ZCS ENGINEERING

City of Coos Bay

STRUCTURAL CALCULATIONS

Mingus Pool Building Coos Bay
Coos Bay, Oregon

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REVIEWED BY: Sylas E. Allen, PE

EXPIRES: 12-31-17

4/6/16
Job Number: G-0703-14

ZCS ENGINEERING Inc.

CLIENT City of Coos Bay
PROJECT Mingus Pool
Retaining Wall Design
NO. 6·703-14
BY KmH DATE _____ SHEET _____ OF _____

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Lateral Pressures on Wall

Active Earth Pressure:

$\phi = 36°$

$\gamma = 115$ pcf

$k_a = \frac{1-\sin 36}{1+\sin 36} = .26$

$P_a = \frac{1}{2}(.26)(5')^2(115\text{ pcf}) = 375$ plf

Surcharge:

1. Slab + Live

Slab: $(160\text{ pcf})(\frac{6''}{12}) = 80$ psf

Live = 125 psf

Total = 205 psf

$P_q = (205)(.26)(5') = 267$ plf

$P_{Total} = 642$ plf

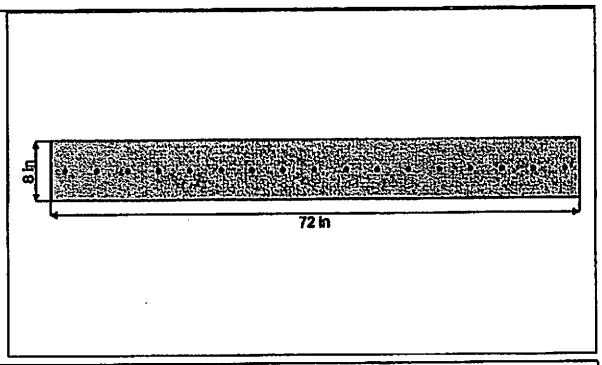
Description : Tank Wall (KMH)

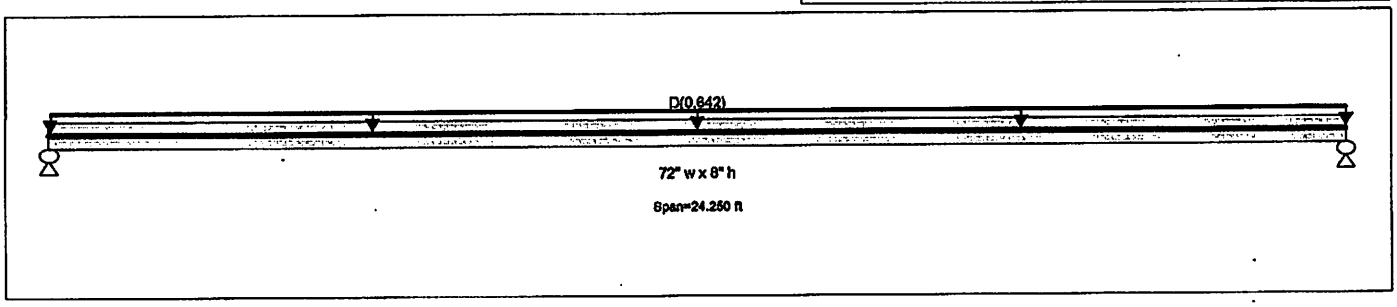
CODE REFERENCES

Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-05

Material Properties

f'c	= 4.50 ksi	ϕ Phi Values	Flexure :	0.90
fr = f'c$^{1/2}$ * 7.50	= 503.12 psi		Shear :	0.750
ψ Density	= 145.0 pcf	β_1	=	0.8250
λ LtWt Factor	= 1.0			
Elastic Modulus	= 3,122.0 ksi	Fy - Stirrups		40.0 ksi
fy - Main Rebar	= 60.0 ksi	E - Stirrups	=	29,000.0 ksi
E - Main Rebar	= 29,000.0 ksi	Stirrup Bar Size #		3
		Number of Resisting Legs Per Stirrup =		2





Cross Section & Reinforcing Details

Rectangular Section, Width = 72.0 in, Height = 8.0 in
Span #1 Reinforcing....
17-#5 at 4.0 in from Top, from 0.0 to 24.250 ft in this span

Applied Loads

Service loads entered. Load Factors will be applied for calculations.

Load for Span Number 1
Uniform Load : D = 0.6420 k/ft, Tributary Width = 1.0 ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio =	0.813 : 1	Maximum Deflection			
Section used for this span	Typical Section	Max Downward Transient Deflection	0.000 in	Ratio =	0<360
Mu : Applied	66.069 k-ft	Max Upward Transient Deflection	0.000 in	Ratio =	0<360
Mn * Phi : Allowable	81.246 k-ft	Max Downward Total Deflection	1.270 in	Ratio =	229>=18
Location of maximum on span	12.147 ft	Max Upward Total Deflection	0.000 in	Ratio =	999<180
Span # where maximum occurs	Span # 1				

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	7.784	7.784
Overall MINimum	4.671	4.671
D Only	7.784	7.784
+D+L	7.784	7.784
+D+Lr	7.784	7.784
+D+S	7.784	7.784
+D+0.750Lr+0.750L	7.784	7.784
+D+0.750L+0.750S	7.784	7.784
+D+W	7.784	7.784
+D+0.70E	7.784	7.784
+D+0.750Lr+0.750L+0.750W	7.784	7.784
+D+0.750L+0.750S+0.750W	7.784	7.784
+D+0.750Lr+0.750L+0.5250E	7.784	7.784
+D+0.750L+0.750S+0.5250E	7.784	7.784

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Conduit Support
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DL

- Schedule 80 6" PVC Pipe DL = 6 plf

Weight of water = $(62.4\ pcf)\left(\frac{\pi}{4}\right)\left(\frac{6}{12}''\right)^2 = 13\ plf$

Total = 19 plf => Use 20 plf for support structure

max of (3) 6" ϕ PVC pipes ∴ Design for (3.5) Pipes to be conserv.

Use $(3)(20\ plf) = 60\ plf$ for Design load of support structure

Conduit Span Check

$$S_{pipe} = \frac{\pi(d^4 - d_i^4)}{32d} = \frac{\pi(6.625^4 - 5.761^4)}{32(6.625)} = 12.2\ in^3$$

$$M_{max} = \frac{(.019)(19' \times 12)^2}{8} = 27.8\ k\text{-}in$$

$$I = \frac{\pi(6.625^4 - 5.761^4)}{64}$$

$$I = 40.5\ in^4$$

$$f_b = \frac{27.8\ k\text{-}in}{12.2\ in^3} = 2.3\ ksi < 7.2\ ksi \quad \text{Yok Bending}$$

$$\Delta_{max} = \frac{5wl^4}{384EI} = \frac{5(.019\ klf)(9')(9 \times 12)^3}{384(430\ ksi)(40.5\ in^4)} = .17\ in < .3 \quad \text{Yok}$$

$$\Delta_{allow} = \frac{(9)(12)}{360} = .3\ in$$