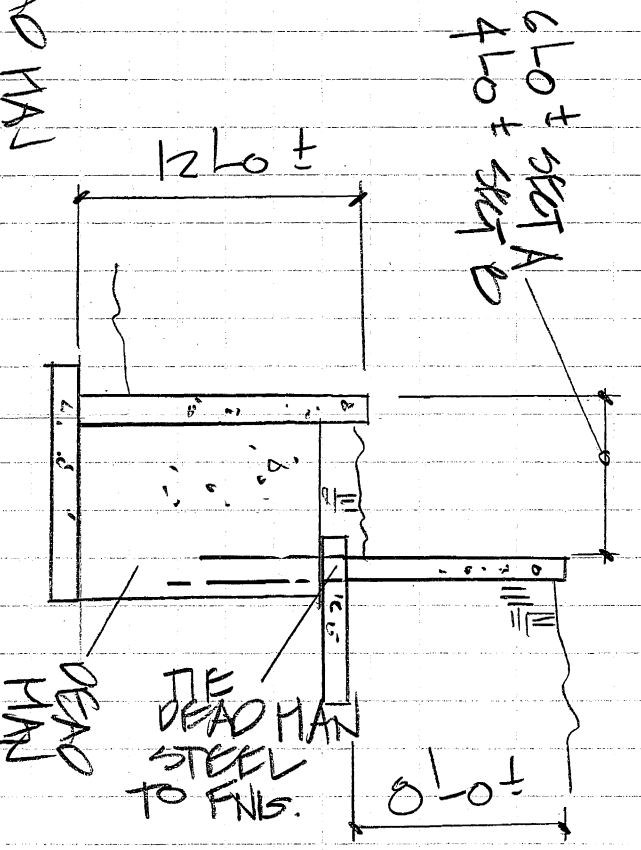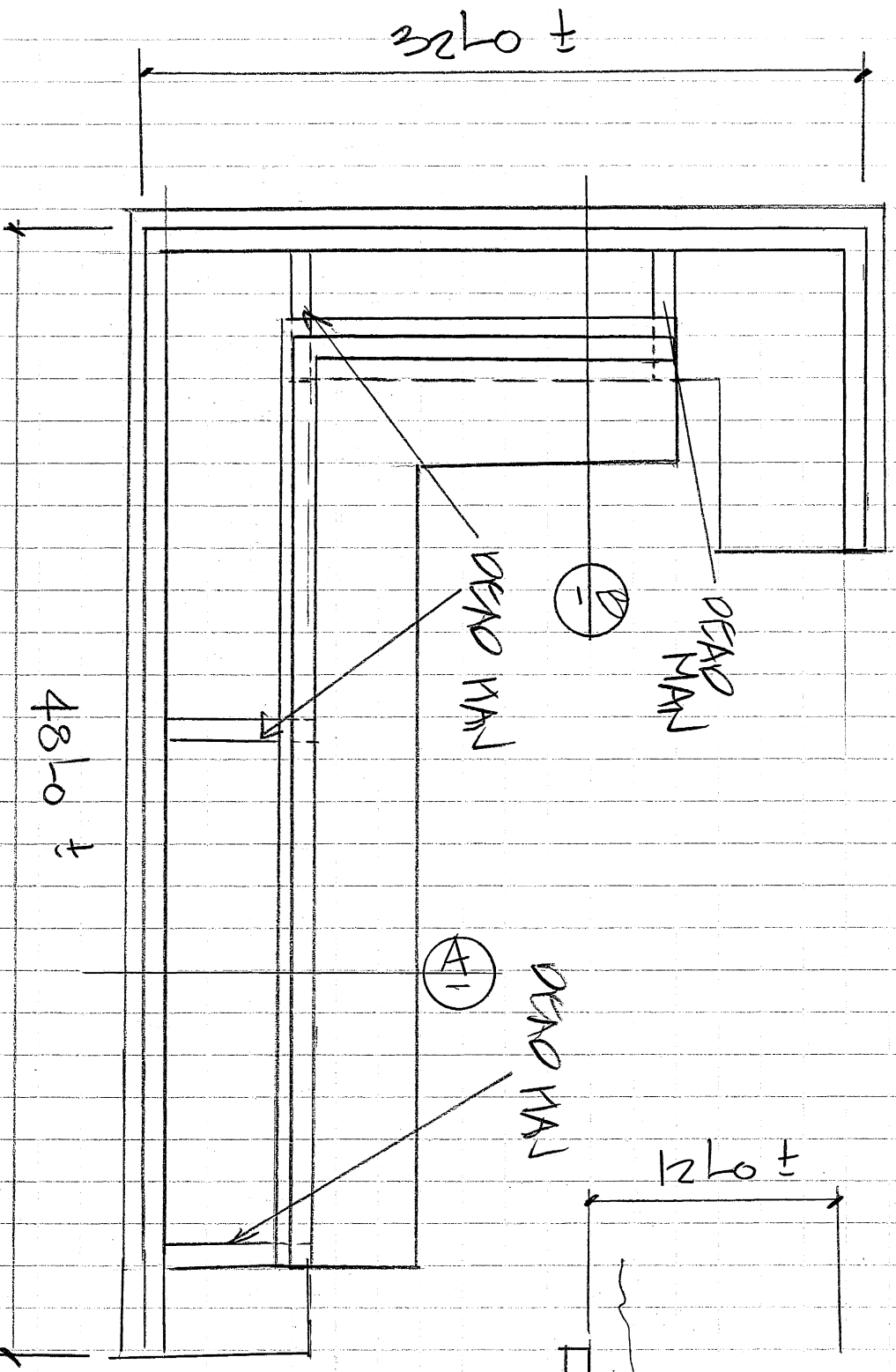
Construction materials and details shall be in strict conformance with the latest edition of the International Building Code and other referenced standards. Details not in conformance with the calculations shall be approved in writing by the engineer.

Unless specifically indicated no investigation has been made by Engineering West, of the lot, or it's soil characteristics, t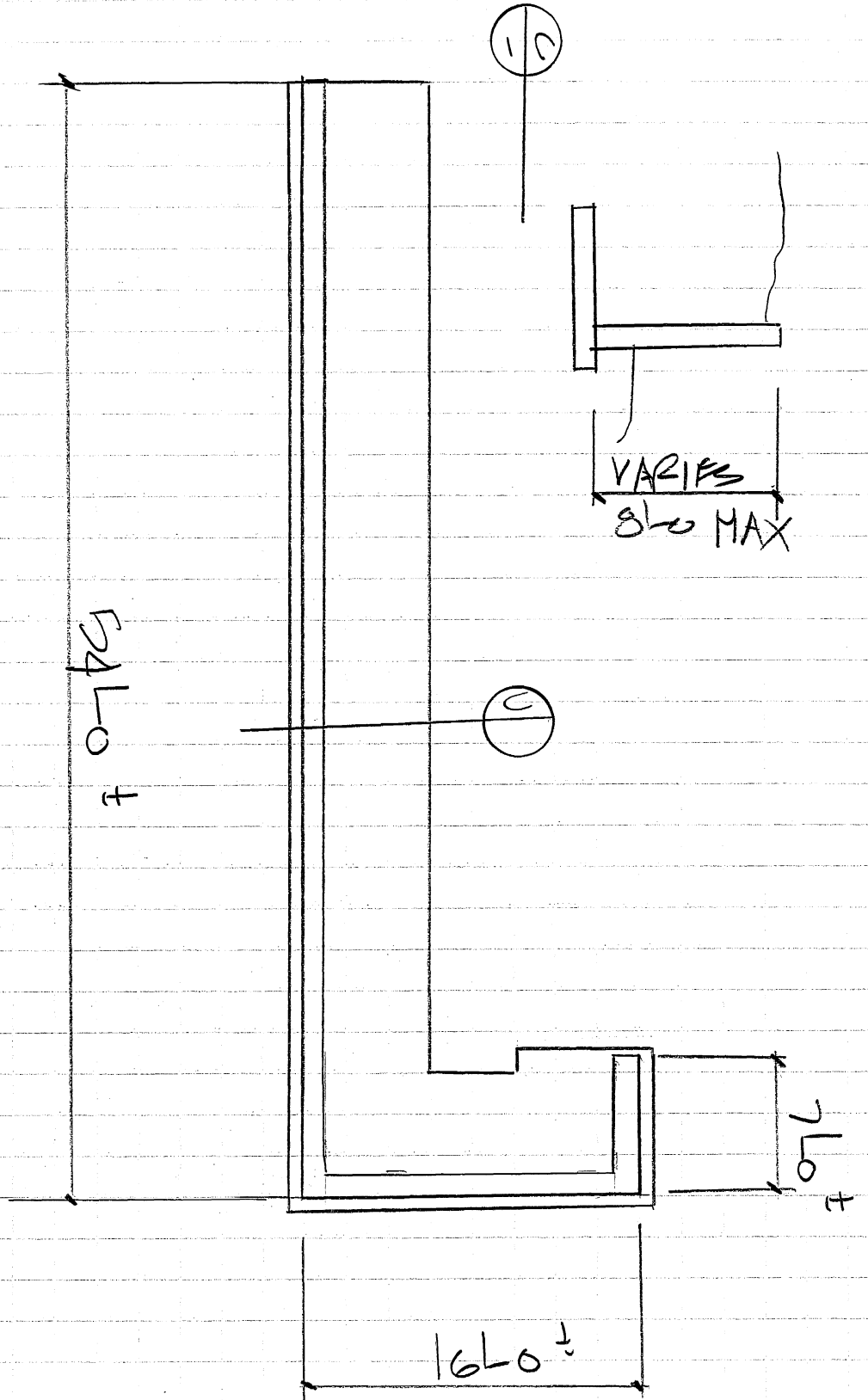o determine it's ability to support the structure. Engineering West, LLC has assumed a 1,500 psf allowable soil bearing pressure. If there are any concerns with regard to the site a geo-technical specialist should be consulted. If conditions indicate a need for additional structural design, based on the soil conditions, including grade, Engineering West should be notified immediately.
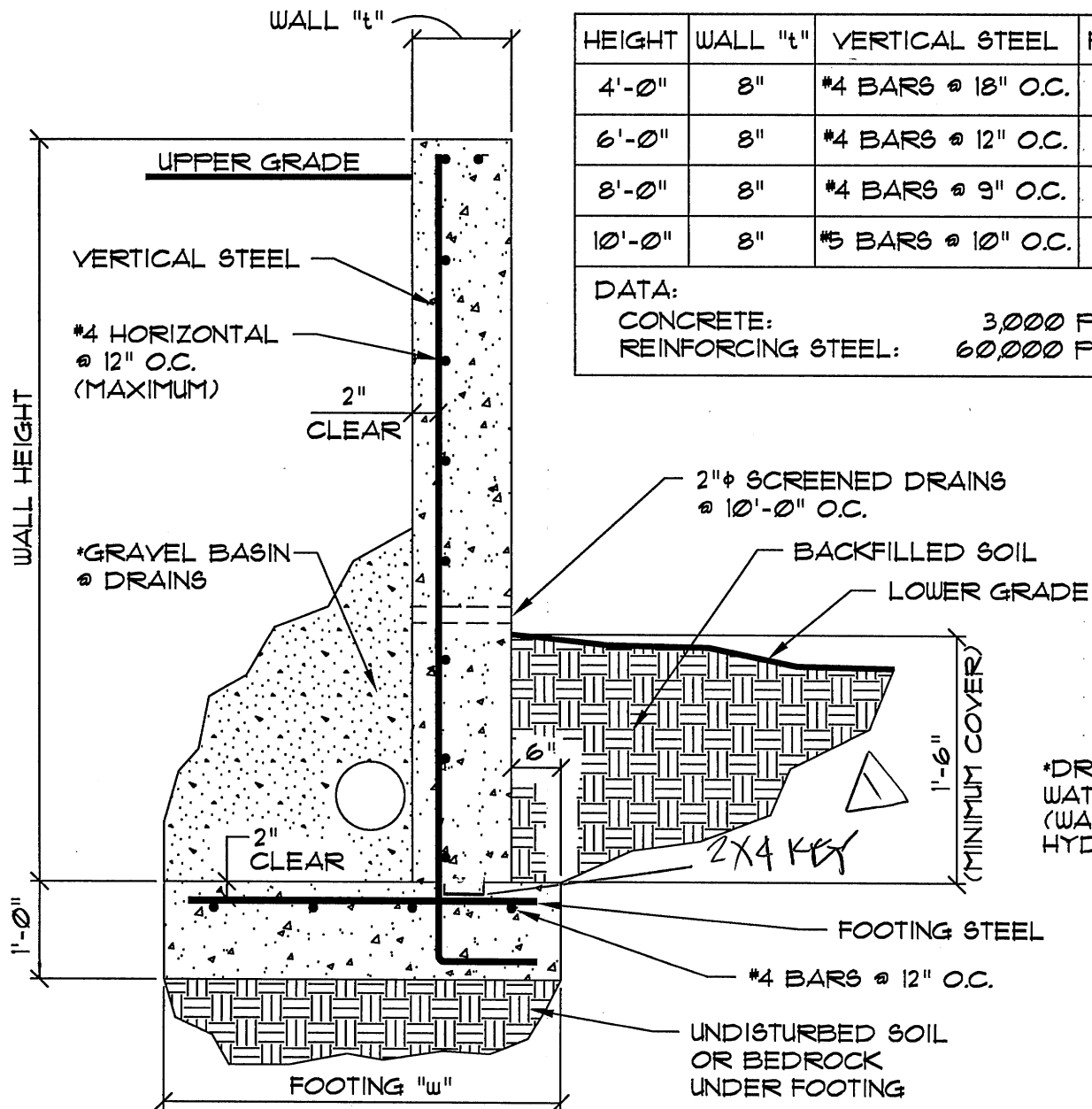
The above design criteria should be reviewed and approved by the building official and contractor to assure actual conditions meet those used. Engineering West should be notified immediately of any discrepancies. Unless otherwise agreed in writing maximum total liability to Engineering West, L.L.C. will be limited to the dollar value of the engineering performed.

③

PLAN (RIGHT OF ENTRY)

32'-0" ±

48'-0" ±

DEAD MAN

DEAD MAN

DEAD MAN

Ⓑ

Ⓐ

Ⓐ Ⓑ

12'-0" ±

6'-0" ± SECT A
4'-0" ± SECT B

8'-0" ±

TIE DEAD MAN STEEL TO FNG.

DEAD MAN

PLAN (LEFT OF ENTRY)

VARIES
8'-0" MAX

54'-0" ±

16'-0" ±

7'-0" ±

④

SECTION THRU RETAINING WALL

F1 — SCALE: NONE

Table:

HEIGHT	WALL "t"	VERTICAL STEEL	FTG "w"	FOOTING STEEL
4'-0"	8"	#4 BARS @ 18" O.C.	2'-9"	#4 BARS @ 18" O.C.
6'-0"	8"	#4 BARS @ 12" O.C.	3'-6"	#4 BARS @ 12" O.C.
8'-0"	8"	#4 BARS @ 9" O.C.	4'-6"	#4 BARS @ 9" O.C.
10'-0"	8"	#5 BARS @ 10" O.C.	5'-6"	#5 BARS @ 10" O.C.

DATA:
CONCRETE: 3,000 PSI
REINFORCING STEEL: 60,000 PSI

WALL "t"

UPPER GRADE

VERTICAL STEEL

#4 HORIZONTAL @ 12" O.C. (MAXIMUM)

2" CLEAR

*GRAVEL BASIN @ DRAINS

WALL HEIGHT

2" CLEAR

1'-0"

FOOTING "w"

2"⌀ SCREENED DRAINS @ 10'-0" O.C.

BACKFILLED SOIL

LOWER GRADE

1'-6" (MINIMUM COVER)

6"

2X4 KEY

FOOTING STEEL

#4 BARS @ 12" O.C.

UNDISTURBED SOIL OR BEDROCK UNDER FOOTING

*DRAIN SYSTEM MUST PREVENT WATER BUILD-UP BEHIND WALLS (WALL NOT DESIGNED FOR HYDRO-STATIC LOAD)

Provide Calculations to verify embedment, Note 3" cover requirement against soil. Enercalc is stating footing thickness + cover < req'd embed.
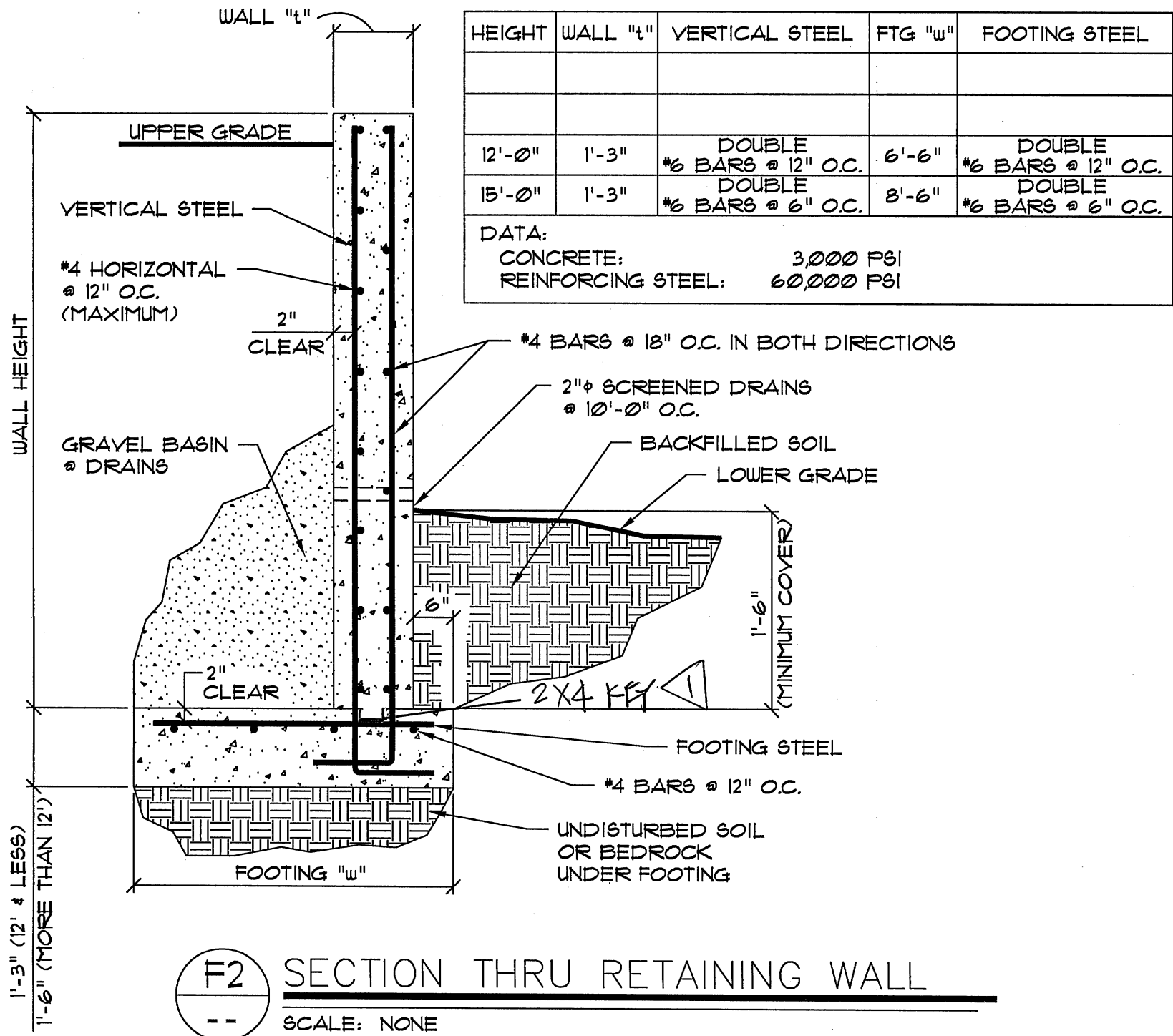
6|4|13

WALL "t"

UPPER GRADE

HEIGHT	WALL "t"	VERTICAL STEEL	FTG "w"	FOOTING STEEL
12'-0"	1'-3"	DOUBLE #6 BARS @ 12" O.C.	6'-6"	DOUBLE #6 BARS @ 12" O.C.
15'-0"	1'-3"	DOUBLE #6 BARS @ 6" O.C.	8'-6"	DOUBLE #6 BARS @ 6" O.C.

DATA:
   CONCRETE: 3,000 PSI
   REINFORCING STEEL: 60,000 PSI

VERTICAL STEEL

#4 HORIZONTAL
@ 12" O.C.
(MAXIMUM)

2"
CLEAR

#4 BARS @ 18" O.C. IN BOTH DIRECTIONS

2"φ SCREENED DRAINS
@ 10'-0" O.C.

BACKFILLED SOIL

LOWER GRADE

GRAVEL BASIN
@ DRAINS

6"

1'-6"
(MINIMUM COVER)

WALL HEIGHT

2"
CLEAR

2X4 KEY

FOOTING STEEL

#4 BARS @ 12" O.C.

UNDISTURBED SOIL
OR BEDROCK
UNDER FOOTING

FOOTING "w"

1'-3" (12' & LESS)
1'-6" (MORE THAN 12')

F2   SECTION THRU RETAINING WALL
--
       SCALE: NONE

$1.125'$ ◁

1800 lb

$12(125.10) = 1380$ pcf

$975^{\#}$

$3.25'9(125)0.4 = 4150$ pcf

$12(125)0.4 = 600$ pcf
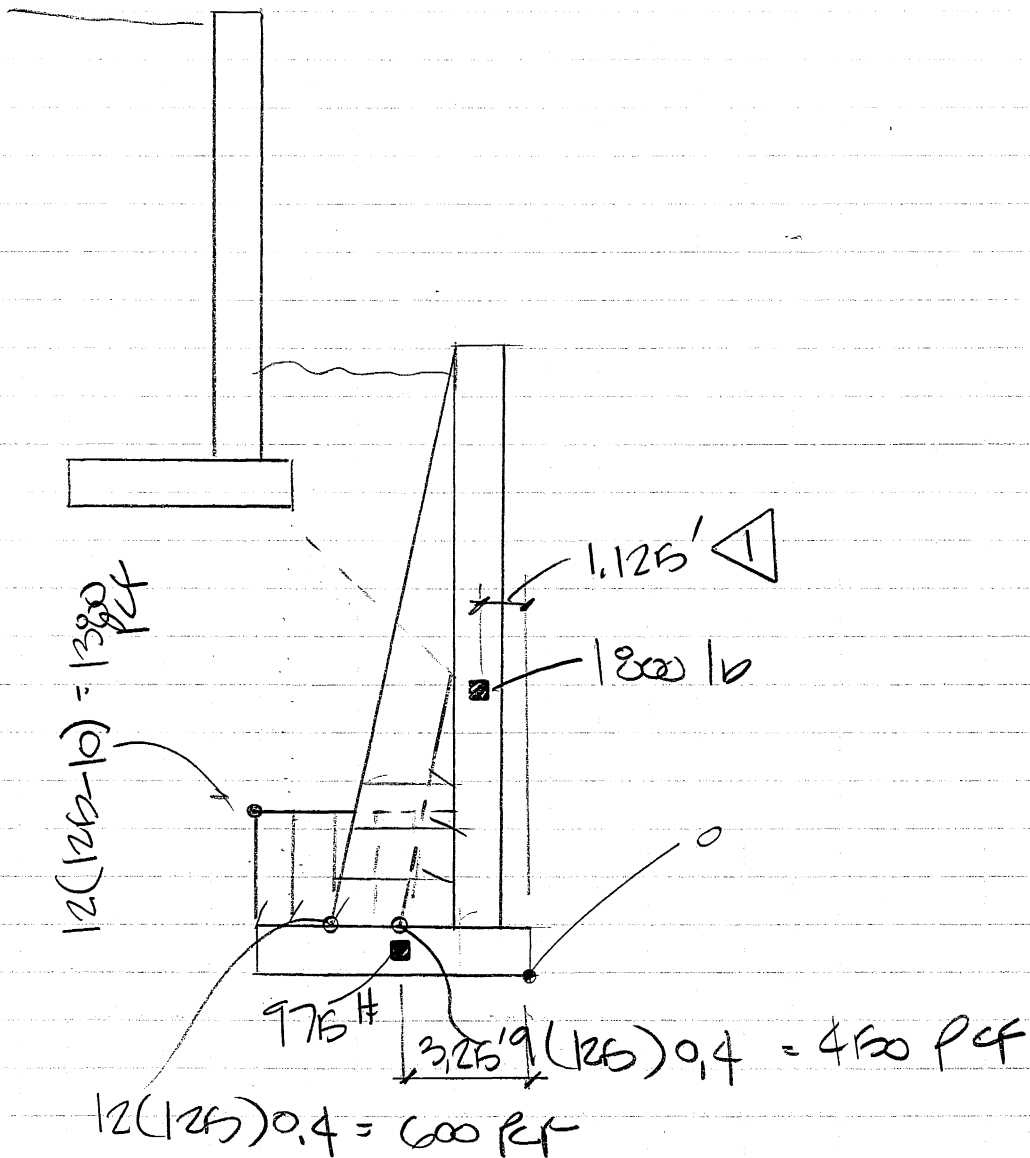
$$\Sigma M_b = 0: \quad -4150\left(\frac{5}{2}\right)\left(\frac{5}{3}\right) - 600\left(\frac{12}{2}\right)\left(\frac{12}{3}\right) + 1380(5)(4)$$

◁

$$+ 1800(1.125) + 975\left(\frac{6.5}{2}\right) =$$
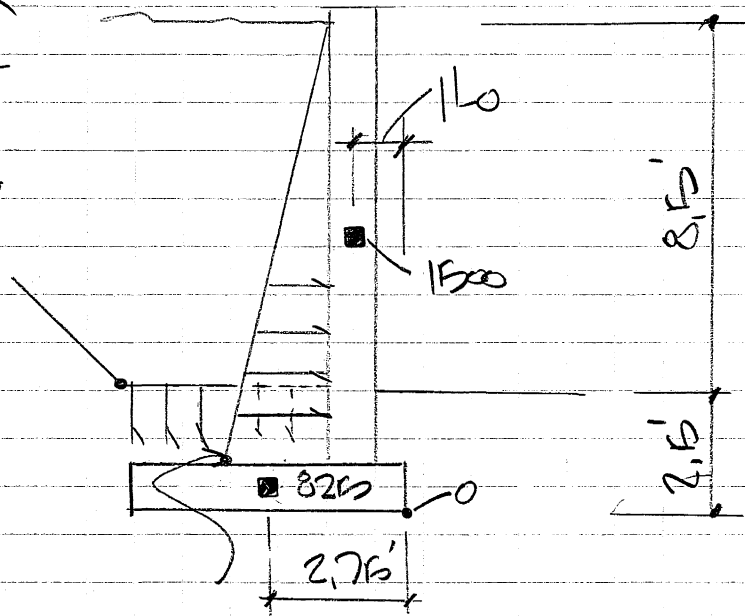
$$-16,276 + 32,794 = 16,518 \text{ CCW}$$

$$M_{max\,stem} = 600\left(\frac{12}{2}\right)\left(\frac{12}{3}\right) + 4150\left(\frac{5}{2}\right)\left(\frac{5}{3}\right) = \underline{16,276} \text{ FT LB}$$

$$M_{max\,ftng} = 1380(5)^2/2 = \underline{17,250} \text{ FT LB}$$

EIGHT FOOT RETAINING WALLS

UNKNOWN SOILS

USE $\omega = 125$ PCF

USE $K_q = 0.4$

$10(125-10) = 1150$ PCF

110

1500

8.5'

2.5'

825

0

2.75'

$10(125)0.4 = 500 \text{ LB/FT}$

CHECK 10LO WALL

$\Sigma M_0 = -500 \dfrac{(10)}{2}(4\frac{1}{3}) + 1150(4)3.5 +$

$825(2.75) + 1500(1) = 0$

$+9034 \text{ LB} \quad \text{OK}$

$M_{MAX_{STEM}} = 500\left(\dfrac{10}{2}\right)\left(\dfrac{10}{3}\right) = \underline{8,333} \text{ FT LB}$

$M_{MAX_{FOOT}} = 1150(4)2.5 = \underline{11,500} \text{ FT LB}$

CHECK STEM 1000 WALLS

TRY #5 @ 10" O.C.

$$a - \frac{60(0.31)}{0.85(3)10} = 0.73$$

$$M_u = 0.9(60)\left(0.31\left(\frac{12}{10}\right)\right)\left(10 - \frac{0.73}{2}\right) = 16,129 \text{ FT LB}$$

OK

$$1.7(8333) = 14,166 \text{ FT LB}$$

CHECK FOOTING 1000 WALLS

SAME AS.

check rho_min, minimum steel reinforcement.

TWELVE FOOT WALLS STEM

TRY #6° @ 10

$$a = \frac{60(0.44)}{0.85(3)10} = 1.0353$$

$$M_n = 0.9(60,000)(0.44(\tfrac{12}{10}))(10 - \frac{1.03533}{2}) = 22,530 \text{ FT LBS}$$

$$1.7(16,275) = 27,668 \text{ FT LBS} \quad \text{INCREASE}$$
$$\text{to}$$
$$PBLSC @ 12''$$

$$a = \frac{60(0.88)}{0.85(3)12} = 1.7265$$

$$M_n = 0.9(60,000)(0.88)(13 - \frac{1.7265}{2}) = 48,064 \text{ FT LBS}$$
$$OK$$

REVIEW COMMENTS

CHECK BEARING PRESSURE

VERTICAL LOADS:

STEM	1500
FTNG	825

2325

> This does not include resisting the overturning moment. Please revise.

$$\frac{2325}{5.5} = 423 \text{ lb/ft}^2$$

ADD TO SOIL BEARING

$$(4) \frac{1150}{5.5} + 423 = 1259 \text{ PSF OK.}$$

HANS WILL BE LESS THAN
9' ∴ CONSERVATIVE

CHECK SLIDING

Ka (SOILS REPORT) = 0.35
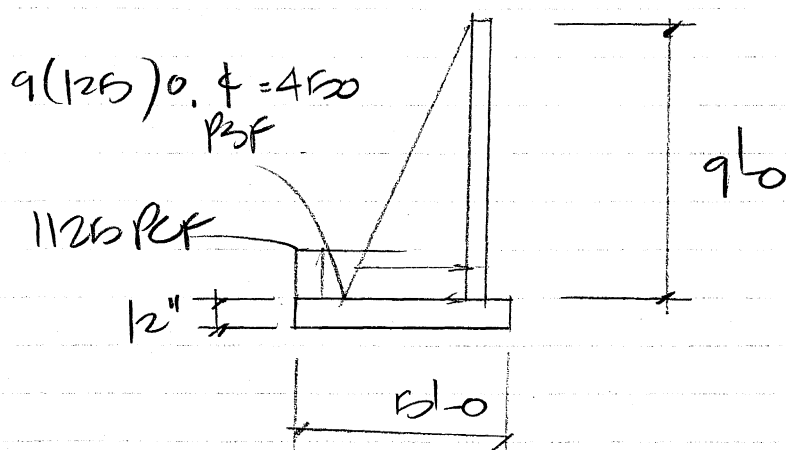
TOTAL LATERAL FORCE

$$0.35(125)10 = 437.5 \text{ PSF}$$

$$437.5\left(\frac{10}{2}\right) = 2,187.5 \text{ lb/ft}$$

PASSIVE 337 PSF (2.5) = 843 lb/ft

FRICTION $0.3\left((1150 \times 4) + 1500 + 825\right) = 2078 \text{ lb/ft}$

$$2078 + 843 = 2920 \text{ lb/ft OK}$$

FOR 9'-0 WALLS

$9(125)0.4 = 450$ PSF

1125 PCF

$12"$

$9'-0$

$5'-0$

$$\Sigma M_o = -450\left(\frac{5}{2}\right)\left(\frac{5}{3}\right) - 450\left(\frac{9}{2}\right)\left(\frac{9}{3}\right) + 1125(3.5)3.25$$
$$+ 5(150)\left(\frac{5}{2}\right) + 9(150)1 =$$

$$-7950 + 16,022 = 8071 \text{ FT } \cancel{LB}$$

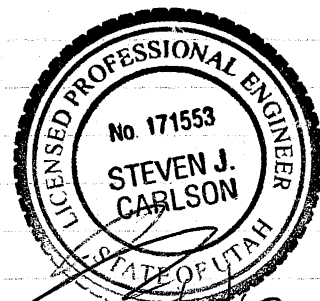MOMENT IN STEM

$-7950 \text{ FT } \cancel{LB}$

$$\frac{0.2}{0.76} = 0.2467 \text{ IN}^2/\text{FT}$$
$$= 0.31$$

$$\frac{0.31}{0.8333} = 0.372 \text{ IN}^2/\text{FT}$$

TRY #5 @ 12" O.C.

$$a = \frac{60(0.31)}{0.85(3)12} = 0.61$$

$$M_u = 0.9(60,000)(0.31)\left(6 - \frac{0.61}{2}\right) = 7946 \text{ FT } \cancel{LB}$$

6/3/13