

Hartman Engineering

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ENGINEERING CALCULATIONS FOR DESIGN OF COFFERDAMS
FOR REMEDIATION OF FORMER RAYTHEON
FACILITY SITE IN WAYLAND, MA

Prepared for
Environmental Resources Management, Inc.



Richard J. Hartman
5/25/06

Project No. 06-602
May 25, 2006

HARTMAN ENGINEERING

BY RJH DATE 5/25/06 SUBJECT _____ SHT. NO. TC-1 OF _____
CHKD. BY _____ DATE _____ JOB NO. 06-602

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HARTMAN ENGINEERING

BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO GI-1 OF _____
CHKD. BY ATB DATE 3/12/06 GENERAL INFORMATION JOB NO. 06-602

This project involves design of excavation protection for remediation of a former Raytheon site in Wayland, MA. The client is Environmental Resources Management (ERM).

The excavation area has been segmented by ERM into "Head" and "Neck" areas. The Head area is approximately 40' x 63'; the Neck area approximately 34' x 69'. Anticipated depth of excavation is 35'.

A meeting was conducted with the client at the site on Feb. 2, 2006. Options were generally discussed. The client requested that options focus upon circular cofferdams versus rectangular cofferdams. It was agreed to formulate preliminary designs and cost estimates for various diameter cofferdams. ERM is continuing subsurface investigations and the preliminary design information, combined with the investigation information, will be used to select an excavation plan.

The site location is situated north of the facility parking lot a sufficient distance that settlement in the vicinity of the cofferdam is not anticipated to be a problem. Some existing utilities, cables, etc., exist at the site; the client advised that they all are abandoned and can be disposed of.

4/20/06

The client advised that the desired cofferdam layout is

- 1) 40' radius, 25' deep at Center Point $X=691447.5020, Y=2958537.1875$
- 2) 30' radius, 35' deep at Center Point $X=691392.9312, Y=2958539.5333$

The design will proceed on that basis.

5/20/06

Preliminary designs were developed. Meetings on 5/16 & 5/17 indicated that no changes are required. The designs will be finalized.

5/21/06

Designs are finalized.

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BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO. SI-1 OF _____

CHKD. BY BRW DATE 3/8/06 SUBSURFACE INFORMATION JOB NO. 06-602

The client provided soil boring logs and some interpretive cross sections. In general terms the cross sections show strata

- (1) coarse to fine sand $5' \pm$ thick
- (2) fine sand & silt $30' \pm$ thick
- (3) medium to fine sand $15' \pm$ thick
- (4) fine sand & silt $15' \pm$ thick
- (5) gravel $5' \pm$ thick
- (6) fine sand & silt $10' \pm$ thick
- (7) till $5' \pm$ thick
- (8) bedrock.

A generalized profile using MW-552 and MW-262D is shown on sheet SI-3

Using the descriptions and SPT values from MW-262D, consider

EL 127 to EL 118

$N_{avg} = 78/4 = 19.5 \rightarrow$ Med dense sand & silt

$$\begin{aligned} \gamma &= 120 \text{ #/ft}^3 & \phi &= 30^\circ \rightarrow k_a = 0.333 = \frac{1}{3} \\ \gamma' &= 65 \text{ #/ft}^3 & \delta &= 15^\circ & k_p &= 3.0 \end{aligned}$$

EL 118 to EL 81

$N_{typical} = 7 \pm \rightarrow$ Loose sand & silt

$$\begin{aligned} \gamma &= 110 \text{ #/ft}^3 & \phi &= 28^\circ \rightarrow k_a = 0.361 \\ \gamma' &= 60 \text{ #/ft}^3 & \delta &= 14^\circ & k_p &= 2.77 \end{aligned}$$

EL 81 to EL 73

$N_{range} 12 \text{ to } 63 \rightarrow$ Conservatively use - Med dense sand & silt

$$\begin{aligned} \gamma &= 120 \text{ #/ft}^3 & \phi &= 30^\circ \rightarrow k_a = 0.333 = \frac{1}{3} \\ \gamma' &= 65 \text{ #/ft}^3 & \delta &= 15^\circ & k_p &= 3.0 \end{aligned}$$

EL 73 to EL 65

$N_{avg} = 172/4 = 43 \rightarrow$ Dense granular

$$\begin{aligned} \gamma &= 130 \text{ #/ft}^3 & \phi &= 38^\circ \rightarrow k_a = 0.238 \\ \gamma' &= 78 \text{ #/ft}^3 & \delta &= 19^\circ & k_p &= 4.20 \end{aligned}$$

EL 65 to EL 57

$N_{avg} = 146/3 = 49 \rightarrow$ Dense silt, sand

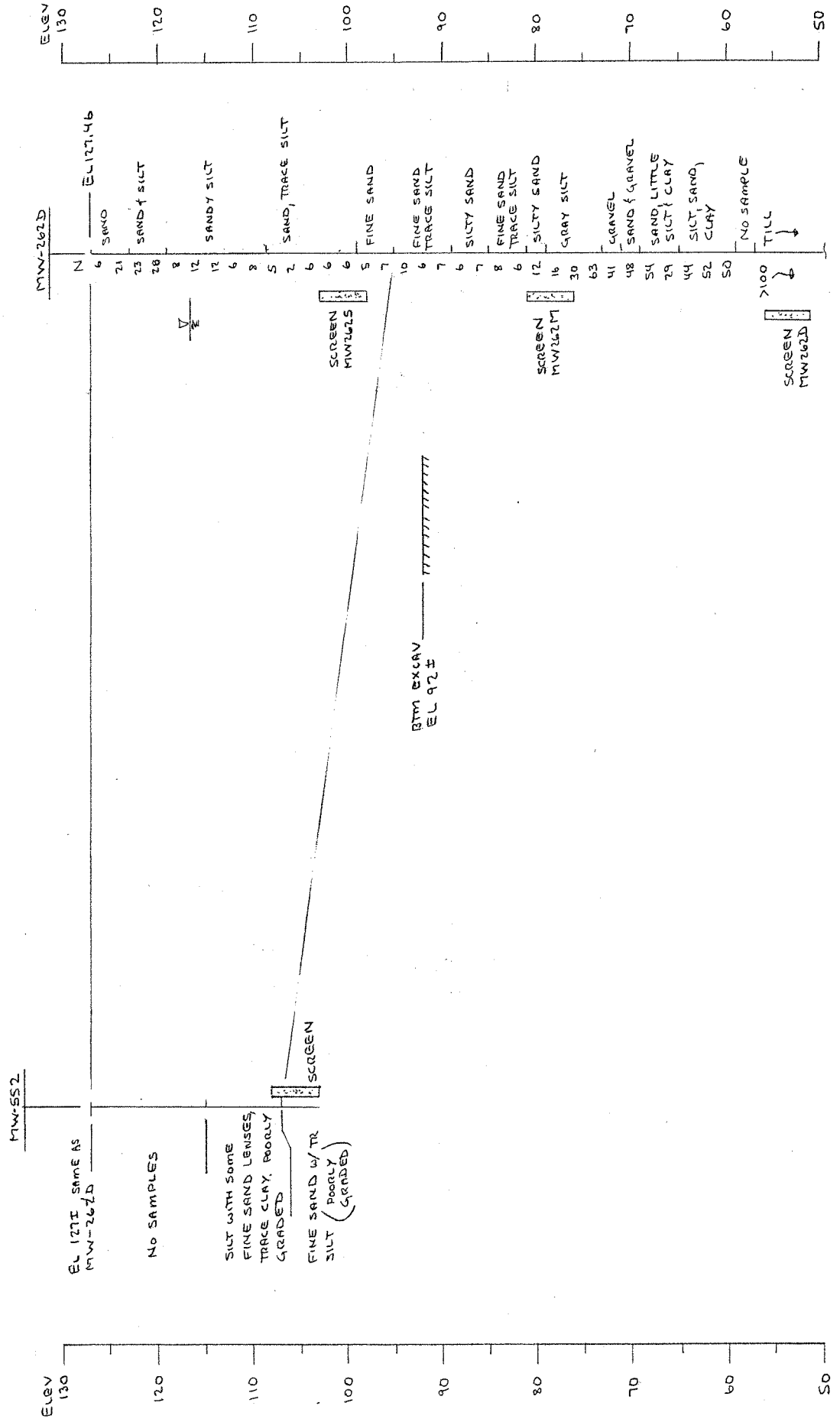
$$\begin{aligned} \gamma &= 130 \text{ #/ft}^3 & \phi &= 36^\circ \rightarrow k_a = 0.260 \\ \gamma' &= 78 \text{ #/ft}^3 & \delta &= 18^\circ & k_p &= 3.85 \end{aligned}$$

BELOW EL 57
TILL

HARTMAN ENGINEERING

BY D.J.H. DATE 3/6/06 SUBJECT _____
 CHKD. BY STB DATE 3/13/06

SHTNO. SI-3 OF _____
 JOB NO. 06-602

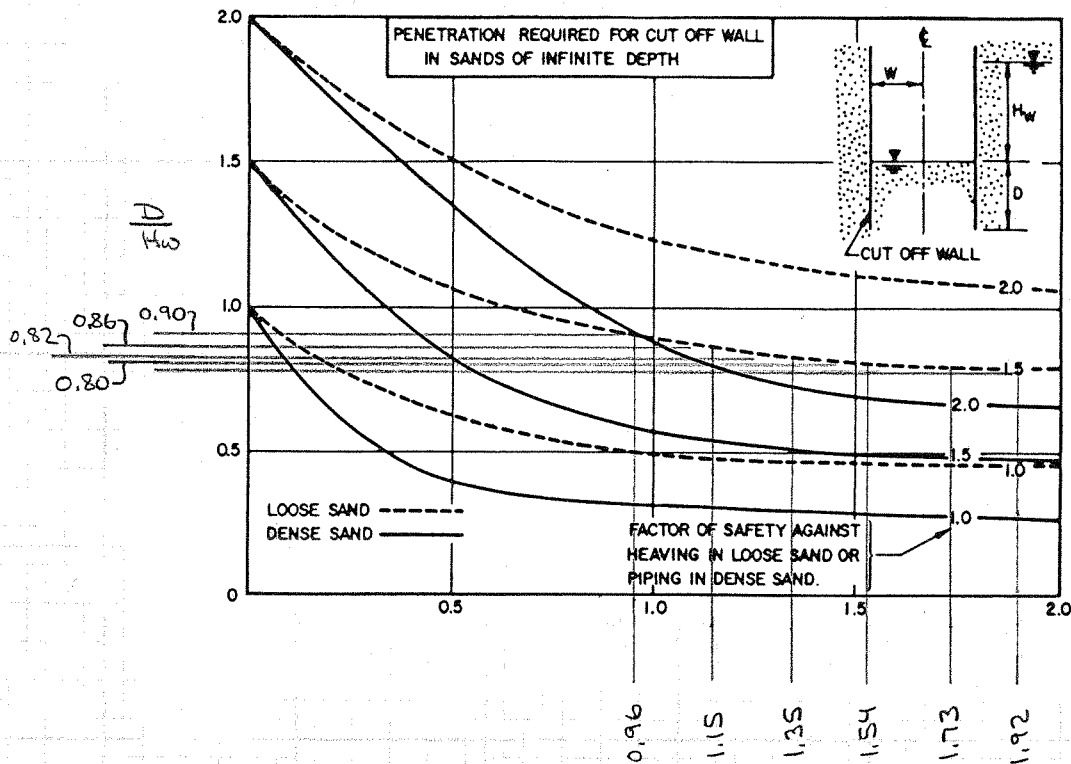


HARTMAN ENGINEERING

BY RJH DATE 3/9/06 SUBJECT _____ SHT.NO. SB-1 OF _____

CHKD. BY GTB DATE 3/12/06 STABILITY OF BOTTOM JOB NO. 06-602

ITEM No. 1- REQ'D TOE Using NAVFAC DM7.1



$H_w = 118 - 92 = 26'$ Ref: SI-2

Use $W = \text{Radius} = \frac{1}{2}$ Diameter

Use req'd FS = 1.5 for loose sand

HARTMAN ENGINEERING

BY RJH DATE 3/9/06 SUBJECT _____ SHT.NO SB-2 OF _____

CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602

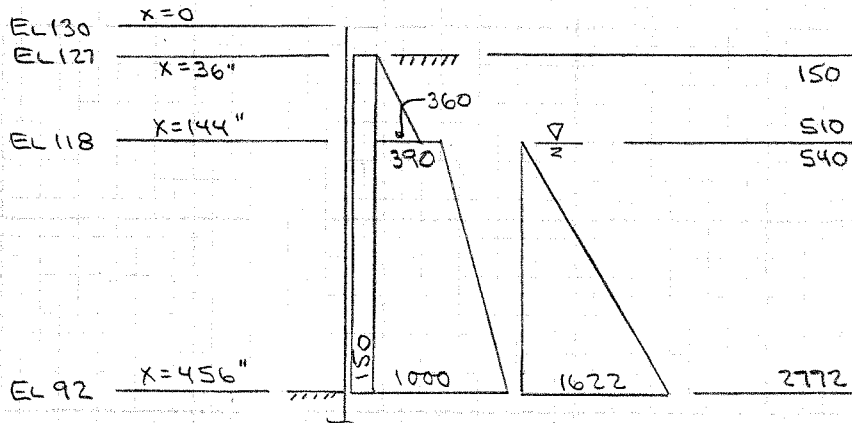
DIA	$W = \frac{1}{2} DIA$	W/H_w	D/H_w	D
50'	25	0.96	0.90	23.4'
60	30	1.15	0.86	22.4'
70	35	1.35	0.82	21.3'
80	40	1.54	0.80	20.8'
90	45	1.73	↓	↓
100	50	1.92		
110	55	2.12		
120	60	2.31		

} Use 22' antic 60' ϕ
or larger

HARTMAN ENGINEERING

BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO. PA-1 OF _____
 CHKD. BY GTS DATE 3/12/06 PRESSURE APPLIED TO JOB NO. 06-602
THE WALLS

ITEM No. 1 - Soil at EL 127, Bottom EL 92
RANKINE DISTRIBUTION
WATER EL 118
SURCHARGE = 150 psf HOR



At EL 127

$$P_a = 0$$

At EL 118⁺

$$P_a = k_a \gamma z = 0.333(120)(127-118) = 360 \text{ psf}$$

At EL 118⁻

$$P_a = k_a \Sigma(\gamma H) = 0.361(120)(127-118) = 390 \text{ psf}$$

At EL 92

$$P_a = 390 + k_a \gamma' (z) = 390 + (0.361)(65)(118-92) = 390 + 610 = 1000 \text{ psf}$$

$$P_w = \gamma_w H_w = 62.4(118-92) = 1622 \text{ psf}$$

$$\Sigma F = 150(36) + \frac{1}{2}(360)(9) + \frac{1}{2}(390+1000)(26) + \frac{1}{2}(1622)(26) = 46,026 \text{ #/ft}$$

HARTMAN ENGINEERING

BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO. PA-2 OF _____

CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	144	$150 \#/\text{ft} = 12.50 \#/\text{in}$	$510 \#/\text{ft} = 42.50 \#/\text{in}$
2	144	456	$540 \#/\text{ft} = 45.00 \#/\text{in}$	$2772 \#/\text{ft} = 231.00 \#/\text{in}$

HARTMAN ENGINEERING

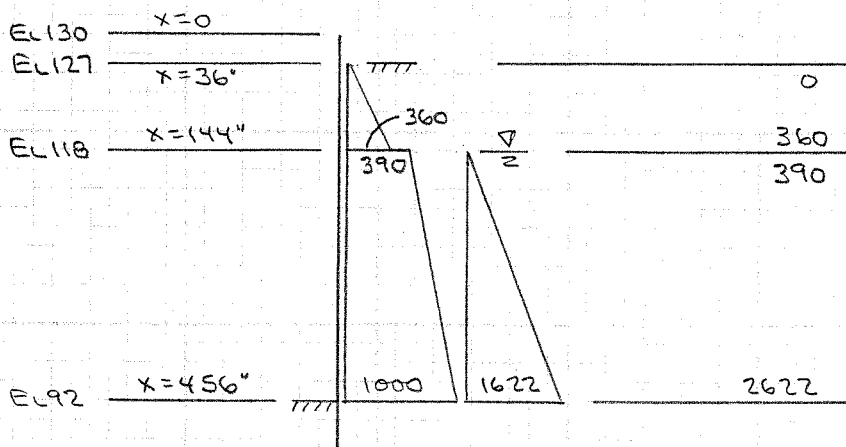
BY RSH DATE 3/6/06 SUBJECT _____ SHT. NO. PA-3 OF _____

CHKD. BY GTS DATE 3/12/06 JOB NO. 06-602

ITEM No. 2 - Soil at EL 127, Bottom EL 92

- RANKINE DISTRIBUTION
- WATER EL 118
- SURCHARGE = 0

Use the information on PA-2 without the surcharge.



$$\Sigma F = \frac{1}{2} (360)(9) + \frac{1}{2} (390 + 1000)(26) + \frac{1}{2} (1622)(26)$$

$$= 40,776 \#/\text{ft}$$

check $40,776 + 150(35) \stackrel{?}{=} 46,026$ (ref: PA-1)

$46,026 = 46,026$ OK

INPUT DATA

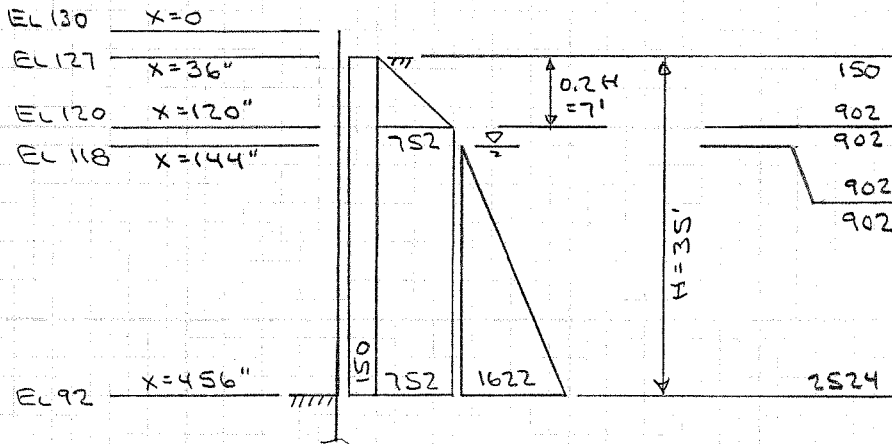
LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	144	0	$360 \#/\text{ft} = 30.00 \#/\text{in}$
2	144	456	$390 \#/\text{ft} = 32.50 \#/\text{in}$	$2622 \#/\text{ft} = 218.50 \#/\text{in}$

HARTMAN ENGINEERING

BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO. PA-4 OF _____
 CHKD. BY GIB DATE 3/12/06 JOB NO. 06-602

- ITEM No. 3 - Soil at EL 127 Bottom EL 92
- TRAPEZOIDAL DISTRIBUTION
 - WATER EL 118
 - SURCHARGE = 150 psf HOR

Ref: Teng, Pg 393



$$\begin{aligned}
 P_b &= 0.8 k_a \gamma H \cos \delta \\
 &= 0.8 [0.333(120)(127-118)(\cos 15^\circ) + 0.361(65)(118-92)(\cos 14^\circ)] \\
 &= 752 \text{ psf} \\
 \Sigma F &= 150(35) + 752\left(\frac{7}{2} + 28\right) + \frac{1}{2}(1622)(26) \\
 &= 50,024 \text{ #/ft}
 \end{aligned}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	120	150 #/ft = 12.50 #/in	902 #/ft = 75.17 #/in
2	120	144	75.17	75.17
3	144	456	75.17	2524 #/ft = 210.33 #/in

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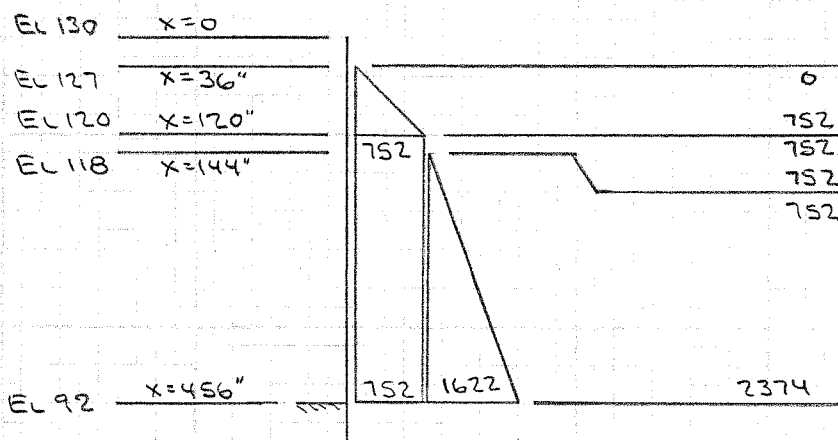
BY RJH DATE 3/6/06 SUBJECT _____ SHT.NO. PA-5 OF _____

CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602 _____

ITEM No. 4 - Soil at EL 127, Bottom EL 92

- TRAPAZOIDAL DISTRIBUTION
- WATER EL 118
- SURCHARGE = 0

Use the information on PA-4 without the surcharge.



$$\Sigma F = 752 \left(\frac{7}{2} + 28 \right) + \frac{1}{2} (1622)(26)$$

$$= 44,774 \text{ #/ft}$$

Check $44,744 + 150(35) \stackrel{?}{=} 50,024$
 $50,024 \stackrel{?}{=} 50,024 \text{ OK}$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	120	0	$752 \text{ #/ft} = 62.67 \text{ #/in}$
2	120	144	62.67	62.67
3	144	456	62.67	$2374 \text{ #/ft} = 197.83 \text{ #/in}$

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BY RJH DATE 3/6/06 SUBJECT _____ SHT. NO. PA-6 OF _____

CHKD. BY GTB DATE 3/12/06 JOB NO. 06-602

ITEM No. 5 - SOIL AT EL 121 BOTTOM EL 92

- RANKINE DISTRIBUTION
- WATER EL 118
- SURCHARGE = 150 psf HOR

For 6' of removed soil use vertical surcharge

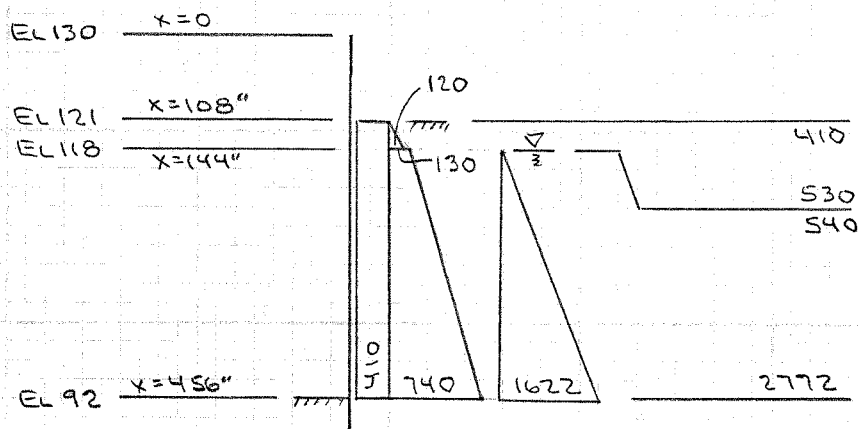
$$q_v = \gamma(\Delta H) = 120(6) = 720 \text{ psf}$$

Use k_a for loose soil

$$P_s = k_a q_v = 0.361(720) = 260 \text{ psf}$$

The P_s adds to equipment, storage surcharge of 150

$$\text{total} = 260 + 150 = 410 \text{ psf.}$$



At EL 121

$$P_a = 0$$

At EL 118⁺

$$P_a = k_a \gamma z = (0.333)(120)(3) = 120 \text{ psf}$$

At EL 118⁻

$$P_a = k_a \sum \gamma H = (0.361)[120(3)] = 130 \text{ psf}$$

At EL 92

$$P_a = 130 + k_a \gamma' (\Delta z) = 130 + (0.361)(65)(118-92) = 740 \text{ psf}$$

$$\begin{aligned} \Sigma F &= 410(121-92) + \frac{1}{2}(120)(3) + \frac{1}{2}(130+740)(26) + \frac{1}{2}(1622)(26) \\ &= 44,466 \text{ #/ft} \end{aligned}$$

HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT.NO. PA-7 OF _____

CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602 _____

INPUT DATA

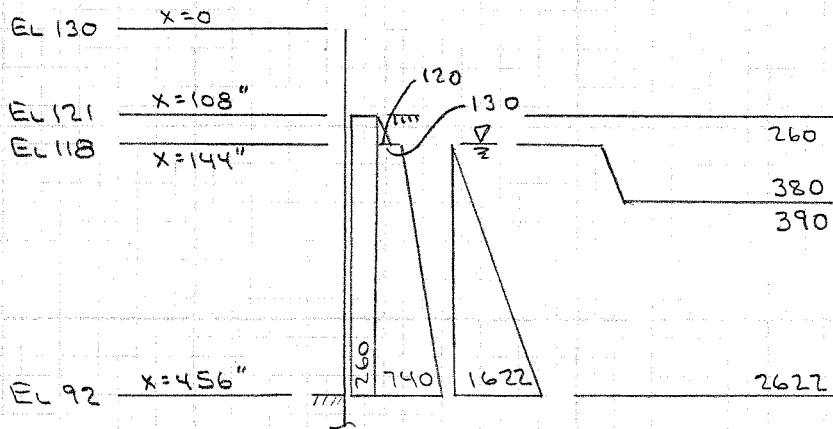
LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	108	144	$410 \text{ #/4} = 34.17 \text{ #/in}$	$530 \text{ #/4} = 44.17 \text{ #/in}$
2	144	456	$540 \text{ #/4} = 45.00 \text{ #/in}$	$2772 \text{ #/4} = 231.00 \text{ #/in}$

HARTMAN ENGINEERING

BY RSW DATE 3/7/06 SUBJECT _____ SHT. NO. PA-8 OF _____
 CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602

- ITEM No. 6 - SOIL AT EL 121, BOTTOM EL 92
- RANKINE DISTRIBUTION
 - WATER EL 118
 - SURCHARGE = 0 FROM EQPT, ETC

Use the information on PA-6 without the 150 psf horizontal surcharge



$$\Sigma F = 260(29) + \frac{1}{2}(120)(3) + \frac{1}{2}(130 + 740)(26) + \frac{1}{2}(1622)(26)$$

$$= 40,116 \text{ #/ft}$$

Check

$$40,116 + 150(29) \stackrel{?}{=} 44,466$$

$$40,466 = 40,466 \text{ OK}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	108	144	$260 \text{ #/ft} = 21.67 \text{ #/in}$	$380 \text{ #/ft} = 31.67 \text{ #/in}$
2	144	456	$390 \text{ #/ft} = 32.50 \text{ #/in}$	$2622 \text{ #/ft} = 218.50 \frac{\text{#}}{\text{in}}$

HARTMAN ENGINEERING

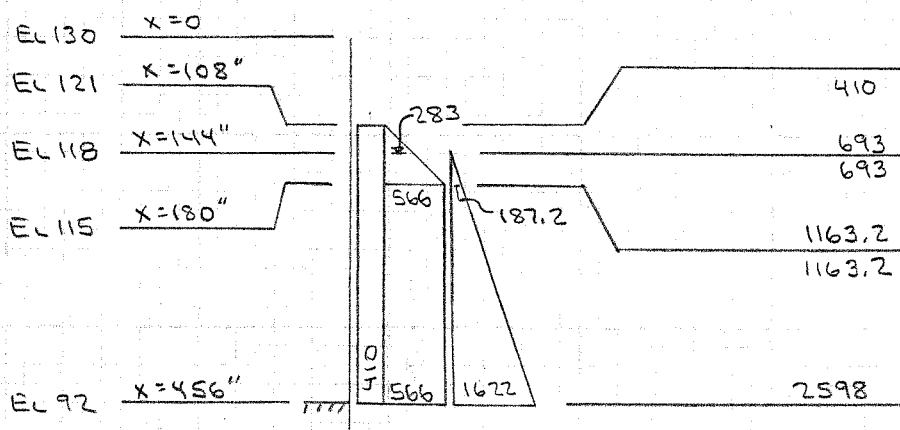
BY RJH DATE 3/7/06 SUBJECT _____ SHT. NO. PA-9 OF _____

CHKD. BY GFB DATE 3/12/06 JOB NO. 06-602

ITEM No. 7 - Soil at EL 121 Bottom EL 92

- TRAPAZOIDAL DISTRIBUTION
- WATER EL 118
- EQPT, ETC SURCHARGE = 150 psf HOR

Ref: Teng, Pg 393



$$H = 121 - 92 = 29'$$

$$0.214 = 5.8' \rightarrow \text{Use } 6'$$

$$P_b = 0.8 k_a \gamma H (\cos \delta)$$

$$= 0.8 \left[0.333 (120) (121 - 118) (\cos 15^\circ) + 0.361 (65) (118 - 92) (\cos 14^\circ) \right] = 566 \text{ psf}$$

$$\Sigma F = 410 (121 - 92) + 566 \left(\frac{6}{2} + 23 \right) + \frac{1}{2} (1622) (26)$$

$$= 47,692 \text{ #/ft}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	108	144	$410 \text{ #/ft} = 34.17 \text{ #/in}$	$693 \text{ #/ft} = 57.75 \text{ #/in}$
2	144	180	57.75	$1163.2 \text{ #/ft} = 96.93 \text{ #/ft}$
3	180	456	96.93	$2598 \text{ #/ft} = 216.50 \text{ #/in}$

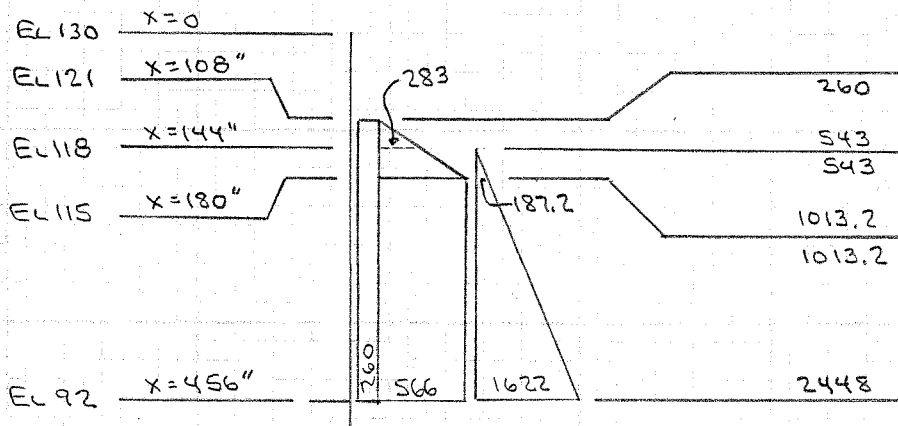
HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT. NO. PA-10 OF _____
 CHKD. BY GJB DATE 3/12/06 JOB NO. 06-602

ITEM No. 8 - Soil at EL 121, Bottom EL 92

- TRAPAZOIDAL DISTRIBUTION
- WATER EL 118
- SURCHARGE = 0 FROM EQPT, ETC

Use the information from PA-9 without the 150 psf horizontal surcharge



$$\Sigma F = 260(29) + 566\left(\frac{6}{2} + 23\right) + \frac{1}{2}(1622)(26)$$

$$= 43,342 \text{ #/ft}$$

Check $43,342 + 150(29) \stackrel{?}{=} 47,692$
 $47,692 \stackrel{?}{=} 47,692 \text{ OK}$

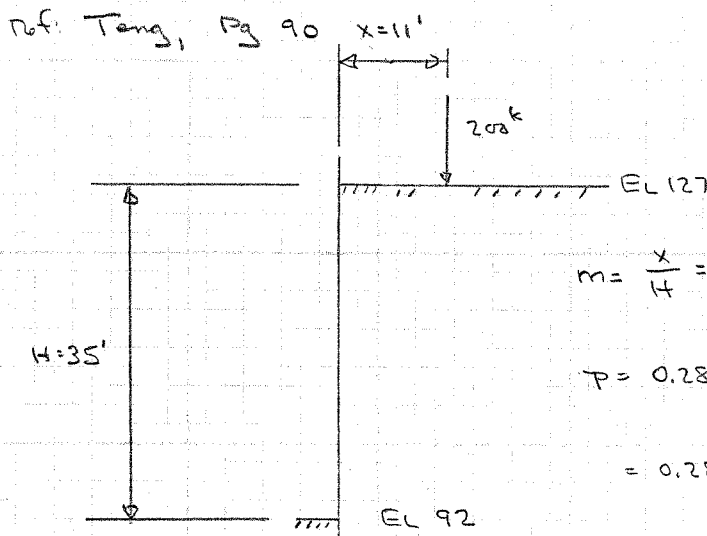
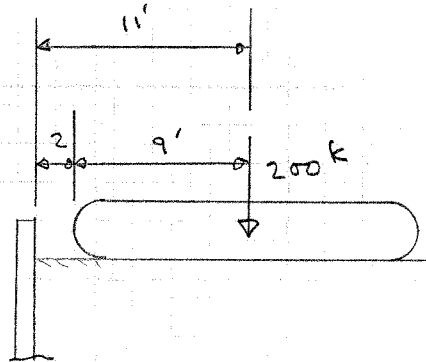
INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	108	144	$260 \text{ #/ft} = 21.67 \text{ #/in}$	$543 \text{ #/ft} = 45.25 \text{ #/in}$
2	144	180	45.25	$1013.2 \text{ #/ft} = 84.43 \text{ #/in}$
3	180	456	84.43	$2448 \text{ #/ft} = 204.00 \text{ #/in}$

HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT.NO. PA-11 OF _____
 CHKD. BY GTB DATE 3/12/06 _____ JOB NO. 06-602

- ITEM No. 9 - Soil at EL 127, Bottom EL 92
- CRANE SURCHARGE
 - CONCENTRATED LOAD = 200 k



$$m = \frac{x}{H} = \frac{11}{35} = 0.314 < 0.4$$

$$P = 0.28 \frac{Q}{H^2} \frac{n^2}{(0.16 + n^2)^3}$$

$$= 0.28 \frac{200,000}{35^2} \frac{n^2}{(0.16 + n^2)^3}$$

$$= \frac{45.71 n^2}{(0.16 + n^2)^3}$$

Ref: PA-12

INPUT DATA

$$\Sigma F = 4496 \#/\text{ft}$$

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	120	0	$218.5 \frac{\#}{\text{ft}} = 18.21 \#/\text{in}$
2	120	204	18.21	18.21
3	204	336	18.21	$81 \#/\text{ft} = 6.75 \#/\text{in}$
4	336	456	6.75	$30 \#/\text{ft} = 2.50 \#/\text{in}$

HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT. NO. PA-12 OF _____
 CHKD. BY GSS DATE 3/12/06 JOB NO. 06-602

ELEV	z	P
126.5	0.5	2
125.5	1.5	20
124.5	2.5	52
123.5	3.5	93
122.5	4.5	137
121.5	5.5	179
120.5	6.5	214
119.5	7.5	240
118.5	8.5	257
117.5	9.5	264
116.5	10.5	263
115.5	11.5	256
114.5	12.5	245
113.5	13.5	231
112.5	14.5	215
111.5	15.5	198
110.5	16.5	182
109.5	17.5	166
108.5	18.5	150
107.5	19.5	136
106.5	20.5	123

ELEV	z	P
105.5	21.5	111
104.5	22.5	100
103.5	23.5	90
102.5	24.5	82
101.5	25.5	74
100.5	26.5	66
99.5	27.5	60
98.5	28.5	54
97.5	29.5	49
96.5	30.5	45
95.5	31.5	40
94.5	32.5	37
93.5	33.5	34
92.5	34.5	31

$$\Sigma = 4496 \text{ #/ft}$$

Calculate p so that $\Sigma F = 4496$

$$\frac{1}{2}(p)(7) + 7p + \frac{1}{2}(p+81)(11) + \frac{1}{2}(81+30)(10) = 4496$$

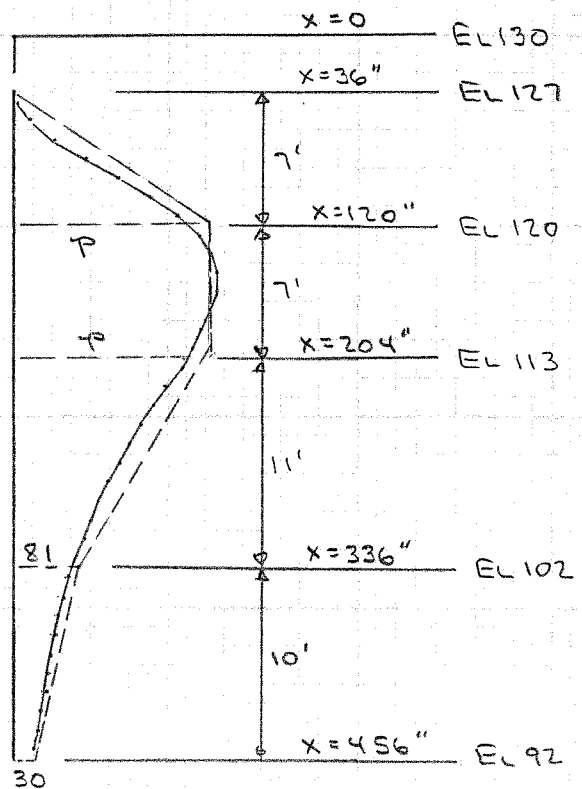
$$p[3.5 + 7 + 5.5] + 445.5 + 555 = 4496$$

$$16p = 4496 - 1000.5 = 3495.5$$

$$p = 218.5 \text{ psf}$$

Check

$$\begin{aligned} &\frac{1}{2}(218.5)(7) + 7(218.5) \\ &+ \frac{1}{2}(218.5+81)(11) + \frac{1}{2}(81+30)(10) \\ &= 4496 \text{ #/ft OK} \end{aligned}$$

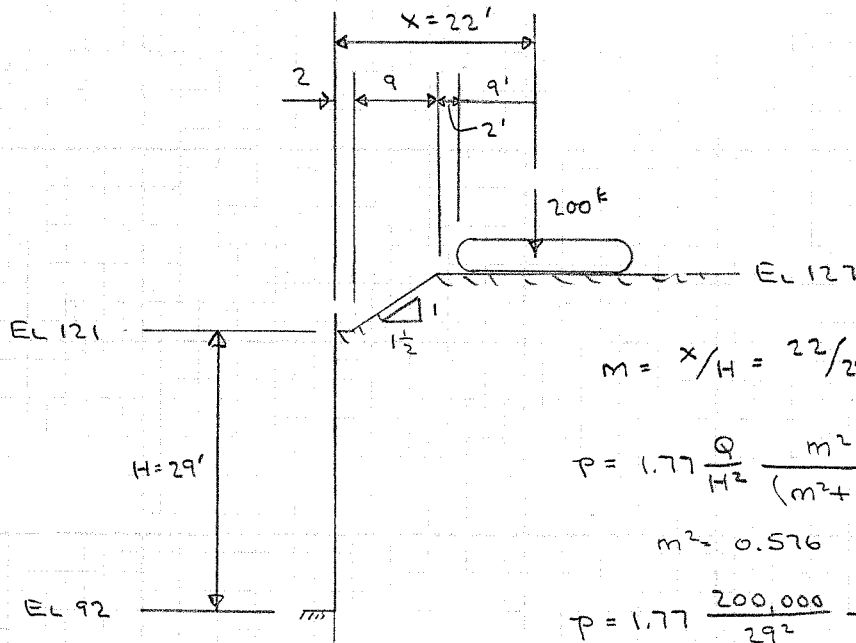


HARTMAN ENGINEERING

BY RS4 DATE 3/7/06 SUBJECT _____ SHT.NO. PA-13 OF _____
 CHKD. BY G5B DATE 2/12/11 JOB NO. 06-602

ITEM No. 10 - Soil at EL 121 Bottom EL 92

- CRANE SURCHARGE
- CONCENTRATED LOAD = 200k



$$m = x/H = 22/29 = 0.759 > 0.4$$

$$P = 1.77 \frac{Q}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3}$$

$$m^2 = 0.576$$

$$P = 1.77 \frac{200,000}{29^2} \frac{0.576 n^2}{(0.576 + n^2)^3}$$

$$= \frac{242.45 n^2}{(0.576 + n^2)^3}$$

Ref: PA-14

INPUT DATA

$$\Sigma F = 2115 \#/ft$$

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	108	252	0	102 #/ft = 8.50 #/in
2	252	324	8.50	8.50
3	324	456	8.50	60 #/ft = 5.00 #/in

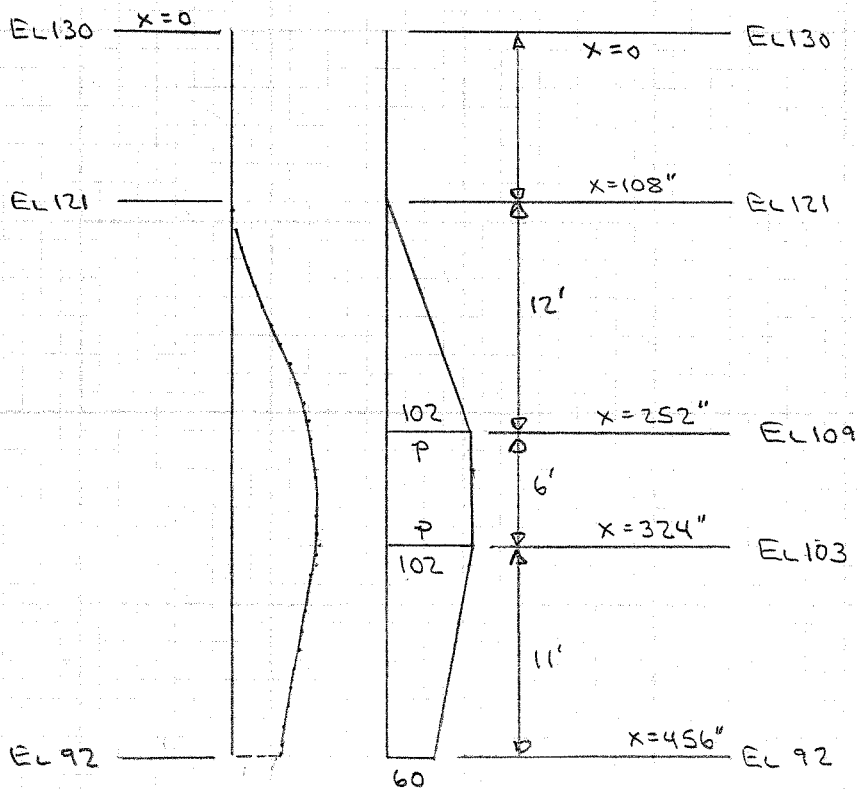
HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT.NO. PA-14 OF _____
 CHKD. BY GJB DATE 3/12/06 JOB NO. 06-602

ELEV	Z	P
120.5	0.5	0
119.5	1.5	3
118.5	2.5	9
117.5	3.5	17
116.5	4.5	27
115.5	5.5	38
114.5	6.5	50
113.5	7.5	61
112.5	8.5	72
111.5	9.5	82
110.5	10.5	90
109.5	11.5	97
108.5	12.5	102
107.5	13.5	105
106.5	14.5	108

ELEV	Z	P
105.5	15.5	108
104.5	16.5	108
103.5	17.5	106
102.5	18.5	104
101.5	19.5	101
100.5	20.5	97
99.5	21.5	93
98.5	22.5	89
97.5	23.5	85
96.5	24.5	81
95.5	25.5	76
94.5	26.5	72
93.5	27.5	68
92.5	28.5	64

$\Sigma = 2113 \#/\text{ft}$



Find p so that $\Sigma F = 2113 \#/\text{ft}$

$$\frac{1}{2}(p)(12) + 6p + \frac{1}{2}(p+60)(11) = 2113$$

$$p(6+6+5.5) + 330 = 2113$$

$$p = (2113 - 330) / 17.5 = 102 \text{ psf.}$$

Check

$$\Sigma F = \frac{1}{2}(102)(12) + 102(6) + \frac{1}{2}(102+60)(11) = 2115 \#/\text{ft} \text{ OK}$$

HARTMAN ENGINEERING

BY RJH DATE 4/20/06 SUBJECT _____ SHT.NO. PA-15 OF _____

CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

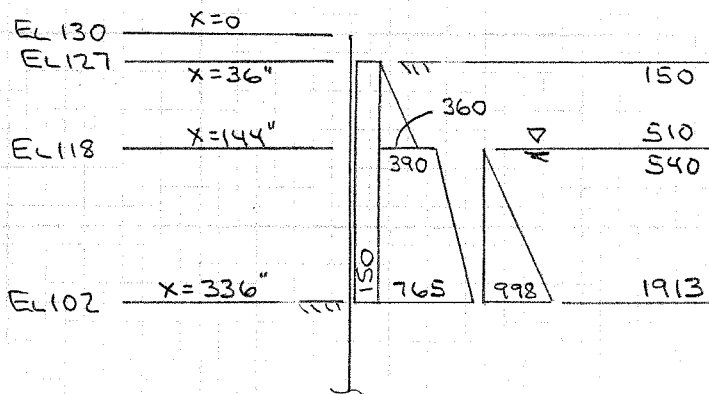
ITEM No. 11 - Soil at EL 127 Bottom EL 102

RANKINE DISTRIBUTION

WATER EL 118

SURCHARGE = 150 psf Hor

Ref: PA-1 for similar situation



At EL 102

$$P_a = 390 + k_a \delta' (\Delta z) = 390 + (0.361)(65)(118 - 102) = 390 + 375 = 765 \text{ psf}$$

$$P_w = \gamma_w H_w = 62.4(118 - 102) = 998 \text{ psf}$$

$$\Sigma F = 150(25) + \frac{1}{2}(360)(9) + \frac{1}{2}(390 + 765)(16) + \frac{1}{2}(998)(16) = 22,594 \text{ #/ft}$$

INPUT DATA

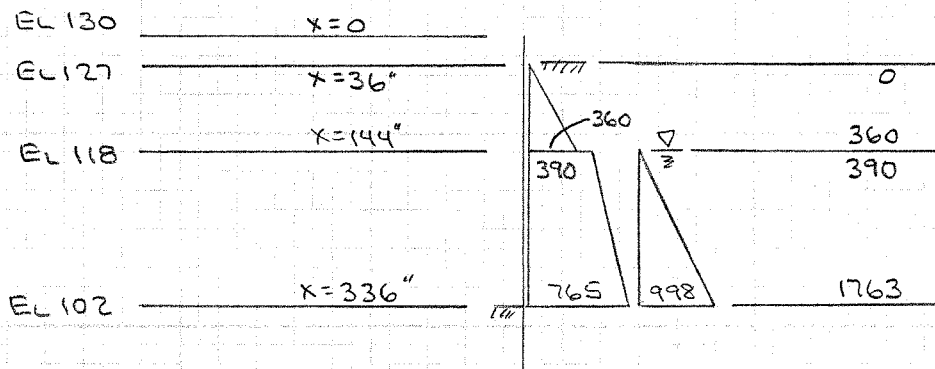
LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	144	150 #/ft = 12.5 #/in	510 #/ft = 42.5 #/in
2	144	336	540 #/ft = 45 #/in	1913 #/ft = 159.42 #/in

HARTMAN ENGINEERING

BY RSH DATE 4/21/06 SUBJECT _____ SHT. NO. PA-16 OF _____
 CHKD. BY GJZ DATE 5/23/06 JOB NO. 06-602

- ITEM No. 12 - Soil at EL 127, Bottom EL 102
- RANKINE DISTRIBUTION
 - WATER EL 118
 - SURCHARGE = 0

Use the information on PA-15 without the surcharge



$$\Sigma F = \frac{1}{2}(360)(9) + \frac{1}{2}(390 + 765)(16) + \frac{1}{2}(998)(16)$$

$$= 18,844 \text{ #/ft}$$

Check

$$18,844 + 150(25) \stackrel{?}{=} 22,594 \quad (\text{Ref: PA-15})$$

$$22,594 \stackrel{?}{=} 22,594 \quad \underline{\text{OK}}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	144	0	$360 \text{ #/ft} = 30 \text{ #/in}$
2	144	336	$390 \text{ #/ft} = 32.5 \text{ #/in}$	$1763 \text{ #/ft} = 146.92 \text{ #/in}$

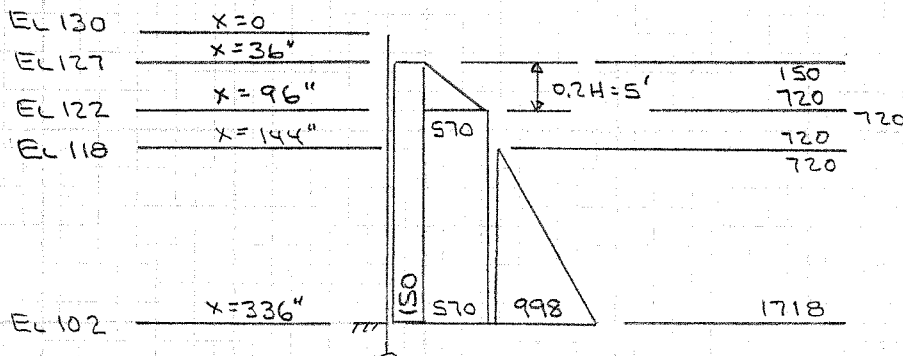
HARTMAN ENGINEERING

BY RJM DATE 4/21/06 SUBJECT _____ SHT. NO. PA-17 OF _____

CHKD. BY GTB DATE 5/23/06 JOB NO. 06-602

ITEM No. 13 - Soil AT EL 127, Bottom EL 102

- TRAPEZOIDAL DISTRIBUTION
- WATER EL 118
- SURCHARGE = 150 psf HOR



$$\begin{aligned}
 P_b &= 0.8 k_a \gamma H (\cos \delta) \\
 &= 0.8 [0.333 (120)(127-118)(\cos 15^\circ) + 0.361 (65)(118-102)(\cos 14^\circ)] \\
 &= 570 \text{ psf}
 \end{aligned}$$

$$\begin{aligned}
 \Sigma F &= 150(25) + 570 \left(\frac{5}{2} + 20 \right) + \frac{1}{2}(998)(16) \\
 &= 24,559 \text{ #/ft}
 \end{aligned}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	96	$150 \text{ #/ft} = 12.5 \text{ #/in}$	$720 \text{ #/in} = 60 \text{ #/in}$
2	96	144	60	60
3	144	336	60	$1718 \text{ #/ft} = 143.17 \text{ #/in}$

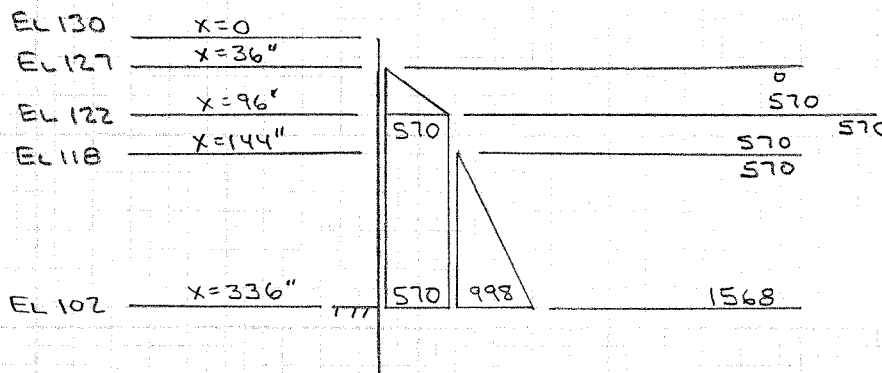
HARTMAN ENGINEERING

BY RSH DATE 4/21/06 SUBJECT _____ SHT.NO. PA-18 OF _____
 CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

Item No. 14 - Soil at EL 127, Bottom EL 102

- TRAPEZOIDAL DISTRIBUTION
- WATER EL 118
- SURCHARGE = 0

Use the information on PA-17 without the surcharge



$$\Sigma F = 570 \left[\frac{5}{2} + 20 \right] + \frac{1}{2} (998)(16)$$

$$= 20,809 \text{ #/ft}$$

Check

$$20,809 + 25(150) = 24,559$$

$$24,559 = 24,559 \text{ OK}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	96	0	$570 \text{ #/ft} = 47.5 \text{ #/in}$
2	96	144	47.5	47.5
3	144	336	47.5	$1568 \text{ #/ft} = 130.67 \text{ #/in}$

HARTMAN ENGINEERING

BY RJH DATE 4/21/06 SUBJECT _____ SHT. NO. PA-19 OF _____

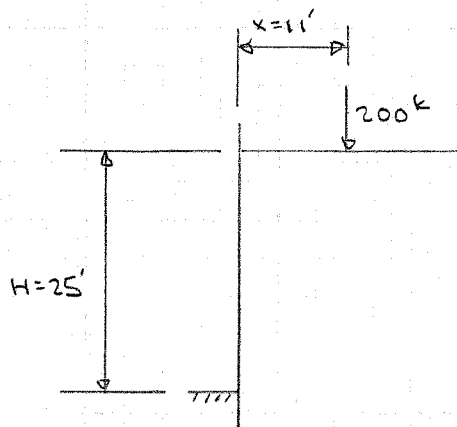
CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

ITEM No. 15 - SOIL AT EL 127, BOTTOM EL 102

CRANE SURCHARGE

CONCENTRATED LOAD = 200k

Ref: sketch on PA-11



$$m = \frac{x}{H} = \frac{11}{25} = 0.44 > 0.4$$

$$p = 1.77 \frac{Q}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^2}$$

$$= 1.77 \frac{200,000}{25^2} \left[\frac{(0.44)^2 n^2}{(0.44^2 + n^2)^2} \right]$$

$$= 109.66 \frac{n^2}{(0.1936 + n^2)^2}$$

Ref: PA-20

$$\Sigma F = 5652 \#/\text{ft}$$

INPUT DATA

LOAD	LOCATION		MAGNITUDE	
	START	STOP	START	STOP
1	36	108	0	385 #/ft = 32.08 #/in
2	108	156	32.08	32.08
3	156	240	32.08	180 #/ft = 15 #/in
4	240	336	15	65 #/ft = 5.42 #/in

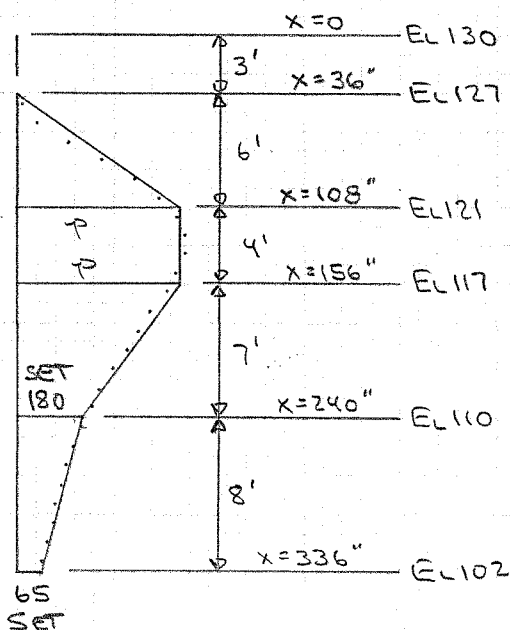
HARTMAN ENGINEERING

BY RJH DATE 4/26/06 SUBJECT _____ SHT. NO. PA-20 OF _____

CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

ELEV	Z	P
126.5	0.5	6
125.5	1.5	51
124.5	2.5	130
123.5	3.5	222
122.5	4.5	308
121.5	5.5	374
120.5	6.5	416
119.5	7.5	433
118.5	8.5	429
117.5	9.5	410
116.5	10.5	382
115.5	11.5	349
114.5	12.5	314
113.5	13.5	280
112.5	14.5	248
111.5	15.5	218

ELEV	Z	P
110.5	16.5	192
109.5	17.5	168
108.5	18.5	147
107.5	19.5	129
106.5	20.5	114
105.5	21.5	100
104.5	22.5	88
103.5	23.5	78
102.5	24.5	68
		$\Sigma = 5654 \text{ #/ft}$



Calculate p so that $\Sigma F = 5654 \text{ #/ft}$

$$\frac{1}{2}P(6) + P(4) + \frac{1}{2}(P+180)(7) + \frac{1}{2}(180+65)(8) = 5654$$

$$P[3+4+3.5] + 1610 = 5654$$

$$P = \frac{(5654 - 1610)}{10.5} = 385 \text{ psf}$$

Check

$$\begin{aligned} &\frac{1}{2}(385)(6) + 385(4) \\ &+ \frac{1}{2}(385 + 180)(7) \\ &+ \frac{1}{2}(180 + 65)(8) = 5652 \text{ #/ft} \end{aligned}$$

OK

HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT. NO. WA-1 OF _____

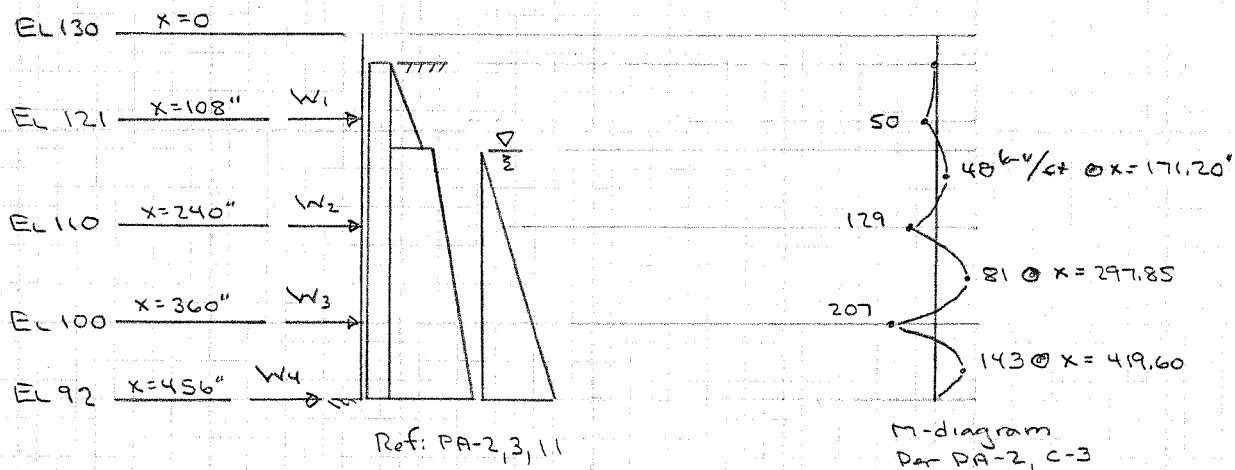
CHKD. BY LJB DATE 3/12/06 WALL ANALYSIS JOB NO. 06-602

ITEM No. 1 - SOIL AT EL 127, Bottom EL 92

RANKINE DISTRIBUTION

WATER EL 118

WALES AT EL 121, 110, 100



ANALYSIS RESULTS

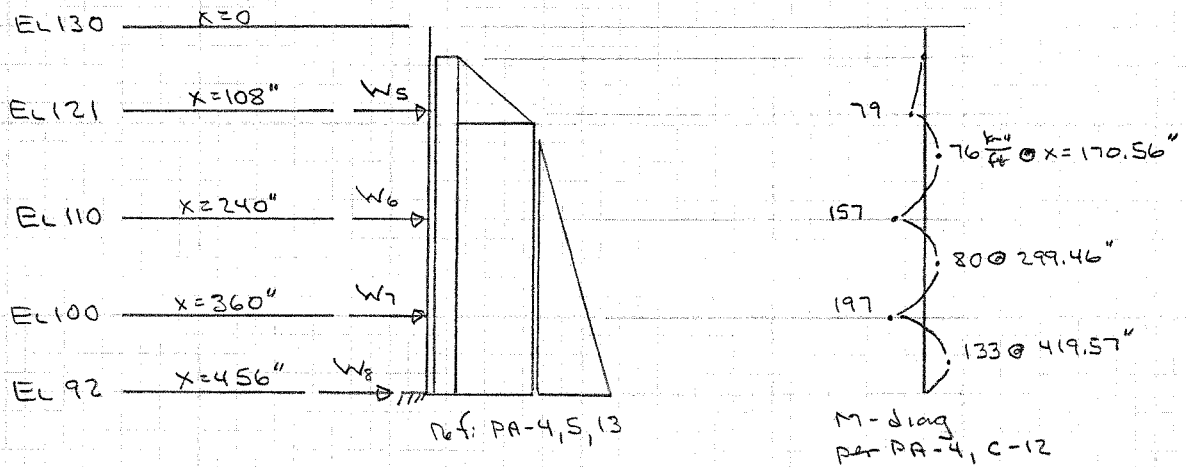
ELEV	WITH SURCH Ref: PA-2 $\Sigma F = 46,026 \#/\text{ft}$	W/O SURCH Ref: PA-3 $\Sigma F = 40,776 \#/\text{ft}$	CRANE LOAD Ref: PA-11 $\Sigma F = 4496 \#/\text{ft}$
	Ref: C-1 to C-3 $\Sigma F = 46,026 \#/\text{ft}$ OK	Ref: C-4 to C-6 $\Sigma F = 40,776 \#/\text{ft}$ OK	Ref: C-7 to C-9 $\Sigma F = 4497 \#/\text{ft}$ OK
121	$W_1 = 4415 \#/\text{ft}$	$W'_1 = 2542 \#/\text{ft}$	$W''_1 = 1660 \#/\text{ft}$
110	$W_2 = 12,534 \#/\text{ft}$	$W'_2 = 11,128 \#/\text{ft}$	$W''_2 = 2095 \#/\text{ft}$
100	$W_3 = 21,064 \#/\text{ft}$	$W'_3 = 19,533 \#/\text{ft}$	$W''_3 = 620 \#/\text{ft}$
92	$W_4 = 8014 \#/\text{ft}$	$W'_4 = 7573 \#/\text{ft}$	$W''_4 = 123 \#/\text{ft}$

HARTMAN ENGINEERING

BY RJH DATE 3/7/06 SUBJECT _____ SHT. NO. WA-2 OF _____
 CHKD. BY GTD DATE 3/12/06 JOB NO. 06-602

ITEM No. 2 - Soil at EL 127 Bottom EL 92

- TRAPAZOIDAL DISTRIBUTION
- WATER EL 118
- WALES AT EL 121, 110, 100



ANALYSIS RESULTS

ELEV	WITH SURCH Ref: PA-4 $\Sigma F = 50,024 \#/\text{ft}$	W/O SURCH Ref: PA-5 $\Sigma F = 44,744 \#/\text{ft}$	CRANE LOAD Ref: PA-11 Same as WA-1
	Ref: C-10 to C-12 $\Sigma F = 50,024 \#/\text{ft}$ OK	Ref: C-13 to C-15 $\Sigma F = 44,774 \#/\text{ft}$ OK	
121	$W_5 = 7636 \#/\text{ft}$	$W'_5 = 5763 \#/\text{ft}$	$W_1'' = 1660 \#/\text{ft}$
110	$W_6 = 14,771 \#/\text{ft}$	$W'_6 = 13,365 \#/\text{ft}$	$W_2'' = 2095 \#/\text{ft}$
100	$W_7 = 20,241 \#/\text{ft}$	$W'_7 = 18,711 \#/\text{ft}$	$W_3'' = 620 \#/\text{ft}$
92	$W_8 = 7376 \#/\text{ft}$	$W'_8 = 6935 \#/\text{ft}$	$W_4'' = 123 \#/\text{ft}$

HARTMAN ENGINEERING

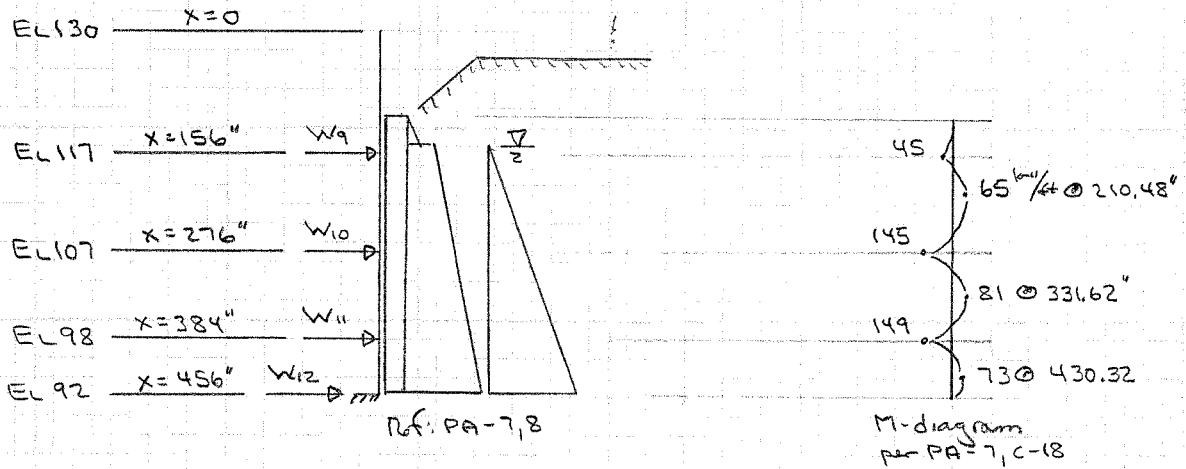
BY RJH DATE 3/8/06 SUBJECT _____ SHT. NO. WA-3 OF _____
 CHKD. BY GJB DATE 3/12/06 JOB NO. 06-602

ITEM No. 3 - SOIL AT EL 121 BOTTOM EL 92

- RANKINE DISTRIBUTION

- WATER EL 118

- WALES AT EL 117, 107, 98



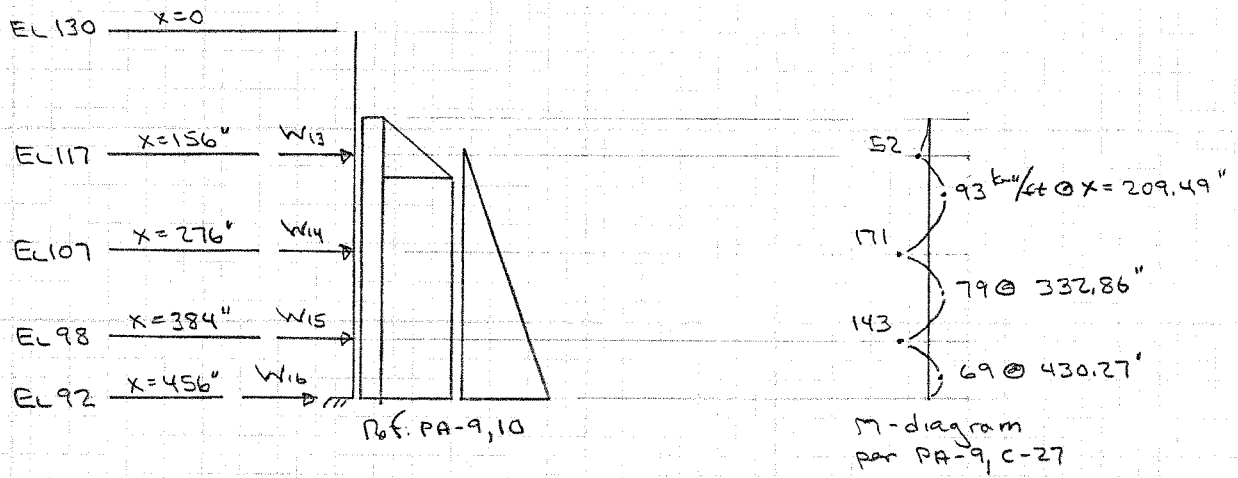
ANALYSIS RESULTS

ELEV	WITH SURCH Ref: PA-6,7 $\Sigma F = 44,466 \text{ #/ft}$	W/O SURCHARGE Ref: PA-8 $\Sigma F = 40,116 \text{ #/ft}$	CRANE LOAD Ref: PA-13 $\Sigma F = 2115 \text{ #/ft}$
	Ref: C-16 to C-18 $\Sigma F = 44,466 \text{ #/ft OK}$	Ref: C-19 to C-21 $\Sigma F = 40,116 \text{ #/ft OK}$	Ref: C-22 to C-24 $\Sigma F = 2115 \text{ #/ft OK}$
117	$W_9 = 5719 \text{ #/ft}$	$W'_9 = 4368 \text{ #/ft}$	$W''_9 = 302 \text{ #/ft}$
107	$W_{10} = 14,626 \text{ #/ft}$	$W'_{10} = 13,160 \text{ #/ft}$	$W''_{10} = 1008 \text{ #/ft}$
98	$W_{11} = 18,386 \text{ #/ft}$	$W'_{11} = 17,166 \text{ #/ft}$	$W''_{11} = 679 \text{ #/ft}$
92	$W_{12} = 5735 \text{ #/ft}$	$W'_{12} = 5422 \text{ #/ft}$	$W''_{12} = 126 \text{ #/ft}$

HARTMAN ENGINEERING

BY RJH DATE 3/8/06 SUBJECT _____ SHT. NO. WA-4 OF _____
 CHKD. BY GFB DATE 3/12/06 JOB NO. 06-602

- Item No. 4 - Soil at EL 121, Bottom EL 92
 - TRAPAZOIDAL DISTRIBUTION
 - WATER EL 118
 - WALES AT EL 117, 107, 98



ANALYSIS RESULTS

ELEV	With SURCH Ref: PA-9 $\Sigma F = 47,692 \text{ #/ft}$	W/O SURCH. Ref: PA-10 $\Sigma F = 43,342 \text{ #/ft}$	CRANE LOAD Ref: PA-13 Same as WA-3
	Ref: C-25 to C-27 $\Sigma F = 47,692 \text{ #/ft OK}$	Ref: C-28 to C-30 $\Sigma F = 43,342 \text{ #/ft OK}$	
117	$W_{13} = 7486 \text{ #/ft}$	$W'_{13} = 6135 \text{ #/ft}$	$W''_9 = 302 \text{ #/ft}$
107	$W_{14} = 16,832 \text{ #/ft}$	$W'_{14} = 15,366 \text{ #/ft}$	$W''_{10} = 1008 \text{ #/ft}$
98	$W_{15} = 17,948 \text{ #/ft}$	$W'_{15} = 16,727 \text{ #/ft}$	$W''_{11} = 679 \text{ #/ft}$
92	$W_{16} = 5427 \text{ #/ft}$	$W'_{16} = 5114 \text{ #/ft}$	$W''_{12} = 126 \text{ #/ft}$

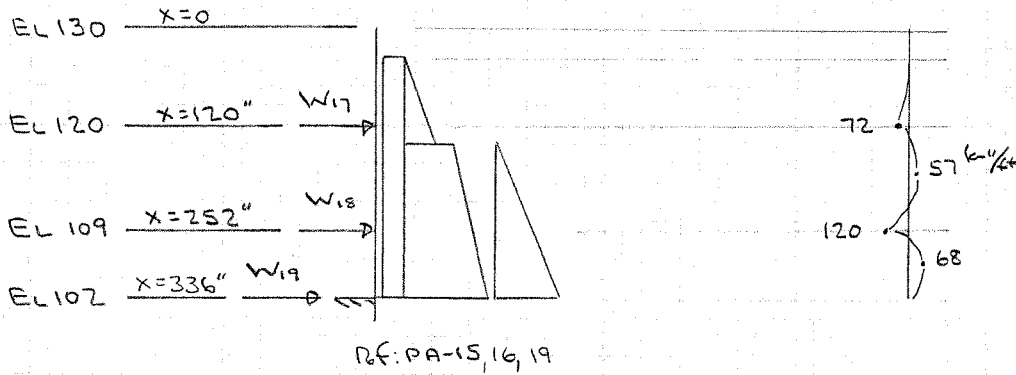
HARTMAN ENGINEERING

BY RJH DATE 4/21/06 SUBJECT _____ SHT. NO. WA-5 OF _____

CHKD. BY LSB DATE 5/23/06 JOB NO. 06-602

ITEM No. 5 - Soil at EL 127, Bottom EL 102

- RANKINE DISTRIBUTION
- WATER EL 118
- WALES AT EL 120, 109



ANALYSIS RESULTS

ELEV	WITH SURCH Ref: PA-15 $\Sigma F = 22,594 \text{ #/ft}$	W/O SURCH Ref: PA-16 $\Sigma F = 18,844 \text{ #/ft}$	CRANE LOAD Ref: PA-19 $\Sigma F = 5652 \text{ #/ft}$
	Ref: C-31 to C-33 $\Sigma F = 22,605 \text{ #/ft}$	Ref: C-34 to C-36 $\Sigma F = 18,844 \text{ #/ft}$	Ref: C-37 to C-39 $\Sigma F = 5652 \text{ #/ft}$
120	$W_{17} = 5449 \text{ #/ft}$	$W'_{17} = 3296 \text{ #/ft}$	$W''_{17} = 3589 \text{ #/ft}$
109	$W_{18} = 12,591 \text{ #/ft}$	$W'_{18} = 11,423 \text{ #/ft}$	$W''_{18} = 1991 \text{ #/ft}$
102	$W_{19} = 4565 \text{ #/ft}$	$W'_{19} = 4126 \text{ #/ft}$	$W''_{19} = 72 \text{ #/ft}$

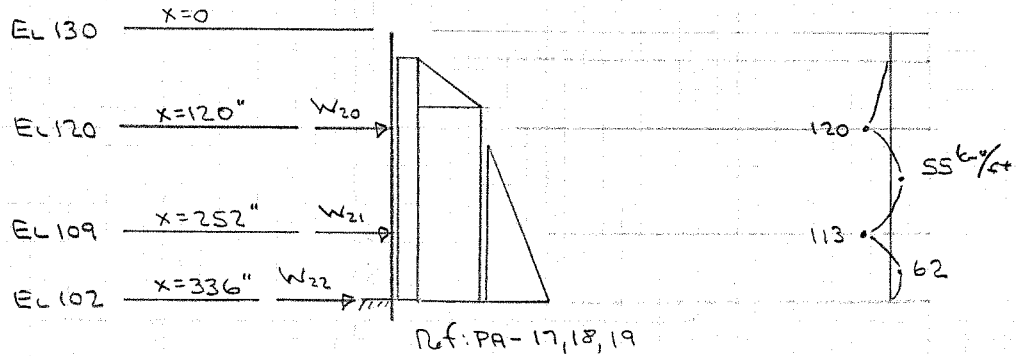
HARTMAN ENGINEERING

BY RJH DATE 4/21/06 SUBJECT _____ SHT. NO. WA-6 OF _____

CHKD. BY GSS DATE 5/23/06 JOB NO. 06-602

ITEM No. 6 - Soil at EL 127, Bottom EL 102

- TRAPAZOIDAL DISTRIBUTION
- WATER EL 118
- WALE EL 120, 109



ANALYSIS RESULTS

ELEV	WITH SURCH Ref: PA-17 $\Sigma F = 24,559 \#/\text{ft}$	w/o SURCH Ref: PA-18 $\Sigma F = 20,809 \#/\text{ft}$	CRANE LOAD (Same as WA-5) $\Sigma F = 5652 \#/\text{ft}$
	Ref: C-40 to C-42 $\Sigma F = 24,559 \#/\text{ft}$	Ref: C-43 to C-45 $\Sigma F = 20,809 \#/\text{ft}$	Ref: C-37 to C-39 $\Sigma F = 5652 \#/\text{ft}$
120	$W_{20} = 8324 \#/\text{ft}$	$W'_{20} = 6171 \#/\text{ft}$	$W'_{20} = 3589 \#/\text{ft}$
109	$W_{21} = 12,071 \#/\text{ft}$	$W'_{21} = 10,910 \#/\text{ft}$	$W'_{21} = 1991 \#/\text{ft}$
102	$W_{22} = 4164 \#/\text{ft}$	$W'_{22} = 3728 \#/\text{ft}$	$W'_{22} = 72 \#/\text{ft}$

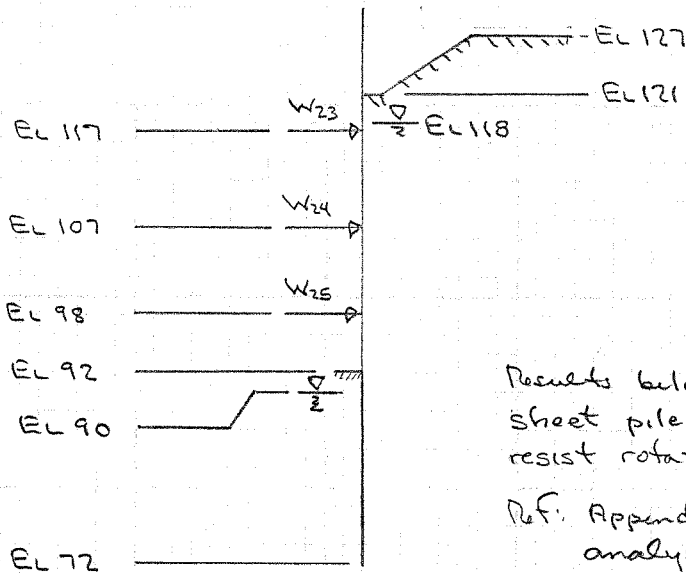
HARTMAN ENGINEERING

BY RJM DATE 4/22/06 SUBJECT _____ SHT.NO. WA-7 OF _____
 CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

ITEM No. 7 - R=30' COFFERDAM

- SOIL AT EL 121
- EXCAV EL 92
- WATER EL 118
- WALES AT EL 117, 107, 98
- RANKINE DISTRIBUTION
- PROVISION FOR LOAD BELOW SUBGRADE

Use Shoring Suite software for evaluation of sheet pile loads below bottom of excavation Ref: Appendix B



Results below indicate load pattern if sheet pile strength is required to resist rotation about lower wale.

Ref: Appendix B for results of computer analysis

ELEV	WITH SURCH	W/O SURCH	CRANE LOAD
117	3.4 k/ft	2.1 k/ft	302 #/ft
107	2.7	0	1008 #/ft
98	33.6	33.9	679 #/ft

Ref: App. B
B-1 to B-9

Ref: APP B
B-10 to B-17

Ref: WA-3

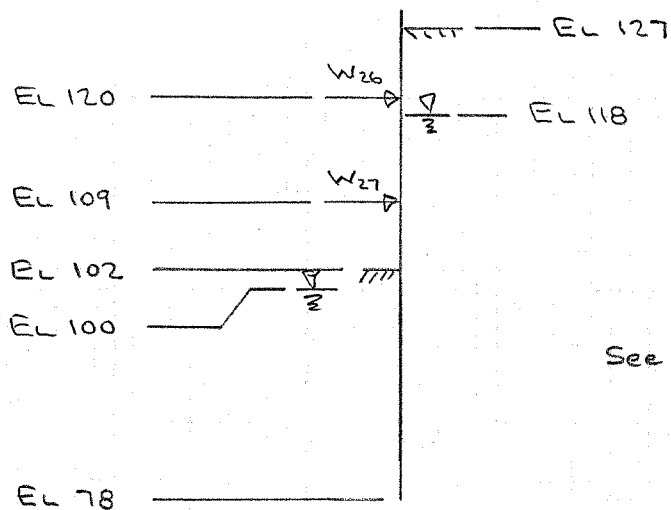
HARTMAN ENGINEERING

BY RJH DATE 5/9/06 SUBJECT _____ SHT. NO. WA-8 OF _____
 CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

ITEM No. 8 - R = 40' COFFERDAM

- SOIL AT EL 127
- EXCAV EL 102
- WATER EL 118
- WALES AT EL 120, 109
- RANKINE DISTRIBUTION
- PROVISION FOR LOAD BELOW SUBGRADE

Ref: Appendix C



See note on WA-7

ELEV	WITH SURCH	w/o SURCH	CRANE LOAD
120	-2.8 ^k / _{ft}	-3.5 ^k / _{ft}	3589 [#] / _{ft}
109	+23.5	+21.1	1991 [#] / _{ft}

Ref: App C
C-1 to C-8

Ref App C
C-9 to C-15

Ref: WA-5

HARTMAN ENGINEERING

BY RJH DATE 3/9/06 SUBJECT _____ SHT.NO RD-1 OF _____

CHKD. BY GTB DATE 3/12/06 RING DESIGN JOB NO. 06-602

- ITEM No. 1 - SOIL ELEV 127
- WALES AT EL 121, 110, 100
 - DIAMETER RANGE 50' TO 120'

DIA	WALE ELEV	DESIGN LOADS			Ref:	OPTIONS
		RANGE OF P	V _{max}	M _{max}		
50'	121	185-377 ^k	88.89 ^k	10,805 ^{k-in}	RA-2 ↓	24x30 w/ 12#10
	110	342-597	62.65	7858		24x30 w/ 8#10
	100	531-783	41.91	5054		24x30 w/ 6#10
60'	121	223-450	104.88	15,340	RA-2 ↓	24x42 w/ 12#10
	110	410-712	72.93	10,946		24x30 w/ 10#10
	100	637-939	49.62	7193		24x30 w/ 6#10
70'	121	260-522	120.50	20,575	RA-2 ↓	30x42 w/ 6#18
	110	479-827	82.73	14,642		24x36 w/ 12#10
	100	743-1094	57.20	9676		24x36 w/ 8#10
80'	121	297-593	116.52	21,966	RA-3 ↓	30x42 w/ 6#18
	110	547-942	92.05	18,634		24x42 w/ 12#10
	100	849-1249	64.63	12,493		24x42 w/ 8#10
90'	121	334-664	150.64	33,098	RA-3 ↓	36x48 w/ 8#18
	110	616-1055	100.96	23,049		30x42 w/ 6#18
	100	955-1404	71.94	15,654		30x42 w/ 6#18
100'	121	371-735	165.28	40,417	RA-3 ↓	36x54 w/ 8#18
	110	684-1169	109.51	27,896		36x54 w/ 6#18
	100	1062-1559	79.15	19,160		30x42 w/ 6#18

CONTINUED ON RD-2

HARTMAN ENGINEERING

BY RSJ DATE 3/9/06 SUBJECT _____ SHT.NO RD-2 OF _____
 CHKD. BY ATB DATE 3/12/06 _____ JOB NO. 06-602

DIA	WALE ELEV	DESIGN LOADS			Ref:	OPTIONS
		RANGE OF P	V _{max}	M _{max}		
110	121	409-806 ^k	179.67 ^k	48,397 ^{k-in}	RA-4 ↓	36x60 w/8 [#] 18
	110	752-1282	117.78	33,112		36x54 w/6 [#] 18
	100	1168-1714	86.27	22,994		30x42 w/6 [#] 18
120	121	446-876	193.87	57,025	RA-4 ↓	36x60 w/10 [#] 18
	110	821-1395	125.79	38,685		36x48 w/8 [#] 18
	100	1274-1869	93.31	27,151		30x42 w/6 [#] 18

HARTMAN ENGINEERING

BY RJH DATE 3/9/06 SUBJECT _____ SHT. NO. RD-3 OF _____

CHKD. BY GJB DATE 3/12/06 _____ JOB NO. 06-602

ITEM No. 2 - SOIL ELEV 121

- WALES AT EL 117, 107, 98
- DIAMETER RANGE 50' TO 120'

DIA	WALE ELEV	DESIGN LOADS			Ref:	OPTIONS
		RANGE OF P	V _{max}	M _{max}		
50'	117	181-317 ^k	40.06 ^k	4736 ^{kw}	RA-6	16x28 w/6#9
	107	394-651	49.93	5998	↓	↓
	98	467-685	37.88	4537	↓	↓
60'	117	217-380	47.85	6803	RA-6	24x30 w/6#10
	107	472-780	59.18	8584	↓	↓
	98	560-822	44.96	6497	↓	↓
70'	117	254-443	55.56	9232	RA-6	24x30 w/10#10
	107	551-908	68.16	11,591	↓	24x30 w/10#10
	98	653-958	51.86	8782	↓	24x30 w/6#10
80	117	290-506	63.20	12,019	RA-7	24x36 w/10#10
	107	630-1036	76.89	15,012	↓	24x36 w/10#10
	98	747-1093	58.59	11,380	↓	24x36 w/8#10
90	117	326-569	70.77	15,158	RA-7	24x42 w/10#10
	107	709-1164	85.41	18,830	↓	24x42 w/10#10
	98	840-1229	65.17	14,289	↓	24x42 w/8#10
100	117	363-632	78.33	18,646	RA-7	24x48 w/10#10
	107	788-1292	93.88	23,031	↓	24x48 w/10#10
	98	934-1364	71.73	17,495	↓	24x42 w/10#10

CONTINUED ON RD-4

HARTMAN ENGINEERING

BY RSH DATE 3/9/06 SUBJECT _____ SHT.NO. RD-4 OF _____

CHKD. BY GTB DATE 3/12/06 _____ JOB NO. 06-602

DIA.	WALE ELEV	DESIGN LOADS			Ref:	OPTIONS
		RANGE OF P	V _{max}	M _{max}		
110	117	399-695	85.85	22,481	RA-8 ↓	30x42 w/6 #18 ↓
	107	866-1419	102.20	27,603		
	98	1027-1499	78.18	20,991		
120	117	435-757	93.31	26,659	RA-8 ↓	30x48 w/6 #18 30x48 w/6 #18 30x42 w/6 #18
	107	945-1546	110.37	32,537		
	98	1120-1634	84.53	24,770		

HARTMAN ENGINEERING

BY RJH DATE 5/9/06 SUBJECT _____ SHT. NO. RD-S OF _____

CHKD. BY _____ DATE _____ JOB NO. 06-602

ITEM No. 3 - 60' DIA.
- WALES AT EL 117, 107, 98

WALE ELEV	ARC	DESIGN LOADS			Ref;	OPTIONS
		RANGE OF P	V	M		
117	110°	168-244	52.70	6796	RA-10	24" x 30" w/ 6#10 ↓
	125°	168-244	61.03	9144		
107	110°	496-725	55.72	7320	RA-10	24" x 30" w/ 6#10 ↓
	125°	496-724	63.84	9798		
98	110°	588-843	42.35	5547	RA-10	} 24" x 30" w/ 6#10 ↓
		1026-1456	19.92	2680		
	125°	588-843	48.61	7431		
		1026-1456	22.51	3564		

For prelim design, use 24" x 30" w/ 6#10 for all sections

HARTMAN ENGINEERING

BY RJM DATE 5/9/06 SUBJECT _____ SHT.NO. RD-6 OF _____
 CHKD. BY _____ DATE _____ JOB NO. 06-602

ITEM No. 4 - 80' DIA
- WALES AT EL 120, 109

WALE ELEV	ARC	DESIGN LOADS			Ref.	OPTIONS
		RANGE OF P	V	M		
120	100°	364-612 ^k	159.94	25,945 ^{lb}	RA-12	36" x 48" w/ 6#18
	130°	364-603	204.11	44,837		36" x 60" w/ 8#18
109	100°	1059-1539	107.36	17,228	RA-10	36" x 42" w/ 6#18
	130°	1059-1534	138.68	30,105		36" x 48" w/ 6#18

Use: ELEV 120

ARC = 100° → 36" x 48" w/ 6#18

130° → 36" x 60" w/ 8#18

ELEV 109

ARC = 100° → 36" x 42" w/ 6#18

130° → 36" x 48" w/ 6#18

SUPERCEDED
SEE RD-7

HARTMAN ENGINEERING

BY RJK DATE 5/20/06 SUBJECT _____ SHT.NO RD-7 OF _____

CHKD. BY _____ DATE _____ JOB NO. 06-602

ITEM No. 5 - 80' DIAMETER

- WALES AT EL 120, 109
- VERIFY USING 48", 60" WALE WIDTH

Ref: RD-6

AT EL 109
width = 48" for all

AT EL 120
width = 60" for all

} Use constant width versus reducing width in 100° arc. Difficulties in rebar bending outweigh savings in concrete.

$$R_o = \frac{1}{2} (80.96) = 40.48'$$

AT EL 109

$$R_o/R_e = 40.48 / (40.48 - 2.00) = 40.48 / 38.48 = 1.052$$

AT EL 120

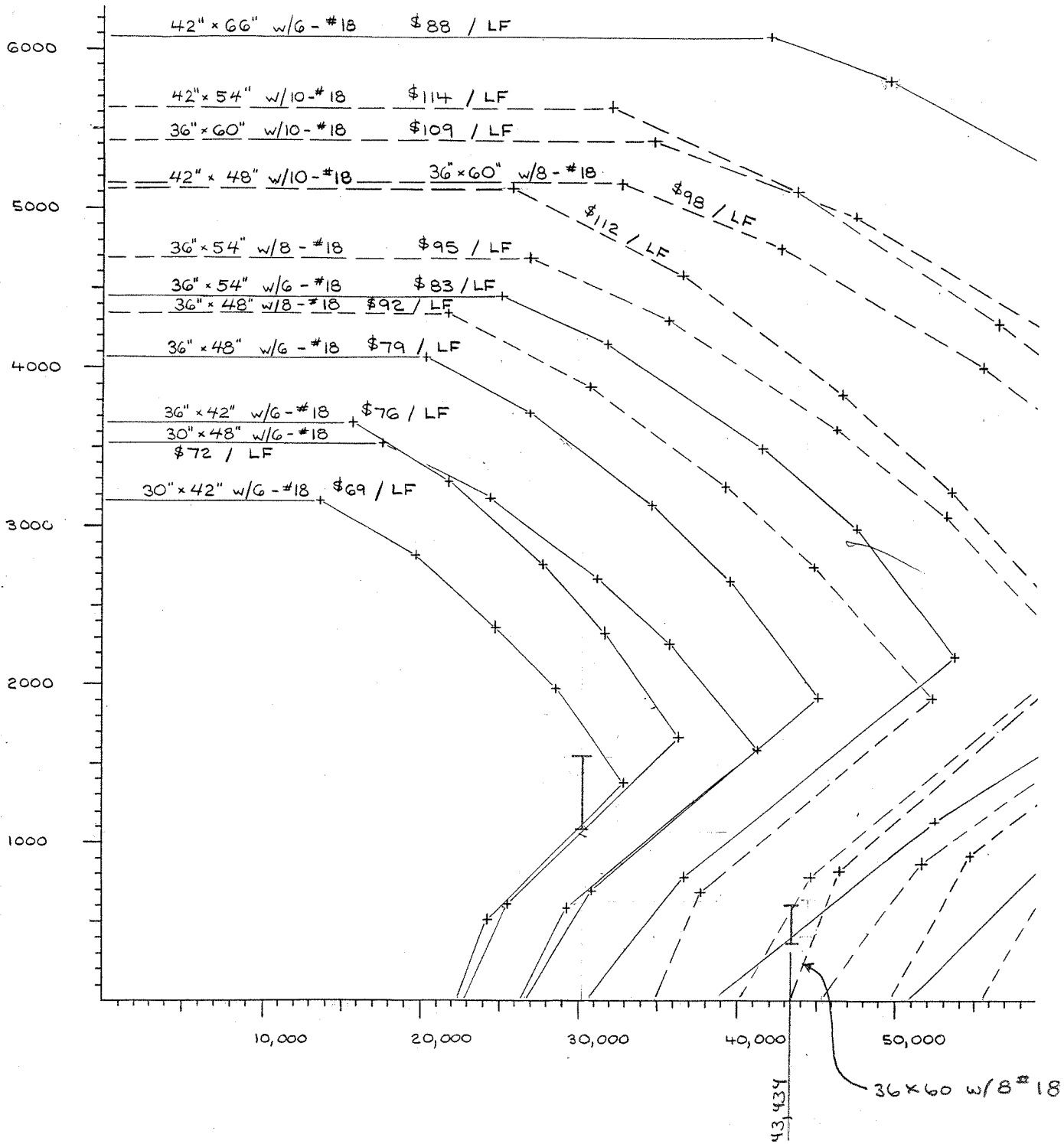
$$R_o/R_e = 40.48 / (40.48 - 2.5) = 40.48 / 37.98 = 1.066$$

WALE ELEV	ARC	DESIGN LOADS			Ref:	OPTIONS Ref: RD-8
		P	V	M		
120	130	359-595 ^k	201.66 ^k	43,434 ^{lb}	RA-14	36x60 w/8#18
	100	359-604	157.99	25,104	↓	↓
109	130	1073-1554	139.84	30,139	RA-14	30x48 w/6#18
	100	1073-1559	108.18	17,232	↓	↓

HARTMAN ENGINEERING

BY RH DATE 5/20/06 SUBJECT _____ SHT.NO. 20-8 OF _____

CHKD. BY _____ DATE _____ JOB NO. 06-602



HARTMAN ENGINEERING

BY RJH DATE 5/20/06 SUBJECT _____ SHT. NO. RD-9 OF _____
 CHKD. BY _____ DATE _____ JOB NO. 06-602

COLUMN TIES

At EL 120

36 x 60 w/ 8 # 18

(a) Min dia ties # 4 Per ACI 7.10.5.1

(b) Maximum spacing Per ACI 7.10.5.2

1) 16 longitudinal bar dia = 16(2.25) = 36"

2) 48 tie bar dia = 48(0.5) = 24"

3) least dim of member = 36"

} Use # 4 @ 24"

At EL 109

30 x 48 w/ 6 # 18

(a) # 4 min

(b) Max spacing

1) 16(2.25) = 36"

2) 48(0.5) = 24"

3) 30"

} Use # 4 @ 24"

CHECK SHEAR CAP'Y

At EL 120

36 x 60 w/ 8 # 18

$P = 359 - 595 \text{ k}$

$V = 201.66 \text{ k max}$

$V_u = \phi (V_c + V_s)$ (Ref ACI 11.1.1)

$\phi = 0.85$

$V_c = 2 \left[1 + \frac{N_u}{2000 A_g} \right] \sqrt{f'_c} b_w d$ Ref: ACI 11.3.1.2

$d \approx 60 - 2 \text{ cover} - \frac{1}{2}(2\frac{1}{4}) = 56.75 \rightarrow \text{Use } 56''$

$V_c = 2 \left[1 + \frac{359,000}{2000(36)(60)} \right] \sqrt{4000} (36)(56)$

$= 276,198 \text{ #}$

$\phi V_c = 0.85(276,198) = 234,768 \text{ #} = 234.77 \text{ k} > 201.66 \text{ ok}$

HARTMAN ENGINEERING

BY RJH DATE 5/20/06 SUBJECT _____ SHT. NO. RD-10 OF _____
 CHKD. BY _____ DATE _____ JOB NO. 06-602

AT EL 109

30x48 w/ 6 #18

$$P = 1073 - 1554 \text{ k}$$

$$V = 139.84 \text{ k}$$

$$d \approx 48 - 2 - 1.25 = 44.75" \rightarrow \text{Use } 44"$$

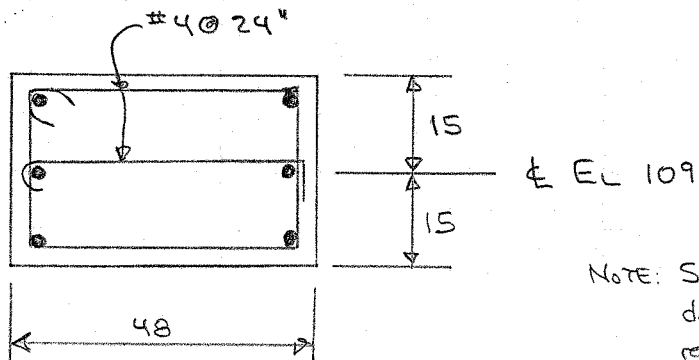
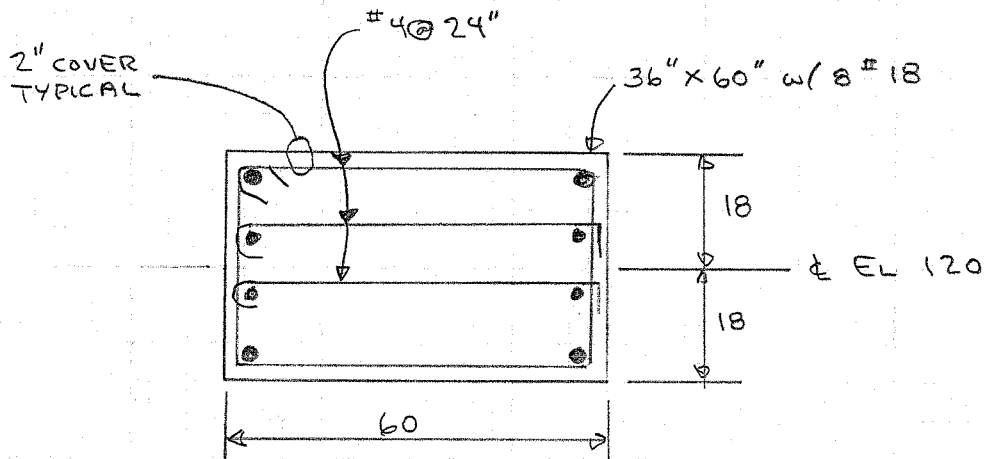
$$V_c = 2 \left[1 + \frac{N_v}{2000 A_g} \right] \sqrt{f'_c} b_w d$$

$$= 2 \left[1 + \frac{1,073,000}{2,000 (30)(44)} \right] \sqrt{4000} (30)(44)$$

$$= 234,831 \text{ \#} = 234.83 \text{ k}$$

$$\phi V_c = 0.85 (234.83) = 199.61 \text{ k} > 139.84 \text{ OK}$$

SUMMARY FOR 80' DIA COFFERDAM



NOTE: See RD-11 for determination regarding add'l ties

HARTMAN ENGINEERING

BY RJH DATE _____ SUBJECT _____ SHT. NO. RD-11 OF _____
 CHKD. BY _____ DATE _____ _____ JOB NO. 06-602

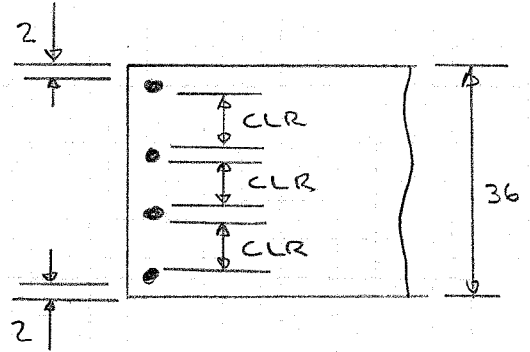
Check clear distance between restrained bars (Ref: ACI 7.10.5.3)
 Max clear = 6"

At El 120

$$CLR = \frac{1}{3} [36 - 2 - 2 - 4(2\frac{1}{4})]$$

$$= 7.66" > 6$$

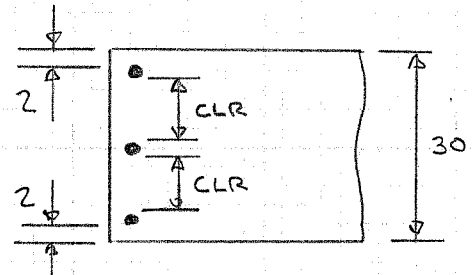
Need tie on all bars



At El 109

$$CLR = \frac{1}{2} [30 - 2 - 2 - 3(2\frac{1}{4})]$$

$$= 9.62" > 6$$



HARTMAN ENGINEERING

BY RSK DATE 5/21/06 SUBJECT _____ SHT.NO RD-12 OF _____

CHKD. BY GJB DATE 5/23/06 _____ JOB NO. 06-602

ITEM No. 6 - 60' DIAMETER

- WALES AT EL 117, 107, 98
- VERIFY & SELECT TIES

Wale dimensions used for the analyses on RA-9, RA-10 were 24" x 30" so there is no need to rerun the analyses.

EL 117

Design Loads (Ref: RA-10)

110°

$$P = 168 \text{ to } 244 \text{ k}$$

$$M = 6796 \text{ k-in}$$

125°

$$P = 168 \text{ to } 244 \text{ k}$$

$$M = 9144 \text{ k-in}$$

Ref: RD-13

Use 24" x 30" w/ 10 #10

EL 107

Design Loads (Ref: RA-10)

110°

$$P = 496 \text{ to } 725 \text{ k}$$

$$M = 7320 \text{ k-in}$$

125°

$$P = 496 \text{ to } 724 \text{ k}$$

$$M = 9798 \text{ k-in}$$

Ref: RD-13

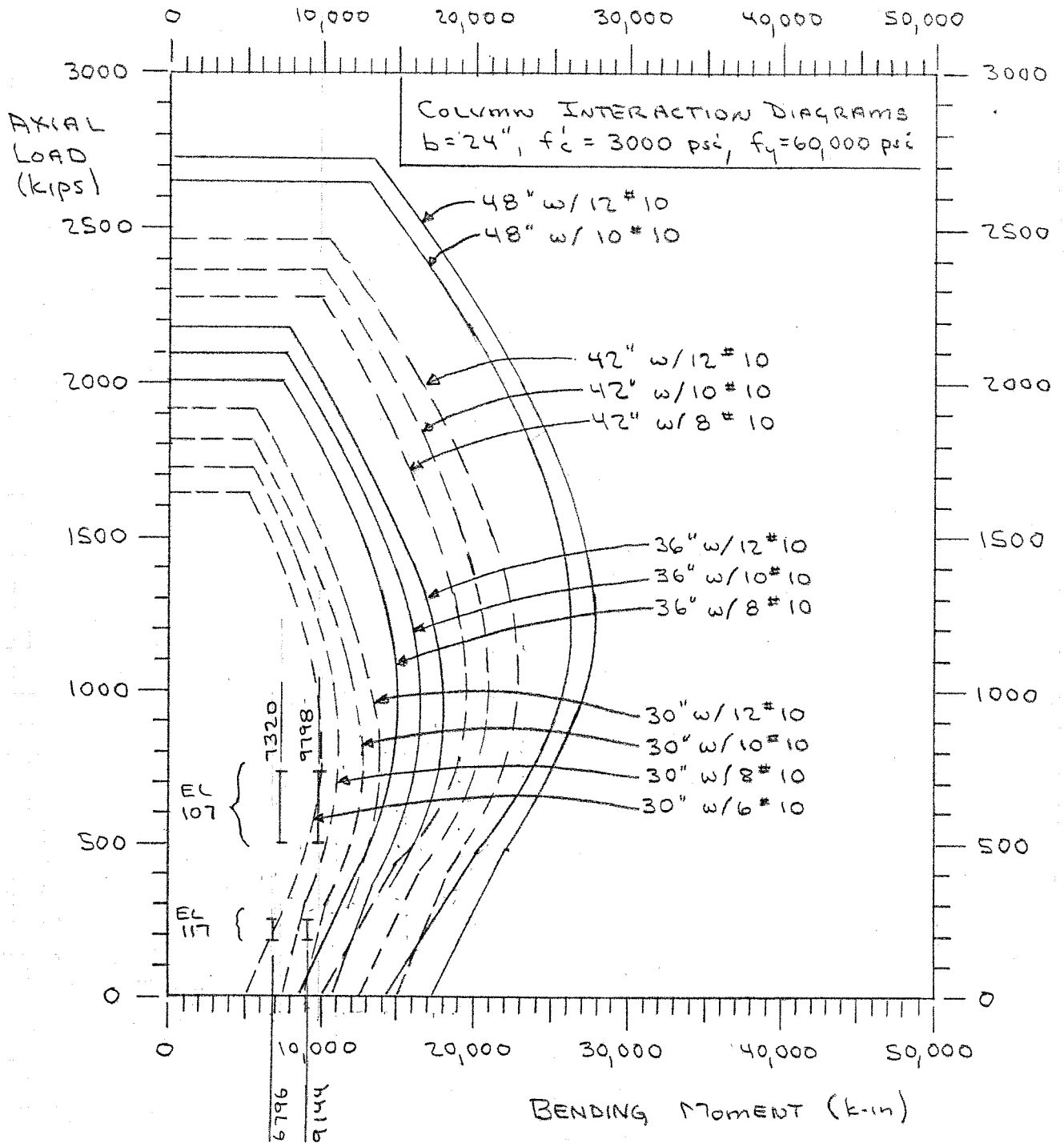
Use 24" x 30" w/ 8 #10

(CON'T ON RD-14)

HARTMAN ENGINEERING

BY RJH DATE 5/21/06 SUBJECT _____ SHT.NO. RD-13 OF _____

CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602



HARTMAN ENGINEERING

BY RSK DATE 5/21/06 SUBJECT _____ SHT.NO. RD-14 OF _____

CHKD. BY GJB DATE 5/23/06 _____ JOB NO. 06-602

EL 98

Design Loads (Ref: RA-10)

Evaluate two conditions, Trapezoidal + Loads from WA-7

110°

Trapezoidal

$$P = 588 \text{ to } 843 \text{ k}$$

$$M = 5547 \text{ k-in}$$

From WA-7

$$P = 1026 \text{ to } 1456 \text{ k}$$

$$M = 2680 \text{ k-in}$$

125°

Trapezoidal

$$P = 588 \text{ to } 843 \text{ k-in}$$

$$M = 7431 \text{ k-in}$$

From WA-7

$$P = 1026 \text{ to } 1456 \text{ k}$$

$$M = 3564 \text{ k-in}$$

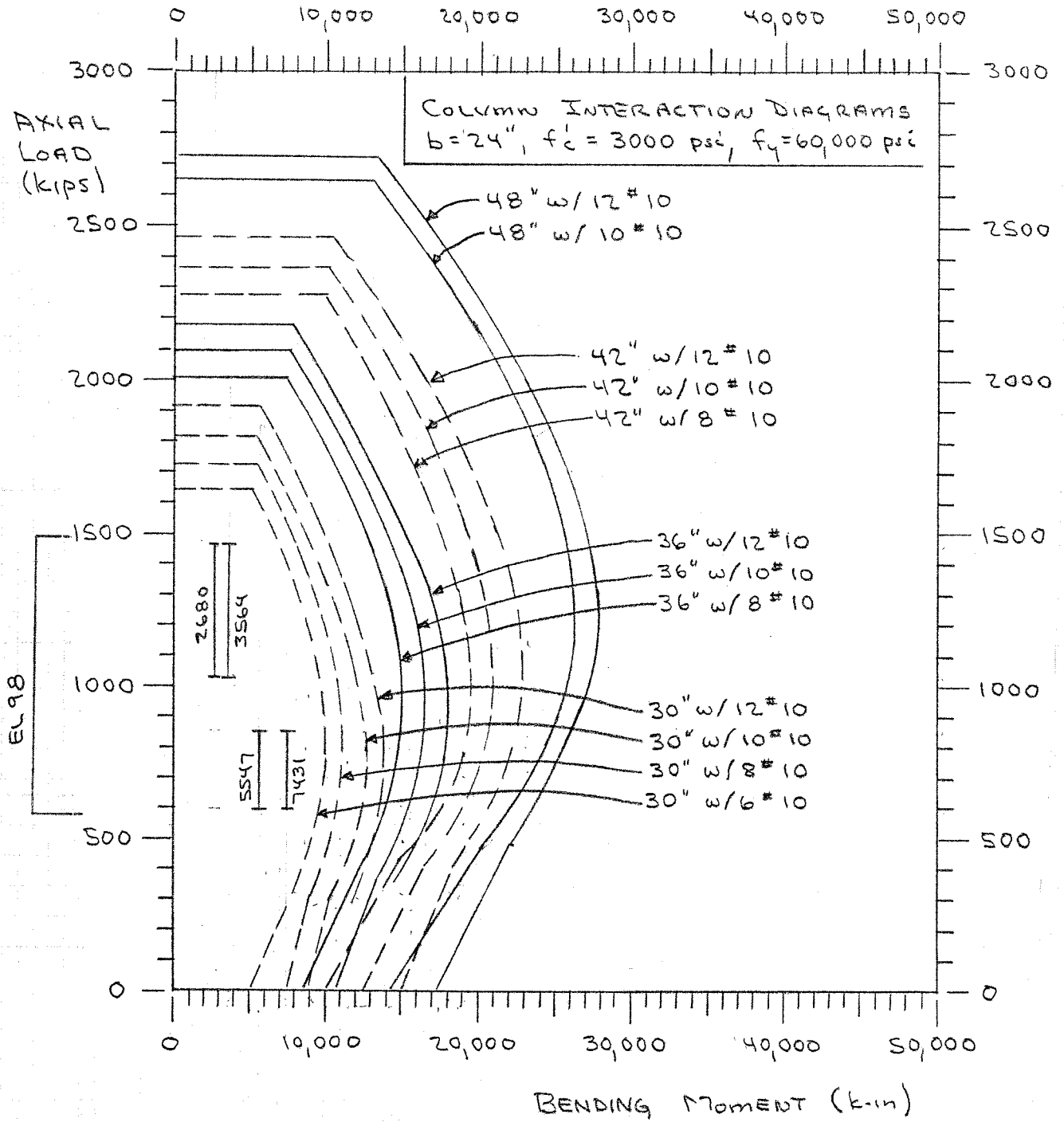
Ref: RD-15

Use 24" x 30" w/ 6 # 10

HARTMAN ENGINEERING

BY RJH DATE 5/21/06 SUBJECT _____ SHT.NO. RD-15 OF _____

CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602



HARTMAN ENGINEERING

BY RSK DATE 5/21/06 SUBJECT _____ SHT. NO. RD-16 OF _____
 CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

Column Ties

Wales are 24" x 30" at all levels. Primary reinf is #10
 Ties can be either #3 or #4 Per ACI 7.10.5.1

Maximum spacing Per ACI 7.10.5.2

1) 16 long bar diameters = $16(1.25) = 20"$

2) 48 tie bar diameters
 = $48(0.5) = 24"$ for #4
 = $48(0.375) = 18"$ for #3

3) least dimension of member = 24"

Use #3 @ 18"

CHECK SHEAR CAP'Y

AT EL 117

24" x 30" w/ 10#10

$P = 168$ to 244 k

$V = 61.03$ k (Ref: RA-10)

$V_u = \phi (V_c + V_s)$ (Ref: ACI 11.1.1)

$\phi = 0.85$

$V_c = 2 \left[1 + \frac{N_u}{2000 A_g} \right] f'_c b_w d$ (Ref: ACI 11.3.1.2)

Use $d = 30 - 2 \text{ cover} - \frac{1}{2}(1\frac{1}{4}) = 26.75" \rightarrow$ use 26"

$V_c = 2 \left[1 + \frac{168,000}{2000(24)(30)} \right] \sqrt{4000} (24)(26) = 88,139$ #
 = 88.14 k

$\phi V_c = 0.85(88.14) = 74.92$ k > 61.03 OK

AT EL 107

24" x 30" w/ 8#10

$P = 496$ to 725 k

$V = 63.84$ k (Ref: RA-10)

HARTMAN ENGINEERING

BY RJH DATE 5/21/06 SUBJECT _____ SHT.NO RD-17 OF _____

CHKD. BY GTD DATE 5/23/06 JOB NO. 06-602

$$V_c = 2 \left[1 + \frac{496,000}{2000(24)(30)} \right] \sqrt{4000} (24)(26) = 106,118 \#$$

$$= 106.12^k$$

$$\phi V_c = 0.85 (106.12) = 90.20^k > 63.84 \text{ OK}$$

At EI 98

24" x 30" w/ 6# 10

$$P = 588 \text{ to } 843^k$$

$$V = 48.61^k \quad (\text{Ref: RA-10})$$

$$V_c = 2 \left[1 + \frac{588,000}{2000(24)(30)} \right] \sqrt{4000} (24)(26) = 111,160 \#$$

$$= 111.16^k$$

$$\phi V_c = 0.85 (111.16) = 94.49^k > 48.61 \text{ OK}$$

Check clear distance between restrained bars (Ref ACI 7.10.5.3)

Max clear = 6"

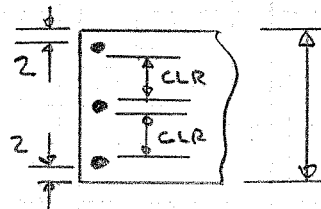
At EL 98

$$CLR = \frac{1}{2} [24 - 2 - 2 - 3(1\frac{1}{4})]$$

$$= \frac{1}{2} [16.25]$$

$$= 8.125 > 6$$

∴ Need tie on center bar



At EI 107

$$CLR = \frac{1}{3} [24 - 2 - 2 - 4(1\frac{1}{4})] = 5" \text{ OK}$$

At EI 117

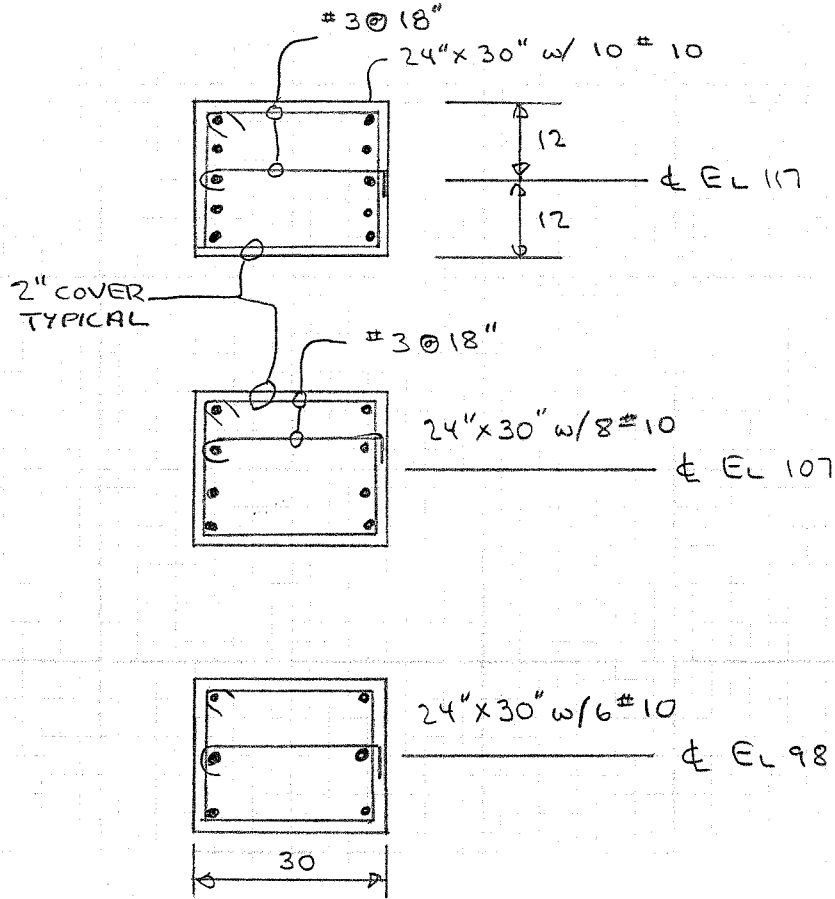
$$CLR = \frac{1}{4} [24 - 2 - 2 - 5(1\frac{1}{4})] = 3.4" \text{ OK}$$

HARTMAN ENGINEERING

BY RJH DATE 5/21/06 SUBJECT _____ SHT.NO RD-18 OF _____

CHKD. BY GJB DATE 5/25/06 _____ JOB NO. 06-602

SUMMARY FOR 60' DIA COFFERDAM



HARTMAN ENGINEERING

BY RJH DATE 3/8/06 SUBJECT _____ SHT. NO. RA-1 OF _____
 CHKD. BY GJB DATE 3/12/06 RING ANALYSIS JOB NO. 06-602

Item No. 1 - Soil Elev 127

- WALES AT EL 121, 110, 100
- RADIUS RANGE 25' to 60'

Estimate wale depth = 3% diameter for initial work
 = 6% of radius
 $\frac{1}{2}$ radius = outside radius - 3% (outside radius)
 = 0.97 (outside radius)

Ref: WA-1

RANKINE DIST

El 121	$W_1 = 4415 \#/\text{ft}$	$\alpha = 4415 / 2542 = 1.737$	Crane Ld = 1660 #/ft
El 110	$W_2 = 12,534 \#/\text{ft}$	$\alpha = 12,534 / 11,128 = 1.126$	C.L. = 2095 #/ft
El 100	$W_3 = 21,064 \#/\text{ft}$	$\alpha = 21,064 / 19,533 = 1.078$	C.L. = 620 #/ft

Ref: WA-2

TRAPAZOIDAL DIST

El 121	$W_5 = 7636 \#/\text{ft}$	$\alpha = 7636 / 5763 = 1.325$	C.L. = 1660 #/ft	} same
El 110	$W_6 = 14,771 \#/\text{ft}$	$\alpha = 14,771 / 13,365 = 1.105$	C.L. = 2095 #/ft	
El 100	$W_7 = 20,241$	$\alpha = 20,241 / 18,711 = 1.082$	C.L. = 620 #/ft	

Distance from wale

$D = 11 + 1.5 \pm = 12.5' \pm$ (Ref: PA-11)

HARTMAN ENGINEERING

 BY RSH DATE 3/8/06 SUBJECT _____

 SHT. NO. RA-2 OF _____

 CHKD. BY GTB DATE 3/12/06

 JOB NO. 06-602

TABULATION OF DESIGN LOADS

Dia	ϕ RAD	WALE ELEV	SOIL PR DISTR	APPLIED LOAD	VAR. FACTOR	DESIGN LOADS		Ref.	
						RANGE OF P	Y		
50'	24.25'	121	RANK TRAP	4415 ^{1/4} ft	1.737	185 ⁶ to 294 ⁶	88.89 k	10,805 ^{km}	RAC-1
				7636	1.325	245 - 377	73.76	9039	-2
				12,534	1.126	342 - 521	62.65	7858	RAC-3
				14,771	1.105	395 - 597	62.10	7793	-4
				21,064	1.078	550 - 783	41.58	5015	RAC-5
60'	29.10	121	R T	20,241	1.082	531 - 756	41.91	5054	-6
				4415	1.737	223 - 350	104.88	15,340	RAC-7
				7636	1.325	294 - 450	86.72	12,798	-8
				12,534	1.126	410 - 622	72.93	10,835	RAC-9
				14,771	1.105	474 - 712	72.26	10,946	-10
70'	33.95	121	R T	21,064	1.078	660 - 939	49.23	7,137	RAC-11
				20,241	1.082	637 - 906	49.62	7,193	-12
				4415	1.737	260 - 405	120.50	20,575	RAC-13
				7636	1.325	343 - 522	99.31	17,115	-14
				12,534	1.126	479 - 722	82.73	14,642	RAC-15
100'	100	R T	14,771	1.105	554 - 827	81.95	14,515	-16	
			21,064	1.078	770 - 1094	56.74	9601	RAC-17	
			20,241	1.082	743 - 1056	57.20	9676	-18	

HARTMAN ENGINEERING

 BY RWH DATE 3/8/06 SUBJECT _____

 SHT. NO. RA-3 OF _____

 CHKD. BY GJB DATE 3/12/06

 JOB NO. 06-602

TABULATION OF DESIGN LOADS - CONTINUED

Dia	Ø RAD	WALE ELEV	SOIL PR DIST	APPLIED LOAD	VAR. FACTOR	DESIGN LOADS		Def.	
						RANGE OF P	V		
80'	38.80	121	R	4415	1.737	297 to 416 ^k	102.04 ^k	19,113 ^k	RAC-19
			T	7636	1.325	392-593	111.52	21,966	-20
	110	R	12,534	1.126	547-822	92.05	18,634	RAC-21	
		T	14,771	1.105	633-942	91.16	18,468	-22	
	100	R	21,064	1.078	881-1249	64.11	12,395	RAC-23	
		T	20,241	1.082	849-1206	64.63	12,493	-24	
90'	43.65	121	R	4415	1.737	334-514	150.64	33,098	RAC-25
			T	7636	1.325	441-664	123.40	27,377	-26
	110	R	12,534	1.126	616-920	100.96	23,049	RAC-27	
		T	14,771	1.105	712-1055	99.96	22,839	-28	
	100	R	21,064	1.078	991-1404	71.35	15,530	RAC-29	
		T	20,241	1.082	955-1355	71.94	15,654	-30	
100'	48.50	121	R	4415	1.737	371-569	165.28	40,417	RAC-31
			T	7636	1.325	490-735	135.01	33,356	-32
	110	R	12,534	1.126	684-1019	109.51	27,896	RAC-33	
		T	14,771	1.105	791-1169	108.40	27,637	-34	
	100	R	21,064	1.078	1101-1559	78.49	19,007	RAC-35	
		T	20,241	1.082	1062-1505	79.15	19,160	-36	

HARTMAN ENGINEERING

 BY RJH DATE 3/8/06 SUBJECT _____

 SHT.NO RA-4 OF _____

 CHKD. BY GTB DATE 3/12/06

 JOB NO. 06-602

TABULATION OF DESIGN LOADS - CONTINUED

Dia	± RAD	WAVE ELEV	SOIL PR. DIST	APPLIED LOAD	VAR FACTOR	DESIGN LOADS			Ref
						RANGE OF P	V	M	
110'	53.35	121	R	4415	1.737	409-623 k	179.67 k	48,397 k	RAC-37
			T	7636	1.325	539-806	146.38	39,852	-38
	110	R	12,534	1.126	752-1117	117.78	33,112	RAC-39	
		T	14,771	1.105	870-1282	116.56	32,799	-40	
	100	R	21,064	1.078	1211-1714	85.55	22,808	RAC-41	
		T	20,241	1.082	1168-1654	86.27	22,994	-42	
120	58.20	121	R	4415	1.737	446-677	193.87	57,025	RAC-43
			T	7636	1.325	588-876	157.55	46,856	-44
	110	R	12,534	1.126	821-1215	125.79	38,685	RAC-45	
		T	14,771	1.105	949-1395	124.45	38,312	-46	
	100	R	21,064	1.078	1321-1869	92.53	26,930	RAC-47	
		T	20,241	1.082	1274-1803	93.31	27,151	-48	

HARTMAN ENGINEERING

BY RJH DATE 3/8/06 SUBJECT _____ SHT. NO. RA-5 OF _____
 CHKD. BY GIB DATE 3/12/06 JOB NO. 06-602

ITEM No. 2 - SOIL ELEV 121

- WALES AT EL 117, 107, 98
- RADIUS RANGE 25' TO 60'

± radius = 0.97 (outside radius) Ref: RA-1

Ref: WA-3

RANKINE DIST

EL 117	$W_9 = 5719 \text{ #/ft}$	$\alpha = 5719 / 4368 = 1.309$	C.L. = 302 #/ft
EL 107	$W_{10} = 14,626 \text{ #/ft}$	$\alpha = 14,626 / 13,160 = 1.111$	C.L. = 1008 #/ft
EL 98	$W_{11} = 18,386 \text{ #/ft}$	$\alpha = 18,386 / 17,166 = 1.071$	C.L. = 679 #/ft

Ref: WA-4

TRAPEZOIDAL DIST

EL 117	$W_{13} = 7486 \text{ #/ft}$	$\alpha = 7486 / 6135 = 1.220$	C.L. = 302 #/ft
EL 107	$W_{14} = 16,832 \text{ #/ft}$	$\alpha = 16,832 / 15,366 = 1.095$	C.L. = 1008 #/ft
EL 98	$W_{15} = 17,948 \text{ #/ft}$	$\alpha = 17,948 / 16,727 = 1.073$	C.L. = 679 #/ft

Distance from wall

$D = 22 + 1.5 \pm = 23.5' \pm$ (Ref: PA-13)

HARTMAN ENGINEERING

BY RJH DATE 3/8/06 SUBJECT _____ SHT.NO. RA-6 OF _____

CHKD. BY STB DATE 3/12/06 JOB NO. 06-602

TABULATION OF DESIGN LOADS

DIA	E RAD	WAVE ELEV.	SOIL PR DIST	APPLIED LOAD	VARZ FACTOR	DESIGN LOADS			Ref.
						RANGE OF P	V	M	
50'	24,25'	117	R	5719 ^{3/4}	1.309	181 to 261k	40.06k	4736 ^{6'}	RAC-49
			T	7486	1.220	221 - 317	37.70	4460	-50
	107	R	14,626	1.111	394 - 577	49.93	5998	RAC-51	
		T	16,832	1.095	446 - 651	49.45	5942	-52	
	98	R	18,386	1.071	477 - 685	37.78	4526	RAC-53	
		T	17,948	1.073	467 - 670	37.88	4537	-54	
60'	29,10	117	R	5719	1.309	217 - 313	47.85	6803	RAC-55
			T	7486	1.220	265 - 380	45.02	6406	-56
	107	R	14,626	1.111	472 - 690	59.18	8584	RAC-57	
		T	16,832	1.095	536 - 780	58.60	8503	-58	
	100	R	18,386	1.071	573 - 822	44.84	6482	RAC-59	
		T	17,948	1.073	560 - 804	44.96	6497	-60	
70	33,95	117	R	5719	1.309	254 - 365	55.56	9232	RAC-61
			T	7486	1.220	310 - 443	52.26	8692	-62
	107	R	14,626	1.111	551 - 805	62.16	11,591	RAC-63	
		T	16,832	1.095	625 - 908	67.49	11,481	-64	
	100	R	18,386	1.071	668 - 958	51.72	8760	RAC-65	
		T	17,948	1.073	653 - 937	51.86	8782	-66	

HARTMAN ENGINEERING

BY RJH DATE 3/8/06 SUBJECT _____ SHT.NO. RA-7 OF _____

CHKD. BY GTE DATE 3/12/06 JOB NO. 06-602

TABULATION OF DESIGN LOADS - CONTINUED

DIA.	± RAD	WAVE ELEV.	SOIL PR DIST	APPLIED LOAD	VAR. FACTOR	DESIGN LOADS			Ref.
						RANGE OF P	V	M	
80	38.80	117	R	5719	1.309	290-417	63.20	12,019	RAC-67
			T	7486	1.220	354-506	59.43	11,312	-68
	107	R	14,626	1.111	630-918	76.89	15,012	RAC-69	
		T	16,832	1.095	715-1036	76.13	14,869	-70	
	98	R	18,386	1.071	764-1093	58.44	11,352	RAC-71	
		T	17,948	1.073	747-1070	58.59	11,380	-72	
90	43.65	117	R	5719	1.309	326-468	70.77	15,158	RAC-73
			T	7486	1.220	398-569	66.53	14,264	-74
	107	R	14,626	1.111	709-1031	85.41	18,830	RAC-75	
		T	16,832	1.095	804-1164	84.55	18,649	-76	
	98	R	18,386	1.071	859-1229	65.00	14,253	RAC-77	
		T	17,948	1.073	840-1202	65.17	14,289	-78	
100	48.50	117	R	5719	1.309	363-520	78.33	18,646	RAC-79
			T	7486	1.220	442-632	73.62	17,542	-80
	107	R	14,626	1.111	788-1143	93.88	23,031	RAC-81	
		T	16,832	1.095	893-1292	92.92	22,807	-82	
	98	R	18,386	1.071	955-1364	71.54	17,451	RAC-83	
		T	17,948	1.073	934-1335	71.73	17,495	-84	

HARTMAN ENGINEERING

BY RJH DATE 3/9/06 SUBJECT _____ SHT.NO RA-8 OF _____

CHKD. BY GJBS DATE 3/12/06 JOB NO. 06-602

TABULATION OF DESIGN LOADS - CONTINUED

DIA.	± RAD	WALE ELEV	SOIL PR DIST.	APPLIED LOAD	VAR. FACTOR	DESIGN LOADS			Ref.
						RANGE OF P	V	M	
110'	53.35	117	R	5719	1.309	399-572	85.85	22,481	RAC-85
			T	7486	1.220	487-695	80.66	21,145	-86
	107	R	14,626	1.111	866-1256	102.20	27,603	RAC-87	
		T	16,832	1.095	983-1419	101.14	27,333	-88	
	98	R	18,386	1.071	1050-1499	77.97	20,938	RAC-89	
		T	17,948	1.073	1027-1467	78.18	20,991	-90	
120'	58.20	117	R	5719	1.309	435-623	93.31	26,659	RAC-91
			T	7486	1.220	531-757	87.66	25,069	-92
	107	R	14,626	1.111	945-1369	110.37	32,537	RAC-93	
		T	16,832	1.095	1072-1546	109.22	32,215	-94	
	98	R	18,386	1.071	1146-1634	84.31	24,707	RAC-95	
		T	17,948	1.073	1120-1599	84.53	24,770	-96	

ITEM No. 3 - R = 30' COFFERDAM

- PRECIS SHEET PILING → R_{inside piling} = 30.53 feet
- SOIL ELEV 121 USING PRE-EXCAVATION
- BOTTOM EL = 92

Estimate wale dimensions 24" x 30" (ref: RD-3 with 60' Dia)

$$\text{Ratio } R_o/R_{\#} = 30.53 / (30.53 - \frac{2.5}{2}) = 30.53 / 29.28 = 1.043$$

Use $R_{\#} = 29.28$

Applied Loads (Ref: RA-S)

EL 117

R:	$1.043 W_9 = 1.043 (5719) = 5965 \text{ #/ft}$	$\alpha = 1.309$	C.L. = 302 #/ft
T:	$1.043 W_{13} = 1.043 (7486) = 7808$	$\alpha = 1.220$	C.L. = 302
WA-7	$1.043 W_{23} = 1.043 (3400) = 3546$	$\alpha = 1.619$	C.L. = 302
		$\alpha = 3.4 / 2.1 = 1.619$	

EL 107

R:	$1.043 W_{10} = 1.043 (14,626) = 15,255$	$\alpha = 1.111$	C.L. = 1008
T:	$1.043 W_{14} = 1.043 (16,832) = 17,556$	$\alpha = 1.095$	C.L. = 1008
WA-7	$1.043 W_{24} = 1.043 (-)$ not applicable		C.L. = 1008

EL 98

R:	$1.043 W_{11} = 1.043 (18,386) = 19,177$	$\alpha = 1.071$	C.L. = 679
T:	$1.043 W_{15} = 1.043 (17,948) = 18,720$	$\alpha = 1.073$	C.L. = 679
WA-7	$1.043 W_{25} = 1.043 (33,600) = 35,045$	$\alpha = 0.991$	C.L. = 679
		$\alpha = 33.6 / 33.9 = 0.991$	

HARTMAN ENGINEERING

BY RJH DATE 5/9/06 SUBJECT _____ SHT. NO. RA-10 OF _____

CHKD. BY GJB DATE 5/23/06 JOB NO. 06-602

TABULATION OF DESIGN LOADS

R = 29.28' FOR ALL Crane dist = 23.5' for all

ARC	WALE ELEV	SOIL PRES TYPE	APPLIED LOAD	VAR FACTOR	DESIGN LOADS			REF/NOTES
					RANGE OF P	N	M	
110°	117	RANK TRAP WA-7	5965 [#]	1.309	228 - 329 K	45.20 K	5837 ^{lb}	RAC-97
			7808	1.220	278 - 399	42.52	5495	-98
			3546	1.619	168 - 244	52.70	6796	-99
	107	RANK TRAP WA-7	15,255	1.111	496 - 725	55.72	7320	-100
			17,556	1.095	562 - 818	55.18	7251	-101
			-	-	-	-	-	-
98	RANK TRAP WA-7	19,177	1.071	601 - 862	42.25	5534	RAC-102	
		18,720	1.073	588 - 843	42.35	5547	-103	
		35,045	0.991	1026 - 1456	19.92	2680	-104	
125°	117	RANK TRAP WA-7	5965	1.309	228 - 328	52.29	7849	RAC-105
			7808	1.220	278 - 399	49.18	7388	-106
			3546	1.619	168 - 244	61.03	9144	-107
	107	RANK TRAP WA-7	15,255	1.111	496 - 724	63.84	9798	-108
			17,556	1.095	562 - 817	63.20	9704	-109
			-	-	-	-	-	-
98	RANK TRAP WA-7	19,177	1.071	601 - 861	48.49	7412	RAC-110	
		18,720	1.073	588 - 843	48.61	7431	-111	
		35,045	0.991	1026 - 1456	22.51	3564	-112	

HARTMAN ENGINEERING

BY RJH DATE 5/9/06 SUBJECT _____ SHT. NO. RA-11 OF _____
 CHKD. BY GJS DATE 5/23/06 JOB NO. 06-602

ITEM No. 4 - R = 40' COFFERDAM

- P2C18 SHEET PILING → R_I = 40.48 feet
- SOIL ELEV 127
- BOTTOM ELEV 102

Estimate wale dimensions 24' x 42" (ref. RD-1 w/ 80' Dw)

$$\text{Ratio } R_o/R_e = 40.48 / \left(40.48 - \frac{21}{12}\right) = 40.48 / 38.73 = 1.045$$

Use R_e = 38.73'

Applied Loads

RAWKINE DIST

EL 120

$$w = 1.045 W_{17} = 1.045 (5449) = 5694 \text{ #/ft}$$

$$\alpha = W_{17}/W'_{17} = 5449/3296 = 1.653$$

EL 109

$$w = 1.045 W_{18} = 1.045 (12,591) = 13,158 \text{ #/ft}$$

$$\alpha = W_{18}/W'_{18} = 12,591/11,423 = 1.102$$

TRAPAZOIDAL DIST

EL 120

$$w = 1.045 W_{20} = 1.045 (8324) = 8698 \text{ #/ft}$$

$$\alpha = W_{20}/W'_{20} = 8324/6171 = 1.349$$

EL 109

$$w = 1.045 W_{21} = 1.045 (12,071) = 12,614 \text{ #/ft}$$

$$\alpha = W_{21}/W'_{21} = 12,071/10,910 = 1.106$$

FROM WA-8

EL 120 → not applicable

EL 109

$$w = 1.045 W_{22} = 1.045 (23,500) = 24,558 \text{ #/ft}$$

$$\alpha = 23.5/21.1 = 1.114$$

HARTMAN ENGINEERING

BY RJH DATE 5/9/06 SUBJECT _____ SHT.NO. RA-12 OF _____
 CHKD. BY GJB DATE 5/23/06 _____ JOB NO. 06-602

TABULATION OF DESIGN LOADS

R = 38.73' FOR ALL CRANE DIST # 12.5' FOR ALL (REF RA-1)

ARC	WALE ELEV	SOIL PRES TYPE	APPLIED LOAD	VAR FACTOR	DESIGN LOADS			REF./NOTES
					RANGE OF P	V	M	
100°	120	RANK	5694#	1.653	364-612 ^k	159.94 ^k	25,945 ^{6"}	RAC-113
		TRAP	8698	1.349	454-738	142.68	23,318	-114
		WA-B	-	-	-	-	-	-
109	109	RANK	13,158	1.102	561-842	70.51	11,620	RAC-115
		TRAP	12,614	1.106	540-812	70.38	11,601	-116
		WA-B	24,558	1.114	1059-1539	107.36	17,228	-117
130°	120	RANK	5694	1.653	364-603	204.11	44,837	RAC-118
		TRAP	8698	1.349	454-728	180.53	40,017	-119
		WA-B	-	-	-	-	-	-
109	109	RANK	13,158	1.102	561-837	88.34	19,794	RAC-120
		TRAP	12,614	1.106	540-807	88.16	19,759	-121
		WA-B	24,558	1.114	1059-1534	138.68	30,105	-122

HARTMAN ENGINEERING

BY RJH DATE 5/20/06 SUBJECT _____ SHT. NO. RA-13 OF _____

CHKD. BY GJZ DATE 5/23/06 JOB NO. 06-602

Item No. 5 - R = 40' COFFERDAM

$R_1 = 40.48'$

Soil EL 127

Bottom EL 102

VERIFY USING 48" 60" WALE WIDTH

Ref: RD-7

Applied Loads

RANKINE DIST

EL 120

$w = 1.052(W_{17}) = 1.052(5449) = 5732 \#/\text{ft}$ (Ref RD-7)

$\alpha = 1.653$ (Ref: RA-11)

EL 109

$w = 1.066(W_{18}) = 1.066(12,591) = 13,422 \#/\text{ft}$

$\alpha = 1.102$

TRAPAZOIDAL DIST

EL 120

$w = 1.052(W_{20}) = 1.052(8324) = 8757 \#/\text{ft}$

$\alpha = 1.349$

EL 109

$w = 1.066(W_{21}) = 1.066(12,071) = 12,868 \#/\text{ft}$

$\alpha = 1.106$

From WA-8

EL 120 → not applicable

EL 109

$w = 1.066(W_{27}) = 1.066(23,500) = 25,051 \#/\text{ft}$

$\alpha = 1.114$

HARTMAN ENGINEERING

BY RJH DATE 5/20/06 SUBJECT _____

SHT.NO RA-14 OF _____

CHKD. BY GJB DATE 5/23/06

JOB NO. 06-602

Crane distance = 12.5' for all (Ref. RA-1)
 At EL 120
 $w_{17} = 3589 \text{ #/ft}$
 At EL 109
 $w_{18} = 1991 \text{ #/ft}$

TABULATION OF DESIGN LOADS

WALE ELEV/ R.F.	ARC	SOIL PRES TYPE	APPLIED LOAD	VAR. FACTOR	DESIGN LOADS			Ref./NOTES
					RANGE OF P	Y	M	
120 R=37.98	100°	RANK	5732 #	1.653	359-604 k	157.99 k	25,104 k-ft	RAC-123 -124
		TRAP	8757	1.349	448-728	140.97	22,563	
		WA-8	-	-	-	-	-	
109 R=38.48	130°	RANK	5732	1.653	359-595	201.66	43,434	RAC-125 -126
		TRAP	8757	1.349	448-720	178.40	38,769	
		WA-8	-	-	-	-	-	
109 R=38.48	100°	RANK	13,422	1.102	569-853	70.83	11,585	RAC-127 -128 -129
		TRAP	12,868	1.106	547-822	70.70	11,565	
		WA-8	25,051	1.114	1073-1559	108.18	17,232	
109 R=38.48	130°	RANK	13,422	1.102	569-848	88.82	19,754	RAC-130 -131 -132
		TRAP	12,868	1.106	547-818	88.64	19,719	
		WA-8	25,051	1.114	1073-1554	139.84	30,139	

Ref: RA-13

BY RJH DATE 4/21/06 SUBJECT _____ SHT. NO. LG-1 OF _____
 CHKD. BY GJS DATE 5/23/06 LAYOUT & GEOMETRY JOB NO. 06-602

ITEM No. 1 - OVERLAP OF CIRCULAR COFFERDAMS
DETERMINE ARC OF INTERFERENCE

Specified layout information

1) 40' radius, 25' deep

$$x = 691,447.5020'$$

$$y = 2,958,537.1875$$

2) 30' radius, 35' deep

$$x = 691,392.9312$$

$$y = 2,958,539.5333$$

The x,y differences between the centers are

$$\begin{aligned} \Delta x &= 447.5020 - 392.9312 \\ &= 54.5708 \end{aligned}$$

$$\begin{aligned} \Delta y &= 537.1875 - 539.5333 \\ &= -2.3458 \end{aligned}$$

The distance between the centers is

$$\begin{aligned} L &= [54.5708^2 + 2.3458^2]^{1/2} \\ &= 54.62' \end{aligned}$$

Ref: LG-2

Scaling the angles with a protractor

$$\alpha_1 = 43.5^\circ$$

$$\alpha_2 = 48.4^\circ$$

$$\beta_1 = 35.7^\circ$$

$$\beta_2 = 30.1^\circ$$

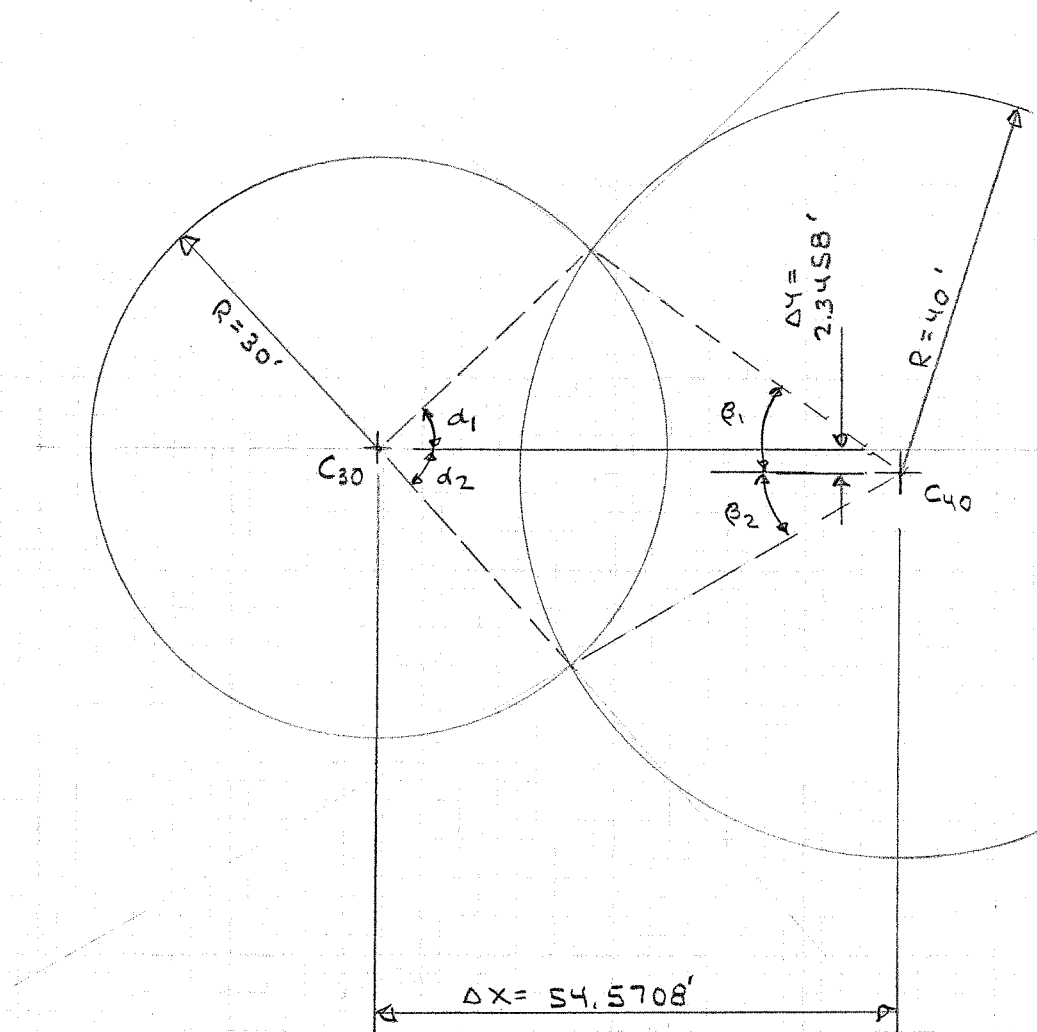
For ring designs consider the theoretical intercepted arcs to be

$$\left. \begin{aligned} \alpha_1 + \alpha_2 &= 43.5 + 48.4 = 91.9^\circ \\ \beta_1 + \beta_2 &= 35.7 + 30.1 = 65.8^\circ \end{aligned} \right\} \text{ to LG-3}$$

HARTMAN ENGINEERING

BY RJH DATE 4/22/06 SUBJECT _____ SHT.NO L9-2 OF _____

CHKD. BY GJB DATE 5/23/06 _____ JOB NO. 06-602



check reasonableness of scaled angles

In the x direction

$$30(\cos \alpha_1) + 40(\cos \beta_1) = 54.24 \text{ vs } 54.57 \text{ OK}$$

$$30(\cos \alpha_2) + 40(\cos \beta_2) = 54.52 \text{ vs } 54.57 \text{ OK}$$

In the y direction

$$30(\sin \alpha_1) - 40(\sin \beta_1) = -2.69 \text{ vs } -2.35 \text{ OK}$$

$$-30(\sin \alpha_2) + 40(\sin \beta_2) = -2.37 \text{ vs } -2.35 \text{ OK}$$

HARTMAN ENGINEERING

BY RSK DATE 4/22/06 SUBJECT _____ SHT. NO. LG-3 OF _____
 CHKD. BY GTS DATE 5/23/06 JOB NO. 06-602

For practical considerations

(1) circumference may increase by 1 pair of sheet piles, say 4.5'. Radius increase = $4.5/\pi = 1.43'$

(2) sheet pile depth $\approx 18" = 1.5'$

Calculated potential radius increase is $1.43 + 1.5 = 2.93'$

Use 4' potential radius increase

For conservatism consider radii \perp at circle intersections

To gain 4' arc distance in $R=30'$ circle

$$\Delta S = R \delta$$

$\Delta S =$ arc distance

$\delta =$ angle in radians

$$\delta_{30} = \frac{\Delta S}{R} = \frac{4}{30} = 0.133 \text{ radians} = 7.64^\circ$$

To gain 4' arc distance in $R=40'$ circle

$$\delta_{40} = \frac{\Delta S}{R} = \frac{4}{40} = 0.100 \text{ radians} = 5.73^\circ$$

For design purposes

In the $R=30'$ circle, use

$$(\alpha_1 + \alpha_2) + 2\delta_{30} = 91.9 + 2(7.64) = 107.2^\circ \rightarrow \text{Use } 110^\circ$$

Design with arcs $110^\circ, 125^\circ, 125^\circ$

In the $R=40'$ circle, use

$$(\beta_1 + \beta_2) + 2\delta_{40} = 65.8 + 2(5.73) = 77.3^\circ$$

Design with arcs ~~$80^\circ, 110^\circ, 110^\circ$~~

$100^\circ, 130^\circ, 130^\circ$

Revised to reduce loads on longer wales

HARTMAN ENGINEERING

BY RSH DATE 5/9/06 SUBJECT _____ SHT.NO. LG-4 OF _____
CHKD. BY GTB DATE 5/23/06 _____ JOB NO. 06-602

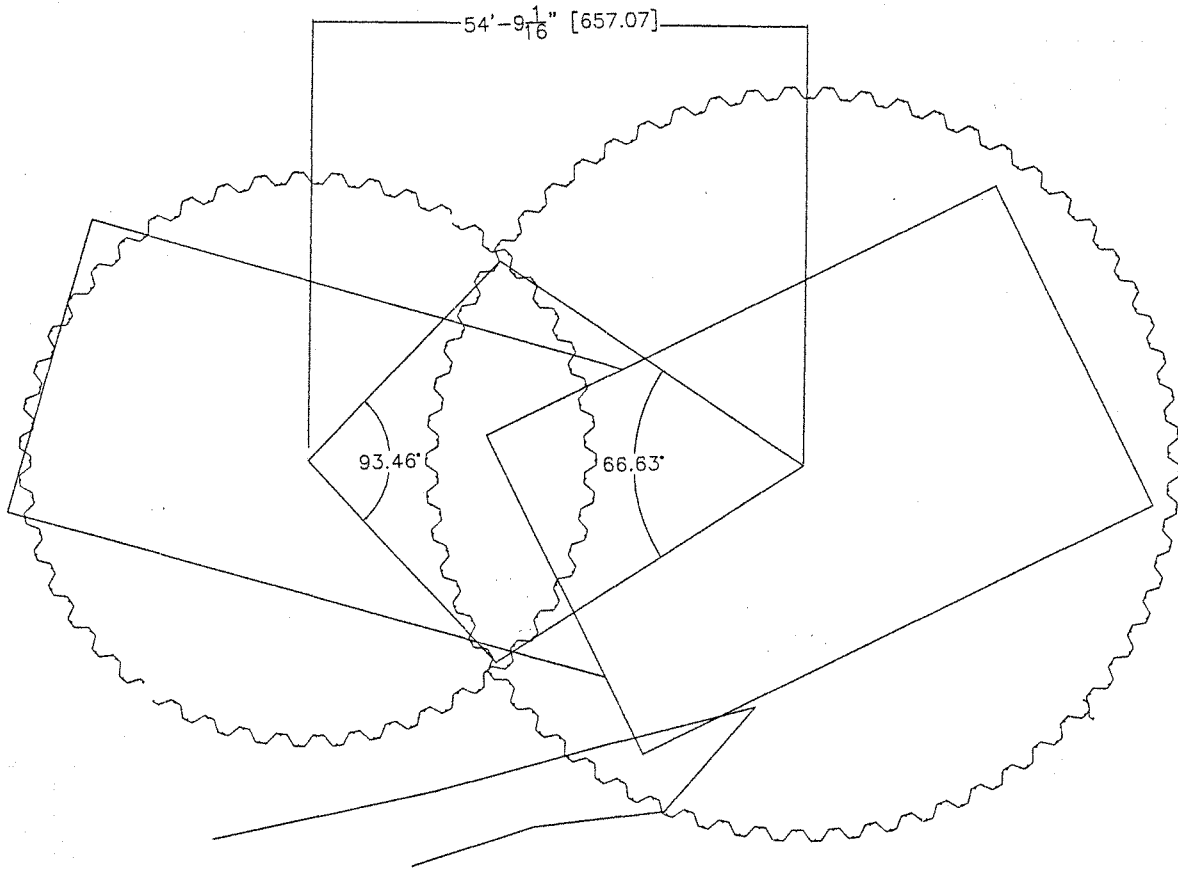
CAD Confirmation of calculated angles

The comparisons are:

$$\left. \begin{array}{l} 1) d_1 + d_2 = 43.5 + 48.4 = 91.9^\circ \text{ vs } 93.46^\circ \\ 2) \beta_1 + \beta_2 = 35.7 + 30.1 = 65.8^\circ \text{ vs } 66.63^\circ \end{array} \right\} \text{OK}$$

Design values of circular arcs are

$$\left. \begin{array}{l} 1) 110^\circ > 93.46 \\ 2) \cancel{80^\circ} > 66.6 \\ 100^\circ > 66.6 \end{array} \right\} \text{OK}$$



HARTMAN ENGINEERING

BY RJH DATE 5/3/06 SUBJECT _____ SHT. NO. LG-5 OF _____

CHKD. BY GJB DATE 5/24/06 JOB NO. 06-602

ITEM No. 2 - SHEET PILING LAYOUT

- 80' DIAMETER
- P2C18 SHEET PILING

For 80' Diameter

add sheet pile depth

$$D + \Delta D = 80 + 15.25/12 = 81.27' \text{ for } \phi \text{ between flanges}$$

$$\text{Circum} = \pi (D + \Delta D) = 255.32' = 3063.84''$$

$$\text{No. sheet piles} = 3063.84/25 = 122.55 \rightarrow \text{Use } 124 \text{ pcs}$$

For 124 Pcs P2C18

$$\phi \text{ circum} = 124(25) = 3100''$$

$$\phi \text{ diam} = 3100/\pi = 986.76''$$

$$\text{inside diam} = 986.76 - 15.25 = 971.51'' = 80' - 11\frac{1}{2}'' \pm \quad (80.959')$$

HARTMAN ENGINEERING

BY RJH DATE 5/3/06 SUBJECT _____ SHT.NO. LG-6 OF _____
 CHKD. BY GTS DATE 5/24/06 JOB NO. 06-602

ITEM No. 3 - SHEET PILING LAYOUT

- 60' DIAMETER
- PC218 SHEET PILING

For 60' diameter

add sheet pile depth

$$D + AD = 60 + 15.25/2 = 61.27' \text{ for } \epsilon \text{ between flanges}$$

$$\text{Circum} = \pi (D + AD) = 192.49' = 2309.86''$$

$$\text{No. sheet piles} = 2309.86/25 = 92.39 \rightarrow \text{Use } 94 \text{ pcs}$$

For 94 Pcs PC218

$$\epsilon \text{ circum} = 94(25) = 2350''$$

$$\epsilon \text{ diam} = 2350/\pi = 748.03''$$

$$\text{inside diameter} = 748.03 - 15.25'' = 732.78'' = 61' - 0\frac{3}{4}'' \pm \quad (61.065')$$

HARTMAN ENGINEERING

BY RJH DATE 5/21/06 SUBJECT _____ SHT. NO. DE-1 OF _____
 CHKD. BY GJB DATE 5/24/06 DETAILS JOB NO. 06-602

ITEM No. 1 - WALE HANGER ASSEMBLY
- 80' DIA COFFERDAM

Wales are

(a) 36" x 60" @ EI 120

(b) 30" x 48" @ EI 109

At EI 120

$$\text{Weight} = 150(36 \times 60) / 144 = 2250 \text{ \# / ft}$$

If use 2 rods at 45°, the tension per rod is

$$T = \frac{1}{2}(2250)(\sqrt{2}) = 1591 \text{ \# / ft of wale}$$

If use standard HE design with #8 rebar the stress is

$$f_a = 1591 \text{ \#} / 0.79 \text{ in}^2 = 2014 \text{ psi / ft of wale}$$

If $F_a = 0.6 F_y = 0.6(60) = 36 \text{ ksi}$

$$\text{max } S = 36,000 / 2014 = 17.9 \text{ ft}$$

Spacing of P2C18 sheet piling is 50" per pair

$$\text{max no. pairs} = 17.9(12) / 50 = 4.3$$

To provide for impact, etc, use spacing = 3 pairs = 150" = 12.5 ft

Tension load in rod is

$$(1591 \text{ \# / ft})(12.5 \text{ ft}) = 19,888 \text{ \#} = 19.89 \text{ k}$$

check: $f_a = 2014(19.89) = 40,058 \text{ psi} = 40.06 \text{ ksi OK}$

If use standard HE detail

Ref: DE-2

The load in the weld between rebar and PL $\frac{1}{2}$ is

$$19.89 / 16 = 1.24 \text{ k / in OK}$$

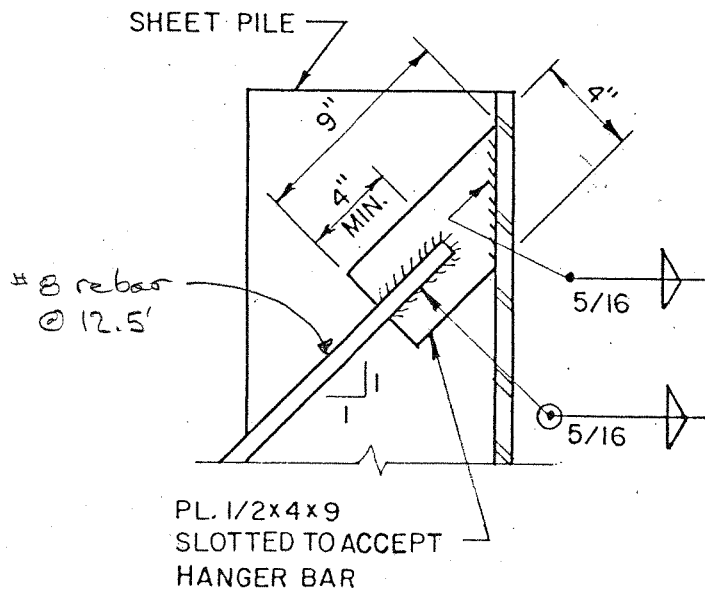
HARTMAN ENGINEERING

BY RSK DATE 5/21/06 SUBJECT _____ SHT.NO. DE-2 OF _____

CHKD. BY GJS DATE 5/24/06 _____ JOB NO. 06-602

The load on the weld between the PL $\frac{1}{2}$ and the sheet pile is

$$19.89 / 2(4)\sqrt{2} = 1.76 \text{ k/in OK}$$



Use detail at E1 120 & E1 109

Space @ 12'-6

HARTMAN ENGINEERING

BY RJK DATE 5/21/06 SUBJECT _____ SHT. NO. DE-3 OF _____

CHKD. BY GTS DATE 5/24/06 _____ JOB NO. 06-602

ITEM No. 2 - WALE HANGER ASSEMBLY
- 60' DIA COFFERDAM

All wales are 24" x 30"

$$\text{Weight} = 150(24)(30) / 144 = 750 \#/4$$

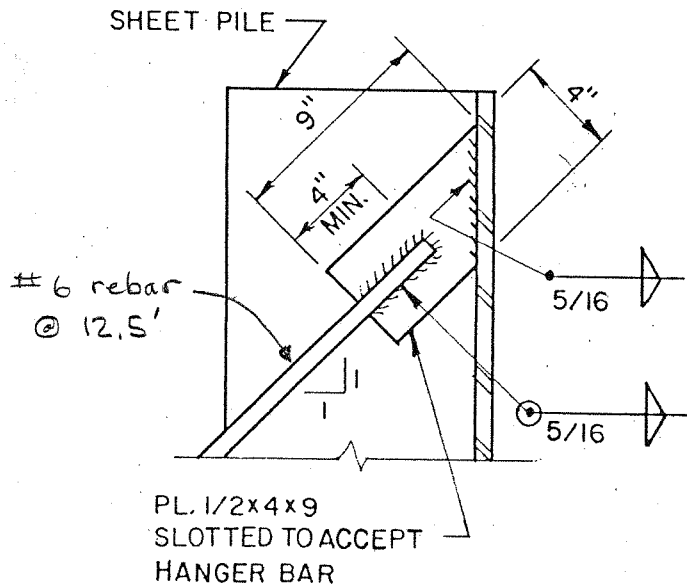
Consider that 3 pairs of sheet piles, or 12.5 ft, is max desirable spacing. The load on each bar is

$$T = \frac{1}{2} [750 (12.5) (2)] = 6629 \#$$

If use #6 bar w/ Area = 0.44 in²

$$f_a = 6629 / 0.44 = 15,066 \text{ psi} = 15.07 \text{ ksi} \quad \text{ok}$$

Use same connection detail



Use detail at EL 117, EL 107, & EL 98
 Space @ 12'-6"

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 1 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 1

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	185	0.00	0	14	0.00	0	185 to 285	0.00	0
5	185	6.52	82	14	2.59	16	185 to 285	13.54	144
10	185	12.25	312	14	4.91	99	185 to 285	25.51	606
15	185	17.13	656	14	6.80	239	185 to 284	35.56	1326
20	185	21.11	1083	14	8.19	426	185 to 284	43.49	2241
25	185	24.16	1595	14	9.17	635	185 to 285	49.42	3314
30	185	26.30	2142	15	9.54	849	185 to 286	53.04	4442
35	185	27.54	2681	16	9.63	1086	185 to 287	54.94	5600
40	185	27.94	3232	17	9.26	1306	185 to 289	54.87	6747
45	185	27.56	3743	17	9.08	1500	185 to 290	54.04	7791
50	185	26.51	4209	18	8.27	1659	185 to 291	51.18	8714
55	185	24.87	4611	19	7.51	1782	185 to 292	47.60	9486
60	185	22.77	4940	19	6.91	1886	185 to 293	43.63	10123
65	185	20.32	5166	19	6.51	1954	185 to 294	39.53	10555
70	185	17.65	5313	20	6.34	1979	185 to 294	35.50	10805
75	185	14.88	5333	20	6.39	1961	185 to 294	31.69	10801
80	185	12.12	5246	20	6.65	1901	185 to 294	28.28	10578
85	185	12.60	5041	19	7.13	1798	185 to 294	29.78	10116
90	185	16.97	4700	19	8.51	1654	185 to 293	38.24	9392
95	185	21.60	4236	18	9.20	1469	185 to 292	45.90	8430
100	185	26.35	3647	18	9.55	1246	185 to 291	53.14	7225
105	185	31.20	2923	17	10.98	985	185 to 290	62.35	5768
110	185	36.09	2069	16	12.33	689	185 to 288	71.49	4069
115	185	40.80	1097	15	13.58	359	185 to 287	80.22	2147
120	185	45.55	0	14	14.77	0	185 to 285	88.89	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 2 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 2

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	245	0.00	0	14	0.00	0	245 to 368	0.00	0
5	245	4.97	63	14	2.59	16	245 to 368	11.38	116
10	245	9.34	238	14	4.91	99	245 to 368	21.44	502
15	245	13.07	500	14	6.80	239	245 to 368	29.87	1108
20	245	16.10	826	14	8.19	426	245 to 368	36.47	1881
25	245	18.43	1217	14	9.17	635	245 to 368	41.39	2784
30	245	20.06	1633	15	9.54	849	245 to 369	44.30	3731
35	245	21.00	2044	16	9.63	1086	245 to 371	45.79	4709
40	245	21.31	2465	17	9.26	1306	245 to 372	45.59	5673
45	245	21.02	2855	17	9.08	1500	245 to 373	44.88	6547
50	245	20.22	3210	18	8.27	1659	245 to 375	42.37	7315
55	245	18.97	3517	19	7.51	1782	245 to 376	39.33	7954
60	245	17.37	3767	19	6.91	1886	245 to 376	36.07	8482
65	245	15.50	3940	19	6.51	1954	245 to 377	32.78	8839
70	245	13.46	4052	20	6.34	1979	245 to 377	29.63	9039
75	245	11.35	4067	20	6.39	1961	245 to 377	26.75	9029
80	245	9.24	4001	20	6.65	1901	245 to 377	24.26	8834
85	245	9.61	3845	19	7.13	1798	245 to 377	25.59	8441
90	245	12.94	3584	19	8.51	1654	245 to 376	32.60	7831
95	245	16.47	3231	18	9.20	1469	245 to 375	38.72	7022
100	245	20.10	2782	18	9.55	1246	245 to 374	44.38	6013
105	245	23.79	2229	17	10.98	985	245 to 373	51.98	4796
110	245	27.52	1578	16	12.33	689	245 to 371	59.50	3381
115	245	31.12	836	15	13.58	359	245 to 370	66.66	1783
120	245	34.74	0	14	14.77	0	245 to 368	73.76	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 3 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 3

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	342	0.00	0	18	0.00	0	342 to 510	0.00	0
5	342	3.16	40	18	3.27	21	342 to 510	10.00	92
10	342	5.94	151	18	6.20	125	342 to 510	18.07	425
15	342	8.31	318	18	8.59	302	342 to 510	26.25	960
20	342	10.24	525	18	10.34	537	342 to 510	31.92	1650
25	342	11.73	774	18	11.57	802	342 to 510	36.10	2448
30	342	12.76	1039	19	12.04	1071	342 to 512	38.34	3277
35	342	13.36	1301	20	12.16	1371	342 to 513	39.39	4152
40	342	13.56	1568	21	11.69	1649	342 to 515	38.07	5000
45	342	13.38	1817	22	11.46	1893	342 to 517	38.22	5762
50	342	12.86	2042	23	10.43	2094	342 to 518	35.76	6420
55	342	12.07	2238	24	9.48	2249	342 to 520	33.02	6958
60	342	11.05	2397	24	8.72	2381	342 to 521	30.30	7404
65	342	9.86	2507	25	8.22	2466	342 to 521	27.79	7703
70	342	8.57	2579	25	8.00	2498	342 to 522	25.60	7858
75	342	7.22	2588	25	8.06	2476	342 to 522	23.02	7833
80	342	5.88	2546	25	8.40	2399	342 to 522	22.52	7644
85	342	6.11	2447	25	9.00	2270	342 to 521	23.88	7284
90	342	8.23	2281	24	10.74	2087	342 to 520	29.80	6743
95	342	10.48	2056	23	11.62	1854	342 to 519	34.43	6032
100	342	12.79	1770	23	12.05	1572	342 to 518	38.40	5152
105	342	15.14	1419	22	13.86	1243	342 to 516	44.76	4100
110	342	17.51	1004	21	15.56	869	342 to 514	50.98	2884
115	342	19.80	532	19	17.14	454	342 to 512	56.87	1517
120	342	22.11	0	18	18.64	0	342 to 510	62.65	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 4 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 4

INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	395	0.00	0	18	0.00	0	395 to 585	0.00	0
5	395	3.10	39	18	3.27	21	395 to 585	9.92	91
10	395	5.84	148	18	6.20	125	395 to 585	18.72	422
15	395	8.16	312	18	8.59	302	395 to 585	26.04	952
20	395	10.06	516	18	10.34	537	395 to 585	31.66	1637
25	395	11.52	760	18	11.57	802	395 to 585	35.80	2428
30	395	12.53	1021	19	12.04	1071	395 to 587	38.02	3251
35	395	13.12	1277	20	12.16	1371	395 to 588	39.05	4120
40	395	13.31	1540	21	11.69	1649	395 to 590	38.53	4961
45	395	13.14	1784	22	11.46	1893	395 to 592	37.88	5716
50	395	12.63	2006	23	10.43	2094	395 to 593	35.43	6369
55	395	11.85	2198	24	9.48	2249	395 to 595	32.72	6902
60	395	10.85	2354	24	8.72	2381	395 to 596	30.02	7344
65	395	9.69	2462	25	8.22	2466	395 to 596	27.54	7641
70	395	8.41	2532	25	8.00	2498	395 to 597	25.38	7792
75	395	7.09	2542	25	8.06	2476	395 to 597	23.64	7768
80	395	5.77	2500	25	8.40	2399	395 to 597	22.37	7580
85	395	6.01	2403	25	9.00	2270	395 to 596	23.73	7223
90	395	8.09	2240	24	10.74	2087	395 to 595	29.59	6686
95	395	10.29	2019	23	11.62	1854	395 to 594	34.17	5980
100	395	12.56	1738	23	12.05	1572	395 to 593	38.08	5107
105	395	14.87	1393	22	13.86	1243	395 to 591	44.38	4064
110	395	17.20	986	21	15.56	869	395 to 589	50.54	2859
115	395	19.45	522	19	17.14	454	395 to 587	56.37	1504
120	395	21.71	0	18	18.64	0	395 to 585	62.10	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 5 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 5

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	550	0.00	0	5	0.00	0	550 to 780	0.00	0
5	550	3.29	41	5	0.97	6	550 to 780	6.26	69
10	550	6.18	157	5	1.83	37	550 to 780	11.78	283
15	550	8.65	331	5	2.54	89	550 to 780	16.43	616
20	550	10.66	547	5	3.06	159	550 to 780	20.12	1036
25	550	12.20	805	5	3.42	237	550 to 780	22.90	1531
30	550	13.28	1081	5	3.56	317	550 to 780	24.65	2053
35	550	13.90	1353	6	3.59	405	550 to 781	25.58	2585
40	550	14.10	1632	6	3.46	488	550 to 781	25.63	3114
45	550	13.92	1890	6	3.39	560	550 to 782	25.25	3599
50	550	13.38	2125	6	3.08	619	550 to 782	23.99	4029
55	550	12.56	2328	7	2.80	665	550 to 783	22.35	4391
60	550	11.50	2494	7	2.58	704	550 to 783	20.49	4690
65	550	10.26	2608	7	2.43	730	550 to 783	18.50	4893
70	550	8.91	2683	7	2.36	739	550 to 783	16.50	5013
75	550	7.51	2692	7	2.38	732	550 to 783	14.57	5015
80	550	6.11	2649	7	2.48	710	550 to 783	12.79	4916
85	550	6.36	2545	7	2.66	671	550 to 783	13.44	4706
90	550	8.57	2373	7	3.18	617	550 to 783	17.40	4373
95	550	10.90	2139	7	3.43	548	550 to 782	21.11	3928
100	550	13.30	1841	6	3.56	465	550 to 782	24.69	3369
105	550	15.75	1476	6	4.10	367	550 to 782	29.03	2692
110	550	18.22	1045	6	4.60	257	550 to 781	33.34	1900
115	550	20.60	554	5	5.07	134	550 to 780	37.47	1004
120	550	23.00	0	5	5.51	0	550 to 780	41.58	0

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 6 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 6INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 24.25 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	531	0.00	0	5	0.00	0	531 to 752	0.00	0
5	531	3.32	42	5	0.97	6	531 to 752	6.30	69
10	531	6.25	159	5	1.83	37	531 to 752	11.87	286
15	531	8.74	334	5	2.54	89	531 to 752	16.56	621
20	531	10.77	552	5	3.06	159	531 to 752	20.28	1044
25	531	12.32	814	5	3.42	237	531 to 752	23.08	1543
30	531	13.41	1092	5	3.56	317	531 to 753	24.84	2068
35	531	14.04	1367	6	3.59	405	531 to 753	25.78	2604
40	531	14.25	1648	6	3.46	488	531 to 754	25.83	3138
45	531	14.06	1909	6	3.39	560	531 to 754	25.45	3626
50	531	13.52	2147	6	3.08	619	531 to 755	24.18	4059
55	531	12.69	2352	7	2.80	665	531 to 755	22.53	4425
60	531	11.61	2519	7	2.58	704	531 to 756	20.65	4725
65	531	10.37	2635	7	2.43	730	531 to 756	18.65	4930
70	531	9.00	2710	7	2.36	739	531 to 756	16.63	5051
75	531	7.59	2720	7	2.38	732	531 to 756	14.68	5054
80	531	6.18	2676	7	2.48	710	531 to 756	12.88	4954
85	531	6.43	2571	7	2.66	671	531 to 756	13.53	4742
90	531	8.65	2397	7	3.18	617	531 to 755	17.52	4407
95	531	11.02	2161	7	3.43	548	531 to 755	21.27	3958
100	531	13.44	1860	6	3.56	465	531 to 755	24.88	3396
105	531	15.91	1491	6	4.10	367	531 to 754	29.25	2713
110	531	18.41	1055	6	4.60	257	531 to 754	33.60	1915
115	531	20.81	559	5	5.07	134	531 to 753	37.76	1011
120	531	23.23	0	5	5.51	0	531 to 752	41.91	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 7 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 7

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	223	0.00	0	16	0.00	0	223 to 339	0.00	0
5	223	7.82	119	15	2.56	30	223 to 339	15.32	219
10	223	14.71	449	15	6.28	153	223 to 339	31.28	889
15	223	20.56	945	15	7.97	363	223 to 339	42.35	1942
20	223	25.33	1560	15	10.26	633	223 to 339	52.92	3261
25	223	29.00	2298	16	10.84	930	223 to 340	59.03	4799
30	223	31.56	3084	17	11.62	1232	223 to 341	63.95	6414
35	223	33.05	3860	18	11.21	1561	223 to 343	65.34	8059
40	223	33.52	4654	18	10.96	1860	223 to 344	65.59	9679
45	223	33.08	5391	19	9.95	2118	223 to 346	63.23	11149
50	223	31.81	6061	20	9.26	2329	223 to 347	60.29	12445
55	223	29.85	6640	21	8.37	2490	223 to 348	56.03	13530
60	223	27.33	7113	21	7.85	2608	223 to 349	51.62	14394
65	223	24.39	7439	22	7.66	2694	223 to 350	47.19	14994
70	223	21.18	7652	22	7.34	2721	223 to 350	42.14	15340
75	223	17.85	7679	22	7.64	2691	223 to 350	37.99	15327
80	223	14.54	7555	22	7.79	2604	223 to 350	33.61	15005
85	223	15.13	7260	21	8.75	2459	223 to 349	36.06	14346
90	223	20.37	6768	21	9.27	2259	223 to 348	44.27	13317
95	223	25.92	6100	20	10.67	2005	223 to 347	54.44	11950
100	223	31.63	5252	20	11.26	1698	223 to 346	63.42	10241
105	223	37.44	4210	19	12.50	1341	223 to 345	73.67	8174
110	223	43.31	2980	18	14.00	937	223 to 343	84.44	5766
115	223	48.96	1579	17	15.40	489	223 to 341	94.73	3043
120	223	54.66	0	16	16.67	0	223 to 339	104.88	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 8 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 8

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	294	0.00	0	16	0.00	0	294 to 439	0.00	0
5	294	5.96	91	15	2.56	30	294 to 439	12.72	179
10	294	11.21	342	15	6.28	153	294 to 439	26.39	740
15	294	15.68	721	15	7.97	363	294 to 438	35.51	1628
20	294	19.32	1189	15	10.26	633	294 to 438	44.50	2743
25	294	22.12	1752	16	10.84	930	294 to 439	49.39	4035
30	294	24.07	2352	17	11.62	1232	294 to 441	53.46	5389
35	294	25.20	2944	18	11.21	1561	294 to 442	54.36	6776
40	294	25.57	3550	18	10.96	1860	294 to 444	54.45	8133
45	294	25.23	4111	19	9.95	2118	294 to 446	52.24	9358
50	294	24.26	4622	20	9.26	2329	294 to 447	49.72	10432
55	294	22.77	5064	21	8.37	2490	294 to 448	46.11	11324
60	294	20.84	5425	21	7.85	2608	294 to 449	42.54	12030
65	294	18.60	5673	22	7.66	2694	294 to 449	39.08	12523
70	294	16.16	5836	22	7.34	2721	294 to 450	35.10	12798
75	294	13.62	5857	22	7.64	2691	294 to 450	32.05	12776
80	294	11.09	5762	22	7.79	2604	294 to 449	28.77	12495
85	294	11.54	5537	21	8.75	2459	294 to 449	31.04	11934
90	294	15.53	5162	21	9.27	2259	294 to 448	37.51	11068
95	294	19.77	4653	20	10.67	2005	294 to 447	45.83	9923
100	294	24.12	4006	20	11.26	1698	294 to 446	52.92	8496
105	294	28.55	3211	19	12.50	1341	294 to 444	61.23	6776
110	294	33.03	2273	18	14.00	937	294 to 443	70.05	4776
115	294	37.34	1205	17	15.40	489	294 to 441	78.46	2518
120	294	41.69	0	16	16.67	0	294 to 439	86.72	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 9 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 9

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	410	0.00	0	20	0.00	0	410 to 609	0.00	0
5	410	3.79	57	20	3.24	38	410 to 609	10.82	147
10	410	7.13	218	19	7.93	193	410 to 608	23.48	634
15	410	9.98	458	19	10.06	459	410 to 608	31.08	1423
20	410	12.29	757	19	12.95	799	410 to 608	39.24	2419
25	410	14.07	1115	20	13.68	1174	410 to 609	42.96	3557
30	410	15.31	1497	21	14.67	1555	410 to 611	46.39	4741
35	410	16.04	1873	22	14.15	1970	410 to 613	46.52	5973
40	410	16.27	2259	23	13.84	2348	410 to 615	46.31	7155
45	410	16.05	2616	25	12.55	2674	410 to 617	43.82	8209
50	410	15.44	2941	26	11.69	2939	410 to 619	41.49	9116
55	410	14.49	3223	26	10.57	3142	410 to 620	38.25	9854
60	410	13.26	3452	27	9.91	3292	410 to 621	35.43	10430
65	410	11.84	3610	28	9.67	3400	410 to 622	33.03	10835
70	410	10.28	3714	28	9.26	3435	410 to 622	30.14	11039
75	410	8.66	3727	28	9.64	3397	410 to 622	28.52	10993
80	410	7.05	3667	28	9.83	3286	410 to 622	26.60	10721
85	410	7.34	3523	27	11.05	3104	410 to 621	29.06	10210
90	410	9.88	3285	26	11.69	2851	410 to 620	33.73	9447
95	410	12.58	2961	26	13.47	2530	410 to 619	40.52	8447
100	410	15.35	2549	25	14.21	2143	410 to 618	45.65	7213
105	410	18.17	2043	24	15.77	1693	410 to 616	52.26	5739
110	410	21.02	1446	22	17.67	1183	410 to 614	59.47	4036
115	410	23.76	766	21	19.43	617	410 to 611	66.31	2122
120	410	26.53	0	20	21.04	0	410 to 609	72.93	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 10 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 10INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	474	0.00	0	20	0.00	0	474 to 699	0.00	0
5	474	3.73	56	20	3.24	38	474 to 699	10.73	145
10	474	7.01	214	19	7.93	193	474 to 698	23.30	628
15	474	9.80	450	19	10.06	459	474 to 698	30.83	1411
20	474	12.07	743	19	12.95	799	474 to 698	38.93	2400
25	474	13.82	1095	20	13.68	1174	474 to 699	42.61	3529
30	474	15.04	1470	21	14.67	1555	474 to 701	46.01	4703
35	474	15.75	1840	22	14.15	1970	474 to 703	46.12	5926
40	474	15.98	2218	23	13.84	2348	474 to 705	45.90	7098
45	474	15.76	2569	25	12.55	2674	474 to 707	43.42	8143
50	474	15.16	2889	26	11.69	2939	474 to 709	41.10	9042
55	474	14.23	3165	26	10.57	3142	474 to 710	37.89	9773
60	474	13.02	3390	27	9.91	3292	474 to 711	35.10	10344
65	474	11.62	3545	28	9.67	3400	474 to 712	32.73	10744
70	474	10.09	3647	28	9.26	3435	474 to 712	29.89	10946
75	474	8.51	3660	28	9.64	3397	474 to 712	28.31	10900
80	474	6.93	3601	28	9.83	3286	474 to 712	26.42	10629
85	474	7.21	3460	27	11.05	3104	474 to 711	28.88	10122
90	474	9.70	3226	26	11.69	2851	474 to 710	33.48	9364
95	474	12.35	2907	26	13.47	2530	474 to 709	40.20	8373
100	474	15.07	2503	25	14.21	2143	474 to 708	45.27	7149
105	474	17.84	2006	24	15.77	1693	474 to 706	51.80	5687
110	474	20.64	1420	22	17.67	1183	474 to 704	58.94	4000
115	474	23.34	753	21	19.43	617	474 to 701	65.71	2103
120	474	26.05	0	20	21.04	0	474 to 699	72.26	0

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 11 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 11

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	660	0.00	0	5	0.00	0	660 to 935	0.00	0
5	660	3.95	60	5	0.95	11	660 to 935	7.16	103
10	660	7.42	226	5	2.34	57	660 to 935	14.39	415
15	660	10.38	477	5	2.97	135	660 to 935	19.60	899
20	660	12.79	787	5	3.83	236	660 to 935	24.42	1505
25	660	14.64	1160	6	4.04	347	660 to 935	27.38	2215
30	660	15.93	1557	6	4.34	460	660 to 935	29.69	2963
35	660	16.68	1949	6	4.19	583	660 to 936	30.48	3720
40	660	16.93	2350	7	4.09	694	660 to 937	30.66	4471
45	660	16.70	2722	7	3.71	791	660 to 937	29.70	5156
50	660	16.06	3060	7	3.46	870	660 to 938	28.37	5763
55	660	15.07	3353	7	3.12	930	660 to 938	26.42	6275
60	660	13.80	3591	8	2.93	974	660 to 938	24.31	6685
65	660	12.31	3756	8	2.86	1006	660 to 939	22.11	6969
70	660	10.69	3863	8	2.74	1016	660 to 939	19.64	7137
75	660	9.01	3877	8	2.85	1005	660 to 939	17.47	7137
80	660	7.34	3815	8	2.91	972	660 to 939	15.23	6994
85	660	7.64	3665	8	3.27	918	660 to 938	16.25	6694
90	660	10.28	3417	7	3.46	843	660 to 938	20.28	6219
95	660	13.09	3080	7	3.98	748	660 to 938	25.10	5585
100	660	15.97	2652	7	4.20	634	660 to 937	29.51	4791
105	660	18.90	2125	7	4.66	501	660 to 937	34.40	3828
110	660	21.87	1505	6	5.23	350	660 to 936	39.51	2702
115	660	24.72	797	6	5.75	182	660 to 935	44.39	1427
120	660	27.60	0	5	6.22	0	660 to 935	49.23	0

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 12 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 12

INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 29.1 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	637	0.00	0	5	0.00	0	637 to 902	0.00	0
5	637	3.99	60	5	0.95	11	637 to 902	7.21	104
10	637	7.50	229	5	2.34	57	637 to 902	14.49	418
15	637	10.49	482	5	2.97	135	637 to 902	19.75	906
20	637	12.92	795	5	3.83	236	637 to 902	24.61	1516
25	637	14.79	1172	6	4.04	347	637 to 902	27.59	2231
30	637	16.09	1573	6	4.34	460	637 to 903	29.92	2985
35	637	16.85	1969	6	4.19	583	637 to 903	30.72	3748
40	637	17.10	2374	7	4.09	694	637 to 904	30.90	4505
45	637	16.87	2750	7	3.71	791	637 to 904	29.94	5195
50	637	16.22	3091	7	3.46	870	637 to 905	28.60	5807
55	637	15.22	3387	7	3.12	930	637 to 905	26.63	6323
60	637	13.94	3628	8	2.93	974	637 to 906	24.50	6736
65	637	12.44	3794	8	2.86	1006	637 to 906	22.29	7023
70	637	10.80	3903	8	2.74	1016	637 to 906	19.79	7192
75	637	9.10	3917	8	2.85	1005	637 to 906	17.60	7193
80	637	7.41	3854	8	2.91	972	637 to 906	15.33	7049
85	637	7.71	3703	8	3.27	918	637 to 906	16.36	6746
90	637	10.39	3452	7	3.46	843	637 to 905	20.43	6268
95	637	13.22	3112	7	3.98	748	637 to 905	25.29	5629
100	637	16.13	2679	7	4.20	634	637 to 904	29.73	4829
105	637	19.09	2147	7	4.66	501	637 to 904	34.67	3858
110	637	22.09	1520	6	5.23	350	637 to 903	39.82	2723
115	637	24.97	805	6	5.75	182	637 to 903	44.74	1438
120	637	27.88	0	5	6.22	0	637 to 902	49.62	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 13 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 13

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 33.95 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	260	0.00	0	17	0.00	0	260 to 393	0.00	0
5	260	9.13	162	17	2.54	44	260 to 393	17.10	303
10	260	17.16	611	16	6.17	218	260 to 393	34.53	1227
15	260	23.99	1286	16	9.12	511	260 to 392	49.10	2671
20	260	29.56	2123	16	11.15	878	260 to 393	60.35	4467
25	260	33.83	3127	17	12.38	1271	260 to 394	68.41	6541
30	260	36.82	4198	18	12.80	1670	260 to 396	73.32	8718
35	260	38.55	5254	19	12.56	2098	260 to 397	75.35	10923
40	260	39.11	6335	20	12.00	2481	260 to 399	75.16	13089
45	260	38.59	7338	21	11.08	2809	260 to 401	72.87	15049
50	260	37.12	8249	22	10.11	3074	260 to 402	69.16	16776
55	260	34.83	9038	23	9.28	3274	260 to 403	64.54	18221
60	260	31.88	9682	23	8.69	3409	260 to 404	59.42	19351
65	260	28.46	10125	24	8.28	3496	260 to 405	53.93	20119
70	260	24.72	10415	24	8.17	3525	260 to 405	48.50	20575
75	260	20.83	10452	24	8.34	3482	260 to 405	43.35	20553
80	260	16.96	10283	24	8.87	3364	260 to 405	38.84	20117
85	260	17.65	9881	23	9.64	3174	260 to 404	41.11	19231
90	260	23.76	9212	23	10.62	2913	260 to 403	51.33	17850
95	260	30.24	8304	22	11.79	2583	260 to 402	62.39	16017
100	260	36.90	7149	21	12.51	2186	260 to 401	72.93	13726
105	260	43.68	5730	20	13.81	1725	260 to 399	84.64	10956
110	260	50.53	4057	19	15.45	1205	260 to 397	97.01	7728
115	260	57.13	2150	18	16.97	628	260 to 395	108.83	4079
120	260	63.77	0	17	18.36	0	260 to 393	120.50	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 14 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 14

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 33.95 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	343	0.00	0	17	0.00	0	343 to 509	0.00	0
5	343	6.96	123	17	2.54	44	343 to 509	14.06	249
10	343	13.08	466	16	6.17	218	343 to 509	28.83	1024
15	343	18.30	981	16	9.12	511	343 to 509	41.13	2244
20	343	22.54	1619	16	11.15	878	343 to 509	50.53	3761
25	343	25.80	2385	17	12.38	1271	343 to 510	57.17	5501
30	343	28.08	3202	18	12.80	1670	343 to 512	61.08	7323
35	343	29.40	4007	19	12.56	2098	343 to 514	62.54	9177
40	343	29.83	4832	20	12.00	2481	343 to 516	62.17	10984
45	343	29.43	5596	21	11.08	2809	343 to 517	60.05	12611
50	343	28.31	6292	22	10.11	3074	343 to 519	56.83	14035
55	343	26.56	6893	23	9.28	3274	343 to 520	52.97	15218
60	343	24.32	7384	23	8.69	3409	343 to 521	48.83	16134
65	343	21.70	7722	24	8.28	3496	343 to 521	44.48	16755
70	343	18.85	7943	24	8.17	3525	343 to 522	40.28	17115
75	343	15.89	7972	24	8.34	3482	343 to 522	36.43	17080
80	343	12.94	7843	24	8.87	3364	343 to 521	33.21	16700
85	343	13.46	7536	23	9.64	3174	343 to 521	35.24	15948
90	343	18.12	7026	23	10.62	2913	343 to 520	43.44	14789
95	343	23.06	6333	22	11.79	2583	343 to 518	52.34	13258
100	343	28.14	5453	21	12.51	2186	343 to 517	60.67	11351
105	343	33.31	4370	20	13.81	1725	343 to 515	70.13	9052
110	343	38.54	3094	19	15.45	1205	343 to 514	80.22	6380
115	343	43.57	1640	18	16.97	628	343 to 512	89.85	3364
120	343	48.64	0	17	18.36	0	343 to 509	99.31	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 15 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 15

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 33.95 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	479	0.00	0	21	0.00	0	479 to 707	0.00	0
5	479	4.43	78	21	3.20	56	479 to 707	11.65	206
10	479	8.32	296	21	7.79	275	479 to 706	24.91	883
15	479	11.64	624	21	11.51	645	479 to 706	35.88	1972
20	479	14.34	1030	21	14.08	1109	479 to 706	44.02	3328
25	479	16.42	1518	22	15.62	1604	479 to 708	49.55	4853
30	479	17.87	2037	23	16.16	2108	479 to 710	52.49	6437
35	479	18.71	2550	24	15.86	2647	479 to 712	53.16	8072
40	479	18.98	3075	26	15.14	3132	479 to 715	52.33	9629
45	479	18.73	3561	27	13.98	3545	479 to 717	50.00	11013
50	479	18.01	4004	28	12.76	3880	479 to 719	46.92	12201
55	479	16.90	4387	29	11.71	4133	479 to 720	43.58	13168
60	479	15.47	4699	29	10.97	4302	479 to 721	40.32	13893
65	479	13.81	4914	30	10.46	4412	479 to 722	37.12	14381
70	479	11.99	5055	30	10.31	4449	479 to 722	34.32	14642
75	479	10.11	5073	30	10.53	4394	479 to 722	32.06	14573
80	479	8.23	4991	30	11.20	4246	479 to 722	30.57	14206
85	479	8.56	4796	29	12.17	4006	479 to 721	32.69	13525
90	479	11.53	4471	29	13.41	3676	479 to 720	38.94	12510
95	479	14.68	4030	28	14.88	3260	479 to 718	45.85	11184
100	479	17.91	3470	27	15.79	2759	479 to 717	51.92	9549
105	479	21.20	2781	26	17.43	2178	479 to 715	59.32	7596
110	479	24.52	1969	24	19.50	1521	479 to 712	67.48	5342
115	479	27.72	1043	23	21.41	793	479 to 710	75.23	2809
120	479	30.95	0	21	23.17	0	479 to 707	82.73	0

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 16 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 16INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 33.95 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	554	0.00	0	21	0.00	0	554 to 812	0.00	0
5	554	4.35	77	21	3.20	56	554 to 812	11.54	204
10	554	8.18	291	21	7.79	275	554 to 811	24.71	876
15	554	11.43	613	21	11.51	645	554 to 811	35.59	1956
20	554	14.09	1012	21	14.08	1109	554 to 811	43.66	3302
25	554	16.12	1490	22	15.62	1604	554 to 813	49.14	4815
30	554	17.55	2001	23	16.16	2108	554 to 815	52.04	6386
35	554	18.37	2504	24	15.86	2647	554 to 817	52.69	8007
40	554	18.64	3019	26	15.14	3132	554 to 820	51.85	9552
45	554	18.39	3497	27	13.98	3545	554 to 822	49.53	10924
50	554	17.69	3932	28	12.76	3880	554 to 824	46.47	12101
55	554	16.60	4308	29	11.71	4133	554 to 825	43.15	13058
60	554	15.20	4615	29	10.97	4302	554 to 826	39.93	13775
65	554	13.56	4826	30	10.46	4412	554 to 827	36.77	14257
70	554	11.78	4964	30	10.31	4449	554 to 827	34.02	14515
75	554	9.93	4982	30	10.53	4394	554 to 827	31.80	14445
80	554	8.08	4901	30	11.20	4246	554 to 827	30.37	14081
85	554	8.41	4710	29	12.17	4006	554 to 826	32.47	13405
90	554	11.32	4391	29	13.41	3676	554 to 825	38.65	12398
95	554	14.41	3958	28	14.88	3260	554 to 823	45.48	11083
100	554	17.58	3408	27	15.79	2759	554 to 822	51.47	9461
105	554	20.82	2731	26	17.43	2178	554 to 820	58.79	7526
110	554	24.08	1933	24	19.50	1521	554 to 817	66.87	5293
115	554	27.23	1025	23	21.41	793	554 to 815	74.53	2783
120	554	30.40	0	21	23.17	0	554 to 812	81.95	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 17 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 17

INPUT DATA

Applied Load = 21064 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
Radius CL = 33.95 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	770	0.00	0	6	0.00	0	770 to 1090	0.00	0
5	770	4.61	81	6	0.94	16	770 to 1090	8.06	143
10	770	8.66	308	6	2.30	81	770 to 1089	16.05	570
15	770	12.11	649	6	3.40	191	770 to 1089	22.75	1234
20	770	14.92	1072	6	4.16	328	770 to 1089	27.98	2059
25	770	17.08	1579	6	4.62	474	770 to 1090	31.78	3018
30	770	18.59	2120	6	4.78	624	770 to 1091	34.16	4029
35	770	19.47	2653	7	4.69	783	770 to 1091	35.23	5046
40	770	19.75	3199	7	4.48	926	770 to 1092	35.27	6054
45	770	19.48	3705	8	4.13	1049	770 to 1093	34.32	6971
50	770	18.74	4165	8	3.77	1148	770 to 1093	32.66	7783
55	770	17.58	4564	8	3.46	1223	770 to 1093	30.51	8469
60	770	16.10	4889	8	3.24	1273	770 to 1094	28.06	9009
65	770	14.37	5112	8	3.09	1305	770 to 1094	25.38	9377
70	770	12.48	5259	9	3.05	1316	770 to 1094	22.66	9601
75	770	10.52	5277	9	3.11	1300	770 to 1094	20.02	9600
80	770	8.56	5192	8	3.31	1256	770 to 1094	17.63	9406
85	770	8.91	4989	8	3.60	1185	770 to 1094	18.60	9001
90	770	12.00	4651	8	3.96	1088	770 to 1093	23.54	8362
95	770	15.27	4193	8	4.40	964	770 to 1093	28.86	7510
100	770	18.63	3610	8	4.67	816	770 to 1092	34.03	6442
105	770	22.05	2893	7	5.15	644	770 to 1092	39.65	5146
110	770	25.51	2048	7	5.77	450	770 to 1091	45.53	3633
115	770	28.84	1085	6	6.33	234	770 to 1090	51.16	1919
120	770	32.20	0	6	6.85	0	770 to 1090	56.74	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 18 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 18

INPUT DATA

Applied Load = 20241 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
Radius CL = 33.95 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	743	0.00	0	6	0.00	0	743 to 1051	0.00	0
5	743	4.65	82	6	0.94	16	743 to 1051	8.13	144
10	743	8.75	312	6	2.30	81	743 to 1051	16.17	575
15	743	12.23	656	6	3.40	191	743 to 1051	22.92	1243
20	743	15.07	1083	6	4.16	328	743 to 1051	28.19	2074
25	743	17.25	1595	6	4.62	474	743 to 1052	32.02	3041
30	743	18.78	2141	6	4.78	624	743 to 1052	34.42	4059
35	743	19.66	2680	7	4.69	783	743 to 1053	35.51	5084
40	743	19.95	3231	7	4.48	926	743 to 1054	35.55	6100
45	743	19.68	3743	8	4.13	1049	743 to 1054	34.60	7024
50	743	18.93	4208	8	3.77	1148	743 to 1055	32.93	7843
55	743	17.76	4610	8	3.46	1223	743 to 1055	30.76	8534
60	743	16.26	4938	8	3.24	1273	743 to 1056	28.29	9079
65	743	14.51	5164	8	3.09	1305	743 to 1056	25.58	9450
70	743	12.60	5312	9	3.05	1316	743 to 1056	22.84	9676
75	743	10.62	5331	9	3.11	1300	743 to 1056	20.17	9675
80	743	8.65	5245	8	3.31	1256	743 to 1056	17.75	9480
85	743	9.00	5040	8	3.60	1185	743 to 1055	18.73	9072
90	743	12.12	4699	8	3.96	1088	743 to 1055	23.71	8428
95	743	15.42	4235	8	4.40	964	743 to 1055	29.08	7570
100	743	18.82	3647	8	4.67	816	743 to 1054	34.29	6494
105	743	22.28	2923	7	5.15	644	743 to 1054	39.96	5188
110	743	25.77	2069	7	5.77	450	743 to 1053	45.89	3662
115	743	29.14	1096	6	6.33	234	743 to 1052	51.57	1934
120	743	32.53	0	6	6.85	0	743 to 1051	57.20	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 19 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 19

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 38.8 feet
 Distance to Surcharge = 0 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	297	0.00	0	0	0.00	0	297 to 416	0.00	0
5	297	10.43	212	0	0.00	0	297 to 416	14.61	296
10	297	19.61	798	0	0.00	0	297 to 416	27.45	1118
15	297	27.42	1680	0	0.00	0	297 to 416	38.39	2353
20	297	33.78	2773	0	0.00	0	297 to 416	47.29	3883
25	297	38.67	4085	0	0.00	0	297 to 416	54.13	5719
30	297	42.08	5484	0	0.00	0	297 to 416	58.91	7677
35	297	44.06	6863	0	0.00	0	297 to 416	61.69	9608
40	297	44.70	8275	0	0.00	0	297 to 416	62.58	11585
45	297	44.11	9584	0	0.00	0	297 to 416	61.75	13418
50	297	42.42	10775	0	0.00	0	297 to 416	59.39	15085
55	297	39.80	11805	0	0.00	0	297 to 416	55.73	16528
60	297	36.44	12646	0	0.00	0	297 to 416	51.02	17705
65	297	32.52	13225	0	0.00	0	297 to 416	45.53	18515
70	297	28.25	13603	0	0.00	0	297 to 416	39.55	19045
75	297	23.81	13652	0	0.00	0	297 to 416	33.33	19113
80	297	19.39	13432	0	0.00	0	297 to 416	27.14	18804
85	297	20.17	12906	0	0.00	0	297 to 416	28.24	18069
90	297	27.16	12032	0	0.00	0	297 to 416	38.02	16845
95	297	34.56	10846	0	0.00	0	297 to 416	48.39	15184
100	297	42.17	9338	0	0.00	0	297 to 416	59.04	13074
105	297	49.92	7484	0	0.00	0	297 to 416	69.89	10478
110	297	57.75	5299	0	0.00	0	297 to 416	80.85	7418
115	297	65.29	2808	0	0.00	0	297 to 416	91.40	3932
120	297	72.89	0	0	0.00	0	297 to 416	102.04	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 20 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 20

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 38.8 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	392	0.00	0	17	0.00	0	392 to 580	0.00	0
5	392	7.95	161	17	3.98	65	392 to 580	17.92	338
10	392	14.95	609	17	7.55	295	392 to 579	33.79	1355
15	392	20.91	1282	17	11.21	683	392 to 579	48.35	2957
20	392	25.76	2115	17	13.03	1158	392 to 579	58.22	4930
25	392	29.49	3115	18	13.78	1655	392 to 581	64.73	7176
30	392	32.09	4182	19	14.43	2154	392 to 583	69.46	9519
35	392	33.61	5234	21	13.71	2686	392 to 585	70.37	11896
40	392	34.09	6311	22	13.13	3159	392 to 587	70.07	14207
45	392	33.64	7310	23	12.00	3559	392 to 589	67.50	16285
50	392	32.35	8218	24	10.84	3882	392 to 590	63.74	18105
55	392	30.36	9004	24	10.09	4124	392 to 591	59.67	19618
60	392	27.79	9645	25	9.40	4285	392 to 592	54.90	20788
65	392	24.80	10086	25	9.12	4362	392 to 593	50.24	21538
70	392	21.54	10375	25	8.93	4377	392 to 593	45.36	21966
75	392	18.16	10412	25	9.00	4317	392 to 593	40.73	21918
80	392	14.79	10244	25	9.85	4168	392 to 593	37.46	21428
85	392	15.38	9844	25	10.44	3930	392 to 592	39.30	20462
90	392	20.71	9177	24	11.24	3604	392 to 591	48.11	18975
95	392	26.36	8272	23	12.77	3193	392 to 590	58.62	17010
100	392	32.16	7122	22	13.92	2701	392 to 588	68.71	14564
105	392	38.07	5708	21	14.95	2131	392 to 586	78.73	11615
110	392	44.04	4041	20	16.70	1487	392 to 584	90.06	8187
115	392	49.79	2142	19	18.33	775	392 to 582	100.88	4317
120	392	55.59	0	17	19.81	0	392 to 580	111.52	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 21 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 21

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 38.8 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	547	0.00	0	22	0.00	0	547 to 805	0.00	0
5	547	5.06	102	22	5.03	83	547 to 805	15.65	285
10	547	9.51	387	22	9.53	373	547 to 804	29.54	1177
15	547	13.30	815	22	14.15	863	547 to 804	42.70	2609
20	547	16.39	1346	22	16.44	1461	547 to 804	50.91	4369
25	547	18.76	1982	23	17.40	2088	547 to 806	55.85	6327
30	547	20.42	2661	25	18.21	2719	547 to 809	59.55	8349
35	547	21.38	3331	26	17.31	3391	547 to 812	59.37	10428
40	547	21.69	4016	28	16.58	3987	547 to 814	58.56	12401
45	547	21.40	4651	29	15.14	4492	547 to 816	55.72	14150
50	547	20.59	5229	30	13.69	4899	547 to 818	52.10	15651
55	547	19.32	5730	31	12.74	5205	547 to 819	48.71	16872
60	547	17.68	6138	31	11.87	5408	547 to 820	44.94	17787
65	547	15.78	6418	32	11.51	5505	547 to 821	41.68	18346
70	547	13.71	6602	32	11.27	5524	547 to 822	38.37	18634
75	547	11.55	6626	32	11.36	5449	547 to 822	35.50	18540
80	547	9.41	6519	32	12.44	5260	547 to 821	34.32	18070
85	547	9.79	6264	31	13.18	4959	547 to 820	36.12	17202
90	547	13.18	5840	31	14.19	4548	547 to 819	42.58	15909
95	547	16.77	5264	30	16.11	4030	547 to 817	50.88	14222
100	547	20.46	4532	28	17.57	3409	547 to 815	58.54	12142
105	547	24.23	3632	27	18.87	2690	547 to 813	66.00	9659
110	547	28.03	2571	26	21.08	1877	547 to 810	75.08	6793
115	547	31.69	1363	24	23.13	978	547 to 807	83.70	3572
120	547	35.37	0	22	25.01	0	547 to 805	92.05	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 22 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 22

INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 38.8 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	633	0.00	0	22	0.00	0	633 to 925	0.00	0
5	633	4.97	101	22	5.03	83	633 to 925	15.52	282
10	633	9.34	380	22	9.53	373	633 to 924	29.30	1167
15	633	13.07	801	22	14.15	863	633 to 924	42.36	2589
20	633	16.10	1322	22	16.44	1461	633 to 924	50.50	4335
25	633	18.43	1947	23	17.40	2088	633 to 926	55.38	6277
30	633	20.05	2613	25	18.21	2719	633 to 929	59.04	8282
35	633	21.00	3271	26	17.31	3391	633 to 932	58.84	10344
40	633	21.30	3944	28	16.58	3987	633 to 934	58.02	12301
45	633	21.02	4568	29	15.14	4492	633 to 936	55.18	14033
50	633	20.22	5136	30	13.69	4899	633 to 938	51.58	15520
55	633	18.97	5627	31	12.74	5205	633 to 939	48.22	16728
60	633	17.37	6027	31	11.87	5408	633 to 940	44.50	17633
65	633	15.50	6303	32	11.51	5505	633 to 941	41.28	18185
70	633	13.46	6484	32	11.27	5524	633 to 942	38.02	18468
75	633	11.34	6507	32	11.36	5449	633 to 942	35.21	18374
80	633	9.24	6402	32	12.44	5260	633 to 941	34.09	17906
85	633	9.61	6152	31	13.18	4959	633 to 940	35.87	17044
90	633	12.94	5735	31	14.19	4548	633 to 939	42.25	15762
95	633	16.47	5169	30	16.11	4030	633 to 937	50.46	14090
100	633	20.10	4451	28	17.57	3409	633 to 935	58.02	12028
105	633	23.79	3567	27	18.87	2690	633 to 933	65.40	9568
110	633	27.52	2525	26	21.08	1877	633 to 930	74.38	6728
115	633	31.12	1338	24	23.13	978	633 to 927	82.90	3538
120	633	34.74	0	22	25.01	0	633 to 925	91.16	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 23 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 23

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 38.8 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	881	0.00	0	6	0.00	0	881 to 1244	0.00	0
5	881	5.26	107	6	1.49	24	881 to 1244	9.91	191
10	881	9.90	403	6	2.82	110	881 to 1244	18.66	752
15	881	13.84	848	6	4.19	255	881 to 1244	26.50	1622
20	881	17.05	1400	6	4.86	432	881 to 1244	32.15	2696
25	881	19.52	2062	6	5.14	618	881 to 1245	36.09	3938
30	881	21.24	2769	7	5.38	804	881 to 1246	38.91	5244
35	881	22.25	3465	7	5.12	1003	881 to 1246	39.86	6557
40	881	22.57	4178	8	4.90	1180	881 to 1247	39.94	7856
45	881	22.27	4839	8	4.48	1329	881 to 1248	38.80	9035
50	881	21.42	5440	9	4.05	1450	881 to 1248	36.87	10082
55	881	20.10	5961	9	3.77	1540	881 to 1249	34.55	10964
60	881	18.40	6385	9	3.51	1600	881 to 1249	31.73	11660
65	881	16.42	6677	9	3.40	1629	881 to 1249	28.78	12119
70	881	14.26	6868	9	3.33	1634	881 to 1249	25.64	12395
75	881	12.02	6893	9	3.36	1612	881 to 1249	22.55	12392
80	881	9.79	6782	9	3.68	1556	881 to 1249	19.96	12142
85	881	10.18	6517	9	3.90	1467	881 to 1249	20.89	11619
90	881	13.71	6075	9	4.20	1346	881 to 1249	26.34	10794
95	881	17.45	5476	8	4.77	1192	881 to 1248	32.54	9695
100	881	21.29	4715	8	5.20	1009	881 to 1247	38.65	8317
105	881	25.20	3779	8	5.58	796	881 to 1247	44.78	6644
110	881	29.16	2675	7	6.24	555	881 to 1246	51.43	4690
115	881	32.96	1418	7	6.84	289	881 to 1245	57.79	2477
120	881	36.80	0	6	7.40	0	881 to 1244	64.11	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 24 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 24

INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 38.8 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	849	0.00	0	6	0.00	0	849 to 1201	0.00	0
5	849	5.32	108	6	1.49	24	849 to 1201	9.98	193
10	849	10.00	407	6	2.82	110	849 to 1200	18.80	758
15	849	13.98	857	6	4.19	255	849 to 1200	26.70	1634
20	849	17.23	1414	6	4.86	432	849 to 1200	32.40	2716
25	849	19.72	2083	6	5.14	618	849 to 1201	36.36	3968
30	849	21.46	2797	7	5.38	804	849 to 1202	39.21	5284
35	849	22.47	3500	7	5.12	1003	849 to 1203	40.18	6607
40	849	22.80	4221	8	4.90	1180	849 to 1203	40.26	7915
45	849	22.50	4888	8	4.48	1329	849 to 1204	39.12	9104
50	849	21.63	5496	9	4.05	1450	849 to 1204	37.18	10160
55	849	20.30	6022	9	3.77	1540	849 to 1205	34.83	11050
60	849	18.59	6450	9	3.51	1600	849 to 1205	32.00	11752
65	849	16.59	6746	9	3.40	1629	849 to 1205	29.02	12214
70	849	14.41	6939	9	3.33	1634	849 to 1206	25.85	12493
75	849	12.14	6964	9	3.36	1612	849 to 1206	22.72	12491
80	849	9.89	6851	9	3.68	1556	849 to 1205	20.10	12238
85	849	10.29	6583	9	3.90	1467	849 to 1205	21.04	11712
90	849	13.85	6137	9	4.20	1346	849 to 1205	26.53	10881
95	849	17.63	5532	8	4.77	1192	849 to 1204	32.79	9773
100	849	21.51	4763	8	5.20	1009	849 to 1204	38.96	8384
105	849	25.46	3817	8	5.58	796	849 to 1203	45.14	6698
110	849	29.45	2702	7	6.24	555	849 to 1202	51.85	4728
115	849	33.30	1432	7	6.84	289	849 to 1201	58.26	2498
120	849	37.18	0	6	7.40	0	849 to 1201	64.63	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 25 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 25

INPUT DATA

Applied Load = 4415 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
Radius CL = 43.65 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	334	0.00	0	18	0.00	0	334 to 500	0.00	0
5	334	11.74	268	18	3.97	87	334 to 500	23.19	524
10	334	22.06	1011	18	8.90	385	334 to 500	46.02	2070
15	334	30.84	2127	18	12.26	878	334 to 499	64.03	4472
20	334	38.00	3510	18	14.72	1468	334 to 500	78.25	7411
25	334	43.50	5170	19	15.50	2077	334 to 502	87.26	10770
30	334	47.34	6940	21	15.37	2677	334 to 504	92.41	14269
35	334	49.57	8686	22	14.69	3319	334 to 506	94.39	17803
40	334	50.29	10473	23	13.87	3884	334 to 508	94.00	21266
45	334	49.62	12130	24	12.75	4360	334 to 510	91.15	24396
50	334	47.72	13637	25	11.65	4743	334 to 512	86.63	27156
55	334	44.78	14941	26	10.57	5029	334 to 513	80.68	29468
60	334	41.00	16005	26	9.99	5216	334 to 514	74.39	31276
65	334	36.59	16738	27	9.61	5304	334 to 514	67.57	32450
70	334	31.78	17217	27	9.69	5290	334 to 514	60.98	33098
75	334	26.78	17279	27	10.05	5188	334 to 514	54.60	33010
80	334	21.81	16999	26	10.26	5005	334 to 514	47.98	32309
85	334	22.69	16335	26	11.16	4716	334 to 513	50.75	30887
90	334	30.55	15228	25	12.30	4323	334 to 512	63.69	28669
95	334	38.88	13727	24	13.63	3829	334 to 511	77.62	25727
100	334	47.44	11819	23	15.12	3237	334 to 509	92.13	22051
105	334	56.16	9473	22	15.94	2553	334 to 507	105.73	17603
110	334	64.97	6706	21	17.79	1781	334 to 505	121.21	12418
115	334	73.45	3554	20	19.51	928	334 to 502	136.01	6555
120	334	82.00	0	18	21.08	0	334 to 500	150.64	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 26 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 26INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 43.65 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	441	0.00	0	18	0.00	0	441 to 650	0.00	0
5	441	8.95	204	18	3.97	87	441 to 650	19.29	435
10	441	16.82	771	18	8.90	385	441 to 649	38.69	1734
15	441	23.52	1622	18	12.26	878	441 to 649	53.78	3765
20	441	28.98	2677	18	14.72	1468	441 to 649	65.62	6245
25	441	33.18	3943	19	15.50	2077	441 to 652	72.80	9052
30	441	36.10	5293	21	15.37	2677	441 to 654	76.68	11963
35	441	37.81	6625	22	14.69	3319	441 to 656	77.92	14918
40	441	38.35	7987	23	13.87	3884	441 to 658	77.29	17786
45	441	37.84	9251	24	12.75	4360	441 to 660	74.66	20365
50	441	36.40	10401	25	11.65	4743	441 to 661	70.77	22625
55	441	34.15	11396	26	10.57	5029	441 to 663	65.80	24504
60	441	31.27	12207	26	9.99	5216	441 to 663	60.77	25959
65	441	27.90	12766	27	9.61	5304	441 to 664	55.41	26889
70	441	24.24	13131	27	9.69	5290	441 to 664	50.42	27377
75	441	20.43	13178	27	10.05	5188	441 to 664	45.70	27270
80	441	16.63	12965	26	10.26	5005	441 to 664	40.74	26661
85	441	17.31	12458	26	11.16	4716	441 to 663	43.21	25460
90	441	23.30	11614	25	12.30	4323	441 to 662	53.54	23610
95	441	29.66	10469	24	13.63	3829	441 to 660	64.70	21166
100	441	36.18	9014	23	15.12	3237	441 to 659	76.37	18124
105	441	42.83	7225	22	15.94	2553	441 to 656	87.07	14456
110	441	49.55	5115	21	17.79	1781	441 to 654	99.63	10190
115	441	56.02	2711	20	19.51	928	441 to 652	111.61	5374
120	441	62.54	0	18	21.08	0	441 to 650	123.40	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 27 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 27

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 43.65 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	616	0.00	0	23	0.00	0	616 to 902	0.00	0
5	616	5.69	130	23	5.02	110	616 to 902	16.51	370
10	616	10.70	490	23	11.23	485	616 to 902	34.09	1513
15	616	14.97	1032	23	15.47	1108	616 to 901	47.26	3330
20	616	18.44	1703	23	18.58	1853	616 to 902	57.42	5536
25	616	21.11	2509	25	19.56	2621	616 to 905	62.82	7970
30	616	22.97	3368	26	19.39	3379	616 to 907	65.14	10461
35	616	24.06	4216	28	18.54	4189	616 to 910	65.21	13024
40	616	24.41	5083	29	17.51	4902	616 to 913	63.94	15450
45	616	24.08	5887	31	16.09	5503	616 to 915	61.07	17598
50	616	23.16	6619	32	14.71	5986	616 to 917	57.43	19443
55	616	21.73	7252	33	13.35	6347	616 to 918	53.12	20943
60	616	19.90	7768	33	12.61	6584	616 to 919	49.31	22068
65	616	17.76	8124	34	12.13	6694	616 to 920	45.49	22753
70	616	15.42	8356	34	12.23	6676	616 to 920	42.39	23049
75	616	13.00	8386	34	12.69	6547	616 to 920	39.78	22872
80	616	10.58	8251	33	12.95	6317	616 to 920	36.84	22290
85	616	11.01	7928	33	14.09	5952	616 to 919	39.38	21218
90	616	14.83	7391	32	15.52	5456	616 to 917	47.15	19623
95	616	18.87	6662	31	17.20	4832	616 to 916	55.67	17542
100	616	23.02	5736	30	19.08	4086	616 to 913	64.69	14977
105	616	27.26	4597	28	20.12	3222	616 to 911	72.37	11915
110	616	31.53	3255	27	22.46	2248	616 to 908	82.33	8380
115	616	35.65	1725	25	24.63	1171	616 to 905	91.78	4407
120	616	39.79	0	23	26.61	0	616 to 902	100.96	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 28 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 28

INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 43.65 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	712	0.00	0	23	0.00	0	712 to 1037	0.00	0
5	712	5.59	127	23	5.02	110	712 to 1037	16.36	366
10	712	10.51	481	23	11.23	485	712 to 1037	33.82	1500
15	712	14.70	1014	23	15.47	1108	712 to 1036	46.89	3304
20	712	18.11	1673	23	18.58	1853	712 to 1037	56.96	5493
25	712	20.73	2464	25	19.56	2621	712 to 1040	62.29	7907
30	712	22.56	3308	26	19.39	3379	712 to 1042	64.57	10376
35	712	23.63	4140	28	18.54	4189	712 to 1045	64.61	12918
40	712	23.97	4992	29	17.51	4902	712 to 1048	63.33	15323
45	712	23.65	5781	31	16.09	5503	712 to 1050	60.47	17450
50	712	22.74	6500	32	14.71	5986	712 to 1052	56.85	19277
55	712	21.34	7122	33	13.35	6347	712 to 1053	52.58	20761
60	712	19.54	7629	33	12.61	6584	712 to 1054	48.81	21873
65	712	17.44	7978	34	12.13	6694	712 to 1055	45.04	22549
70	712	15.14	8206	34	12.23	6676	712 to 1055	42.01	22839
75	712	12.76	8236	34	12.69	6547	712 to 1055	39.45	22662
80	712	10.39	8103	33	12.95	6317	712 to 1055	36.57	22083
85	712	10.81	7786	33	14.09	5952	712 to 1054	39.10	21019
90	712	14.56	7258	32	15.52	5456	712 to 1052	46.78	19437
95	712	18.53	6543	31	17.20	4832	712 to 1051	55.20	17375
100	712	22.61	5633	30	19.08	4086	712 to 1048	64.11	14833
105	712	26.77	4515	28	20.12	3222	712 to 1046	71.68	11800
110	712	30.96	3196	27	22.46	2248	712 to 1043	81.54	8298
115	712	35.01	1694	25	24.63	1171	712 to 1040	90.88	4364
120	712	39.08	0	23	26.61	0	712 to 1037	99.96	0

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 29 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 29

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 43.65 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	991	0.00	0	6	0.00	0	991 to 1399	0.00	0
5	991	5.92	135	6	1.48	32	991 to 1399	10.82	245
10	991	11.14	510	6	3.32	143	991 to 1399	21.25	959
15	991	15.57	1074	6	4.57	328	991 to 1399	29.59	2061
20	991	19.19	1772	6	5.50	548	991 to 1399	36.22	3413
25	991	21.96	2610	7	5.79	775	991 to 1400	40.59	4974
30	991	23.90	3504	7	5.74	1000	991 to 1401	43.22	6606
35	991	25.03	4386	8	5.48	1239	991 to 1401	44.37	8248
40	991	25.39	5288	8	5.18	1450	991 to 1402	44.36	9870
45	991	25.05	6125	9	4.76	1628	991 to 1403	43.17	11343
50	991	24.09	6886	9	4.35	1771	991 to 1403	41.13	12652
55	991	22.61	7544	9	3.95	1878	991 to 1404	38.37	13756
60	991	20.70	8081	10	3.73	1948	991 to 1404	35.33	14627
65	991	18.47	8451	10	3.59	1981	991 to 1404	31.97	15200
70	991	16.04	8693	10	3.62	1975	991 to 1404	28.62	15530
75	991	13.52	8724	10	3.75	1937	991 to 1404	25.32	15509
80	991	11.01	8583	10	3.83	1869	991 to 1404	21.93	15195
85	991	11.46	8248	9	4.17	1761	991 to 1404	23.13	14542
90	991	15.42	7689	9	4.59	1614	991 to 1404	29.41	13510
95	991	19.63	6931	9	5.09	1430	991 to 1403	36.14	12135
100	991	23.95	5967	8	5.64	1209	991 to 1402	43.14	10410
105	991	28.35	4783	8	5.95	953	991 to 1402	49.82	8318
110	991	32.80	3386	8	6.64	665	991 to 1401	57.22	5872
115	991	37.08	1795	7	7.28	346	991 to 1400	64.31	3102
120	991	41.40	0	6	7.87	0	991 to 1399	71.35	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 30 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 30

INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 43.65 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	955	0.00	0	6	0.00	0	955 to 1350	0.00	0
5	955	5.98	136	6	1.48	32	955 to 1350	10.90	247
10	955	11.25	515	6	3.32	143	955 to 1350	21.41	966
15	955	15.73	1085	6	4.57	328	955 to 1349	29.81	2077
20	955	19.38	1790	6	5.50	548	955 to 1350	36.49	3439
25	955	22.19	2637	7	5.79	775	955 to 1350	40.91	5011
30	955	24.14	3540	7	5.74	1000	955 to 1351	43.56	6656
35	955	25.28	4430	8	5.48	1239	955 to 1352	44.73	8310
40	955	25.65	5342	8	5.18	1450	955 to 1353	44.72	9945
45	955	25.31	6187	9	4.76	1628	955 to 1354	43.53	11431
50	955	24.34	6956	9	4.35	1771	955 to 1354	41.48	12750
55	955	22.84	7621	9	3.95	1878	955 to 1355	38.69	13863
60	955	20.91	8164	10	3.73	1948	955 to 1355	35.62	14742
65	955	18.66	8538	10	3.59	1981	955 to 1355	32.23	15321
70	955	16.21	8782	10	3.62	1975	955 to 1355	28.85	15654
75	955	13.66	8813	10	3.75	1937	955 to 1355	25.51	15633
80	955	11.12	8671	10	3.83	1869	955 to 1355	22.09	15318
85	955	11.57	8332	9	4.17	1761	955 to 1355	23.29	14660
90	955	15.58	7768	9	4.59	1614	955 to 1354	29.63	13620
95	955	19.83	7002	9	5.09	1430	955 to 1354	36.42	12234
100	955	24.20	6028	8	5.64	1209	955 to 1353	43.48	10496
105	955	28.64	4832	8	5.95	953	955 to 1352	50.23	8386
110	955	33.14	3420	8	6.64	665	955 to 1352	57.69	5920
115	955	37.46	1813	7	7.28	346	955 to 1351	64.84	3128
120	955	41.82	0	6	7.87	0	955 to 1350	71.94	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 31 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 31

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 48.5 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	371	0.00	0	19	0.00	0	371 to 553	0.00	0
5	371	13.04	331	19	5.34	112	371 to 553	27.34	656
10	371	24.51	1248	19	10.21	484	371 to 553	51.68	2571
15	371	34.27	2626	18	13.26	1093	371 to 552	70.54	5535
20	371	42.23	4333	19	15.48	1808	371 to 553	85.45	9141
25	371	48.33	6383	20	16.59	2534	371 to 556	95.89	13245
30	371	52.60	8568	22	16.61	3232	371 to 558	101.88	17492
35	371	55.08	10724	23	15.58	3987	371 to 560	103.62	21793
40	371	55.88	12929	24	14.51	4648	371 to 563	102.91	26004
45	371	55.13	14975	26	13.36	5203	371 to 565	99.92	29812
50	371	53.02	16836	26	12.16	5648	371 to 566	94.91	33174
55	371	49.75	18446	27	11.16	5979	371 to 567	88.64	35991
60	371	45.55	19760	28	10.66	6194	371 to 568	81.90	38195
65	371	40.65	20664	28	10.43	6291	371 to 569	74.65	39626
70	371	35.31	21255	28	10.35	6270	371 to 569	67.04	40417
75	371	29.76	21332	28	10.56	6130	371 to 568	59.63	40286
80	371	24.24	20987	28	11.05	5872	371 to 568	52.73	39366
85	371	25.21	20167	27	11.81	5525	371 to 567	55.38	37628
90	371	33.95	18800	26	13.17	5063	371 to 566	69.93	34928
95	371	43.20	16946	26	14.39	4483	371 to 564	84.95	31347
100	371	52.71	14591	24	15.76	3789	371 to 563	100.61	26870
105	371	62.40	11695	23	16.80	2988	371 to 560	115.94	21452
110	371	72.19	8279	22	18.74	2084	371 to 558	132.93	15135
115	371	81.61	4388	20	20.54	1085	371 to 556	149.19	7990
120	371	91.11	0	19	22.19	0	371 to 553	165.28	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 32 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 32

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 48.5 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	490	0.00	0	19	0.00	0	490 to 719	0.00	0
5	490	9.94	252	19	5.34	112	490 to 719	23.00	545
10	490	18.69	952	19	10.21	484	490 to 719	43.53	2156
15	490	26.14	2003	18	13.26	1093	490 to 719	59.15	4663
20	490	32.20	3305	19	15.48	1808	490 to 720	71.42	7701
25	490	36.86	4868	20	16.59	2534	490 to 722	79.83	11124
30	490	40.12	6535	22	16.61	3232	490 to 724	84.40	14645
35	490	42.01	8179	23	15.58	3987	490 to 727	85.31	18230
40	490	42.62	9861	24	14.51	4648	490 to 729	84.34	21709
45	490	42.05	11421	26	13.36	5203	490 to 731	81.60	24837
50	490	40.44	12841	26	12.16	5648	490 to 732	77.29	27580
55	490	37.95	14069	27	11.16	5979	490 to 734	72.10	29862
60	490	34.74	15070	28	10.66	6194	490 to 734	66.76	31630
65	490	31.01	15760	28	10.43	6291	490 to 735	61.14	32761
70	490	26.93	16211	28	10.35	6270	490 to 735	55.31	33356
75	490	22.70	16269	28	10.56	6130	490 to 735	49.74	33199
80	490	18.48	16007	28	11.05	5872	490 to 734	44.68	32393
85	490	19.23	15381	27	11.81	5525	490 to 733	47.00	30928
90	490	25.89	14339	26	13.17	5063	490 to 732	58.65	28682
95	490	32.95	12925	26	14.39	4483	490 to 731	70.60	25716
100	490	40.20	11128	24	15.76	3789	490 to 729	83.09	22022
105	490	47.59	8919	23	16.80	2988	490 to 727	95.20	17567
110	490	55.05	6314	22	18.74	2084	490 to 724	108.95	12384
115	490	62.24	3347	20	20.54	1085	490 to 722	122.07	6532
120	490	69.49	0	19	22.19	0	490 to 719	135.01	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 33 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 33

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 48.5 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	684	0.00	0	24	0.00	0	684 to 999	0.00	0
5	684	6.33	160	24	6.74	142	684 to 999	20.32	467
10	684	11.89	605	24	12.88	611	684 to 999	38.56	1887
15	684	16.63	1274	23	16.74	1379	684 to 998	51.75	4130
20	684	20.49	2103	24	19.54	2281	684 to 1000	61.92	6824
25	684	23.46	3098	26	20.94	3198	684 to 1002	68.45	9774
30	684	25.53	4158	28	20.96	4080	684 to 1006	71.38	12758
35	684	26.73	5204	29	19.67	5032	684 to 1009	70.87	15842
40	684	27.12	6275	31	18.31	5867	684 to 1011	69.11	18759
45	684	26.76	7268	32	16.87	6567	684 to 1014	66.14	21341
50	684	25.73	8171	34	15.34	7129	684 to 1016	62.12	23559
55	684	24.15	8953	34	14.08	7547	684 to 1017	57.76	25364
60	684	22.11	9590	35	13.45	7818	684 to 1018	53.83	26718
65	684	19.73	10029	35	13.16	7940	684 to 1019	50.00	27540
70	684	17.14	10316	35	13.06	7913	684 to 1019	46.21	27896
75	684	14.44	10353	35	13.33	7736	684 to 1019	42.89	27647
80	684	11.76	10186	35	13.95	7411	684 to 1018	40.19	26861
85	684	12.23	9788	34	14.90	6974	684 to 1017	42.47	25559
90	684	16.47	9125	33	16.63	6390	684 to 1016	51.34	23638
95	684	20.97	8225	32	18.16	5657	684 to 1014	60.23	21134
100	684	25.58	7082	31	19.90	4782	684 to 1011	69.65	18045
105	684	30.28	5676	29	21.21	3771	684 to 1009	78.46	14357
110	684	35.03	4018	28	23.66	2630	684 to 1006	89.27	10098
115	684	39.61	2130	26	25.93	1370	684 to 1003	99.54	5312
120	684	44.22	0	24	28.00	0	684 to 999	109.51	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 34 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 34

INPUT DATA

Applied Load = 14771 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
Radius CL = 48.5 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	791	0.00	0	24	0.00	0	791 to 1149	0.00	0
5	791	6.21	157	24	6.74	142	791 to 1149	20.16	463
10	791	11.68	595	24	12.88	611	791 to 1149	38.26	1872
15	791	16.33	1251	23	16.74	1379	791 to 1148	51.34	4098
20	791	20.12	2065	24	19.54	2281	791 to 1150	61.41	6771
25	791	23.04	3042	26	20.94	3198	791 to 1152	67.86	9696
30	791	25.07	4084	28	20.96	4080	791 to 1156	70.74	12654
35	791	26.25	5111	29	19.67	5032	791 to 1159	70.20	15712
40	791	26.63	6163	31	18.31	5867	791 to 1161	68.43	18602
45	791	26.28	7138	32	16.87	6567	791 to 1164	65.47	21158
50	791	25.27	8025	34	15.34	7129	791 to 1166	61.47	23354
55	791	23.71	8792	34	14.08	7547	791 to 1167	57.15	25139
60	791	21.71	9418	35	13.45	7818	791 to 1168	53.27	26477
65	791	19.38	9849	35	13.16	7940	791 to 1169	49.51	27288
70	791	16.83	10131	35	13.06	7913	791 to 1169	45.78	27637
75	791	14.18	10168	35	13.33	7736	791 to 1169	42.53	27387
80	791	11.55	10003	35	13.95	7411	791 to 1168	39.90	26605
85	791	12.02	9612	34	14.90	6974	791 to 1167	42.17	25313
90	791	16.18	8961	33	16.63	6390	791 to 1165	50.92	23409
95	791	20.59	8077	32	18.16	5657	791 to 1164	59.71	20927
100	791	25.12	6955	31	19.90	4782	791 to 1161	69.01	17867
105	791	29.74	5574	29	21.21	3771	791 to 1159	77.70	14215
110	791	34.40	3946	28	23.66	2630	791 to 1156	88.39	9997
115	791	38.90	2091	26	25.93	1370	791 to 1153	98.54	5258
120	791	43.42	0	24	28.00	0	791 to 1149	108.40	0

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 35 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 35

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 48.5 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1101	0.00	0	7	0.00	0	1101 to 1554	0.00	0
5	1101	6.58	167	7	1.99	42	1101 to 1554	12.61	305
10	1101	12.37	630	7	3.81	180	1101 to 1553	23.81	1190
15	1101	17.30	1326	7	4.95	408	1101 to 1553	32.65	2550
20	1101	21.32	2188	7	5.78	675	1101 to 1554	39.68	4211
25	1101	24.40	3223	7	6.19	946	1101 to 1555	44.70	6121
30	1101	26.56	4326	8	6.20	1207	1101 to 1555	47.73	8110
35	1101	27.81	5414	8	5.82	1489	1101 to 1556	48.83	10112
40	1101	28.21	6528	9	5.42	1736	1101 to 1557	48.72	12092
45	1101	27.84	7561	9	4.99	1943	1101 to 1558	47.46	13890
50	1101	26.77	8501	10	4.54	2109	1101 to 1558	45.20	15488
55	1101	25.12	9314	10	4.16	2233	1101 to 1559	42.26	16837
60	1101	23.00	9977	10	3.98	2313	1101 to 1559	38.97	17902
65	1101	20.53	10434	10	3.89	2349	1101 to 1559	35.36	18602
70	1101	17.83	10732	10	3.86	2341	1101 to 1559	31.53	19007
75	1101	15.02	10771	10	3.94	2289	1101 to 1559	27.74	18972
80	1101	12.23	10597	10	4.13	2193	1101 to 1559	24.15	18565
85	1101	12.73	10183	10	4.41	2063	1101 to 1559	25.32	17765
90	1101	17.14	9493	10	4.92	1891	1101 to 1558	32.36	16505
95	1101	21.81	8557	9	5.37	1674	1101 to 1558	39.68	14826
100	1101	26.61	7367	9	5.88	1415	1101 to 1557	47.27	12721
105	1101	31.51	5905	8	6.27	1116	1101 to 1556	54.78	10164
110	1101	36.45	4180	8	7.00	778	1101 to 1555	62.93	7176
115	1101	41.21	2216	7	7.67	405	1101 to 1555	70.74	3792
120	1101	46.00	0	7	8.28	0	1101 to 1554	78.49	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 36 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 36

INPUT DATA

Applied Load = 20241 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
Radius CL = 48.5 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1062	0.00	0	7	0.00	0	1062 to 1499	0.00	0
5	1062	6.65	169	7	1.99	42	1062 to 1499	12.70	308
10	1062	12.50	636	7	3.81	180	1062 to 1499	23.99	1199
15	1062	17.48	1339	7	4.95	408	1062 to 1499	32.90	2569
20	1062	21.54	2210	7	5.78	675	1062 to 1499	39.99	4242
25	1062	24.65	3256	7	6.19	946	1062 to 1500	45.05	6167
30	1062	26.83	4370	8	6.20	1207	1062 to 1501	48.11	8171
35	1062	28.09	5470	8	5.82	1489	1062 to 1502	49.23	10190
40	1062	28.50	6595	9	5.42	1736	1062 to 1502	49.12	12185
45	1062	28.12	7638	9	4.99	1943	1062 to 1503	47.86	13998
50	1062	27.04	8588	10	4.54	2109	1062 to 1504	45.59	15610
55	1062	25.38	9409	10	4.16	2233	1062 to 1504	42.62	16970
60	1062	23.23	10079	10	3.98	2313	1062 to 1504	39.30	18044
65	1062	20.74	10540	10	3.89	2349	1062 to 1505	35.65	18752
70	1062	18.01	10842	10	3.86	2341	1062 to 1505	31.79	19160
75	1062	15.18	10881	10	3.94	2289	1062 to 1505	27.96	19126
80	1062	12.36	10705	10	4.13	2193	1062 to 1504	24.33	18716
85	1062	12.86	10287	10	4.41	2063	1062 to 1504	25.50	17910
90	1062	17.31	9590	10	4.92	1891	1062 to 1504	32.61	16641
95	1062	22.04	8644	9	5.37	1674	1062 to 1503	39.99	14948
100	1062	26.89	7443	9	5.88	1415	1062 to 1502	47.65	12826
105	1062	31.83	5965	8	6.27	1116	1062 to 1502	55.23	10249
110	1062	36.82	4223	8	7.00	778	1062 to 1501	63.45	7236
115	1062	41.63	2238	7	7.67	405	1062 to 1500	71.33	3823
120	1062	46.47	0	7	8.28	0	1062 to 1499	79.15	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 37 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 37

INPUT DATA

Applied Load = 4415 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
 Radius CL = 53.35 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	409	0.00	0	19	0.00	0	409 to 606	0.00	0
5	409	14.34	401	19	5.33	141	409 to 606	29.16	802
10	409	26.96	1510	19	11.47	593	409 to 606	57.26	3123
15	409	37.70	3177	19	14.23	1327	409 to 605	76.99	6705
20	409	46.45	5243	20	16.97	2174	409 to 607	93.89	11039
25	409	53.17	7724	21	17.59	3022	409 to 609	104.34	15952
30	409	57.86	10368	23	17.35	3814	409 to 612	110.51	21000
35	409	60.59	12976	24	16.39	4686	409 to 614	112.69	26133
40	409	61.47	15645	26	15.17	5445	409 to 617	111.85	31160
45	409	60.65	18120	27	13.78	6081	409 to 618	108.35	35708
50	409	58.33	20372	28	12.60	6590	409 to 620	103.08	39725
55	409	54.73	22320	28	11.81	6968	409 to 621	96.70	43095
60	409	50.11	23909	29	11.23	7211	409 to 622	89.26	45733
65	409	44.72	25003	29	10.82	7318	409 to 623	81.01	47446
70	409	38.84	25719	29	10.92	7288	409 to 623	72.95	48397
75	409	32.74	25811	29	11.02	7121	409 to 622	64.58	48242
80	409	26.66	25394	29	11.73	6818	409 to 622	57.27	47144
85	409	27.73	24402	28	12.69	6382	409 to 622	57.27	47144
90	409	37.34	22748	27	13.62	5819	409 to 621	60.42	45013
95	409	47.53	20505	26	15.05	5151	409 to 620	75.44	41741
100	409	57.98	17655	26	16.66	4353	409 to 618	92.14	37465
105	409	68.64	14151	25	18.10	3431	409 to 616	109.51	32118
110	409	79.40	10018	24	19.57	2393	409 to 614	126.87	25645
115	409	89.77	5310	22	21.44	1246	409 to 611	144.45	18095
120	409	100.22	0	21	23.15	0	409 to 609	162.15	9553
				19			409 to 606	179.67	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 38 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 38

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 53.35 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	539	0.00	0	19	0.00	0	539 to 789	0.00	0
5	539	10.94	305	19	5.33	141	539 to 789	24.39	669
10	539	20.56	1152	19	11.47	593	539 to 789	48.30	2621
15	539	28.75	2423	19	14.23	1327	539 to 788	64.46	5649
20	539	35.43	3999	20	16.97	2174	539 to 790	78.45	9296
25	539	40.55	5891	21	17.59	3022	539 to 792	86.67	13386
30	539	44.13	7907	23	17.35	3814	539 to 795	91.28	17556
35	539	46.21	9896	24	16.39	4686	539 to 797	92.56	21821
40	539	46.88	11932	26	15.17	5445	539 to 799	91.43	25962
45	539	46.25	13820	27	13.78	6081	539 to 801	88.20	29688
50	539	44.48	15537	28	12.60	6590	539 to 803	83.70	32957
55	539	41.74	17023	28	11.81	6968	539 to 804	78.52	35679
60	539	38.22	18235	29	11.23	7211	539 to 805	72.61	37789
65	539	34.11	19070	29	10.82	7318	539 to 806	66.15	39139
70	539	29.62	19616	29	10.92	7288	539 to 806	60.05	39852
75	539	24.97	19686	29	11.02	7121	539 to 805	53.71	39667
80	539	20.33	19368	29	11.73	6818	539 to 805	48.41	38707
85	539	21.15	18611	28	12.69	6382	539 to 804	51.20	36906
90	539	28.48	17350	27	13.62	5819	539 to 803	63.03	34183
95	539	36.25	15639	26	15.05	5151	539 to 801	76.35	30652
100	539	44.22	13465	25	16.66	4353	539 to 799	90.24	26252
105	539	52.35	10793	24	18.10	3431	539 to 797	104.07	20944
110	539	60.56	7641	22	19.57	2393	539 to 794	118.07	14766
115	539	68.47	4050	21	21.44	1246	539 to 792	132.32	7789
120	539	76.44	0	19	23.15	0	539 to 789	146.38	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 39 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 39

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 53.35 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	752	0.00	0	25	0.00	0	752 to 1096	0.00	0
5	752	6.96	194	25	6.73	178	752 to 1096	21.20	576
10	752	13.08	733	24	14.48	748	752 to 1096	42.95	2299
15	752	18.30	1542	24	17.97	1674	752 to 1095	56.17	5006
20	752	22.54	2545	25	21.42	2744	752 to 1097	67.98	8229
25	752	25.80	3748	27	22.19	3814	752 to 1100	73.86	11733
30	752	28.08	5032	29	21.90	4814	752 to 1103	76.55	15229
35	752	29.40	6298	31	20.68	5914	752 to 1107	76.34	18871
40	752	29.83	7593	32	19.15	6872	752 to 1109	74.32	22314
45	752	29.43	8794	34	17.40	7675	752 to 1112	70.79	25361
50	752	28.31	9887	35	15.90	8318	752 to 1114	66.67	27983
55	752	26.56	10833	36	14.90	8794	752 to 1115	62.53	30117
60	752	24.32	11604	37	14.18	9101	752 to 1117	58.16	31718
65	752	21.70	12135	37	13.66	9235	752 to 1117	53.61	32691
70	752	18.85	12483	37	13.78	9197	752 to 1117	49.83	33112
75	752	15.89	12527	37	13.92	8987	752 to 1117	45.91	32817
80	752	12.94	12325	36	14.80	8605	752 to 1116	43.28	31884
85	752	13.46	11843	36	16.02	8055	752 to 1115	46.09	30275
90	752	18.12	11041	35	17.19	7344	752 to 1113	54.60	27943
95	752	23.06	9952	33	19.00	6501	752 to 1111	64.60	24985
100	752	28.14	8569	32	21.02	5494	752 to 1109	75.15	21336
105	752	33.31	6868	30	22.84	4331	752 to 1106	85.48	16978
110	752	38.54	4862	29	24.71	3020	752 to 1103	95.96	11942
115	752	43.57	2577	27	27.06	1573	752 to 1100	107.02	6283
120	752	48.64	0	25	29.22	0	752 to 1096	117.78	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 40 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 40INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 53.35 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	870	0.00	0	25	0.00	0	870 to 1261	0.00	0
5	870	6.83	191	25	6.73	178	870 to 1261	21.03	571
10	870	12.85	720	24	14.48	748	870 to 1261	42.62	2281
15	870	17.97	1514	24	17.97	1674	870 to 1260	55.71	4967
20	870	22.14	2499	25	21.42	2744	870 to 1262	67.41	8165
25	870	25.34	3681	27	22.19	3814	870 to 1265	73.22	11639
30	870	27.58	4942	29	21.90	4814	870 to 1268	75.84	15103
35	870	28.88	6185	31	20.68	5914	870 to 1272	75.60	18713
40	870	29.30	7457	32	19.15	6872	870 to 1274	73.58	22123
45	870	28.91	8637	34	17.40	7675	870 to 1277	70.05	25140
50	870	27.80	9710	35	15.90	8318	870 to 1279	65.96	27735
55	870	26.08	10639	36	14.90	8794	870 to 1280	61.86	29845
60	870	23.88	11396	37	14.18	9101	870 to 1282	57.55	31427
65	870	21.31	11918	37	13.66	9235	870 to 1282	53.07	32386
70	870	18.51	12259	37	13.78	9197	870 to 1282	49.36	32799
75	870	15.60	12303	37	13.92	8987	870 to 1282	45.51	32502
80	870	12.70	12104	36	14.80	8605	870 to 1281	42.96	31575
85	870	13.22	11631	36	16.02	8055	870 to 1280	45.75	29977
90	870	17.80	10843	35	17.19	7344	870 to 1278	54.14	27666
95	870	22.65	9774	33	19.00	6501	870 to 1276	64.02	24735
100	870	27.64	8415	32	21.02	5494	870 to 1274	74.44	21121
105	870	32.72	6745	30	22.84	4331	870 to 1271	84.64	16805
110	870	37.85	4775	29	24.71	3020	870 to 1268	94.99	11820
115	870	42.79	2531	27	27.06	1573	870 to 1265	105.92	6218
120	870	47.77	0	25	29.22	0	870 to 1261	116.56	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 41 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 41

INPUT DATA

Applied Load = 21064 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
Radius CL = 53.35 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1211	0.00	0	7	0.00	0	1211 to 1708	0.00	0
5	1211	7.24	202	7	1.99	52	1211 to 1708	13.53	373
10	1211	13.61	762	7	4.28	221	1211 to 1708	26.35	1444
15	1211	19.03	1604	7	5.31	495	1211 to 1708	35.69	3089
20	1211	23.45	2647	7	6.33	812	1211 to 1708	43.61	5087
25	1211	26.84	3900	8	6.56	1128	1211 to 1709	48.75	7379
30	1211	29.21	5235	8	6.48	1424	1211 to 1710	51.92	9751
35	1211	30.59	6552	9	6.12	1750	1211 to 1711	53.24	12148
40	1211	31.03	7899	9	5.66	2033	1211 to 1712	53.09	14517
45	1211	30.62	9149	10	5.15	2271	1211 to 1713	51.63	16671
50	1211	29.45	10286	10	4.70	2461	1211 to 1713	49.23	18586
55	1211	27.63	11270	10	4.41	2602	1211 to 1714	46.19	20203
60	1211	25.30	12072	10	4.19	2693	1211 to 1714	42.56	21480
65	1211	22.58	12625	11	4.04	2733	1211 to 1714	38.49	22322
70	1211	19.61	12986	11	4.08	2722	1211 to 1714	34.39	22808
75	1211	16.53	13033	11	4.11	2659	1211 to 1714	30.14	22768
80	1211	13.46	12822	10	4.38	2546	1211 to 1714	26.29	22281
85	1211	14.00	12321	10	4.74	2383	1211 to 1714	27.67	21302
90	1211	18.85	11486	10	5.08	2173	1211 to 1713	35.04	19776
95	1211	23.99	10354	10	5.62	1923	1211 to 1713	43.16	17766
100	1211	29.28	8915	9	6.22	1625	1211 to 1712	51.57	15245
105	1211	34.66	7145	9	6.76	1281	1211 to 1711	60.02	12182
110	1211	40.09	5058	8	7.31	893	1211 to 1710	68.56	8601
115	1211	45.33	2681	8	8.01	465	1211 to 1709	77.08	4545
120	1211	50.60	0	7	8.64	0	1211 to 1708	85.55	0

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 42 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 42

INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 53.35 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1168	0.00	0	7	0.00	0	1168 to 1648	0.00	0
5	1168	7.31	204	7	1.99	52	1168 to 1648	13.63	376
10	1168	13.75	770	7	4.28	221	1168 to 1648	26.54	1455
15	1168	19.23	1621	7	5.31	495	1168 to 1648	35.96	3112
20	1168	23.69	2674	7	6.33	812	1168 to 1648	43.95	5125
25	1168	27.12	3939	8	6.56	1128	1168 to 1649	49.14	7435
30	1168	29.51	5288	8	6.48	1424	1168 to 1650	52.34	9826
35	1168	30.90	6618	9	6.12	1750	1168 to 1651	53.67	12241
40	1168	31.35	7980	9	5.66	2033	1168 to 1652	53.53	14630
45	1168	30.93	9243	10	5.15	2271	1168 to 1653	52.06	16802
50	1168	29.75	10391	10	4.70	2461	1168 to 1653	49.65	18733
55	1168	27.92	11385	10	4.41	2602	1168 to 1654	46.58	20364
60	1168	25.56	12196	10	4.19	2693	1168 to 1654	42.92	21653
65	1168	22.81	12754	11	4.04	2733	1168 to 1654	38.81	22502
70	1168	19.81	13119	11	4.08	2722	1168 to 1654	34.67	22994
75	1168	16.70	13166	11	4.11	2659	1168 to 1654	30.38	22954
80	1168	13.60	12953	10	4.38	2546	1168 to 1654	26.49	22464
85	1168	14.14	12447	10	4.74	2383	1168 to 1653	27.87	21479
90	1168	19.05	11604	10	5.08	2173	1168 to 1653	35.31	19940
95	1168	24.24	10459	10	5.62	1923	1168 to 1652	43.50	17914
100	1168	29.57	9006	9	6.22	1625	1168 to 1652	51.99	15372
105	1168	35.01	7218	9	6.76	1281	1168 to 1651	60.51	12284
110	1168	40.50	5110	8	7.31	893	1168 to 1650	69.14	8674
115	1168	45.79	2708	8	8.01	465	1168 to 1649	77.73	4584
120	1168	51.12	0	7	8.64	0	1168 to 1648	86.27	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 43 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 43

INPUT DATA

Applied Load = 4415 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 1660 lb./ft.

Variation Factor = 1.737
Radius CL = 58.2 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	446	0.00	0	20	0.00	0	446 to 659	0.00	0
5	446	15.65	477	20	6.60	171	446 to 659	33.14	960
10	446	29.42	1797	20	12.70	711	446 to 659	62.78	3726
15	446	41.13	3782	19	15.83	1580	446 to 658	84.50	7981
20	446	50.67	6240	20	18.30	2565	446 to 660	102.06	13099
25	446	58.00	9192	22	18.48	3540	446 to 663	112.63	18887
30	446	63.12	12339	24	18.29	4437	446 to 665	119.48	24819
35	446	66.10	15442	25	17.08	5408	446 to 668	121.59	30814
40	446	67.05	18619	26	15.64	6268	446 to 670	120.48	36723
45	446	66.16	21565	28	14.25	6988	446 to 672	116.85	42072
50	446	63.63	24244	29	13.06	7563	446 to 674	111.29	46800
55	446	59.71	26563	29	12.14	7988	446 to 675	104.25	50768
60	446	54.66	28454	30	11.74	8259	446 to 676	96.49	53878
65	446	48.79	29756	30	11.43	8376	446 to 676	87.75	55899
70	446	42.37	30608	30	11.41	8337	446 to 677	78.74	57025
75	446	35.71	30718	30	11.71	8142	446 to 676	69.91	56847
80	446	29.08	30222	30	12.30	7793	446 to 676	61.63	55559
85	446	30.26	29040	29	13.17	7292	446 to 674	64.76	53053
90	446	40.74	27073	28	14.30	6643	446 to 673	81.35	49196
95	446	51.85	24403	27	15.64	5852	446 to 671	99.19	44114
100	446	63.26	21011	26	17.17	4925	446 to 669	117.75	37790
105	446	74.88	16841	25	18.82	3882	446 to 667	136.84	30177
110	446	86.62	11922	23	20.30	2707	446 to 665	155.80	21294
115	446	97.93	6319	22	22.24	1410	446 to 662	174.92	11244
120	446	109.33	0	20	24.00	0	446 to 659	193.87	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 44 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 44

INPUT DATA

Applied Load = 7636 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1660 lb./ft.

Variation Factor = 1.325
 Radius CL = 58.2 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	588	0.00	0	20	0.00	0	588 to 859	0.00	0
5	588	11.93	364	20	6.60	171	588 to 859	27.94	801
10	588	22.43	1371	20	12.70	711	588 to 858	53.00	3129
15	588	31.37	2884	19	15.83	1580	588 to 858	70.84	6724
20	588	38.65	4759	20	18.30	2565	588 to 860	85.22	11025
25	588	44.24	7010	22	18.48	3540	588 to 862	93.36	15833
30	588	48.14	9411	24	18.29	4437	588 to 865	98.51	20719
35	588	50.41	11777	25	17.08	5408	588 to 867	99.62	25684
40	588	51.14	14200	26	15.64	6268	588 to 870	98.20	30537
45	588	50.46	16447	28	14.25	6988	588 to 872	94.87	34907
50	588	48.53	18491	29	13.06	7563	588 to 873	90.15	38745
55	588	45.54	20259	29	12.14	7988	588 to 875	84.41	41943
60	588	41.69	21702	30	11.74	8259	588 to 876	78.33	44424
65	588	37.21	22695	30	11.43	8376	588 to 876	71.54	46013
70	588	32.32	23344	30	11.41	8337	588 to 876	64.66	46856
75	588	27.24	23428	30	11.71	8142	588 to 876	58.04	46641
80	588	22.18	23050	30	12.30	7793	588 to 875	51.97	45518
85	588	23.08	22149	29	13.17	7292	588 to 874	54.70	43405
90	588	31.07	20648	28	14.30	6643	588 to 873	67.81	40202
95	588	39.54	18612	27	15.64	5852	588 to 871	81.96	36006
100	588	48.24	16025	26	17.17	4925	588 to 869	96.74	30809
105	588	57.11	12844	25	18.82	3882	588 to 867	111.96	24582
110	588	66.07	9093	23	20.30	2707	588 to 864	127.02	17333
115	588	74.69	4820	22	22.24	1410	588 to 861	142.38	9145
120	588	83.38	0	20	24.00	0	588 to 859	157.55	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 45 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 45

INPUT DATA

Applied Load = 12534 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.126
 Radius CL = 58.2 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	821	0.00	0	25	0.00	0	821 to 1193	0.00	0
5	821	7.59	231	25	8.33	216	821 to 1193	24.81	692
10	821	14.27	872	25	16.02	898	821 to 1193	47.24	2748
15	821	19.96	1835	25	19.98	1994	821 to 1192	61.92	5960
20	821	24.59	3028	26	23.09	3238	821 to 1194	73.70	9745
25	821	28.15	4461	28	23.33	4468	821 to 1198	79.08	13841
30	821	30.63	5988	30	23.09	5600	821 to 1201	82.15	17905
35	821	32.08	7495	32	21.56	6826	821 to 1204	81.57	22097
40	821	32.54	9036	34	19.74	7911	821 to 1207	79.13	26101
45	821	32.11	10466	35	17.98	8820	821 to 1210	75.53	29647
50	821	30.88	11767	36	16.48	9545	821 to 1212	71.26	32701
55	821	28.98	12892	37	15.33	10081	821 to 1214	66.64	35188
60	821	26.53	13810	38	14.81	10424	821 to 1215	62.33	37056
65	821	23.68	14442	38	14.43	10571	821 to 1215	57.69	38191
70	821	20.56	14856	38	14.41	10522	821 to 1215	53.29	38685
75	821	17.33	14909	38	14.78	10275	821 to 1215	49.39	38342
80	821	14.11	14668	38	15.52	9835	821 to 1214	46.15	37255
85	821	14.68	14095	37	16.62	9203	821 to 1213	48.82	35378
90	821	19.77	13140	36	18.04	8384	821 to 1211	58.36	32650
95	821	25.16	11844	34	19.74	7386	821 to 1209	68.80	29138
100	821	30.70	10198	33	21.67	6216	821 to 1206	79.82	24845
105	821	36.34	8173	31	23.75	4899	821 to 1204	91.27	19773
110	821	42.04	5786	29	25.62	3417	821 to 1200	102.43	13910
115	821	47.53	3067	27	28.06	1779	821 to 1197	114.26	7319
120	821	53.06	0	25	30.29	0	821 to 1193	125.79	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 46 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 46

INPUT DATA

Applied Load = 14771 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 2095 lb./ft.

Variation Factor = 1.105
 Radius CL = 58.2 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	949	0.00	0	25	0.00	0	949 to 1373	0.00	0
5	949	7.46	227	25	8.33	216	949 to 1373	24.62	687
10	949	14.02	856	25	16.02	898	949 to 1373	46.88	2726
15	949	19.60	1802	25	19.98	1994	949 to 1372	61.42	5914
20	949	24.15	2974	26	23.09	3238	949 to 1374	73.08	9669
25	949	27.64	4381	28	23.33	4468	949 to 1378	78.37	13729
30	949	30.08	5881	30	23.09	5600	949 to 1381	81.38	17755
35	949	31.50	7360	32	21.56	6826	949 to 1384	80.77	21909
40	949	31.96	8874	34	19.74	7911	949 to 1387	78.31	25874
45	949	31.53	10278	35	17.98	8820	949 to 1390	74.72	29384
50	949	30.33	11556	36	16.48	9545	949 to 1392	70.48	32405
55	949	28.46	12661	37	15.33	10081	949 to 1393	65.91	34864
60	949	26.05	13562	38	14.81	10424	949 to 1395	61.67	36709
65	949	23.25	14183	38	14.43	10571	949 to 1395	57.09	37828
70	949	20.19	14589	38	14.41	10522	949 to 1395	52.78	38312
75	949	17.02	14641	38	14.78	10275	949 to 1395	48.96	37967
80	949	13.86	14405	38	15.52	9835	949 to 1394	45.80	36887
85	949	14.42	13842	37	16.62	9203	949 to 1393	48.46	35024
90	949	19.41	12904	36	18.04	8384	949 to 1391	57.87	32320
95	949	24.71	11631	34	19.74	7386	949 to 1389	68.17	28841
100	949	30.15	10015	33	21.67	6216	949 to 1386	79.05	24589
105	949	35.69	8027	31	23.75	4899	949 to 1383	90.36	19567
110	949	41.29	5682	29	25.62	3417	949 to 1380	101.37	13765
115	949	46.68	3012	27	28.06	1779	949 to 1377	113.07	7242
120	949	52.11	0	25	30.29	0	949 to 1373	124.45	0

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 47 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 47

INPUT DATA

Applied Load = 21064 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.078
 Radius CL = 58.2 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1321	0.00	0	7	0.00	0	1321 to 1863	0.00	0
5	1321	7.90	241	7	2.46	64	1321 to 1863	15.26	446
10	1321	14.85	907	7	4.74	265	1321 to 1862	28.86	1722
15	1321	20.76	1909	7	5.91	590	1321 to 1862	39.13	3676
20	1321	25.58	3151	7	6.83	958	1321 to 1863	47.44	6040
25	1321	29.28	4641	8	6.90	1322	1321 to 1864	52.74	8745
30	1321	31.87	6230	8	6.83	1657	1321 to 1865	56.24	11540
35	1321	33.37	7797	9	6.38	2020	1321 to 1866	57.57	14350
40	1321	33.86	9401	10	5.84	2341	1321 to 1867	57.33	17142
45	1321	33.41	10889	10	5.32	2610	1321 to 1868	55.82	19682
50	1321	32.13	12241	10	4.87	2824	1321 to 1868	53.27	21940
55	1321	30.15	13412	11	4.53	2983	1321 to 1869	49.92	23849
60	1321	27.60	14367	11	4.38	3085	1321 to 1869	46.10	25359
65	1321	24.63	15025	11	4.27	3128	1321 to 1869	41.75	26354
70	1321	21.39	15455	11	4.26	3113	1321 to 1869	37.20	26930
75	1321	18.03	15510	11	4.37	3041	1321 to 1869	32.68	26884
80	1321	14.68	15260	11	4.59	2910	1321 to 1869	28.37	26312
85	1321	15.28	14663	11	4.92	2723	1321 to 1868	29.75	25159
90	1321	20.57	13670	10	5.34	2481	1321 to 1868	37.88	23356
95	1321	26.18	12322	10	5.84	2185	1321 to 1867	46.58	20967
100	1321	31.94	10609	9	6.41	1839	1321 to 1867	55.62	17980
105	1321	37.81	8503	9	7.03	1450	1321 to 1866	64.89	14370
110	1321	43.74	6020	8	7.58	1011	1321 to 1865	74.13	10147
115	1321	49.45	3191	8	8.30	526	1321 to 1864	83.35	5362
120	1321	55.20	0	7	8.96	0	1321 to 1863	92.53	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 48 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 48

INPUT DATA

Applied Load = 20241 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 620 lb./ft.

Variation Factor = 1.082
 Radius CL = 58.2 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1274	0.00	0	7	0.00	0	1274 to 1797	0.00	0
5	1274	7.98	243	7	2.46	64	1274 to 1797	15.37	449
10	1274	15.00	916	7	4.74	265	1274 to 1797	29.07	1735
15	1274	20.98	1929	7	5.91	590	1274 to 1797	39.42	3704
20	1274	25.85	3183	7	6.83	958	1274 to 1797	47.81	6085
25	1274	29.58	4688	8	6.90	1322	1274 to 1798	53.16	8812
30	1274	32.19	6294	8	6.83	1657	1274 to 1799	56.69	11629
35	1274	33.71	7877	9	6.38	2020	1274 to 1800	58.05	14462
40	1274	34.20	9497	10	5.84	2341	1274 to 1801	57.82	17276
45	1274	33.75	11000	10	5.32	2610	1274 to 1802	56.29	19837
50	1274	32.45	12366	10	4.87	2824	1274 to 1802	53.73	22115
55	1274	30.45	13549	11	4.53	2983	1274 to 1803	50.35	24041
60	1274	27.88	14514	11	4.38	3085	1274 to 1803	46.49	25564
65	1274	24.88	15178	11	4.27	3128	1274 to 1803	42.10	26568
70	1274	21.61	15612	11	4.26	3113	1274 to 1803	37.51	27151
75	1274	18.21	15669	11	4.37	3041	1274 to 1803	32.94	27106
80	1274	14.83	15416	11	4.59	2910	1274 to 1803	28.58	26530
85	1274	15.43	14813	11	4.92	2723	1274 to 1803	29.97	25368
90	1274	20.78	13809	10	5.34	2481	1274 to 1802	38.17	23552
95	1274	26.44	12448	10	5.84	2185	1274 to 1802	46.96	21143
100	1274	32.26	10718	9	6.41	1839	1274 to 1801	56.07	18132
105	1274	38.19	8590	9	7.03	1450	1274 to 1800	65.43	14491
110	1274	44.18	6081	8	7.58	1011	1274 to 1799	74.75	10233
115	1274	49.95	3223	8	8.30	526	1274 to 1798	84.06	5408
120	1274	55.77	0	7	8.96	0	1274 to 1797	93.31	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 49 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 49

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	181	0.00	0	3	0.00	0	181 to 260	0.00	0
5	181	3.54	45	3	0.44	3	181 to 260	5.71	69
10	181	6.65	169	3	0.83	16	181 to 260	10.73	265
15	181	9.30	356	3	1.17	40	181 to 260	15.02	568
20	181	11.46	588	3	1.44	72	181 to 260	18.51	946
25	181	13.12	866	3	1.64	111	181 to 260	21.16	1403
30	181	14.28	1163	3	1.77	154	181 to 260	23.00	1890
35	181	14.95	1456	3	1.81	196	181 to 260	24.02	2373
40	181	15.17	1755	3	1.80	240	181 to 260	24.31	2866
45	181	14.97	2033	3	1.84	282	181 to 260	24.10	3327
50	181	14.40	2285	4	1.71	320	181 to 261	23.07	3744
55	181	13.51	2504	4	1.55	350	181 to 261	21.55	4101
60	181	12.37	2682	4	1.39	372	181 to 261	19.69	4389
65	181	11.04	2805	4	1.27	391	181 to 261	17.63	4593
70	181	9.58	2886	4	1.20	400	181 to 261	15.47	4721
75	181	8.08	2896	4	1.19	400	181 to 261	13.34	4736
80	181	6.58	2849	4	1.24	391	181 to 261	11.33	4654
85	181	6.84	2738	4	1.36	372	181 to 261	11.90	4466
90	181	9.21	2552	4	1.58	344	181 to 261	15.60	4159
95	181	11.73	2300	4	1.62	307	181 to 261	19.19	3743
100	181	14.31	1981	4	1.96	262	181 to 261	23.38	3219
105	181	16.94	1587	4	2.28	209	181 to 261	27.61	2578
110	181	19.60	1124	3	2.59	147	181 to 260	31.85	1824
115	181	22.16	595	3	2.90	77	181 to 260	35.96	965
120	181	24.74	0	3	3.19	0	181 to 260	40.06	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 50 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 50INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	221	0.00	0	3	0.00	0	221 to 316	0.00	0
5	221	3.30	41	3	0.44	3	221 to 316	5.37	65
10	221	6.20	157	3	0.83	16	221 to 316	10.10	249
15	221	8.67	332	3	1.17	40	221 to 316	14.14	534
20	221	10.68	548	3	1.44	72	221 to 315	17.41	890
25	221	12.23	807	3	1.64	111	221 to 315	19.91	1320
30	221	13.31	1084	3	1.77	154	221 to 316	21.64	1779
35	221	13.94	1356	3	1.81	196	221 to 316	22.60	2234
40	221	14.14	1636	3	1.80	240	221 to 316	22.86	2699
45	221	13.95	1894	3	1.84	282	221 to 316	22.67	3133
50	221	13.42	2130	4	1.71	320	221 to 317	21.69	3526
55	221	12.59	2334	4	1.55	350	221 to 317	20.26	3863
60	221	11.52	2500	4	1.39	372	221 to 317	18.52	4134
65	221	10.28	2614	4	1.27	391	221 to 317	16.58	4326
70	221	8.93	2689	4	1.20	400	221 to 317	14.56	4446
75	221	7.53	2699	4	1.19	400	221 to 317	12.57	4460
80	221	6.13	2655	4	1.24	391	221 to 317	10.70	4382
85	221	6.38	2551	4	1.36	372	221 to 317	11.24	4205
90	221	8.59	2378	4	1.58	344	221 to 317	14.72	3915
95	221	10.93	2144	4	1.62	307	221 to 317	18.07	3524
100	221	13.34	1846	4	1.96	262	221 to 317	22.01	3030
105	221	15.79	1479	4	2.28	209	221 to 317	25.99	2427
110	221	18.26	1047	3	2.59	147	221 to 316	29.99	1717
115	221	20.65	555	3	2.90	77	221 to 316	33.85	909
120	221	23.05	0	3	3.19	0	221 to 316	37.70	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 51 OF _____
 CHKD. BY: _____ DATE: _____ _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 51INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	394	0.00	0	11	0.00	0	394 to 571	0.00	0
5	394	3.25	41	11	1.47	12	394 to 571	7.06	79
10	394	6.11	155	11	2.78	55	394 to 571	13.29	312
15	394	8.55	327	11	3.92	136	394 to 571	18.63	690
20	394	10.53	540	11	4.82	241	394 to 571	22.95	1167
25	394	12.05	796	11	5.47	372	394 to 571	26.19	1747
30	394	13.12	1068	11	5.91	514	394 to 571	28.42	2370
35	394	13.74	1337	12	6.05	657	394 to 572	29.53	2990
40	394	13.94	1612	12	6.02	802	394 to 573	29.75	3622
45	394	13.75	1868	13	6.16	944	394 to 574	29.73	4220
50	394	13.22	2100	13	5.71	1068	394 to 574	28.23	4756
55	394	12.41	2300	14	5.18	1168	394 to 575	26.18	5208
60	394	11.36	2464	14	4.67	1244	394 to 576	23.85	5566
65	394	10.14	2577	14	4.27	1306	394 to 577	21.46	5829
70	394	8.81	2651	15	4.02	1337	394 to 577	19.18	5985
75	394	7.42	2660	15	3.97	1337	394 to 577	17.15	5998
80	394	6.04	2617	15	4.16	1305	394 to 577	15.54	5884
85	394	6.29	2515	15	4.54	1242	394 to 577	16.53	5634
90	394	8.47	2345	14	5.30	1149	394 to 576	20.87	5236
95	394	10.77	2113	14	5.43	1025	394 to 576	24.33	4703
100	394	13.15	1820	14	6.55	875	394 to 575	29.56	4036
105	394	15.56	1458	13	7.62	698	394 to 575	34.76	3229
110	394	18.00	1032	13	8.66	491	394 to 574	39.94	2281
115	394	20.36	547	12	9.69	258	394 to 573	44.98	1205
120	394	22.72	0	11	10.65	0	394 to 571	49.93	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 52 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 52INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	446	0.00	0	11	0.00	0	446 to 645	0.00	0
5	446	3.20	40	11	1.47	12	446 to 645	6.99	78
10	446	6.02	153	11	2.78	55	446 to 645	13.16	309
15	446	8.42	322	11	3.92	136	446 to 645	18.45	683
20	446	10.37	532	11	4.82	241	446 to 645	22.72	1156
25	446	11.87	784	11	5.47	372	446 to 645	25.93	1731
30	446	12.92	1052	11	5.91	514	446 to 645	28.14	2347
35	446	13.53	1317	12	6.05	657	446 to 646	29.24	2962
40	446	13.73	1588	12	6.02	802	446 to 647	29.46	3588
45	446	13.54	1839	13	6.16	944	446 to 648	29.44	4181
50	446	13.03	2068	13	5.71	1068	446 to 649	27.95	4711
55	446	12.22	2266	14	5.18	1168	446 to 649	25.92	5160
60	446	11.19	2427	14	4.67	1244	446 to 650	23.61	5514
65	446	9.99	2538	14	4.27	1306	446 to 651	21.24	5775
70	446	8.67	2611	15	4.02	1337	446 to 651	18.99	5929
75	446	7.31	2620	15	3.97	1337	446 to 651	16.99	5942
80	446	5.95	2578	15	4.16	1305	446 to 651	15.41	5829
85	446	6.19	2477	15	4.54	1242	446 to 651	16.39	5581
90	446	8.34	2309	14	5.30	1149	446 to 651	20.69	5187
95	446	10.61	2082	14	5.43	1025	446 to 650	24.10	4658
100	446	12.95	1792	14	6.55	875	446 to 649	29.28	3998
105	446	15.33	1436	13	7.62	698	446 to 649	34.43	3198
110	446	17.73	1017	13	8.66	491	446 to 648	39.56	2260
115	446	20.05	539	12	9.69	258	446 to 647	44.55	1194
120	446	22.38	0	11	10.65	0	446 to 645	49.45	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 53 OF _____
 CHKD. BY: _____ DATE: _____ _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 53INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	477	0.00	0	7	0.00	0	477 to 682	0.00	0
5	477	2.61	33	7	0.99	8	477 to 682	5.35	60
10	477	4.91	125	7	1.87	37	477 to 681	10.07	239
15	477	6.87	263	7	2.64	91	477 to 681	14.11	524
20	477	8.47	434	7	3.24	162	477 to 681	17.38	885
25	477	9.69	640	7	3.68	250	477 to 681	19.84	1322
30	477	10.55	859	7	3.98	346	477 to 682	21.54	1791
35	477	11.04	1075	8	4.08	442	477 to 682	22.40	2258
40	477	11.20	1296	8	4.05	540	477 to 683	22.59	2734
45	477	11.06	1502	8	4.15	636	477 to 683	22.54	3184
50	477	10.63	1688	9	3.84	719	477 to 684	21.43	3587
55	477	9.98	1850	9	3.49	787	477 to 684	19.90	3928
60	477	9.13	1981	9	3.14	838	477 to 685	18.14	4199
65	477	8.15	2072	10	2.87	880	477 to 685	16.30	4397
70	477	7.08	2131	10	2.71	900	477 to 685	14.53	4516
75	477	5.97	2139	10	2.67	900	477 to 685	12.91	4526
80	477	4.86	2104	10	2.80	879	477 to 685	11.57	4442
85	477	5.05	2022	10	3.06	837	477 to 685	12.28	4254
90	477	6.81	1885	10	3.57	774	477 to 685	15.60	3956
95	477	8.66	1699	9	3.66	691	477 to 685	18.36	3554
100	477	10.57	1463	9	4.41	589	477 to 684	22.31	3051
105	477	12.51	1172	9	5.13	470	477 to 684	26.26	2441
110	477	14.48	830	8	5.83	331	477 to 683	30.19	1725
115	477	16.37	440	8	6.53	174	477 to 682	34.02	912
120	477	18.27	0	7	7.17	0	477 to 682	37.78	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 54 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 54INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 24.25 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	467	0.00	0	7	0.00	0	467 to 667	0.00	0
5	467	2.62	33	7	0.99	8	467 to 667	5.36	61
10	467	4.93	125	7	1.87	37	467 to 667	10.09	239
15	467	6.90	264	7	2.64	91	467 to 667	14.15	526
20	467	8.50	436	7	3.24	162	467 to 667	17.42	887
25	467	9.73	642	7	3.68	250	467 to 667	19.89	1326
30	467	10.59	862	7	3.98	346	467 to 667	21.59	1796
35	467	11.09	1079	8	4.08	442	467 to 667	22.46	2264
40	467	11.25	1301	8	4.05	540	467 to 668	22.64	2741
45	467	11.10	1507	8	4.15	636	467 to 668	22.59	3192
50	467	10.67	1694	9	3.84	719	467 to 669	21.48	3596
55	467	10.01	1856	9	3.49	787	467 to 670	19.95	3938
60	467	9.17	1989	9	3.14	838	467 to 670	18.19	4209
65	467	8.18	2080	10	2.87	880	467 to 670	16.35	4408
70	467	7.11	2139	10	2.71	900	467 to 671	14.56	4527
75	467	5.99	2147	10	2.67	900	467 to 671	12.94	4537
80	467	4.88	2112	10	2.80	879	467 to 671	11.60	4452
85	467	5.07	2030	10	3.06	837	467 to 671	12.31	4265
90	467	6.83	1892	10	3.57	774	467 to 670	15.64	3965
95	467	8.69	1705	9	3.66	691	467 to 670	18.40	3563
100	467	10.61	1468	9	4.41	589	467 to 670	22.36	3059
105	467	12.56	1177	9	5.13	470	467 to 669	26.32	2447
110	467	14.53	833	8	5.83	331	467 to 668	30.27	1730
115	467	16.43	441	8	6.53	174	467 to 668	34.10	914
120	467	18.34	0	7	7.17	0	467 to 667	37.88	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 55 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 55INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	217	0.00	0	3	0.00	0	217 to 311	0.00	0
5	217	4.25	64	3	0.42	5	217 to 311	6.67	99
10	217	7.98	244	3	1.06	26	217 to 311	12.99	386
15	217	11.16	513	3	1.38	62	217 to 311	17.99	824
20	217	13.76	847	3	1.83	109	217 to 311	22.38	1372
25	217	15.75	1248	3	1.99	166	217 to 311	25.43	2031
30	217	17.14	1675	4	2.21	227	217 to 311	27.76	2732
35	217	17.95	2096	4	2.20	288	217 to 312	28.88	3425
40	217	18.21	2528	4	2.22	352	217 to 312	29.27	4139
45	217	17.96	2927	4	2.08	411	217 to 312	28.70	4799
50	217	17.28	3291	4	1.98	462	217 to 312	27.56	5394
55	217	16.21	3606	4	1.75	502	217 to 313	25.68	5904
60	217	14.84	3863	4	1.64	534	217 to 313	23.57	6316
65	217	13.24	4040	5	1.56	558	217 to 313	21.20	6605
70	217	11.50	4155	5	1.45	569	217 to 313	18.57	6786
75	217	9.69	4170	5	1.54	567	217 to 313	16.19	6803
80	217	7.89	4103	5	1.55	552	217 to 313	13.69	6684
85	217	8.21	3943	5	1.76	524	217 to 313	14.51	6412
90	217	11.06	3675	5	1.79	484	217 to 313	18.53	5969
95	217	14.08	3313	4	1.92	431	217 to 313	22.99	5372
100	217	17.17	2852	4	2.31	367	217 to 313	27.98	4617
105	217	20.33	2286	4	2.67	291	217 to 312	33.02	3697
110	217	23.52	1618	4	3.02	205	217 to 312	38.07	2615
115	217	26.59	858	4	3.37	107	217 to 312	42.97	1384
120	217	29.69	0	3	3.70	0	217 to 311	47.85	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 56 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 56INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	265	0.00	0	3	0.00	0	265 to 378	0.00	0
5	265	3.96	60	3	0.42	5	265 to 378	6.27	93
10	265	7.44	227	3	1.06	26	265 to 378	12.23	363
15	265	10.40	478	3	1.38	62	265 to 378	16.93	775
20	265	12.82	789	3	1.83	109	265 to 378	21.06	1292
25	265	14.67	1163	3	1.99	166	265 to 378	23.93	1912
30	265	15.97	1561	4	2.21	227	265 to 378	26.13	2573
35	265	16.72	1954	4	2.20	288	265 to 379	27.17	3226
40	265	16.97	2355	4	2.22	352	265 to 379	27.54	3898
45	265	16.74	2728	4	2.08	411	265 to 379	26.99	4520
50	265	16.10	3067	4	1.98	462	265 to 380	25.91	5081
55	265	15.11	3361	4	1.75	502	265 to 380	24.13	5560
60	265	13.83	3600	4	1.64	534	265 to 380	22.15	5948
65	265	12.34	3765	5	1.56	558	265 to 380	19.94	6220
70	265	10.72	3873	5	1.45	569	265 to 380	17.48	6390
75	265	9.03	3886	5	1.54	567	265 to 380	15.27	6406
80	265	7.36	3824	5	1.55	552	265 to 380	12.94	6293
85	265	7.65	3674	5	1.76	524	265 to 380	13.73	6036
90	265	10.31	3425	5	1.79	484	265 to 380	17.48	5619
95	265	13.12	3087	4	1.92	431	265 to 380	21.65	5057
100	265	16.00	2658	4	2.31	367	265 to 380	26.34	4346
105	265	18.95	2130	4	2.67	291	265 to 379	31.08	3479
110	265	21.92	1508	4	3.02	205	265 to 379	35.83	2461
115	265	24.78	799	4	3.37	107	265 to 379	40.43	1302
120	265	27.66	0	3	3.70	0	265 to 378	45.02	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 57 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 57INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	472	0.00	0	13	0.00	0	472 to 684	0.00	0
5	472	3.90	59	13	1.42	16	472 to 684	7.89	111
10	472	7.33	224	13	3.55	87	472 to 684	16.32	462
15	472	10.26	471	13	4.62	207	472 to 684	22.23	1013
20	472	12.64	778	12	6.11	366	472 to 684	28.09	1712
25	472	14.47	1146	13	6.64	557	472 to 684	31.56	2552
30	472	15.74	1539	13	7.39	760	472 to 684	34.62	3448
35	472	16.49	1926	13	7.37	962	472 to 685	35.62	4333
40	472	16.72	2322	14	7.43	1177	472 to 686	36.05	5253
45	472	16.50	2689	15	6.96	1374	472 to 687	34.94	6102
50	472	15.87	3024	15	6.62	1543	472 to 688	33.48	6857
55	472	14.89	3313	16	5.85	1678	472 to 689	30.81	7492
60	472	13.63	3549	16	5.47	1783	472 to 690	28.40	8000
65	472	12.17	3711	17	5.22	1863	472 to 690	25.92	8363
70	472	10.57	3817	17	4.84	1900	472 to 691	23.03	8575
75	472	8.91	3831	17	5.14	1893	472 to 691	21.21	8584
80	472	7.25	3769	17	5.18	1844	472 to 691	18.97	8412
85	472	7.54	3622	17	5.90	1751	472 to 691	20.61	8049
90	472	10.16	3376	16	5.98	1616	472 to 690	24.39	7476
95	472	12.93	3043	16	6.43	1440	472 to 690	29.05	6711
100	472	15.78	2620	16	7.72	1225	472 to 689	35.22	5751
105	472	18.68	2100	15	8.94	974	472 to 688	41.36	4597
110	472	21.61	1487	14	10.10	685	472 to 687	47.42	3247
115	472	24.43	788	14	11.26	360	472 to 685	53.35	1715
120	472	27.27	0	13	12.35	0	472 to 684	59.18	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 58 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 58INPUT DATA

Applied Load = 16832 lb./ft.
 Arc subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	536	0.00	0	13	0.00	0	536 to 773	0.00	0
5	536	3.84	58	13	1.42	16	536 to 773	7.81	110
10	536	7.22	220	13	3.55	87	536 to 773	16.17	457
15	536	10.10	464	13	4.62	207	536 to 773	22.01	1003
20	536	12.45	766	12	6.11	366	536 to 772	27.82	1696
25	536	14.25	1129	13	6.64	557	536 to 773	31.25	2528
30	536	15.51	1515	13	7.39	760	536 to 773	34.29	3415
35	536	16.24	1897	13	7.37	962	536 to 774	35.27	4293
40	536	16.47	2287	14	7.43	1177	536 to 775	35.70	5204
45	536	16.25	2649	15	6.96	1374	536 to 776	34.60	6045
50	536	15.63	2978	15	6.62	1543	536 to 777	33.14	6793
55	536	14.67	3263	16	5.85	1678	536 to 778	30.50	7422
60	536	13.43	3495	16	5.47	1783	536 to 779	28.12	7925
65	536	11.98	3655	17	5.22	1863	536 to 779	25.66	8285
70	536	10.41	3760	17	4.84	1900	536 to 780	22.80	8495
75	536	8.77	3773	17	5.14	1893	536 to 780	21.02	8503
80	536	7.14	3713	17	5.18	1844	536 to 780	18.82	8333
85	536	7.43	3567	17	5.90	1751	536 to 780	20.45	7972
90	536	10.01	3326	16	5.98	1616	536 to 779	24.18	7405
95	536	12.74	2998	16	6.43	1440	536 to 778	28.78	6646
100	536	15.54	2581	16	7.72	1225	536 to 778	34.88	5696
105	536	18.40	2069	15	8.94	974	536 to 777	40.96	4553
110	536	21.28	1464	14	10.10	685	536 to 776	46.97	3216
115	536	24.06	776	14	11.26	360	536 to 774	52.84	1699
120	536	26.86	0	13	12.35	0	536 to 773	58.60	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____ SHT. NO.: RAC - 59 OF _____
 CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 59INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	573	0.00	0	8	0.00	0	573 to 817	0.00	0
5	573	3.14	47	8	0.96	11	573 to 817	6.03	86
10	573	5.90	180	8	2.39	58	573 to 817	12.33	352
15	573	8.25	379	8	3.11	139	573 to 817	16.85	768
20	573	10.16	625	8	4.11	246	573 to 817	21.23	1295
25	573	11.63	921	8	4.47	375	573 to 817	23.90	1928
30	573	12.66	1237	9	4.98	512	573 to 817	26.19	2603
35	573	13.25	1548	9	4.96	648	573 to 818	27.00	3271
40	573	13.45	1867	9	5.00	793	573 to 818	27.34	3963
45	573	13.27	2162	10	4.69	925	573 to 819	26.55	4602
50	573	12.76	2431	10	4.46	1039	573 to 820	25.45	5171
55	573	11.97	2664	10	3.94	1130	573 to 820	23.47	5651
60	573	10.96	2853	11	3.69	1201	573 to 821	21.62	6037
65	573	9.78	2984	11	3.51	1255	573 to 821	19.68	6311
70	573	8.50	3069	11	3.26	1280	573 to 822	17.44	6473
75	573	7.16	3080	11	3.46	1275	573 to 822	15.91	6482
80	573	5.83	3031	11	3.49	1242	573 to 822	14.10	6355
85	573	6.07	2912	11	3.97	1179	573 to 821	15.26	6083
90	573	8.17	2715	11	4.02	1089	573 to 821	18.29	5653
95	573	10.40	2447	11	4.33	970	573 to 821	21.93	5076
100	573	12.68	2107	10	5.20	825	573 to 820	26.60	4353
105	573	15.02	1689	10	6.02	656	573 to 819	31.27	3480
110	573	17.37	1195	9	6.80	461	573 to 819	35.89	2459
115	573	19.64	633	9	7.58	242	573 to 818	40.40	1299
120	573	21.93	0	8	8.32	0	573 to 817	44.84	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-08-2006 SUBJECT _____

SHT. NO.: RAC - 60 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 60INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 29.1 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	560	0.00	0	8	0.00	0	560 to 799	0.00	0
5	560	3.15	48	8	0.96	11	560 to 799	6.04	86
10	560	5.92	180	8	2.39	58	560 to 799	12.36	353
15	560	8.28	380	8	3.11	139	560 to 799	16.89	770
20	560	10.20	628	8	4.11	246	560 to 799	21.28	1298
25	560	11.67	925	8	4.47	375	560 to 799	23.96	1933
30	560	12.70	1242	9	4.98	512	560 to 799	26.26	2610
35	560	13.30	1554	9	4.96	648	560 to 800	27.07	3279
40	560	13.50	1874	9	5.00	793	560 to 801	27.41	3972
45	560	13.32	2170	10	4.69	925	560 to 801	26.62	4613
50	560	12.81	2440	10	4.46	1039	560 to 802	25.51	5184
55	560	12.02	2673	10	3.94	1130	560 to 803	23.53	5665
60	560	11.00	2864	11	3.69	1201	560 to 803	21.68	6052
65	560	9.82	2995	11	3.51	1255	560 to 804	19.73	6327
70	560	8.53	3081	11	3.26	1280	560 to 804	17.48	6489
75	560	7.19	3092	11	3.46	1275	560 to 804	15.95	6497
80	560	5.85	3042	11	3.49	1242	560 to 804	14.13	6371
85	560	6.09	2923	11	3.97	1179	560 to 804	15.29	6098
90	560	8.20	2725	11	4.02	1089	560 to 803	18.33	5667
95	560	10.43	2456	11	4.33	970	560 to 803	21.98	5089
100	560	12.73	2115	10	5.20	825	560 to 802	26.67	4364
105	560	15.07	1695	10	6.02	656	560 to 802	31.35	3489
110	560	17.44	1200	9	6.80	461	560 to 801	35.98	2465
115	560	19.71	636	9	7.58	242	560 to 800	40.50	1303
120	560	22.01	0	8	8.32	0	560 to 799	44.96	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 61 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 61

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 33.95 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	254	0.00	0	4	0.00	0	254 to 363	0.00	0
5	254	4.95	88	4	0.41	7	254 to 363	7.64	135
10	254	9.32	332	4	1.04	38	254 to 363	14.83	529
15	254	13.03	698	4	1.60	87	254 to 363	20.96	1127
20	254	16.05	1153	4	2.01	154	254 to 363	25.90	1878
25	254	18.37	1698	4	2.33	233	254 to 363	29.70	2774
30	254	19.99	2280	4	2.49	315	254 to 363	32.24	3728
35	254	20.94	2853	4	2.58	398	254 to 363	33.70	4672
40	254	21.24	3440	4	2.51	484	254 to 364	34.02	5640
45	254	20.96	3985	5	2.40	561	254 to 364	33.44	6533
50	254	20.16	4480	5	2.23	626	254 to 364	32.02	7337
55	254	18.91	4909	5	2.03	677	254 to 365	29.95	8025
60	254	17.31	5258	5	1.86	718	254 to 365	27.41	8582
65	254	15.45	5499	5	1.73	747	254 to 365	24.59	8969
70	254	13.42	5656	5	1.69	760	254 to 365	21.67	9211
75	254	11.31	5676	5	1.73	756	254 to 365	18.78	9232
80	254	9.21	5585	5	1.83	734	254 to 365	16.01	9068
85	254	9.58	5366	5	2.00	696	254 to 365	16.82	8698
90	254	12.90	5003	5	2.22	642	254 to 365	21.85	8096
95	254	16.42	4509	5	2.32	571	254 to 365	26.94	7285
100	254	20.04	3883	5	2.63	485	254 to 364	32.54	6261
105	254	23.72	3112	5	3.04	384	254 to 364	38.39	5010
110	254	27.44	2203	4	3.43	269	254 to 364	44.25	3543
115	254	31.02	1167	4	3.80	141	254 to 363	49.90	1875
120	254	34.63	0	4	4.16	0	254 to 363	55.56	0

HAKIMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 62 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 62

INPUT DATA

Applied Load = 7486 lb./ft.
Arc Subtended = 120 degrees
Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
Radius CL = 33.95 feet
Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	310	0.00	0	4	0.00	0	310 to 441	0.00	0
5	310	4.62	82	4	0.41	7	310 to 441	7.17	127
10	310	8.68	309	4	1.04	38	310 to 441	13.94	498
15	310	12.14	651	4	1.60	87	310 to 441	19.72	1060
20	310	14.96	1074	4	2.01	154	310 to 441	24.37	1768
25	310	17.12	1583	4	2.33	233	310 to 441	27.95	2612
30	310	18.63	2125	4	2.49	315	310 to 441	30.33	3510
35	310	19.51	2659	4	2.58	398	310 to 441	31.71	4400
40	310	19.79	3206	4	2.51	484	310 to 442	31.99	5312
45	310	19.53	3714	5	2.40	561	310 to 442	31.44	6153
50	310	18.78	4175	5	2.23	626	310 to 443	30.10	6910
55	310	17.62	4574	5	2.03	677	310 to 443	28.14	7557
60	310	16.14	4900	5	1.86	718	310 to 443	25.76	8081
65	310	14.40	5125	5	1.73	747	310 to 443	23.11	8446
70	310	12.51	5271	5	1.69	760	310 to 443	20.39	8672
75	310	10.54	5290	5	1.73	756	310 to 443	17.70	8692
80	310	8.58	5205	5	1.83	734	310 to 443	15.14	8536
85	310	8.93	5001	5	2.00	696	310 to 443	15.90	8186
90	310	12.02	4662	5	2.22	642	310 to 443	20.62	7619
95	310	15.30	4203	5	2.32	571	310 to 443	25.37	6855
100	310	18.67	3618	5	2.63	485	310 to 443	30.63	5891
105	310	22.11	2900	5	3.04	384	310 to 442	36.13	4714
110	310	25.57	2053	4	3.43	269	310 to 442	41.63	3333
115	310	28.91	1088	4	3.80	141	310 to 441	46.94	1764
120	310	32.28	0	4	4.16	0	310 to 441	52.26	0

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 63 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 63INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 33.95 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	551	0.00	0	14	0.00	0	551 to 797	0.00	0
5	551	4.55	81	14	1.38	24	551 to 796	8.73	154
10	551	8.56	305	14	3.50	126	551 to 796	17.94	643
15	551	11.97	642	14	5.35	292	551 to 796	25.85	1396
20	551	14.74	1059	14	6.73	517	551 to 796	32.09	2362
25	551	16.88	1560	14	7.80	778	551 to 796	36.90	3507
30	551	18.37	2094	14	8.33	1051	551 to 797	39.89	4721
35	551	19.23	2621	15	8.61	1329	551 to 798	41.57	5930
40	551	19.51	3161	16	8.39	1615	551 to 799	41.60	7172
45	551	19.25	3661	16	8.03	1873	551 to 801	40.62	8310
50	551	18.52	4116	17	7.46	2091	551 to 802	38.61	9317
55	551	17.37	4509	18	6.80	2262	551 to 803	35.90	10160
60	551	15.91	4831	18	6.21	2396	551 to 803	32.84	10838
65	551	14.20	5052	18	5.79	2495	551 to 804	29.72	11315
70	551	12.33	5196	19	5.64	2537	551 to 804	26.86	11589
75	551	10.39	5215	19	5.77	2523	551 to 805	24.37	11591
80	551	8.46	5131	19	6.12	2452	551 to 805	22.25	11352
85	551	8.80	4930	19	6.67	2325	551 to 804	23.68	10855
90	551	11.85	4596	18	7.42	2143	551 to 804	29.22	10078
95	551	15.09	4143	18	7.74	1907	551 to 803	34.29	9043
100	551	18.41	3567	17	8.80	1620	551 to 802	40.73	7748
105	551	21.79	2859	17	10.16	1282	551 to 801	47.79	6183
110	551	25.21	2024	16	11.44	901	551 to 799	54.76	4365
115	551	28.50	1072	15	12.68	472	551 to 798	61.47	2305
120	551	31.82	0	14	13.89	0	551 to 797	68.16	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 64 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 64

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 33.95 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	625	0.00	0	14	0.00	0	625 to 900	0.00	0
5	625	4.48	79	14	1.38	24	625 to 900	8.64	153
10	625	8.43	300	14	3.50	126	625 to 900	17.76	636
15	625	11.79	632	14	5.35	292	625 to 900	25.60	1382
20	625	14.52	1043	14	6.73	517	625 to 900	31.78	2340
25	625	16.62	1537	14	7.80	778	625 to 900	36.54	3474
30	625	18.09	2063	14	8.33	1051	625 to 901	39.50	4676
35	625	18.94	2582	15	8.61	1329	625 to 902	41.17	5875
40	625	19.22	3113	16	8.39	1615	625 to 903	41.19	7105
45	625	18.96	3606	16	8.03	1873	625 to 904	40.22	8233
50	625	18.24	4054	17	7.46	2091	625 to 905	38.22	9230
55	625	17.11	4442	18	6.80	2262	625 to 906	35.53	10065
60	625	15.67	4758	18	6.21	2396	625 to 907	32.51	10736
65	625	13.98	4976	18	5.79	2495	625 to 908	29.42	11208
70	625	12.14	5118	19	5.64	2537	625 to 908	26.60	11480
75	625	10.23	5136	19	5.77	2523	625 to 908	24.15	11481
80	625	8.33	5053	19	6.12	2452	625 to 908	22.08	11244
85	625	8.67	4856	19	6.67	2325	625 to 908	23.49	10752
90	625	11.67	4527	18	7.42	2143	625 to 907	28.97	9981
95	625	14.86	4080	18	7.74	1907	625 to 907	33.97	8956
100	625	18.13	3513	17	8.80	1620	625 to 906	40.34	7673
105	625	21.46	2816	17	10.16	1282	625 to 904	47.33	6123
110	625	24.83	1993	16	11.44	901	625 to 903	54.23	4323
115	625	28.07	1056	15	12.68	472	625 to 902	60.87	2283
120	625	31.34	0	14	13.89	0	625 to 900	67.49	0

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 65 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 65INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 33.95 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	668	0.00	0	9	0.00	0	668 to 952	0.00	0
5	668	3.66	65	9	0.93	16	668 to 952	6.71	119
10	668	6.88	245	9	2.36	85	668 to 952	13.65	488
15	668	9.62	516	9	3.60	197	668 to 952	19.60	1057
20	668	11.85	851	9	4.53	348	668 to 952	24.31	1784
25	668	13.57	1254	9	5.25	524	668 to 952	27.94	2647
30	668	14.77	1684	9	5.61	708	668 to 952	30.23	3562
35	668	15.46	2108	10	5.80	895	668 to 953	31.52	4473
40	668	15.69	2541	10	5.65	1088	668 to 954	31.59	5408
45	668	15.48	2943	11	5.41	1261	668 to 955	30.88	6266
50	668	14.89	3309	11	5.02	1408	668 to 956	29.39	7028
55	668	13.97	3626	12	4.58	1524	668 to 956	27.35	7667
60	668	12.79	3884	12	4.18	1614	668 to 957	25.03	8183
65	668	11.41	4062	12	3.90	1681	668 to 957	22.61	8544
70	668	9.91	4178	12	3.80	1709	668 to 957	20.35	8756
75	668	8.35	4193	12	3.88	1699	668 to 958	18.31	8760
80	668	6.80	4125	12	4.12	1651	668 to 957	16.54	8584
85	668	7.08	3964	12	4.49	1566	668 to 957	17.56	8213
90	668	9.53	3695	12	5.00	1443	668 to 957	21.85	7628
95	668	12.13	3331	12	5.21	1285	668 to 956	25.85	6848
100	668	14.80	2868	11	5.92	1091	668 to 956	30.80	5870
105	668	17.52	2299	11	6.84	864	668 to 955	36.17	4687
110	668	20.27	1627	10	7.71	606	668 to 954	41.49	3310
115	668	22.92	862	10	8.54	318	668 to 953	46.61	1749
120	668	25.58	0	9	9.35	0	668 to 952	51.72	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 66 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 66

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 33.95 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	653	0.00	0	9	0.00	0	653 to 931	0.00	0
5	653	3.67	65	9	0.93	16	653 to 931	6.73	119
10	653	6.91	246	9	2.36	85	653 to 931	13.68	490
15	653	9.66	518	9	3.60	197	653 to 931	19.65	1060
20	653	11.90	855	9	4.53	348	653 to 931	24.37	1789
25	653	13.62	1259	9	5.25	524	653 to 931	28.01	2654
30	653	14.82	1690	9	5.61	708	653 to 932	30.30	3571
35	653	15.52	2115	10	5.80	895	653 to 933	31.60	4484
40	653	15.75	2551	10	5.65	1088	653 to 933	31.67	5422
45	653	15.54	2954	11	5.41	1261	653 to 934	30.96	6281
50	653	14.94	3321	11	5.02	1408	653 to 935	29.47	7045
55	653	14.02	3639	12	4.58	1524	653 to 936	27.43	7686
60	653	12.84	3898	12	4.18	1614	653 to 936	25.09	8203
65	653	11.46	4077	12	3.90	1681	653 to 937	22.67	8565
70	653	9.95	4193	12	3.80	1709	653 to 937	20.40	8777
75	653	8.38	4208	12	3.88	1699	653 to 937	18.35	8782
80	653	6.83	4140	12	4.12	1651	653 to 937	16.57	8605
85	653	7.10	3979	12	4.49	1566	653 to 937	17.59	8233
90	653	9.56	3709	12	5.00	1443	653 to 936	21.90	7647
95	653	12.17	3343	12	5.21	1285	653 to 936	25.92	6865
100	653	14.85	2879	11	5.92	1091	653 to 935	30.88	5885
105	653	17.58	2307	11	6.84	864	653 to 934	36.26	4699
110	653	20.34	1633	10	7.71	606	653 to 933	41.59	3318
115	653	23.00	865	10	8.54	318	653 to 932	46.73	1753
120	653	25.68	0	9	9.35	0	653 to 931	51.86	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 67 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 67

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	290	0.00	0	4	0.00	0	290 to 414	0.00	0
5	290	5.66	115	4	0.69	10	290 to 414	9.11	179
10	290	10.65	433	4	1.28	52	290 to 414	17.09	696
15	290	14.89	912	4	2.05	118	290 to 414	24.34	1478
20	290	18.34	1506	4	2.39	207	290 to 414	29.75	2462
25	290	21.00	2218	4	2.67	309	290 to 414	33.95	3632
30	290	22.85	2978	4	2.91	414	290 to 414	36.95	4875
35	290	23.93	3727	5	2.92	524	290 to 415	38.48	6109
40	290	24.28	4494	5	2.90	632	290 to 415	38.93	7367
45	290	23.95	5205	5	2.69	729	290 to 416	38.12	8527
50	290	23.04	5852	5	2.46	810	290 to 416	36.44	9570
55	290	21.61	6411	5	2.28	873	290 to 416	34.15	10461
60	290	19.79	6868	6	2.06	921	290 to 417	31.21	11182
65	290	17.66	7182	6	1.99	957	290 to 417	28.13	11682
70	290	15.34	7388	6	1.92	971	290 to 417	24.74	11994
75	290	12.93	7414	6	1.91	963	290 to 417	21.35	12019
80	290	10.53	7294	6	2.08	935	290 to 417	18.29	11802
85	290	10.95	7009	6	2.21	885	290 to 417	19.10	11319
90	290	14.75	6534	6	2.40	815	290 to 417	24.74	10534
95	290	18.77	5890	5	2.76	724	290 to 416	30.99	9479
100	290	22.90	5071	5	2.93	615	290 to 416	37.05	8146
105	290	27.11	4065	5	3.38	486	290 to 416	43.71	6518
110	290	31.36	2877	5	3.80	340	290 to 415	50.37	4607
115	290	35.46	1525	4	4.19	178	290 to 415	56.77	2438
120	290	39.58	0	4	4.57	0	290 to 414	63.20	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 68 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 68

INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	354	0.00	0	4	0.00	0	354 to 504	0.00	0
5	354	5.28	107	4	0.69	10	354 to 504	8.57	168
10	354	9.92	404	4	1.28	52	354 to 503	16.07	654
15	354	13.87	850	4	2.05	118	354 to 503	22.93	1392
20	354	17.10	1403	4	2.39	207	354 to 503	28.01	2318
25	354	19.57	2067	4	2.67	309	354 to 504	31.95	3421
30	354	21.30	2775	4	2.91	414	354 to 504	34.77	4591
35	354	22.30	3473	5	2.92	524	354 to 504	36.20	5754
40	354	22.62	4188	5	2.90	632	354 to 505	36.62	6939
45	354	22.32	4851	5	2.69	729	354 to 505	35.83	8031
50	354	21.47	5453	5	2.46	810	354 to 505	34.25	9013
55	354	20.14	5975	5	2.28	873	354 to 506	32.09	9850
60	354	18.44	6400	6	2.06	921	354 to 506	29.33	10528
65	354	16.46	6693	6	1.99	957	354 to 506	26.44	10998
70	354	14.29	6885	6	1.92	971	354 to 506	23.28	11290
75	354	12.05	6910	6	1.91	963	354 to 506	20.12	11312
80	354	9.81	6798	6	2.08	935	354 to 506	17.29	11107
85	354	10.21	6532	6	2.21	885	354 to 506	18.06	10651
90	354	13.74	6090	6	2.40	815	354 to 506	23.33	9912
95	354	17.49	5489	5	2.76	724	354 to 506	29.20	8917
100	354	21.34	4726	5	2.93	615	354 to 505	34.87	7663
105	354	25.26	3788	5	3.38	486	354 to 505	41.12	6131
110	354	29.23	2682	5	3.80	340	354 to 505	47.38	4333
115	354	33.04	1421	4	4.19	178	354 to 504	53.39	2293
120	354	36.89	0	4	4.57	0	354 to 504	59.43	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 69 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 69

INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	630	0.00	0	15	0.00	0	630 to 909	0.00	0
5	630	5.20	105	15	2.30	36	630 to 909	11.21	210
10	630	9.78	398	15	4.27	174	630 to 908	20.97	854
15	630	13.68	838	15	6.87	394	630 to 908	30.83	1844
20	630	16.85	1383	15	7.99	693	630 to 908	37.18	3116
25	630	19.29	2038	15	8.93	1033	630 to 909	42.19	4609
30	630	20.99	2736	16	9.73	1384	630 to 910	45.94	6185
35	630	21.98	3424	16	9.77	1749	630 to 911	47.39	7767
40	630	22.30	4128	17	9.70	2112	630 to 912	47.73	9371
45	630	22.00	4782	18	8.99	2435	630 to 914	46.10	10834
50	630	21.16	5376	19	8.22	2704	630 to 915	43.62	12125
55	630	19.86	5890	19	7.62	2914	630 to 916	40.77	13201
60	630	18.18	6309	20	6.88	3076	630 to 917	37.16	14064
65	630	16.22	6598	20	6.67	3194	630 to 917	34.06	14668
70	630	14.09	6787	20	6.41	3241	630 to 918	30.63	15012
75	630	11.88	6811	20	6.38	3216	630 to 918	27.48	15005
80	630	9.67	6701	20	6.97	3121	630 to 918	25.39	14689
85	630	10.06	6439	20	7.40	2956	630 to 917	26.67	14041
90	630	13.55	6003	20	8.03	2721	630 to 917	32.63	13031
95	630	17.24	5411	19	9.24	2419	630 to 916	39.85	11689
100	630	21.04	4659	19	9.80	2053	630 to 915	46.12	10013
105	630	24.90	3734	18	11.29	1624	630 to 913	54.06	7989
110	630	28.81	2643	17	12.69	1136	630 to 912	61.92	5633
115	630	32.57	1401	16	14.00	594	630 to 910	69.41	2973
120	630	36.36	0	15	15.28	0	630 to 909	76.89	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 70 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 70

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	715	0.00	0	15	0.00	0	715 to 1027	0.00	0
5	715	5.12	104	15	2.30	36	715 to 1027	11.10	208
10	715	9.63	392	15	4.27	174	715 to 1027	20.76	845
15	715	13.47	826	15	6.87	394	715 to 1027	30.54	1827
20	715	16.60	1362	15	7.99	693	715 to 1027	36.83	3087
25	715	19.00	2007	15	8.93	1033	715 to 1027	41.78	4566
30	715	20.68	2695	16	9.73	1384	715 to 1028	45.50	6127
35	715	21.65	3372	16	9.77	1749	715 to 1029	46.93	7695
40	715	21.97	4066	17	9.70	2112	715 to 1031	47.26	9284
45	715	21.67	4710	18	8.99	2435	715 to 1032	45.64	10734
50	715	20.84	5295	19	8.22	2704	715 to 1033	43.17	12011
55	715	19.56	5801	19	7.62	2914	715 to 1035	40.35	13077
60	715	17.91	6214	20	6.88	3076	715 to 1035	36.78	13931
65	715	15.98	6499	20	6.67	3194	715 to 1036	33.72	14529
70	715	13.88	6685	20	6.41	3241	715 to 1036	30.33	14869
75	715	11.70	6709	20	6.38	3216	715 to 1036	27.23	14861
80	715	9.52	6600	20	6.97	3121	715 to 1036	25.19	14548
85	715	9.91	6342	20	7.40	2956	715 to 1036	26.46	13905
90	715	13.34	5913	20	8.03	2721	715 to 1035	32.34	12904
95	715	16.98	5330	19	9.24	2419	715 to 1034	39.49	11575
100	715	20.72	4589	19	9.80	2053	715 to 1033	45.67	9915
105	715	24.53	3678	18	11.29	1624	715 to 1032	53.54	7910
110	715	28.38	2604	17	12.69	1136	715 to 1030	61.31	5577
115	715	32.08	1380	16	14.00	594	715 to 1029	68.72	2943
120	715	35.82	0	15	15.28	0	715 to 1027	76.13	0

BY: RJH

DATE: 03-09-2006

SUBJECT _____

SHT. NO.: RAC - 71 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 71INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	764	0.00	0	10	0.00	0	764 to 1087	0.00	0
5	764	4.18	85	10	1.55	24	764 to 1087	8.50	161
10	764	7.86	320	10	2.88	117	764 to 1087	15.91	648
15	764	11.00	674	10	4.62	265	764 to 1087	23.26	1395
20	764	13.55	1112	10	5.38	467	764 to 1087	28.13	2352
25	764	15.51	1639	10	6.01	695	764 to 1087	31.94	3477
30	764	16.88	2200	10	6.55	932	764 to 1088	34.78	4666
35	764	17.67	2753	11	6.58	1178	764 to 1088	35.94	5857
40	764	17.93	3319	11	6.53	1422	764 to 1089	36.22	7066
45	764	17.69	3845	12	6.06	1640	764 to 1090	35.07	8171
50	764	17.01	4322	12	5.54	1822	764 to 1091	33.25	9149
55	764	15.97	4736	13	5.13	1963	764 to 1092	31.09	9968
60	764	14.62	5073	13	4.63	2072	764 to 1092	28.35	10626
65	764	13.04	5305	13	4.49	2151	764 to 1093	25.91	11086
70	764	11.33	5457	14	4.31	2183	764 to 1093	23.21	11352
75	764	9.55	5477	14	4.29	2166	764 to 1093	20.68	11351
80	764	7.77	5388	14	4.69	2102	764 to 1093	18.87	11119
85	764	8.09	5178	13	4.98	1991	764 to 1093	19.80	10634
90	764	10.89	4827	13	5.41	1833	764 to 1092	24.45	9874
95	764	13.86	4351	13	6.22	1629	764 to 1092	29.99	8862
100	764	16.91	3746	12	6.60	1382	764 to 1091	34.91	7596
105	764	20.02	3002	12	7.60	1094	764 to 1090	40.97	6064
110	764	23.16	2125	11	8.55	765	764 to 1089	46.97	4277
115	764	26.19	1126	11	9.43	400	764 to 1088	52.70	2258
120	764	29.24	0	10	10.29	0	764 to 1087	58.44	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 72 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 72

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 38.8 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	747	0.00	0	10	0.00	0	747 to 1063	0.00	0
5	747	4.20	85	10	1.55	24	747 to 1063	8.52	161
10	747	7.89	321	10	2.88	117	747 to 1063	15.95	649
15	747	11.04	676	10	4.62	265	747 to 1063	23.32	1399
20	747	13.60	1116	10	5.38	467	747 to 1063	28.19	2358
25	747	15.57	1645	10	6.01	695	747 to 1063	32.02	3486
30	747	16.94	2208	10	6.55	932	747 to 1064	34.87	4677
35	747	17.74	2763	11	6.58	1178	747 to 1065	36.03	5872
40	747	18.00	3332	11	6.53	1422	747 to 1066	36.31	7083
45	747	17.76	3859	12	6.06	1640	747 to 1067	35.16	8191
50	747	17.08	4338	12	5.54	1822	747 to 1068	33.33	9171
55	747	16.02	4753	13	5.13	1963	747 to 1068	31.17	9992
60	747	14.67	5092	13	4.63	2072	747 to 1069	28.43	10652
65	747	13.09	5325	13	4.49	2151	747 to 1069	25.97	11113
70	747	11.37	5477	14	4.31	2183	747 to 1070	23.26	11380
75	747	9.58	5497	14	4.29	2166	747 to 1070	20.73	11380
80	747	7.80	5408	14	4.69	2102	747 to 1070	18.91	11146
85	747	8.12	5197	13	4.98	1991	747 to 1069	19.85	10661
90	747	10.93	4845	13	5.41	1833	747 to 1069	24.51	9899
95	747	13.91	4367	13	6.22	1629	747 to 1068	30.07	8885
100	747	16.98	3760	12	6.60	1382	747 to 1068	34.99	7615
105	747	20.10	3013	12	7.60	1094	747 to 1067	41.07	6079
110	747	23.25	2133	11	8.55	765	747 to 1066	47.09	4288
115	747	26.29	1131	11	9.43	400	747 to 1065	52.84	2264
120	747	29.35	0	10	10.29	0	747 to 1063	58.59	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 73 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 73

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	326	0.00	0	4	0.00	0	326 to 465	0.00	0
5	326	6.37	145	4	0.68	14	326 to 465	10.08	229
10	326	11.98	549	4	1.53	68	326 to 465	19.38	885
15	326	16.75	1155	4	2.27	153	326 to 465	27.32	1879
20	326	20.64	1906	4	2.79	267	326 to 465	33.64	3124
25	326	23.62	2808	4	3.16	395	326 to 465	38.45	4604
30	326	25.71	3769	5	3.17	526	326 to 466	41.38	6172
35	326	26.92	4717	5	3.25	664	326 to 466	43.22	7733
40	326	27.31	5688	5	3.15	797	326 to 467	43.61	9319
45	326	26.95	6587	5	2.95	915	326 to 467	42.76	10779
50	326	25.92	7406	6	2.73	1012	326 to 468	40.93	12090
55	326	24.32	8114	6	2.44	1087	326 to 468	38.20	13209
60	326	22.26	8692	6	2.24	1142	326 to 468	34.98	14112
65	326	19.87	9090	6	2.14	1183	326 to 468	31.47	14739
70	326	17.26	9350	6	2.13	1199	326 to 468	27.78	15129
75	326	14.54	9384	6	2.18	1188	326 to 468	24.08	15158
80	326	11.84	9232	6	2.21	1151	326 to 468	20.35	14883
85	326	12.32	8871	6	2.42	1089	326 to 468	21.37	14272
90	326	16.59	8270	6	2.68	1002	326 to 468	27.80	13282
95	326	21.12	7455	6	3.01	890	326 to 468	34.69	11950
100	326	25.76	6419	6	3.21	754	326 to 467	41.53	10269
105	326	30.50	5144	5	3.69	596	326 to 467	48.98	8217
110	326	35.28	3642	5	4.14	417	326 to 466	56.45	5808
115	326	39.89	1930	5	4.57	217	326 to 466	63.62	3073
120	326	44.53	0	4	4.95	0	326 to 465	70.77	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 74 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 74

INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	398	0.00	0	4	0.00	0	398 to 566	0.00	0
5	398	5.94	135	4	0.68	14	398 to 566	9.48	215
10	398	11.16	511	4	1.53	68	398 to 566	18.24	832
15	398	15.61	1076	4	2.27	153	398 to 566	25.72	1769
20	398	19.23	1776	4	2.79	267	398 to 566	31.67	2943
25	398	22.01	2617	4	3.16	395	398 to 566	36.20	4336
30	398	23.96	3513	5	3.17	526	398 to 566	38.94	5813
35	398	25.09	4396	5	3.25	664	398 to 567	40.65	7284
40	398	25.45	5300	5	3.15	797	398 to 567	41.01	8777
45	398	25.11	6139	5	2.95	915	398 to 568	40.19	10151
50	398	24.15	6902	6	2.73	1012	398 to 568	38.46	11384
55	398	22.66	7562	6	2.44	1087	398 to 569	35.88	12436
60	398	20.75	8101	6	2.24	1142	398 to 569	32.86	13284
65	398	18.52	8471	6	2.14	1183	398 to 569	29.58	13873
70	398	16.08	8714	6	2.13	1199	398 to 569	26.14	14238
75	398	13.55	8745	6	2.18	1188	398 to 569	22.70	14264
80	398	11.04	8604	6	2.21	1151	398 to 569	19.22	14004
85	398	11.48	8268	6	2.42	1089	398 to 569	20.19	13427
90	398	15.46	7707	6	2.68	1002	398 to 569	26.22	12494
95	398	19.68	6947	6	3.01	890	398 to 568	32.68	11240
100	398	24.01	5982	6	3.21	754	398 to 568	39.08	9658
105	398	28.42	4794	5	3.69	596	398 to 568	46.08	7727
110	398	32.88	3394	5	4.14	417	398 to 567	53.09	5461
115	398	37.17	1799	5	4.57	217	398 to 567	59.82	2889
120	398	41.50	0	4	4.95	0	398 to 566	66.53	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 75 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 75

INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	709	0.00	0	16	0.00	0	709 to 1021	0.00	0
5	709	5.85	133	16	2.28	49	709 to 1020	12.07	271
10	709	11.00	504	16	5.12	228	709 to 1020	24.12	1094
15	709	15.39	1061	16	7.58	513	709 to 1020	34.44	2359
20	709	18.96	1751	16	9.31	894	709 to 1020	42.38	3972
25	709	21.70	2579	16	10.56	1321	709 to 1021	48.34	5857
30	709	23.62	3463	17	10.58	1757	709 to 1022	51.06	7835
35	709	24.73	4334	18	10.85	2217	709 to 1023	53.08	9836
40	709	25.09	5225	19	10.54	2663	709 to 1025	53.06	11843
45	709	24.76	6052	20	9.87	3054	709 to 1027	51.44	13666
50	709	23.81	6804	20	9.11	3378	709 to 1028	48.83	15270
55	709	22.34	7455	21	8.15	3628	709 to 1029	45.14	16605
60	709	20.45	7985	21	7.48	3814	709 to 1030	41.37	17665
65	709	18.25	8351	22	7.17	3951	709 to 1031	37.75	18409
70	709	15.85	8590	22	7.11	4002	709 to 1031	34.29	18830
75	709	13.36	8621	22	7.30	3966	709 to 1031	31.12	18812
80	709	10.88	8481	22	7.40	3844	709 to 1031	27.82	18410
85	709	11.32	8150	22	8.08	3636	709 to 1030	29.59	17592
90	709	15.24	7598	21	8.97	3344	709 to 1030	36.60	16323
95	709	19.40	6848	21	10.06	2971	709 to 1029	44.27	14640
100	709	23.67	5897	20	10.72	2519	709 to 1027	51.38	12539
105	709	28.02	4726	19	12.33	1991	709 to 1026	60.20	10003
110	709	32.41	3346	18	13.84	1393	709 to 1024	68.92	7052
115	709	36.64	1773	17	15.25	727	709 to 1022	77.24	3719
120	709	40.91	0	16	16.54	0	709 to 1021	85.41	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 76 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 76

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	804	0.00	0	16	0.00	0	804 to 1154	0.00	0
5	804	5.76	131	16	2.28	49	804 to 1154	11.95	268
10	804	10.84	496	16	5.12	228	804 to 1154	23.88	1083
15	804	15.16	1045	16	7.58	513	804 to 1153	34.12	2337
20	804	18.67	1725	16	9.31	894	804 to 1153	41.98	3935
25	804	21.37	2540	16	10.56	1321	804 to 1154	47.88	5803
30	804	23.26	3410	17	10.58	1757	804 to 1155	50.57	7762
35	804	24.36	4268	18	10.85	2217	804 to 1157	52.55	9745
40	804	24.71	5146	19	10.54	2663	804 to 1158	52.53	11732
45	804	24.38	5961	20	9.87	3054	804 to 1160	50.92	13538
50	804	23.45	6701	20	9.11	3378	804 to 1161	48.33	15126
55	804	22.00	7342	21	8.15	3628	804 to 1162	44.67	16448
60	804	20.14	7865	21	7.48	3814	804 to 1163	40.94	17496
65	804	17.98	8225	22	7.17	3951	804 to 1164	37.37	18233
70	804	15.61	8461	22	7.11	4002	804 to 1164	33.95	18649
75	804	13.16	8491	22	7.30	3966	804 to 1164	30.84	18631
80	804	10.72	8354	22	7.40	3844	804 to 1164	27.59	18231
85	804	11.15	8027	22	8.08	3636	804 to 1164	29.35	17420
90	804	15.01	7483	21	8.97	3344	804 to 1163	36.28	16163
95	804	19.11	6745	21	10.06	2971	804 to 1162	43.86	14495
100	804	23.31	5808	20	10.72	2519	804 to 1161	50.88	12414
105	804	27.60	4655	19	12.33	1991	804 to 1159	59.61	9903
110	804	31.92	3295	18	13.84	1393	804 to 1158	68.24	6982
115	804	36.09	1746	17	15.25	727	804 to 1156	76.47	3682
120	804	40.29	0	16	16.54	0	804 to 1154	84.55	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 77 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 77

INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	859	0.00	0	11	0.00	0	859 to 1222	0.00	0
5	859	4.71	107	11	1.53	33	859 to 1222	9.20	207
10	859	8.85	405	10	3.45	153	859 to 1222	18.25	829
15	859	12.37	853	10	5.11	346	859 to 1221	26.01	1783
20	859	15.24	1408	10	6.27	602	859 to 1221	32.01	2995
25	859	17.45	2074	11	7.11	889	859 to 1222	36.53	4417
30	859	18.99	2784	11	7.13	1183	859 to 1223	38.71	5910
35	859	19.88	3484	12	7.31	1493	859 to 1224	40.27	7417
40	859	20.17	4201	12	7.10	1793	859 to 1225	40.32	8932
45	859	19.90	4866	13	6.65	2057	859 to 1226	39.17	10311
50	859	19.14	5471	14	6.14	2276	859 to 1227	37.24	11528
55	859	17.96	5994	14	5.49	2444	859 to 1227	34.49	12547
60	859	16.44	6421	14	5.04	2569	859 to 1228	31.60	13358
65	859	14.68	6715	15	4.83	2661	859 to 1228	28.77	13926
70	859	12.75	6907	15	4.79	2696	859 to 1229	25.99	14253
75	859	10.74	6932	15	4.91	2671	859 to 1229	23.40	14247
80	859	8.75	6820	15	4.98	2589	859 to 1228	20.72	13950
85	859	9.10	6553	14	5.44	2449	859 to 1228	22.00	13339
90	859	12.25	6109	14	6.04	2253	859 to 1228	27.44	12383
95	859	15.60	5507	14	6.78	2001	859 to 1227	33.36	11112
100	859	19.03	4741	13	7.22	1697	859 to 1226	38.93	9523
105	859	22.53	3800	13	8.30	1341	859 to 1225	45.67	7601
110	859	26.06	2690	12	9.32	938	859 to 1224	52.35	5362
115	859	29.46	1426	11	10.27	489	859 to 1223	58.72	2829
120	859	32.89	0	11	11.14	0	859 to 1222	65.00	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 78 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 78

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 43.65 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	840	0.00	0	11	0.00	0	840 to 1195	0.00	0
5	840	4.72	108	11	1.53	33	840 to 1195	9.22	207
10	840	8.88	407	10	3.45	153	840 to 1195	18.30	831
15	840	12.42	856	10	5.11	346	840 to 1195	26.07	1787
20	840	15.30	1413	10	6.27	602	840 to 1195	32.09	3003
25	840	17.51	2081	11	7.11	889	840 to 1195	36.62	4427
30	840	19.06	2794	11	7.13	1183	840 to 1196	38.81	5924
35	840	19.96	3497	12	7.31	1493	840 to 1197	40.37	7435
40	840	20.25	4217	12	7.10	1793	840 to 1198	40.42	8953
45	840	19.98	4884	13	6.65	2057	840 to 1199	39.28	10336
50	840	19.21	5491	14	6.14	2276	840 to 1200	37.34	11557
55	840	18.03	6016	14	5.49	2444	840 to 1201	34.58	12578
60	840	16.50	6444	14	5.04	2569	840 to 1202	31.68	13391
65	840	14.73	6739	15	4.83	2661	840 to 1202	28.84	13960
70	840	12.79	6932	15	4.79	2696	840 to 1202	26.06	14289
75	840	10.78	6957	15	4.91	2671	840 to 1202	23.46	14282
80	840	8.78	6845	15	4.98	2589	840 to 1202	20.77	13985
85	840	9.13	6577	14	5.44	2449	840 to 1202	22.04	13372
90	840	12.30	6131	14	6.04	2253	840 to 1201	27.50	12415
95	840	15.65	5527	14	6.78	2001	840 to 1201	33.44	11141
100	840	19.10	4759	13	7.22	1697	840 to 1200	39.03	9547
105	840	22.61	3814	13	8.30	1341	840 to 1199	45.78	7621
110	840	26.16	2700	12	9.32	938	840 to 1198	52.48	5375
115	840	29.57	1431	11	10.27	489	840 to 1197	58.87	2837
120	840	33.01	0	11	11.14	0	840 to 1195	65.17	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 79 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 79

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	363	0.00	0	5	0.00	0	363 to 517	0.00	0
5	363	7.08	180	5	0.95	19	363 to 517	11.54	284
10	363	13.31	678	5	1.78	86	363 to 517	21.67	1096
15	363	18.61	1426	5	2.48	194	363 to 516	30.29	2327
20	363	22.93	2353	5	2.95	335	363 to 516	37.13	3865
25	363	26.25	3466	5	3.47	491	363 to 517	42.65	5689
30	363	28.56	4653	5	3.57	649	363 to 517	46.06	7618
35	363	29.91	5824	5	3.55	817	363 to 518	47.91	9544
40	363	30.35	7022	6	3.39	977	363 to 518	48.26	11493
45	363	29.94	8133	6	3.21	1116	363 to 519	47.38	13284
50	363	28.80	9143	6	2.91	1230	363 to 519	45.27	14893
55	363	27.02	10018	6	2.64	1318	363 to 519	42.33	16266
60	363	24.74	10731	7	2.43	1379	363 to 520	38.77	17368
65	363	22.08	11222	7	2.38	1426	363 to 520	34.96	18136
70	363	19.17	11544	7	2.32	1442	363 to 520	30.79	18613
75	363	16.16	11585	7	2.34	1427	363 to 520	26.61	18646
80	363	13.16	11398	7	2.43	1382	363 to 520	22.57	18307
85	363	13.69	10952	7	2.60	1306	363 to 520	23.61	17554
90	363	18.43	10210	6	2.98	1200	363 to 520	30.88	16336
95	363	23.46	9203	6	3.24	1066	363 to 519	38.36	14697
100	363	28.63	7924	6	3.47	903	363 to 519	45.98	12630
105	363	33.89	6351	6	3.98	713	363 to 518	54.22	10105
110	363	39.20	4496	5	4.46	498	363 to 518	62.48	7143
115	363	44.32	2383	5	4.91	260	363 to 517	70.41	3779
120	363	49.48	0	5	5.33	0	363 to 517	78.33	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 80 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 80

INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	442	0.00	0	5	0.00	0	442 to 628	0.00	0
5	442	6.60	167	5	0.95	19	442 to 628	10.86	267
10	442	12.40	631	5	1.78	86	442 to 628	20.41	1031
15	442	17.34	1329	5	2.48	194	442 to 628	28.51	2191
20	442	21.37	2193	5	2.95	335	442 to 628	34.95	3640
25	442	24.46	3231	5	3.47	491	442 to 629	40.15	5359
30	442	26.62	4337	5	3.57	649	442 to 629	43.34	7175
35	442	27.88	5427	5	3.55	817	442 to 629	45.06	8989
40	442	28.28	6544	6	3.39	977	442 to 630	45.37	10824
45	442	27.90	7579	6	3.21	1116	442 to 630	44.53	12510
50	442	26.84	8521	6	2.91	1230	442 to 631	42.53	14022
55	442	25.18	9336	6	2.64	1318	442 to 631	39.75	15312
60	442	23.05	10001	7	2.43	1379	442 to 632	36.41	16346
65	442	20.57	10459	7	2.38	1426	442 to 632	32.85	17067
70	442	17.87	10758	7	2.32	1442	442 to 632	28.97	17513
75	442	15.06	10797	7	2.34	1427	442 to 632	25.07	17542
80	442	12.26	10622	7	2.43	1382	442 to 632	21.32	17221
85	442	12.76	10207	7	2.60	1306	442 to 632	22.30	16511
90	442	17.18	9515	6	2.98	1200	442 to 631	29.13	15363
95	442	21.87	8577	6	3.24	1066	442 to 631	36.12	13820
100	442	26.68	7385	6	3.47	903	442 to 631	43.25	11875
105	442	31.58	5919	6	3.98	713	442 to 630	50.99	9500
110	442	36.53	4190	5	4.46	498	442 to 630	58.75	6715
115	442	41.30	2221	5	4.91	260	442 to 629	66.19	3552
120	442	46.11	0	5	5.33	0	442 to 628	73.62	0

BY: RJH

DATE: 03-09-2006

SUBJECT _____

SHT. NO.: RAC - 81 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 81INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	788	0.00	0	17	0.00	0	788 to 1132	0.00	0
5	788	6.50	165	17	3.18	64	788 to 1132	14.53	341
10	788	12.23	622	17	5.96	288	788 to 1132	27.26	1362
15	788	17.10	1310	16	8.30	648	788 to 1132	38.05	2936
20	788	21.07	2162	17	9.87	1119	788 to 1132	46.28	4929
25	788	24.11	3184	17	11.58	1640	788 to 1133	53.45	7248
30	788	26.24	4275	18	11.92	2166	788 to 1134	57.01	9669
35	788	27.48	5350	19	11.85	2729	788 to 1136	58.62	12131
40	788	27.88	6451	20	11.33	3262	788 to 1137	58.29	14578
45	788	27.51	7472	21	10.72	3726	788 to 1139	56.75	16796
50	788	26.45	8400	22	9.73	4107	788 to 1141	53.59	18743
55	788	24.82	9203	22	8.82	4399	788 to 1142	49.76	20364
60	788	22.73	9859	23	8.11	4602	788 to 1143	45.62	21627
65	788	20.28	10310	23	7.94	4759	788 to 1143	41.91	22526
70	788	17.62	10605	24	7.75	4814	788 to 1144	37.84	23031
75	788	14.85	10643	24	7.81	4765	788 to 1144	34.07	23001
80	788	12.09	10471	23	8.14	4613	788 to 1143	30.77	22503
85	788	12.58	10062	23	8.71	4360	788 to 1143	32.42	21499
90	788	16.94	9380	23	9.95	4007	788 to 1142	40.64	19945
95	788	21.55	8455	22	10.81	3558	788 to 1141	48.57	17886
100	788	26.30	7280	21	11.58	3014	788 to 1140	56.52	15317
105	788	31.13	5835	20	13.30	2382	788 to 1138	66.20	12219
110	788	36.01	4131	19	14.91	1665	788 to 1136	75.78	8614
115	788	40.72	2189	18	16.41	869	788 to 1134	84.91	4543
120	788	45.45	0	17	17.79	0	788 to 1132	93.88	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 82 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 82

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	893	0.00	0	17	0.00	0	893 to 1280	0.00	0
5	893	6.41	162	17	3.18	64	893 to 1280	14.39	337
10	893	12.04	613	17	5.96	288	893 to 1280	27.00	1349
15	893	16.84	1290	16	8.30	648	893 to 1280	37.69	2908
20	893	20.75	2129	17	9.87	1119	893 to 1280	45.83	4883
25	893	23.75	3137	17	11.58	1640	893 to 1281	52.94	7181
30	893	25.85	4210	18	11.92	2166	893 to 1282	56.45	9578
35	893	27.07	5270	19	11.85	2729	893 to 1284	58.04	12018
40	893	27.46	6354	20	11.33	3262	893 to 1286	57.71	14442
45	893	27.09	7359	21	10.72	3726	893 to 1287	56.17	16639
50	893	26.06	8273	22	9.73	4107	893 to 1289	53.03	18566
55	893	24.45	9065	22	8.82	4399	893 to 1290	49.24	20170
60	893	22.38	9710	23	8.11	4602	893 to 1291	45.14	21420
65	893	19.98	10155	23	7.94	4759	893 to 1291	41.48	22308
70	893	17.35	10445	24	7.75	4814	893 to 1292	37.47	22807
75	893	14.62	10483	24	7.81	4765	893 to 1292	33.76	22777
80	893	11.91	10313	23	8.14	4613	893 to 1291	30.51	22282
85	893	12.39	9910	23	8.71	4360	893 to 1291	32.15	21287
90	893	16.68	9239	23	9.95	4007	893 to 1290	40.29	19748
95	893	21.23	8328	22	10.81	3558	893 to 1289	48.11	17708
100	893	25.90	7170	21	11.58	3014	893 to 1288	55.97	15164
105	893	30.66	5747	20	13.30	2382	893 to 1286	65.55	12096
110	893	35.47	4068	19	14.91	1665	893 to 1284	75.02	8527
115	893	40.10	2156	18	16.41	869	893 to 1283	84.05	4497
120	893	44.77	0	17	17.79	0	893 to 1280	92.92	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 83 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 83

INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	955	0.00	0	11	0.00	0	955 to 1356	0.00	0
5	955	5.23	132	11	2.14	43	955 to 1356	10.97	259
10	955	9.83	500	11	4.01	194	955 to 1356	20.60	1031
15	955	13.75	1053	11	5.59	436	955 to 1356	28.75	2217
20	955	16.94	1738	11	6.64	753	955 to 1356	35.02	3715
25	955	19.39	2560	11	7.80	1105	955 to 1357	40.41	5464
30	955	21.10	3437	12	8.03	1459	955 to 1358	43.19	7294
35	955	22.09	4302	13	7.98	1838	955 to 1359	44.51	9149
40	955	22.41	5187	13	7.63	2197	955 to 1360	44.36	10998
45	955	22.12	6008	14	7.22	2510	955 to 1361	43.25	12679
50	955	21.27	6754	14	6.55	2767	955 to 1362	40.93	14160
55	955	19.96	7400	15	5.94	2963	955 to 1363	38.05	15398
60	955	18.27	7927	15	5.46	3100	955 to 1363	34.88	16369
65	955	16.31	8290	16	5.35	3206	955 to 1364	31.93	17057
70	955	14.16	8527	16	5.22	3242	955 to 1364	28.71	17451
75	955	11.94	8558	16	5.26	3209	955 to 1364	25.66	17438
80	955	9.72	8419	16	5.48	3107	955 to 1364	22.93	17071
85	955	10.11	8090	15	5.86	2937	955 to 1363	24.13	16320
90	955	13.62	7542	15	6.70	2699	955 to 1363	30.47	15149
95	955	17.33	6798	15	7.28	2396	955 to 1362	36.65	13592
100	955	21.14	5853	14	7.80	2030	955 to 1361	42.88	11648
105	955	25.03	4691	13	8.96	1604	955 to 1360	50.28	9297
110	955	28.96	3321	13	10.04	1121	955 to 1359	57.62	6557
115	955	32.74	1760	12	11.05	585	955 to 1358	64.63	3460
120	955	36.55	0	11	11.98	0	955 to 1356	71.54	0

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 84 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 84

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 48.5 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	934	0.00	0	11	0.00	0	934 to 1327	0.00	0
5	934	5.25	133	11	2.14	43	934 to 1327	11.00	260
10	934	9.87	502	11	4.01	194	934 to 1327	20.65	1034
15	934	13.80	1057	11	5.59	436	934 to 1327	28.82	2222
20	934	17.00	1744	11	6.64	753	934 to 1327	35.11	3724
25	934	19.46	2570	11	7.80	1105	934 to 1327	40.51	5477
30	934	21.18	3450	12	8.03	1459	934 to 1328	43.30	7311
35	934	22.18	4318	13	7.98	1838	934 to 1329	44.62	9171
40	934	22.50	5206	13	7.63	2197	934 to 1330	44.47	11025
45	934	22.20	6030	14	7.22	2510	934 to 1332	43.36	12709
50	934	21.35	6779	14	6.55	2767	934 to 1333	41.04	14195
55	934	20.03	7427	15	5.94	2963	934 to 1333	38.16	15436
60	934	18.34	7956	15	5.46	3100	934 to 1334	34.97	16410
65	934	16.37	8320	16	5.35	3206	934 to 1334	32.02	17099
70	934	14.22	8558	16	5.22	3242	934 to 1335	28.78	17495
75	934	11.98	8589	16	5.26	3209	934 to 1335	25.73	17482
80	934	9.76	8450	16	5.48	3107	934 to 1334	22.98	17114
85	934	10.15	8120	15	5.86	2937	934 to 1334	24.19	16362
90	934	13.67	7570	15	6.70	2699	934 to 1334	30.54	15187
95	934	17.39	6823	15	7.28	2396	934 to 1333	36.74	13627
100	934	21.22	5875	14	7.80	2030	934 to 1332	42.98	11678
105	934	25.12	4709	13	8.96	1604	934 to 1331	50.41	9321
110	934	29.06	3333	13	10.04	1121	934 to 1330	57.77	6574
115	934	32.86	1767	12	11.05	585	934 to 1328	64.80	3469
120	934	36.68	0	11	11.98	0	934 to 1327	71.73	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 85 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 85

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	399	0.00	0	5	0.00	0	399 to 568	0.00	0
5	399	7.79	217	5	0.94	24	399 to 568	12.52	346
10	399	14.64	820	5	2.03	106	399 to 568	23.97	1329
15	399	20.47	1725	5	2.69	238	399 to 568	33.25	2822
20	399	25.22	2847	5	3.33	409	399 to 568	40.99	4683
25	399	28.87	4194	5	3.76	596	399 to 568	46.82	6886
30	399	31.42	5631	5	3.80	782	399 to 569	50.46	9213
35	399	32.90	7047	6	3.82	983	399 to 569	52.57	11538
40	399	33.38	8496	6	3.69	1170	399 to 570	53.01	13886
45	399	32.94	9841	6	3.36	1332	399 to 570	51.84	16042
50	399	31.68	11064	7	3.09	1464	399 to 571	49.61	17978
55	399	29.72	12122	7	2.85	1564	399 to 571	46.47	19630
60	399	27.21	12985	7	2.66	1632	399 to 571	42.63	20955
65	399	24.29	13579	7	2.51	1681	399 to 571	38.27	21870
70	399	21.09	13968	7	2.49	1698	399 to 572	33.78	22443
75	399	17.78	14018	7	2.48	1679	399 to 572	29.12	22481
80	399	14.48	13792	7	2.63	1624	399 to 571	24.75	22071
85	399	15.06	13252	7	2.90	1534	399 to 571	26.02	21163
90	399	20.28	12354	7	3.12	1409	399 to 571	33.70	19693
95	399	25.81	11136	7	3.53	1250	399 to 571	42.14	17717
100	399	31.49	9588	6	3.86	1059	399 to 570	50.65	15225
105	399	37.28	7685	6	4.25	836	399 to 570	59.42	12182
110	399	43.12	5441	6	4.76	584	399 to 569	68.47	8611
115	399	48.75	2884	5	5.23	305	399 to 569	77.16	4556
120	399	54.43	0	5	5.67	0	399 to 568	85.85	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 86 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 86

INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	487	0.00	0	5	0.00	0	487 to 691	0.00	0
5	487	7.26	203	5	0.94	24	487 to 691	11.78	325
10	487	13.65	764	5	2.03	106	487 to 691	22.57	1251
15	487	19.08	1608	5	2.69	238	487 to 691	31.30	2657
20	487	23.51	2654	5	3.33	409	487 to 691	38.59	4412
25	487	26.91	3909	5	3.76	596	487 to 691	44.07	6487
30	487	29.28	5247	5	3.80	782	487 to 691	47.47	8676
35	487	30.66	6567	6	3.82	983	487 to 692	49.44	10867
40	487	31.11	7918	6	3.69	1170	487 to 693	49.83	13076
45	487	30.69	9171	6	3.36	1332	487 to 693	48.70	15105
50	487	29.52	10311	7	3.09	1464	487 to 694	46.59	16924
55	487	27.70	11297	7	2.85	1564	487 to 694	43.64	18475
60	487	25.36	12101	7	2.66	1632	487 to 694	40.03	19717
65	487	22.63	12655	7	2.51	1681	487 to 694	35.96	20576
70	487	19.66	13017	7	2.49	1698	487 to 695	31.77	21112
75	487	16.57	13064	7	2.48	1679	487 to 695	27.42	21145
80	487	13.49	12853	7	2.63	1624	487 to 694	23.37	20757
85	487	14.04	12351	7	2.90	1534	487 to 694	24.59	19900
90	487	18.90	11514	7	3.12	1409	487 to 694	31.76	18516
95	487	24.05	10378	7	3.53	1250	487 to 694	39.68	16656
100	487	29.35	8936	6	3.86	1059	487 to 693	47.65	14311
105	487	34.74	7162	6	4.25	836	487 to 693	55.87	11450
110	487	40.19	5070	6	4.76	584	487 to 692	64.36	8093
115	487	45.44	2687	5	5.23	305	487 to 692	72.52	4281
120	487	50.72	0	5	5.67	0	487 to 691	80.66	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 87 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 87INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	866	0.00	0	18	0.00	0	866 to 1244	0.00	0
5	866	7.15	200	18	3.16	81	866 to 1244	15.40	419
10	866	13.45	753	17	6.80	355	866 to 1244	30.40	1660
15	866	18.81	1585	17	9.01	796	866 to 1243	41.65	3574
20	866	23.17	2616	17	11.14	1367	866 to 1243	51.39	5987
25	866	26.52	3853	18	12.56	1990	866 to 1245	58.49	8779
30	866	28.87	5173	19	12.69	2611	866 to 1246	62.00	11681
35	866	30.23	6474	20	12.77	3283	866 to 1248	64.03	14646
40	866	30.67	7806	21	12.32	3908	866 to 1250	63.89	17572
45	866	30.26	9041	22	11.24	4446	866 to 1251	61.48	20217
50	866	29.10	10164	23	10.33	4886	866 to 1253	58.32	22537
55	866	27.30	11136	24	9.53	5221	866 to 1254	54.45	24468
60	866	25.00	11929	24	8.89	5449	866 to 1255	50.11	25965
65	866	22.31	12475	25	8.38	5612	866 to 1256	45.49	27006
70	866	19.38	12832	25	8.33	5669	866 to 1256	41.29	27603
75	866	16.33	12878	25	8.30	5606	866 to 1256	36.98	27561
80	866	13.30	12670	25	8.80	5423	866 to 1256	33.58	26959
85	866	13.84	12175	24	9.69	5122	866 to 1255	35.85	25753
90	866	18.63	11350	24	10.41	4705	866 to 1254	43.79	23889
95	866	23.71	10231	23	11.78	4174	866 to 1253	53.23	21421
100	866	28.93	8809	22	12.88	3535	866 to 1252	62.41	18343
105	866	34.25	7060	21	14.19	2792	866 to 1250	72.08	14632
110	866	39.62	4998	20	15.90	1951	866 to 1248	82.50	10315
115	866	44.79	2649	19	17.48	1018	866 to 1246	92.43	5440
120	866	50.00	0	18	18.93	0	866 to 1244	102.20	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 88 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 88

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	983	0.00	0	18	0.00	0	983 to 1407	0.00	0
5	983	7.05	197	18	3.16	81	983 to 1407	15.25	414
10	983	13.25	742	17	6.80	355	983 to 1407	30.11	1644
15	983	18.52	1561	17	9.01	796	983 to 1406	41.25	3541
20	983	22.82	2576	17	11.14	1367	983 to 1406	50.90	5932
25	983	26.13	3795	18	12.56	1990	983 to 1407	57.93	8697
30	983	28.43	5095	19	12.69	2611	983 to 1409	61.39	11572
35	983	29.77	6376	20	12.77	3283	983 to 1411	63.40	14509
40	983	30.20	7688	21	12.32	3908	983 to 1413	63.25	17407
45	983	29.80	8905	22	11.24	4446	983 to 1414	60.84	20026
50	983	28.66	10011	23	10.33	4886	983 to 1416	57.70	22323
55	983	26.89	10968	24	9.53	5221	983 to 1417	53.87	24233
60	983	24.62	11750	24	8.89	5449	983 to 1418	49.59	25713
65	983	21.97	12287	25	8.38	5612	983 to 1419	45.02	26743
70	983	19.09	12639	25	8.33	5669	983 to 1419	40.88	27333
75	983	16.09	12684	25	8.30	5606	983 to 1419	36.63	27289
80	983	13.10	12479	25	8.80	5423	983 to 1419	33.30	26691
85	983	13.63	11991	24	9.69	5122	983 to 1418	35.56	25496
90	983	18.35	11179	24	10.41	4705	983 to 1417	43.40	23650
95	983	23.35	10077	23	11.78	4174	983 to 1416	52.73	21205
100	983	28.49	8676	22	12.88	3535	983 to 1415	61.80	18158
105	983	33.73	6954	21	14.19	2792	983 to 1413	71.36	14483
110	983	39.02	4923	20	15.90	1951	983 to 1411	81.66	10210
115	983	44.11	2609	19	17.48	1018	983 to 1409	91.49	5384
120	983	49.25	0	18	18.93	0	983 to 1407	101.14	0

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 89 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 89

INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1050	0.00	0	12	0.00	0	1050 to 1491	0.00	0
5	1050	5.75	160	12	2.13	55	1050 to 1491	11.68	318
10	1050	10.81	606	12	4.58	239	1050 to 1491	22.93	1255
15	1050	15.12	1274	11	6.06	536	1050 to 1491	31.49	2697
20	1050	18.63	2103	11	7.50	921	1050 to 1491	38.85	4511
25	1050	21.33	3098	12	8.46	1340	1050 to 1491	44.24	6617
30	1050	23.21	4159	13	8.55	1758	1050 to 1492	47.04	8813
35	1050	24.30	5205	13	8.60	2211	1050 to 1494	48.65	11048
40	1050	24.66	6276	14	8.30	2632	1050 to 1495	48.64	13262
45	1050	24.33	7269	15	7.57	2995	1050 to 1496	46.94	15270
50	1050	23.40	8173	15	6.96	3291	1050 to 1497	44.60	17038
55	1050	21.95	8954	16	6.42	3517	1050 to 1498	41.66	18516
60	1050	20.10	9592	16	5.98	3670	1050 to 1499	38.32	19669
65	1050	17.94	10031	16	5.64	3780	1050 to 1499	34.72	20470
70	1050	15.58	10318	17	5.61	3819	1050 to 1499	31.35	20938
75	1050	13.13	10355	17	5.59	3776	1050 to 1499	27.89	20917
80	1050	10.69	10188	16	5.92	3653	1050 to 1499	25.05	20474
85	1050	11.12	9789	16	6.52	3450	1050 to 1499	26.68	19571
90	1050	14.98	9126	16	7.01	3169	1050 to 1498	32.90	18165
95	1050	19.06	8226	15	7.94	2812	1050 to 1497	40.19	16298
100	1050	23.26	7083	15	8.68	2381	1050 to 1496	47.33	13965
105	1050	27.54	5677	14	9.56	1881	1050 to 1495	54.81	11146
110	1050	31.85	4019	13	10.71	1314	1050 to 1494	62.81	7861
115	1050	36.01	2130	13	11.77	685	1050 to 1492	70.44	4148
120	1050	40.20	0	12	12.75	0	1050 to 1491	77.97	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 90 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 90

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 53.35 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1027	0.00	0	12	0.00	0	1027 to 1459	0.00	0
5	1027	5.77	161	12	2.13	55	1027 to 1459	11.71	319
10	1027	10.85	608	12	4.58	239	1027 to 1458	22.99	1259
15	1027	15.18	1279	11	6.06	536	1027 to 1458	31.57	2704
20	1027	18.70	2111	11	7.50	921	1027 to 1458	38.94	4522
25	1027	21.41	3110	12	8.46	1340	1027 to 1459	44.35	6633
30	1027	23.29	4174	13	8.55	1758	1027 to 1460	47.16	8834
35	1027	24.39	5224	13	8.60	2211	1027 to 1461	48.78	11075
40	1027	24.75	6299	14	8.30	2632	1027 to 1463	48.77	13294
45	1027	24.42	7296	15	7.57	2995	1027 to 1464	47.06	15307
50	1027	23.48	8203	15	6.96	3291	1027 to 1465	44.72	17080
55	1027	22.03	8987	16	6.42	3517	1027 to 1466	41.77	18562
60	1027	20.17	9627	16	5.98	3670	1027 to 1466	38.43	19718
65	1027	18.00	10068	16	5.64	3780	1027 to 1467	34.81	20522
70	1027	15.64	10356	17	5.61	3819	1027 to 1467	31.43	20991
75	1027	13.18	10393	17	5.59	3776	1027 to 1467	27.96	20971
80	1027	10.73	10225	16	5.92	3653	1027 to 1467	25.11	20526
85	1027	11.16	9825	16	6.52	3450	1027 to 1466	26.73	19622
90	1027	15.03	9160	16	7.01	3169	1027 to 1466	32.98	18212
95	1027	19.13	8256	15	7.94	2812	1027 to 1465	40.29	16340
100	1027	23.35	7109	15	8.68	2381	1027 to 1464	47.45	14002
105	1027	27.64	5698	14	9.56	1881	1027 to 1463	54.95	11175
110	1027	31.97	4033	13	10.71	1314	1027 to 1461	62.97	7882
115	1027	36.14	2138	13	11.77	685	1027 to 1460	70.63	4159
120	1027	40.35	0	12	12.75	0	1027 to 1459	78.18	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____

SHT. NO.: RAC - 91 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 91

INPUT DATA

Applied Load = 5719 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	435	0.00	0	5	0.00	0	435 to 619	0.00	0
5	435	8.50	259	5	1.21	29	435 to 619	13.96	413
10	435	15.97	976	5	2.28	128	435 to 619	26.25	1585
15	435	22.33	2054	5	3.11	288	435 to 619	36.56	3365
20	435	27.52	3389	5	3.70	490	435 to 619	44.82	5579
25	435	31.50	4992	5	4.04	709	435 to 619	50.97	8195
30	435	34.28	6701	6	4.15	925	435 to 620	55.06	10954
35	435	35.90	8386	6	4.08	1161	435 to 620	57.19	13715
40	435	36.42	10112	6	3.89	1376	435 to 621	57.60	16496
45	435	35.93	11711	7	3.58	1561	435 to 622	56.40	19050
50	435	34.56	13167	7	3.26	1711	435 to 622	53.93	21343
55	435	32.42	14426	7	2.98	1824	435 to 622	50.46	23299
60	435	29.69	15453	7	2.82	1901	435 to 623	46.37	24867
65	435	26.49	16160	7	2.70	1948	435 to 623	41.69	25937
70	435	23.01	16623	7	2.65	1966	435 to 623	36.73	26615
75	435	19.39	16683	7	2.69	1942	435 to 623	31.73	26659
80	435	15.79	16413	7	2.83	1878	435 to 623	26.94	26172
85	435	16.43	15772	7	3.07	1772	435 to 623	28.23	25094
90	435	22.12	14703	7	3.38	1627	435 to 622	36.72	23351
95	435	28.16	13253	7	3.74	1443	435 to 622	45.79	21009
100	435	34.35	11411	7	4.03	1222	435 to 622	54.95	18053
105	435	40.67	9146	6	4.50	964	435 to 621	64.59	14445
110	435	47.04	6475	6	5.03	673	435 to 620	74.43	10211
115	435	53.19	3432	6	5.53	351	435 to 620	83.87	5402
120	435	59.38	0	5	5.99	0	435 to 619	93.31	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 92 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 92

INPUT DATA

Applied Load = 7486 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	531	0.00	0	5	0.00	0	531 to 753	0.00	0
5	531	7.92	241	5	1.21	29	531 to 753	13.15	389
10	531	14.89	909	5	2.28	128	531 to 753	24.73	1492
15	531	20.81	1914	5	3.11	288	531 to 753	34.43	3169
20	531	25.65	3158	5	3.70	490	531 to 753	42.20	5256
25	531	29.35	4652	5	4.04	709	531 to 753	47.97	7719
30	531	31.95	6245	6	4.15	925	531 to 754	51.79	10316
35	531	33.45	7816	6	4.08	1161	531 to 755	53.77	12916
40	531	33.94	9423	6	3.89	1376	531 to 755	54.13	15533
45	531	33.48	10915	7	3.58	1561	531 to 756	52.98	17934
50	531	32.20	12271	7	3.26	1711	531 to 756	50.64	20088
55	531	30.22	13444	7	2.98	1824	531 to 757	47.37	21925
60	531	27.66	14402	7	2.82	1901	531 to 757	43.54	23395
65	531	24.69	15061	7	2.70	1948	531 to 757	39.16	24398
70	531	21.44	15492	7	2.65	1966	531 to 757	34.54	25031
75	531	18.07	15547	7	2.69	1942	531 to 757	29.88	25069
80	531	14.72	15296	7	2.83	1878	531 to 757	25.43	24608
85	531	15.31	14698	7	3.07	1772	531 to 757	26.67	23592
90	531	20.62	13702	7	3.38	1627	531 to 757	34.61	21950
95	531	26.24	12351	7	3.74	1443	531 to 756	43.11	19746
100	531	32.01	10635	7	4.03	1222	531 to 756	51.68	16966
105	531	37.90	8523	6	4.50	964	531 to 755	60.71	13573
110	531	43.84	6034	6	5.03	673	531 to 755	69.95	9594
115	531	49.57	3198	6	5.53	351	531 to 754	78.81	5075
120	531	55.33	0	5	5.99	0	531 to 753	87.66	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 93 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 93

INPUT DATA

Applied Load = 14626 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	945	0.00	0	18	0.00	0	945 to 1355	0.00	0
5	945	7.81	238	18	4.05	100	945 to 1355	17.83	503
10	945	14.67	897	18	7.63	429	945 to 1355	33.52	1985
15	945	20.52	1886	18	10.39	961	945 to 1355	46.39	4276
20	945	25.28	3113	18	12.36	1637	945 to 1355	56.41	7143
25	945	28.94	4586	19	13.49	2368	945 to 1356	63.46	10447
30	945	31.49	6156	20	13.87	3088	945 to 1358	67.68	13869
35	945	32.98	7704	21	13.61	3875	945 to 1360	69.32	17375
40	945	33.45	9289	22	12.98	4594	945 to 1362	68.92	20816
45	945	33.01	10759	23	11.97	5210	945 to 1364	66.57	23921
50	945	31.75	12096	24	10.89	5711	945 to 1365	62.97	26644
55	945	29.79	13253	25	9.94	6091	945 to 1367	58.62	28910
60	945	27.27	14197	25	9.43	6347	945 to 1368	54.22	30666
65	945	24.34	14846	26	9.01	6503	945 to 1368	49.41	31841
70	945	21.14	15271	26	8.85	6563	945 to 1369	44.65	32537
75	945	17.82	15326	26	8.98	6484	945 to 1369	40.22	32481
80	945	14.51	15079	26	9.47	6268	945 to 1368	36.42	31768
85	945	15.09	14489	25	10.26	5917	945 to 1368	38.58	30344
90	945	20.32	13507	25	11.28	5432	945 to 1366	47.64	28146
95	945	25.87	12175	24	12.51	4818	945 to 1365	57.49	25237
100	945	31.56	10483	23	13.46	4078	945 to 1364	67.07	21611
105	945	37.36	8402	22	15.02	3220	945 to 1362	77.85	17238
110	945	43.22	5948	21	16.81	2249	945 to 1360	89.09	12152
115	945	48.86	3153	20	18.47	1173	945 to 1358	99.82	6409
120	945	54.55	0	18	19.99	0	945 to 1355	110.37	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 94 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 94

INPUT DATA

Applied Load = 16832 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1072	0.00	0	18	0.00	0	1072 to 1533	0.00	0
5	1072	7.69	234	18	4.05	100	1072 to 1533	17.66	498
10	1072	14.45	883	18	7.63	429	1072 to 1533	33.21	1966
15	1072	20.21	1858	18	10.39	961	1072 to 1532	45.96	4237
20	1072	24.90	3066	18	12.36	1637	1072 to 1533	55.88	7078
25	1072	28.50	4517	19	13.49	2368	1072 to 1534	62.85	10350
30	1072	31.02	6063	20	13.87	3088	1072 to 1536	67.02	13739
35	1072	32.48	7588	21	13.61	3875	1072 to 1538	68.63	17212
40	1072	32.95	9150	22	12.98	4594	1072 to 1540	68.21	20620
45	1072	32.51	10597	23	11.97	5210	1072 to 1541	65.87	23695
50	1072	31.27	11914	24	10.89	5711	1072 to 1543	62.30	26389
55	1072	29.34	13054	25	9.94	6091	1072 to 1544	57.99	28630
60	1072	26.86	13983	25	9.43	6347	1072 to 1545	53.65	30366
65	1072	23.97	14623	26	9.01	6503	1072 to 1546	48.89	31528
70	1072	20.82	15041	26	8.85	6563	1072 to 1546	44.21	32215
75	1072	17.55	15095	26	8.98	6484	1072 to 1546	39.84	32158
80	1072	14.29	14852	26	9.47	6268	1072 to 1546	36.12	31450
85	1072	14.87	14271	25	10.26	5917	1072 to 1545	38.27	30039
90	1072	20.02	13304	25	11.28	5432	1072 to 1544	47.22	27861
95	1072	25.48	11992	24	12.51	4818	1072 to 1543	56.94	24980
100	1072	31.08	10325	23	13.46	4078	1072 to 1541	66.41	21390
105	1072	36.80	8276	22	15.02	3220	1072 to 1540	77.06	17061
110	1072	42.57	5859	21	16.81	2249	1072 to 1538	88.18	12027
115	1072	48.12	3105	20	18.47	1173	1072 to 1535	98.79	6342
120	1072	53.73	0	18	19.99	0	1072 to 1533	109.22	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 95 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 95

INPUT DATA

Applied Load = 18386 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1146	0.00	0	12	0.00	0	1146 to 1625	0.00	0
5	1146	6.28	191	12	2.73	67	1146 to 1625	13.43	382
10	1146	11.80	721	12	5.14	289	1146 to 1625	25.26	1501
15	1146	16.50	1517	12	6.99	647	1146 to 1625	35.00	3225
20	1146	20.33	2503	12	8.32	1103	1146 to 1625	42.61	5380
25	1146	23.27	3687	12	9.09	1595	1146 to 1626	48.03	7874
30	1146	25.32	4950	13	9.34	2080	1146 to 1627	51.34	10466
35	1146	26.51	6195	14	9.17	2610	1146 to 1629	52.72	13111
40	1146	26.90	7469	15	8.74	3094	1146 to 1630	52.53	15718
45	1146	26.54	8651	15	8.06	3510	1146 to 1631	50.87	18079
50	1146	25.52	9726	16	7.33	3847	1146 to 1632	48.21	20157
55	1146	23.95	10656	17	6.70	4103	1146 to 1633	44.93	21894
60	1146	21.93	11415	17	6.35	4275	1146 to 1634	41.51	23250
65	1146	19.57	11938	17	6.07	4380	1146 to 1634	37.72	24160
70	1146	17.00	12279	17	5.96	4421	1146 to 1634	33.94	24707
75	1146	14.32	12323	17	6.05	4368	1146 to 1634	30.34	24679
80	1146	11.66	12124	17	6.38	4222	1146 to 1634	27.18	24153
85	1146	12.14	11650	17	6.91	3985	1146 to 1634	28.75	23087
90	1146	16.34	10861	17	7.60	3659	1146 to 1633	35.80	21426
95	1146	20.80	9790	16	8.42	3245	1146 to 1632	43.45	19223
100	1146	25.37	8429	15	9.06	2747	1146 to 1631	50.94	16472
105	1146	30.04	6756	15	10.12	2169	1146 to 1630	59.26	13147
110	1146	34.75	4783	14	11.32	1515	1146 to 1628	67.91	9272
115	1146	39.29	2535	13	12.44	790	1146 to 1627	76.16	4893
120	1146	43.86	0	12	13.47	0	1146 to 1625	84.31	0

HARTMAN ENGINEERING

BY: RJH DATE: 03-09-2006 SUBJECT _____ SHT. NO.: RAC - 96 OF _____

CHKD. BY: _____ DATE: _____ _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 96

INPUT DATA

Applied Load = 17948 lb./ft.
 Arc Subtended = 120 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 58.2 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1120	0.00	0	12	0.00	0	1120 to 1590	0.00	0
5	1120	6.30	192	12	2.73	67	1120 to 1590	13.47	383
10	1120	11.84	723	12	5.14	289	1120 to 1590	25.32	1505
15	1120	16.56	1522	12	6.99	647	1120 to 1590	35.08	3233
20	1120	20.40	2512	12	8.32	1103	1120 to 1590	42.72	5393
25	1120	23.35	3701	12	9.09	1595	1120 to 1591	48.15	7893
30	1120	25.41	4968	13	9.34	2080	1120 to 1592	51.47	10492
35	1120	26.61	6218	14	9.17	2610	1120 to 1593	52.85	13143
40	1120	27.00	7497	15	8.74	3094	1120 to 1595	52.67	15757
45	1120	26.64	8683	15	8.06	3510	1120 to 1596	51.01	18123
50	1120	25.62	9762	16	7.33	3847	1120 to 1597	48.34	20207
55	1120	24.04	10695	17	6.70	4103	1120 to 1598	45.05	21949
60	1120	22.01	11457	17	6.35	4275	1120 to 1598	41.62	23308
65	1120	19.64	11981	17	6.07	4380	1120 to 1599	37.83	24221
70	1120	17.06	12324	17	5.96	4421	1120 to 1599	34.03	24770
75	1120	14.38	12369	17	6.05	4368	1120 to 1599	30.42	24742
80	1120	11.71	12169	17	6.38	4222	1120 to 1599	27.24	24215
85	1120	12.18	11693	17	6.91	3985	1120 to 1598	28.81	23147
90	1120	16.40	10901	17	7.60	3659	1120 to 1598	35.89	21482
95	1120	20.87	9826	16	8.42	3245	1120 to 1597	43.55	19274
100	1120	25.47	8460	15	9.06	2747	1120 to 1596	51.07	16515
105	1120	30.15	6781	15	10.12	2169	1120 to 1595	59.42	13181
110	1120	34.88	4800	14	11.32	1515	1120 to 1593	68.09	9297
115	1120	39.43	2544	13	12.44	790	1120 to 1592	76.37	4906
120	1120	44.02	0	12	13.47	0	1120 to 1590	84.53	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 97 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 97

INPUT DATA

Applied Load = 5965 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	228	0.00	0	4	0.00	0	228 to 327	0.00	0
5	228	4.41	67	4	0.40	5	228 to 327	6.85	103
10	228	8.19	251	4	1.01	25	228 to 327	13.19	395
15	228	11.31	523	4	1.29	59	228 to 327	18.03	833
20	228	13.75	854	4	1.70	103	228 to 327	22.15	1372
25	228	15.51	1251	4	1.81	157	228 to 327	24.80	2019
30	228	16.61	1655	4	2.01	213	228 to 327	26.68	2681
35	228	17.09	2044	4	1.95	269	228 to 327	27.25	3319
40	228	17.00	2443	4	1.94	323	228 to 328	27.11	3971
45	228	16.41	2779	4	1.77	374	228 to 328	25.99	4528
50	228	15.40	3094	5	1.65	416	228 to 328	24.38	5040
55	228	14.04	3322	5	1.53	447	228 to 328	22.27	5411
60	228	12.44	3504	5	1.34	466	228 to 328	19.70	5699
65	228	10.67	3591	5	1.35	476	228 to 329	17.25	5837
70	228	8.84	3591	5	1.31	474	228 to 329	14.60	5835
75	228	7.02	3506	5	1.48	460	228 to 329	12.35	5691
80	228	8.80	3312	5	1.56	431	228 to 329	14.99	5371
85	228	11.80	3019	5	1.69	390	228 to 328	19.39	4891
90	228	14.94	2628	5	1.97	336	228 to 328	24.27	4251
95	228	18.21	2126	4	2.37	269	228 to 328	29.53	3435
100	228	21.54	1518	4	2.75	190	228 to 328	34.84	2449
105	228	24.78	811	4	3.11	100	228 to 327	39.99	1306
110	228	28.09	0	4	3.45	0	228 to 327	45.20	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 98 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 98

INPUT DATA

Applied Load = 7808 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	278	0.00	0	4	0.00	0	278 to 397	0.00	0
5	278	4.11	63	4	0.40	5	278 to 397	6.43	97
10	278	7.63	234	4	1.01	25	278 to 397	12.41	371
15	278	10.54	487	4	1.29	59	278 to 397	16.95	783
20	278	12.81	796	4	1.70	103	278 to 397	20.84	1290
25	278	14.45	1166	4	1.81	157	278 to 397	23.32	1900
30	278	15.48	1543	4	2.01	213	278 to 397	25.09	2523
35	278	15.93	1905	4	1.95	269	278 to 398	25.62	3125
40	278	15.85	2277	4	1.94	323	278 to 398	25.49	3738
45	278	15.30	2590	4	1.77	374	278 to 398	24.43	4263
50	278	14.35	2884	5	1.65	416	278 to 399	22.91	4746
55	278	13.09	3096	5	1.53	447	278 to 399	20.93	5095
60	278	11.59	3266	5	1.34	466	278 to 399	18.52	5365
65	278	9.94	3346	5	1.35	476	278 to 399	16.23	5495
70	278	8.23	3346	5	1.31	474	278 to 399	13.76	5493
75	278	6.54	3267	5	1.48	460	278 to 399	11.68	5357
80	278	8.20	3086	5	1.56	431	278 to 399	14.15	5056
85	278	10.99	2814	5	1.69	390	278 to 399	18.27	4604
90	278	13.92	2449	5	1.97	336	278 to 399	22.85	4001
95	278	16.97	1981	4	2.37	269	278 to 398	27.79	3233
100	278	20.07	1414	4	2.75	190	278 to 398	32.79	2305
105	278	23.09	755	4	3.11	100	278 to 398	37.63	1229
110	278	26.18	0	4	3.45	0	278 to 397	42.52	0

BY: RJH DATE: 05-09-2006 SUBJECT _____

SHT. NO.: RAC - 99 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 99INPUT DATA

Applied Load = 3546 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.619
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	168	0.00	0	4	0.00	0	168 to 242	0.00	0
5	168	5.25	80	4	0.40	5	168 to 242	8.03	121
10	168	9.75	300	4	1.01	25	168 to 242	15.38	462
15	168	13.47	623	4	1.29	59	168 to 242	21.06	973
20	168	16.37	1017	4	1.70	103	168 to 242	25.83	1600
25	168	18.47	1490	4	1.81	157	168 to 242	28.95	2354
30	168	19.78	1971	4	2.01	213	168 to 242	31.12	3124
35	168	20.35	2434	4	1.95	269	168 to 243	31.82	3866
40	168	20.25	2909	4	1.94	323	168 to 243	31.65	4624
45	168	19.55	3309	4	1.77	374	168 to 243	30.38	5270
50	168	18.34	3685	5	1.65	416	168 to 243	28.49	5867
55	168	16.72	3956	5	1.53	447	168 to 244	26.02	6299
60	168	14.81	4173	5	1.34	466	168 to 244	23.03	6636
65	168	12.71	4276	5	1.35	476	168 to 244	20.10	6796
70	168	10.52	4276	5	1.31	474	168 to 244	16.97	6794
75	168	8.36	4175	5	1.48	460	168 to 244	14.22	6627
80	168	10.48	3944	5	1.56	431	168 to 244	17.34	6256
85	168	14.05	3596	5	1.69	390	168 to 244	22.55	5698
90	168	17.79	3130	5	1.97	336	168 to 243	28.27	4954
95	168	21.68	2532	4	2.37	269	168 to 243	34.40	4003
100	168	25.65	1807	4	2.75	190	168 to 243	40.59	2855
105	168	29.51	965	4	3.11	100	168 to 243	46.62	1523
110	168	33.45	0	4	3.45	0	168 to 242	52.70	0

HARTMAN ENGINEERING

BY: RJH

DATE: 05-09-2006

SUBJECT _____

SHT. NO.: RAC - 100 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 100

INPUT DATA

Applied Load = 15255 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	496	0.00	0	14	0.00	0	496 to 719	0.00	0
5	496	4.05	62	14	1.33	17	496 to 719	7.95	117
10	496	7.52	231	14	3.37	83	496 to 719	16.28	466
15	496	10.39	480	14	4.31	198	496 to 718	21.88	1010
20	496	12.63	784	14	5.69	345	496 to 718	27.37	1686
25	496	14.25	1149	14	6.06	524	496 to 719	30.25	2502
30	496	15.26	1521	14	6.71	713	496 to 719	32.78	3343
35	496	15.70	1878	15	6.52	898	496 to 720	33.08	4156
40	496	15.62	2244	15	6.47	1080	496 to 721	32.88	4979
45	496	15.08	2553	16	5.91	1250	496 to 722	31.17	5700
50	496	14.15	2843	16	5.52	1390	496 to 723	29.20	6344
55	496	12.90	3052	17	5.11	1493	496 to 723	26.76	6811
60	496	11.42	3219	17	4.49	1556	496 to 724	23.64	7153
65	496	9.80	3299	17	4.53	1589	496 to 724	21.44	7320
70	496	8.12	3299	17	4.37	1585	496 to 725	18.81	7313
75	496	6.45	3221	17	4.94	1535	496 to 725	17.43	7120
80	496	8.09	3042	17	5.22	1441	496 to 724	20.20	6711
85	496	10.84	2774	17	5.64	1303	496 to 724	24.77	6100
90	496	13.72	2414	17	6.59	1122	496 to 723	30.43	5289
95	496	16.73	1953	16	7.92	899	496 to 722	36.90	4264
100	496	19.78	1394	15	9.19	637	496 to 721	43.34	3035
105	496	22.77	745	15	10.40	336	496 to 720	49.56	1615
110	496	25.80	0	14	11.52	0	496 to 719	55.72	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 101 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 101

INPUT DATA

Applied Load = 17556 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	562	0.00	0	14	0.00	0	562 to 812	0.00	0
5	562	3.99	61	14	1.33	17	562 to 812	7.86	116
10	562	7.41	227	14	3.37	83	562 to 812	16.12	461
15	562	10.23	473	14	4.31	198	562 to 812	21.66	1000
20	562	12.44	772	14	5.69	345	562 to 812	27.10	1670
25	562	14.03	1132	14	6.06	524	562 to 812	29.95	2477
30	562	15.03	1498	14	6.71	713	562 to 813	32.45	3310
35	562	15.46	1850	15	6.52	898	562 to 813	32.75	4116
40	562	15.39	2211	15	6.47	1080	562 to 814	32.55	4932
45	562	14.85	2514	16	5.91	1250	562 to 815	30.85	5646
50	562	13.93	2800	16	5.52	1390	562 to 816	28.91	6284
55	562	12.71	3006	17	5.11	1493	562 to 817	26.49	6747
60	562	11.25	3171	17	4.49	1556	562 to 817	23.40	7085
65	562	9.65	3249	17	4.53	1589	562 to 818	21.23	7251
70	562	7.99	3249	17	4.37	1585	562 to 818	18.64	7244
75	562	6.35	3172	17	4.94	1535	562 to 818	17.29	7052
80	562	7.97	2997	17	5.22	1441	562 to 818	20.03	6647
85	562	10.67	2732	17	5.64	1303	562 to 817	24.54	6041
90	562	13.52	2378	17	6.59	1122	562 to 816	30.14	5238
95	562	16.47	1924	16	7.92	899	562 to 816	36.54	4223
100	562	19.49	1373	15	9.19	637	562 to 815	42.92	3006
105	562	22.42	733	15	10.40	336	562 to 813	49.08	1599
110	562	25.42	0	14	11.52	0	562 to 812	55.18	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 102 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 102

INPUT DATA

Applied Load = 19177 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	601	0.00	0	9	0.00	0	601 to 858	0.00	0
5	601	3.25	50	9	0.90	12	601 to 858	6.09	90
10	601	6.05	186	9	2.27	56	601 to 858	12.34	356
15	601	8.35	386	9	2.90	133	601 to 858	16.63	768
20	601	10.16	630	9	3.83	232	601 to 858	20.74	1279
25	601	11.46	924	9	4.08	353	601 to 858	22.98	1895
30	601	12.27	1223	9	4.52	480	601 to 858	24.87	2529
35	601	12.62	1510	10	4.39	605	601 to 859	25.15	3142
40	601	12.56	1805	10	4.36	727	601 to 859	25.00	3764
45	601	12.12	2053	10	3.98	842	601 to 860	23.75	4306
50	601	11.37	2286	11	3.72	936	601 to 861	22.26	4792
55	601	10.37	2454	11	3.44	1005	601 to 861	20.38	5145
60	601	9.18	2589	11	3.02	1048	601 to 861	18.01	5407
65	601	7.88	2652	11	3.05	1070	601 to 862	16.23	5534
70	601	6.53	2652	12	2.94	1067	601 to 862	14.15	5529
75	601	5.18	2590	12	3.32	1034	601 to 862	12.92	5385
80	601	6.50	2446	11	3.51	971	601 to 862	15.08	5076
85	601	8.71	2230	11	3.80	878	601 to 861	18.67	4616
90	601	11.03	1941	11	4.44	756	601 to 861	23.00	4003
95	601	13.45	1570	11	5.34	606	601 to 860	27.91	3229
100	601	15.91	1121	10	6.19	429	601 to 860	32.81	2299
105	601	18.30	599	10	7.00	226	601 to 859	37.54	1224
110	601	20.75	0	9	7.76	0	601 to 858	42.25	0

HARTMAN ENGINEERING

BY: RJH

DATE: 05-09-2006

SUBJECT _____

SHT. NO.: RAC - 103 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 103

INPUT DATA

Applied Load = 18720 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	588	0.00	0	9	0.00	0	588 to 839	0.00	0
5	588	3.27	50	9	0.90	12	588 to 839	6.11	90
10	588	6.07	186	9	2.27	56	588 to 839	12.37	357
15	588	8.38	388	9	2.90	133	588 to 839	16.68	770
20	588	10.19	633	9	3.83	232	588 to 839	20.80	1282
25	588	11.50	928	9	4.08	353	588 to 839	23.04	1900
30	588	12.31	1227	9	4.52	480	588 to 840	24.93	2536
35	588	12.67	1515	10	4.39	605	588 to 840	25.21	3150
40	588	12.61	1811	10	4.36	727	588 to 841	25.07	3773
45	588	12.17	2060	10	3.98	842	588 to 841	23.81	4317
50	588	11.42	2294	11	3.72	936	588 to 842	22.31	4804
55	588	10.41	2463	11	3.44	1005	588 to 843	20.44	5158
60	588	9.22	2598	11	3.02	1048	588 to 843	18.06	5420
65	588	7.91	2662	11	3.05	1070	588 to 843	16.27	5547
70	588	6.55	2662	12	2.94	1067	588 to 843	14.19	5542
75	588	5.20	2599	12	3.32	1034	588 to 843	12.94	5398
80	588	6.53	2455	11	3.51	971	588 to 843	15.12	5089
85	588	8.74	2238	11	3.80	878	588 to 843	18.71	4627
90	588	11.07	1948	11	4.44	756	588 to 842	23.06	4013
95	588	13.50	1576	11	5.34	606	588 to 842	27.98	3237
100	588	15.97	1125	10	6.19	429	588 to 841	32.89	2305
105	588	18.37	601	10	7.00	226	588 to 840	37.63	1227
110	588	20.82	0	9	7.76	0	588 to 839	42.35	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 104 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 104

INPUT DATA

Applied Load = 35045 lb./ft.
 Arc Subtended = 110 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = .991
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1026	0.00	0	9	0.00	0	1026 to 1453	0.00	0
5	1026	0.75	11	9	0.90	12	1026 to 1453	2.59	36
10	1026	1.40	43	9	2.27	56	1026 to 1452	5.83	155
15	1026	1.93	89	9	2.90	133	1026 to 1452	7.64	352
20	1026	2.35	146	9	3.83	232	1026 to 1452	9.81	600
25	1026	2.65	214	9	4.08	353	1026 to 1453	10.65	900
30	1026	2.84	283	9	4.52	480	1026 to 1453	11.66	1214
35	1026	2.92	349	10	4.39	605	1026 to 1453	11.56	1518
40	1026	2.91	418	10	4.36	727	1026 to 1454	11.49	1822
45	1026	2.80	475	10	3.98	842	1026 to 1455	10.70	2097
50	1026	2.63	529	11	3.72	936	1026 to 1455	10.02	2333
55	1026	2.40	568	11	3.44	1005	1026 to 1456	9.22	2506
60	1026	2.12	599	11	3.02	1048	1026 to 1456	8.13	2621
65	1026	1.82	614	11	3.05	1070	1026 to 1456	7.75	2680
70	1026	1.51	614	12	2.94	1067	1026 to 1456	7.13	2675
75	1026	1.20	599	12	3.32	1034	1026 to 1456	7.33	2598
80	1026	1.50	566	11	3.51	971	1026 to 1456	8.08	2444
85	1026	2.01	516	11	3.80	878	1026 to 1456	9.29	2216
90	1026	2.55	449	11	4.44	756	1026 to 1456	11.13	1915
95	1026	3.11	363	11	5.34	606	1026 to 1455	13.44	1539
100	1026	3.68	259	10	6.19	429	1026 to 1454	15.69	1093
105	1026	4.24	138	10	7.00	226	1026 to 1454	17.84	579
110	1026	4.80	0	9	7.76	0	1026 to 1453	19.92	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 105 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 105

INPUT DATA

Applied Load = 5965 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.309
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	228	0.00	0	3	0.00	0	228 to 326	0.00	0
5	228	4.48	68	3	0.43	5	228 to 326	7.02	105
10	228	8.47	260	3	1.09	27	228 to 326	13.72	411
15	228	11.91	551	3	1.43	64	228 to 326	19.10	881
20	228	14.76	914	3	1.89	114	228 to 326	23.88	1476
25	228	17.01	1349	3	2.07	174	228 to 326	27.34	2186
30	228	18.64	1822	3	2.31	239	228 to 326	30.03	2958
35	228	19.67	2297	4	2.32	304	228 to 326	31.49	3733
40	228	20.12	2776	4	2.35	373	228 to 327	32.18	4522
45	228	20.04	3241	4	2.23	437	228 to 327	31.85	5281
50	228	19.47	3658	4	2.13	492	228 to 327	30.89	5959
55	228	18.48	4044	4	2.00	538	228 to 328	29.28	6577
60	228	17.14	4356	4	1.77	577	228 to 328	27.03	7081
65	228	15.54	4605	5	1.68	607	228 to 328	24.61	7481
70	228	13.74	4775	5	1.54	624	228 to 328	21.85	7747
75	228	11.83	4843	5	1.55	628	228 to 328	19.21	7849
80	228	9.89	4840	5	1.53	620	228 to 328	16.45	7830
85	228	7.99	4723	5	1.71	598	228 to 328	14.10	7630
90	228	10.03	4499	5	1.80	564	228 to 328	17.10	7258
95	228	13.10	4183	4	1.98	517	228 to 328	21.72	6736
100	228	16.30	3751	4	2.11	459	228 to 328	26.43	6033
105	228	19.65	3207	4	2.49	390	228 to 328	31.74	5153
110	228	23.00	2563	4	2.84	308	228 to 327	37.03	4114
115	228	26.28	1812	4	3.19	216	228 to 327	42.23	2904
120	228	29.58	955	4	3.53	113	228 to 327	47.42	1529
125	228	32.69	0	3	3.84	0	228 to 326	52.29	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 106 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 106

INPUT DATA

Applied Load = 7808 lb./ft.
Arc Subtended = 125 degrees
Surcharge Load = 302 lb./ft.

Variation Factor = 1.22
Radius CL = 29.28 feet
Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	278	0.00	0	3	0.00	0	278 to 397	0.00	0
5	278	4.17	64	3	0.43	5	278 to 396	6.59	98
10	278	7.89	242	3	1.09	27	278 to 396	12.91	386
15	278	11.10	513	3	1.43	64	278 to 396	17.97	828
20	278	13.76	852	3	1.89	114	278 to 396	22.47	1389
25	278	15.85	1257	3	2.07	174	278 to 396	25.71	2057
30	278	17.37	1698	3	2.31	239	278 to 397	28.25	2784
35	278	18.33	2140	4	2.32	304	278 to 397	29.62	3514
40	278	18.75	2587	4	2.35	373	278 to 397	30.26	4258
45	278	18.67	3020	4	2.23	437	278 to 397	29.94	4972
50	278	18.14	3409	4	2.13	492	278 to 398	29.04	5611
55	278	17.22	3769	4	2.00	538	278 to 398	27.52	6192
60	278	15.98	4060	4	1.77	577	278 to 398	25.39	6666
65	278	14.48	4292	5	1.68	607	278 to 399	23.13	7042
70	278	12.80	4450	5	1.54	624	278 to 399	20.54	7292
75	278	11.02	4513	5	1.55	628	278 to 399	18.08	7388
80	278	9.21	4510	5	1.53	620	278 to 399	15.51	7369
85	278	7.44	4402	5	1.71	598	278 to 399	13.34	7180
90	278	9.35	4193	5	1.80	564	278 to 399	16.15	6829
95	278	12.21	3898	4	1.98	517	278 to 398	20.47	6337
100	278	15.19	3496	4	2.11	459	278 to 398	24.87	5676
105	278	18.31	2989	4	2.49	390	278 to 398	29.87	4848
110	278	21.43	2389	4	2.84	308	278 to 398	34.84	3870
115	278	24.49	1688	4	3.19	216	278 to 397	39.73	2732
120	278	27.57	890	4	3.53	113	278 to 397	44.61	1438
125	278	30.46	0	3	3.84	0	278 to 397	49.18	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 107 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 107

INPUT DATA

Applied Load = 3546 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 302 lb./ft.

Variation Factor = 1.619
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	168	0.00	0	3	0.00	0	168 to 241	0.00	0
5	168	5.33	81	3	0.43	5	168 to 241	8.22	123
10	168	10.08	310	3	1.09	27	168 to 241	15.98	480
15	168	14.18	656	3	1.43	64	168 to 241	22.29	1028
20	168	17.58	1089	3	1.89	114	168 to 241	27.83	1720
25	168	20.25	1606	3	2.07	174	168 to 241	31.88	2546
30	168	22.20	2170	3	2.31	239	168 to 241	35.01	3445
35	168	23.42	2735	4	2.32	304	168 to 242	36.75	4347
40	168	23.96	3306	4	2.35	373	168 to 242	37.56	5264
45	168	23.86	3860	4	2.23	437	168 to 242	37.21	6147
50	168	23.18	4356	4	2.13	492	168 to 243	36.10	6937
55	168	22.01	4816	4	2.00	538	168 to 243	34.22	7658
60	168	20.42	5188	4	1.77	577	168 to 243	31.61	8245
65	168	18.50	5485	5	1.68	607	168 to 243	28.77	8712
70	168	16.36	5686	5	1.54	624	168 to 244	25.53	9023
75	168	14.09	5767	5	1.55	628	168 to 244	22.37	9144
80	168	11.78	5763	5	1.53	620	168 to 244	19.10	9123
85	168	9.51	5625	5	1.71	598	168 to 244	16.24	8893
90	168	11.94	5358	5	1.80	564	168 to 243	19.79	8460
95	168	15.61	4982	4	1.98	517	168 to 243	25.23	7854
100	168	19.42	4467	4	2.11	459	168 to 243	30.78	7036
105	168	23.40	3819	4	2.49	390	168 to 243	37.00	6010
110	168	27.39	3053	4	2.84	308	168 to 243	43.18	4799
115	168	31.30	2158	4	3.19	216	168 to 242	49.25	3389
120	168	35.23	1137	4	3.53	113	168 to 242	55.33	1785
125	168	38.93	0	3	3.84	0	168 to 241	61.03	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 108 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 108

INPUT DATA

Applied Load = 15255 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.111
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	496	0.00	0	12	0.00	0	496 to 716	0.00	0
5	496	4.11	63	12	1.46	17	496 to 716	8.26	117
10	496	7.78	239	12	3.65	91	496 to 716	17.10	490
15	496	10.94	506	12	4.77	215	496 to 716	23.43	1075
20	496	13.56	840	12	6.30	383	496 to 715	29.71	1828
25	496	15.62	1239	12	6.91	583	496 to 716	33.64	2727
30	496	17.12	1674	12	7.72	798	496 to 716	37.11	3700
35	496	18.07	2110	13	7.76	1016	496 to 717	38.50	4682
40	496	18.48	2551	14	7.87	1246	496 to 718	39.26	5691
45	496	18.41	2977	14	7.46	1459	496 to 719	38.45	6649
50	496	17.88	3360	15	7.13	1644	496 to 720	37.17	7501
55	496	16.98	3715	15	6.68	1797	496 to 721	35.14	8257
60	496	15.75	4002	16	5.93	1928	496 to 722	32.14	8881
65	496	14.27	4231	16	5.61	2028	496 to 723	29.53	9371
70	496	12.62	4387	17	5.14	2085	496 to 723	26.41	9687
75	496	10.87	4449	17	5.19	2099	496 to 724	24.05	9798
80	496	9.08	4446	17	5.11	2070	496 to 724	21.42	9744
85	496	7.34	4339	17	5.72	1997	496 to 724	20.01	9471
90	496	9.21	4133	17	6.00	1882	496 to 723	23.12	8988
95	496	12.04	3843	16	6.62	1726	496 to 723	28.12	8315
100	496	14.98	3446	16	7.06	1533	496 to 722	32.99	7431
105	496	18.05	2946	15	8.31	1302	496 to 721	39.40	6339
110	496	21.13	2355	15	9.49	1031	496 to 720	45.72	5050
115	496	24.14	1664	14	10.67	722	496 to 719	51.94	3558
120	496	27.18	877	13	11.79	377	496 to 717	58.10	1870
125	496	30.03	0	12	12.82	0	496 to 716	63.84	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 109 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 109

INPUT DATA

Applied Load = 17556 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 1008 lb./ft.

Variation Factor = 1.095
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	562	0.00	0	12	0.00	0	562 to 809	0.00	0
5	562	4.05	62	12	1.46	17	562 to 809	8.17	116
10	562	7.66	235	12	3.65	91	562 to 809	16.94	485
15	562	10.77	498	12	4.77	215	562 to 809	23.20	1065
20	562	13.36	827	12	6.30	383	562 to 809	29.43	1811
25	562	15.39	1220	12	6.91	583	562 to 809	33.31	2701
30	562	16.86	1649	12	7.72	798	562 to 809	36.75	3665
35	562	17.80	2078	13	7.76	1016	562 to 810	38.12	4637
40	562	18.20	2512	14	7.87	1246	562 to 811	38.88	5637
45	562	18.13	2933	14	7.46	1459	562 to 813	38.07	6586
50	562	17.62	3310	15	7.13	1644	562 to 814	36.80	7430
55	562	16.72	3659	15	6.68	1797	562 to 815	34.78	8178
60	562	15.51	3942	16	5.93	1928	562 to 815	31.81	8797
65	562	14.06	4167	16	5.61	2028	562 to 816	29.23	9282
70	562	12.43	4321	17	5.14	2085	562 to 817	26.14	9594
75	562	10.70	4382	17	5.19	2099	562 to 817	23.83	9704
80	562	8.95	4379	17	5.11	2070	562 to 817	21.23	9650
85	562	7.23	4274	17	5.72	1997	562 to 817	19.86	9380
90	562	9.07	4071	17	6.00	1882	562 to 816	22.92	8901
95	562	11.86	3785	16	6.62	1726	562 to 816	27.87	8234
100	562	14.75	3394	16	7.06	1533	562 to 815	32.67	7359
105	562	17.78	2902	15	8.31	1302	562 to 814	39.02	6276
110	562	20.81	2319	15	9.49	1031	562 to 813	45.27	5000
115	562	23.78	1639	14	10.67	722	562 to 812	51.43	3523
120	562	26.77	864	13	11.79	377	562 to 811	57.52	1852
125	562	29.58	0	12	12.82	0	562 to 809	63.20	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 110 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 110

INPUT DATA

Applied Load = 19177 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = 1.071
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	601	0.00	0	8	0.00	0	601 to 856	0.00	0
5	601	3.31	50	8	0.98	11	601 to 856	6.31	91
10	601	6.25	192	8	2.46	61	601 to 856	12.94	374
15	601	8.79	407	8	3.21	145	601 to 856	17.78	817
20	601	10.90	675	8	4.25	258	601 to 856	22.49	1385
25	601	12.56	996	8	4.66	393	601 to 856	25.51	2063
30	601	13.77	1346	8	5.20	537	601 to 856	28.12	2798
35	601	14.53	1696	9	5.23	684	601 to 857	29.23	3539
40	601	14.86	2051	9	5.30	839	601 to 857	29.82	4299
45	601	14.80	2394	9	5.02	982	601 to 858	29.26	5023
50	601	14.38	2702	10	4.80	1108	601 to 859	28.31	5667
55	601	13.65	2987	10	4.50	1210	601 to 860	26.77	6240
60	601	12.66	3218	11	3.99	1298	601 to 860	24.53	6713
65	601	11.48	3402	11	3.78	1366	601 to 861	22.50	7086
70	601	10.15	3527	11	3.46	1404	601 to 861	20.09	7326
75	601	8.74	3577	11	3.50	1414	601 to 861	18.19	7412
80	601	7.30	3575	11	3.44	1394	601 to 861	16.09	7376
85	601	5.90	3489	11	3.85	1345	601 to 861	14.82	7173
90	601	7.41	3323	11	4.04	1268	601 to 861	17.25	6809
95	601	9.68	3090	11	4.46	1162	601 to 860	21.14	6303
100	601	12.04	2771	10	4.76	1032	601 to 860	24.96	5635
105	601	14.51	2369	10	5.59	877	601 to 859	29.84	4808
110	601	16.99	1893	10	6.39	694	601 to 859	34.65	3832
115	601	19.41	1338	9	7.18	486	601 to 858	39.40	2701
120	601	21.85	705	9	7.94	254	601 to 857	44.10	1420
125	601	24.14	0	8	8.63	0	601 to 856	48.49	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 111 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 111

INPUT DATA

Applied Load = 18720 lb./ft.
Arc Subtended = 125 degrees
Surcharge Load = 679 lb./ft.

Variation Factor = 1.073
Radius CL = 29.28 feet
Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	588	0.00	0	8	0.00	0	588 to 838	0.00	0
5	588	3.32	50	8	0.98	11	588 to 838	6.33	91
10	588	6.28	193	8	2.46	61	588 to 837	12.97	375
15	588	8.83	408	8	3.21	145	588 to 837	17.83	819
20	588	10.94	678	8	4.25	258	588 to 837	22.55	1389
25	588	12.61	1000	8	4.66	393	588 to 837	25.58	2068
30	588	13.82	1351	8	5.20	537	588 to 838	28.19	2805
35	588	14.58	1703	9	5.23	684	588 to 838	29.31	3548
40	588	14.92	2058	9	5.30	839	588 to 839	29.90	4310
45	588	14.85	2403	9	5.02	982	588 to 840	29.34	5035
50	588	14.43	2712	10	4.80	1108	588 to 840	28.38	5681
55	588	13.70	2998	10	4.50	1210	588 to 841	26.84	6256
60	588	12.71	3229	11	3.99	1298	588 to 842	24.59	6730
65	588	11.52	3414	11	3.78	1366	588 to 842	22.56	7103
70	588	10.18	3540	11	3.46	1404	588 to 842	20.15	7344
75	588	8.77	3590	11	3.50	1414	588 to 843	18.23	7431
80	588	7.33	3588	11	3.44	1394	588 to 843	16.13	7394
85	588	5.92	3502	11	3.85	1345	588 to 843	14.85	7190
90	588	7.43	3336	11	4.04	1268	588 to 842	17.29	6826
95	588	9.71	3101	11	4.46	1162	588 to 842	21.19	6319
100	588	12.09	2781	10	4.76	1032	588 to 841	25.02	5650
105	588	14.57	2378	10	5.59	877	588 to 841	29.91	4820
110	588	17.05	1900	10	6.39	694	588 to 840	34.74	3841
115	588	19.48	1343	9	7.18	486	588 to 839	39.50	2708
120	588	21.93	708	9	7.94	254	588 to 838	44.21	1424
125	588	24.23	0	8	8.63	0	588 to 838	48.61	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____

SHT. NO.: RAC - 112 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 112

INPUT DATA

Applied Load = 35045 lb./ft.
 Arc Subtended = 125 degrees
 Surcharge Load = 679 lb./ft.

Variation Factor = .991
 Radius CL = 29.28 feet
 Distance to Surcharge = 23.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1026	0.00	0	8	0.00	0	1026 to 1451	0.00	0
5	1026	0.76	11	8	0.98	11	1026 to 1451	2.75	36
10	1026	1.44	44	8	2.46	61	1026 to 1451	6.21	167
15	1026	2.03	94	8	3.21	145	1026 to 1450	8.32	379
20	1026	2.52	156	8	4.25	258	1026 to 1450	10.76	658
25	1026	2.91	230	8	4.66	393	1026 to 1450	11.99	991
30	1026	3.19	311	8	5.20	537	1026 to 1451	13.31	1350
35	1026	3.36	393	9	5.23	684	1026 to 1451	13.60	1714
40	1026	3.44	475	9	5.30	839	1026 to 1452	13.83	2093
45	1026	3.42	554	9	5.02	982	1026 to 1453	13.34	2447
50	1026	3.33	626	10	4.80	1108	1026 to 1454	12.83	2760
55	1026	3.16	692	10	4.50	1210	1026 to 1454	12.08	3026
60	1026	2.93	745	11	3.99	1298	1026 to 1455	10.90	3251
65	1026	2.65	788	11	3.78	1366	1026 to 1455	10.15	3426
70	1026	2.35	817	11	3.46	1404	1026 to 1456	9.17	3532
75	1026	2.02	828	11	3.50	1414	1026 to 1456	8.78	3564
80	1026	1.69	828	11	3.44	1394	1026 to 1456	8.23	3530
85	1026	1.36	808	11	3.85	1345	1026 to 1456	8.47	3419
90	1026	1.71	769	11	4.04	1268	1026 to 1456	9.28	3234
95	1026	2.24	715	11	4.46	1162	1026 to 1455	10.72	2979
100	1026	2.79	641	10	4.76	1032	1026 to 1455	12.00	2654
105	1026	3.36	548	10	5.59	877	1026 to 1454	14.22	2259
110	1026	3.93	438	10	6.39	694	1026 to 1453	16.38	1795
115	1026	4.49	310	9	7.18	486	1026 to 1453	18.51	1261
120	1026	5.06	163	9	7.94	254	1026 to 1452	20.59	661
125	1026	5.59	0	8	8.63	0	1026 to 1451	22.51	0

HARTMAN ENGINEERING

BY: RJH

DATE: 05-09-2006

SUBJECT _____

SHT. NO.: RAC - 113 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 113

INPUT DATA

Applied Load = 5694 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 3589 lb./ft.

Variation Factor = 1.653
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	364	0.00	0	47	0.00	0	364 to 591	0.00	0
5	364	11.62	235	47	8.06	130	364 to 591	29.99	551
10	364	21.30	866	47	14.81	587	364 to 590	55.01	2211
15	364	28.98	1773	47	21.97	1333	364 to 590	77.93	4750
20	364	34.67	2884	48	24.65	2248	364 to 592	90.46	7860
25	364	38.43	4160	50	25.45	3183	364 to 595	97.07	11235
30	364	40.36	5407	52	25.85	4048	364 to 599	100.47	14453
35	364	40.63	6626	54	23.53	4925	364 to 603	96.89	17650
40	364	39.43	7761	56	21.85	5690	364 to 606	92.36	20539
45	364	36.99	8709	57	19.47	6271	364 to 608	84.91	22854
50	364	33.57	9480	59	18.12	6659	364 to 610	77.82	24594
55	364	29.43	10003	59	17.40	6851	364 to 611	70.79	25652
60	364	24.86	10220	59	16.98	6845	364 to 612	63.68	25945
65	364	20.11	10192	59	17.29	6641	364 to 611	57.55	25560
70	364	16.70	9794	59	19.48	6242	364 to 611	56.50	24324
75	364	24.13	9056	58	21.22	5650	364 to 609	69.86	22284
80	364	32.14	7990	57	24.68	4885	364 to 607	86.96	19492
85	364	40.71	6539	55	25.94	3942	364 to 604	101.10	15857
90	364	49.50	4714	53	30.26	2807	364 to 600	120.76	11373
95	364	58.19	2542	50	34.65	1490	364 to 596	140.38	6093
100	364	67.15	0	47	38.78	0	364 to 591	159.94	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 114 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 114

INPUT DATA

Applied Load = 8698 lb./ft. Variation Factor = 1.349
 Arc Subtended = 100 degrees Radius CL = 38.73 feet
 Surcharge Load = 3589 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	454	0.00	0	47	0.00	0	454 to 717	0.00	0
5	454	9.49	192	47	8.06	130	454 to 716	27.00	491
10	454	17.39	707	47	14.81	587	454 to 716	49.53	1988
15	454	23.66	1448	47	21.97	1333	454 to 716	70.48	4294
20	454	28.31	2355	48	24.65	2248	454 to 718	81.55	7119
25	454	31.37	3396	50	25.45	3183	454 to 721	87.19	10166
30	454	32.95	4415	52	25.85	4048	454 to 725	90.10	13063
35	454	33.17	5410	54	23.53	4925	454 to 728	86.45	15947
40	454	32.19	6336	56	21.85	5690	454 to 732	82.23	18544
45	454	30.20	7110	57	19.47	6271	454 to 734	75.40	20616
50	454	27.41	7740	59	18.12	6659	454 to 736	69.19	22157
55	454	24.03	8167	59	17.40	6851	454 to 737	63.23	23081
60	454	20.29	8343	59	16.98	6845	454 to 738	57.29	23318
65	454	16.41	8321	59	17.29	6641	454 to 737	52.38	22940
70	454	13.63	7996	59	19.48	6242	454 to 737	52.21	21806
75	454	19.70	7394	58	21.22	5650	454 to 735	63.66	19956
80	454	26.24	6523	57	24.68	4885	454 to 733	78.70	17439
85	454	33.23	5338	55	25.94	3942	454 to 730	90.64	14176
90	454	40.41	3848	53	30.26	2807	454 to 726	108.04	10161
95	454	47.50	2076	50	34.65	1490	454 to 722	125.43	5439
100	454	54.82	0	47	38.78	0	454 to 717	142.68	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 115 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 115

INPUT DATA

Applied Load = 13158 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.102
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	561	0.00	0	26	0.00	0	561 to 831	0.00	0
5	561	4.19	85	26	4.47	72	561 to 830	13.48	242
10	561	7.69	312	26	8.21	325	561 to 830	24.73	991
15	561	10.46	640	26	12.18	739	561 to 830	35.37	2153
20	561	12.51	1041	26	13.67	1247	561 to 831	40.77	3578
25	561	13.87	1501	27	14.12	1765	561 to 833	43.42	5104
30	561	14.57	1952	29	14.34	2245	561 to 835	44.78	6550
35	561	14.66	2392	30	13.05	2732	561 to 837	42.72	7993
40	561	14.23	2801	31	12.12	3156	561 to 839	40.54	9288
45	561	13.35	3143	32	10.80	3479	561 to 840	37.06	10315
50	561	12.11	3422	32	10.05	3694	561 to 841	34.06	11071
55	561	10.62	3611	33	9.65	3800	561 to 842	31.28	11516
60	561	8.97	3689	33	9.42	3797	561 to 842	28.58	11620
65	561	7.25	3678	33	9.59	3684	561 to 842	26.47	11414
70	561	6.02	3535	32	10.80	3463	561 to 842	26.81	10836
75	561	8.71	3269	32	11.77	3134	561 to 841	32.21	9905
80	561	11.60	2884	31	13.69	2710	561 to 840	39.52	8645
85	561	14.69	2360	30	14.39	2187	561 to 838	45.04	7022
90	561	17.86	1701	29	16.79	1557	561 to 836	53.56	5030
95	561	21.00	917	28	19.22	826	561 to 833	62.09	2690
100	561	24.23	0	26	21.51	0	561 to 831	70.51	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 116 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 116

INPUT DATA

Applied Load = 12614 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.106
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	540	0.00	0	26	0.00	0	540 to 801	0.00	0
5	540	4.18	84	26	4.47	72	540 to 801	13.46	241
10	540	7.66	311	26	8.21	325	540 to 801	24.69	990
15	540	10.42	637	26	12.18	739	540 to 801	35.31	2150
20	540	12.47	1037	26	13.67	1247	540 to 801	40.71	3572
25	540	13.82	1496	27	14.12	1765	540 to 803	43.35	5096
30	540	14.51	1944	29	14.34	2245	540 to 805	44.71	6540
35	540	14.61	2383	30	13.05	2732	540 to 807	42.65	7981
40	540	14.18	2791	31	12.12	3156	540 to 809	40.46	9273
45	540	13.30	3131	32	10.80	3479	540 to 811	36.99	10299
50	540	12.07	3409	32	10.05	3694	540 to 812	34.00	11053
55	540	10.58	3597	33	9.65	3800	540 to 812	31.23	11497
60	540	8.93	3675	33	9.42	3797	540 to 812	28.53	11601
65	540	7.23	3665	33	9.59	3684	540 to 812	26.43	11395
70	540	6.00	3521	32	10.80	3463	540 to 812	26.78	10817
75	540	8.67	3256	32	11.77	3134	540 to 811	32.16	9888
80	540	11.56	2873	31	13.69	2710	540 to 810	39.46	8630
85	540	14.64	2351	30	14.39	2187	540 to 808	44.96	7010
90	540	17.80	1695	29	16.79	1557	540 to 806	53.47	5021
95	540	20.92	914	28	19.22	826	540 to 804	61.98	2685
100	540	24.14	0	26	21.51	0	540 to 801	70.38	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 117 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 117

INPUT DATA

Applied Load = 24558 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.114
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1059	0.00	0	26	0.00	0	1059 to 1528	0.00	0
5	1059	8.75	177	26	4.47	72	1059 to 1528	19.86	371
10	1059	16.04	652	26	8.21	325	1059 to 1527	36.43	1467
15	1059	21.82	1335	26	12.18	739	1059 to 1528	51.28	3127
20	1059	26.11	2171	26	13.67	1247	1059 to 1528	59.80	5161
25	1059	28.93	3132	27	14.12	1765	1059 to 1530	64.51	7387
30	1059	30.39	4071	29	14.34	2245	1059 to 1532	66.93	9518
35	1059	30.59	4989	30	13.05	2732	1059 to 1534	65.02	11630
40	1059	29.69	5844	31	12.12	3156	1059 to 1536	62.18	13548
45	1059	27.85	6557	32	10.80	3479	1059 to 1538	57.36	15095
50	1059	25.28	7138	32	10.05	3694	1059 to 1539	52.49	16274
55	1059	22.16	7532	33	9.65	3800	1059 to 1539	47.44	17006
60	1059	18.71	7695	33	9.42	3797	1059 to 1539	42.22	17228
65	1059	15.14	7674	33	9.59	3684	1059 to 1539	37.50	17007
70	1059	12.57	7374	32	10.80	3463	1059 to 1539	35.98	16211
75	1059	18.17	6819	32	11.77	3134	1059 to 1538	45.45	14875
80	1059	24.20	6016	31	13.69	2710	1059 to 1537	57.16	13030
85	1059	30.65	4923	30	14.39	2187	1059 to 1535	67.38	10611
90	1059	37.27	3549	29	16.79	1557	1059 to 1533	80.73	7617
95	1059	43.81	1914	28	19.22	826	1059 to 1531	94.02	4085
100	1059	50.56	0	26	21.51	0	1059 to 1528	107.36	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 118 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 118

INPUT DATA

Applied Load = 5694 lb./ft. Variation Factor = 1.653
 Arc Subtended = 130 degrees Radius CL = 38.73 feet
 Surcharge Load = 3589 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	364	0.00	0	35	0.00	0	364 to 570	0.00	0
5	364	12.02	243	35	8.87	146	364 to 570	31.91	590
10	364	22.83	928	34	17.01	664	364 to 569	60.89	2428
15	364	32.27	1974	34	25.25	1534	364 to 568	88.11	5373
20	364	40.23	3297	34	29.74	2603	364 to 568	106.90	9042
25	364	46.63	4867	36	31.74	3735	364 to 571	119.25	13164
30	364	51.44	6616	38	33.62	4929	364 to 576	129.17	17642
35	364	54.66	8392	41	32.43	6176	364 to 581	131.66	22249
40	364	56.34	10169	44	31.44	7308	364 to 586	132.34	26662
45	364	56.58	11955	46	29.05	8297	364 to 590	128.61	30844
50	364	55.49	13540	49	26.46	9130	364 to 593	122.67	34479
55	364	53.22	15092	50	24.59	9801	364 to 596	116.32	37790
60	364	49.95	16333	52	22.63	10304	364 to 599	108.41	40384
65	364	45.87	17436	53	21.57	10669	364 to 601	100.88	42548
70	364	41.18	18199	54	20.65	10918	364 to 602	92.76	44041
75	364	36.10	18681	54	20.19	10978	364 to 603	84.87	44818
80	364	30.83	18853	54	21.06	10848	364 to 602	78.99	44837
85	364	25.57	18627	54	21.72	10529	364 to 602	72.73	43979
90	364	22.66	18092	53	22.82	10024	364 to 600	70.53	42370
95	364	30.63	17169	51	25.51	9335	364 to 598	86.26	39907
100	364	39.15	15836	50	27.46	8469	364 to 595	101.51	36569
105	364	47.99	14141	48	29.69	7432	364 to 592	117.66	32432
110	364	56.90	12067	46	33.31	6231	364 to 588	136.30	27488
115	364	65.82	9595	43	35.20	4877	364 to 584	152.00	21726
120	364	74.76	6745	40	38.60	3379	364 to 579	170.30	15189
125	364	83.26	3550	37	41.72	1749	364 to 574	187.49	7946
130	364	91.74	0	35	44.51	0	364 to 570	204.11	0

HARTMAN ENGINEERING

BY: RJH

DATE: 05-09-2006

SUBJECT _____

SHT. NO.: RAC - 119 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 119

INPUT DATA

Applied Load = 8698 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 3589 lb./ft.

Variation Factor = 1.349
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	454	0.00	0	35	0.00	0	454 to 696	0.00	0
5	454	9.81	199	35	8.87	146	454 to 696	28.82	527
10	454	18.64	757	34	17.01	664	454 to 695	55.02	2190
15	454	26.35	1612	34	25.25	1534	454 to 694	79.82	4865
20	454	32.84	2691	34	29.74	2603	454 to 694	96.56	8195
25	454	38.07	3974	36	31.74	3735	454 to 697	107.26	11913
30	454	41.99	5401	38	33.62	4929	454 to 702	115.95	15941
35	454	44.62	6851	41	32.43	6176	454 to 707	117.61	20092
40	454	46.00	8302	44	31.44	7308	454 to 711	117.86	24048
45	454	46.19	9760	46	29.05	8297	454 to 716	114.07	27771
50	454	45.30	11055	49	26.46	9130	454 to 719	108.40	30998
55	454	43.45	12321	50	24.59	9801	454 to 722	102.64	33912
60	454	40.78	13335	52	22.63	10304	454 to 725	95.57	36186
65	454	37.44	14235	53	21.57	10669	454 to 727	89.10	38067
70	454	33.62	14858	54	20.65	10918	454 to 728	82.18	39263
75	454	29.47	15252	54	20.19	10978	454 to 728	75.59	40017
80	454	25.17	15392	54	21.06	10848	454 to 728	71.06	39992
85	454	20.88	15208	54	21.72	10529	454 to 728	66.16	39192
90	454	18.50	14770	53	22.82	10024	454 to 726	64.71	37720
95	454	25.01	14017	51	25.51	9335	454 to 724	78.39	35494
100	454	31.97	12929	50	27.46	8469	454 to 721	91.44	32499
105	454	39.18	11545	48	29.69	7432	454 to 718	105.33	28798
110	454	46.46	9851	46	33.31	6231	454 to 714	121.68	24386
115	454	53.74	7834	43	35.20	4877	454 to 710	135.08	19259
120	454	61.03	5507	40	38.60	3379	454 to 705	151.08	13456
125	454	67.98	2899	37	41.72	1749	454 to 700	166.09	7033
130	454	74.89	0	35	44.51	0	454 to 696	180.53	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 117 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 117

INPUT DATA

Applied Load = 24558 lb./ft. Variation Factor = 1.114
 Arc Subtended = 100 degrees Radius CL = 38.73 feet
 Surcharge Load = 1991 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1059	0.00	0	26	0.00	0	1059 to 1528	0.00	0
5	1059	8.75	177	26	4.47	72	1059 to 1528	19.86	371
10	1059	16.04	652	26	8.21	325	1059 to 1527	36.43	1467
15	1059	21.82	1335	26	12.18	739	1059 to 1528	51.28	3127
20	1059	26.11	2171	26	13.67	1247	1059 to 1528	59.80	5161
25	1059	28.93	3132	27	14.12	1765	1059 to 1530	64.51	7387
30	1059	30.39	4071	29	14.34	2245	1059 to 1532	66.93	9518
35	1059	30.59	4989	30	13.05	2732	1059 to 1534	65.02	11630
40	1059	29.69	5844	31	12.12	3156	1059 to 1536	62.18	13548
45	1059	27.85	6557	32	10.80	3479	1059 to 1538	57.36	15095
50	1059	25.28	7138	32	10.05	3694	1059 to 1539	52.49	16274
55	1059	22.16	7532	33	9.65	3800	1059 to 1539	47.44	17006
60	1059	18.71	7695	33	9.42	3797	1059 to 1539	42.22	17228
65	1059	15.14	7674	33	9.59	3684	1059 to 1539	37.50	17007
70	1059	12.57	7374	32	10.80	3463	1059 to 1539	35.98	16211
75	1059	18.17	6819	32	11.77	3134	1059 to 1538	45.45	14875
80	1059	24.20	6016	31	13.69	2710	1059 to 1537	57.16	13030
85	1059	30.65	4923	30	14.39	2187	1059 to 1535	67.38	10611
90	1059	37.27	3549	29	16.79	1557	1059 to 1533	80.73	7617
95	1059	43.81	1914	28	19.22	826	1059 to 1531	94.02	4085
100	1059	50.56	0	26	21.51	0	1059 to 1528	107.36	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 118 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 118

INPUT DATA

Applied Load = 5694 lb./ft. Variation Factor = 1.653
 Arc Subtended = 130 degrees Radius CL = 38.73 feet
 Surcharge Load = 3589 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	364	0.00	0	35	0.00	0	364 to 570	0.00	0
5	364	12.02	243	35	8.87	146	364 to 570	31.91	590
10	364	22.83	928	34	17.01	664	364 to 569	60.89	2428
15	364	32.27	1974	34	25.25	1534	364 to 568	88.11	5373
20	364	40.23	3297	34	29.74	2603	364 to 568	106.90	9042
25	364	46.63	4867	36	31.74	3735	364 to 571	119.25	13164
30	364	51.44	6616	38	33.62	4929	364 to 576	129.17	17642
35	364	54.66	8392	41	32.43	6176	364 to 581	131.66	22249
40	364	56.34	10169	44	31.44	7308	364 to 586	132.34	26662
45	364	56.58	11955	46	29.05	8297	364 to 590	128.61	30844
50	364	55.49	13540	49	26.46	9130	364 to 593	122.67	34479
55	364	53.22	15092	50	24.59	9801	364 to 596	116.32	37790
60	364	49.95	16333	52	22.63	10304	364 to 599	108.41	40384
65	364	45.87	17436	53	21.57	10669	364 to 601	100.88	42548
70	364	41.18	18199	54	20.65	10918	364 to 602	92.76	44041
75	364	36.10	18681	54	20.19	10978	364 to 603	84.87	44818
80	364	30.83	18853	54	21.06	10848	364 to 602	78.99	44837
85	364	25.57	18627	54	21.72	10529	364 to 602	72.73	43979
90	364	22.66	18092	53	22.82	10024	364 to 600	70.53	42370
95	364	30.63	17169	51	25.51	9335	364 to 598	86.26	39907
100	364	39.15	15836	50	27.46	8469	364 to 595	101.51	36569
105	364	47.99	14141	48	29.69	7432	364 to 592	117.66	32432
110	364	56.90	12067	46	33.31	6231	364 to 588	136.30	27488
115	364	65.82	9595	43	35.20	4877	364 to 584	152.00	21726
120	364	74.76	6745	40	38.60	3379	364 to 579	170.30	15189
125	364	83.26	3550	37	41.72	1749	364 to 574	187.49	7946
130	364	91.74	0	35	44.51	0	364 to 570	204.11	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 119 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 119

INPUT DATA

Applied Load = 8698 lb./ft.
Arc Subtended = 130 degrees
Surcharge Load = 3589 lb./ft.

Variation Factor = 1.349
Radius CL = 38.73 feet
Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	454	0.00	0	35	0.00	0	454 to 696	0.00	0
5	454	9.81	199	35	8.87	146	454 to 696	28.82	527
10	454	18.64	757	34	17.01	664	454 to 695	55.02	2190
15	454	26.35	1612	34	25.25	1534	454 to 694	79.82	4865
20	454	32.84	2691	34	29.74	2603	454 to 694	96.56	8195
25	454	38.07	3974	36	31.74	3735	454 to 697	107.26	11913
30	454	41.99	5401	38	33.62	4929	454 to 702	115.95	15941
35	454	44.62	6851	41	32.43	6176	454 to 707	117.61	20092
40	454	46.00	8302	44	31.44	7308	454 to 711	117.86	24048
45	454	46.19	9760	46	29.05	8297	454 to 716	114.07	27771
50	454	45.30	11055	49	26.46	9130	454 to 719	108.40	30998
55	454	43.45	12321	50	24.59	9801	454 to 722	102.64	33912
60	454	40.78	13335	52	22.63	10304	454 to 725	95.57	36186
65	454	37.44	14235	53	21.57	10669	454 to 727	89.10	38067
70	454	33.62	14858	54	20.65	10918	454 to 728	82.18	39263
75	454	29.47	15252	54	20.19	10978	454 to 728	75.59	40017
80	454	25.17	15392	54	21.06	10848	454 to 728	71.06	39992
85	454	20.88	15208	54	21.72	10529	454 to 728	66.16	39192
90	454	18.50	14770	53	22.82	10024	454 to 726	64.71	37720
95	454	25.01	14017	51	25.51	9335	454 to 724	78.39	35494
100	454	31.97	12929	50	27.46	8469	454 to 721	91.44	32499
105	454	39.18	11545	48	29.69	7432	454 to 718	105.33	28798
110	454	46.46	9851	46	33.31	6231	454 to 714	121.68	24386
115	454	53.74	7834	43	35.20	4877	454 to 710	135.08	19259
120	454	61.03	5507	40	38.60	3379	454 to 705	151.08	13456
125	454	67.98	2899	37	41.72	1749	454 to 700	166.09	7033
130	454	74.89	0	35	44.51	0	454 to 696	180.53	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 120 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 120

INPUT DATA

Applied Load = 13158 lb./ft. Variation Factor = 1.102
 Arc Subtended = 130 degrees Radius CL = 38.73 feet
 Surcharge Load = 1991 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	561	0.00	0	19	0.00	0	561 to 819	0.00	0
5	561	4.33	88	19	4.92	81	561 to 819	14.44	261
10	561	8.24	335	19	9.43	368	561 to 819	27.58	1095
15	561	11.65	712	19	14.00	851	561 to 818	40.12	2444
20	561	14.52	1190	18	16.50	1444	561 to 818	48.38	4121
25	561	16.83	1757	20	17.60	2072	561 to 820	53.50	5982
30	561	18.56	2388	21	18.65	2734	561 to 822	57.70	7992
35	561	19.73	3029	23	17.99	3426	561 to 825	58.20	10065
40	561	20.33	3670	24	17.44	4054	561 to 828	58.13	12031
45	561	20.42	4315	26	16.11	4603	561 to 830	55.99	13867
50	561	20.02	4887	27	14.67	5065	561 to 832	52.99	15453
55	561	19.21	5447	28	13.64	5437	561 to 834	50.09	16869
60	561	18.03	5895	29	12.55	5716	561 to 835	46.59	17972
65	561	16.55	6293	29	11.96	5918	561 to 836	43.52	18873
70	561	14.86	6569	30	11.45	6057	561 to 837	40.28	19494
75	561	13.03	6743	30	11.20	6090	561 to 837	37.28	19794
80	561	11.13	6805	30	11.68	6018	561 to 837	35.45	19758
85	561	9.23	6723	29	12.05	5841	561 to 837	33.41	19343
90	561	8.18	6530	29	12.66	5560	561 to 836	32.98	18596
95	561	11.05	6197	28	14.15	5178	561 to 835	39.54	17480
100	561	14.13	5716	27	15.23	4698	561 to 833	45.69	15990
105	561	17.32	5104	26	16.47	4122	561 to 831	52.25	14155
110	561	20.54	4355	25	18.48	3457	561 to 829	60.17	11975
115	561	23.76	3463	24	19.52	2705	561 to 827	66.46	9449
120	561	26.98	2434	22	21.41	1875	561 to 824	74.19	6596
125	561	30.05	1281	21	23.14	970	561 to 822	81.42	3444
130	561	33.11	0	19	24.69	0	561 to 819	88.34	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-09-2006 SUBJECT _____ SHT. NO.: RAC - 121 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 121

INPUT DATA

Applied Load = 12614 lb./ft. Variation Factor = 1.106
 Arc Subtended = 130 degrees Radius CL = 38.73 feet
 Surcharge Load = 1991 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	540	0.00	0	19	0.00	0	540 to 789	0.00	0
5	540	4.32	87	19	4.92	81	540 to 789	14.41	261
10	540	8.21	333	19	9.43	368	540 to 789	27.54	1093
15	540	11.60	710	19	14.00	851	540 to 788	40.06	2441
20	540	14.46	1185	18	16.50	1444	540 to 788	48.31	4115
25	540	16.77	1750	20	17.60	2072	540 to 790	53.41	5973
30	540	18.49	2379	21	18.65	2734	540 to 793	57.60	7979
35	540	19.65	3018	23	17.99	3426	540 to 795	58.10	10049
40	540	20.26	3657	24	17.44	4054	540 to 798	58.02	12012
45	540	20.34	4299	26	16.11	4603	540 to 800	55.88	13844
50	540	19.95	4869	27	14.67	5065	540 to 802	52.89	15427
55	540	19.13	5427	28	13.64	5437	540 to 804	49.99	16841
60	540	17.96	5873	29	12.55	5716	540 to 805	46.49	17941
65	540	16.49	6270	29	11.96	5918	540 to 806	43.43	18840
70	540	14.81	6544	30	11.45	6057	540 to 807	40.21	19459
75	540	12.98	6718	30	11.20	6090	540 to 807	37.21	19759
80	540	11.08	6779	30	11.68	6018	540 to 807	35.39	19722
85	540	9.19	6698	29	12.05	5841	540 to 807	33.36	19308
90	540	8.14	6506	29	12.66	5560	540 to 806	32.93	18561
95	540	11.01	6174	28	14.15	5178	540 to 805	39.48	17448
100	540	14.08	5694	27	15.23	4698	540 to 803	45.61	15960
105	540	17.25	5085	26	16.47	4122	540 to 801	52.16	14128
110	540	20.46	4339	25	18.48	3457	540 to 799	60.06	11952
115	540	23.67	3450	24	19.52	2705	540 to 797	66.34	9430
120	540	26.88	2425	22	21.41	1875	540 to 794	74.05	6583
125	540	29.94	1276	21	23.14	970	540 to 792	81.26	3437
130	540	32.99	0	19	24.69	0	540 to 789	88.16	0

HARTMAN ENGINEERING

BY: RJH

DATE: 05-09-2006

SUBJECT _____

SHT. NO.: RAC - 122 OF _____

CHKD. BY: _____ DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 122

INPUT DATA

Applied Load = 24558 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.114
 Radius CL = 38.73 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1059	0.00	0	19	0.00	0	1059 to 1516	0.00	0
5	1059	9.05	183	19	4.92	81	1059 to 1516	21.03	395
10	1059	17.19	699	19	9.43	368	1059 to 1516	40.11	1605
15	1059	24.30	1486	19	14.00	851	1059 to 1515	57.84	3528
20	1059	30.29	2482	18	16.50	1444	1059 to 1515	70.46	5931
25	1059	35.11	3665	20	17.60	2072	1059 to 1517	79.09	8653
30	1059	38.73	4981	21	18.65	2734	1059 to 1520	85.93	11622
35	1059	41.15	6319	23	17.99	3426	1059 to 1522	88.20	14671
40	1059	42.42	7657	24	17.44	4054	1059 to 1525	89.05	17613
45	1059	42.60	9002	26	16.11	4603	1059 to 1527	87.04	20428
50	1059	41.78	10195	27	14.67	5065	1059 to 1529	83.44	22884
55	1059	40.07	11363	28	13.64	5437	1059 to 1531	79.29	25152
60	1059	37.61	12298	29	12.55	5716	1059 to 1532	74.00	26935
65	1059	34.53	13128	29	11.96	5918	1059 to 1533	68.69	28442
70	1059	31.01	13703	30	11.45	6057	1059 to 1534	62.89	29481
75	1059	27.18	14066	30	11.20	6090	1059 to 1534	57.10	30047
80	1059	23.21	14195	30	11.68	6018	1059 to 1534	52.37	30105
85	1059	19.25	14025	29	12.05	5841	1059 to 1534	47.44	29566
90	1059	17.06	13622	29	12.66	5560	1059 to 1533	45.42	28525
95	1059	23.06	12927	28	14.15	5178	1059 to 1532	56.35	26903
100	1059	29.48	11924	27	15.23	4698	1059 to 1530	67.18	24681
105	1059	36.13	10647	26	16.47	4122	1059 to 1528	78.59	21916
110	1059	42.84	9085	25	18.48	3457	1059 to 1526	91.40	18597
115	1059	49.56	7224	24	19.52	2705	1059 to 1524	102.59	14715
120	1059	56.29	5079	22	21.41	1875	1059 to 1521	115.22	10298
125	1059	62.69	2673	21	23.14	970	1059 to 1519	127.11	5393
130	1059	69.07	0	19	24.69	0	1059 to 1516	138.68	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 123 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 123INPUT DATA

Applied Load = 5732 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 3589 lb./ft.

Variation Factor = 1.653
 Radius CL = 37.98 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	359	0.00	0	47	0.00	0	359 to 584	0.00	0
5	359	11.47	228	47	8.07	123	359 to 583	29.79	529
10	359	21.03	838	46	14.86	562	359 to 583	54.71	2131
15	359	28.61	1717	47	19.88	1276	359 to 583	73.86	4574
20	359	34.23	2792	47	24.73	2158	359 to 584	89.97	7578
25	359	37.94	4027	49	25.42	3061	359 to 588	96.34	10843
30	359	39.84	5235	51	24.78	3899	359 to 591	97.92	13958
35	359	40.11	6415	53	23.72	4749	359 to 595	96.48	17054
40	359	38.92	7513	55	21.37	5492	359 to 598	90.84	19855
45	359	36.52	8431	57	19.04	6057	359 to 601	83.50	22100
50	359	33.14	9178	58	17.94	6435	359 to 603	76.90	23789
55	359	29.06	9684	59	16.85	6623	359 to 604	69.33	24817
60	359	24.54	9893	59	16.48	6619	359 to 604	62.37	25104
65	359	19.85	9866	59	18.00	6424	359 to 604	58.40	24735
70	359	16.48	9481	58	19.13	6039	359 to 603	55.60	23540
75	359	23.82	8767	57	20.91	5467	359 to 602	68.91	21568
80	359	31.73	7735	56	24.44	4735	359 to 599	85.98	18879
85	359	40.18	6330	54	25.59	3821	359 to 597	99.78	15359
90	359	48.87	4563	52	29.91	2722	359 to 593	119.27	11016
95	359	57.44	2461	50	34.26	1444	359 to 588	138.67	5902
100	359	66.28	0	47	38.34	0	359 to 584	157.99	0

BY: RJH DATE: 05-20-2006 SUBJECT _____ SHT. NO.: RAC - 124 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 124

INPUT DATA

Applied Load = 8757 lb./ft. Variation Factor = 1.349
 Arc Subtended = 100 degrees Radius CL = 37.98 feet
 Surcharge Load = 3589 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	448	0.00	0	47	0.00	0	448 to 708	0.00	0
5	448	9.37	186	47	8.07	123	448 to 708	26.85	470
10	448	17.17	684	46	14.86	562	448 to 707	49.31	1915
15	448	23.36	1402	47	19.88	1276	448 to 708	66.51	4133
20	448	27.95	2280	47	24.73	2158	448 to 709	81.18	6860
25	448	30.97	3288	49	25.42	3061	448 to 712	86.59	9808
30	448	32.53	4274	51	24.78	3899	448 to 716	87.68	12613
35	448	32.75	5238	53	23.72	4749	448 to 719	86.18	15406
40	448	31.78	6135	55	21.37	5492	448 to 723	80.84	17925
45	448	29.82	6884	57	19.04	6057	448 to 725	74.12	19935
50	448	27.06	7493	58	17.94	6435	448 to 727	68.39	21431
55	448	23.72	7907	59	16.85	6623	448 to 728	61.86	22329
60	448	20.03	8078	59	16.48	6619	448 to 728	56.07	22563
65	448	16.21	8056	59	18.00	6424	448 to 728	53.30	22200
70	448	13.46	7741	58	19.13	6039	448 to 728	51.36	21105
75	448	19.45	7158	57	20.91	5467	448 to 726	62.78	19316
80	448	25.91	6316	56	24.44	4735	448 to 724	77.83	16892
85	448	32.81	5169	54	25.59	3821	448 to 721	89.46	13733
90	448	39.90	3726	52	29.91	2722	448 to 717	106.72	9844
95	448	46.90	2009	50	34.26	1444	448 to 713	123.91	5270
100	448	54.12	0	47	38.34	0	448 to 708	140.97	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 125 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 125INPUT DATA

Applied Load = 5732 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 3589 lb./ft.

Variation Factor = 1.653
 Radius CL = 37.98 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	359	0.00	0	35	0.00	0	359 to 563	0.00	0
5	359	11.86	236	35	8.87	139	359 to 563	31.69	567
10	359	22.54	898	34	17.03	636	359 to 562	60.52	2340
15	359	31.86	1911	34	23.12	1471	359 to 561	83.91	5177
20	359	39.71	3191	33	29.76	2502	359 to 561	106.20	8722
25	359	46.03	4712	35	31.64	3596	359 to 564	118.24	12711
30	359	50.78	6404	38	32.46	4752	359 to 569	126.28	17046
35	359	53.96	8124	41	32.28	5960	359 to 574	130.42	21507
40	359	55.62	9844	44	30.88	7059	359 to 578	130.37	25784
45	359	55.85	11573	46	28.54	8019	359 to 582	126.72	29837
50	359	54.77	13108	48	26.53	8828	359 to 586	121.79	33360
55	359	52.53	14610	50	24.21	9480	359 to 589	114.72	36571
60	359	49.31	15812	51	22.28	9970	359 to 591	106.91	39086
65	359	45.28	16879	52	21.34	10341	359 to 593	99.68	41211
70	359	40.65	17618	53	20.39	10584	359 to 595	91.59	42659
75	359	35.64	18085	54	19.95	10644	359 to 595	83.83	43414
80	359	30.44	18251	54	20.85	10519	359 to 595	78.07	43434
85	359	25.24	18033	53	21.56	10211	359 to 594	72.01	42605
90	359	22.37	17514	52	22.74	9721	359 to 593	69.98	41046
95	359	30.24	16621	51	24.32	9054	359 to 591	83.69	38662
100	359	38.65	15331	49	27.48	8215	359 to 588	100.85	35428
105	359	47.37	13690	47	29.79	7209	359 to 585	116.97	31422
110	359	56.17	11681	45	32.29	6045	359 to 581	133.55	26631
115	359	64.98	9289	43	34.82	4732	359 to 577	150.17	21049
120	359	73.80	6530	40	38.19	3279	359 to 572	168.25	14716
125	359	82.19	3437	37	41.27	1697	359 to 567	185.24	7698
130	359	90.56	0	35	44.04	0	359 to 563	201.66	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-20-2006 SUBJECT _____ SHT. NO.: RAC - 126 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 126

INPUT DATA

Applied Load = 8757 lb./ft. Variation Factor = 1.349
 Arc Subtended = 130 degrees Radius CL = 37.98 feet
 Surcharge Load = 3589 lb./ft. Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	448	0.00	0	35	0.00	0	448 to 688	0.00	0
5	448	9.69	192	35	8.87	139	448 to 687	28.64	506
10	448	18.40	733	34	17.03	636	448 to 687	54.73	2109
15	448	26.01	1560	34	23.12	1471	448 to 685	75.73	4686
20	448	32.43	2606	33	29.76	2502	448 to 685	96.00	7902
25	448	37.58	3847	35	31.64	3596	448 to 688	106.41	11501
30	448	41.46	5229	38	32.46	4752	448 to 693	113.23	15400
35	448	44.05	6633	41	32.28	5960	448 to 698	116.56	19420
40	448	45.41	8038	44	30.88	7059	448 to 703	116.09	23255
45	448	45.60	9450	46	28.54	8019	448 to 707	112.37	26864
50	448	44.72	10703	48	26.53	8828	448 to 710	107.72	29993
55	448	42.89	11929	50	24.21	9480	448 to 713	101.22	32818
60	448	40.26	12910	51	22.28	9970	448 to 716	94.25	35024
65	448	36.97	13782	52	21.34	10341	448 to 718	88.04	36874
70	448	33.19	14385	53	20.39	10584	448 to 719	81.14	38133
75	448	29.10	14766	54	19.95	10644	448 to 720	74.67	38769
80	448	24.85	14902	54	20.85	10519	448 to 719	70.25	38746
85	448	20.61	14724	53	21.56	10211	448 to 719	65.52	37972
90	448	18.26	14300	52	22.74	9721	448 to 717	64.23	36547
95	448	24.69	13571	51	24.32	9054	448 to 715	75.93	34392
100	448	31.56	12517	49	27.48	8215	448 to 712	90.92	31490
105	448	38.68	11178	47	29.79	7209	448 to 709	104.80	27905
110	448	45.87	9538	45	32.29	6045	448 to 705	119.11	23631
115	448	53.06	7584	43	34.82	4732	448 to 701	133.48	18663
120	448	60.26	5331	40	38.19	3279	448 to 696	149.29	13039
125	448	67.11	2806	37	41.27	1697	448 to 692	164.13	6815
130	448	73.94	0	35	44.04	0	448 to 688	178.40	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 127 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 127INPUT DATA

Applied Load = 13422 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.102
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	569	0.00	0	26	0.00	0	569 to 841	0.00	0
5	569	4.25	85	26	4.47	70	569 to 841	13.56	240
10	569	7.79	314	26	8.22	321	569 to 841	24.89	987
15	569	10.60	644	26	12.18	728	569 to 841	35.56	2141
20	569	12.68	1048	26	13.69	1230	569 to 842	41.04	3559
25	569	14.06	1512	27	14.11	1743	569 to 843	43.68	5080
30	569	14.76	1965	28	14.35	2218	569 to 846	45.07	6522
35	569	14.86	2408	30	13.09	2699	569 to 848	43.06	7961
40	569	14.42	2821	31	11.84	3119	569 to 849	40.33	9253
45	569	13.53	3165	32	10.82	3439	569 to 851	37.34	10278
50	569	12.28	3445	32	9.88	3652	569 to 852	33.99	11033
55	569	10.76	3636	33	9.12	3758	569 to 852	30.59	11479
60	569	9.09	3714	33	9.54	3755	569 to 853	28.95	11585
65	569	7.35	3704	33	9.73	3644	569 to 853	26.84	11381
70	569	6.10	3559	32	10.94	3425	569 to 852	27.15	10806
75	569	8.82	3291	32	11.92	3100	569 to 851	32.63	9879
80	569	11.76	2904	31	13.24	2682	569 to 850	38.97	8626
85	569	14.89	2376	30	14.33	2164	569 to 848	45.21	7007
90	569	18.11	1713	29	16.72	1541	569 to 846	53.79	5019
95	569	21.28	924	27	19.15	818	569 to 844	62.36	2685
100	569	24.56	0	26	21.43	0	569 to 841	70.83	0

HARTMAN ENGINEERING

BY: RJH DATE: 05-20-2006 SUBJECT _____ SHT. NO.: RAC - 128 OF _____

CHKD. BY: _____ DATE: _____ JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 128INPUT DATA

Applied Load = 12868 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.106
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	547	0.00	0	26	0.00	0	547 to 811	0.00	0
5	547	4.23	85	26	4.47	70	547 to 811	13.54	240
10	547	7.76	313	26	8.22	321	547 to 811	24.85	985
15	547	10.56	642	26	12.18	728	547 to 811	35.50	2138
20	547	12.63	1044	26	13.69	1230	547 to 811	40.97	3554
25	547	14.00	1506	27	14.11	1743	547 to 813	43.60	5072
30	547	14.71	1958	28	14.35	2218	547 to 815	45.00	6512
35	547	14.81	2399	30	13.09	2699	547 to 817	42.99	7949
40	547	14.37	2810	31	11.84	3119	547 to 819	40.25	9238
45	547	13.48	3153	32	10.82	3439	547 to 821	37.27	10262
50	547	12.23	3433	32	9.88	3652	547 to 822	33.92	11016
55	547	10.72	3622	33	9.12	3758	547 to 822	30.53	11461
60	547	9.06	3700	33	9.54	3755	547 to 822	28.90	11565
65	547	7.32	3690	33	9.73	3644	547 to 822	26.80	11362
70	547	6.08	3546	32	10.94	3425	547 to 822	27.12	10788
75	547	8.79	3279	32	11.92	3100	547 to 821	32.59	9862
80	547	11.71	2893	31	13.24	2682	547 to 820	38.91	8611
85	547	14.83	2368	30	14.33	2164	547 to 818	45.13	6995
90	547	18.04	1707	29	16.72	1541	547 to 816	53.69	5010
95	547	21.20	920	27	19.15	818	547 to 814	62.25	2680
100	547	24.47	0	26	21.43	0	547 to 811	70.70	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 129 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 129INPUT DATA

Applied Load = 25051 lb./ft.
 Arc Subtended = 100 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.114
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1073	0.00	0	26	0.00	0	1073 to 1548	0.00	0
5	1073	8.87	178	26	4.47	70	1073 to 1548	20.03	371
10	1073	16.25	656	26	8.22	321	1073 to 1547	36.74	1465
15	1073	22.12	1344	26	12.18	728	1073 to 1547	51.68	3122
20	1073	26.46	2186	26	13.69	1230	1073 to 1548	60.32	5153
25	1073	29.32	3154	27	14.11	1743	1073 to 1550	65.05	7379
30	1073	30.80	4100	28	14.35	2218	1073 to 1552	67.53	9511
35	1073	31.00	5024	30	13.09	2699	1073 to 1554	65.66	11623
40	1073	30.09	5884	31	11.84	3119	1073 to 1556	62.26	13542
45	1073	28.23	6603	32	10.82	3439	1073 to 1557	57.92	15091
50	1073	25.62	7188	32	9.88	3652	1073 to 1558	52.66	16273
55	1073	22.46	7584	33	9.12	3758	1073 to 1559	46.96	17007
60	1073	18.97	7748	33	9.54	3755	1073 to 1559	42.77	17232
65	1073	15.34	7727	33	9.73	3644	1073 to 1559	38.03	17013
70	1073	12.74	7425	32	10.94	3425	1073 to 1559	36.44	16219
75	1073	18.41	6866	32	11.92	3100	1073 to 1558	46.06	14884
80	1073	24.53	6058	31	13.24	2682	1073 to 1557	56.85	13041
85	1073	31.06	4958	30	14.33	2164	1073 to 1555	67.85	10621
90	1073	37.77	3574	29	16.72	1541	1073 to 1553	81.32	7624
95	1073	44.40	1927	27	19.15	818	1073 to 1550	94.73	4090
100	1073	51.24	0	26	21.43	0	1073 to 1548	108.18	0

BY: RJH

DATE: 05-20-2006

SUBJECT

SHT. NO.: RAC - 130 OF

CHKD. BY:

DATE:

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 130INPUT DATA

Applied Load = 13422 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.102
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	569	0.00	0	19	0.00	0	569 to 830	0.00	0
5	569	4.39	88	19	4.92	79	569 to 830	14.52	260
10	569	8.35	337	19	9.44	363	569 to 829	27.74	1090
15	569	11.80	717	18	13.99	839	569 to 829	40.32	2431
20	569	14.71	1198	18	16.50	1425	569 to 828	48.66	4101
25	569	17.06	1769	19	17.59	2046	569 to 830	53.78	5955
30	569	18.81	2404	21	18.64	2701	569 to 833	58.04	7959
35	569	19.99	3050	23	17.96	3386	569 to 836	58.53	10027
40	569	20.61	3696	24	17.15	4008	569 to 838	58.01	11989
45	569	20.69	4345	25	16.11	4551	569 to 840	56.38	13821
50	569	20.29	4921	27	14.69	5009	569 to 842	53.40	15405
55	569	19.46	5485	28	13.38	5377	569 to 844	50.00	16821
60	569	18.27	5936	28	12.58	5654	569 to 845	46.98	17923
65	569	16.78	6337	29	11.85	5857	569 to 847	43.64	18830
70	569	15.06	6614	29	11.49	5995	569 to 847	40.63	19452
75	569	13.20	6790	30	11.25	6028	569 to 848	37.62	19754
80	569	11.28	6852	30	11.29	5957	569 to 848	35.00	19721
85	569	9.35	6770	29	12.21	5782	569 to 847	33.87	19308
90	569	8.29	6575	29	12.86	5504	569 to 846	33.47	18564
95	569	11.20	6240	28	13.73	5126	569 to 845	39.03	17452
100	569	14.32	5756	27	15.44	4651	569 to 843	46.30	15965
105	569	17.55	5139	26	16.70	4081	569 to 842	52.98	14134
110	569	20.81	4385	25	18.08	3422	569 to 840	59.88	11958
115	569	24.08	3487	24	19.45	2678	569 to 837	66.79	9436
120	569	27.34	2451	22	21.34	1856	569 to 835	74.57	6588
125	569	30.46	1290	21	23.06	961	569 to 832	81.85	3440
130	569	33.56	0	19	24.60	0	569 to 830	88.82	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 131 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 131INPUT DATA

Applied Load = 12868 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.106
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	547	0.00	0	19	0.00	0	547 to 800	0.00	0
5	547	4.38	88	19	4.92	79	547 to 799	14.50	259
10	547	8.32	336	19	9.44	363	547 to 799	27.70	1088
15	547	11.76	715	18	13.99	839	547 to 798	40.26	2427
20	547	14.66	1193	18	16.50	1425	547 to 798	48.59	4095
25	547	16.99	1762	19	17.59	2046	547 to 800	53.70	5946
30	547	18.74	2395	21	18.64	2701	547 to 803	57.94	7946
35	547	19.92	3039	23	17.96	3386	547 to 805	58.43	10011
40	547	20.53	3682	24	17.15	4008	547 to 808	57.91	11970
45	547	20.62	4329	25	16.11	4551	547 to 810	56.27	13799
50	547	20.22	4903	27	14.69	5009	547 to 812	53.29	15380
55	547	19.39	5465	28	13.38	5377	547 to 814	49.90	16793
60	547	18.20	5914	28	12.58	5654	547 to 815	46.88	17893
65	547	16.71	6314	29	11.85	5857	547 to 816	43.55	18798
70	547	15.01	6590	29	11.49	5995	547 to 817	40.56	19418
75	547	13.15	6765	30	11.25	6028	547 to 818	37.55	19719
80	547	11.23	6827	30	11.29	5957	547 to 817	34.94	19685
85	547	9.32	6745	29	12.21	5782	547 to 817	33.82	19274
90	547	8.26	6551	29	12.86	5504	547 to 816	33.42	18530
95	547	11.16	6217	28	13.73	5126	547 to 815	38.97	17420
100	547	14.27	5734	27	15.44	4651	547 to 813	46.23	15935
105	547	17.49	5121	26	16.70	4081	547 to 812	52.89	14108
110	547	20.74	4369	25	18.08	3422	547 to 810	59.77	11936
115	547	23.99	3474	24	19.45	2678	547 to 807	66.67	9418
120	547	27.24	2442	22	21.34	1856	547 to 805	74.43	6575
125	547	30.34	1285	21	23.06	961	547 to 802	81.69	3434
130	547	33.43	0	19	24.60	0	547 to 800	88.64	0

BY: RJH

DATE: 05-20-2006

SUBJECT _____

SHT. NO.: RAC - 132 OF _____

CHKD. BY: _____

DATE: _____

JOB NO.: 06-602

ANALYSIS AND DESIGN LOADS FOR WALE NO. 132INPUT DATA

Applied Load = 25051 lb./ft.
 Arc Subtended = 130 degrees
 Surcharge Load = 1991 lb./ft.

Variation Factor = 1.114
 Radius CL = 38.48 feet
 Distance to Surcharge = 12.5 feet

TABULATION OF INTERNAL LOADS

Point	Analysis Loads						Design Loads		
	Soil & Water			Surcharge			Range of P (kips)	V (kips)	M (k-in)
	P (kips)	V (kips)	M (k-in)	P (kips)	V (kips)	M (k-in)			
0	1073	0.00	0	19	0.00	0	1073 to 1536	0.00	0
5	1073	9.17	184	19	4.92	79	1073 to 1536	21.21	394
10	1073	17.42	703	19	9.44	363	1073 to 1536	40.44	1603
15	1073	24.63	1497	18	13.99	839	1073 to 1535	58.27	3522
20	1073	30.70	2499	18	16.50	1425	1073 to 1535	71.04	5923
25	1073	35.58	3690	19	17.59	2046	1073 to 1537	79.72	8645
30	1073	39.25	5016	21	18.64	2701	1073 to 1539	86.65	11615
35	1073	41.71	6363	23	17.96	3386	1073 to 1542	88.93	14665
40	1073	42.99	7710	24	17.15	4008	1073 to 1545	89.35	17608
45	1073	43.17	9064	25	16.11	4551	1073 to 1547	87.85	20428
50	1073	42.34	10266	27	14.69	5009	1073 to 1549	84.26	22888
55	1073	40.61	11442	28	13.38	5377	1073 to 1551	79.60	25161
60	1073	38.11	12384	28	12.58	5654	1073 to 1552	74.76	26950
65	1073	35.00	13219	29	11.85	5857	1073 to 1553	69.15	28466
70	1073	31.42	13798	29	11.49	5995	1073 to 1554	63.54	29509
75	1073	27.55	14164	30	11.25	6028	1073 to 1554	57.70	30078
80	1073	23.53	14294	30	11.29	5957	1073 to 1554	52.15	30139
85	1073	19.51	14123	29	12.21	5782	1073 to 1554	48.09	29602
90	1073	17.29	13717	29	12.86	5504	1073 to 1553	46.07	28562
95	1073	23.37	13017	28	13.73	5126	1073 to 1552	56.07	26940
100	1073	29.88	12007	27	15.44	4651	1073 to 1550	68.08	24717
105	1073	36.62	10721	26	16.70	4081	1073 to 1548	79.67	21949
110	1073	43.42	9149	25	18.08	3422	1073 to 1546	91.53	18627
115	1073	50.23	7275	24	19.45	2678	1073 to 1544	103.40	14739
120	1073	57.05	5114	22	21.34	1856	1073 to 1541	116.15	10315
125	1073	63.54	2692	21	23.06	961	1073 to 1539	128.16	5402
130	1073	70.00	0	19	24.60	0	1073 to 1536	139.84	0

APPENDIX A

Selected Pages from Foundation Design
by Wayne C. Teng

**FOUNDATION
DESIGN**

Wayne C. Teng

*Teng and Associates
Consulting Engineers, Chicago, Illinois*

Prentice-Hall, Inc.

Englewood Cliffs, New Jersey

tential lines at various points. At point j , for example, it intersects equipotential line 2, hence the pressure

$$P_w = \frac{2}{9}h\gamma_w$$

With the pressure at the various intersections known, as shown on the right hand side of Fig. 4-13(a), the total pressure P_w , acting at right angle to the sliding surface ab , can be computed.

In computing the earth pressure during a rain storm, the wedge theory (Sec. 4-4) is used. The computation should include the total hydraulic pressure P_w (pore pressure) acting on the sliding surface; the saturated weight of soil should be used. These forces are shown in Fig. 4-13(d) and the force polygon is shown in Fig. 4-13(e). If the back of wall is vertical, the wall is built on top of a relatively impervious layer, and an adequate drain layer is provided against the back of the wall, the value of total pressure P_w acting on any trial sliding surface can be obtained directly from Fig. 4-13(f).

With the aid of flow net, the hydraulic uplift against the base of the wall can be determined at intersections of equipotential lines.

4-9 Surcharge Load

The lateral pressure introduced on a retaining structure may be classified into four types for convenience of computation.

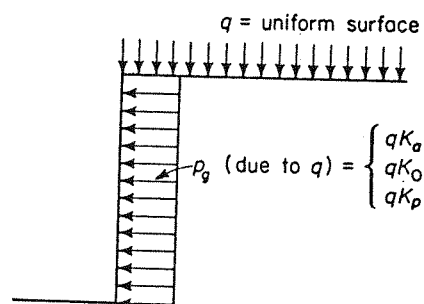


Fig. 4-14 Lateral pressure due to uniform surcharge.

A. Uniform load. When the ground surface is subjected to a uniformly distributed load, the earth pressure computation is often made by substituting the load by an equivalent surcharge layer. The thickness of this surcharge layer is equal to the distributed load divided by the unit weight of the underlying soil.

The computation of lateral pressure due to a uniform surcharge is relatively simple. In the case where the wedge theory is used, the surcharge load can be readily included in the computation of the weight of wedges. In the case where Rankine theory is applicable, the pressure caused by a uniform surcharge q is a constant pressure and is equal to

$$P_q = qK_a, \quad p_q = qK_0, \quad \text{or} \quad p_q = qK_p \quad (4-6)$$

where the earth pressure coefficient K_a , K_0 , or K_p is a constant within any soil stratum having a constant φ value, Fig. 4-14.

Contrary to the uniform surcharge, the lateral pressure due to a surcharge applied on a limited area of the ground surface is difficult to determine. The effect of a strip load or a line load parallel to a retaining wall may be included in the trial wedge method. In other cases, the theory of elasticity has been widely used. However, the validity of the elastic theory has not been proved in all cases. The results of a limited number of tests (Terzaghi, 1954) have proved that the measured horizontal unit pressure against a vertical rigid wall are about twice as high as those calculated by the elastic theory.

B. Strip load. Highways, railroads and continuous wall footings are strip loads when they are parallel to the retaining structure. Refer to Fig. 4-15 and let:

- p_q = horizontal pressure at point a ;
- β = angle of visibility at point a , in radian;
- α = angle between vertical and the bisector of β ;
- q = strip load, psf.

The actual lateral pressure against a rigid wall is twice the value determined by theory of elasticity:

$$p_q = \frac{2q}{\pi} (\beta + \sin \beta) \sin^2 \alpha + \frac{2q}{\pi} (\beta - \sin \beta) \cos^2 \alpha \quad (4-7)$$

as shown in Fig. 4-15, the value of p_q varies with depth.

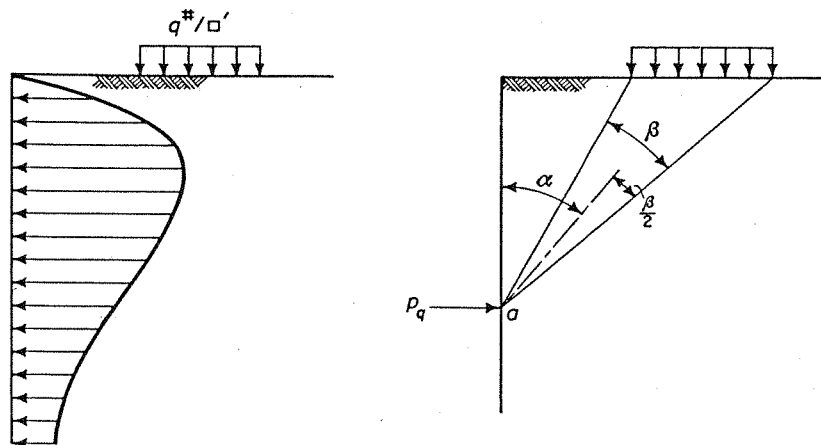


Fig. 4-15 Lateral pressure due to strip load.

C. Line load. A continuous wall footing of narrow width may be taken as a line load when located parallel to the retaining structure. Similar to the case of strip load, the lateral pressure increases from zero at the ground surface to a maximum value at a certain depth and gradually diminishes to

(Handwritten note: Val B, misprint)

zero at a greater depth, Fig. 4-16. The unit horizontal pressure may be computed by the following equation (Terzaghi, 1954):

$$\left. \begin{aligned} p_q &= 1.27q \frac{xz}{R^4} \\ &= 1.27 \frac{q}{H} \frac{m^2 n}{(m^2 + n^2)^2} \end{aligned} \right\} (m > 0.4) \quad (4-8a)$$

$$p_q = 0.203 \frac{q}{H} \frac{n}{(0.16 + n^2)^2} \quad (m < 0.4) \quad (4-8b)$$

D. Point load. A wheel load or any load concentrated on a small area may be treated as a point load. The intensity of lateral pressure in this case varies not only with the depth but also with the horizontal distance from the load. The pressure is greatest along the vertical line ab closest to the load, Fig. 4-17. Along this line ab , the unit horizontal pressure p may be computed by the following empirical equations (Terzaghi, 1954):

$$p_1 = 1.77 \frac{Q}{H^2} \frac{m^2 n^2}{(m^2 + n^2)^3} \quad (m > 0.4) \quad (4-9a)$$

$$p_1 = 0.28 \frac{Q}{H^2} \frac{n^2}{(0.16 + n^2)^3} \quad (m < 0.4) \quad (4-9b)$$

The unit horizontal pressure on any other points on both sides of ab is smaller than p_1 at the same depth, and may be calculated by the following equation.

$$p_Q = p_1 \cos^2 (1.1\psi) \quad (4-9c)$$

The notations used in the equations above are self-explanatory in Fig. 4-17.

4-10 Ice Thrust

Substructures are subjected to ice thrust where the ground water or capillary water is above the frost line (depth of frost penetration). Lateral thrust is caused by the volume expansion of ice upon change in temperature. The magnitude of the thrust is very large, being equal to the buckling or crushing strength of the ice sheet. In practice the horizontal ice thrust acting

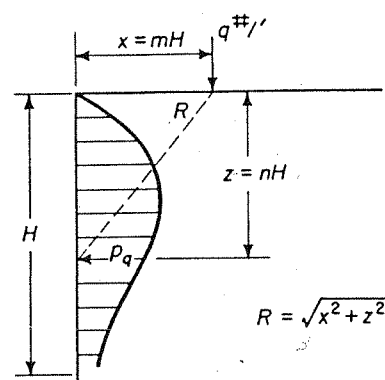


Fig. 4-16 Lateral pressure due to line load.

The maximum water level should be established.

3. Compute the lateral pressure—Sec. 13-4.
4. Select the type and material for the components of the cofferdam—Sec. 13-2.
5. Design the various components—Sec. 13-5.
6. Investigate the stability of the cofferdam—Sec. 13-6.
7. Investigate the safety against piping—Sec. 13-7.

The plan dimension of a braced cofferdam is controlled by the size of the substructure to be constructed within the cofferdam. The cofferdam should be at least 5 ft larger on each side so as to allow sufficient room for work and the installation of formwork. Space should also be provided for sumps if they are used for dewatering the cofferdam. If the substructure will be poured against the lagging or sheeting, the plan size of the cofferdam is, of course, the size of the substructure. It should be borne in mind, in this case, that the final dimensions of the cofferdam are likely to differ somewhat from the design dimensions. Therefore, it is essential to allow for such variations in the design. The amount of variation between the design and the actual dimensions depends on the characteristics of the soil and the workmanship of the constructor. In unfavorable conditions, the variation may exceed 6 in. Sheetpiling tends to creep in the direction of driving. Consequently, the total length of wall is generally longer than the theoretical dimension.

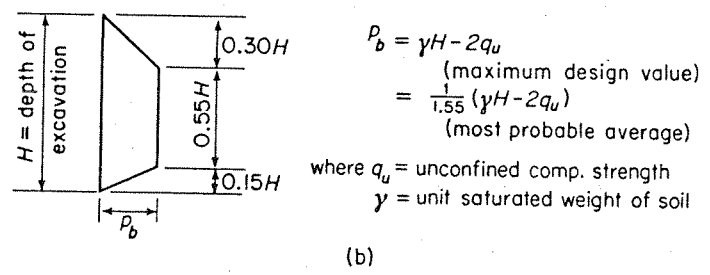
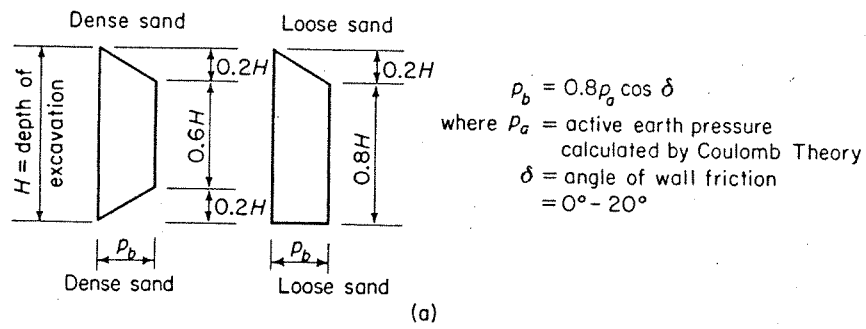
In water, the height of a cofferdam is controlled by the high water level expected during the useful life of the cofferdam. The high water level also controls the necessary depth of penetration of the piling in order to prevent boil and heave of the bottom of excavation.

13-4 Lateral Pressure on Braced Cofferdams

A braced cofferdam may be subjected to earth pressure, surcharge load, hydrostatic pressure, wave pressure, and earthquake forces. With the exception of earth pressure, all these forces may be evaluated by the principles discussed in Chapter 4. The earth pressure, however, cannot be calculated by the classical earth pressure theories (Rankine, Coulomb and wedge theories) because the yield (movement) of cofferdam walls does not satisfy the basic assumptions of these theories. For cofferdams in sand and soft to medium clays, the trapezoidal rules proposed by Terzaghi and Peck (1948) may be used for design purposes. In stiff clays, the earth pressure is very small in the beginning but frequently increases with time and may approach a value corresponding to the earth pressure assuming a zero cohesion (Kirkdam, 1958). These cases are discussed below.

A. Earth pressure on braced cofferdam in sand. The actual earth pressure at a given vertical profile of the cofferdam varies considerably from place to place. The greatest load that a strut may be required to take can be calculated by the trapezoidal pressure diagrams shown in Fig. 13-2(a). These trapezoids represent the maximum pressure which may exist on some of the profiles in a given braced cofferdam in sand. However, the actual loads on many struts are likely to be smaller.

For ordinary design, the value of ϕ to be used for calculation of P_a may be



	Theoretical rupture surface	Av measured pressure $1/m^2$	Values used for computing earth pressure, in percentage of triaxial values	
			ϕ	C
Shortly after excavation (September)		2.27	100	80
September 20th		2.27	100	60
October 21st		4.29	100	15
November 15th		7.13	100	0

Fig. 13-2 Earth pressure on braced cofferdams: (a) in sand; (b) in soft and medium clays (after Terzaghi and Peck); (c) on an experimental cofferdam in stiff fissured clay (after Kirkdam).

estimated on the basis of the standard penetration resistance using the relationship between φ and N shown in Table 1-1. The angle of wall friction δ should be assumed zero unless the sheeting or soldier beams are driven to dense soil. In the latter case, the value of δ may be taken up to 20 degrees.

B. Earth pressure on braced cofferdams in soft and medium clays. Similar to the case of braced cofferdams in sand, the earth pressure varies from place to place and may be approximated, for the design purpose, by a trapezoid shown in Fig. 13-2(b). The total earth pressure represented by the area of the trapezoid is probably equal to the total Rankine active earth pressure, by assuming the angle of internal friction φ equal to zero and the cohesion c equal to one-half the unconfined compression strength. According to Rankine, the total active pressure is equal to $\frac{1}{2}\gamma H^2[1 - (2q_u/\gamma H)]$. The total area of the trapezoid is $\frac{1}{2}(1.55p_bH)$. Equating these two values, we get

$$p_b = \frac{1}{1.55}(\gamma H - 2q_u)$$

This value is the probable average pressure. Since the actual pressure varies considerably from place to place, the design should be made for the most unfavorable condition using

$$p_b = \gamma H - 2q_u \quad (13-1)$$

where q_u = unconfined compression strength of the soil.

C. Earth pressure on braced cofferdams in stiff clays. Immediately after the installation of a cofferdam, the earth pressure due to stiff clays is relatively small. However, as time goes on, the fissures in the stiff clay become softened and the earth pressure increases considerably. This phenomenon has been studied in a test trench, the results of which are shown in Fig. 13-2(c). At a time shortly after excavation, the average earth pressure was 2.27 tons per square meter, corresponding to $\varphi = 100$ per cent, and $c = 80$ per cent of the values determined by triaxial test. At the end of about two months, the earth pressure increased to 7.13 tons per square meter, corresponding to $\varphi = 100$ per cent and $c = 0$ per cent of the test values. The results of this experiment leads to the conclusion that the final maximum earth pressure may be calculated on the basis of $c = 0$ and φ = the value determined by tri-axial test

D. Earth pressure on braced cofferdams in stratified soils. When layers of sand and soft clay are encountered, the trapezoidal distribution shown in Fig. 13-2(b) may be used if the unconfined compression strength q_u is substituted by the average value q_a and the unit weight of the soil by the average value γ_a (Peck, 1943).

$$q_a = \frac{1}{H} [\gamma_s K_s H_s^2 \tan \varphi_s (H - H_s) n q_u] \quad (13-2)$$

$$\gamma_a = \frac{1}{H} [\gamma_s H_s + (H - H_s) \gamma_c] \quad (13-3)$$

where γ_s = unit saturated weight of sand;

K_s = hydrostatic pressure ratio for the sand layer, may be taken as 1.0 for design purposes;

H_s = thickness of the sand layer;

φ = angle of internal friction of the sand;

H = total depth of excavation;

q_u = unconfined compression strength of the clay;

γ_c = unit saturated weight of the clay;

n = coefficient of progressive failure, the value ranges usually from 0.5 to 1.0. This value varies with the creep characteristics of the clay, the length of time during which the excavation remains open, and the care exercised in construction. In Chicago clay, the value ranges between 0.75 to 1.0.

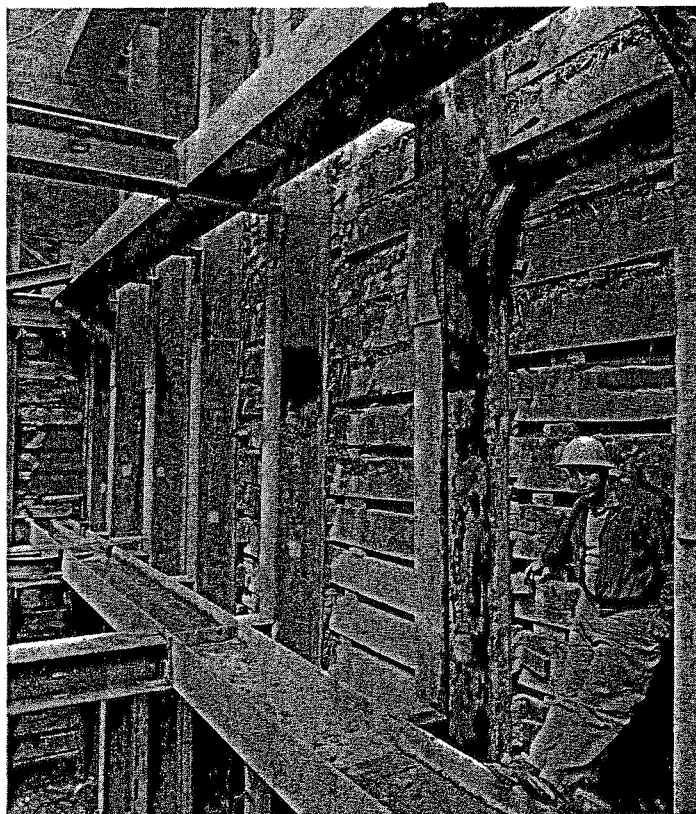


Fig. 13-3 Interior of a braced cofferdam. Courtesy of Spencer, White & Prentis.

13-5 Components of Braced Cofferdams

A. Lagging. Usually made of 2 in. or 3 in. planks, the lagging is installed by hand after a depth of several feet is excavated. The maximum depth made each time before a series of lagging is placed depends on the soil characteristics. Soft clay and loose sand must be planked in short depths to reduce the amount of soil moving or running into the excavation. Immediately after placement of lagging, wedges should be driven to force it tightly against the soil. Voids behind the lagging should be packed by hand to reduce the amount of loss of ground. Figure 13-3 shows an interior view of a braced cofferdam using lagging.

Due to flexibility of wood, lagging usually deflects considerably. This deflection tends to reduce the magnitude of the earth pressure at the midspan of the lagging. Consequently, lagging is seldom subjected to high bending stress even if the calculated value is high.

B. Sheetpiling. Generally sheetpiling is designed as a continuous member supported at the strut levels. In addition, a fictitious support is introduced at the bottom of excavation and the sheetpiling is assumed to be hinged at this level, Fig. 13-4(a). The struts may be arranged at such levels that either

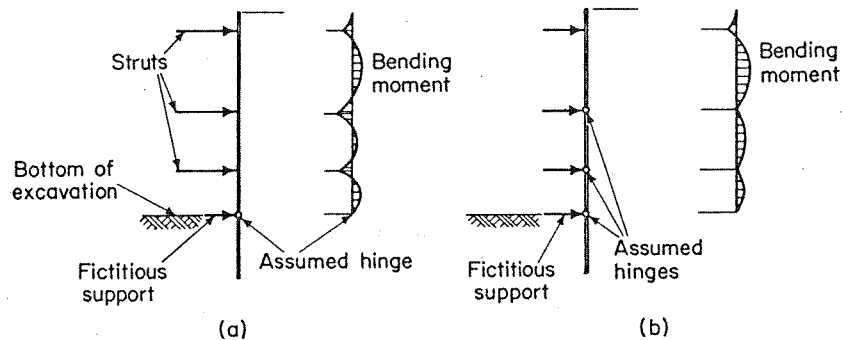


Fig. 13-4 Assumptions used in the design of sheeting and soldier beams: (a) sheeting and soldier beams; (b) soldier beams (alternate design).

the maximum bending moments are equal in all spans of the sheetpiling, or the reactions on the struts at all levels are equal. In many cases, the arrangements of struts is governed by the details of the permanent substructure.

Sheetpiling driven in soft soil also offers resistance against heaving force of the soil at the bottom of excavation. This is discussed in Sec. 13-7.

C. Soldier beams. Soldier beams may be designed as fully continuous over-all supports as discussed above, or as simple spans as shown in Fig. 13-4(b). The latter assumption gives a more conservative design.

D. Wales. Wales are designed to resist horizontal reactions from soldier beams or sheetpiling. In addition they are also subjected to axial load due

to reaction from the perpendicular wales at the corner of the cofferdam. Usually moment splices are provided in wales and in such cases, they are designed as continuous beams subjected to lateral and axial loads.

E. Struts. Struts are pure compression members. They must be tightened against the wales for several reasons. Excessive yielding of struts means horizontal movement of the sides of excavation and therefore, causing settlement of the adjacent ground. In fissured clays, such lateral movement opens up the fissures which readily absorb moisture and become soft. Once the shear strength is reduced on the fissures, large earth pressure will be inevitable. Furthermore, unyielding supports are essential to maintain minimum bending moment in the wales.

Long struts required in large excavations are also subjected to considerable expansion and contraction due to temperature variations. At high ambient temperature, additional stress exists in the struts.

It is always advantageous to provide posts at some intermediate points for the purpose of reducing l/r value of the horizontal struts. It also reduces undue stresses due to excessive sagging of the struts.

Although close spacing of struts may be desirable from the designer's point of view, a spacing of 8 ft is considered minimum for construction operations. The struts and wales in each tier may be located at the same elevation in both directions. At the point of intersection, the strut in one direction is continuous and the perpendicular struts are framed into it. Each point of intersection is a field connection which must be designed and constructed to carry the axial stress of the strut. This field connections may be eliminated by running continuous struts in both directions, one strut being immediately above the other. Since the struts meet the wales at the same elevation, this arrangement will have wales meeting at different elevations at each corner of the cofferdam. The horizontal reaction transferred from one wale to the other introduces axial stress as well as bending moment resulting from the eccentricity of the reaction. In such cases, the wale must be designed for the combined stress due to the axial force, the bending moment from the lateral earth pressure, and the bending moment from the eccentrically applied longitudinal force.

13-6 Stability of Braced Cofferdams

A braced cofferdam may fail as a unit due to unbalanced external forces or by heaving of the bottom of excavation.

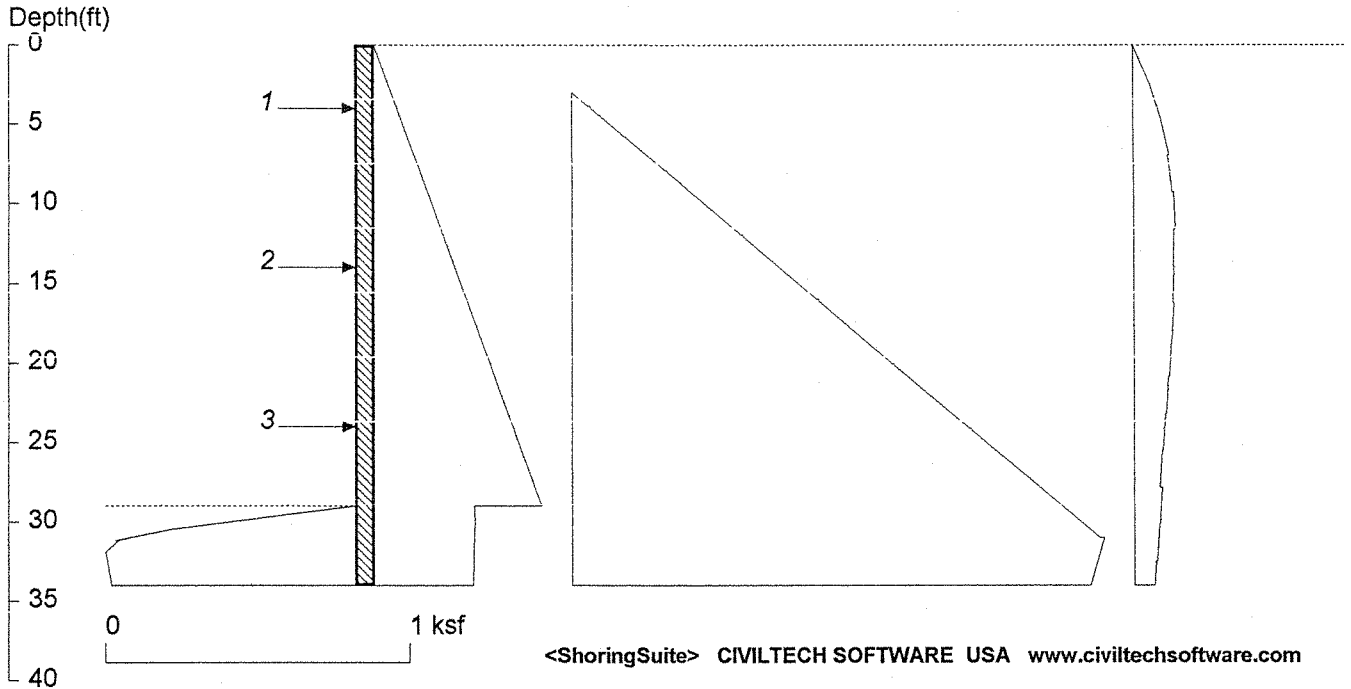
A. Unbalanced external forces. If the external forces acting on the opposite sides of cofferdams are unequal, the stability of the entire cofferdam as a unit should be analyzed. For example, a cofferdam driven to shallow depth in a river may be damaged by forces from swift current during a flash flood. Soil

APPENDIX B

Software Output for Analysis on Sheet WA-7

Raytheon Facility - Wayland, MA

Ref: WA-7



Licensed to Richard Hartman Hartman Engineering

Date: 5/3/2006 File Name: UNTITLED

Wall Height=29.0

Pile Diameter=1.0

Pile Spacing=1.0

ACTIVE SPACE:		
	Z depth	Spacing
1	0.00	1.00
2	29.00	1.00
PASSIVE SPACE:		
	Z depth	Spacing
1	29.00	1.00

PILE LENGTH: Min. Embedment=5.01, Min. Pile Length=34.01

MOMENT IN PILE: Max. Moment=80.06 at Depth of 24.01

PILE SELECTION:

Request Min. Section Modulus = 29.1 in³/feet, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66

PZC18 has Section Modulus = 33.5. It is greater than Min. Requirements!

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

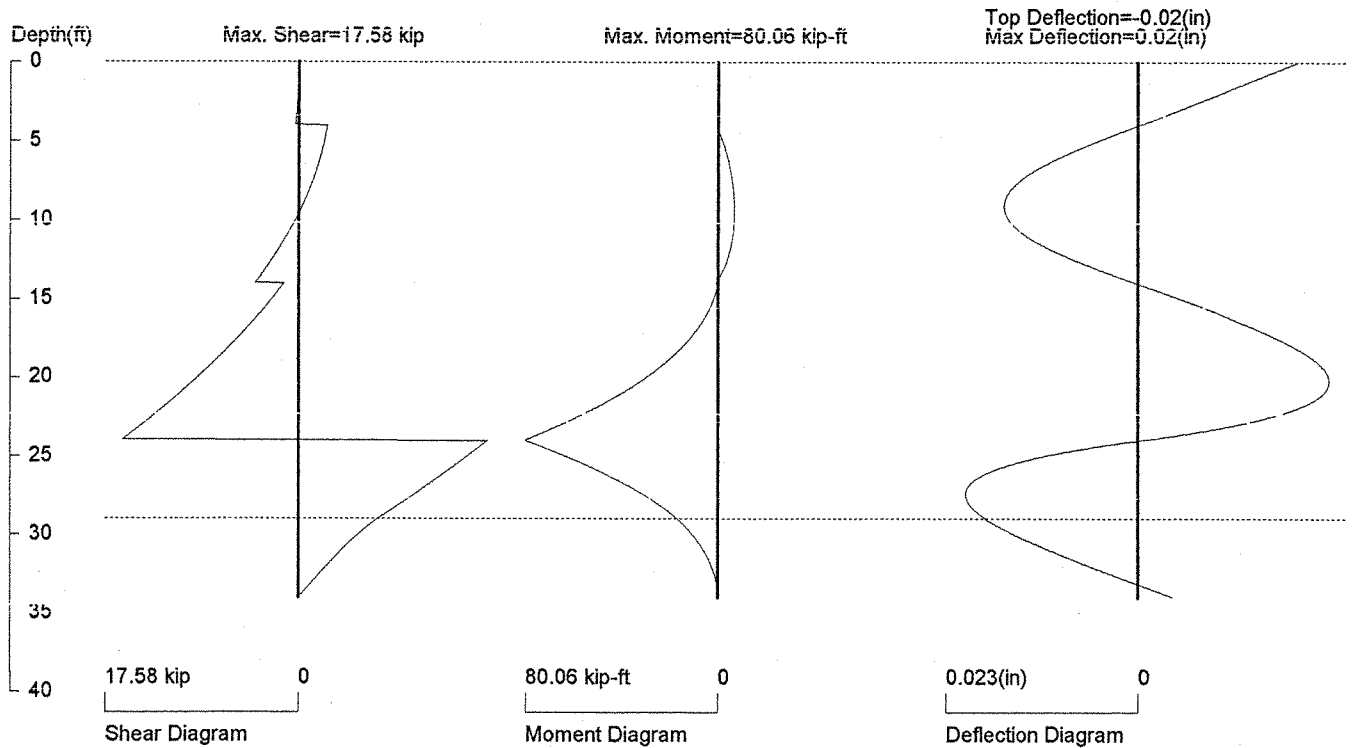
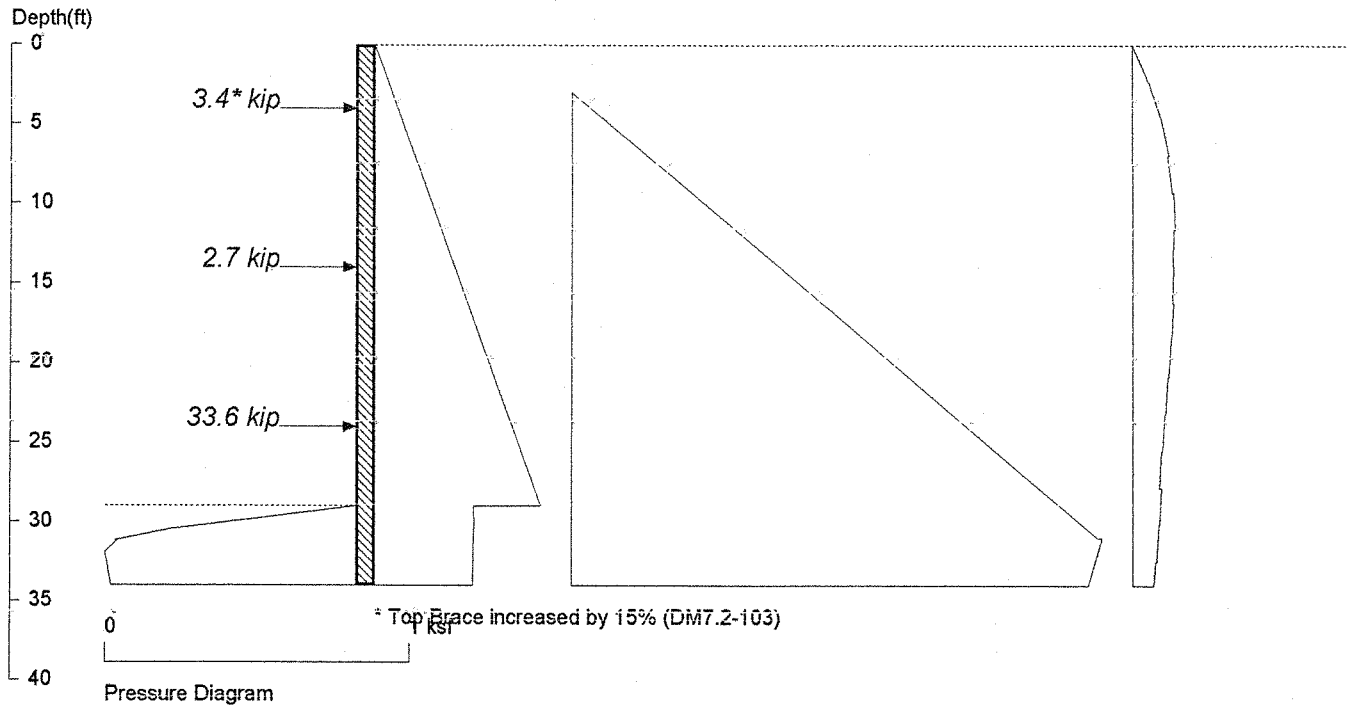
No. & Type	Depth	Angle	Total	Horiz.	Vert.	N/A	N/A
1. Strut	4.0	0.0	3.4*	3.4	0.0	0.0	0.0
2. Strut	14.0	0.0	2.7	2.7	0.0	0.0	0.0
3. Strut	24.0	0.0	33.6	33.6	0.0	0.0	0.0

* Top Brace increased by 15% (DM7.2-103)

UNITS: Length/Depth - ft, Force - kip, Moment - kip-ft, Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

Raytheon Facility - Wayland, MA

Ref: WA-7



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on one soldier pile or one foot spacing of sheet pile

Pile: PZC18 meet Section Requirements. Properties: 6. E (ksi)=29000, 4. I (in⁴)=255.5

Date: 5/3/2006 File Name: UNTITLED

report.out

SHORING WALL CALCULATION SUMMARY
 The leading shoring design and calculation software
 Software Copyright by CivilTech Software
 www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.

The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002

DEPTH: ft, PRESSURE, FRICTION, BEARING: ksf, SLOPE: kcf, FORCE: kip, MOMENT: kip-ft, DEFLECTION: in, I: in4, E: ksi

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 Date: 5/3/2006 File: UNTITLED

Title: Raytheon Facility - Wayland, MA
 Subtitle: Ref: WA-7

*****INPUT DATA*****

Wall Type: 1. Sheet Pile
 wall Height: 29.00
 Pile Diameter: 1.00
 Pile Spacing: 1.00
 Factor of Safety (F.S.): 1.00
 Max. Moment reduce 20%
 Lateral Support Type (Braces): 2. Strut, Raker
 Top Brace Increase (Multi-Bracing): Add 15%*
 Embedment Option: 1. Yes
 Friction at Pile Tip: No*
 Pile Properties:
 Allowable Fb/Fy: 0.66
 Steel Strength, Fy: 50 ksi = 345 MPa
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 100.00
 User Input Pile: PZC18

* ACTIVE PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z2 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	0.00	0.00	29.00	0.56	0.0190
2	29.00	0.33	30.45	0.33	0.0010
3	30.45	0.33	36.97	0.32	-0.0010
4	36.97	0.32	38.43	0.32	0.0010
5	38.43	0.32	39.15	0.32	-0.0010
6	39.15	0.32	40.60	0.32	-0.0050
7	40.60	0.32	47.13	0.31	0.0000
8	47.13	0.31	47.85	0.30	-0.0170
9	47.85	0.30	48.57	0.29	-0.0180
10	48.57	0.29	49.30	0.29	-0.0010
11	49.30	0.29	50.75	0.29	0.0020
12	50.75	0.29	51.47	0.29	-0.0020

			report.out		
13	51.47	0.29	54.38	0.28	-0.0040
14	54.38	0.28	55.10	0.28	-0.0010
15	55.10	0.28	56.55	0.29	0.0060
16	56.55	0.29	57.28	0.28	-0.0010
17	57.28	0.28	59.45	0.28	-0.0020
18	59.45	0.28	60.18	0.28	0.0000
19	60.18	0.28	60.90	0.28	0.0010
20	60.90	0.28	62.35	0.29	0.0040
21	62.35	0.29	63.07	0.29	0.0000
22	63.07	0.29	63.80	0.28	-0.0120
23	63.80	0.28	64.52	0.27	-0.0160
24	64.52	0.27	65.25	0.26	-0.0030
25	65.25	0.26	65.98	0.27	0.0040
26	65.98	0.27	69.60	0.29	0.0060
27	69.60	0.29	74.68	0.31	0.0040
28	74.68	0.31	76.85	0.31	0.0030
29	76.85	0.31	78.30	0.32	0.0060
30	78.30	0.32	83.38	0.34	0.0030
31	83.38	0.34	86.27	0.35	0.0050
32	86.27	0.35	87.00	0.36	0.0070
33	87.00	0.36	87.73	0.36	0.0080
34	87.73	0.36	88.45	0.37	0.0060
35	88.45	0.37	100.77	0.43	0.0050
36	100.77	0.43	101.50	0.43	0.0060
37	101.50	0.43	102.23	0.44	0.0080
38	102.23	0.44	102.95	0.44	0.0060
39	102.95	0.44	122.52	0.54	0.0050
40	122.52	0.54	123.98	0.55	0.0070
41	123.98	0.55	145.00	0.66	0.0050
42	3.00	0.00	31.00	1.75	0.0620
43	31.00	1.75	145.00	0.00	-0.0150
44	0.00	0.00	2.32	0.05	0.0210
45	2.32	0.05	4.64	0.09	0.0170
46	4.64	0.09	6.96	0.11	0.0110
47	6.96	0.11	9.28	0.13	0.0060
48	9.28	0.13	11.60	0.13	0.0020
49	11.60	0.13	13.92	0.13	-0.0010
50	13.92	0.13	16.24	0.13	-0.0020
51	16.24	0.13	18.56	0.12	-0.0030
52	18.56	0.12	20.88	0.11	-0.0030
53	20.88	0.11	23.20	0.10	-0.0030
54	23.20	0.10	25.52	0.09	-0.0030
55	25.52	0.09	27.84	0.09	-0.0030
56	27.84	0.09	30.16	0.08	-0.0030
57	30.16	0.08	32.48	0.07	-0.0030
58	32.48	0.07	34.80	0.07	-0.0030
59	34.80	0.07	37.12	0.06	-0.0020
60	37.12	0.06	39.44	0.06	-0.0020
61	39.44	0.06	41.76	0.05	-0.0020
62	41.76	0.05	44.08	0.05	-0.0020
63	44.08	0.05	46.40	0.04	-0.0020
64	46.40	0.04	48.72	0.04	-0.0020
65	48.72	0.04	51.04	0.04	-0.0010
66	51.04	0.04	53.36	0.03	-0.0010
67	53.36	0.03	55.68	0.03	-0.0010
68	55.68	0.03	58.00	0.03	-0.0010
69	58.00	0.03	60.32	0.03	-0.0010
70	60.32	0.03	62.64	0.02	-0.0010
71	62.64	0.02	64.96	0.02	-0.0010
72	64.96	0.02	67.28	0.02	-0.0010
73	67.28	0.02	69.60	0.02	-0.0010
74	69.60	0.02	71.92	0.02	-0.0010

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75	71.92	0.02	74.24	0.02	-0.0010
76	74.24	0.02	76.56	0.02	0.0000
77	76.56	0.02	78.88	0.01	0.0000
78	78.88	0.01	81.20	0.01	0.0000
79	81.20	0.01	83.52	0.01	0.0000
80	83.52	0.01	85.84	0.01	0.0000
81	85.84	0.01	88.16	0.01	0.0000
82	88.16	0.01	90.48	0.01	0.0000
83	90.48	0.01	92.80	0.01	0.0000
84	92.80	0.01	95.12	0.01	0.0000
85	95.12	0.01	97.44	0.01	0.0000
86	97.44	0.01	99.76	0.01	0.0000
87	99.76	0.01	102.08	0.01	0.0000
88	102.08	0.01	104.40	0.01	0.0000
89	104.40	0.01	106.72	0.01	0.0000
90	106.72	0.01	109.04	0.01	0.0000
91	109.04	0.01	111.36	0.01	0.0000
92	111.36	0.01	113.68	0.01	0.0000
93	113.68	0.01	116.00	0.01	0.0000

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	29.00	0.00	29.73	0.30	0.4140
2	29.73	0.30	30.45	0.60	0.4080
3	30.45	0.60	31.18	0.78	0.2570
4	31.18	0.78	31.90	0.82	0.0520
5	31.90	0.82	39.15	0.75	-0.0090
6	39.15	0.75	39.88	0.78	0.0280
7	39.88	0.78	40.60	0.81	0.0450
8	40.60	0.81	41.33	0.82	0.0180
9	41.33	0.82	47.13	0.88	0.0110
10	47.13	0.88	47.85	1.01	0.1730
11	47.85	1.01	48.58	1.19	0.2510
12	48.58	1.19	49.30	1.29	0.1300
13	49.30	1.29	52.20	1.56	0.0940
14	52.20	1.56	52.93	1.62	0.0900
15	52.93	1.62	53.65	1.69	0.0890
16	53.65	1.69	55.10	1.82	0.0930
17	55.10	1.82	55.83	1.84	0.0250
18	55.83	1.84	56.55	1.84	-0.0020
19	56.55	1.84	57.28	1.89	0.0620
20	57.28	1.89	60.18	2.13	0.0840
21	60.18	2.13	60.90	2.19	0.0810
22	60.90	2.19	61.63	2.24	0.0790
23	61.63	2.24	62.35	2.30	0.0820
24	62.35	2.30	63.08	2.36	0.0830
25	63.08	2.36	63.80	2.57	0.2830
26	63.80	2.57	64.53	2.85	0.3950
27	64.53	2.85	65.25	3.03	0.2370
28	65.25	3.03	68.88	3.63	0.1670
29	68.88	3.63	69.60	3.75	0.1580
30	69.60	3.75	70.32	3.86	0.1550
31	70.32	3.86	71.05	3.98	0.1630
32	71.05	3.98	78.30	5.18	0.1660
33	78.30	5.17	79.75	5.41	0.1650
34	79.75	5.41	80.48	5.53	0.1600
35	80.48	5.53	81.20	5.64	0.1520
36	81.20	5.64	81.93	5.75	0.1560
37	81.93	5.75	90.63	7.17	0.1630
38	90.63	7.17	107.30	9.87	0.1620

			report.out		
39	107.30	9.86	111.65	10.56	0.1610
40	111.65	10.56	112.38	10.67	0.1600
41	112.38	10.67	113.83	10.89	0.1520
42	113.83	10.89	145.00	15.90	0.1610

* ACTIVE SPACE *

No.	Z depth	Spacing
1	0.00	1.00
2	29.00	1.00

* PASSIVE SPACE *

No.	Z depth	Spacing
1	29.00	1.00

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angle	Spacing	Input1*	Input2*
1	4.00	0.0	1.00	1.00	1.00
Strut					
2	14.00	0.0	1.00	1.00	1.00
Strut					
3	24.00	0.0	1.00	1.00	1.00
Strut					

*For Tieback: Input1 = Diameter; Input2 = Bond Strength

*For Plate: Input1 = Diameter; Input2 = Allowable Pressure

*For Deaman: Input1 = Horz. width; Input2 = Allowable Pressure; Angle = 0

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!
PZC18 SX= 33.5 IX= 255.5 Weight= 24.2

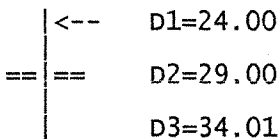
* Note: All the pile dimensions are in English Units per one foot width.

Add Pile Capacity in Emdment Calculation
Pile Moment Capacity, Ms: 92.13

*****CALCULATION*****

Top Pressures start at depth = 0.00

* CALCULATE EMBEDMENT *



D1 - TOP DEPTH	R1 - TOP REACTION
D2 - EXCAVATION BASE	
D3 - PILE TIP	

TOTAL REACTION: R1 = 17.61

report.out

TOTAL PRESSURE ACTING ON WALL = 17.61
 Total Reaction = Total Pressure, OK!
 The Calculated Embedment, Yend = 5.01

-----MULTIPLE BRACE / TIEBACK CASE-----
 ** Use the calculated embedment, Yend = 5.01

NUMBER OF BRACE LEVEL= 3

* CANTILEVER SPAN *

D1=0.00	
<-- D2=4.00	R2=0.35, with Cantilever Moment=0.44

D1 - TOP DEPTH
 D2 - BOTTOM DEPTH R2 - BOTTOM REACTION

TOTAL REACTION: R2 = 0.35
 TOTAL PRESSURE ACTING ON WALL = 0.35
 Total Reaction = Total Pressure, OK!

BRACE NO.1 AT DEPTH = 4.00
 R2 of Cantilever Span } Sum of Reaction = Brace Load = 2.98
 R1 of Span No.1

* MIDDLE SPAN NO.1 *

<-- D1=4.00	R1=2.64, with Cantilever Moment=0.44
<-- D2=14.00	R2=3.97

D1 - TOP DEPTH R1 - TOP REACTION
 D2 - BOTTOM DEPTH R2 - BOTTOM REACTION

TOTAL REACTION: R1+R2 = 6.61
 TOTAL PRESSURE ACTING ON WALL = 6.61
 Total Reaction = Total Pressure, OK!

BRACE NO.2 AT DEPTH = 14.00
 R2 of Span No.1 } Sum of Reaction = Brace Load = 2.65
 R1 of Last Span

* LAST SPAN *

<-- D1=14.00	R1=-1.32
<-- D2=24.00	R2=33.64
D3=34.01	

report.out

D1 - TOP DEPTH R1 - TOP REACTION
 D2 - LAST BRACE DEPTH R2 - LAST BRACE REACTION
 D3 - BOTTOM DEPTH

TOTAL REACTION: R1+R2 = 32.31
 TOTAL PRESSURE ACTING ON WALL = 32.31
 Total Reaction = Total Pressure, OK!

*****RESULTS*****

* EMBEDMENT *
 MINIMUM EMBEDMENT = 5.01 (8~10 recommended)
 TOTAL MINIMUM PILE LENGTH = 34.01

* MOMENT IN PILE *

No.	Depth	M @ Brace	Mmax in Span	Depth of Mmax
1	4.00	0.43	6.63	9.15
2	14.00	0.83	0.07	14.05
3	24.00	80.06	0.00	33.98

Overall Maximum Moment = 80.06 at 24.01
 Maximum Shear = 17.58

-> Top Brace Increase 15%. (Horizontal) From 2.98 to 3.43

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
1	4.00	0.0	1.00	3.43	0.00
2	14.00	0.0	1.00	2.65	0.00
3	24.00	0.0	1.00	33.64	0.00

No.	DEPTH	Free length	Type and Data
1	4.00	0.00	Strut
2	14.00	0.00	Strut
3	24.00	0.00	Strut

* VERTICAL LOADING *

Vertical Loading from Braces = 0.00
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 0.00

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!
 PZC18 Sx= 33.5 Ix= 255.5 Weight= 24.2

* Note: All the pile dimensions are in English Units per one foot width.

Request Min. Section Modulus = 29.1 in³/foot, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
 The pile selection is based on the magnitude of the moment only. Axial force is

neglected. Ref. Note 3

report.out

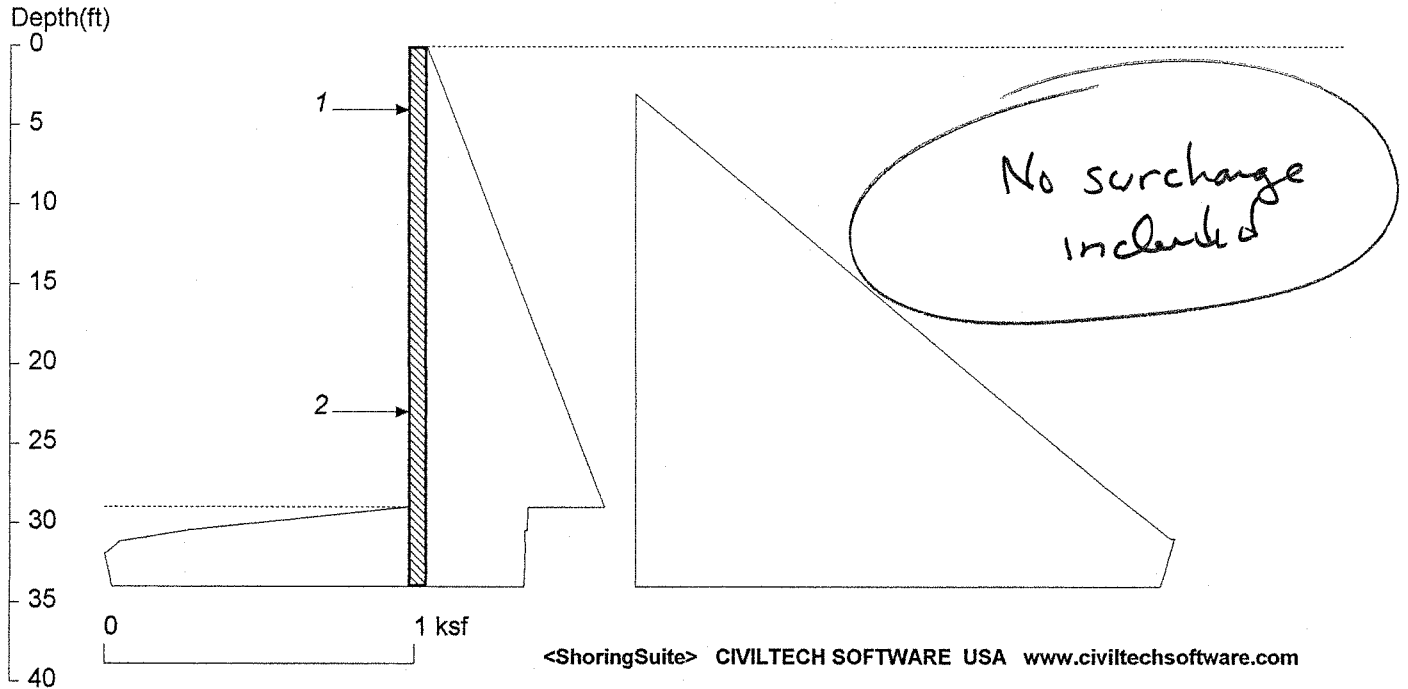
PZC18 is capable to support the shoring!

Top deflection = -0.019(in)

Max. deflection = 0.023(in)

Raytheon Facility - Wayland, MA

Ref: WA-7



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Wall Height=29.0 Pile Diameter=1.0 Pile Spacing=1.0

ACTIVE SPACE:	Z depth	Spacing
1	0.00	1.00
2	29.00	1.00

PASSIVE SPACE:	Z depth	Spacing
1	29.00	1.00

PILE LENGTH: Min. Embedment=5.02, Min. Pile Length=34.02
 MOMENT IN PILE: Max. Moment=89.16 at Depth of 23.00

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=39.5, Vertical Factor of Safety=999.00

PILE SELECTION:

Request Min. Section Modulus = 32.4 in³/feet, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
 PZC18 has Section Modulus = 33.5. It is greater than Min. Requirements!

BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

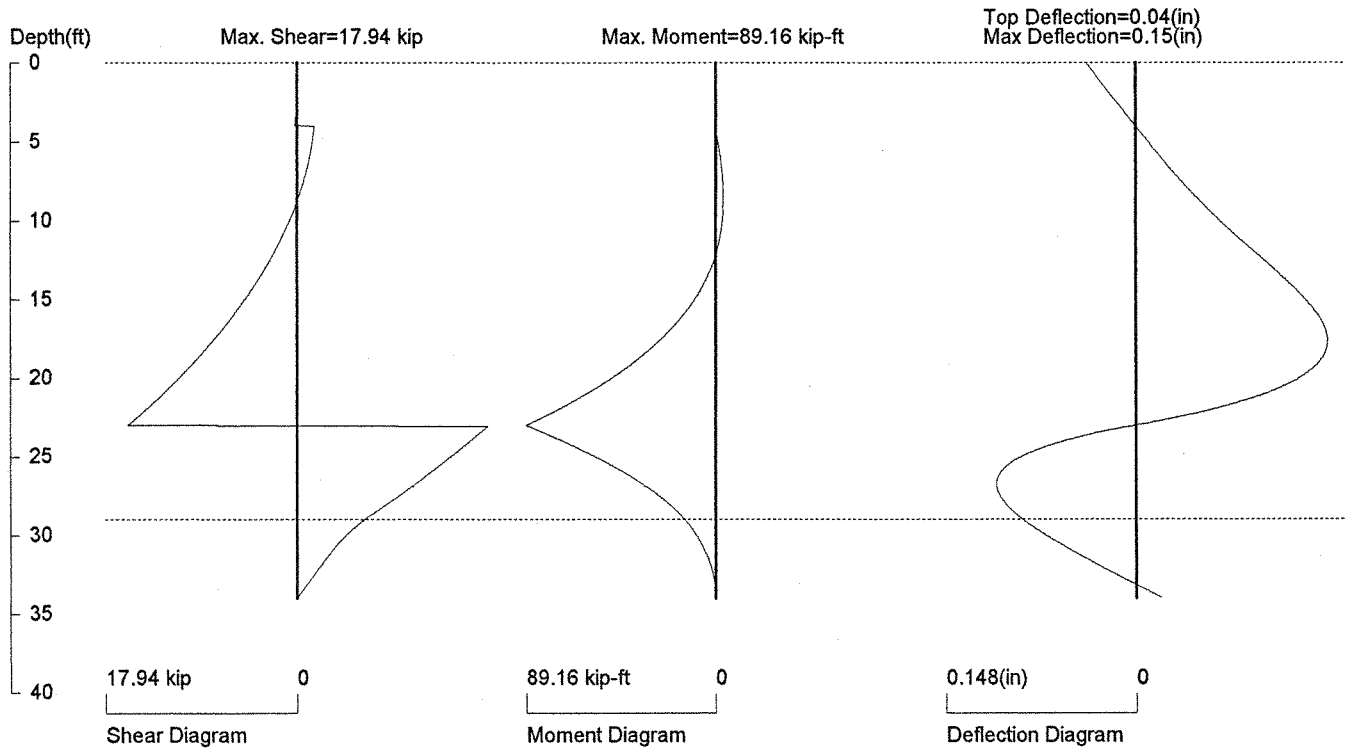
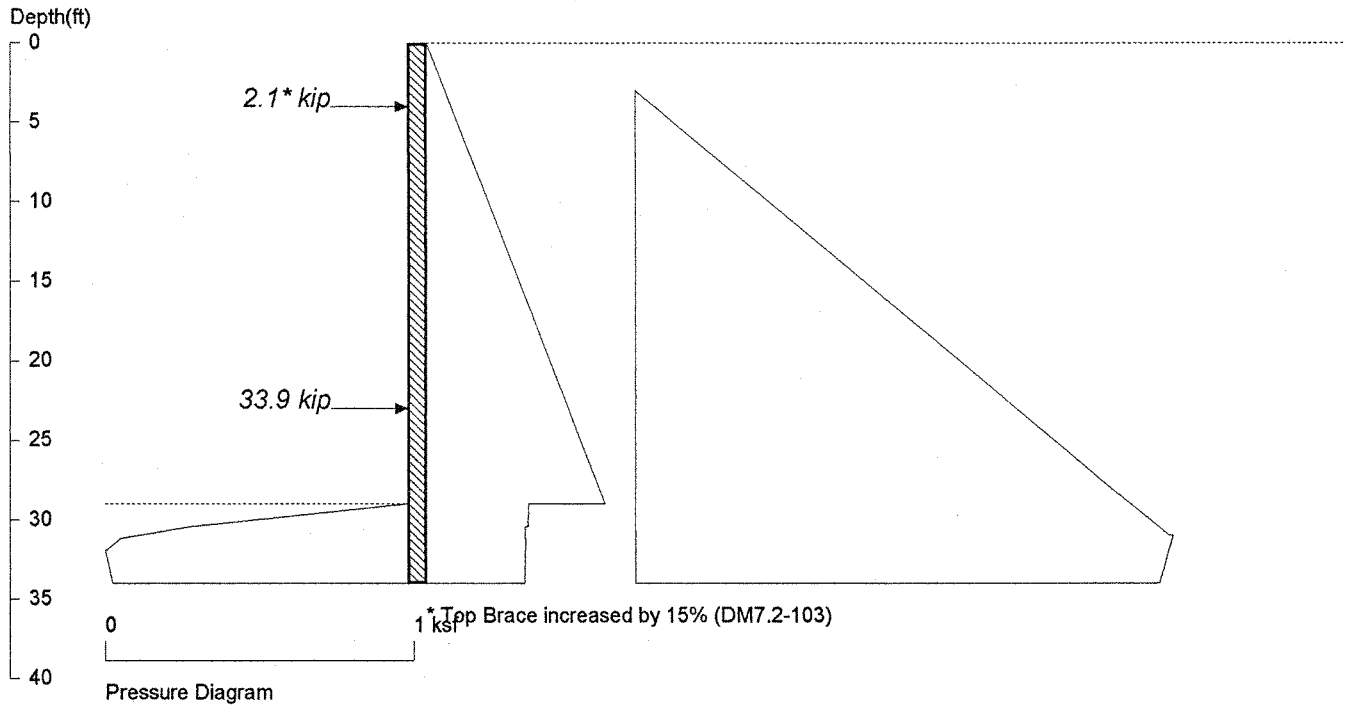
No. & Type	Depth	Angle	Total	Horiz.	Vert.	N/A	N/A
1. Strut	4.0	0.0	2.1*	2.1	0.0	0.0	0.0
2. Strut	23.0	0.0	33.9	33.9	0.0	0.0	0.0

* Top Brace increased by 15% (DM7.2-103)

UNITS: Length/Depth - ft, Force - kip, Moment - kip-ft, Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

Raytheon Facility - Wayland, MA

Ref: WA-7



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on one soldier pile or one foot spacing of sheet pile

Pile: PZC18 meet Section Requirements. Properties: 6. E (ksi)=29000, 4. I (in⁴)=255.5

Date: 4/24/2006 File Name: UNTITLED

report.out

SHORING WALL CALCULATION SUMMARY
 The leading shoring design and calculation software
 Software Copyright by CivilTech Software
 www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
 The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002

DEPTH: ft, PRESSURE, FRICTION, BEARING: ksf, SLOPE: kcf, FORCE: kip, MOMENT: kip-ft,
 DEFLECTION: in, I: in⁴, E: ksi

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 Date: 4/24/2006 File: UNTITLED

Title: Raytheon Facility - Wayland, MA
 Subtitle: Ref: WA-7

*****INPUT DATA*****

Wall Type: 1. Sheet Pile
 Wall Height: 29.00
 Pile Diameter: 1.00
 Pile Spacing: 1.00
 Factor of Safety (F.S.): 1.00
 Max. Moment reduce 20%
 Lateral Support Type (Braces): 2. Strut, Raker
 Top Brace Increase (Multi-Bracing): Add 15%*
 Embedment Option: 1. Yes
 Friction at Pile Tip: No*
 Check vertical Bearing Capacity:
 Side Friction for Bearing: 1.00
 Tip Resistance for Bearing: 1.00
 Pile Properties:
 Allowable Fb/Fy: 0.66
 Steel Strength, Fy: 50 ksi = 345 MPa
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 256.00
 User Input Pile: PZC18

* ACTIVE PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z2 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	0.00	0.00	29.00	0.57	0.0200
2	29.00	0.33	30.45	0.32	-0.0010
3	30.45	0.32	31.90	0.32	0.0010
4	31.90	0.32	39.15	0.32	-0.0010
5	39.15	0.32	40.60	0.31	-0.0050
6	40.60	0.31	47.13	0.31	0.0000
7	47.13	0.31	47.85	0.30	-0.0160
8	47.85	0.30	48.57	0.29	-0.0190
9	48.57	0.29	49.30	0.29	-0.0030

			report.out		
10	49.30	0.29	50.03	0.29	0.0020
11	50.03	0.29	50.75	0.29	0.0000
12	50.75	0.29	52.20	0.28	-0.0030
13	52.20	0.28	53.65	0.28	-0.0010
14	53.65	0.28	55.10	0.27	-0.0040
15	55.10	0.27	55.82	0.28	0.0020
16	55.82	0.28	56.55	0.28	0.0040
17	56.55	0.28	57.28	0.28	0.0000
18	57.28	0.28	58.00	0.28	-0.0020
19	58.00	0.28	58.73	0.28	0.0010
20	58.73	0.28	59.45	0.28	0.0030
21	59.45	0.28	60.18	0.28	0.0010
22	60.18	0.28	63.07	0.28	0.0000
23	63.07	0.28	63.80	0.27	-0.0110
24	63.80	0.27	64.52	0.26	-0.0120
25	64.52	0.26	65.25	0.27	0.0050
26	65.25	0.27	65.98	0.27	0.0090
27	65.98	0.27	66.70	0.28	0.0060
28	66.70	0.28	68.88	0.29	0.0050
29	68.88	0.29	73.23	0.30	0.0040
30	73.23	0.30	73.95	0.31	0.0070
31	73.95	0.31	74.68	0.31	0.0050
32	74.68	0.31	80.48	0.33	0.0030
33	80.48	0.33	81.20	0.33	0.0070
34	81.20	0.33	81.93	0.34	0.0080
35	81.93	0.34	91.35	0.39	0.0050
36	91.35	0.38	92.80	0.40	0.0090
37	92.80	0.40	105.13	0.46	0.0050
38	105.13	0.46	106.57	0.47	0.0070
39	106.57	0.47	126.15	0.58	0.0060
40	126.15	0.57	127.60	0.58	0.0080
41	127.60	0.58	145.00	0.67	0.0050
42	3.00	0.00	31.00	1.75	0.0620
43	31.00	1.75	145.00	0.00	-0.0150

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	29.00	0.00	29.73	0.36	0.4930
2	29.73	0.36	30.45	0.71	0.4860
3	30.45	0.71	31.18	0.93	0.3060
4	31.18	0.93	31.90	0.98	0.0620
5	31.90	0.98	39.15	0.90	-0.0110
6	39.15	0.90	39.88	0.93	0.0450
7	39.88	0.93	40.60	0.98	0.0680
8	40.60	0.98	41.33	1.00	0.0240
9	41.33	1.00	47.13	1.08	0.0140
10	47.13	1.08	47.85	1.28	0.2730
11	47.85	1.28	48.58	1.56	0.3930
12	48.58	1.56	49.30	1.70	0.1920
13	49.30	1.70	50.75	1.89	0.1310
14	50.75	1.89	52.20	2.07	0.1220
15	52.20	2.07	55.10	2.45	0.1310
16	55.10	2.45	55.83	2.46	0.0120
17	55.83	2.46	56.55	2.43	-0.0350
18	56.55	2.43	57.28	2.49	0.0750
19	57.28	2.49	59.45	2.73	0.1120
20	59.45	2.73	60.18	2.81	0.1060
21	60.18	2.81	60.90	2.88	0.1030
22	60.90	2.88	61.63	2.96	0.1090
23	61.63	2.96	63.08	3.12	0.1110

			report.out		
24	63.08	3.12	63.80	3.45	0.4600
25	63.80	3.45	64.53	3.93	0.6480
26	64.53	3.93	65.25	4.19	0.3640
27	65.25	4.19	66.70	4.54	0.2400
28	66.70	4.54	70.32	5.41	0.2410
29	70.32	5.41	71.05	5.57	0.2190
30	71.05	5.57	71.78	5.73	0.2130
31	71.78	5.73	72.50	5.90	0.2350
32	72.50	5.90	76.85	6.94	0.2380
33	76.85	6.93	80.48	7.79	0.2370
34	80.48	7.79	84.10	8.65	0.2360
35	84.10	8.64	87.00	9.33	0.2350
36	87.00	9.32	87.73	9.48	0.2110
37	87.73	9.48	88.45	9.63	0.2040
38	88.45	9.63	89.18	9.79	0.2250
39	89.18	9.79	94.25	10.96	0.2320
40	94.25	10.96	101.50	12.63	0.2310
41	101.50	12.63	113.83	15.46	0.2290
42	113.83	15.45	145.00	22.57	0.2280

 * ACTIVE SPACE *

No.	Z depth	Spacing
1	0.00	1.00
2	29.00	1.00

 * PASSIVE SPACE *

No.	Z depth	Spacing
1	29.00	1.00

 * BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angle	Spacing	Input1*	Input2*
1	4.00	0.0	1.00	1.00	1.00
2	23.00	0.0	1.00	1.00	1.00

 *For Tieback: Input1 = Diameter; Input2 = Bond Strength
 *For Plate: Input1 = Diameter; Input2 = Allowable Pressure
 *For Deaman: Input1 = Horz. width; Input2 = Allowable Pressure; Angle = 0

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!
 PZC18 Sx= 33.5 Ix= 255.5 weight= 24.2

* Note: All the pile dimensions are in English Units per one foot width.

Add Pile Capacity in Emdment Calculation
 Pile Moment Capacity, Ms: 92.13

*****CALCULATION*****

Top Pressures start at depth = 0.00

report.out

* CALCULATE EMBEDMENT *

```

|<-- D1=23.00
==|| D2=29.00
|   D3=34.02

```

D1 - TOP DEPTH R1 - TOP REACTION
D2 - EXCAVATION BASE
D3 - PILE TIP

TOTAL REACTION: R1 = 18.01
TOTAL PRESSURE ACTING ON WALL = 18.01
Total Reaction = Total Pressure, OK!
The Calculated Embedment, Yend = 5.02

-----MULTIPLE BRACE / TIEBACK CASE-----

** Use the calculated embedment, Yend = 5.02

NUMBER OF BRACE LEVEL= 2

* CANTILEVER SPAN *

```

|      D1=0.00
|<--  D2=4.00            R2=0.19, with Cantilever Moment=0.22

```

D1 - TOP DEPTH
D2 - BOTTOM DEPTH R2 - BOTTOM REACTION

TOTAL REACTION: R2 = 0.19
TOTAL PRESSURE ACTING ON WALL = 0.19
Total Reaction = Total Pressure, OK!

BRACE NO.1 AT DEPTH = 4.00
R2 of Span No.0

R1 of Last Span

} Sum of Reaction = Brace Load = 1.81

* LAST SPAN *

```

|<--  D1=4.00            R1=1.62
|
|<--  D2=23.00           R2=33.88
|
|      D3=34.02

```

D1 - TOP DEPTH R1 - TOP REACTION
D2 - LAST BRACE DEPTH R2 - LAST BRACE REACTION
D3 - BOTTOM DEPTH

TOTAL REACTION: R1+R2 = 35.51
TOTAL PRESSURE ACTING ON WALL = 35.51
Total Reaction = Total Pressure, OK!

report.out

*****RESULTS*****

* EMBEDMENT *
 MINIMUM EMBEDMENT = 5.02 (8~10 recommended)
 TOTAL MINIMUM PILE LENGTH = 34.02

* MOMENT IN PILE *

No.	Depth	M @ Brace	Mmax in Span	Depth of Mmax
1	4.00	0.22	3.57	8.43
2	23.00	89.16	0.00	33.99

Overall Maximum Moment = 89.16 at 23.00
 Maximum Shear = 17.94

-> Top Brace Increase 15%. (Horizontal) From 1.81 to 2.09

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
1	4.00	0.0	1.00	2.09	0.00
2	23.00	0.0	1.00	33.88	0.00

No.	DEPTH	Free length	Type and Data
1	4.00	0.00	Strut
2	23.00	0.00	Strut

* VERTICAL LOADING *
 Vertical Loading from Braces = 0.00
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 0.00

* VERTICAL BEARING CAPACITY CHECK *

Tip Depth	Tip Area	Bearing	Tip Resistance
34.02	0.50	1.00	0.50
Embedment	Side Area*	Friction	Side Resistance
5.02	39.05	1.00	39.05

*Side Area is the surface area of embedment below base and contact area between pile and soil above base.

Total Vertical Resistance = 39.55
 Total Vertical Loading = 0.00
 Vertical Factor of Safety = 999.00

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!

PZC18 $S_x = 33.5$ $I_x = 255.5$ report.out
weight= 24.2

* Note: All the pile dimensions are in English Units per one foot width.

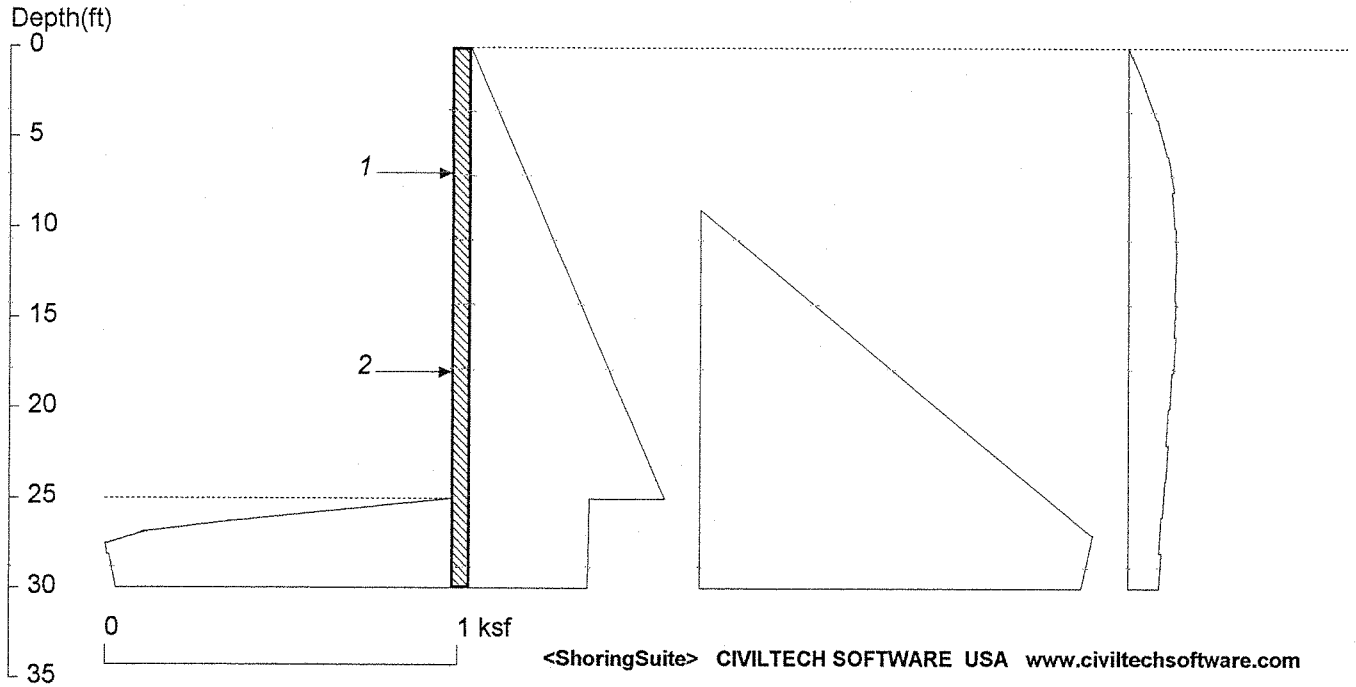
Request Min. Section Modulus = 32.4 in³/feet, $F_y = 50$ ksi = 345 MPa, $F_b/F_y = 0.66$
The pile selection is based on the magnitude of the moment only. Axial force is neglected. Ref. Note 3

PZC18 is capable to support the shoring!
Top deflection = 0.038(in)
Max. deflection = 0.148(in)

APPENDIX C

Software Output for Analysis on Sheet WA-8

Raytheon Facility - Wayland, MA WA-8



Licensed to: Richard Hartman Hartman Engineering
 Date: 5/9/2006 File Name: A:\06-602 WA-8, with surcharge.sh8

Wall Height=25.0 Pile Diameter=1.0 Pile Spacing=1.0

ACTIVE SPACE:	Z depth	Spacing
1	0.00	1.00
2	25.00	1.00

PASSIVE SPACE:	Z depth	Spacing
1	25.00	1.00

PILE LENGTH: Min. Embedment=4.98, Min. Pile Length=29.98
 MOMENT IN PILE: Max. Moment=69.12 at Depth of 18.01

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=35.5, Vertical Factor of Safety=999.00

PILE SELECTION:
 Request Min. Section Modulus = 25.1 in³/feet, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66.
 PZC18 has Section Modulus = 33.5. It is greater than Min. Requirements!

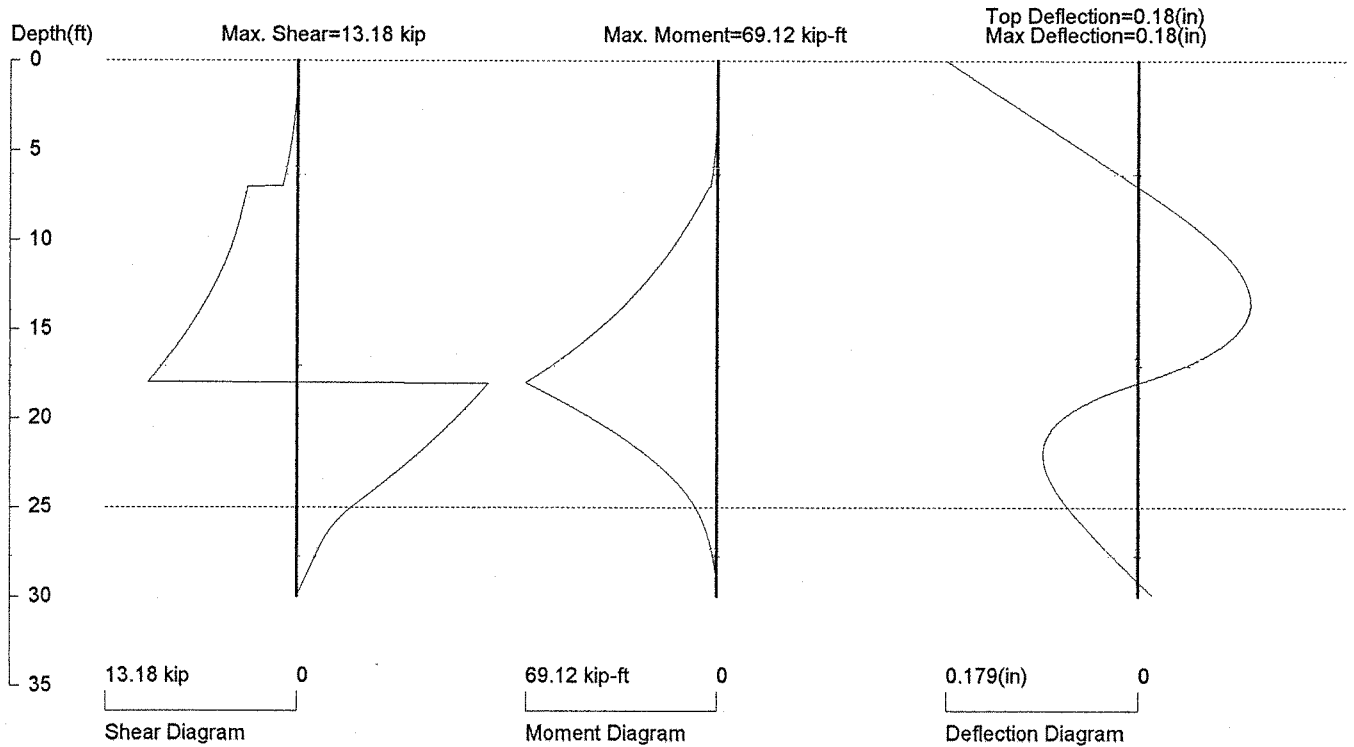
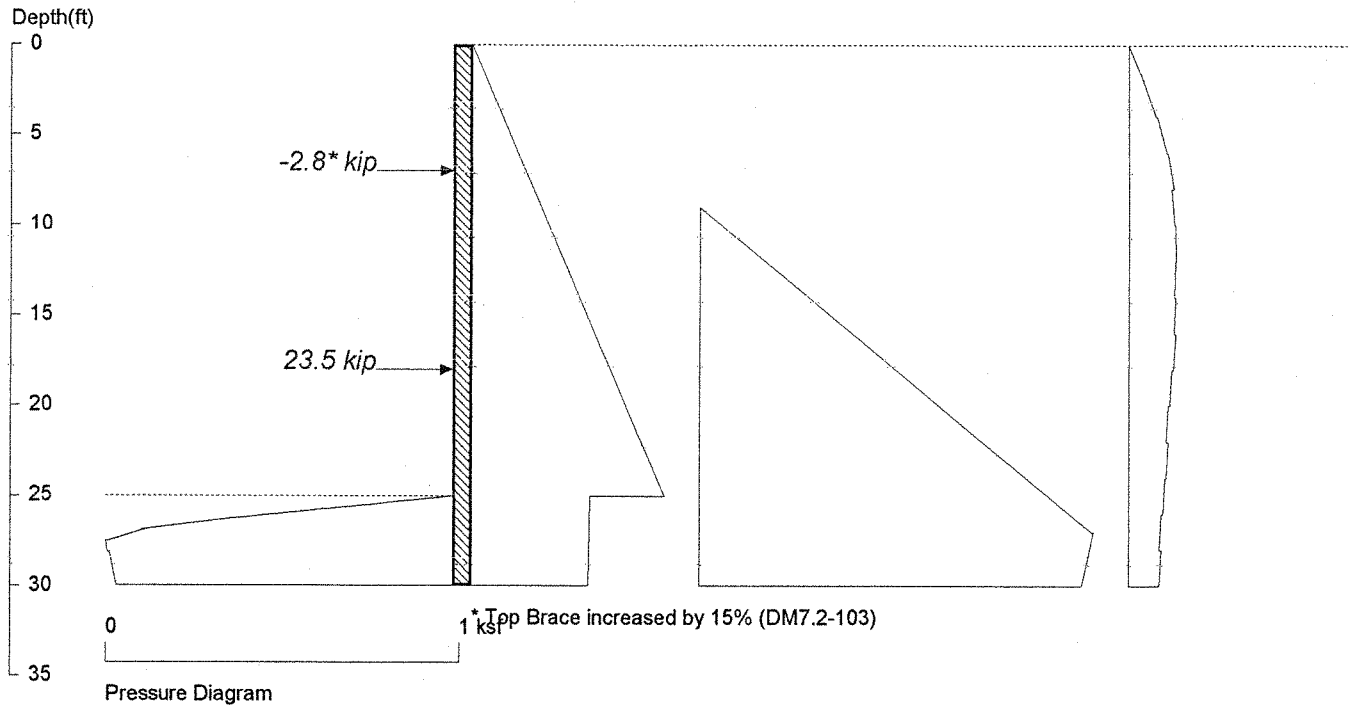
BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Total	Horiz.	Vert.	N/A	N/A
1. Strut	7.0	0.0	-2.8*	-2.8	0.0	0.0	0.0
2. Strut	18.0	0.0	23.5	23.5	0.0	0.0	0.0

* Top Brace increased by 15% (DM7.2-103)

UNITS: Length/Depth - ft, Force - kip, Moment - kip-ft, Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

Raytheon Facility - Wayland, MA WA-8



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on one soldier pile or one foot spacing of sheet pile

Pile: PZC18 meet Section Requirements. Properties: 6. E (ksi)=29000, 4. I (in⁴)=255.5

Date: 5/9/2006 File Name: A:\06-602 WA-8, with surcharge.sh8

report.out

SHORING WALL CALCULATION SUMMARY
 The leading shoring design and calculation software
 Software Copyright by CivilTech Software
 www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
 The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002

DEPTH: ft, PRESSURE, FRICTION, BEARING: ksf, SLOPE: kcf, FORCE: kip, MOMENT: kip-ft,
 DEFLECTION: in, I: in⁴, E: ksi

 Licensed to Richard Hartman Hartman Engineering
 Date: 5/9/2006 File: A:\06-602 WA-8, with surcharge.sh8

Title: Raytheon Facility - Wayland, MA
 Subtitle: WA-8

*****INPUT DATA*****

Wall Type: 1. Sheet Pile
 Wall Height: 25.00
 Pile Diameter: 1.00
 Pile Spacing: 1.00
 Factor of Safety (F.S.): 1.00
 Max. Moment reduce 20%
 Lateral Support Type (Braces): 2. Strut, Raker
 Top Brace Increase (Multi-Bracing): Add 15%*
 Embedment Option: 1. Yes
 Friction at Pile Tip: No*
 Check Vertical Bearing Capacity:
 Side Friction for Bearing: 1.00
 Tip Resistance for Bearing: 1.00
 Pile Properties:
 Allowable Fb/Fy: 0.66
 Steel strength, Fy: 50 ksi = 345 MPa
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 100.00
 User Input Pile: PZC18

* ACTIVE PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z2 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	0.00	0.00	25.00	0.56	0.0220
2	25.00	0.34	45.00	0.32	-0.0010
3	45.00	0.32	45.63	0.32	-0.0080
4	45.63	0.32	46.25	0.31	-0.0190
5	46.25	0.31	46.88	0.30	-0.0110
6	46.88	0.30	53.13	0.30	0.0010
7	53.13	0.30	53.75	0.28	-0.0420
8	53.75	0.28	54.38	0.24	-0.0690
9	54.38	0.24	55.00	0.22	-0.0250

10	55.00	0.22	report.out	58.75	0.23	0.0030
11	58.75	0.23		60.00	0.24	0.0060
12	60.00	0.24		63.13	0.25	0.0030
13	63.13	0.25		63.75	0.26	0.0150
14	63.75	0.26		64.38	0.27	0.0230
15	64.38	0.27		65.00	0.28	0.0110
16	65.00	0.28		69.38	0.29	0.0040
17	69.38	0.29		70.00	0.27	-0.0370
18	70.00	0.27		70.63	0.25	-0.0340
19	70.63	0.25		71.25	0.26	0.0080
20	71.25	0.26		80.00	0.30	0.0060
21	80.00	0.30		81.25	0.31	0.0080
22	81.25	0.31		93.13	0.37	0.0050
23	93.13	0.37		93.75	0.37	0.0080
24	93.75	0.37		94.38	0.38	0.0070
25	94.38	0.38		111.25	0.46	0.0050
26	111.25	0.46		112.50	0.47	0.0080
27	112.50	0.47		125.00	0.53	0.0050
28	9.00	0.00		27.00	1.12	0.0620
29	27.00	1.12		125.00	0.00	-0.0110
30	0.00	0.00		2.00	0.04	0.0210
31	2.00	0.04		4.00	0.08	0.0180
32	4.00	0.08		6.00	0.11	0.0130
33	6.00	0.11		8.00	0.12	0.0080
34	8.00	0.12		10.00	0.13	0.0040
35	10.00	0.13		12.00	0.13	0.0010
36	12.00	0.13		14.00	0.13	-0.0010
37	14.00	0.13		16.00	0.13	-0.0020
38	16.00	0.13		18.00	0.12	-0.0030
39	18.00	0.12		20.00	0.11	-0.0030
40	20.00	0.11		22.00	0.11	-0.0030
41	22.00	0.11		24.00	0.10	-0.0030
42	24.00	0.10		26.00	0.09	-0.0030
43	26.00	0.09		28.00	0.09	-0.0030
44	28.00	0.09		30.00	0.08	-0.0030
45	30.00	0.08		32.00	0.07	-0.0030
46	32.00	0.07		34.00	0.07	-0.0030
47	34.00	0.07		36.00	0.06	-0.0030
48	36.00	0.06		38.00	0.06	-0.0020
49	38.00	0.06		40.00	0.06	-0.0020
50	40.00	0.06		42.00	0.05	-0.0020
51	42.00	0.05		44.00	0.05	-0.0020
52	44.00	0.05		46.00	0.04	-0.0020
53	46.00	0.04		48.00	0.04	-0.0020
54	48.00	0.04		50.00	0.04	-0.0010
55	50.00	0.04		52.00	0.04	-0.0010
56	52.00	0.04		54.00	0.03	-0.0010
57	54.00	0.03		56.00	0.03	-0.0010
58	56.00	0.03		58.00	0.03	-0.0010
59	58.00	0.03		60.00	0.03	-0.0010
60	60.00	0.03		62.00	0.02	-0.0010
61	62.00	0.02		64.00	0.02	-0.0010
62	64.00	0.02		66.00	0.02	-0.0010
63	66.00	0.02		68.00	0.02	-0.0010
64	68.00	0.02		70.00	0.02	-0.0010
65	70.00	0.02		72.00	0.02	-0.0010
66	72.00	0.02		74.00	0.02	-0.0010
67	74.00	0.02		76.00	0.02	-0.0010
68	76.00	0.02		78.00	0.01	0.0000
69	78.00	0.01		80.00	0.01	0.0000
70	80.00	0.01		82.00	0.01	0.0000
71	82.00	0.01		84.00	0.01	0.0000

			report.out		
72	84.00	0.01	86.00	0.01	0.0000
73	86.00	0.01	88.00	0.01	0.0000
74	88.00	0.01	90.00	0.01	0.0000
75	90.00	0.01	92.00	0.01	0.0000
76	92.00	0.01	94.00	0.01	0.0000
77	94.00	0.01	96.00	0.01	0.0000
78	96.00	0.01	98.00	0.01	0.0000
79	98.00	0.01	100.00	0.01	0.0000

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	25.00	0.00	26.25	0.62	0.4930
2	26.25	0.62	26.88	0.87	0.4130
3	26.88	0.87	27.50	0.98	0.1660
4	27.50	0.98	28.13	0.97	-0.0060
5	28.13	0.97	45.00	0.79	-0.0110
6	45.00	0.79	45.63	0.80	0.0160
7	45.63	0.80	46.25	0.84	0.0640
8	46.25	0.84	46.88	0.87	0.0500
9	46.88	0.87	53.13	0.96	0.0130
10	53.13	0.96	53.75	1.09	0.2080
11	53.75	1.09	54.38	1.32	0.3800
12	54.38	1.32	55.00	1.47	0.2390
13	55.00	1.47	55.63	1.55	0.1210
14	55.63	1.55	56.88	1.70	0.1220
15	56.88	1.70	58.13	1.86	0.1240
16	58.13	1.86	59.38	2.02	0.1260
17	59.38	2.02	60.00	2.09	0.1170
18	60.00	2.09	60.63	2.16	0.1150
19	60.63	2.16	61.25	2.24	0.1260
20	61.25	2.24	63.13	2.48	0.1270
21	63.13	2.48	63.75	2.49	0.0220
22	63.75	2.49	64.38	2.46	-0.0560
23	64.38	2.46	65.00	2.48	0.0420
24	65.00	2.48	69.38	2.97	0.1120
25	69.38	2.97	70.00	3.36	0.6270
26	70.00	3.36	70.63	3.80	0.6900
27	70.63	3.80	71.25	3.93	0.2200
28	71.25	3.93	71.88	4.07	0.2120
29	71.88	4.07	72.50	4.21	0.2290
30	72.50	4.21	73.75	4.51	0.2370
31	73.75	4.51	75.00	4.80	0.2390
32	75.00	4.80	76.88	5.25	0.2400
33	76.88	5.25	80.63	6.16	0.2410
34	80.63	6.16	81.25	6.30	0.2210
35	81.25	6.30	81.88	6.43	0.2050
36	81.88	6.43	82.50	6.57	0.2240
37	82.50	6.57	88.13	7.91	0.2380
38	88.13	7.90	91.88	8.79	0.2370
39	91.88	8.79	95.63	9.67	0.2360
40	95.63	9.67	100.00	10.70	0.2350
41	100.00	10.70	100.63	10.82	0.2000
42	100.63	10.82	101.25	10.94	0.1940
43	101.25	10.94	101.88	11.09	0.2270
44	101.88	11.09	108.13	12.53	0.2320
45	108.13	12.53	116.88	14.55	0.2300
46	116.88	14.54	125.00	16.41	0.2290

* ACTIVE SPACE *

report.out

No.	Z depth	Spacing
1	0.00	1.00
2	25.00	1.00

* PASSIVE SPACE *

No.	Z depth	Spacing
1	25.00	1.00

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angle	Spacing	Input1*	Input2*
1	7.00	0.0	1.00	1.00	1.00
Strut					
2	18.00	0.0	1.00	1.00	1.00
Strut					

*For Tieback: Input1 = Diameter; Input2 = Bond Strength
 *For Plate: Input1 = Diameter; Input2 = Allowable Pressure
 *For Deaman: Input1 = Horz. Width; Input2 = Allowable Pressure; Angle = 0

*****SPECIFIED PILE *****

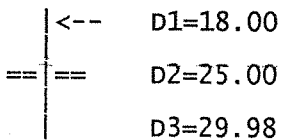
PZC18 has been found in Sheet Pile list!
 PZC18 Sx= 33.5 Ix= 255.5 weight= 24.2

* Note: All the pile dimensions are in English Units per one foot width.

Add Pile Capacity in Emdment Calculation
 Pile Moment Capacity, Ms: 92.13

*****CALCULATION*****

Top Pressures start at depth = 0.00
 * CALCULATE EMBEDMENT *



D1 - TOP DEPTH R1 - TOP REACTION
 D2 - EXCAVATION BASE
 D3 - PILE TIP

TOTAL REACTION: R1 = 13.19
 TOTAL PRESSURE ACTING ON WALL = 13.19
 Total Reaction = Total Pressure, OK!
 The Calculated Embedment, Yend = 4.98

-----MULTIPLE BRACE / TIEBACK CASE-----

** Use the calculated embedment, Yend = 4.98

NUMBER OF BRACE LEVEL= 2

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* CANTILEVER SPAN *

```

      |      D1=0.00
      |
      |<--  D2=7.00      R2=1.00, with Cantilever Moment=2.37
      |
D1 - TOP DEPTH
D2 - BOTTOM DEPTH      R2 - BOTTOM REACTION

```

TOTAL REACTION: R2 = 1.00
TOTAL PRESSURE ACTING ON WALL = 1.00
Total Reaction = Total Pressure, OK!

BRACE NO.1 AT DEPTH = 7.00
R2 of Span No.0
R1 of Last Span } Sum of Reaction = Brace Load = -2.39

* LAST SPAN *

```

      |<--  D1=7.00      R1=-3.39
      |
      |<--  D2=18.00     R2=23.52
      |
      |      D3=29.98
      |
D1 - TOP DEPTH      R1 - TOP REACTION
D2 - LAST BRACE DEPTH  R2 - LAST BRACE REACTION
D3 - BOTTOM DEPTH

```

TOTAL REACTION: R1+R2 = 20.13
TOTAL PRESSURE ACTING ON WALL = 20.13
Total Reaction = Total Pressure, OK!

*****RESULTS*****

* EMBEDMENT *

MINIMUM EMBEDMENT = 4.98 (8~10 recommended)
TOTAL MINIMUM PILE LENGTH = 29.98

* MOMENT IN PILE *

No.	Depth	M @ Brace	Mmax in Span	Depth of Mmax
1	7.00	2.43	2.43	7.02
2	18.00	69.12	0.00	29.95

Overall Maximum Moment = 69.12 at 18.01
Maximum Shear = 13.18

-> Top Brace Increase 15%. (Horizontal) From -2.39 to -2.75

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
TOTAL LOAD					

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 The Braces around No.1 are too low or too close! Move brace up! Results may be incorrect.

The Braces around No.1 are too low or too close! Move brace up! Results may be incorrect.

2 18.00 0.0 1.00 23.52 0.00
 23.52

No.	DEPTH	Free length	Type and Data
1	7.00	0.00	Strut
2	18.00	0.00	Strut

* VERTICAL LOADING *

Vertical Loading from Braces = 0.00
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 0.00

* VERTICAL BEARING CAPACITY CHECK *

Tip Depth	Tip Area	Bearing	Tip Resistance
29.98	0.50	1.00	0.50
Embedment	Side Area*	Friction	Side Resistance
4.98	34.96	1.00	34.96

*Side Area is the surface area of embedment below base and contact area between pile and soil above base.

Total Vertical Resistance = 35.46
 Total Vertical Loading = 0.00
 Vertical Factor of Safety = 999.00

*****SPECIFIED PILE *****

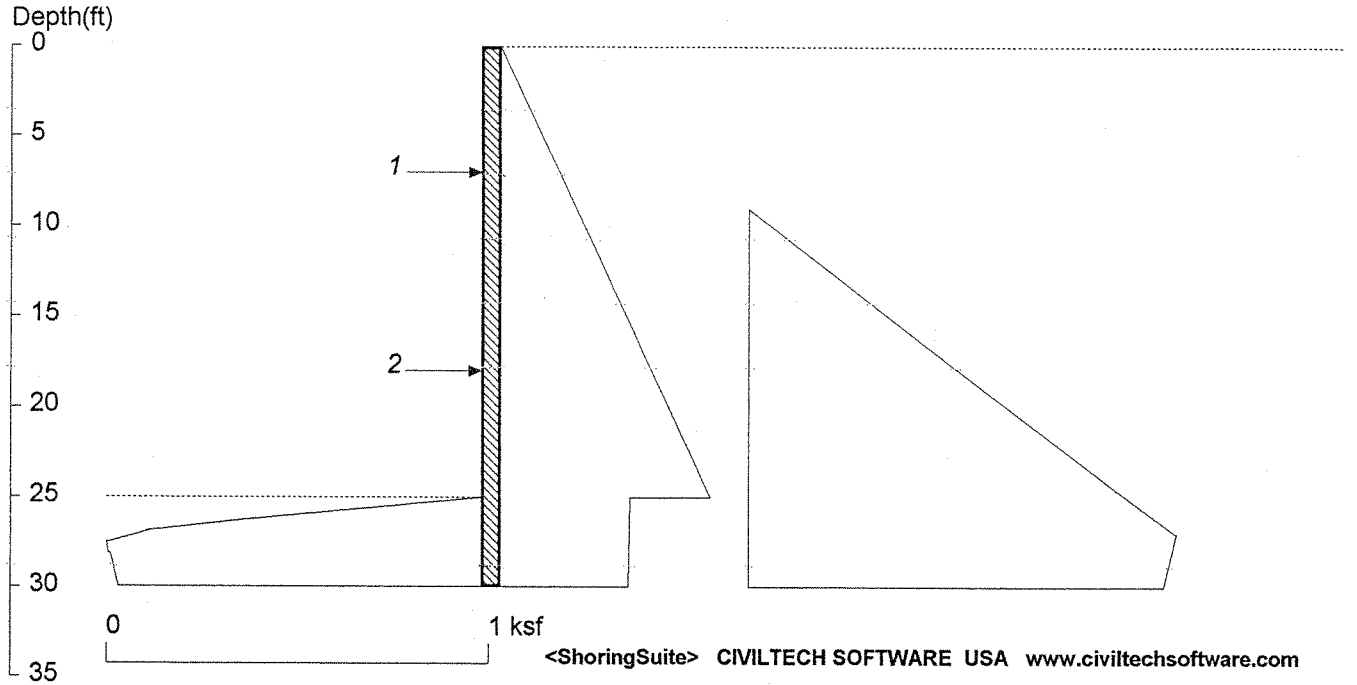
PZC18 has been found in Sheet Pile list!
 PZC18 SX= 33.5 Ix= 255.5 Weight= 24.2

* Note: All the pile dimensions are in English units per one foot width.

Request Min. Section Modulus = 25.1 in³/feet, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
 The pile selection is based on the magnitude of the moment only. Axial force is neglected. Ref. Note 3

PZC18 is capable to support the shoring!
 Top deflection = 0.179(in)
 Max. deflection = 0.179(in)

Raytheon Facility - Wayland, MA WA-8



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Wall Height=25.0 Pile Diameter=1.0 Pile Spacing=1.0

ACTIVE SPACE:	Z depth	Spacing
1	0.00	1.00
2	25.00	1.00

PASSIVE SPACE:	Z depth	Spacing
1	25.00	1.00

PILE LENGTH: Min. Embedment=4.97, Min. Pile Length=29.97
 MOMENT IN PILE: Max. Moment=62.28 at Depth of 18.01

VERTICAL BEARING CAPACITY: Vertical Loading=0.0, Resistance=35.4, Vertical Factor of Safety=999.00

PILE SELECTION:
 Request Min. Section Modulus = 22.6 in³/feet, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
 PZC18 has Section Modulus = 33.5. It is greater than Min. Requirements!

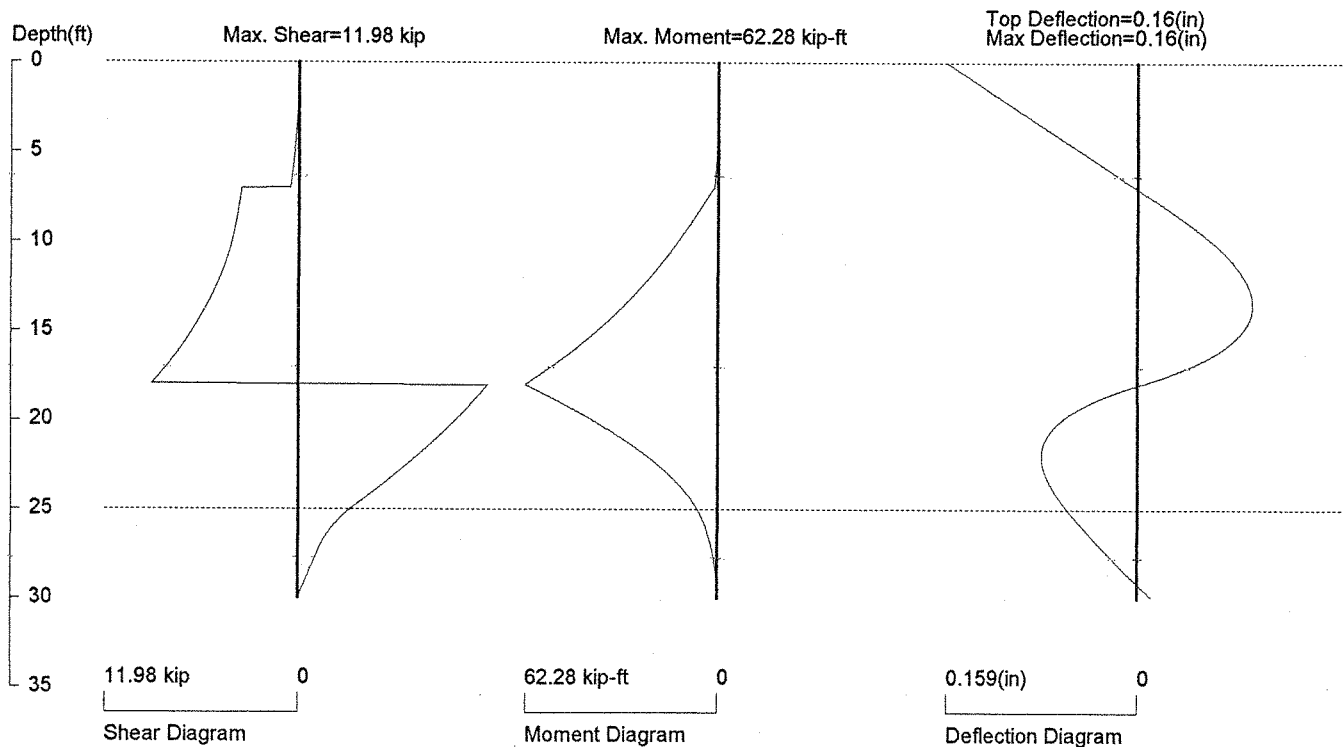
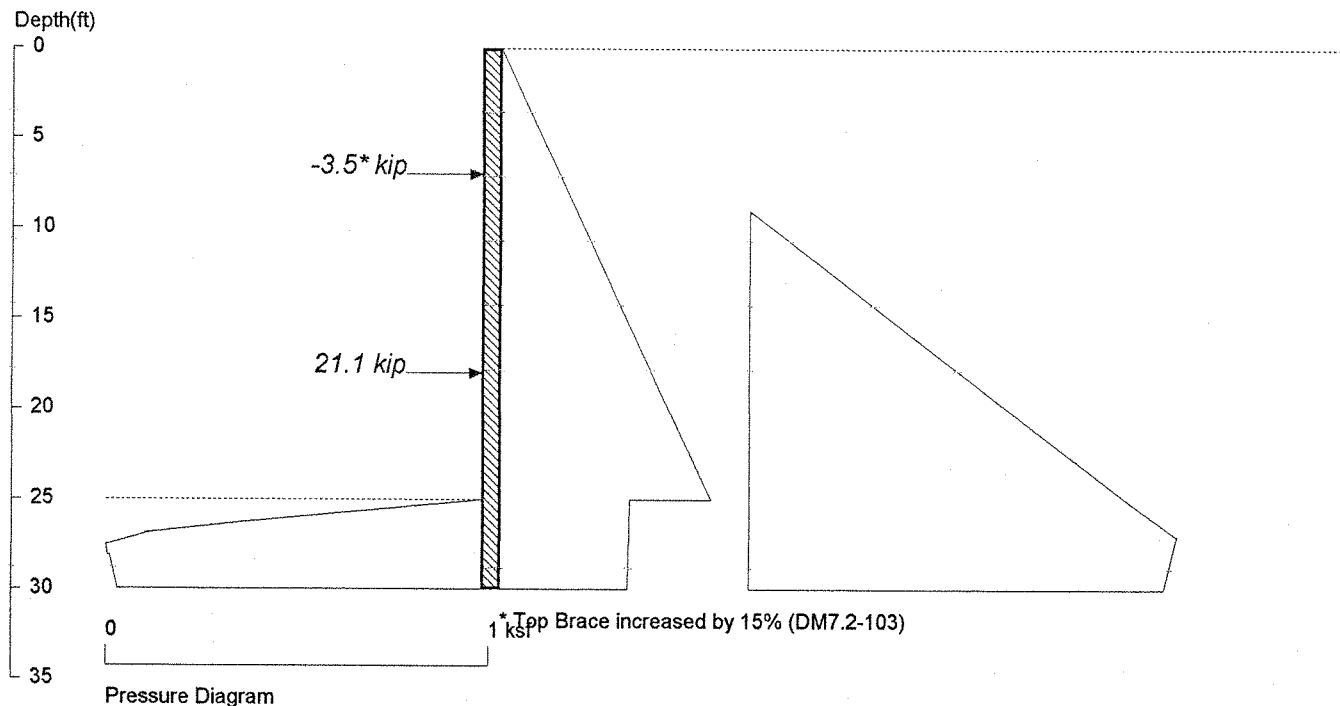
BRACE FORCE: Strut, Tieback, Plate Anchor, and Deadman

No. & Type	Depth	Angle	Total	Horiz.	Vert.	N/A	N/A
1. Strut	7.0	0.0	-3.5*	-3.5	0.0	0.0	0.0
2. Strut	18.0	0.0	21.1	21.1	0.0	0.0	0.0

* Top Brace increased by 15% (DM7.2-103)

UNITS: Length/Depth - ft, Force - kip, Moment - kip-ft, Pressure - ksf, Pres. Slope - kip/ft³, Deflection - in

Raytheon Facility - Wayland, MA WA-8



PRESSURE, SHEAR, MOMENT, AND DEFLECTION DIAGRAMS

Based on one soldier pile or one foot spacing of sheet pile

Pile: PZC18 meet Section Requirements. Properties: 6. E (ksi)=29000, 4. I (in⁴)=255.5

Date: 5/9/2006 File Name: A:\06-602 WA-8, no surcharge.sh8

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SHORING WALL CALCULATION SUMMARY
 The leading shoring design and calculation software
 Software Copyright by CivilTech Software
 www.civiltechsoftware.com

ShoringSuite Software is developed by CivilTech Software, Bellevue, WA, USA.
 The calculation method is based on the following references:

1. FHWA 98-011, FHWA-RD-97-130, FHWA SA 96-069, FHWA-IF-99-015
2. STEEL SHEET PILING DESIGN MANUAL by Pile Buck Inc., 1987
3. DESIGN MANUAL DM-7 (NAVFAC), Department of the Navy, May 1982
4. TRENCHING AND SHORING MANUAL Revision 12, California Department of Transportation, January 2000
6. EARTH SUPPORT SYSTEM & RETAINING STRUCTURES, Pile Buck Inc. 2002
5. DESIGN OF SHEET PILE WALLS, EM 1110-2-2504, U.S. Army Corps of Engineers, 31 March 1994
7. EARTH RETENTION SYSTEMS HANDBOOK, Alan Macnab, McGraw-Hill. 2002

DEPTH: ft, PRESSURE, FRICTION, BEARING: ksf, SLOPE: kcf, FORCE: kip, MOMENT: kip-ft,
 DEFLECTION: in, I: in4, E: ksi

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 Date: 5/9/2006 File: A:\06-602 WA-8, no surcharge.sh8

Title: Raytheon Facility - wayland, MA
 Subtitle: WA-8

*****INPUT DATA*****

Wall Type: 1. Sheet Pile
 wall Height: 25.00
 Pile Diameter: 1.00
 Pile Spacing: 1.00
 Factor of Safety (F.S.): 1.00
 Max. Moment reduce 20%
 Lateral Support Type (Braces): 2. Strut, Raker
 Top Brace Increase (Multi-Bracing): Add 15%*
 Embedment Option: 1. Yes
 Friction at Pile Tip: No*
 Check Vertical Bearing Capacity:
 Side Friction for Bearing: 1.00
 Tip Resistance for Bearing: 1.00
 Pile Properties:
 Allowable Fb/Fy: 0.66
 Steel strength, Fy: 50 ksi = 345 MPa
 Elastic Module, E: 29000.00
 Moment of Inertia, I: 100.00
 User Input Pile: PZC18

* ACTIVE PRESSURE (ACTIVE, WATER, & SURCHARGE) *

No.	Z2 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	0.00	0.00	25.00	0.56	0.0220
2	25.00	0.34	45.00	0.32	-0.0010
3	45.00	0.32	45.63	0.32	-0.0080
4	45.63	0.32	46.25	0.31	-0.0190
5	46.25	0.31	46.88	0.30	-0.0110
6	46.88	0.30	53.13	0.30	0.0010
7	53.13	0.30	53.75	0.28	-0.0420
8	53.75	0.28	54.38	0.24	-0.0690
9	54.38	0.24	55.00	0.22	-0.0250

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10	55.00	0.22	58.75	0.23	0.0030
11	58.75	0.23	60.00	0.24	0.0060
12	60.00	0.24	63.13	0.25	0.0030
13	63.13	0.25	63.75	0.26	0.0150
14	63.75	0.26	64.38	0.27	0.0230
15	64.38	0.27	65.00	0.28	0.0110
16	65.00	0.28	69.38	0.29	0.0040
17	69.38	0.29	70.00	0.27	-0.0370
18	70.00	0.27	70.63	0.25	-0.0340
19	70.63	0.25	71.25	0.26	0.0080
20	71.25	0.26	80.00	0.30	0.0060
21	80.00	0.30	81.25	0.31	0.0080
22	81.25	0.31	93.13	0.37	0.0050
23	93.13	0.37	93.75	0.37	0.0080
24	93.75	0.37	94.38	0.38	0.0070
25	94.38	0.38	111.25	0.46	0.0050
26	111.25	0.46	112.50	0.47	0.0080
27	112.50	0.47	125.00	0.53	0.0050
28	9.00	0.00	27.00	1.12	0.0620
29	27.00	1.12	125.00	0.00	-0.0110

* PASSIVE PRESSURE *

No.	Z1 top	Top Pres.	Z2 bottom	Bottom Pres.	Slope
1	25.00	0.00	26.25	0.62	0.4930
2	26.25	0.62	26.88	0.87	0.4130
3	26.88	0.87	27.50	0.98	0.1660
4	27.50	0.98	28.13	0.97	-0.0060
5	28.13	0.97	45.00	0.79	-0.0110
6	45.00	0.79	45.63	0.80	0.0160
7	45.63	0.80	46.25	0.84	0.0640
8	46.25	0.84	46.88	0.87	0.0500
9	46.88	0.87	53.13	0.96	0.0130
10	53.13	0.96	53.75	1.09	0.2080
11	53.75	1.09	54.38	1.32	0.3800
12	54.38	1.32	55.00	1.47	0.2390
13	55.00	1.47	55.63	1.55	0.1210
14	55.63	1.55	56.88	1.70	0.1220
15	56.88	1.70	58.13	1.86	0.1240
16	58.13	1.86	59.38	2.02	0.1260
17	59.38	2.02	60.00	2.09	0.1170
18	60.00	2.09	60.63	2.16	0.1150
19	60.63	2.16	61.25	2.24	0.1260
20	61.25	2.24	63.13	2.48	0.1270
21	63.13	2.48	63.75	2.49	0.0220
22	63.75	2.49	64.38	2.46	-0.0560
23	64.38	2.46	65.00	2.48	0.0420
24	65.00	2.48	69.38	2.97	0.1120
25	69.38	2.97	70.00	3.36	0.6270
26	70.00	3.36	70.63	3.80	0.6900
27	70.63	3.80	71.25	3.93	0.2200
28	71.25	3.93	71.88	4.07	0.2120
29	71.88	4.07	72.50	4.21	0.2290
30	72.50	4.21	73.75	4.51	0.2370
31	73.75	4.51	75.00	4.80	0.2390
32	75.00	4.80	76.88	5.25	0.2400
33	76.88	5.25	80.63	6.16	0.2410
34	80.63	6.16	81.25	6.30	0.2210
35	81.25	6.30	81.88	6.43	0.2050
36	81.88	6.43	82.50	6.57	0.2240
37	82.50	6.57	88.13	7.91	0.2380

			report.out		
38	88.13	7.90	91.88	8.79	0.2370
39	91.88	8.79	95.63	9.67	0.2360
40	95.63	9.67	100.00	10.70	0.2350
41	100.00	10.70	100.63	10.82	0.2000
42	100.63	10.82	101.25	10.94	0.1940
43	101.25	10.94	101.88	11.09	0.2270
44	101.88	11.09	108.13	12.53	0.2320
45	108.13	12.53	116.88	14.55	0.2300
46	116.88	14.54	125.00	16.41	0.2290

* ACTIVE SPACE *

No.	Z depth	Spacing
1	0.00	1.00
2	25.00	1.00

* PASSIVE SPACE *

No.	Z depth	Spacing
1	25.00	1.00

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	Z brace	Angle	Spacing	Input1*	Input2*
1	7.00	0.0	1.00	1.00	1.00
2	18.00	0.0	1.00	1.00	1.00

*For Tieback: Input1 = Diameter; Input2 = Bond Strength
 *For Plate: Input1 = Diameter; Input2 = Allowable Pressure
 *For Deaman: Input1 = Horz. width; Input2 = Allowable Pressure; Angle = 0

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!
 PZC18 Sx= 33.5 Ix= 255.5 weight= 24.2

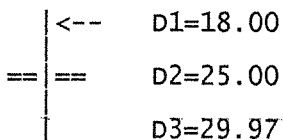
* Note: All the pile dimensions are in English Units per one foot width.

Add Pile Capacity in Emdment Calculation
 Pile Moment Capacity, Ms: 92.13

*****CALCULATION*****

Top Pressures start at depth = 0.00

* CALCULATE EMBEDMENT *



D1 - TOP DEPTH R1 - TOP REACTION
 D2 - EXCAVATION BASE

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D3 - PILE TIP

TOTAL REACTION: R1 = 11.99
TOTAL PRESSURE ACTING ON WALL = 11.99
Total Reaction = Total Pressure, OK!
The Calculated Embedment, Yend = 4.97

-----MULTIPLE BRACE / TIEBACK CASE-----
** Use the calculated embedment, Yend = 4.97

NUMBER OF BRACE LEVEL= 2

* CANTILEVER SPAN *

| D1=0.00
|<-- D2=7.00 R2=0.54, with Cantilever Moment=1.26
D1 - TOP DEPTH R2 - BOTTOM REACTION
D2 - BOTTOM DEPTH

TOTAL REACTION: R2 = 0.54
TOTAL PRESSURE ACTING ON WALL = 0.54
Total Reaction = Total Pressure, OK!

BRACE NO.1 AT DEPTH = 7.00
R2 of Span No.0 } Sum of Reaction = Brace Load = -3.03
R1 of Last Span

* LAST SPAN *

|<-- D1=7.00 R1=-3.57
|<-- D2=18.00 R2=21.10
| D3=29.97
D1 - TOP DEPTH R1 - TOP REACTION
D2 - LAST BRACE DEPTH R2 - LAST BRACE REACTION
D3 - BOTTOM DEPTH

TOTAL REACTION: R1+R2 = 17.53
TOTAL PRESSURE ACTING ON WALL = 17.53
Total Reaction = Total Pressure, OK!

*****RESULTS*****

* EMBEDMENT *
MINIMUM EMBEDMENT = 4.97 (8~10 recommended)
TOTAL MINIMUM PILE LENGTH = 29.97

* MOMENT IN PILE *
No. Depth M @ Brace Mmax in Span Depth of Mmax

1	7.00	1.32	report.out	7.02
2	18.00	62.28	1.32	29.94
			0.00	

Overall Maximum Moment = 62.28 at 18.01
 Maximum Shear = 11.98

-> Top Brace Increase 15%. (Horizontal) From -3.03 to -3.49

* BRACE: STRUT, TIEBACK, ANCHOR PLATE, OR DEADMAN *

No.	DEPTH	Tangle	SPACING	HORIZONTAL	VERTICAL
-----	-------	--------	---------	------------	----------

The Braces around No.1 are too low or too close! Move brace up! Results may be incorrect.

The Braces around No.1 are too low or too close! Move brace up! Results may be incorrect.

2	18.00	0.0	1.00	21.10	0.00
---	-------	-----	------	-------	------

No.	DEPTH	Free length	Type and Data
-----	-------	-------------	---------------

1	7.00	0.00	Strut
2	18.00	0.00	Strut

* VERTICAL LOADING *

Vertical Loading from Braces = 0.00
 Vertical Loading from External Load = 0.00
 Total Vertical Loading = 0.00

* VERTICAL BEARING CAPACITY CHECK *

Tip Depth	Tip Area	Bearing	Tip Resistance
-----------	----------	---------	----------------

29.97	0.50	1.00	0.50
-------	------	------	------

Embedment	Side Area*	Friction	Side Resistance
-----------	------------	----------	-----------------

4.97	34.95	1.00	34.95
------	-------	------	-------

*Side Area is the surface area of embedment below base and contact area between pile and soil above base.

Total Vertical Resistance = 35.45
 Total Vertical Loading = 0.00
 Vertical Factor of Safety = 999.00

*****SPECIFIED PILE *****

PZC18 has been found in Sheet Pile list!
 PZC18 Sx= 33.5 Ix= 255.5 weight= 24.2

* Note: All the pile dimensions are in English Units per one foot width.

Request Min. Section Modulus = 22.6 in³/foot, Fy= 50 ksi = 345 MPa, Fb/Fy=0.66
 The pile selection is based on the magnitude of the moment only. Axial force is neglected. Ref. Note 3

report.out
PZC18 is capable to support the shoring!
Top deflection = 0.159(in)
Max. deflection = 0.159(in)