

AFA Consulting LLC

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STRUCTURAL CALCULATIONS

Project: New Swimming Pool

Owner: Casa Roble 131

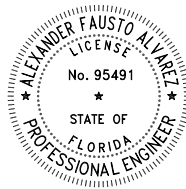
Address: 6545 SW 131st ST, Pinecrest, FL, 33156

Prepared For: Gray Dolphin Pools & Construction, Inc.

9/16/2025

Pages 1-6

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FBC 2023

ASCE 7-16

Pool Details and Properties

Pool Details and Properties

Pool Coping Elevation	10.83 Elev. ft
Pool Water Line Elevation	10.50 Elev. ft
Flood Zone Elevation	8.00 Elev. ft
Bottom Slab Elevation	4.67 Elev. ft
Pool Maximum Depth	5.00 ft
Pool Wall Average Height	4.10 ft
Pool Wall Thickness	9.00 in
Pool Slab Thickness	10.00 in
Unsupported Slab Length	14.00 ft
Total Slab Area	860.00 sf
Pool Perimeter	160.00 ft
Volume Stairs +/- Bench	10.00 cf
Surcharge (Pool Deck)	100.00 psf

Material Properties

Concrete Design Strength	3500.00 psi
Steel Design Strength	60000.00 psi
Weight of Rein. Concrete	150.00 pcf

Soil Properties

C Soil	30.00 Degrees
Soil Density	110.00 pcf
Water Density	62.40 pcf
Soil Friction Force	30.00 psf
Soil Bearing Capacity	2000.00 psf

Reinforcement (sqin)	Single	Double
#3@6" o.c.	0.22	0.44
#3@7" o.c.	0.19	0.38
#3@8" o.c.	0.17	0.33
#3@9" o.c.	0.15	0.29
#3@10" o.c.	0.13	0.26
#4@6" o.c.	0.40	0.80
#4@7" o.c.	0.34	0.69
#4@8" o.c.	0.30	0.60
#4@9" o.c.	0.27	0.53
#4@10" o.c.	0.24	0.48

Constants

Hydrostatic Relief Valve	2.00 Feet
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Reinforcement Details

Slab Reinforcement	#3@9" o.c. sqin
Wall Reinforcement	#3@6" o.c. sqin
Slab Reinforcement Cover	3.00 in
Wall Reinforcement Cover	4.00 in

Double
Single

Buoyancy Calculations - Pool as a Whole

Downward Forces

Bottom Slab	= $\text{Area Slab} \times \text{Slab Thickness} \times \text{Density of Concrete} =$	107,500 lbs
Walls	= $\text{Pool Perimeter} \times \text{Avg. Wall Height} \times \text{Wall Thickness} \times \text{Density of Concrete} =$	65,430 lbs
Stairs +/- Bench	= $\text{Combined Volume of Stairs and Bench} \times \text{Density of Concrete} =$	1,500 lbs
Total Factored Dead Load	= $\text{Dead Loads} = 1.2 * \sum DL =$	191,873 lbs

Uplift Forces

Hydr.Uplift Elev.	= $\text{Depth of concrete below flood elevation} =$	3.33 ft
Net Hydro Uplift	= $\text{Hydrostatic Uplift} - \text{Hydrostatic Valve} =$	1.33 ft
Uplift Force	= $\text{Net Hydrostatic Uplift} \times \text{Area Slab} \times \text{Water Density} =$	23,193 lbs
Total Factored Uplift	= $\text{Uplift Surcharge} = 1.4 * \sum H =$	25,513 lbs

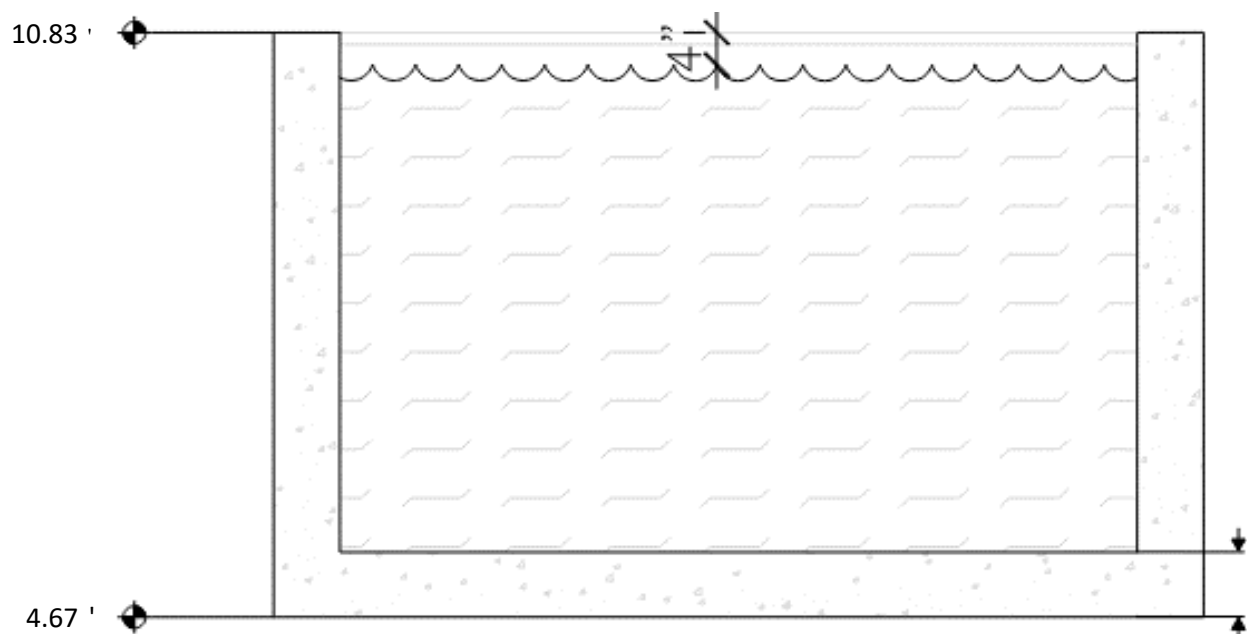
Note: Uplift Forces adjustments are made to account elevation differences in bench/entrance areas

Safety Factor = $\frac{\text{Total Downward Forces}}{\text{Total Uplift Forces}} =$

7.52

O.K.

Pool Resists Uplift Forces



Buoyancy Calculations Tributary Width at Deep End

Downward Forces

Bottom Slab (1ft Tributary Width)	$= 1ft \text{ Tributary width} \times \text{Slab Length} \times \text{Slab Thickness} \times \text{Density of Concrete} =$	1,750 lbs
End Wall	$= 1ft \text{ Tributary width} \times \text{Pool Wall Height} \times \text{Wall Thickness} \times \text{Density of Concrete} \times 2 =$	1,200 lbs
Total Factored Dead Load	$= \text{Dead Loads} = \sum DL =$	2,950 lbs

Uplift Forces

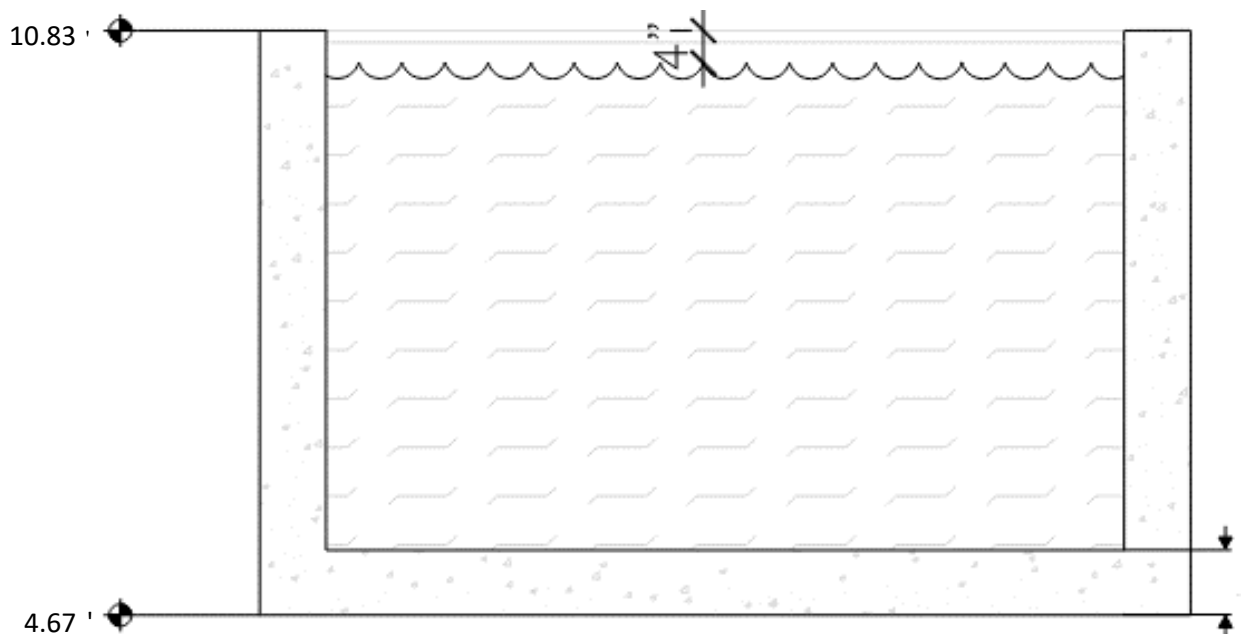
Hydr.Uplift Elev.	$= \text{Depth of concrete below flood elevation} =$	3.33 ft
Net Hydro Uplift	$= \text{Hydrostatic Uplift} - \text{Hydrostatic Valve} =$	1.33 ft
Total Factored Uplift	$= (\text{Net Hydrostatic Uplift} \times 1ft \text{ Tributary width} \times \text{Slab Length} \times \text{Water Density}) =$	1,165 lbs

Net Resultant Forces $= \frac{\text{Total Downward Forces}}{\text{Total Uplift Forces}} =$

2.53 > 1.0

O.K.

Pool Resists Uplift Forces



Wall Design

$$K_A = \tan^2 \left(45^\circ - \frac{\phi}{2} \right) = 0.33$$

$$R_A = \frac{1}{2} K_A \gamma H^2 = 318.3 \text{ plf}$$

$$R_H = \frac{1}{2} K_A \gamma_w h^2 = 115.6 \text{ plf}$$

$$R_S = K_A q H = 166.7 \text{ plf}$$

$$M_u = 1.4 \left(\frac{H}{3} R_A + \frac{h}{3} R_H + \frac{H}{2} R_S \right) = 1486 \text{ lbs-ft}$$

Where:

K_A = coefficient of active earth pressure

R_A = Lateral Earth Pressure

R_H = Lateral Hydrostatic Pressure

R_S = Uniform Surcharge Load

M_u = Ultimate Bending Moment

ϕ = Angle of Internal Friction

H = Height of Pool Wall

h = Hydrostatic Uplift Elevation

γ = Soil Density

Area of Steel Required

$$R_n = \frac{M_u}{\phi b d^2} =$$

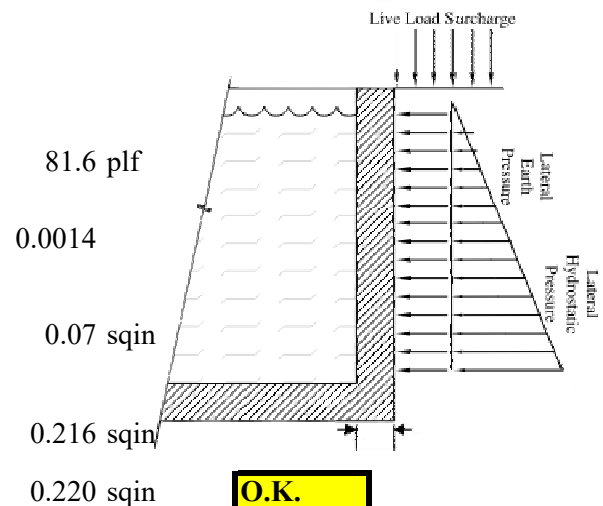
$$p = \frac{0.85 f'_c}{f_y} \times \left[1 - \sqrt{1 - \frac{2 \times R_n}{0.85 \times f'_c}} \right]$$

$$A_{sreq} = p b d =$$

Minimum Reinforcement per ACI 318-19 24.4.3.2

$$A_{smin} = 0.002 b d =$$

Area Steel Provided



Assuming Critical Loading at Service

Bearing Pressure Calculations

Max Bearing Pressure (At base of Walls)

$$= (\text{Wall Height} + \text{Slab Thickness}) \times \text{Weight of Concrete} = 875.00 \text{ psf}$$

$$\text{Safety Factor} = \frac{\text{Soil Bearing Capacity}}{\text{Max Bearing Pressure}} = 2.3$$

O.K.

Slab Deck Design

Assuming Load When Pool Filled W/ Water No Water Uplift to Resist Loads

Loads

Dead Load Due to Self Weight:

$$DL_{sw} = 1.2 \times \text{Weight of Conc.} \times \text{Slab Thickness} = 150.0 \quad \text{plf}$$

Dead Load Due to Water:

$$DL_w = 1.2 \times \text{Weight Water} \times \text{Pool Water Elev.} = 374.4 \quad \text{plf}$$

Total Dead Load (At tributary width of 12"):

$$T_{DL} = \text{Self weight} + \text{Water} = 524.4 \quad \text{psf}$$

Soil Bearing Capacity=

$$2000.00 \quad \text{psf}$$

$$\text{Safety Factor} = \frac{\text{Soil Bearing Capacity}}{\text{Total Dead Load}} =$$

$$3.8 \quad \text{O.K.}$$

Pool Loads Resisted by Soil: Design For Minimum Steel

Minimum Reinforcement per ACI 318-19 24.4.3.2

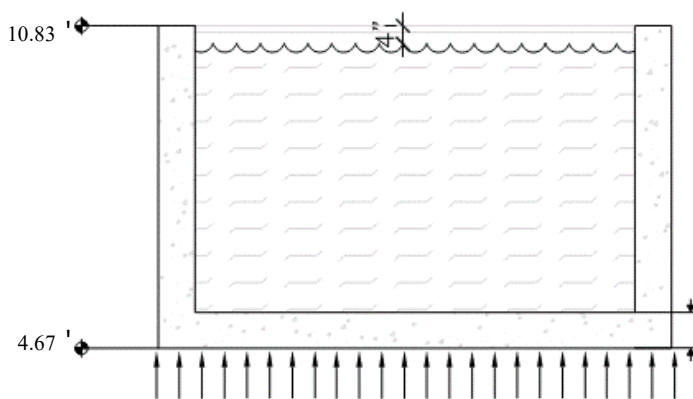
$$A_{smin} = 0.0018bd = 0.22 \quad \text{sqin}$$

Area Steel Provided

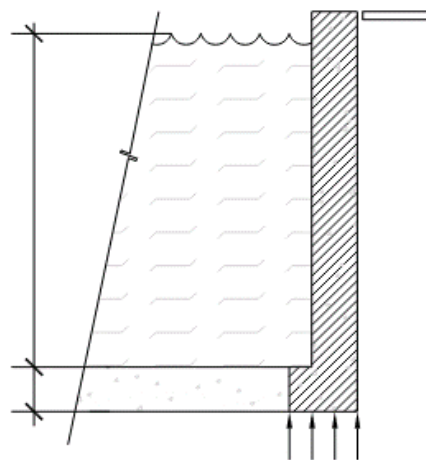
$$0.29 \quad \text{sqin}$$

Steel Check

O.K.



Resisted by Soil



Slab Deck Design

Loads

Positive Dead Load Due to Self Weight:

$$DL_{sw} = 1.2 * \text{Weight of Conc.} \times \text{Slab Thickness} = 150.0 \quad \text{plf}$$

Negative Live Load Due to Uplift:

$$LL_w = 1.4 * \text{Water Density} \times \text{Hydro. Uplift} = -116.5 \quad \text{plf}$$

Net Load on Slab

$$T_w = DL - LL = 33.5 \quad \text{plf}$$

Assuming Critical Loading at Service (Pool Empty - Max Water Table)

Area Steel Required

$$M_u = \frac{wl^2}{8} = 821.2 \quad \text{lbs-ft}$$

$$R_n = \frac{M_u}{\phi b d^2} = 57.0 \quad \text{plf}$$

$$p = \frac{0.85 f'_c}{f_y} \times \left[1 - \sqrt{1 - \frac{2 \times R_n}{0.85 \times f'_c}} \right] = 0.001$$

$$A_{sreq} = p b d = 0.05 \quad \text{sqin}$$

Minimum Reinforcement per ACI 318-19 24.4.3.2

$$A_{smin} = 0.0018 b d = 0.22 \quad \text{sqin}$$

Area Steel Provided

$$0.29 \quad \text{sqin}$$

Steel Check

O.K.

