Structural Calculations

for

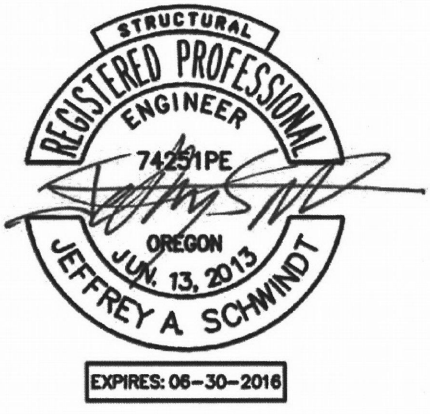
Outfall 10 Pipe Support

Portland, Oregon

Prepared for
Lewis & Clark College

June 8, 2015
JOB NUMBER: LAC-31

Limitations
Engineer was retained in limited capacity for this project. Design is based upon information provided by the client, who is solely responsible for the accuracy of same. No responsibility and/or liability is assumed by, or is to be assigned to the engineer for items beyond that shown on these sheets.
__6__ sheets total including this cover sheet.



This Packet of Calculations is Null and Void if Signature above is not original

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15-186839 SD

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BY: JAS | DATE: 6/1/2015 | JOB NO: LAC-31 | OF

PROJECT:

RE: Pipe Support Review

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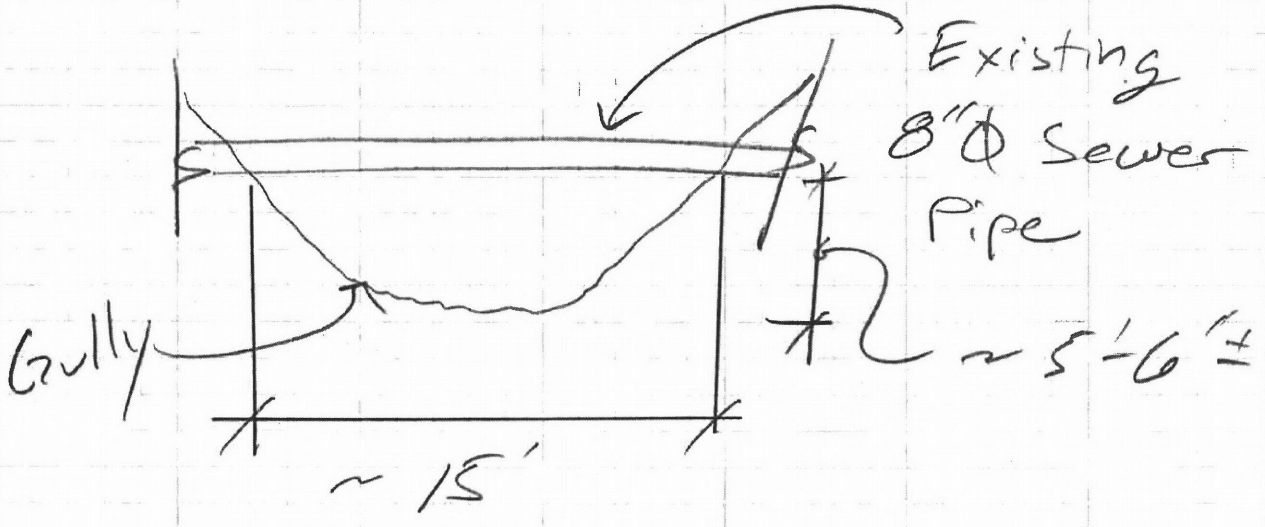

Pipe DL = 65 plf (full)

* Support pipe w/ new conc. beam below, see beam calcs on following pg.

12-1088-20

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Project Title:
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Concrete Beam

File = o:\HHPR Projects\LAC- Lewis and Clark College\LAC-31\CALCS\lac-31 calcs.ec6
ENERCALC, INC. 1983-2015, Build:6.15.4.10, Ver:6.15.4.10

Lic. # : KW-06010278

Licensee : Harper Houf Peterson Righellis Inc.

Description : conc beam clear span

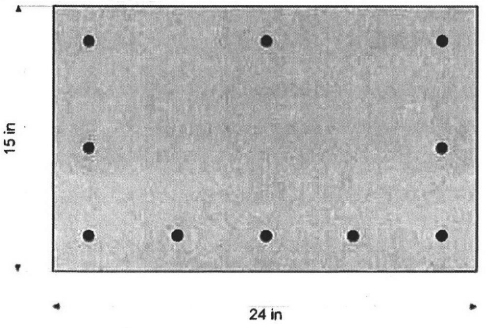
CODE REFERENCES

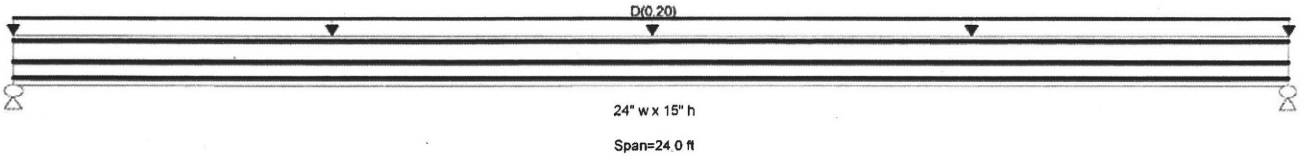
Calculations per ACI 318-11, IBC 2012, ASCE 7-10
Load Combination Set : ASCE 7-10

Material Properties

f'c	= 3.50 ksi	ϕ Phi Values	Flexure :	0.90	
fr = f'c $^{1/2}$ * 7.50	= 443.706 psi		Shear :	0.750	
ψ Density	= 145.0 pcf	β_1	=	0.850	
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	

Load Combination ASCE 7-10





Cross Section & Reinforcing Details

Rectangular Section, Width = 24.0 in, Height = 15.0 in
Span #1 Reinforcing....
5-#5 at 2.0 in from Bottom, from 0.0 to 24.0 ft in this span
2-#5 at 7.0 in from Bottom, from 0.0 to 24.0 ft in this span
3-#5 at 2.0 in from Top, from 0.0 to 24.0 ft in this span

Applied Loads

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

Beam self weight calculated and added to loads
Loads on all spans...
D = 0.20
Uniform Load on ALL spans : D = 0.20 k/ft

DESIGN SUMMARY

Design OK

Maximum Bending Stress Ratio = **0.545** : 1

Section used for this span	**Typical Section**
Mu : Applied	56.70 k-ft
Mn * Phi : Allowable	104.040 k-ft
Load Combination	+1.40D+1.60H
Location of maximum on span	12.000ft
Span # where maximum occurs	Span # 1

Maximum Deflection

Max Downward Transient Deflection	0.000 in	Ratio =	0 <360
Max Upward Transient Deflection	0.000 in	Ratio =	0 <360
Max Downward Total Deflection	0.272 in	Ratio =	1059
Max Upward Total Deflection	0.000 in	Ratio =	999 <180

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
Overall MAXimum	6.750	6.750
Overall MINimum	4.050	4.050
+D+H	6.750	6.750
+D+L+H	6.750	6.750
+D+Lr+H	6.750	6.750
+D+S+H	6.750	6.750
+D+0.750Lr+0.750L+H	6.750	6.750
+D+0.750L+0.750S+H	6.750	6.750
+D+0.60W+H	6.750	6.750
+D+0.70E+H	6.750	6.750
+D+0.750Lr+0.750L+0.450W+H	6.750	6.750
+D+0.750L+0.750S+0.450W+H	6.750	6.750

Concrete Beam

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Description : conc beam clear span

Vertical Reactions

Support notation : Far left is #1

Load Combination	Support 1	Support 2
+D+0.750L+0.750S+0.5250E+H	6.750	6.750
+0.60D+0.60W+0.60H	4.050	4.050
+0.60D+0.70E+0.60H	4.050	4.050
D Only	6.750	6.750
Lr Only		
L Only		
S Only		
W Only		
E Only		
H Only		

Shear Stirrup Requirements

Entire Beam Span Length : Vu < PhiVc/2, Req'd Vs = Not Reqd 11.4.6.1, use stirrups spaced at 0.000 in

Maximum Forces & Stresses for Load Combinations

Load Combination / Segment Length	Span #	Location (ft) in Span	Bending Stress Results (k-ft) Mu : Max	Phi*Mnx	Stress Ratio
MAXimum BENDING Envelope					
Span # 1	1	24.000	56.70	104.04	0.54
+1.40D+1.60H					
Span # 1	1	24.000	56.70	104.04	0.54
+1.20D+0.50Lr+1.60L+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+1.60L+0.50S+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+1.60Lr+0.50L+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+1.60Lr+0.50W+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+0.50L+1.60S+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+1.60S+0.50W+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+0.50Lr+0.50L+W+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+0.50L+0.50S+W+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+1.20D+0.50L+0.20S+E+1.60H					
Span # 1	1	24.000	48.60	104.04	0.47
+0.90D+W+0.90H					
Span # 1	1	24.000	36.45	104.04	0.35
+0.90D+E+0.90H					
Span # 1	1	24.000	36.45	104.04	0.35

Overall Maximum Deflections

Load Combination	Span	Max. "-" Defl	Location in Span	Load Combination	Max. "+" Defl	Location in Span
D Only	1	0.2719	11.760		0.0000	0.000

Detailed Shear Information

Load Combination	Span Number	Distance (ft)	'd' (in)	Vu (k) Actual	Vu (k) Design	Mu (k-ft)	d*Vu/Mu	Phi*Vc (k)	Comment	Phi*Vs (k)	Phi*Vn (k)	Spacing (in) Req'd	Spacing (in) Suggest
+1.40D+1.60H	1	0.00	13.00	9.45	9.45	0.00	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.05	13.00	9.41	9.41	0.50	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.11	13.00	9.37	9.37	1.00	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.16	13.00	9.32	9.32	1.50	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.21	13.00	9.28	9.28	2.00	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.27	13.00	9.24	9.24	2.49	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.32	13.00	9.20	9.20	2.98	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.37	13.00	9.16	9.16	3.47	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.43	13.00	9.11	9.11	3.96	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.48	13.00	9.07	9.07	4.45	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.53	13.00	9.03	9.03	4.93	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.59	13.00	8.99	8.99	5.41	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0
+1.40D+1.60H	1	0.64	13.00	8.95	8.95	5.89	1.00	30.37	Vu < PhiVc/2	Not Reqd 1	30.4	0.0	0.0

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Project:

Client: Job #

Designer: Date: Pg. #

Seismic Design - Equivalent Lateral Force Procedure

ASCE 7-10

$h_n := 15$	Mean Height Of Roof	Site Class = D
$I_e := 1.5$	Component Importance Factor	Design Catagory = D
$R := 2.0$	Responce Modification Factor	$S_1 := 0.424$
$C_t := .02$	Building Period Coefficient	$S_{ds} := 0.728$
$x := .75$	Building Period Coefficient	$S_{d1} := 0.445$

Period $T_a := C_t \cdot (h_n)^x$ $T_a = 0.15$ < 0.5

...need not exceed...

$Cst := \frac{S_{ds} \cdot I_e}{R}$ $Cst = 0.546$ $Cs_{max} := \frac{S_{d1} \cdot I_e}{T_a \cdot R}$ $Cs_{max} = 2.189$

...and shall not be less then...

$C_1 := \text{if}(0.044 \cdot S_{ds} \cdot I_e < 0.01, 0.01, 0.044 \cdot S_{ds} \cdot I_e)$ $C_2 := \text{if}\left(S_1 < 0.6, 0.01, \frac{0.5 \cdot S_1 \cdot I_e}{R}\right)$

$Cs_{min} := \text{if}(C_1 > C_2, C_1, C_2)$ $Cs_{min} = 0.048$

$Cs := \text{if}(Cst < Cs_{min}, Cs_{min}, \text{if}(Cst < Cs_{max}, Cst, Cs_{max}))$ $Cs = 0.546$

$ASD = 0.7 \times C_s$

$= 0.40$

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BY: JAS | DATE: 6/6/15 | JOB NO.: LAC-31 | OF

PROJECT:

RE: Soil Anchor Review

COMMUNICATION RECORD ☐ MEMO TO FILE ☐ TO ☐ FROM ☐ PHONE CALL: ☐ MEETING: ☐ PHONE NO.:

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Vert.: 6.8k MAX @ Each End

→ provide 5k min @ Each Anchor

Eg: $V = 0.4 \times DL$

$= 0.4 \times 6.8k = 2.7k$

→ Provide soil anchor @ Each End G.F 4k ✓

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