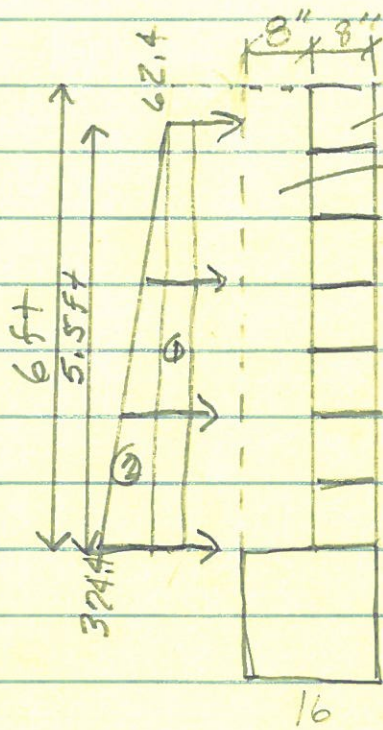


Steel Re Inforcement in Pool Wall



cmu with steel & filled with concrete
Gunitite sprayed with steel

$$\rho h \times 1 \text{ ft wide} = \# / \text{LF}$$

$$62.4 \# / \text{ft}^3 \times 1 \text{ ft} \times 1 \text{ ft} = 62.4 \# / \text{LF}$$

$$62.4 \# / \text{ft}^3 \times 6 \text{ ft} \times 1 \text{ ft} = 374.4 \# / \text{LF}$$

Consider w_D as a point load

$$P_L = (62.4 \times 5.5) + (374.4 - 62.4) \times 5.5 \times \frac{1}{2}$$

$$P_L = 1201.2 \#$$

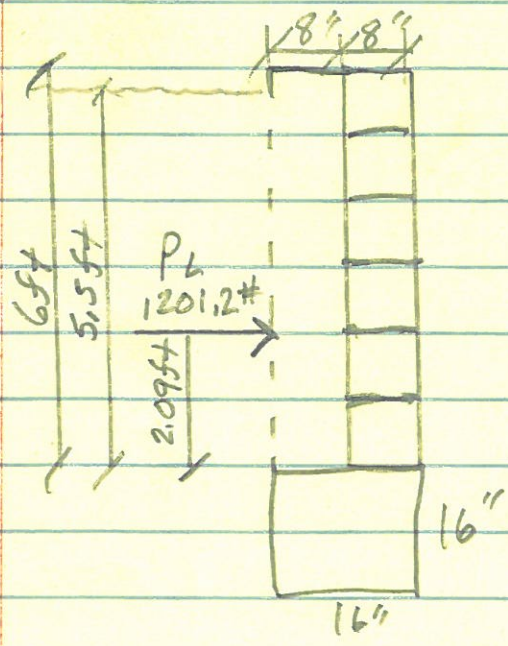
$$A_1 = (62.4 \times 5.5) = 343.2 \text{ ft}^2$$

$$x_{i1} = 5.5 \div 2 = 2.75 \text{ ft}$$

$$A_2 = (374.4 - 62.4) \times 5.5 \times \frac{1}{2} = 858 \text{ ft}^2$$

$$x_{i2} = \frac{1}{3} \times 5.5 = 1.83 \text{ ft}$$

$$\bar{x} = \frac{\sum x_i A_i}{\sum A} = \frac{(2.75 \times 343.2) + (1.83 \times 858)}{343.2 + 858} = 2.09 \text{ ft}$$



Tbl A.7 (Grade 60, 3,000 psi)

$$\rho = \frac{1}{2} \rho_{\text{max}} = \frac{1}{2} (0.0136) = 0.0068$$

$$\gamma_c = 150 \# / \text{ft}^3$$

$$f_y = 60 \text{ ksi}$$

$$f'_c = 3,000 \text{ psi}$$

$$M_u = 1201.2 \# \times 2.09 \text{ ft} = 2510.5 \text{ ft-}\#$$

Convert to inches = 30,126.1 in-#

Use Tbl A-12 when $\rho = 0.0068$

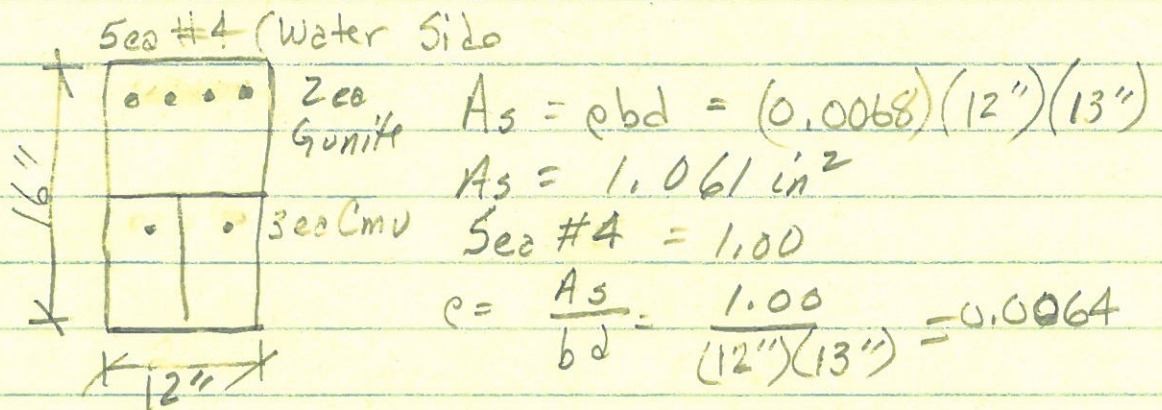
$$\frac{M_u}{\phi b d^2} = 375.3$$

Steel Reinforcement in Pool Wall Cont'd

$$\frac{M_u}{\phi b d^2} = 375.3 \quad \text{therefore} \quad b = \frac{M_u}{\phi 375.3 d^2}$$

$$d = 5.5 \text{ ft. then } b_{\min} = \frac{30,126.1 \text{ in-}\#}{(0.9)(375.3)(5.5)^2} = 2.95''$$

However our wall is 16" therefore $d = 13''$
consider the wall in 12" wide beams.



$$0.0064 > \rho_{\min} = 0.0033$$

$$0.0064 < \rho_{\max} = 0.0136 \quad \therefore \text{beam is ductile}$$

Table A.7 Values of ρ Balanced, ρ to Achieve Various ϵ_t Values, and ρ Minimum for Flexure. All Values Are for Tensile Reinforced Rectangular Sections

f_c	f_t	3000 psi $\beta_1 = 0.85$	4000 psi $\beta_1 = 0.85$	5000 psi $\beta_1 = 0.80$	6000 psi $\beta_1 = 0.75$
Grade 40 40,000 psi (275.8 MPa)	ρ balanced	0.0371	0.0495	0.0582	0.0655
	ρ when $\epsilon_t = 0.004$	0.0232	0.0310	0.0364	0.0410
	ρ when $\epsilon_t = 0.005$	0.0203	0.0271	0.0319	0.0359
	ρ when $\epsilon_t = 0.0075$	0.0155	0.0206	0.0243	0.0273
	ρ min for flexure	0.0050	0.0050	0.0053	0.0058
Grade 50 50,000 psi (344.8 MPa)	ρ balanced	0.0275	0.0367	0.0432	0.0486
	ρ when $\epsilon_t = 0.004$	0.0186	0.0248	0.0291	0.0328
	ρ when $\epsilon_t = 0.005$	0.0163	0.0217	0.0255	0.0287
	ρ when $\epsilon_t = 0.0075$	0.0124	0.0165	0.0194	0.0219
	ρ min for flexure	0.0040	0.0040	0.0042	0.0046
Grade 60 60,000 psi (413.7 MPa)	ρ balanced	0.0214	0.0285	0.0335	0.0377
	ρ when $\epsilon_t = 0.004$	0.0155	0.0206	0.0243	0.0273
	ρ when $\epsilon_t = 0.005$	0.0136	0.0181	0.0212	0.0239
	ρ when $\epsilon_t = 0.0075$	0.0103	0.0138	0.0162	0.0182
	ρ min for flexure	0.0033	0.0033	0.0035	0.0039
Grade 75 75,000 psi (517.1 MPa)	ρ balanced	0.0155	0.0207	0.0243	0.0274
	ρ when $\epsilon_t = 0.004$	0.0124	0.0165	0.0194	0.0219
	ρ when $\epsilon_t = 0.005$	0.0108	0.0144	0.0170	0.0191
	ρ when $\epsilon_t = 0.0075$	0.0083	0.0110	0.0130	0.0146
	ρ min for flexure	0.0027	0.0027	0.0028	0.0031

Table A.11 (Continued)

ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$
0.0184	795.1	0.0193	827.6	0.0202	859.5	0.0210	887.4
0.0185	798.8	0.0194	831.2	0.0203	863.0	0.0211	890.8
0.0186	802.4	0.0195	834.8	0.0204	866.5	0.0212	894.3
0.0187	806.0	0.0196	838.3	0.0205	870.0	0.0213	897.7
0.0188	809.7	0.0197	841.9	0.0206	873.5	0.0214	901.1
0.0189	813.3	0.0198	845.4	0.0207	877.0	0.0215	904.5
0.0190	816.9	0.0199	849.0	0.0208	880.5	0.0216	907.9
0.0191	820.5	0.0200	852.5	0.0209	883.9	0.0217	911.3
0.0192	824.1	0.0201	856.0				

Table A.12 $f_y = 60,000$ PSI; $f'_c = 3000$ PSI—U.S. Customary Units

	ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$	ρ	$\frac{M_u}{\phi b d^2}$
ρ_{min} for temp and shrinkage	0.0018	105.7	0.0039	223.2	0.0060	334.5	0.0081	439.5
	0.0019	111.5	0.0040	228.7	0.0061	339.7	0.0082	444.4
	0.0020	117.2	0.0041	234.1	0.0062	344.8	0.0083	449.2
	0.0021	122.9	0.0042	239.5	0.0063	349.9	0.0084	454.0
	0.0022	128.6	0.0043	244.9	0.0064	355.0	0.0085	458.8
	0.0023	134.3	0.0044	250.3	0.0065	360.1	0.0086	463.6
	0.0024	139.9	0.0045	255.7	0.0066	365.2	0.0087	468.4
	0.0025	145.6	0.0046	261.0	0.0067	370.2	0.0088	473.2
	0.0026	151.2	0.0047	266.4	0.0068	375.3	0.0089	477.9
	0.0027	156.9	0.0048	271.7	0.0069	380.3	0.0090	482.6
	0.0028	162.5	0.0049	277.0	0.0070	385.3	0.0091	487.4
	0.0029	168.1	0.0050	282.3	0.0071	390.3	0.0092	492.1
	0.0030	173.7	0.0051	287.6	0.0072	395.3	0.0093	496.8
	0.0031	179.2	0.0052	292.9	0.0073	400.3	0.0094	501.4
	0.0032	184.8	0.0053	298.1	0.0074	405.2	0.0095	506.1
ρ_{min} for flexure	0.0033	190.3	0.0054	303.4	0.0075	410.2	0.0096	510.7
	0.0034	195.8	0.0055	308.6	0.0076	415.1	0.0097	515.4
	0.0035	201.3	0.0056	313.8	0.0077	420.0	0.0098	520.0
	0.0036	206.8	0.0057	319.0	0.0078	424.9	0.0099	524.6
	0.0037	212.3	0.0058	324.2	0.0079	429.8	0.0100	529.2
	0.0038	217.8	0.0059	329.4	0.0080	434.7	0.0101	533.8