E13087-01

Engineering West, L.L.C.

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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

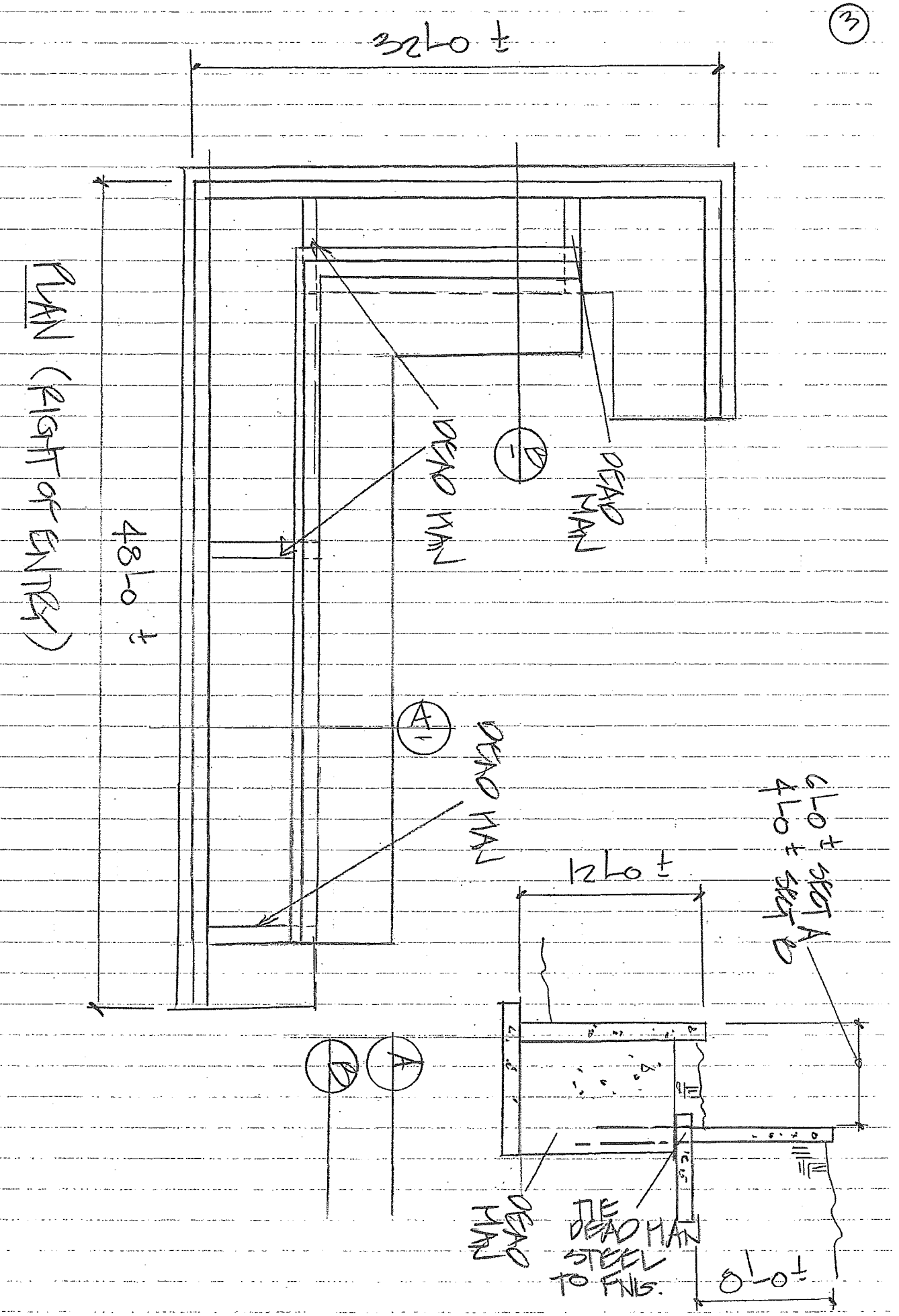
Reinforcement

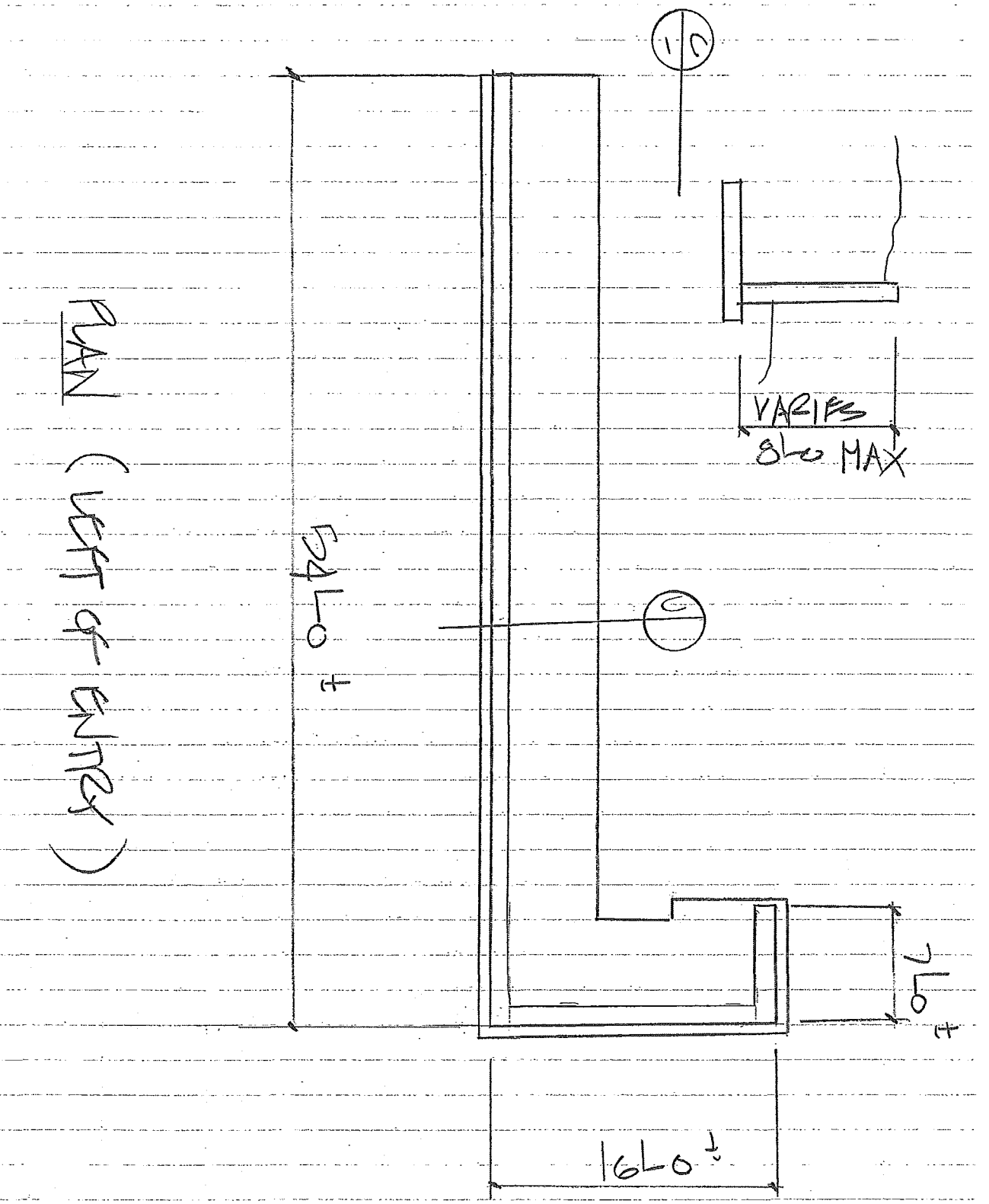
Grade 60, Yield Strength	60,000 PSI
Tensile Strength	90,000 PSI

LICENSED PROFESSIONAL ENGINEER
No. 171553
STEVEN J. CARLSON
STATE OF UTAH
5/23/13

General Notes

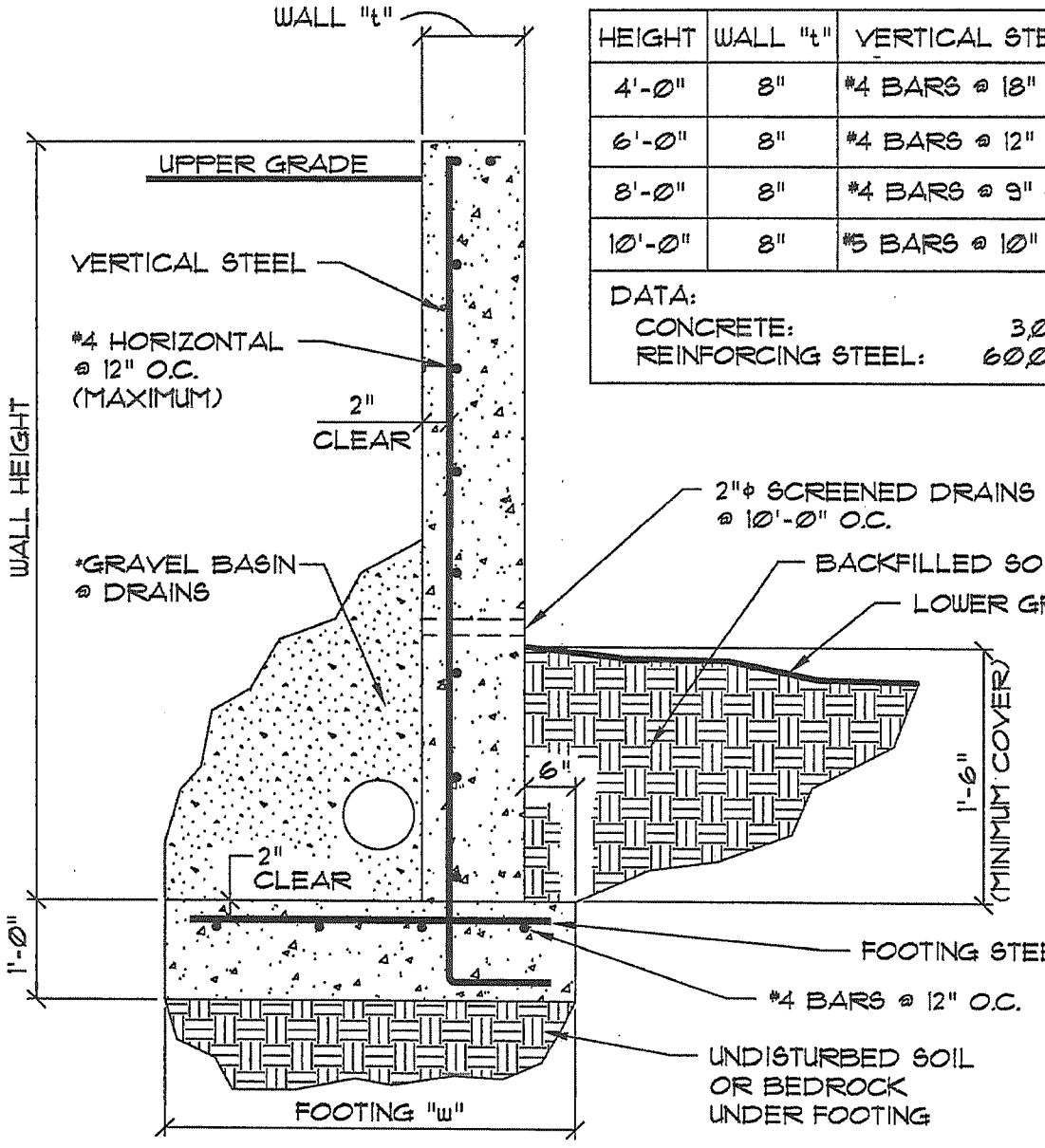
These calculations, and accompanying plans, are for one project, at one location only.
All plans and calculations should be wet stamped.
Engineering West's scope covers structural design of concrete only. Specifically excluded is geotechnical design.: Even if this information is included on a stamped 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, to 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.


32'-0 ±
PLAN (RIGHT OF ENTRY)
48'-0 ±
DEAD MAN
DEAD MAN
B
DEAD MAN
A
12'-0 ±
6'-0 ±
4'-0 ±
SECT A
SECT B
DEAD MAN
DEAD MAN
STEEL TO FNG.
8'-0 ±



PLAN (LEFT OF ENTRY)

(3)



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

Provide Calculations to verify embedment, Note 3" cover requirement against soil.

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

F1
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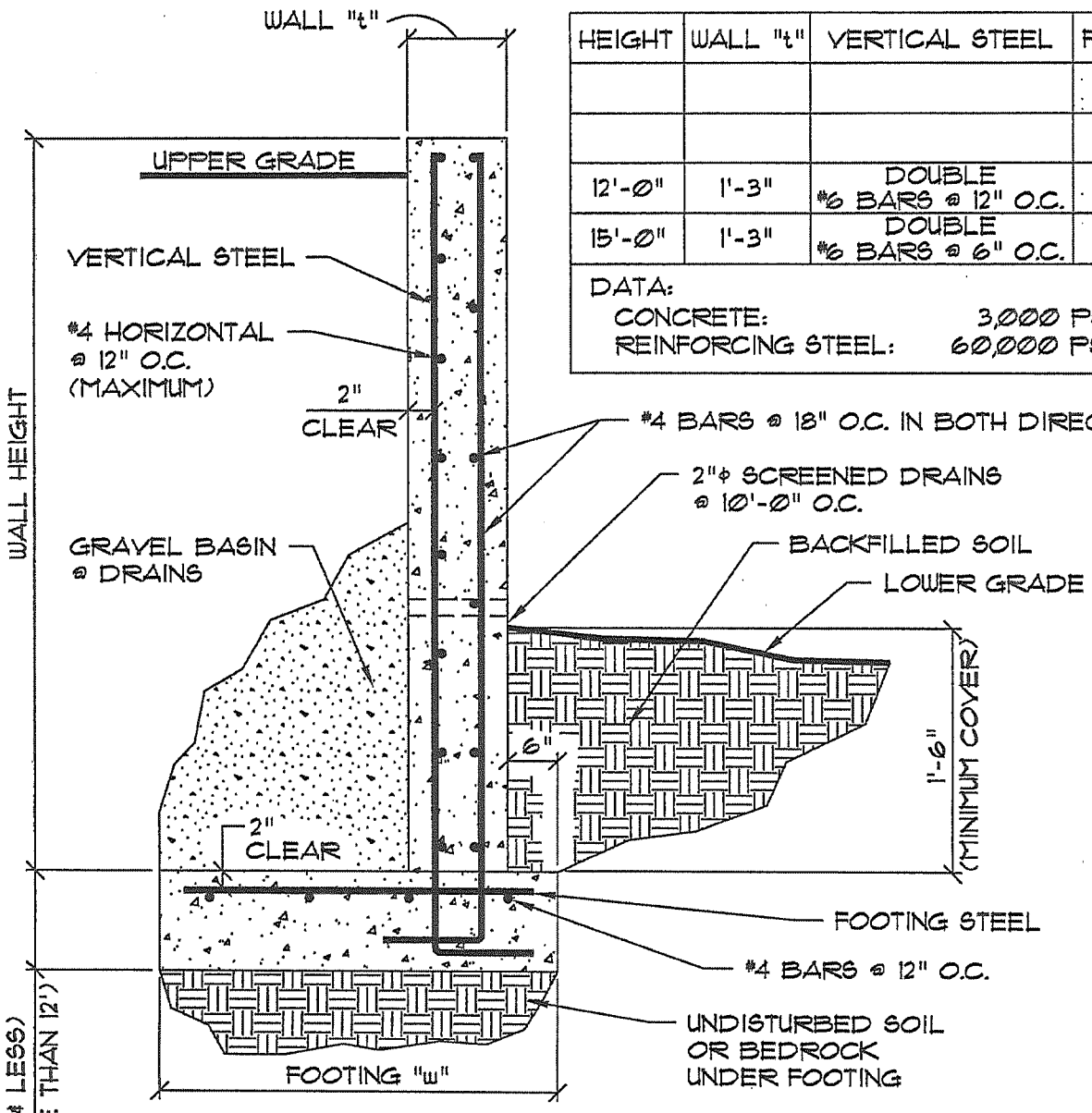
SECTION THRU RETAINING WALL

SCALE: NONE

(9)



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

F2
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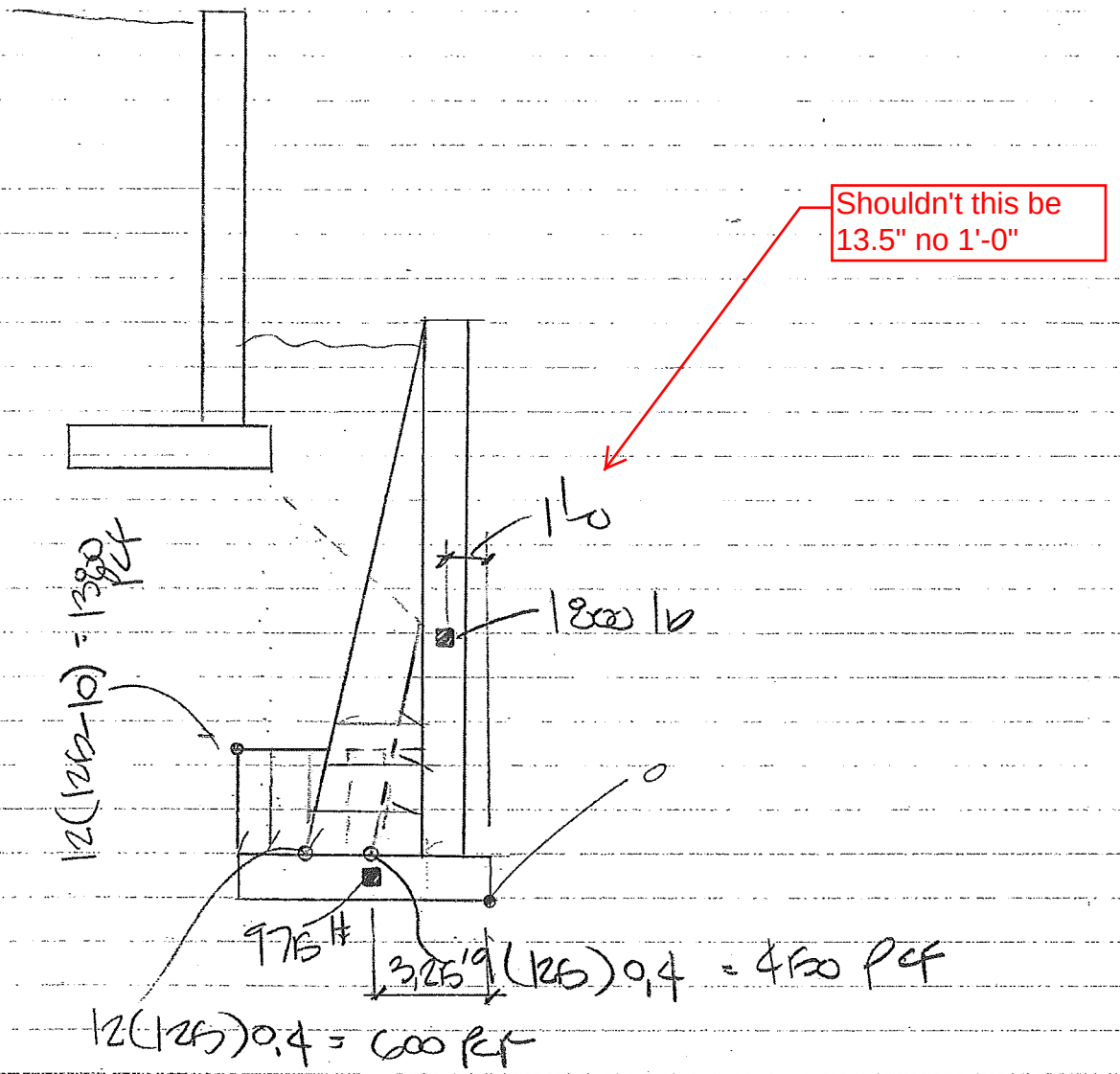
SECTION THRU RETAINING WALL

SCALE: NONE

TWELVE FOOT RETAINING WALLS



$$\Sigma M_0 = 0: \quad -450\left(\frac{5}{2}\right)\left(\frac{5}{3}\right) - 600\left(\frac{12}{2}\right)\left(\frac{12}{3}\right) + 1380(5)(4)$$

$$+ 1800(1) + 975\left(\frac{6.5}{2}\right) =$$

$$-16,275 + 32,580 = 16,293 \text{ OK}$$

$$M_{MAX\ OPEN} = 600\left(\frac{12}{2}\right)\left(\frac{12}{3}\right) + 450\left(\frac{5}{2}\right)\left(\frac{5}{3}\right) = \underline{16,275 \text{ FT LB}}$$

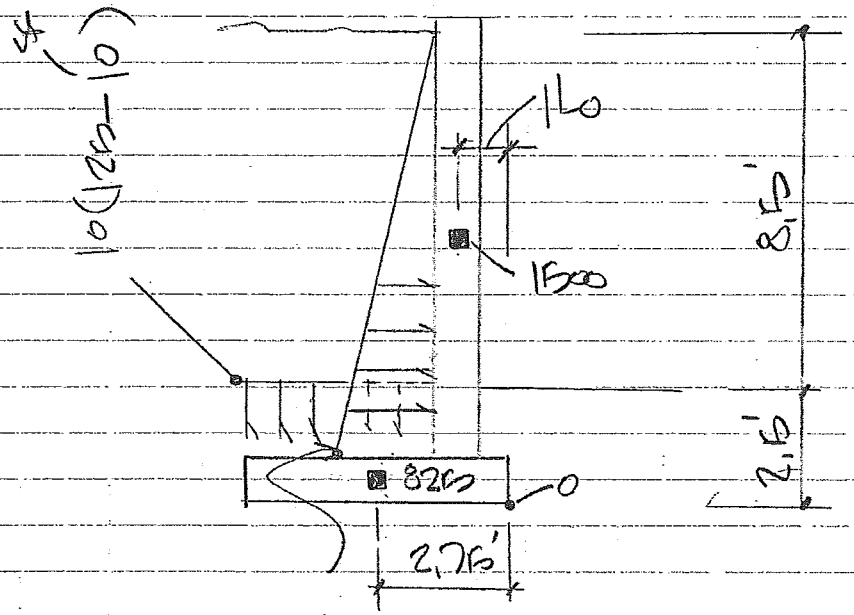
$$M_{MAX\ FILL} = 1380(5)^2/2 = \underline{17,250 \text{ FT LB}}$$

EIGHT FOOT RETAINING WALLS

UNKNOWN SOILS

USE ω = 125 PCF

USE K_a = 0.4



$10(125)0.4 = 500$ LB/FT

Is backfill going to be specified to justify the lateral pressure?

Provide Calculations for Steel Reinforcement. As < min%?

Provide Calculations to verify soil bearing pressure has not exceeded.

Check external stability for sliding.

CHECK 10'-0 WALL

$$\Sigma M_0 = -500\left(\frac{10}{2}\right)\left(4\tfrac{1}{3}\right) + 1150(4)3.5 + 825(2.75) + 1500(1) = 0$$

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

$$M_{MAX\ SOIL} = 500\left(\frac{10}{2}\right)\left(\frac{10}{3}\right) = 8{,}333 \text{ FT LB}$$

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

CHECK STEM 10'-0 WALLS

TRY #5 @ 10" O.C.

$$\frac{9 - 60(0.31)}{0.85(3)10} = 0.73$$

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

OK

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

CHECK FOOTING 10'-0 WALLS

SAME OK.

TWELVE FOOT WALLS STEM

TRY #6's @ 10

$$a = \frac{60(0.44)}{0.85(3)10} = 1.03 \text{ in}$$

$$M_n = 0.9(60{,}000)\left(0.44\left(\frac{12}{10}\right)\left(10 - \frac{1.03}{2}\right)\right) = 22{,}930 \text{ FT LBS}$$

$$1.7(16{,}270) = 27{,}659 \text{ FT LBS}$$ INCREASE TO #6's @ 12"

$$a = \frac{60(0.88)}{0.85(3)12} = 1.72 \text{ in}$$

$$M_n = 0.9(60{,}000)(0.88)\left(13 - \frac{1.72}{2}\right) = 48{,}464 \text{ FT LBS}$$ OK