**SEEMAR CORPORATION**
**Consulting Geotechnical & Materials Engineers**
Inspection, Quality Control, Subsurface Investigations, Laboratory Testing, Analysis, Design and Report Preparations
**P.O. Box 681, Orland Park, Illinois 60462 (708) 478-0266**

May 14, 2013

Village of Orland Park
Development Services Department
14700 Ravinia Avenue
Orland Park, Illinois

Attn: Mr. Kevin Lehmann

RE: Revised Calculations & Drawings for the Caisson Foundation Design, Proposed Rasidence, 14620 S. Westwood Drive, Orland Park, Illinois

Dear Mr. Lehmann:

This letter is prepared in response to the comments presented upon review of the drawings by Christopher B. Burke Engineering of Rosemont, Illinois. The responses are in the same numerical order as comments presented in a letter dated May 02, 2013. Mr. Majid of Christopher B. Burke Engineering was consulted prior to preparing this report.

11. The detailed calculations are attached with this letter considering the lateral loads and the reinforcement in the basement walls are modified accordingly per latest ACI-318.
12. The location of control joints are indicated on Caisson Foundation Plan ( sheet

**S1 )** and the detail cross-sections are exhibited on sheet **S2.**

13. In reference to the soil borings, the builder agreed to hire qualified Geotechnical Engineer to verify the allowable bearing capacity at the bottom of caissons and inspection report will be submitted to the Village of Orland Park.
14. A note is added regarding waterproof coating or membrane on sheet **S1.**

We have welcomed the opportunity to be of service to you on this project. If there are any questions with regard to this report, please call us.

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GHULAM M. KAMAL
081-006522
BENSENVILLE
ILLINOIS
LICENSED STRUCTURAL ENGINEER

Respectfully submitted:

SEEMAR CORPORATION

Lic.Exp. on 11/30/14

Ghulam M. Kamal, S.E.

Lic. Exp. on 11/30/13

Rash Mamtora, P.E.

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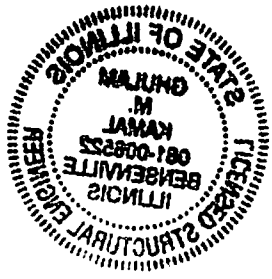
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4-1-13/Rev. 5/14/13

Caisson Foundation Design
Proposed Single Family Residence
14620 S. Westwood Dr.
Orland Park, Illinois


5/14/13
Lic Exp 11/30/14

## Load Calculations:

| | DL | LL |
|---|---|---|
| Max. Ext. Wall | | |
| 20 x 12 | 240 lbs/ft. | |
| 9 x 1 x 150 | 1350 | |
| Floors.: | | |
| 12.5 x 7 x 6 | 525 | |
| 30 x 6 | 180 | |
| 2 x 12 x 6 | 144 | |
| 2 x 40 x 6 | 480 | |
| Roof: | | |
| 10 x 12 | 120 | |
| 25 x 12 | 300 | |
| | 2.4 k/ft. | 1.0 k/ft. |

Total Service Load = 3.4 k/ft.

Shaft Dia. $D_s = \sqrt{\frac{3.4 \times 4}{\pi \times 7.5}} = 2.4'$

Provided 2.5'

$q_u$ : 2.5 TSF
$q_{all}$ : 1.5 x 2.5 x 2
= 7.5 KSF

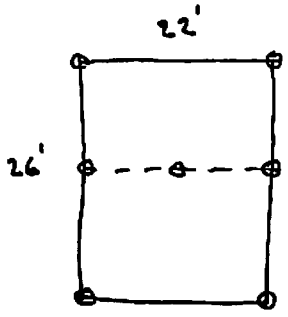
## Interior Column :

| | DL | LL |
|---|---|---|
| Floors: | | |
| 12.5 x 7 x 14 x 11.5 | 14.1 k | |
| 2 x 1.5 x 150 x 15 | 6.8 | |
| 30 x 15 x 14 | | 6.3 |
| 2 (12 x 15 x 14) | 5.0 | |
| 2 (40 x 15 x 14) | | 16.8 |
| Roof : | | |
| 10 x 15 x 14 | 2.1 | |
| 25 x 15 x 14 | | 5.3 |
| | 28.0 k | 28.4 k |

Total S.L. = 56.4 k

$$D_s = \sqrt{\frac{56.4 \times 4}{\pi \times 7.5}} = 3'$$

## Garage :




Short Wall :

| | DL | LL |
|---|---|---|
| 5 x 1 x 150 | 750 lbs/ft. | |
| 12 x 9 | 108 | |
| Floor : | | |
| 12.5 x 7 x 6 | 525 | |
| 60 x 6 | | 360 |
| | 1.4 k/ft | 0.4 |

Total S.L. = 1.8 k/ft

Long Wall:

| | D.L. | LL |
|---|---|---|
| 5 x 1 x 150 | 750 | |
| 12 x 9 | 108 | |
| Roof. | | |
| 10 x 11 | 110 | |
| 25 x 11 | 275 | |
| | 1.0 k/ft | 0.3 |

Total S.L. = 1.3 k/ft.

Total S.L. @ Corner Caisson: $1.8 \times 11 + 1.3 \times 6.5 = 28.3$ k

$$D_s = \sqrt{\frac{28.3 \times 4}{\pi \times 7.5}} = 2.2' < 2.5'$$

Central Grade Beam:

| | D.L | LL |
|---|---|---|
| 12.5 x 7 x 13 | 1138 lbs/ft | |
| 60 x 13 | | 780 |
| 1 x 4.5 x 150 | 675 | |
| | 1.8 k/ft | 0.8 k/ft. |

Total S.L = 2.6 k/ft

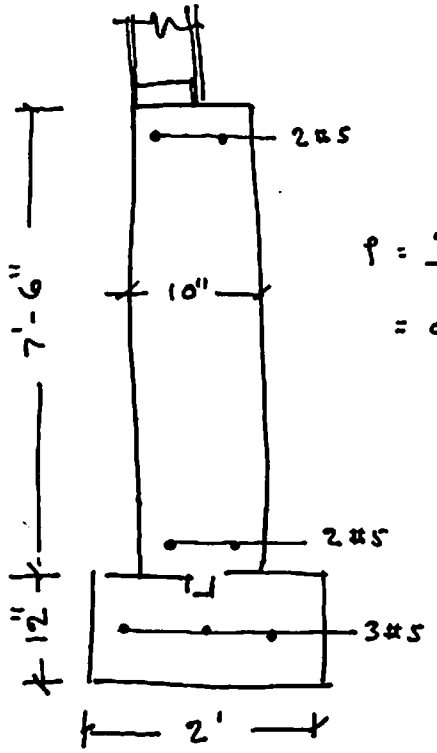
Total S.L. @ Ext. Caisson $2.6 \times 5.5 + 1.3 \times 13 = 31.2$ k.

$$D_s = \sqrt{\frac{31.2 \times 4}{\pi \times 7.5}} = 2.3' < 2.5'$$

Total S.L @ Center Caisson $2.6 \times 11 = 28.6$ K

$$D_s = \frac{28.6 \times 4}{\pi \times 7.5} = 2.2' < 2.5'$$

# R. C. Design :




$$\rho = \frac{2 \times 0.31}{10 \times 84} = 0.0007$$

Exterior Grade Beam (Residence) :

$$U = 1.2 \times 2.4 + 1.6 \times 1 = 4.5 \text{ k/ft}$$

$$Mu = \frac{4.5 \times 10^2}{12} = 37.5 \text{ k.ft.}$$

$$Mu = \phi Mn$$

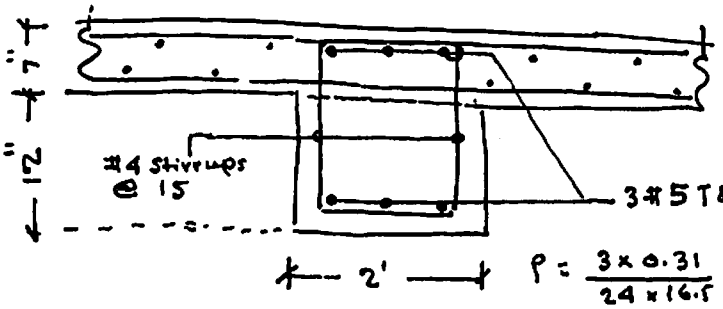
$$= \frac{0.9 \times 0.0007 \times 60 \times 10 \times 84^2 \left(1 - \frac{0.0007 \times 60}{1.7 \times 3}\right)}{12}$$

$$= 220 \text{ k.ft.} > 37.5$$

Check for Shear

$$q_v = \frac{4.5 \times 5 \times 1000}{10 \times 84} = 27 \text{ psi} < 109$$

## Design of Basement Beam & Slab :




$$\rho = \frac{3 \times 0.31}{24 \times 16.5} = 0.0023$$

| | DL | LL |
|---|---|---|
| 12.5 x 7 x 12.5 | 1094 lbs/ft. | |
| 30 x 12.5 | | 375 |
| 2 x 1.5 x 150 | 450 | |
| | 1.55 k/ft | 0.38 |

$$U = 1.2 \times 1.6 + 1.6 \times 0.4 = 2.6 \text{ k/ft.}$$

$$Mu = \frac{2.6 \times 15^2}{12} = 48.8 \text{ k.ft.}$$

$$M_u = \phi M_n$$

$$= \frac{0.9 \times 0.0023 \times 60 \times 24 \times 16.5^2 \left(1 - \frac{0.0023 \times 60}{1.7 \times 3}\right)}{12}$$

$$= 65.8 \text{ k.ft.} > 48.8$$

Check for Shear

$$a_r = \frac{2.6 \times 7.5 \times 1000}{24 \times 16.5} = 49.3 \text{ psi} < 109$$

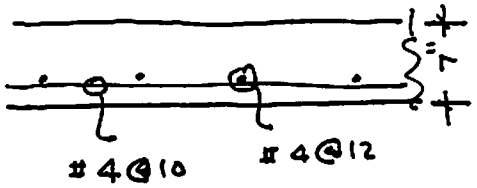
Provide nominal stirrups # 4 @ 15"

Design of Slab:

| DL | LL |
|---|---|
| 87.5 | 30 |

$$u = 1.2 \times 87.5 + 1.6 \times 30 = 153 \text{ lbs/ft.}$$

$$M_u = \frac{153 \times 13^2}{12} = 2155 \text{ ft.lbs.}$$




$$\rho = \frac{0.2}{10 \times 4.5} = 0.0044$$

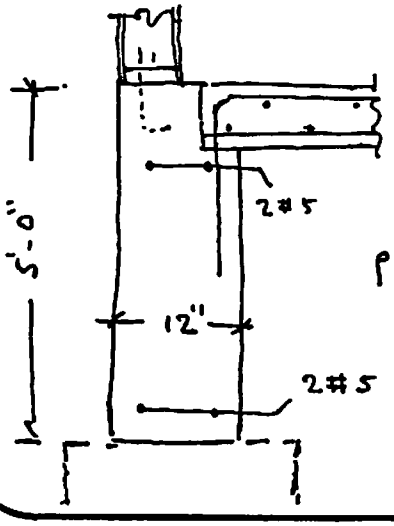
$$M_u = \phi M_n$$

$$= \frac{0.9 \times 0.0044 \times 60 \times 12 \times 4.5^2 \left(1 - \frac{0.0044 \times 60}{1.7 \times 3}\right)}{12}$$

$$= 4.168 \text{ k.ft} \times 1000 = 4168 \text{ ft.lbs.} > 2155$$

Temp. Steel #4@12 $\frac{0.2}{12 \times 7} = 0.0024 > 0.0018$

## Garage:




Ext. Wall: $u = 1.2 \times 1.4 + 1.6 \times 0.4 = 2.3 \text{ k/ft.}$

$$M_u = \frac{2.3 \times 20^2}{12} = 77 \text{ K.ft.}$$

$$M_u = \phi M_n$$

$$= \frac{0.9 \times 0.001 \times 60 \times 12 \times 54^2 \left(1 - \frac{0.001 \times 60}{1.7 \times 3}\right)}{12}$$

$$= 155.6 \text{ k.ft.} > 77$$

$$\rho = \frac{2 \times 0.31}{12 \times 54} = 0.001$$

Check for Shear: $v = \frac{2.3 \times 10 \times 1000}{12 \times 54} = 35.5 \text{ psi} < 109$

Center Grade Beam & Slab:

$$u = 1.2 \times 1.8 + 1.6 \times 0.8 = 3.5 \text{ k/ft}$$

$$Mu = \frac{3.5 \times 11^2}{12} = 35.3 \text{ k.ft.} << 155.6$$

Design of slab:

$$u = 1.2 \times 87.5 + 1.6 \times 60 = 201 \text{ lbs/ft}$$

$$Mu = \frac{201 \times 12^2}{12} = 2412 \text{ ft.lbs}$$

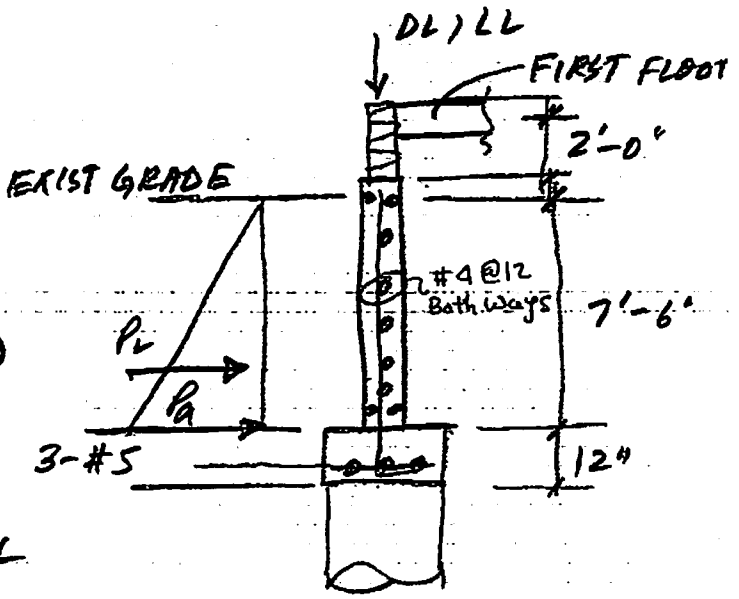
$$Mu = \phi Mn.$$

From previous calculations, Mu = 4168 ft.lbs. > 2412

Temp. steel #4 @12

$$\frac{0.2}{12 \times 7} = 0.0024 > 0.0018$$

# → Retaining Wall Design




EFP = 75 PCF (including water pressure)

$\therefore P_a = 75 \times 7.0' = 525$ PSF

$\therefore P_L = 1838$ PLF LATERAL

$D_L = 2400$ LB/FT (GRAVITY)

$LL = 1000$ LB/FT (GRAVITY)

① CANTILEVER CASE (NEGATIVE MOMENT)

⇒ TOTAL Overturning Moment AT BASE (TOP OF FOUNDATION)

$\therefore M_u = 3.48$ K-FT

$\phi M_n = 4.32$ K-FT

VERTICAL REINFORCEMENT ⇒ MOMENT CAPACITY BASED ON

$A_s = $ #4 @ 12"

$A_s = 0.2$ in²/FT

$d = 10" - 2" - \frac{1}{4}" = 7.75$

Use $d = 5"$

$\therefore \phi M_n = \phi A_s f_y \left(d - 0.59 \frac{f_y}{f'_c}\right)$

$\therefore \phi M_n = 0.9 \times 0.2 \times 60 \times \left(5.00 - \frac{0.59 \times 0.2}{3 \times 12}\right)$

$\phi M_n = 51.88$ K-in

$\phi M_n = 4.32$ K-in

Increase $M_u$ BY 1/3

$= 1/3\, M_u = 1.16 \therefore M_u =$

$\therefore M_u = 4.61$ K-FT WITH 1/3RD INCREASE

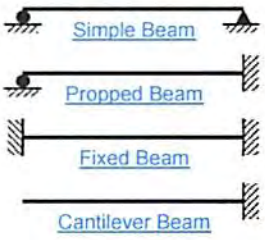
SAY $M_u = \phi M_n$ OK

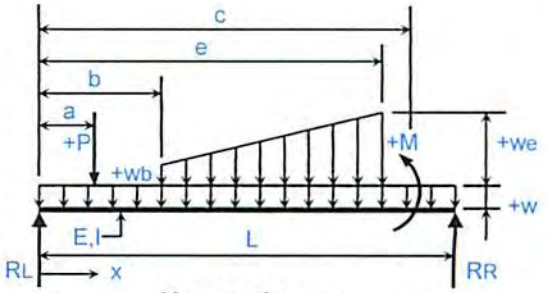
| Job Name: | | Subject: | | | |
|---|---|---|---|---|---|
| Job Number: | | Originator: | | Checker: | |

## Input Data:

### Beam Data:

| | | |
|---|---|---|
| Span Type? | Simple | |
| Span, L = | 9.5000 | ft. |
| Modulus, E = | 3122 | ksi |
| Inertia, I = | 1000.00 | in.^4 |




Nomenclature

### Beam Loadings:

**Full Uniform:**

w = 0.0000 kips/ft.

| Distributed: | Start b (ft.) | Start wb (kips/ft.) | End e (ft.) | End we (kips/ft.) |
|---|---|---|---|---|
| #1: | 0.0000 | 0.8400 | 7.0000 | 0.0000 |
| #2: | | | | |
| #3: | | | | |
| #4: | | | | |
| #5: | | | | |
| #6: | | | | |
| #7: | | | | |
| #8: | | | | |

| Point Loads: | a (ft.) | P (kips) |
|---|---|---|
| #1: | | |
| #2: | | |
| #3: | | |
| #4: | | |
| #5: | | |
| #6: | | |
| #7: | | |
| #8: | | |
| #9: | | |
| #10: | | |
| #11: | | |
| #12: | | |
| #13: | | |
| #14: | | |
| #15: | | |

| Moments: | c (ft.) | M (ft-kips) |
|---|---|---|
| #1: | | |
| #2: | | |
| #3: | | |
| #4: | | |

### Results:

**Reactions:**

| | | | |
|---|---|---|---|
| RL = | 2.22 k | RR = | 0.72 k |
| ML = | N.A. | MR = | N.A. |

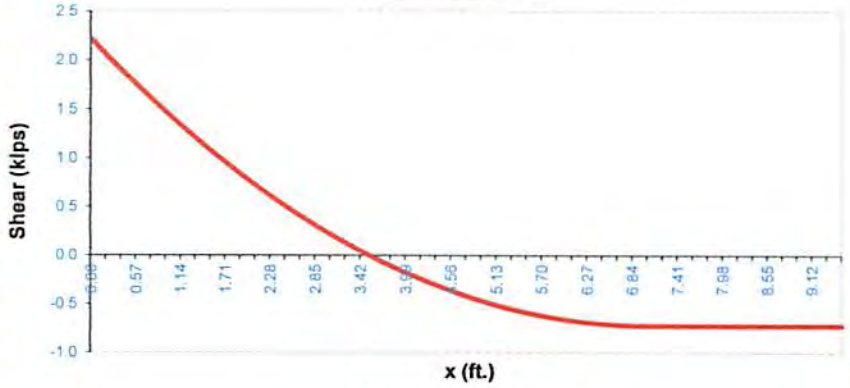
**Maximum Moments:**

| | | | |
|---|---|---|---|
| +M(max) = | 3.48 ft-k | @ x = | 3.53 ft. |
| -M(max) = | 0.00 ft-k | @ x = | 0.00 ft. |

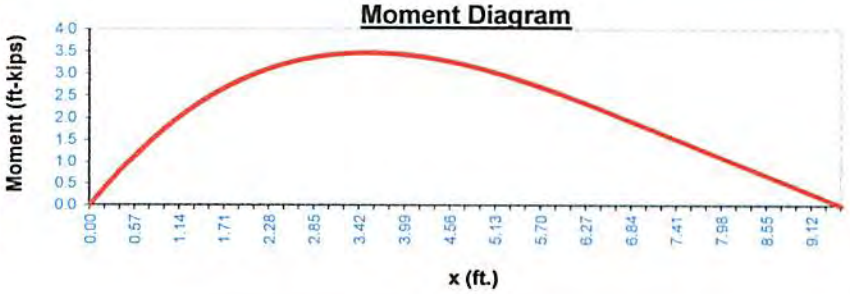
**Maximum Deflections:**

| | | | |
|---|---|---|---|
| -Δ(max) = | -0.017 in. | @ x = | 4.42 ft. |
| +Δ(max) = | 0.000 in. | @ x = | 0.00 ft. |
| Δ(ratio) = | L/6746 | | |

### Shear Diagram




### Moment Diagram



# Minimum Reinforcement for Walls

## Vertical Reinforcement

Per ACI 14.3.2.(a)

$\rho_{min} = 0.0012$

$A_s = 0.0012 \times 12'' \times 10'' = 0.144 in^2$

USE #4 @ 12" $= 0.2 in^2/FT$

Per ACI 7.12.2.1(a) $A_{s\,Temp} = 0.0018 \times 12 \times 10 = 0.168 in^2/FT < 0.2 in^2/F$

OK

## Horizontal Reinforcement (walls)

Per ACI 14.3.3 (a) $\rho_{min} = 0.002$

$A_s = 0.002 \times 10 \times 7.5 \times 12$

$A_s = 1.8 in^2$ Use - 9-#4 Bas @ 12" O.C. Vertically

2-#5 T & B $A_s = 1.24 in^2$

Net $= 1.8 - 1.24 = 0.56 in^2$

Say #4 @ 12"
Total 6 BARS.