Limited Reevaluation Report
Appendix G:
Structural

U.S. Army Corps of Engineers
New York District

January 2004

NEW YORK AND NEW JERSEYHARBOR DEEPINING PROJECT

STRUCTURAL ENGINEERING APPENDIX

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NY HARBOR NAVIGATION STUDY
INTERIM REPORT 50 FOOT CHANNEL PROJECT
STRUCTURAL

I PURPOSE

The purpose of this section of the Interim Report is to evaluate the stability of marine structures, which are considered critical in terms of potential impact of the proposed dredging of Port Jersey, Kill Van Kull, Newark Bay, S. Elizabeth, and Arthur Kill Channels to a depth of the 50-foot below mean low water. The critical facilities were selected by choosing all structures that fall within 75 feet from top of the 50-foot (54 foot design depth) channel side slope (see Fig. 1). A list of 15 facilities was evaluated, if the structure is found unstable, recommendations are proposed to stabilize/ remove/ or remove and reconstruct it. The goal is to ensure the continued use of the facilities and their ability to transfer cargo to and from vessels and to ensure the continued use of waterfront structures such as warehouses, recreation piers, bulkheads etc.

II METHOD OF ANALYSIS

Before commencing the evaluation, a field investigation was performed, a photograph was taken for each structure, and water depth was measured and then converted to mean low water. This is based on NOAA (National Oceanic and Atmospheric Administration) Water Level Station Data at Bergen Point West Reach, NY. The average water depth was reduced by about 4.5 foot to reflect the actual mean low water.

The subsurface soil characteristics are based on the boring log and section view provided by the Geology Group. For structures with pile foundations, the CASE (Computer Aided Structural Engineering) computer program 'CPGA' was used to model the pile group in 2-D or 3-D analysis, the lateral movement of the structure was then determined. For structures with sheet pile/tie back anchorage, the CASE computer program 'CWALSHT' was used to calculate the safety factor due to 54 foot deep channel dredging. For structures requiring removal and reconstruction, the original footprint was kept and new structure was analyzed by STAAD.Pro computer program.

III RESULT SUMMARY

Fifteen (15) facilities were evaluated. Two (2) piers, one dilapidated (one can stay, one needs to be partially removed), One (1) pier need to be partially removed and One (1) pier need to be removed or replaced. The remaining twelve (12) structures are found to be adequate. Following is the detailed tabulation:

Facility	Channel	Type	Dist. from top of slope	Lateral Movement or F.S.	Recommended Improvement
1. MOTBY Berth	Port Jersey	Pier	0’	1.8”	none
2. N. of B&O area	KVK	Pier	75’	dilapidated	stay
3. Exxon Pier 6	KVK	Pier	65’	0.73”	none
4. Commerce St. Pier	KVK	Pier	0’	dilapidated	remove
5. Atlantic Salt Co.	KVK	Bldg.	50’	0”	none
6. Std. Tank	KVK	Pier	50’	0.75”	none
7. Texaco Piers	Newark Bay	Pier	70’	0.16”	none
8. Allied Signal	S. Eliz.	Pier	0’	unstable	remove or replace
9. P&G Piers	Arthur Kill	Pier	0’	7”	remove 60’ of pier or stabilize with riprap
10. Eliz. Marina 1	Arthur Kill	Bulkhead	90’	1.29	none
Eliz. Marina 2	Arthur Kill	Bulkhead	100’	1.67	none
11. Eliz. Marina 3	Arthur Kill	Wave screen	70’	0	none
12. Eliz. Marina 4	Arthur Kill	Pier	65’	.20”	none
13. Eliz. Marina 5	Arthur Kill	Walkway	187’	.069”	none
14. Chevron Plant 1	Arthur Kill	Bulkhead	65’		
Section 1				3.60	none
Section 2				4.00	none
15. Chevron Plant 2	Arthur Kill	Pier	70’	2.50”	none

IV FACILITIES

PORT JERSEY CHANNEL

Facility No.1: Military Ocean Terminal North Berth (see Photo. No.1)

Marine Ocean Terminal North Berth is a prestressed concrete pile foundation structure, The top of 1V: 3H channel slope for 54 foot deep dredge is about 50' away from toe of channel (see Fig.1), the existing back fill rip rap should remain at the same elevation. 'CPGA' computer program is used to analyze the lateral movement of the structure. The structure is modeled in the computer as a 2-D pile group with design parameter soil lateral stiffness NH=25 lb/in*3; average unsupported pile length Lu=42'; total pile length L=80'; design load is from original berth design load LL=1000 psf, berth load=2900 plf, the lateral movement under these design loads is 1.8".

KILL VAN KULL CHANNEL

Facility No.2: Pier north of B&O Transfer Bridge area (see Photo No.2)

As can be seen in Photo No.2, the pier is dilapidated, and since the structure is about 75' beyond the top of dredge slope (see Fig.2), it does not require removal.

Facility No.3: Exxon-Constable Hook Pier #6 (see Photo No.3)

Exxon-Constable Hook Pier #6 is a circular shaped concrete pier, supported by 19-42" diameter steel pipe piles, for plan and section view see Fig.3. Assume black silt (from El. –40' to El. –50') has no lateral resistance, use pile unsupported length Lu=55', for red-brown sand layer, lateral stiffness NH=25 lb/in*3. The piles are bearing on bed rock (C33=1), 3-D computer model is input into 'CPGA' program, analysis is based on design load LL=400 psf, berth load=3000 plf, wave load=2500 plf, berth and wave load may be combined. The lateral movement of the structure is found to be 0.73"for the above loads with the channel depth of –54 m.l.w. No stabilization or improvement is required for this structure.

Facility No.4: Commerce Street Piers (see Photo No.4)

Photo No.4 shows a dilapidated pier, since 1/3 of pier falls within the dredging slope (see Fig.4), it is recommended to remove the piles.

Facility No.5: Atlantic Salt Co. Bldg. (see Photo No.5)

The Atlantic Salt Co. building is supported by woodpile group foundations, based on the latest soil boring information (boring log KVK SB-3), there is a negligible amount of soil in front of the building (see Fig.5). It is concluded that after the 54' deep channel dredging, the building foundation should experience little or no soil loss; therefore, the

building should have no lateral movement. No stabilization or improvement is required for this structure.
Facility No.6: Standard Tank Cleaning Co. Pier (see Photo No.6)

Standard Tank Cleaning Co. Pier is about 60' wide and 285' long. From boring log KVK 98-11, the top 15' of soil is black silt, it is assumed that top of mud line goes from El.-31' at boring location KVK 01-SF1-4 to El.+6' at the shoreline, this gives an average unsupported pile length of Lu=15.5' (see Fig.6). The wood piles are 12" in diameter, and conservatively assuming a pile length L=40', 2-D 'CPGA' computer program modeled only half of pier length (144'), soil lateral stiffness was NH=5 lb/in*3, design load: vertical load V=400 psf, berthing load H=3000 plf for 54' deep dredge, lateral displacement is about 1.53"/2=0.75" No stabilization or improvement is required for this structure.

NEWARK BAY CHANNEL

Facility No.7: Texaco Pier #35 (see Photo No.7)

Texaco Pier #35 is approx. 700'x110' in size, supported by 12" diameter steel pipe pile groups. The subsurface material is approx. 10' of black silt, 15' of silty clay and 10' of sand and gravel (see Fig.7). Assume pile is bearing on bed rock, total pile length L=60', average unsupported length Lu=25', average soil lateral stiffness NH=10 lb/in*3, since there is a two story warehouse sitting on top of the pier, the design vertical load V=1000 psf, berthing load H=3000 plf, the analysis is based on 1/10 of pier length (70'), 2-D modeled by 'CPGA' computer program, the lateral movement of the structure during 54' deep dredging is 1.67"/10=0.167"(10 = 1/10 of pier length). No stabilization or improvement is required for this structure.

SOUTH ELIZABETH CHANNEL

Facility No.8: Allied Signal Pier (see Photo No.8)

The Allied Signal Pier is about 20'x345' in dimension, supported by woodpile groups foundation. For 54' deep dredging with 1V: 3H side slope. The whole structure will have no soil to support the piles (see Fig.8). It is recommended to remove or replace the structure.

ARTHUR KILL CHANNEL

Facility No.9: Proctor & Gamble Pier (see Photo No.9)

Assume woodpiles are bearing on bedrock. For 54' deep dredging with 1V: 3H side slope, wood piles will have about 60' of pier length with less than 5' deep of soil support (see Fig.9). A 60 feet length of the pier was analyzed using a 2-D modeled by 'CPGA'

computer program. The lateral movement of the structure during 54' deep dredging is 7.0 inches. The piles are assumed to bear on bedrock with a total pile length L= 45' and the unsupported length Lu=31', average soil lateral stiffness NH=750 lb/in*2, the design vertical load V= 244 kips and a horizontal load H= 25 kips. To stabilize the pier, an investigation is on going to place riprap in front and between the piles to reduce the movement of the pier. Placing riprap to stabilize the pier will require coordination with environmental agencies on the state and federal level. Another option if riprap cannot be placed is to remove 60' feet of pier within the dredge side slope.

Facility No.10: City of Elizabeth Marina Steel Sheet Pile (see Photo No.10)

a. The City of Elizabeth Marina Steel Sheet Pile at the location in Fig.10 section 1-1 has a distance of 90' from the toe of 54' deep channel slope, sheet pile is driven to bed rock at El.-28', with the embankment side slope of 1V: 3H. The western side of the channel was realigned so the channel side slope will not extend into the steel sheet pile bulkhead. The top of the channel slope is 60 feet from the steel sheet bulkhead. No stabilization will be required for this bulkhead since the deepening of the channel to 54' will not remove any of the supporting soil or bedrock. An analysis was performed on this section using the Corps CWALSHT Program, which computes passive safety factor and maximum deflection. The passive safety factor for this bulkhead equals to 1.29 for Fixed Earth Method and the maximum deflection equaled to .76 inches at Elevation –11.0 Mean Low Water.

b. The City of Elizabeth Marina Steel Sheet Pile at the location in Fig.10 section 2-2 is a distance of 100' from the toe of 54' deep channel slope, sheet pile is driven to bed rock at El.-28'. The top of the channel slope is 50 feet from the steel sheet bulkhead. An analysis was performed on this section using the Corps CWALSHT Program, which computes passive safety factor and maximum deflection. The passive safety factor for this bulkhead equaled to 1.67 for Fixed Earth Method and the maximum deflection equaled to .71 inches at Elevation –11.0 Mean Low Water. No stabilization will be required for this bulkhead since the deepening of the channel to 54' will not remove any of the supporting soil or bedrock.

Facility No.11: City of Elizabeth Marina Wave Screen (see Photo No.11)

Wave screen structure is a timber pile supported structure; the bedrock surface is high in the area (see Fig.11). After 54' deep dredging with 1V: 3H embankment side slope. The toe of the channel slope is 70 feet from the wave screen. The western side of the channel was realigned so that the channel side slope will not extend into the wave screen structure. The top of the slope is 55 feet from the wave screen structure and the deepening of the channel to 54' will not affect the
wave screen structure. No stabilization or improvement is required for this structure.

Facility No.12: City of Elizabeth Marina Public Recreation Pier (see Photo No.12)

The Elizabeth Marina Public Recreation Pier is a timber pile supported structure. The bedrock surface is also high in the area. After 54' deep dredging with 1V: 3H embankment side slope (see Fig.12). The toe of the channel slope is 65 feet from the wooden pier. The western side of the channel was realigned so that the channel side slope will not extend into the recreation pier. The top of the slope is 20 feet from the wooden pier and the deepening of the channel to 54' will not affect the recreation pier. The pier was analyzed using a 2-D modeled by 'CPGA' computer program. No stabilization is required for the recreation pier since none of the soil supporting the wooden piles will be removed during the deepening of the channel.

Facility No.13: City of Elizabeth Marina Walkway (see Photo No.13)

The Elizabeth Marina Walkway is a wood pile supported pier structure, the structure is 187 away from toe of 54' deep channel side slope, with 1V: 3H embankment side slope (Fig 13). The western side of the channel was realigned so that the channel side slope will not extend into the walkway structure. The top of the slope is 65 feet from the walkway and the deepening of the channel to 54' will not affect the walkway. Due to the uncertainty of subsurface data, a new boring was drilled about 20' in front of walkway, based on new boring log AK-SB 02-2, the new section is shown in Fig 13, the embankment slope should remain the same as existing configuration, for slope stability analysis, see geotechnical section of this report. The lateral movement of the structure during 54' deep dredging is .066 inches. The piles are assumed to be bearing on bedrock. The total length, L= 40 feet for each pile, average unsupported length Lu=25', average soil lateral stiffness NH=. 01 lb/in*2, the design vertical load V= 15 kips, the analysis is based on a total number of 20 piles. No stabilization is required for the walkway since none of the soil supporting the wooden piles will be removed during the deepening of the channel. The movement of the walkway during the dredging is minimal.

Facility No.14: Chevron Lubricant Plant Bulkhead (see left side of Photo No.14)

Chevron Lubricant Plant bulkhead is a steel sheet pile supported structure and is 65' away from toe of 54' deep channel slope, with 1V: 3H embankment side slope. The existing marine structure is to be replaced with a new bulkhead. The new bulkhead will be tied-back to bedrock using soil/rock anchors. The sheet piling for the new bulkhead will be driven to bedrock. CME Inc. the property lessee will construct the new bulkhead, which is designed by T&M Associates. The steel bulkhead is 70' away from toe of the 54' deep channel side slope, with 1V: 3H embankment side slope. The top of the slope is 60 from the steel sheet bulkhead where the deepening of the channel to 54' will not affect this structure. An analysis was performed on this section using the Corps CWALSHT Program, which computes passive safety factor and maximum deflection. The passive safety factor for this bulkhead equaled to 3.60 for the fixed earth method and the maximum deflection equaled to .12 inches at Elevation 15.0 Mean Low Water. No stabilization is required for this bulkhead since none of the soil supporting the bulkhead will be removed during the deepening of the channel.

Facility No.15: Chevron Lubricant Plant Pier (see right side of Photo No.14)

Chevron Lubricant Plant Pier is a plant material delivery pier, the structure is supported by woodpiles and the outer most row of piles are dilapidated and was not considered in the analysis. The first row of pile is about 70' away from the toe of the 54' deep dredging slope, with 1V: 3H embankment side slope, (see Fig.14). The top of the slope is 45 from the pier where the deepening of the channel to 54' will not affect the woodpiles. The pier was analyzed using a 2-D modeled by 'CPGA' computer program. The lateral movement of the structure during 54' deep dredging is .25 inches. The piles are assumed to be bearing on bedrock. The total length, L=50 feet for each pile, average unsupported length Lu=30', average soil lateral stiffness NH=100 lb/in*3, the design vertical load V= 200 kips, the analysis is based on of pier length 50.'with total number of piles equaled to 50. No stabilization is required since the soil supporting the pier will not be removed during the deepening of the channel and the lateral movement is minimal.

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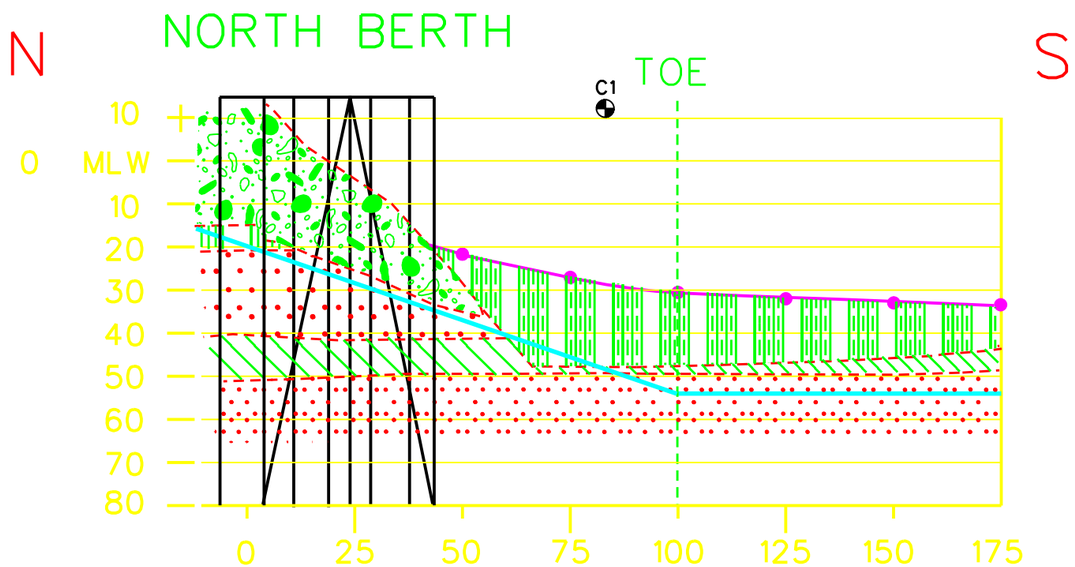
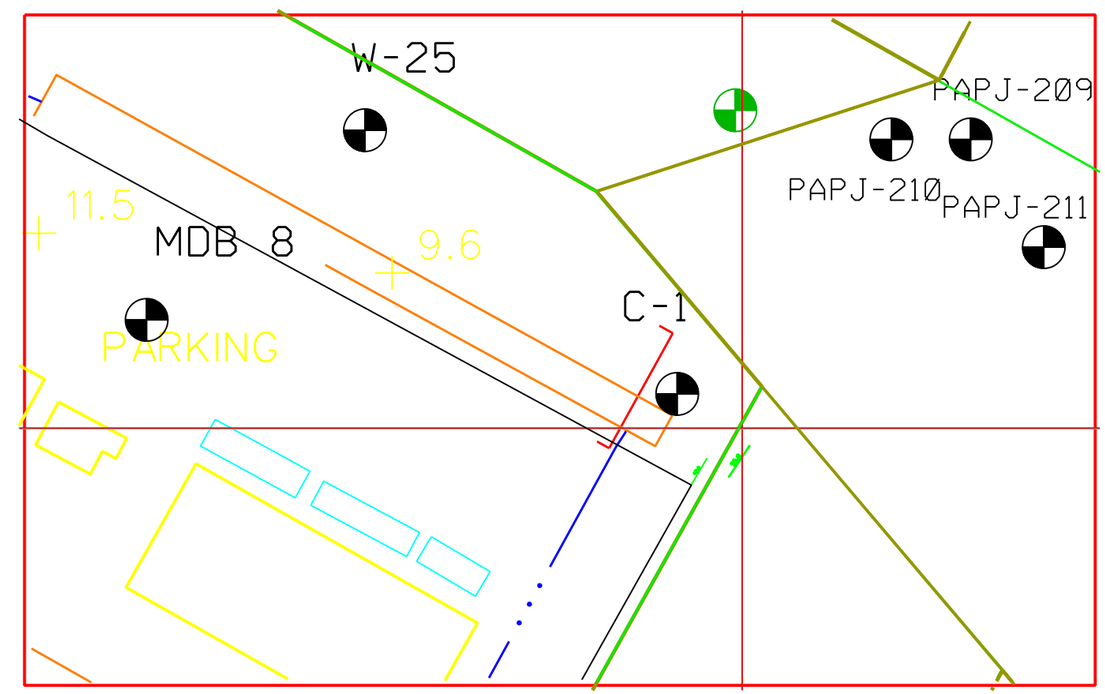
V. FIGURES AND PHOTOS

MARINE OCEAN TERMINAL NORTH BERTH (1)





KEY

SURVEY POINTS

1 ON 3 SLOPE

RIPRAP

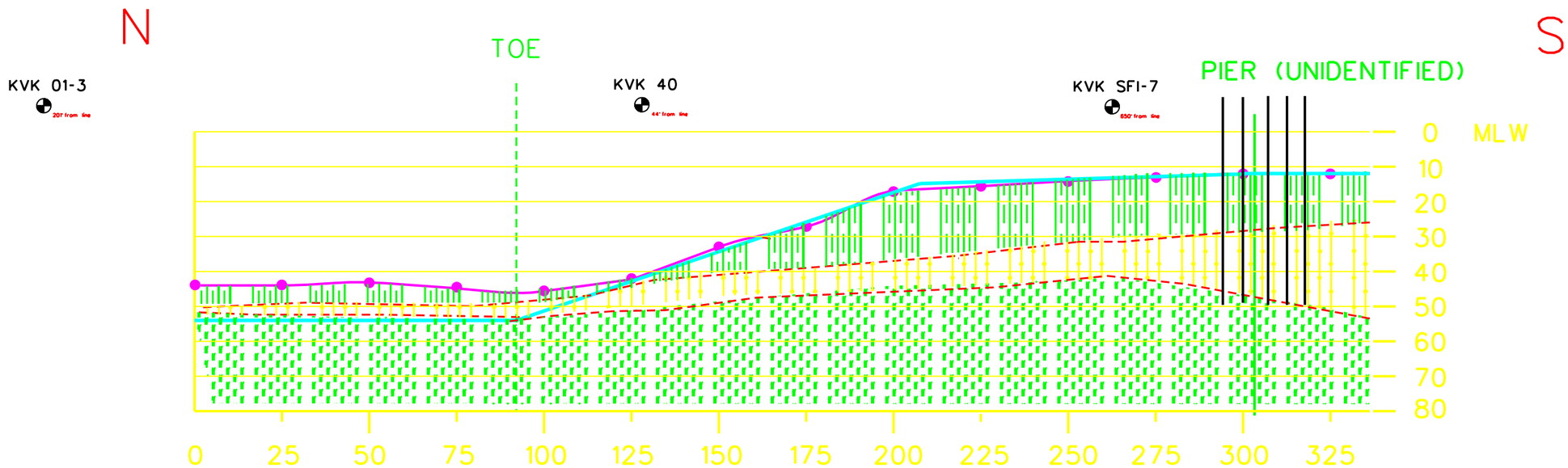
Red-brown, Silty CLAY (CL)

Dark-gray SILT, very soft

Brown, SAND (SP)

FIGURE 1

PIER NEAR B&O TRANSFER BRIDGE, RICHMOND TERRACE (2)



KEY

- SURVEY POINTS
- 1 ON 3 SLOPE
- Black, dark-gray organic SILT
- Red-brown, Silt and Sand (CL/SP)
- SERPENTINITE

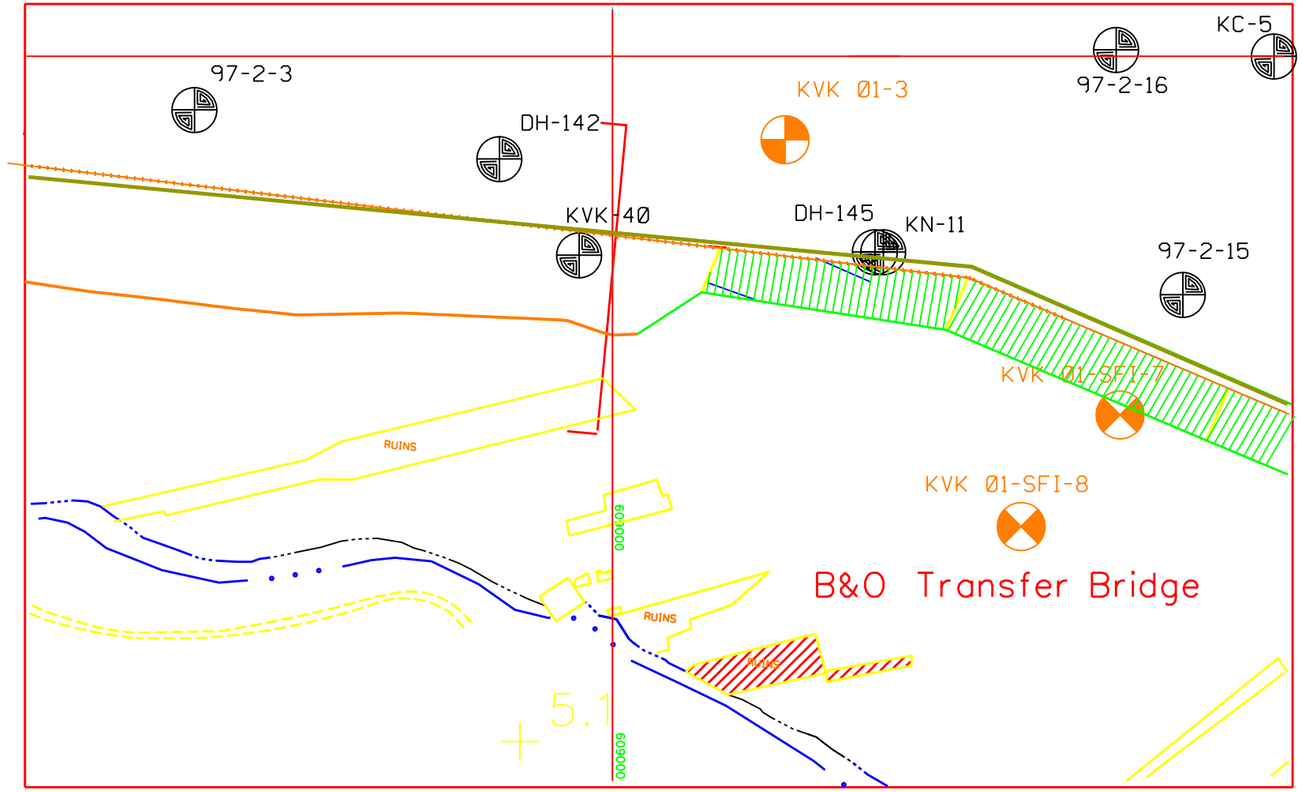


FIGURE 2

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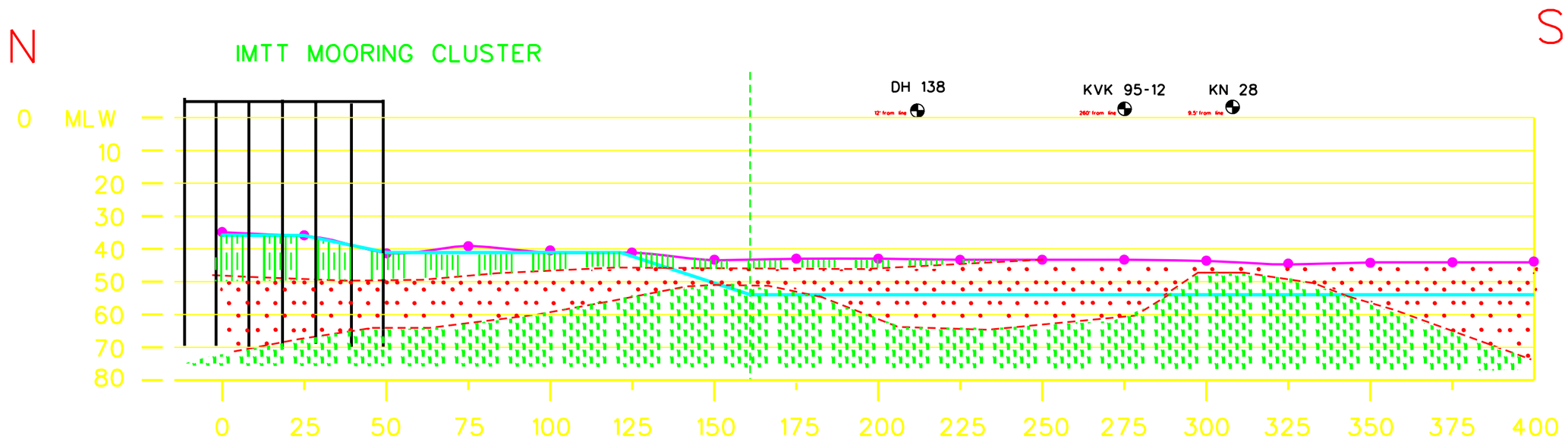
IMTT (Exxon) PIER (3)

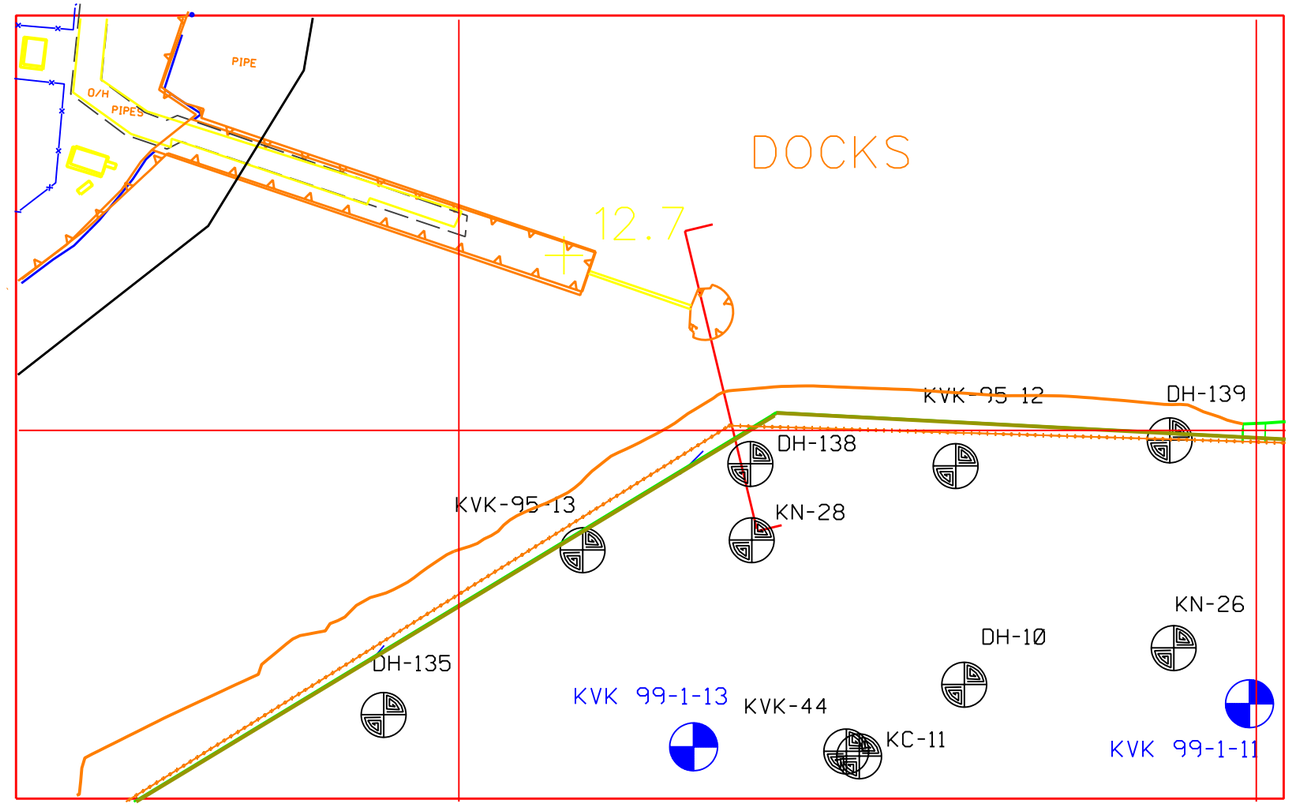
Kill Van Kull



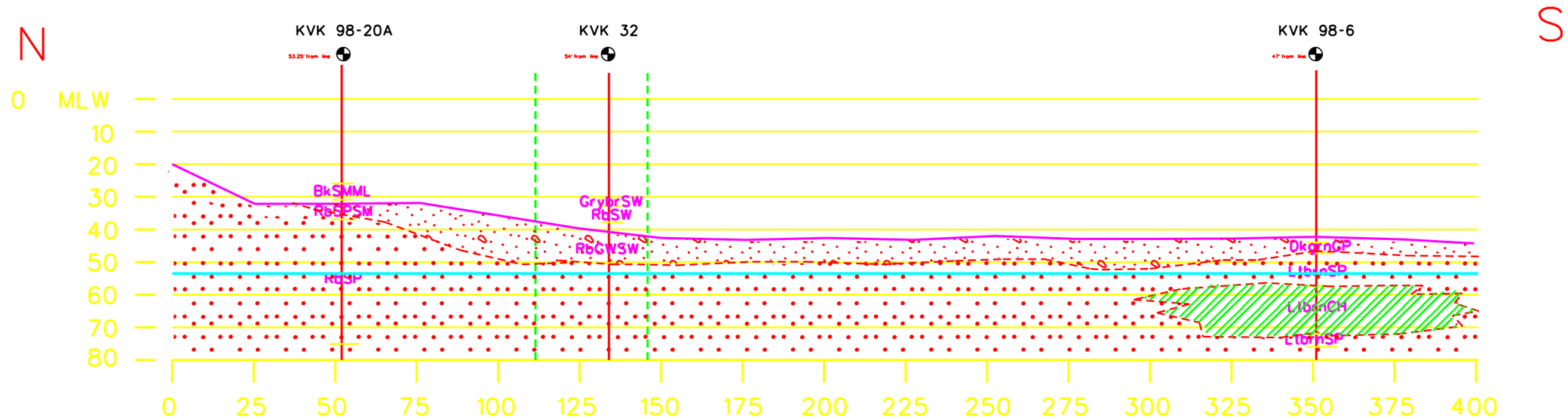
KEY

- SURVEY POINTS
- 1 ON 3 SLOPE
- Black, organic SILT (OL)
- Red-brown, Sand (SP)
- SERPENTINITE

FIGURE 3



COMMERCE STREET PIER (4) Dilapidated Structure



KEY

SURVEY POINTS

1 ON 3 SLOPE

Lt. brown CH

Red-brown Gravel (GWSW)

Red-brown, Sand (SP)

FIGURE 4

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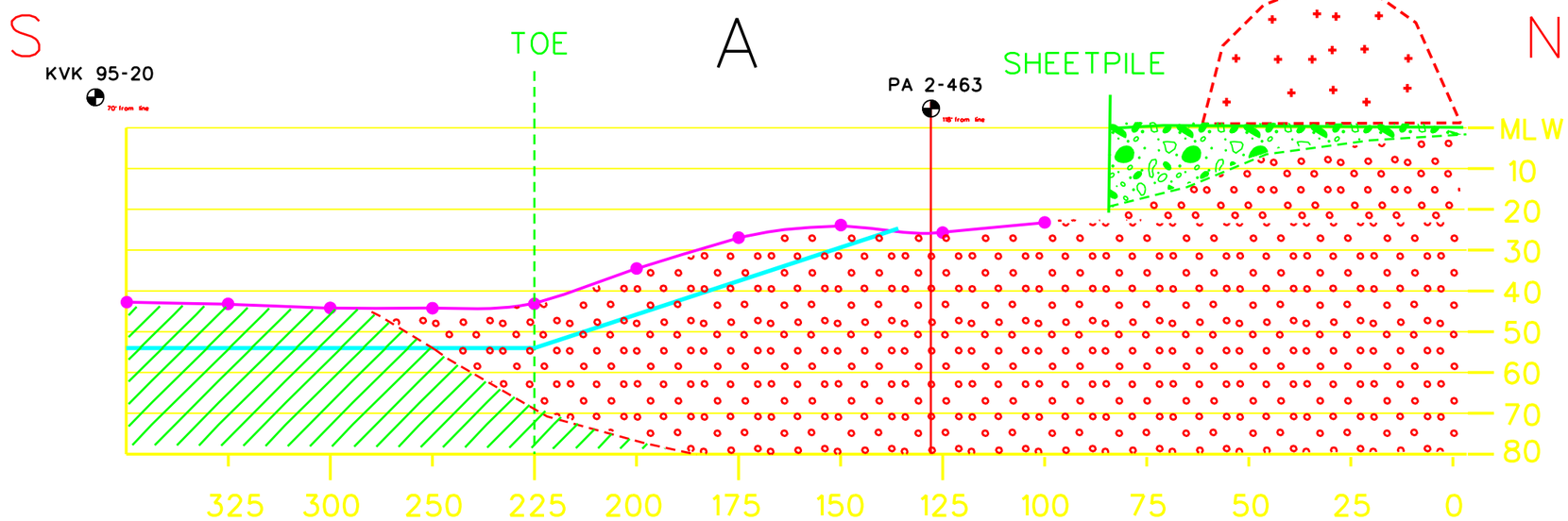
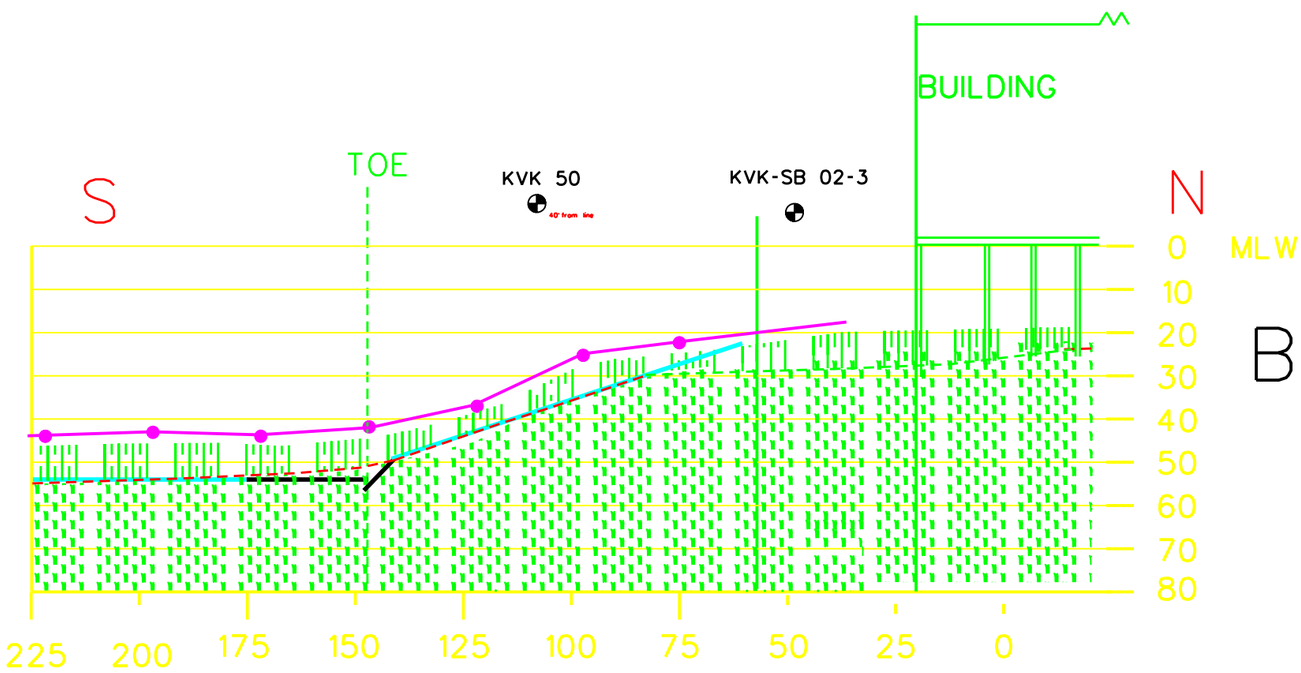
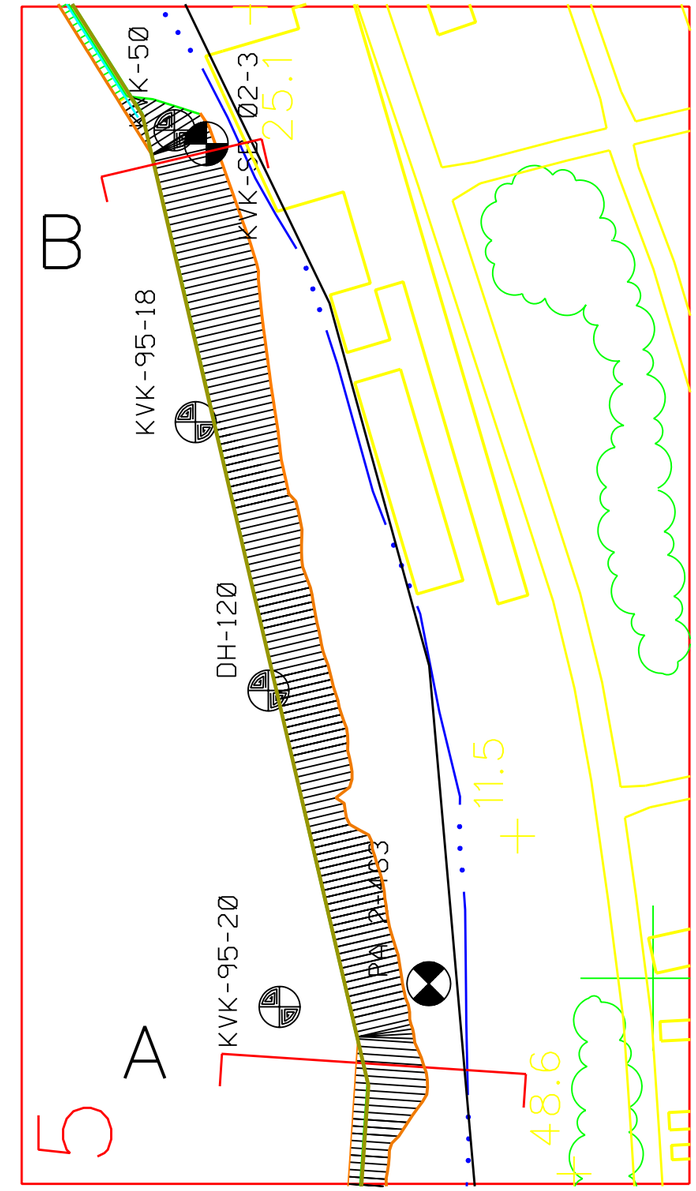
SALT STORAGE, ATLANTIC SALT CO. (5A+B)







KEY KEY

1 ON 3 SLOPE

SURVEY POINTS

Black, SILT

Gray, SAND

Fill material

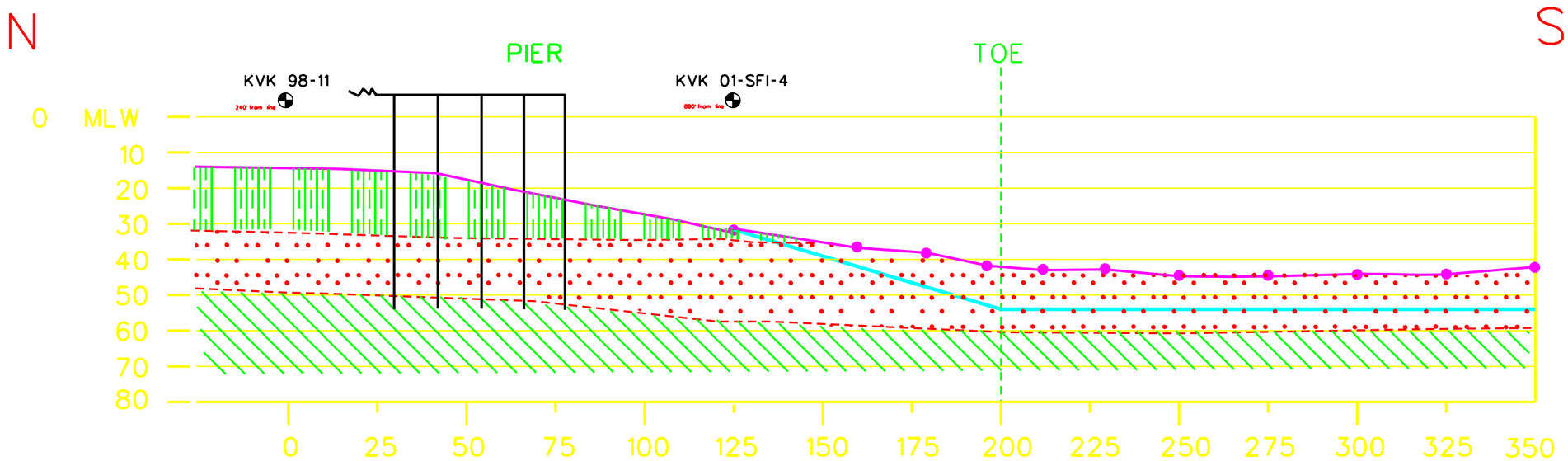
Red-Brown, SAND (SP)

Red-Brown, Silt and Clay

SERPENTINITE

FIGURE 5

STANDARD TANK (7)



KEY

SURVEY POINTS

1 ON 3 SLOPE

Black, SILT

Red-Brown, SAND (SP)

Gray and Red-brown, Silty CLAY (CL)

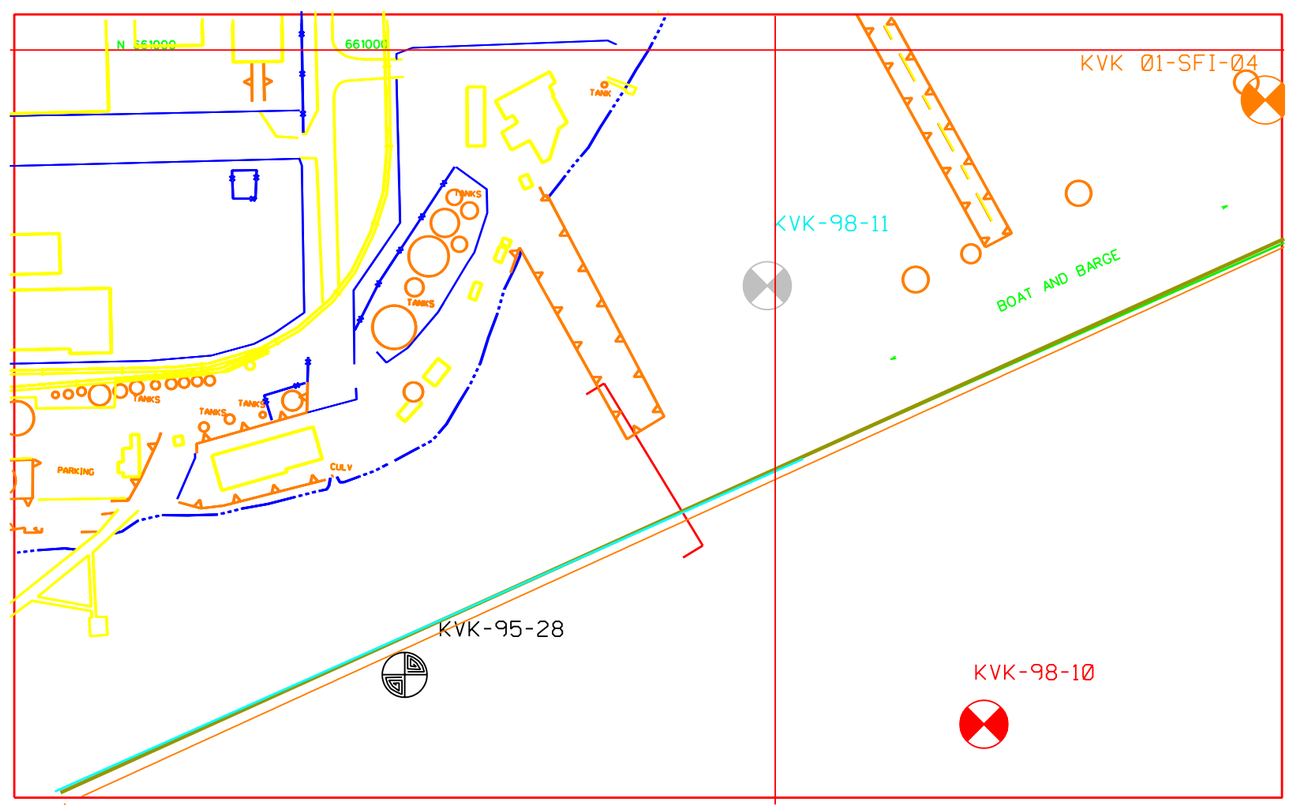


FIGURE 6

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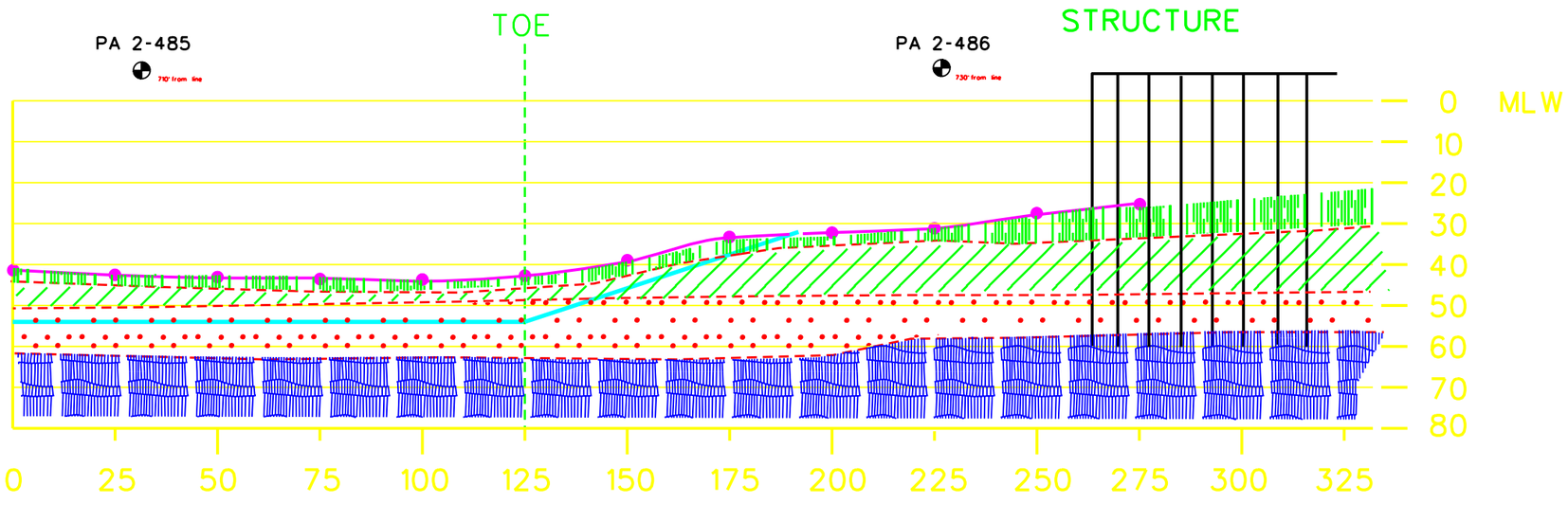
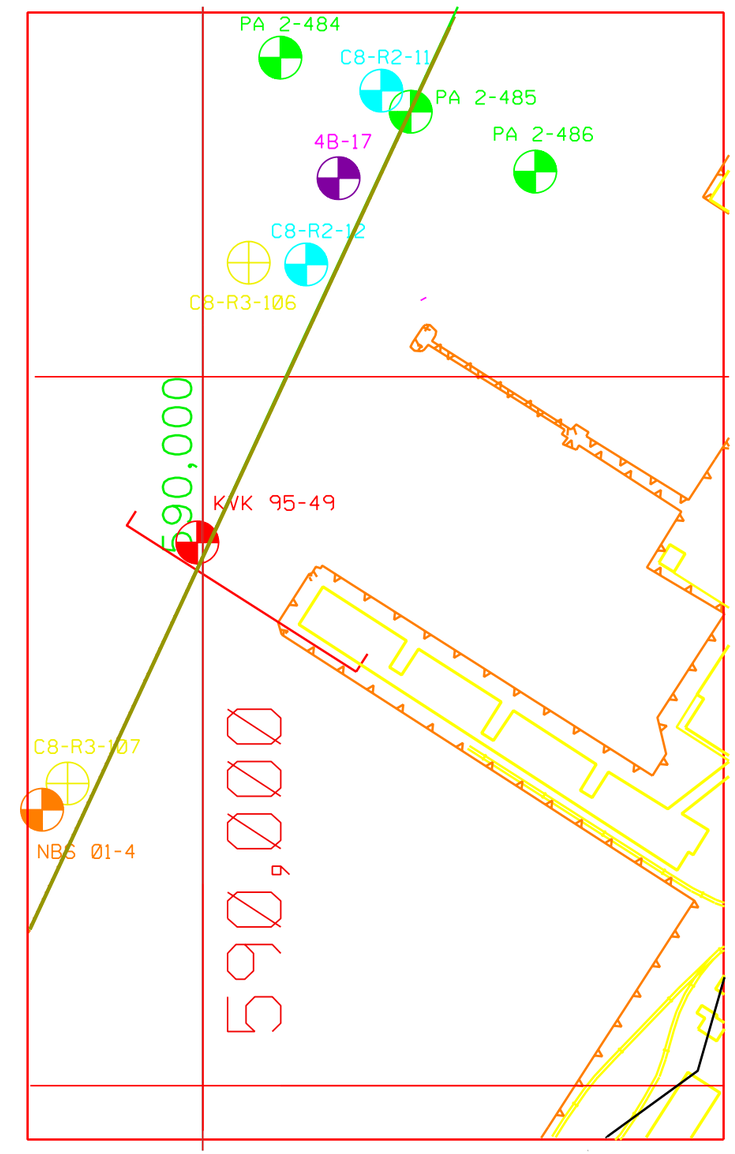
TEXACO PIER (9)

Bergen Point Area, Newark Bay





KEY

SURVEY POINTS

1 ON 3 SLOPE

Black, organic SILT (OL)

Red-brown, Silty CLAY (CL)

Red-brown, Sand and Gravel (SP/GC)

DIABASE

FIGURE 7

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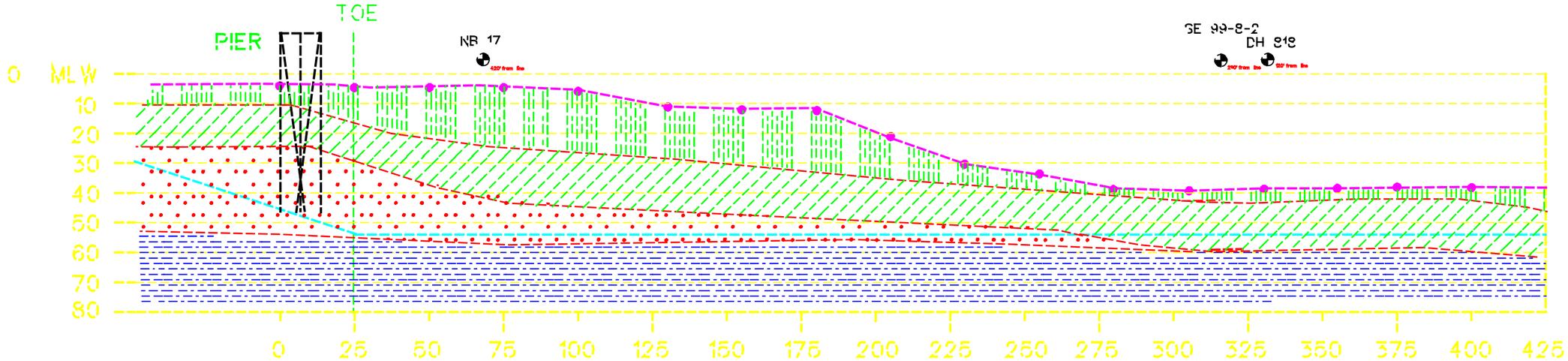
ALLIED SIGNAL PIER (11) South Elizabeth



KEY

- SURVEY POINTS
- 1 ON 3 SLOPE
- Black, SILT
- Brown, SAND (SP)
- Red-brown, Silty CLAY (CL)
- SHALE

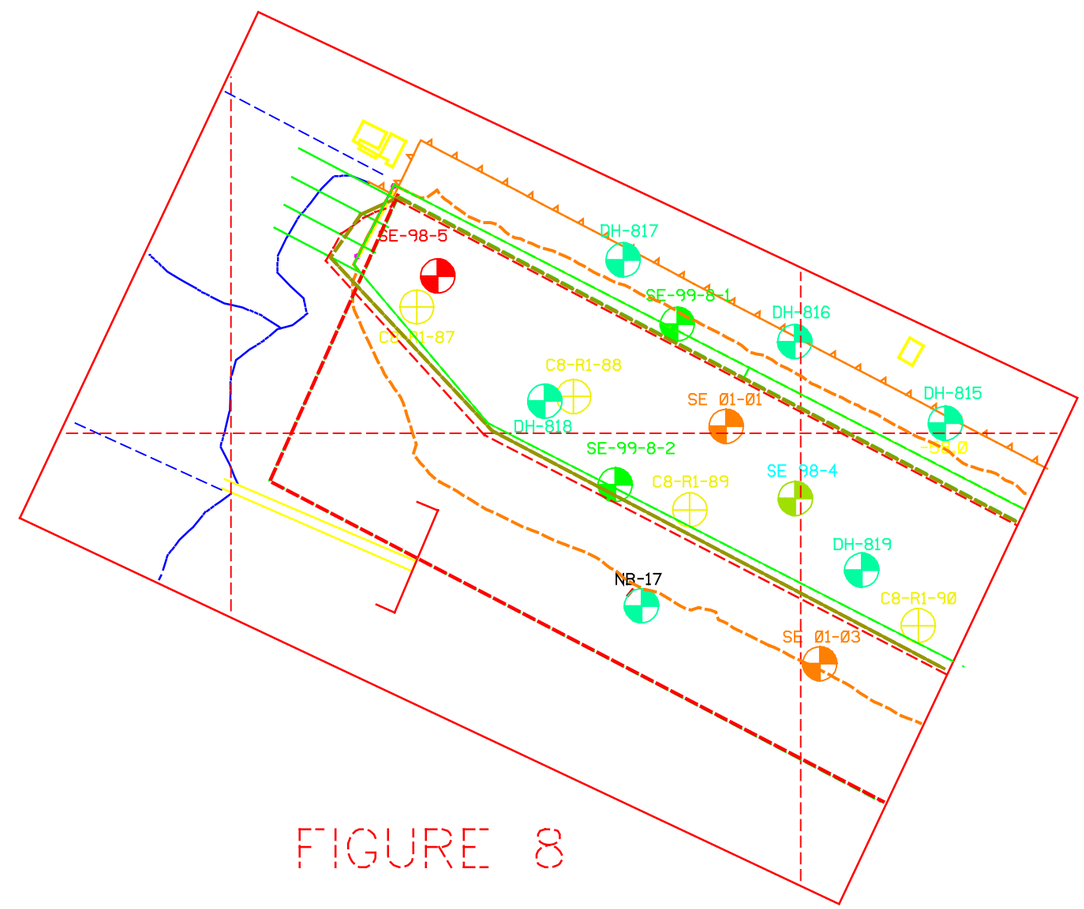


FIGURE 8

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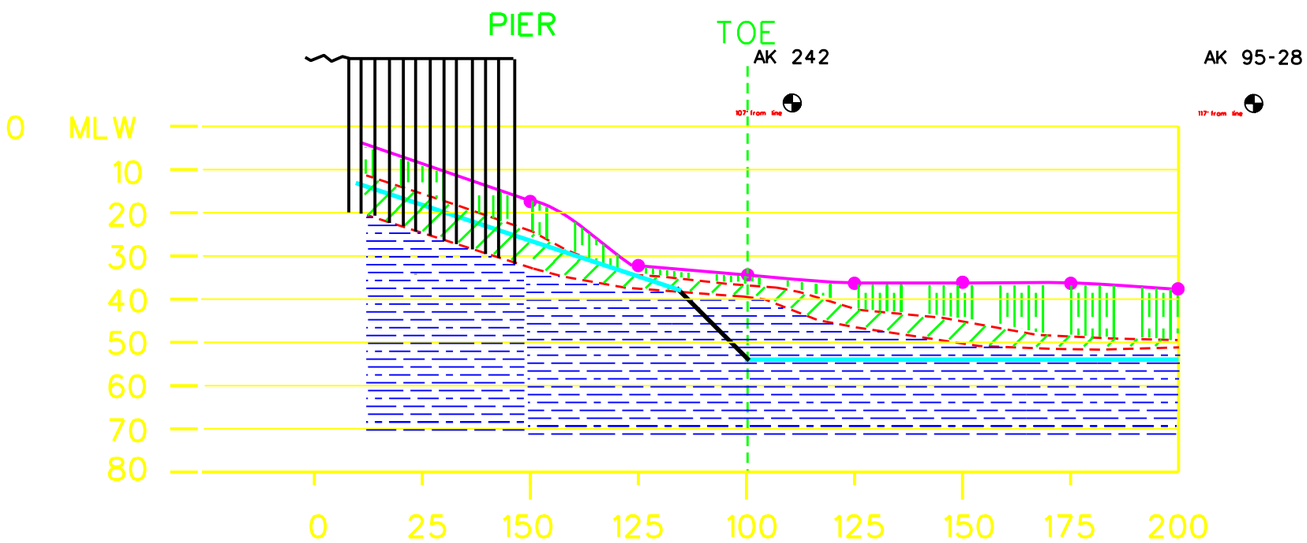
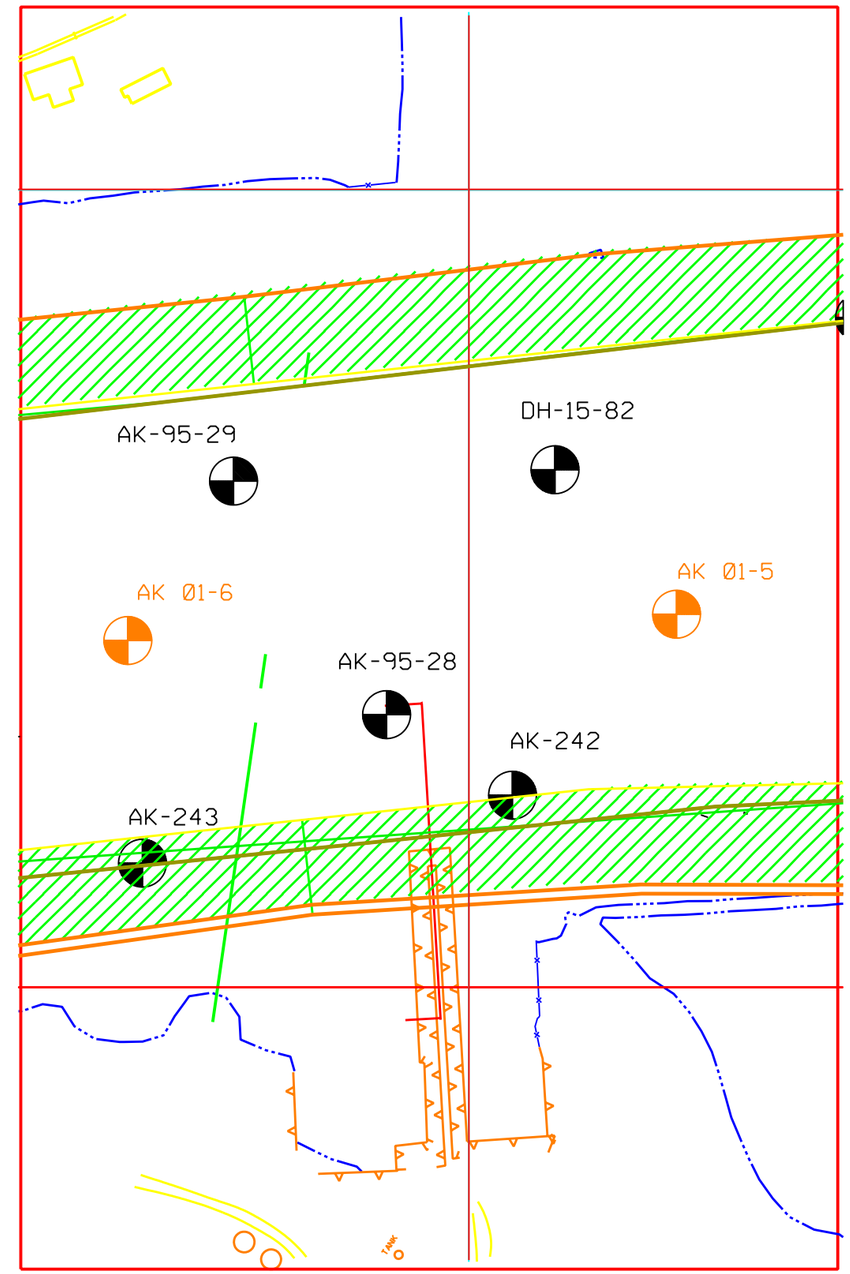
PROCTOR AND GAMBLE (15)





KEY

SURVEY POINTS

1 ON 3 SLOPE

1 ON 1 SLOPE

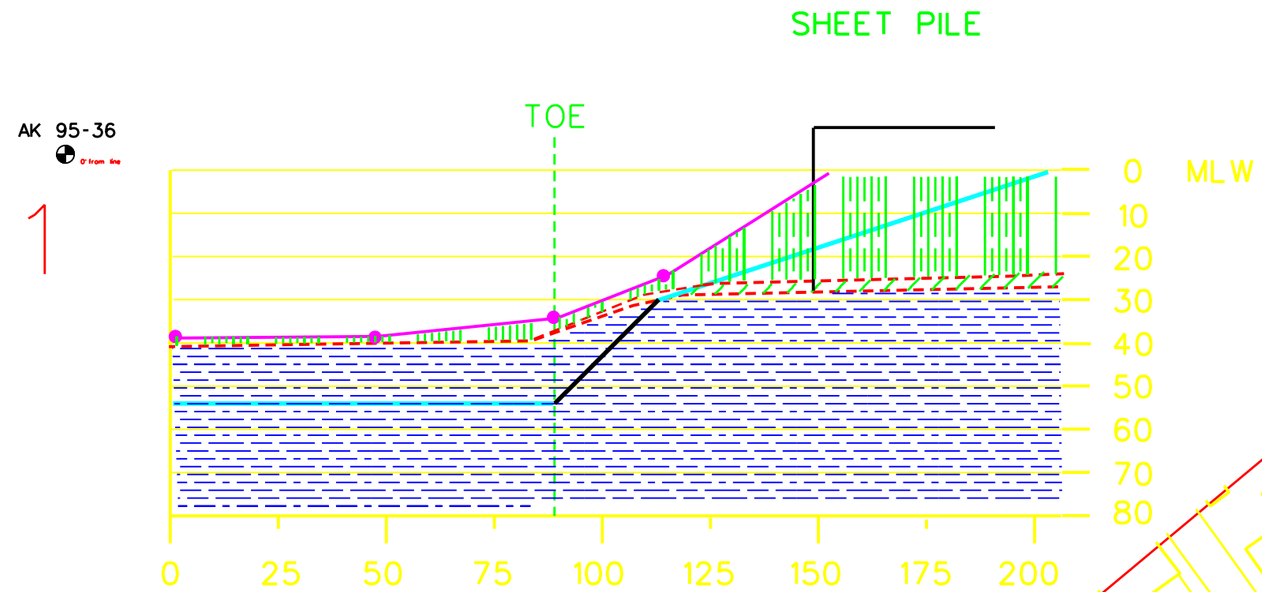
Black, SILT

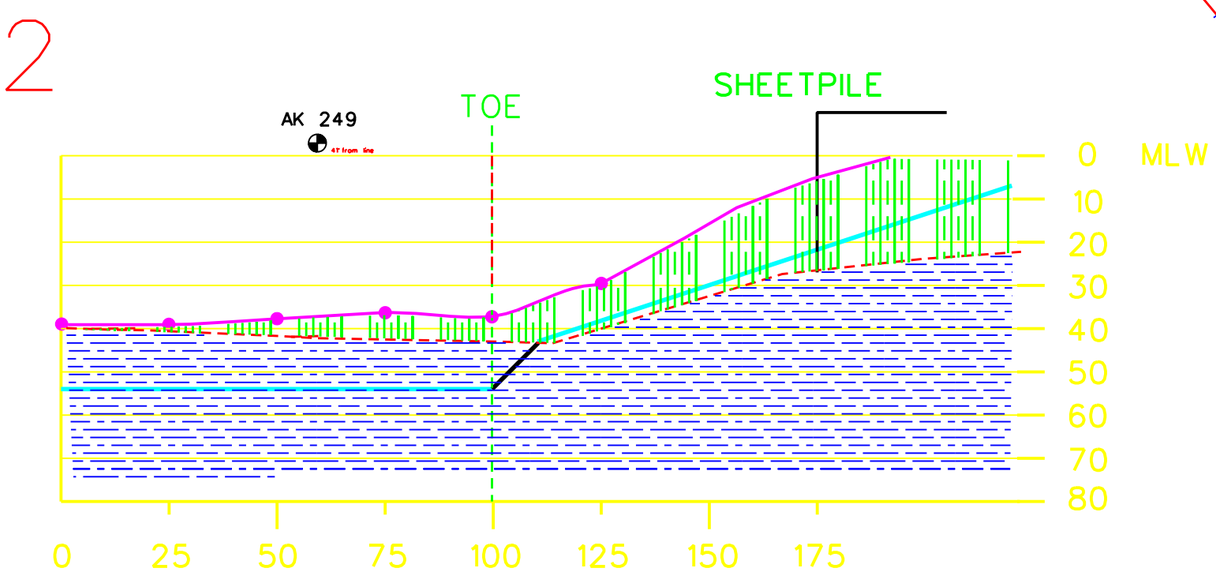
SHALE

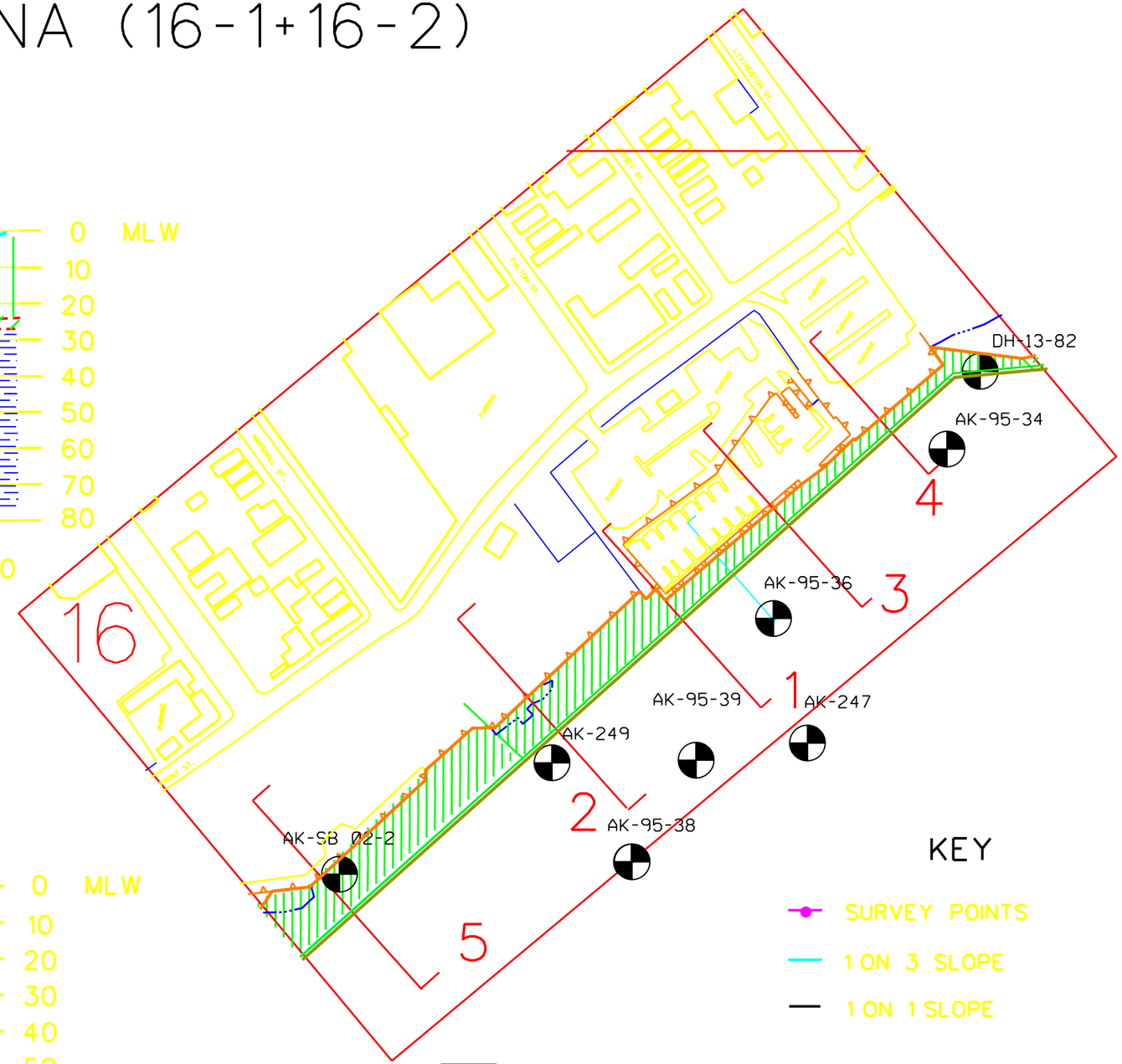
Red-brown, Silty CLAY (CL)

FIGURE 9

CITY OF ELIZABETH MARINA (16-1+16-2)







KEY

- SURVEY POINTS
- 1 ON 3 SLOPE
- 1 ON 1 SLOPE
- Dark-gray, SILT and SAND
- Red-brown, SILT and CLAY
- SHALE

FIGURE 10

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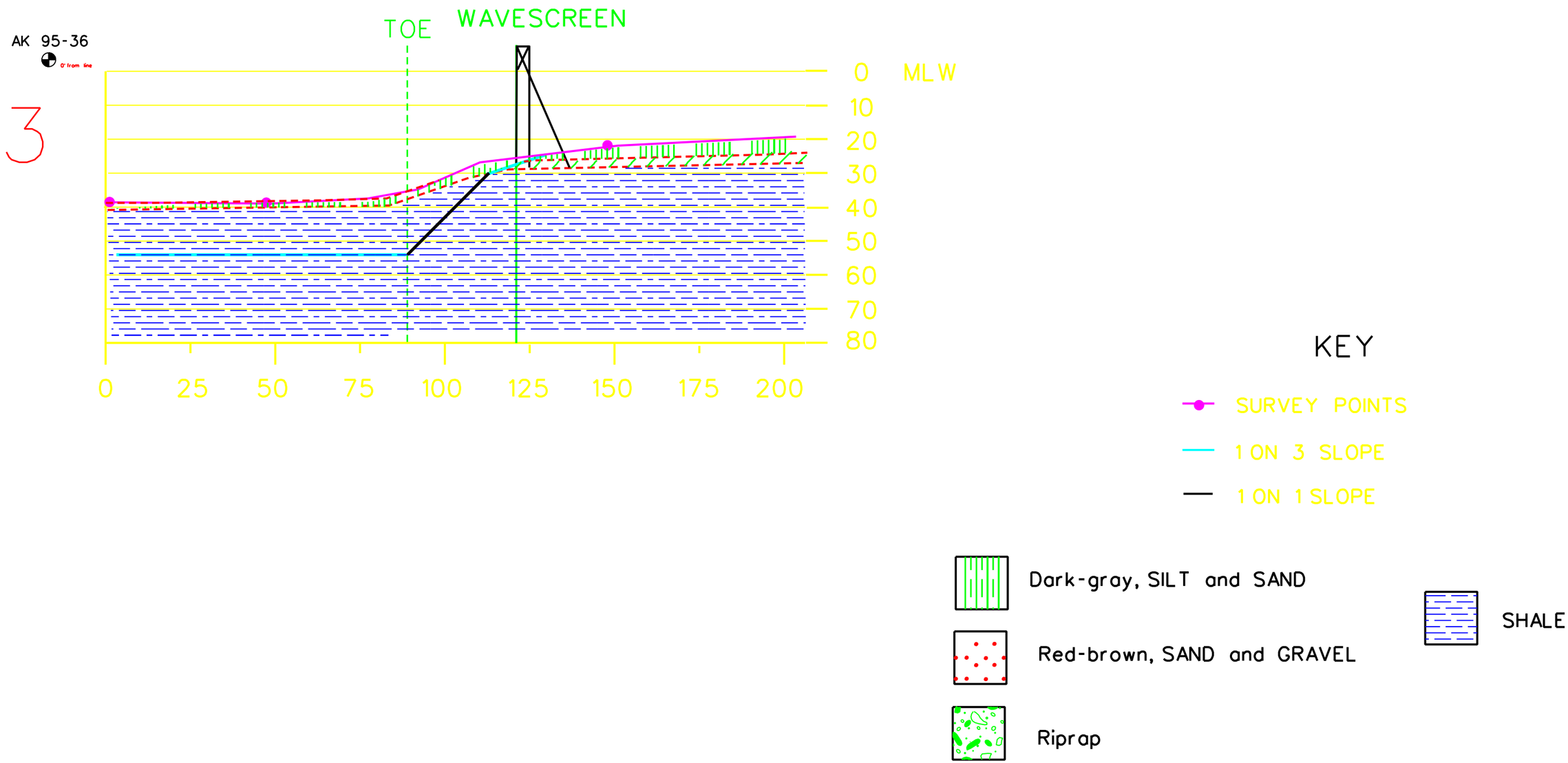
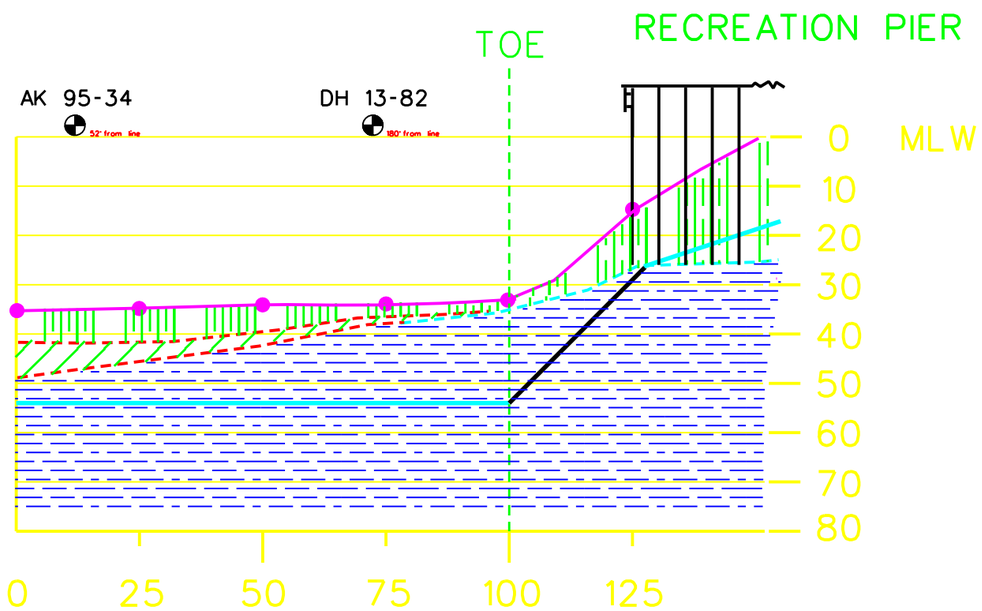

AK 95-36
0' from line
3
TOE
WAVESCREEN
0
MLW
10
20
30
40
50
60
70
80
0
25
50
75
100
125
150
175
200
KEY
SURVEY POINTS
1 ON 3 SLOPE
1 ON 1 SLOPE
Dark-gray, SILT and SAND
Red-brown, SAND and GRAVEL
Riprap
SHALE

FIGURE 11



KEY

SURVEY POINTS

1 ON 3 SLOPE

1 ON 1 SLOPE

Dark-gray, SILT and SAND

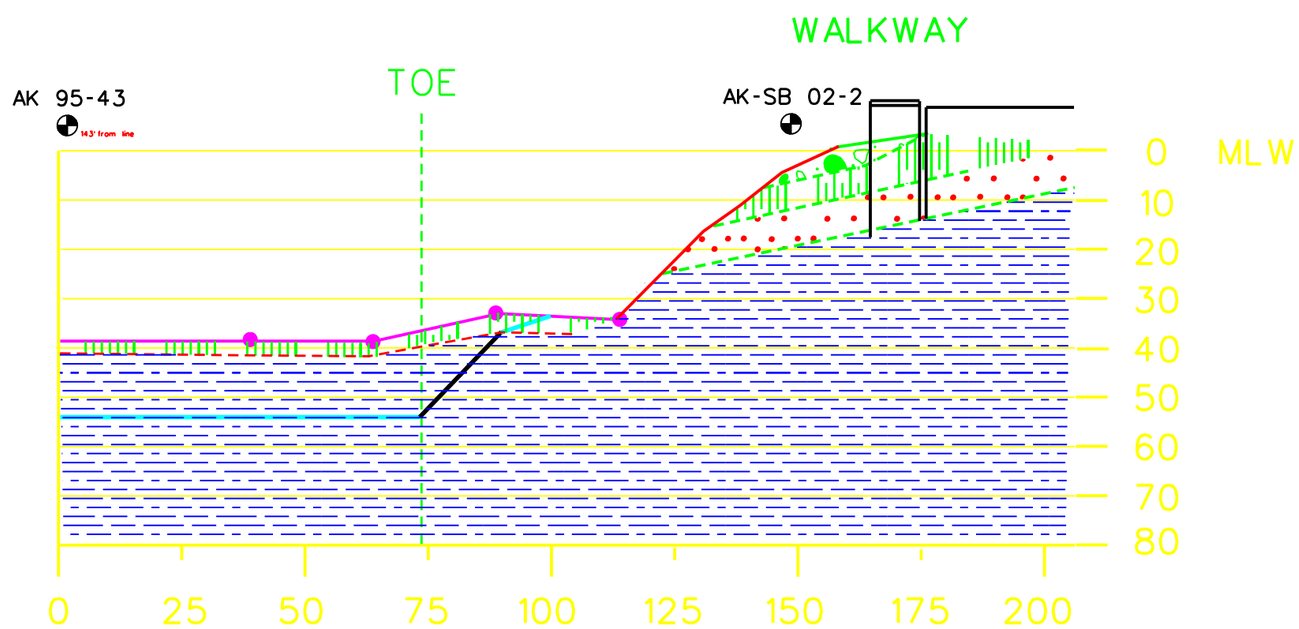
Red-brown, SAND and GRAVEL

Riprap

SHALE

FIGURE 12

CITY OF ELIZABETH MARINA



KEY

SURVEY POINTS

1 ON 3 SLOPE

1 ON 1 SLOPE

Dark-gray, SILT and SAND

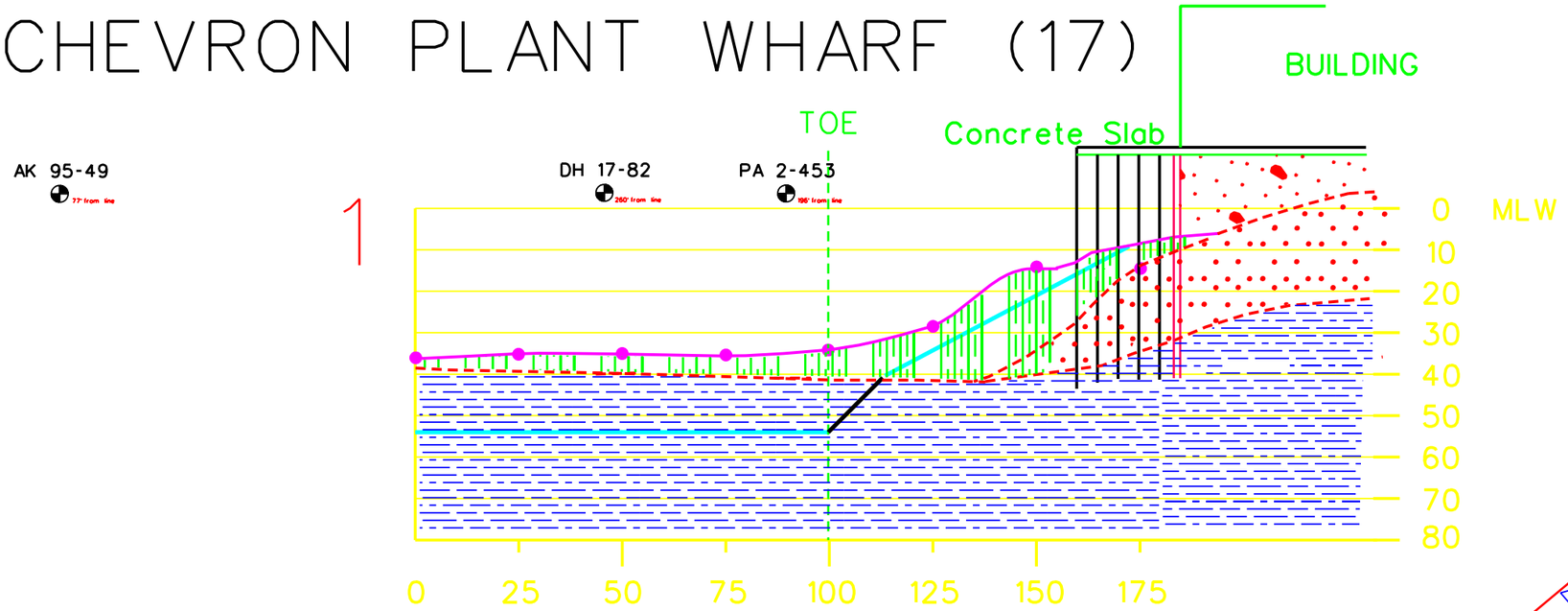
Red-brown, SAND and GRAVEL

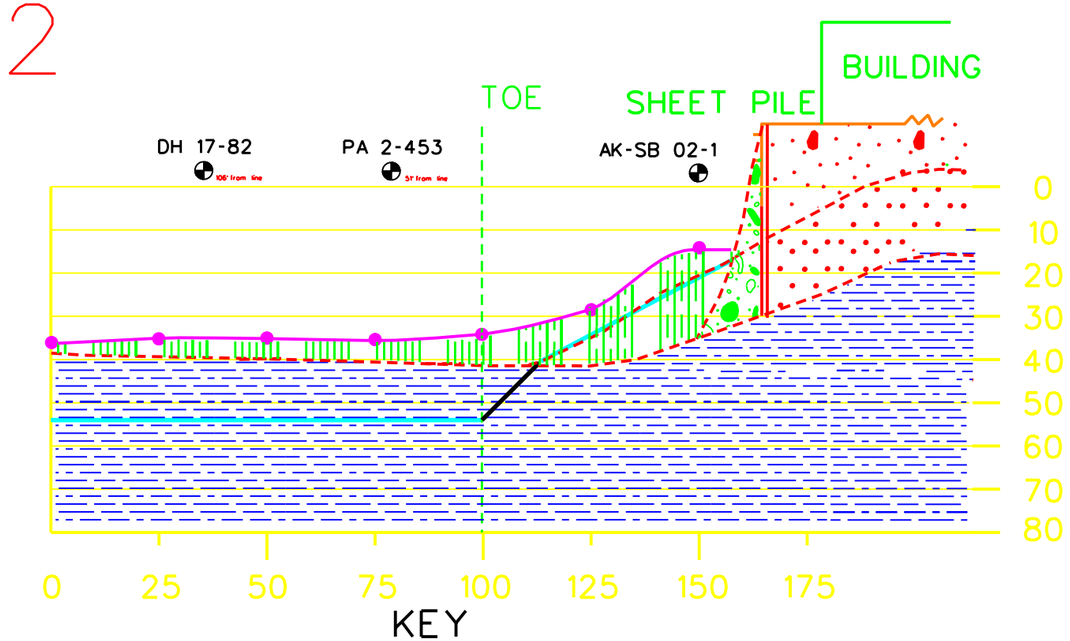
Riprap

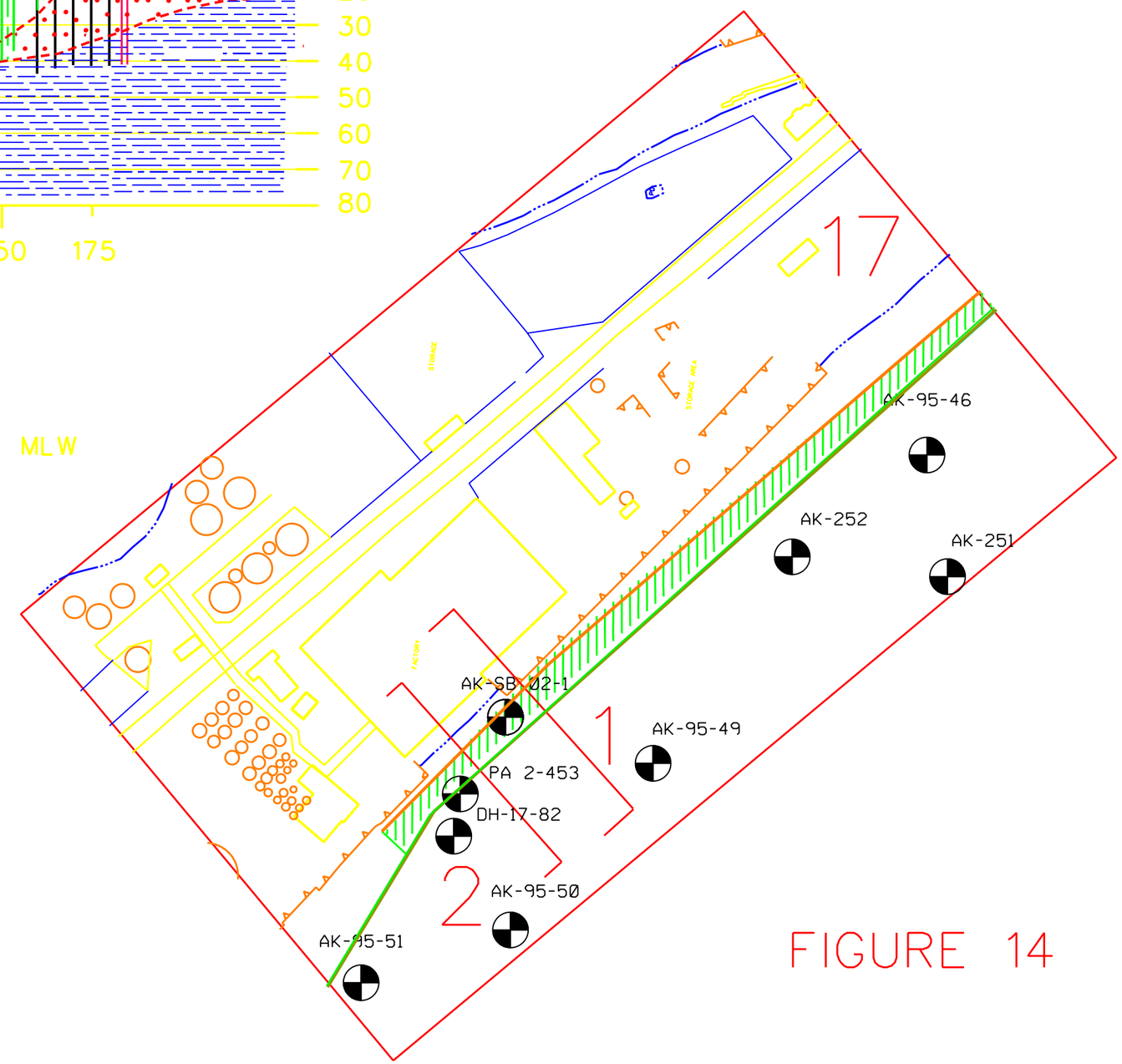
SHALE

FIGURE 13

CHEVRON PLANT WHARF (17)







KEY

- SURVEY POINTS
- 1 ON 3 SLOPE
- 1 ON 1 SLOPE
- Black, SILT (OL)
- SHALE
- RIP-RAP
- FILL

FIGURE 14

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Photo No. 1 Marine Ocean Terminal North Berth

Photo No. 2 Pier in North of B & O Transfer Bridge Area

Photo No. 3 Exxon-Constable Hook Pier #6

Photo No. 4 Commerce Street Piers

Photo No. 5 Atlantic Salt Co. Building

Photo No. 6 Standard Tank Cleaning Co. Pier

Photo No. 7 Texaco Pier #35

Photo No. 8 Allied Signal Pier

Photo No. 9 Proctor & Gamble Pier

Photo No. 10 City of Elizabeth Marina Steel Sheet Pile

Photo No. 11 City of Elizabeth Marina Wave Screen

Photo No. 12 City of Elizabeth Marina Recreation Pier

Photo No. 13 City of Elizabeth Marina Walk Way

Photo No. 14 Chevron Plant Pier (Right) and Bulkhead (Left)

VI. CALCULATIONS

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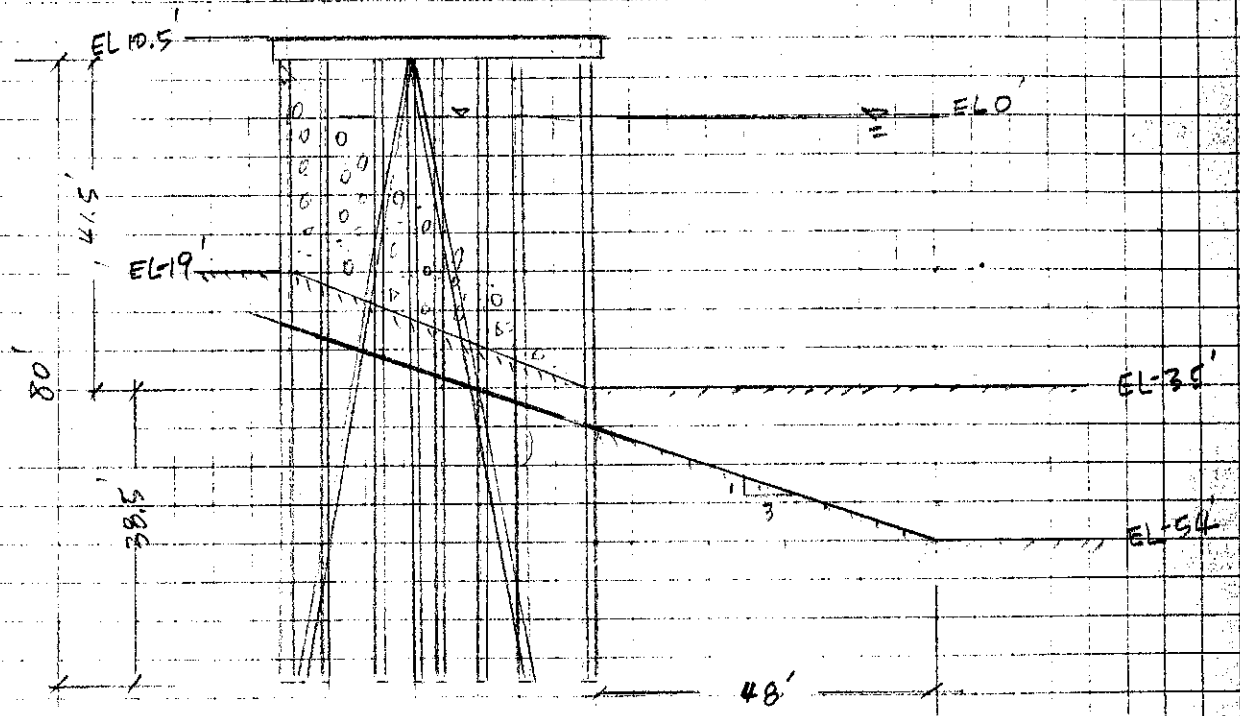
MOTBY BERTH

COMPUTATION SHEET			Page____ of____
Subject MOTBY Berth N-1		Project Port Jersey Channel	
Computed by J. CHU	Date 10/31/2003	Checked by GJW	Date 10/3/2003

Facility No. 1: Military Ocean Terminal North Berth

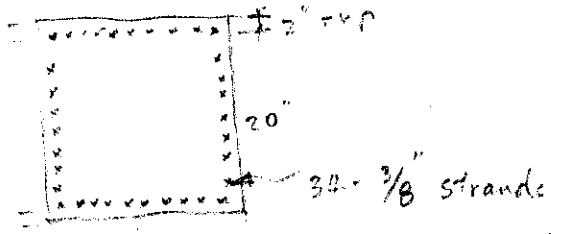


Section view

SQUARE 5 X 5 TO THE INCH

NAVY FORM 229 Apr 79

~~f'_c = 6000 psi~~



$A_s = 34 \times 0.11$ ~~= 66~~ in^2

initial Pre-Stressed force = 15,500 lbs.

$F'_c = 6000$ psi

$f'_c = 4500$ psi (strength at transfer)

$A_g = 400\ in^2$

$I_1 = I_2 = \frac{20(20)^3}{12} = 13{,}333\ in^4$

$E_c = 4000$ ksi $E_s = 28{,}000$ ksi

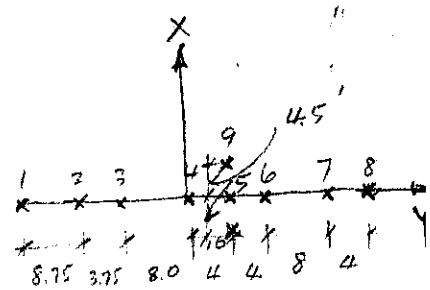
$L = 80'$

CPGA

~~X~~80chk4

a) Port Jersey MOTBY Berth N-1

	E	I_1	I_2	A	C33	B66	LIST
b) Prop	4000.	13333	13333	400	2	0	1 TO 10
c) soil	NH	25 ~~10~~	L	80	32	1 TO 10	
d) FIX	1 TO 10						



plan

e) f) g) omit

	Shape	K	AT	PO	PT	PB	MB	LO	ST	W	LIST
h) DLS	S	360	180	1278	795	10	5062	5000	H	20	ALL

(Design Load Stress)

	Shape	A	S	FBC	JBC	FA	FT	LIST
i) ASC	S	[illegible]	[illegible]	1.05	1.25	1.8	0	ALL

([illegible])

	NSD	CM1	CM2	PCR1	PCR2	ST	LIST
j) unsup	C	0.6	0.6	596	596	H	ALL

(unsupported pile data)

	KMO1	KMO2	LIST
k) PMAXMOM			ALL

(moment factor for pinned piles)

	KMF1U	KMF2U	LIST
l) FUNSMOM	188	188	ALL

(moment factor of fixed piles)

m) overstressed factors (omit)

n) Pile batter LIST

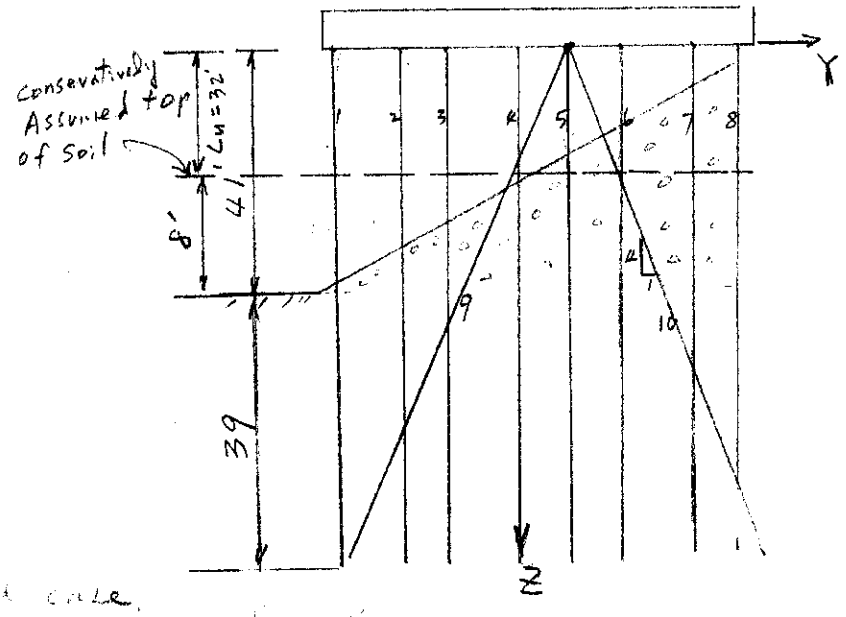
Batter	4	9 to 10

o)

	Ang	LIST
angle	0	10
Angle	180	9

p) Pile coordinates

		X	Y	Z
Pile	1	0	-20.5	0
	2	0	-11.75	0
	3	0	-8.0	
	4	0	0.0	
	5	0	4.0	
	6	0	8.0	
	7	0	16.0	
	8	0	20.0	
	9	[illegible]	4.0	
	10	-4.5	4.0	



y) load case

Load	1	[illegible]	[illegible]	[illegible]	0	0	0
Load	2	0	65	1330	0	0	0

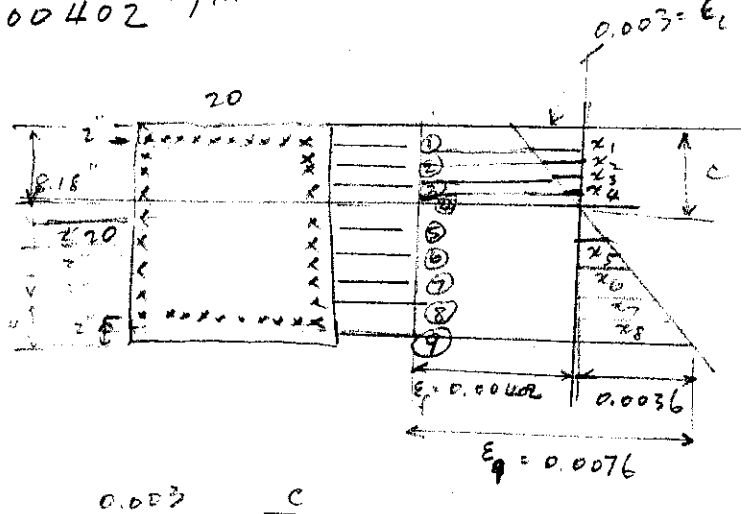
bb) Fout [illegible] 567 [illegible]

cc) [illegible] 1 to 10

$$\varepsilon_f = S/E_s = 421/(34\times 0.11)\times\left(\frac{1}{28{,}000}\right) = 0.00402 \text{ in/in}$$

$$\varepsilon_9 = S_y/E_s = 212.5/28{,}000 = 0.0076$$

$$\therefore\ c = 8.18''$$



$$T_9 = \varepsilon_9 E_s A_s = 0.0076\times 28{,}000(10)(0.11) = 234^K$$

$$T_8 = \varepsilon_8 E_s A_s = 0.0069\times 28{,}000(2)(0.11) = 43^K$$

$$T_7 = \varepsilon_7 E_s A_s = 0.00615\times 28{,}000(2)(0.11) = 38^K$$

$$T_6 = \varepsilon_6 E_s A_s = 0.00542\times 28000\times(2)(0.11) = 33^K$$

$$T_5 = \varepsilon_5 E_s A_s = 0.00468\times 28000\times 2\times 0.11 = 29^K$$

$$T_4 = \varepsilon_4 E_s A_s = (0.00402-0.00007)\times 28000\times 2\times 0.11 = 24^K$$

$$T_3 = \varepsilon_3 E_s A_s = (0.00402-0.0008)\times 28{,}000\times 2\times 0.11 = 20^K$$

$$T_2 = \varepsilon_2 E_s A_s = (0.00402-0.00153)\times 28{,}000\times 2\times 0.11 = 15^K$$

$$T_1 = \varepsilon_1 E_s A_s = (0.00402-0.00226)\times 28{,}000\times 2\times 0.11 = 54^K$$

$$\frac{0.003}{0.0036} = \frac{c}{18-c}$$

$$0.0036c = 18\times 0.003 - 0.003c$$

$$0.0066c = 18\times 0.003$$

$$c = \frac{18\times 0.003}{0.0066} = 8.18''$$

$$\frac{x_8}{0.0036} = \frac{7.82}{9.82} \quad x_8 = 0.0029$$

$$\frac{x_7}{0.0036} = \frac{5.82}{9.82} \quad x_7 = 0.0021$$

$$\frac{x_6}{0.0036} = \frac{3.82}{9.82} \quad x_6 = 0.0014$$

$$\frac{x_5}{0.0036} = \frac{1.82}{9.82} \quad x_5 = 0.00067$$

$$\frac{x_4}{0.003} = \frac{0.18}{8.18} \quad x_4 = 0.00007$$

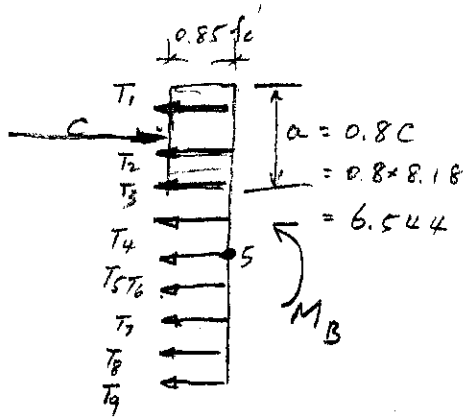
$$\frac{x_3}{0.003} = \frac{2.18}{8.18} \quad x_3 = 0.0008$$

$$\frac{x_2}{0.003} = \frac{4.18}{8.18} \quad x_2 = 0.00153$$

$$\frac{x_1}{0.003} = \frac{6.18}{8.18} \quad x_1 = 0.00226$$

$PB = C - (T_1 + \cdots + T_9)$ $\quad 6.544 \times 20 \times 0.85 \times 4.5 = C$

$500 = C$



$PB = 500 - (54 + 15 + 20 + 24 + 29 + 33 + 38 + 43 + 234)$

$= 10^{K}$

$M_B = C\left(10 - \frac{6.544}{2}\right) + (T_6 \times 2 + T_7 \times 4 + T_8 \times 6 + T_9 \times 8) - (T_4 \times 2 + T_3 \times 4 + T_2 \times 6$

$+ T_1 \times 8)$

$= 500(6.728) + (33 \times 2 + 38 \times 4 + 43 \times 6 + 234 \times 8) - (24 \times 2 + 20 \times 4 + 15 \times 6$

$+ 54 \times 8)$

$= 3364 + 2348 - 650$

$= 5062$ in-K.

2

$\varepsilon_1 = 0.00132$ $\quad T_1 = \varepsilon_1 E_s \cdot A_s = 0.00132 \times 28{,}000 \times 10 \times 0.11 = 41^K$

$\varepsilon_2 = 0.00172$ $\quad T_2 = 0.00172 \times 28{,}000 \times 2 \times 0.11 = 10.6^K$

$\varepsilon_3 = 0.00202$ $\quad T_3 = 0.00202 \times 28{,}000 \times 2 \times 0.11 = 12.4^K$

$\varepsilon_4 = 0.00232$ $\quad T_4 = 0.00232 \times 28{,}000 \times 2 \times 0.11 = 14.3^K$

$\varepsilon_5 = 0.00272$ $\quad T_5 = 0.00272 \times 28{,}000 \times 2 \times 0.11 = 16.8^K$

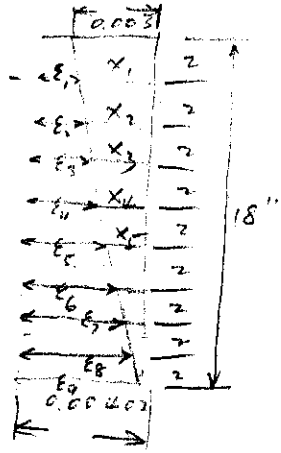
$\varepsilon_6 = 0.00302$ $\quad T_6 = 0.00302 \times 28{,}000 \times 2 \times 0.11 = 18.6^K$

$\varepsilon_7 = 0.00332$ $\quad T_7 = 0.00332 \times 28{,}000 \times 2 \times 0.11 = 20.5^K$

$\varepsilon_8 = 0.00369$ $\quad T_8 = 0.00369 \times 28{,}000 \times 2 \times 0.11 = 22.7^K$

$\varepsilon_9 = 0.00402$ $\quad T_9 = 0.00402 \times 28{,}000 \times 10 \times 0.11 = 123.8^K$

$C = 0.8 \times 18 \times 20 \times 0.85 \times 4.5 = 1102^K$



$\frac{x_1}{0.003} = \frac{16}{18}$

$x_1 = 0.0027$

$\frac{x_2}{0.003} = \frac{14}{18}$

$x_2 = 0.0023$

$x_3 = \frac{0.003 \times 12}{18} = 0.002$

$x_4 = \frac{0.003 \times 10}{18} = 0.0017$

$x_5 = \frac{0.003 \times 8}{18} = 0.0013$

$x_6 = \frac{0.003 \times 6}{18} = 0.001$

$x_7 = \frac{0.003 \times 4}{18} = 0.0007$

$x_8 = \frac{0.003 \times 2}{18} = 0.00033$

$P_2 = 1102 - (41 + 10.6 + 12.4 + 14.3 + 16.8 + 18.6 + 20.5 + 22.7 + 123.8)$

$= 821^K$

$M_2 = 1102\left(10 - \frac{0.8 \times 18}{2}\right) + (T_6 \times 2 + T_7 \times 4 + T_8 \times 6 + T_9 \times 8) - (T_4 \times 2 + T_3 \times 4 + T_2 \times 6 + T_1 \times 8)$

$= 3085 + 1246 - 470 = 3861^{"K}$

3

$\varepsilon_1 = (0.00402 - 0.00247) = 0.00155$ $\quad T_1 = \varepsilon_1 E_s A_s = 0.00155 \times 28{,}000 \times 10 \times 0.11 = 48^K$

$\varepsilon_2 = (0.00402 - 0.00193) = 0.00209$ $\quad T_2 = 0.00209 \times 28{,}000 \times 2 \times 0.11 = 13^K$

$\varepsilon_3 = (0.00402 - 0.0014) = 0.00262$ $\quad T_3 = 0.00262 \times 28{,}000 \times 2 \times 0.11 = 16^K$

$\varepsilon_4 = (0.00402 - 0.0009) = 0.00312$ $\quad T_4 = 0.00312 \times 28{,}000 \times 2 \times 0.11 = 19^K$

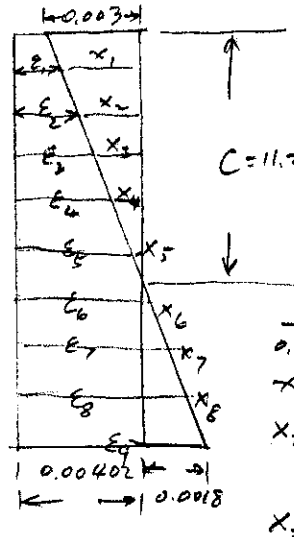
$\varepsilon_5 = (0.00402 - 0.00033) = 0.00369$ $\quad T_5 = 0.00369 \times 28{,}000 \times 2 \times 0.11 = 23^K$

$\varepsilon_6 = (0.00402 + 0.0002) = 0.00422$ $\quad T_6 = 0.00422 \times 28{,}000 \times 2 \times 0.11 = 26^K$

$\varepsilon_7 = (0.00402 + 0.00073) = 0.00475$ $\quad T_7 = 0.00475 \times 28{,}000 \times 2 \times 0.11 = 29^K$

$\varepsilon_8 = (0.00402 + 0.0013) = 0.00532$ $\quad T_8 = 0.00532 \times 28{,}000 \times 2 \times 0.11 = 33^K$

$\varepsilon_9 = (0.00402 + 0.0018) = 0.00582$ $\quad T_9 = 0.00582 \times 28{,}000 \times 10 \times 0.11 = 179^K$



$\frac{c}{0.003} = \frac{18 - c}{0.0018}$

$0.0018c = 0.003(18 - c)$

$c = \frac{0.003 \times 18}{0.00048} = 11.2$

$\frac{x_1}{0.003} = \frac{9.25}{11.25}$

$x_1 = 0.00247$

$x_2 = \left(\frac{7.25}{11.25}\right) \times 0.003 = 0.00193$

$x_3 = \left(\frac{5.25}{11.25}\right) \times 0.003 = 0.0014$

$x_4 = \left(\frac{3.25}{11.25}\right) \times 0.003 = 0.0009$

$x_5 = \left(\frac{1.25}{11.25}\right) \times 0.003 = 0.0003$

$x_6 = \left(\frac{0.75}{6.75}\right) \times 0.0018 = 0.000$

$x_7 = \left(\frac{2.75}{6.75}\right) \times 0.0018 = 0.000$

$x_8 = \left(\frac{4.75}{6.75}\right) \times 0.0018 = 0.0013$

$\varepsilon_1 = 0.004 - 0.002 = 0.002 \quad T_1 = \varepsilon_1 \cdot E_s A_s = 0.002 \times 28{,}000 \times 10 \times 0.11 = 62^{k}$

$\varepsilon_2 = 0.004 - 0.001 = 0.003 \quad T_2 = 0.003 \times 28{,}000 \times 2 \times 0.11 = 19^{k}$

$\varepsilon_3 = 0.004 - 0.00006 = 0.0039 \quad T_3 = 0.0039 \times 28{,}000 \times 2 \times 0.11 = 24^{k}$

$\varepsilon_4 = 0.004 + 0.0009 = 0.0049 \quad T_4 = 0.0049 \times 28{,}000 \times 2 \times 0.11 = 30^{k}$

$\varepsilon_5 = 0.004 + 0.0019 = 0.0059 \quad T_5 = 0.0059 \times 28{,}000 \times 2 \times 0.11 = 36^{k}$

$\varepsilon_6 = 0.004 + 0.0029 = 0.0069 \quad T_6 = 0.0069 \times 28{,}000 \times 2 \times 0.11 = 42^{k}$

$\varepsilon_7 = 0.004 + 0.0038 = 0.0078 \quad T_7 = 0.0076 \times 28000 \times 2 \times 0.11 = 47^{k}$

$\varepsilon_8 = 0.004 + 0.0048 = 0.0088 \quad T_8 = 0.0076 \times 28000 \times 2 \times 0.11 = 47^{k}$

$\varepsilon_9 = 0.004 + 0.0058 = 0.0098 \quad T_9 = 0.0076 \times 28000 \times 10 \times 0.11 = 234^{k}$

$C = 0.8 \times 6.13 \times 0.85 \times 4.5 \times 20 = 375^{k}$

$P_5 = 375 - (62 + 19 + 24 + 30 + 36 + 42 + 47 + 47 + 234)$

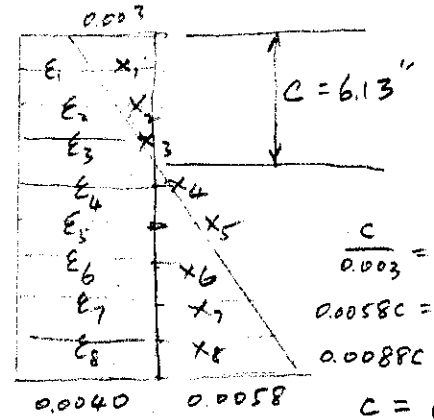
$= -166^{k}$

$M_5 = 375 \times \left(10 - \frac{0.8 \times 6.13}{2}\right) + (T_6 \times 2 + T_7 \times 4 + T_8 \times 6 + T_9 \times 8)$

$- (T_4 \times 2 + T_3 \times 4 + T_2 \times 6 + T_1 \times 8)$

$= 2831 + 2426 - 766$

$= 4491^{"k}$



$\frac{c}{0.003} = \frac{18 - c}{0.0058}$

$0.0058c = (18 - c) \times 0.00$

$0.0088c = 18 \times 0.00$

$c = 6.13''$

$\frac{x_1}{0.003} = \frac{6.13 - 2}{6.13} \quad x_1 = \frac{0.003 \times 4.1}{6.13} = 0.002$

$x_2 = \frac{0.003 \times 2.13}{6.13} = 0.001$

$x_3 = \frac{0.003 \times 0.13}{6.13} = 0.00006$

$\frac{x_4}{0.0058} = \frac{8 - 6.13}{18 - 6.13} \quad x_4 = \frac{0.0058 \times 1.87}{11.87} = 0.0009$

$x_5 = \frac{0.0058 \times 3.87}{11.87} = 0.0019$

$x_6 = \frac{0.0058 \times 5.87}{11.87} = 0.0029$

$x_7 = \frac{0.0058 \times 7.87}{11.87} = 0.0038$

$x_8 = \frac{0.0058 \times 9.87}{11.87} = 0.0048$

3. $C = 0.8 \times 11.25 \times 20 \times 0.85 \times 4.5 = 689^{K}$

$P_3 = 689 - (48+13+16+19+23+26+29+33+179) = 303^{K}$

$M_3 = 689 \times \left(10 - \frac{0.8 \times 11.25}{2}\right) + (T_6 \times 2 + T_7 \times 4 + T_8 \times 6 + T_9 \times 8) - (T_4 \times 2 + T_3 \times 4 + T_2 \times 6 + T_1 \times 8)$

$= 3790 + 1798 - 564$

$= 5024^{"K}$

---

4. $\varepsilon_1 = 0.00402 - 0.00211$
$= 0.00191$

$T_1 = \varepsilon_1 E_s A_s$
$= 0.00191 \times 28{,}000 \times 10 \times 0.11$
$= 59^{K}$

$\varepsilon_2 = 0.00402 - 0.00122$
$= 0.0028$

$T_2 = 0.0028 \times 28{,}000 \times 2 \times 0.11$
$= 17^{K}$

$\varepsilon_3 = 0.00402 - 0.00033$
$= 0.00369$

$T_3 = 0.00369 \times 28{,}000 \times 2 \times 0.11$
$= 23^{K}$

$\varepsilon_4 = 0.00402 + 0.00055$
$= 0.00457$

$T_4 = 0.00457 \times 28{,}000 \times 2 \times 0.11$
$= 28^{K}$

$\varepsilon_5 = 0.00402 + 0.00144$
$= 0.00546$

$T_5 = 0.00546 \times 28{,}000 \times 2 \times 0.11$
$= 34^{K}$

$\varepsilon_6 = 0.00402 + 0.00233$
$= 0.00635$

$T_6 = 0.00635 \times 28{,}000 \times 2 \times 0.11$
$= 39^{K}$

$\varepsilon_7 = 0.00402 + 0.00322$
$= 0.00724$

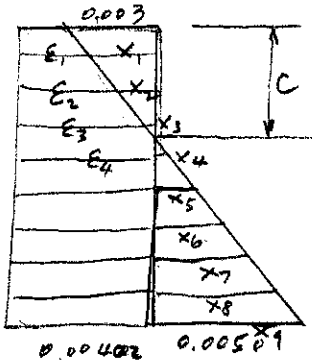
$T_7 = 0.00724 \times 28{,}000 \times 2 \times 0.11$
$= 45^{K}$

$\varepsilon_8 = 0.00402 + 0.00411$
$= 0.00813$

$T_8 = 0.0076 \times 28{,}000 \times 2 \times 0.11$
$= 47^{K}$

$\varepsilon_9 = 0.009$

$T_9 = 0.0076 \times 28{,}000 \times 10 \times 0.11$
$= 234^{K}$



$\frac{c}{0.003} = \frac{18-c}{0.005}$

$0.005c = (18-c)(0.003)$

$0.008c = 18 \times 0.003$

$c = 6.75''$

$\frac{x_1}{0.003} = \frac{6.75-2}{6.75}$

$x_1 = \frac{0.003 \times 4.75}{6.75} = 0.00211$

$x_2 = \frac{0.003 \times 2.75}{6.75} = 0.00122$

$x_3 = \frac{0.003 \times 0.75}{6.75} = 0.00033$

$\frac{x_4}{0.005} = \frac{8-6.75}{10+1.25}$

$x_4 = \frac{0.005(1.25)}{11.25} = 0.00055$

$x_5 = \frac{0.005(3.25)}{11.25} = 0.00144$

$x_6 = \frac{0.005(5.25)}{11.25} = 0.00233$

$x_7 = \frac{0.005(7.25)}{11.25} = 0.00322$

$x_8 = \frac{0.005(9.25)}{11.25} = 0.00411$

$C = 0.8 \times 6.75 \times 20 \times 0.85 \times 4.5 = 413^{K}$

$P_4 = 413 - (59+17+23+28+34+39+45+47+234) = -113$

$M_4 = 413 \times \left(10 - \frac{0.8 \times 6.75}{2}\right) + (T_6 \times 2 + T_7 \times 4 + T_8 \times 6 + T_9 \times 8) - (T_4 \times 2 + T_3 \times 4 + T_2 \times 6 + T_1 \times 8)$

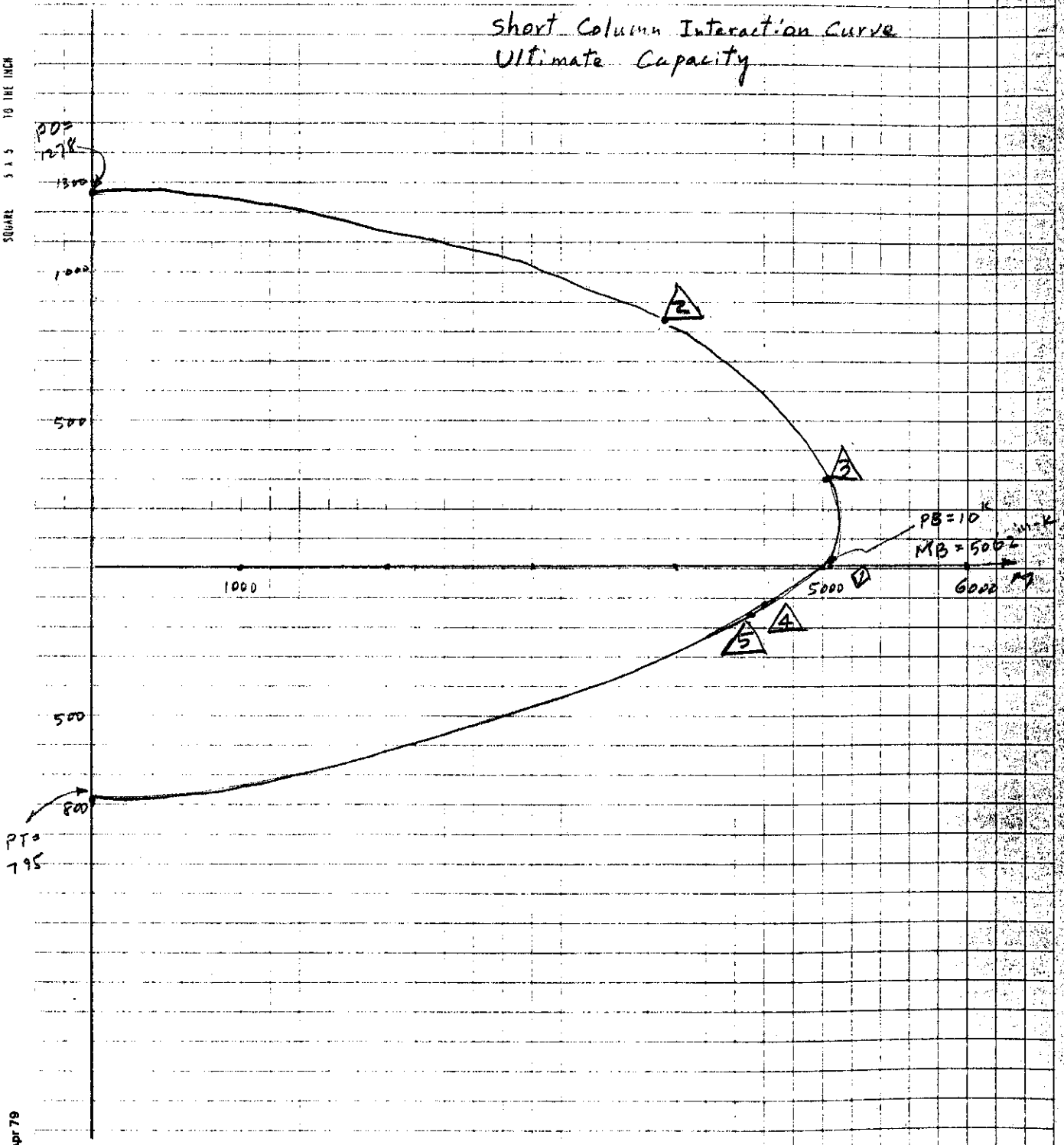
$= 3015 + 2412 - 722 = 4705^{"K}$

COMPUTATION SHEET

Page_____of_____

Subject		Project	
Computed by	Date	Checked by	Date

Short Column Interaction Curve
Ultimate Capacity



SQUARE 5 X 5 10 THE INCH
NANY FORM 229 Apr 79

$AC = 0.2 f_c' A_g = 0.2 \times 4.5 \times 400 = 360^K$

$AT = \frac{1}{2} AC = 180^K$

Final prestress force

~~Design load~~ $= 15.5 \times 0.8 \times 34 \times \cancel{0.11} = 421^K$ (Assume 20% loss)

Final Prestress # $\underline{\underline{FPC}} = \frac{421}{20 \times 20} = 1.05^{ksi}$

Initial prestress force

~~Tension load~~ $= 15.5 \times 34 \times \cancel{0.11} = 527^K$

Initial prestress $= \frac{527}{20 \times 20} = 1.31^{ksi}$

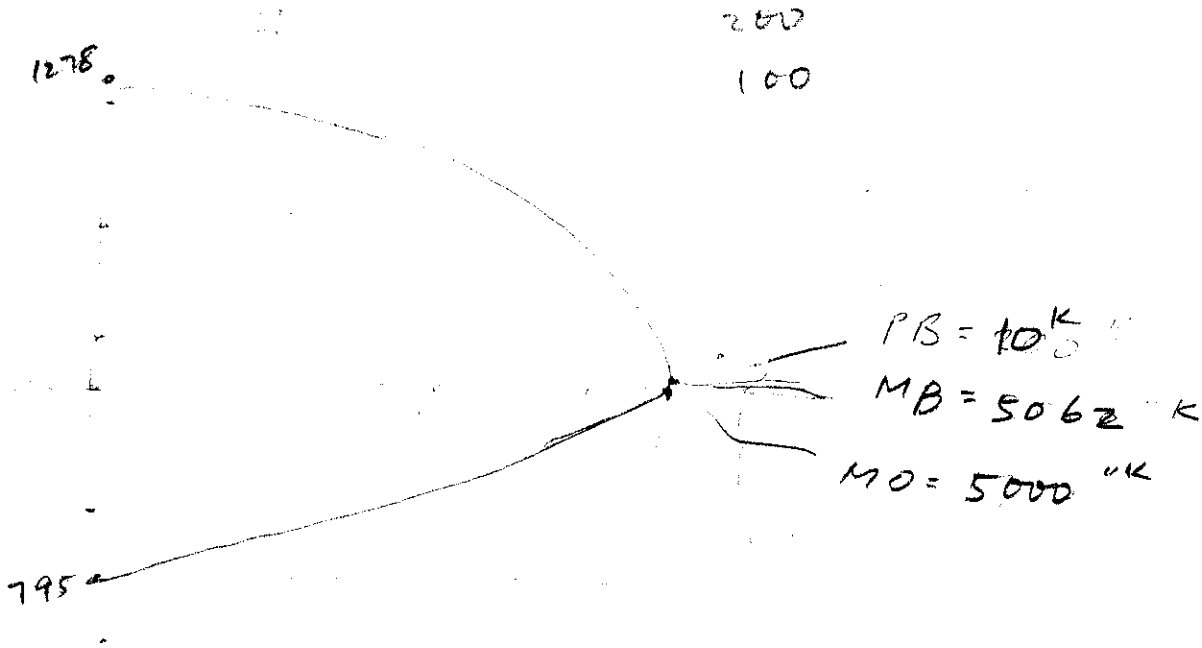
Assume 5% immediate losses due to elastic shortening

$\underline{\underline{IPC}} = 0.95 \times 1.31 = 1.25^{ksi}$

$PO = (0.85 f_c' - 0.6\, FPC) A_c = (0.85 \times 4.5 - 0.6 \times 1.05) \times 400 = 1278^K$

$PT = F_y \cdot A_s = 0.85 \times 250 \times 0.11 \times 34 = 795^K$

stand ultimate strength



FA = allowable comp. stress in concrete

$= 0.4 f_c' = 1.8^{ksi}$

and Computation:

live load/100 psf

Live load = 7 × 46.7 × 1 = 700 K

Z:

pile wt. = $\left(30 \times \frac{30 \times 30}{144} \times 145 \times 9 + 82 \times \frac{9 \times 30}{144} \times 145 \times 2\right)/1000$

= 322 K

Cone slab = 1.33 × 46.7 × 15 × 145/1000 = 135 K

outer Edge Beam: 6.67 × 11 × 15 × 145/1000 = 58 K

interior beam: 7 × 8 × 15 × 145/1000 = 53 K

Terminal edge beam: 3 × 15 × 15 × 145/1000 = 10 K

Pile cap: 3 × 3 × 3.17 × 145/1000 = 42 K

1 + 2 + 6 = 7 K ← use $\boxed{Z = +630^K}$

$\boxed{\text{Total } Z = 1330^K}$

earthing load = 2.9 K

Total berthing load = Y = 2.9 × 15 = +44 K

bollard load = 200 K

Y: bollard load = $-\frac{11 \times 200}{44 \times 15} \times 15$ = 18 K

~~For 50' dredging depth use bollard load instead of berthing load~~

~~since bollard load pulls away from land to sea~~

~~Y = -18 K ← use Y = -20 K~~ use $\boxed{Y = +45^K}$

seismic (use 3/80 of pile weight)

$\left(\frac{3}{80} \times 322 + 135 + 58 + 53 + 10 + 42\right) \times 0.05 = 21$ K

Y = ~~-18~~ 24 + 21 ≈ ~~-40~~ 65 K use Y = $\boxed{+65}$

-) Critical buckling load computation: Refer to "Lateral Load capacity of Piles" M.T. Davisson, Highway Research Record # 333.

Unsupported length $(L_T) = L_u + L_f$

L_u = free standing length = 32'

L_f = depth to fixity = 1.8T

$$T = \sqrt[5]{\frac{E_c I_{cr}}{n_h}} \qquad n_h = 25 \text{ pci}$$

$$= \sqrt[5]{\frac{14,221,867}{0.025}} = (5.6887468E8)^{\frac{1}{5}} = 56.3''$$

$$= 4.69'$$

$$L_f = 1.8 \times 4.69 = 8.45'$$

$$L_T = 32 + 8.45 = 40.45'$$

$$P_{cr} = \frac{\pi^2 E_c I_{cr}}{(K L_T)^2} \qquad K = 1.0$$

$$= \frac{\pi^2 (14,221,867)}{(40.45)^2 (12)^2}$$

$$= 596^K$$

$$E_c I_{cr} = \frac{E_c I_g / 2.5}{1 + Bd}$$

$$E_c I_g = 4000^{ksi} \times 13,333^{in^4} = 53,332,000^{k\,in^2}$$

$$Bd = 0.5$$

$$E_c I_{cr} = \frac{53,332,000/2.5}{1.5} = 14,221,867^{k\,in^2}$$

$$\frac{K L_T}{r} = \frac{40.45 \times 12}{0.3 \times 20} = 81 < 100$$ OK to use moment magnifier method.

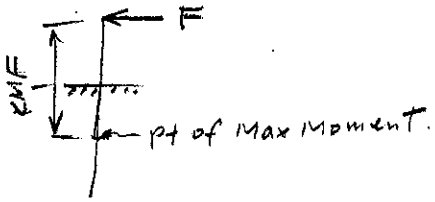
) moment factor for fixed piles. Refer to "Buckling Strength of pile" Nai C. Yang Highway Reserch Record # 147

$(L_u = 32')$

$T = 4.69'$

Free Standing length factor $(m) = L_u/T$

$m = \frac{32}{4.69} = 6.82$ $(H) = 0.3$ (for fixed top)



$M = (KMF) \cdot F = \frac{F \cdot (T)}{H}$

$KMF = \frac{T}{H} = \frac{4.69}{0.3} = 15.6^{ft} = 188''$

$\therefore KMF1 = KMF2 = 188''$

) Critical buckling load computation : for $L_u = 42'$

unsupported length $= (L_T) = L_u + L_f$

$L_u = 42'$ (free standing length)

$L_f = 1.8T$ (depth to fixity)

$$T = \sqrt[5]{\frac{I_c I_{cr}}{n_h}} \qquad n_h = 25 \text{ pci}$$

$$= \sqrt[5]{\frac{14,221,867}{0.025}} = 56.3'' = 4.69'$$

$L_f = 1.8 \times 4.69 = 8.45'$

$L_T = 42 + 8.45 = 50.45'$

$$P_{cr} = \frac{\pi^2 E_c I_{cr}}{(K L_T)^2} = \frac{\pi^2 (14221867)}{(50.45 \times 12)^2}$$

$$= 383^{K}.$$

$$\frac{K L_T}{r} = \frac{50.45 \times 12}{0.3 \times 20} = 100 \simeq 100$$

OK to use moment magnifier method.

1) moment factor for fixed piles (for $L_u = 42'$)

$T = 4.69'$

free standing length factor $(m) = L_u / T = \frac{42}{4.69} = 8.9$

$(H) = 0.28$ (for fixed top)

$M = (KMF) \cdot F = \frac{F(T)}{H}$

$KMF = \frac{T}{H} = \frac{4.69}{0.28} = 16.75' = 201''$

$\therefore KMF1 = KMF2 = 201''$

NH = 0.025 K/in³
Lu = 32'
Actual Allow.

X80CHU4

```
1000 Port Jersey MOTBY BERTH N-1 Dredge Line -35' Pile Cap Displacement

1010 PRO 4000. 13333. 13333. 400. 2 0 ALL
1020 SOI NH .025 L 80. 32. ALL
1030 FIX ALL
1040 DLS S 360. 180. 1278. 795. 10. 5062. 5000. H 20 ALL
1050 ASC S 400. 1333.3 1.05 1.25 1.8 0. ALL
1060 UNS C 0.6 0.6 596. 596. H ALL
1070 FUN 188. 188. ALL
1080 BAT 4. 9 10
1090 ANG 0. 10
1100 180. 9
1110 PIL 1 0. -20.5 0. 2 0. -11.75 0. 3 0. -8.0 0. 4 0. 0. 0.

1120 5 0. 4. 0. 6 0. 8. 0. 7 0. 16. 0. 8 0. 20. 0.
1130 9 4.5 4. 0. 10 -4.5 4. 0.
1140 LOA 1 0. 45. 1330. 0. 0. 0.

1150 loa 2 0. 65. 1330. 0. 0. 0.

1160 FOUT 1 2 3 4 5 6 7 CHU4o

1170 PFO ALL
1180 FPL N
```

```
 ********************************
 * CASE PROGRAM   #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
 * VERSION NUMBER # 1993/03/29   *  RUN DATE 12-SEP-2002   RUN TIME
15.22.28
 ********************************


 PORT JERSEY MOTBY BERTH N-1 DREDGE LINE -35' PILE CAP DISPLACEMENT


 THERE ARE   10 PILES AND
              2 LOAD CASES IN THIS RUN.

 ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX
                                      X          Y          Z
                                    -----      -----      -----
 WITH DIAGONAL COORDINATES = (     -4.50 ,   -20.50 ,      .00 )
                             (      4.50 ,    20.00 ,      .00 )


*************************************************************************
*******

          PILE PROPERTIES AS INPUT


       E           I1           I2           A           C33
B66
      KSI         IN**4        IN**4        IN**2
   .40000E+04   .13333E+05   .13333E+05   .40000E+03   .20000E+01
.00000E+00

 THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          SOIL DESCRIPTIONS AS INPUT


    NH     ESOIL      LENGTH       L            LU
          K/IN**3                  FT           FT
          .25000E-01    L       .80000E+02    .32000E+02

 THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          PILE GEOMETRY AS INPUT AND/OR GENERATED
```

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	.00	-20.50	.00	V	.00	80.00	F
2	.00	-11.75	.00	V	.00	80.00	F
3	.00	-8.00	.00	V	.00	80.00	F
4	.00	.00	.00	V	.00	80.00	F
5	.00	4.00	.00	V	.00	80.00	F
6	.00	8.00	.00	V	.00	80.00	F
7	.00	16.00	.00	V	.00	80.00	F
8	.00	20.00	.00	V	.00	80.00	F
9	4.50	4.00	.00	4.00	.00	80.00	F
10	-4.50	4.00	.00	4.00	.00	80.00	F

						800.00	

****
****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	.0	45.0	1330.0	.0	.0	.0
2	.0	65.0	1330.0	.0	.0	.0

****
****

ORIGINAL PILE GROUP STIFFNESS MATRIX

```
   .32545E+03   .00000E+00   .11183E+04   .53678E+05   .11739E+05
-.14287E+05
   .00000E+00   .45882E+02   .00000E+00  -.11739E+05   .00000E+00
.57287E+03
   .11183E+04   .00000E+00   .23530E+05   .43658E+06  -.57287E+03
-.53678E+05
   .53678E+05  -.11739E+05   .43658E+06   .48007E+09  -.27498E+05
-.27685E+07
   .11739E+05   .00000E+00  -.57287E+03  -.27498E+05   .17150E+08
-.21982E+06
  -.14287E+05   .57287E+03  -.53678E+05  -.27685E+07  -.21982E+06
.16375E+07
```

LOAD CASE 1. NUMBER OF FAILURES = 10. NUMBER OF PILES IN TENSION
= 1.

LOAD CASE 2. NUMBER OF FAILURES = 10. NUMBER OF PILES IN TENSION
= 1.

****
****

PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	RAD
1	-.2511E+00	.9816E+00	.6799E-01	-.1148E-04	.1703E-03	-.3024E-03
2	-.2634E+00	.1423E+01	.6780E-01	-.5668E-06	.1755E-03	-.5508E-03

****
****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO
(F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1	F2	F3	M1	M2	M3	ALF	CBF	ASC	AST
	K	K	K	IN-K	IN-K	IN-K			KSI	KSI
1	-1.3	4.5	168.6	-1164.0	-315.0	.0	.47	2.07	4.49	.36*
		FUNSMOM		-314.7	-72.0			.83	2.41	1.18 #
2	-1.1	4.5	165.7	-1164.0	-277.5	.0	.46	1.95	4.27	.38*
		FUNSMOM		-314.7	-61.9			.79	2.34	1.18 #
3	-1.1	4.5	164.5	-1164.0	-261.4	.0	.46	1.91	4.18	.39*
		FUNSMOM		-314.7	-57.5			.77	2.32	1.18 #
4	-1.0	4.5	161.9	-1164.0	-227.1	.0	.45	1.81	4.00	.41*
		FUNSMOM		-314.7	-48.3			.74	2.27	1.18 #
5	-.9	4.5	160.6	-1164.0	-210.0	.0	.45	1.77	3.92	.42*
		FUNSMOM		-314.7	-43.7			.72	2.24	1.18 #
6	-.8	4.5	159.2	-1164.0	-192.8	.0	.44	1.73	3.84	.43*
		FUNSMOM		-314.7	-39.1			.71	2.22	1.18 #
7	-.7	4.5	156.6	-1164.0	-158.6	.0	.44	1.65	3.69	.45*

```
                    FUNSMOM        -314.7     -29.8                  .68
2.18 1.18
    8      -.6      4.5    155.3   -1164.0    -141.4       .0  .43 1.62
3.62  .46*
                    FUNSMOM        -314.7     -25.2                  .67
2.15 1.18
    9      -.9      4.4     -2.1   -1114.6    -218.3       .0  .01  .64
2.24  .04*
                    FUNSMOM        -295.8     -45.9                  .18
*****  .79
   10      -.9      4.5     40.4   -1153.2    -223.6       .0  .11  .73
2.38  .12*
                    FUNSMOM        -306.2     -47.3                  .25
1.62  .89


 LOAD CASE -     2

 PILE     F1       F2       F3        M1        M2        M3   ALF  CBF
ASC  AST
          K        K        K       IN-K      IN-K      IN-K
KSI  KSI

    1     -1.6      6.5    161.8   -1681.3    -399.5       .0  .45 2.50
5.16 -.11*
                    FUNSMOM        -453.4     -94.4                  .92
2.58 1.04
    2     -1.4      6.5    161.6   -1681.3    -331.2       .0  .45 2.46
5.04 -.06*
                    FUNSMOM        -453.4     -76.0                  .91
2.54 1.06
    3     -1.2      6.5    161.6   -1681.3    -301.9       .0  .45 2.45
4.98 -.03*
                    FUNSMOM        -453.4     -68.1                  .90
2.53 1.06
    4     -1.0      6.5    161.4   -1681.3    -239.5       .0  .45 2.41
4.87  .01*
                    FUNSMOM        -453.4     -51.2                  .89
2.50 1.08
    5      -.9      6.5    161.4   -1681.3    -208.2       .0  .45 2.40
4.81  .04*
                    FUNSMOM        -453.4     -42.8                  .89
2.48 1.08
    6      -.8      6.5    161.3   -1681.3    -177.0       .0  .45 2.39
4.76  .06*
                    FUNSMOM        -453.4     -34.4                  .89
2.47 1.09
    7      -.5      6.5    161.2   -1681.3    -114.6       .0  .45 2.36
4.65  .11*
                    FUNSMOM        -453.4     -17.6                  .88
2.44 1.10
    8      -.4      6.5    161.1   -1681.3     -83.3       .0  .45 2.35
4.59  .13*
                    FUNSMOM        -453.4      -9.1                  .88
2.42 1.11
    9      -.9      6.2     -2.2   -1591.7    -216.6       .0  .01  .90
2.60 -.31*
                    FUNSMOM        -419.0     -45.1                  .24
*****  .70
   10      -.9      6.5     41.6   -1661.9    -222.0       .0  .12 1.00
2.77 -.26*
```

FUNSMOM -438.0 -46.5 .32
1.72 .79

****
****

PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.3	4.5	168.6	-1164.0	-315.0	.0
2	-1.1	4.5	165.7	-1164.0	-277.5	.0
3	-1.1	4.5	164.5	-1164.0	-261.4	.0
4	-1.0	4.5	161.9	-1164.0	-227.1	.0
5	-.9	4.5	160.6	-1164.0	-210.0	.0
6	-.8	4.5	159.2	-1164.0	-192.8	.0
7	-.7	4.5	156.6	-1164.0	-158.6	.0
8	-.6	4.5	155.3	-1164.0	-141.4	.0
9	-1.4	4.4	-1.8	-1081.4	-218.3	270.3
10	8.9	4.5	39.4	-1118.8	-223.6	279.7

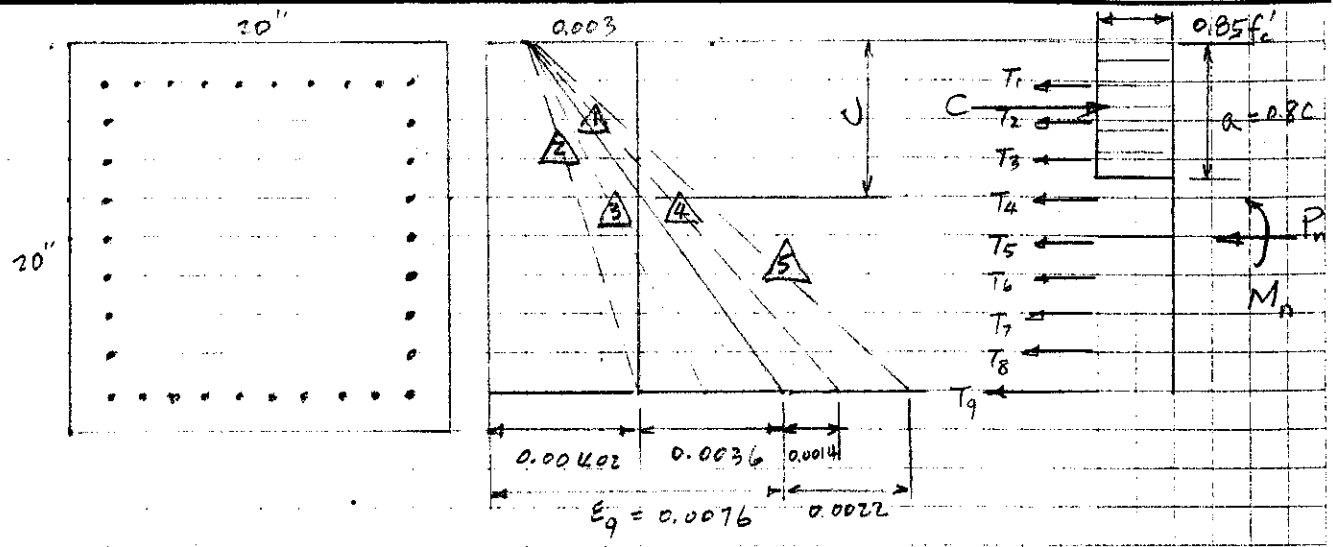
LOAD CASE - 2

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.6	6.5	161.8	-1681.3	-399.5	.0
2	-1.4	6.5	161.6	-1681.3	-331.2	.0
3	-1.2	6.5	161.6	-1681.3	-301.9	.0
4	-1.0	6.5	161.4	-1681.3	-239.5	.0
5	-.9	6.5	161.4	-1681.3	-208.2	.0
6	-.8	6.5	161.3	-1681.3	-177.0	.0
7	-.5	6.5	161.2	-1681.3	-114.6	.0
8	-.4	6.5	161.1	-1681.3	-83.3	.0
9	-1.4	6.2	-1.9	-1544.1	-216.6	386.0
10	9.2	6.5	40.6	-1612.3	-222.0	403.1

COMPUTATION SHEET

Page_____ of_____

Subject Motby Berth N-1		**Project** Port Jersey Channel	
Computed by J. Chu	**Date**	**Checked by** G.J.W.	**Date** 10/31/2003



△	c (in)	ε_1 (T_1) (K)	ε_2 (T_2) (K)	ε_3 (T_3)	ε_4 (T_4)	ε_5 (T_5)	ε_6 (T_6)	ε_7 (T_7)	ε_8 (T_8)	ε_9 (T_9)	c (K)	P_n (K)	M_n (1K)
1	8.18	0.00176 (54)	0.0025 (15)	0.00322 (20)	0.00395 (24)	0.00468 (29)	0.00542 (33)	0.00615 (38)	0.0069 (43)	0.0076 (234)	500	10	5062
2	18	0.00132 (41)	0.00172 (11)	0.00202 (12)	0.00232 (14)	0.00272 (16)	0.00302 (18)	0.00332 (21)	0.00369 (23)	0.00402 (124)	1102	821	3861
3	11.25	0.00155 (48)	0.00209 (13)	0.00262 (16)	0.00312 (19)	0.00369 (23)	0.00422 (26)	0.00475 (29)	0.00532 (33)	0.00582 (179)	689	303	5024
4	6.75	0.00191 (59)	0.0028 (17)	0.00396 (23)	0.00457 (28)	0.00546 (34)	0.00635 (39)	0.00724 (45)	0.00813 (47)	0.009 (234)	413	-113	4705
5	6.13	0.002 (62)	0.003 (19)	0.0039 (24)	0.0049 (30)	0.0059 (36)	0.0069 (42)	0.0078 (47)	0.0088 (47)	0.0098 (234)	375	-166	4491

NAVY FORM 229 Apr 79

-54' deep channel
NH = 0.025 1/n³
Lu = 42'

X80CHU6

```
1000 Port Jersey MOTBY BERTH N-1 Dredge Line -54' Pile Cap Displacement

1010 PRO 4000. 13333. 13333. 400. 2 0 ALL
1020 SOI NH .025 L 80. 42. ALL
1030 FIX ALL
1040 DLS S 360. 180. 1278. 795. 10. 5062. 5000. H 20 ALL
1050 ASC S 400. 1333.3 1.05 1.25 1.8 0. ALL
1060 UNS C 0.6 0.6 383. 383. H ALL
1070 FUN 201. 201. ALL
1080 BAT 4. 9 10
1090 ANG 0. 10
1100 180. 9
1110 PIL 1 0. -20.5 0. 2 0. -11.75 0. 3 0. -8.0 0. 4 0. 0. 0.

1120 5 0. 4. 0. 6 0. 8. 0. 7 0. 16. 0. 8 0. 20. 0.
1130 9 4.5 4. 0. 10 -4.5 4. 0.
1140 LOA 1 0. 45. 1330. 0. 0. 0.

1150 loa 2 0. 65. 1330. 0. 0. 0.

1160 FOUT 1 2 3 4 5 6 7 CHU6o

1170 PFO ALL
1180 FPL N
```

```
*********************************
* CASE PROGRAM    #  X0080        *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
* VERSION NUMBER # 1993/03/29    *  RUN DATE 12-SEP-2002   RUN TIME
15.30.34
*********************************
```

PORT JERSEY MOTBY BERTH N-1 DREDGE LINE -54' PILE CAP DISPLACEMENT

THERE ARE 10 PILES AND
2 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-4.50 ,	-20.50 ,	.00)
(	4.50 ,	20.00 ,	.00)

```
*************************************************************************
*******
```

PILE PROPERTIES AS INPUT

E	I1	I2	A	C33	B66
KSI	IN**4	IN**4	IN**2		
.40000E+04	.13333E+05	.13333E+05	.40000E+03	.20000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

```
*************************************************************************
*******
```

SOIL DESCRIPTIONS AS INPUT

NH	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.25000E-01	L	.80000E+02	.42000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

```
*************************************************************************
*******
```

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	.00	-20.50	.00	V	.00	80.00	F
2	.00	-11.75	.00	V	.00	80.00	F
3	.00	-8.00	.00	V	.00	80.00	F
4	.00	.00	.00	V	.00	80.00	F
5	.00	4.00	.00	V	.00	80.00	F
6	.00	8.00	.00	V	.00	80.00	F
7	.00	16.00	.00	V	.00	80.00	F
8	.00	20.00	.00	V	.00	80.00	F
9	4.50	4.00	.00	4.00	.00	80.00	F
10	-4.50	4.00	.00	4.00	.00	80.00	F

						800.00	

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APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	.0	45.0	1330.0	.0	.0	.0
2	.0	65.0	1330.0	.0	.0	.0

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ORIGINAL PILE GROUP STIFFNESS MATRIX

.28159E+03	.00000E+00	.10274E+04	.49317E+05	.77983E+04
-.12797E+05				
.00000E+00	.24731E+02	.00000E+00	-.77983E+04	.00000E+00
.38054E+03				
.10274E+04	.00000E+00	.21601E+05	.40079E+06	-.38054E+03
-.49317E+05				
.49317E+05	-.77983E+04	.40079E+06	.44031E+09	-.18266E+05
-.25240E+07				
.77983E+04	.00000E+00	-.38054E+03	-.18266E+05	.15330E+08
-.14602E+06				
-.12797E+05	.38054E+03	-.49317E+05	-.25240E+07	-.14602E+06
.11406E+07				

LOAD CASE = 1. NUMBER OF FAILURES = 10. NUMBER OF PILES IN TENSION .

LOAD CASE = 1. NUMBER OF FAILURES = 10. NUMBER OF PILES IN TENSION

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PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	RAD
1	-.3194E+00	.1833E+01	.7467E-01	-.5226E-05	.1552E-03	-.9573E-03
2	-.3465E+00	.2655E+01	.7443E-01	.9412E-05	.1637E-03	-.1514E-02

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PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO (F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1	F2	F3	M1	M2	M3	ALF	CBF	ASC	AST
	K	K	K	IN-K	IN-K	IN-K			KSI	KSI
1	-1.3	4.5	166.0	-1439.48	-383.58	.00	.46	B		
2	-1.0	4.5	164.8	-1439.48	-304.73	.00	.46	B		
3	-.9	4.5	164.3	-1439.48	-270.93	.00	.46	B		
4	-.7	4.5	163.2	-1439.48	-198.84	.00	.45	B		
5	-.6	4.5	162.7	-1439.48	-162.79	.00	.45	B		
6	-.4	4.5	162.1	-1439.48	-126.74	.00	.45	B		
7	-.2	4.5	161.0	-1439.48	-54.65	.00	.45	B		
8	-.1	4.5	160.5	-1439.48	-18.60	.00	.45	B		
9	-.6	4.2	-4.9	-1321.5	-169.0	.0	.03	.75	2.36	-.08*
		FUNSMOM		-472.0	-53.6			.28	*****	.64
10	-.6	4.5	30.6	-1402.6	-172.1	.0	.09	.83	2.51	-.05*
		FUNSMOM		-501.7	-54.8			.33	1.74	.71

LOAD CASE - 2

PILE	F1	F2	F3	M1	M2	M3	ALF	CBF	ASC	AST
	K	K	K	IN-K	IN-K	IN-K			KSI	KSI
1	-1.6	6.6	157.6	-2079.37	-509.45	.00	.44	B		

```
    2     -1.3      6.6    159.8   -2079.37    -384.76       .00   .44    B
    3     -1.1      6.6    160.7   -2079.37    -331.32       .00   .45    B
    4      -.7      6.6    162.7   -2079.37    -217.32       .00   .45    B
    5      -.5      6.6    163.7   -2079.37    -160.32       .00   .45    B
    6      -.4      6.6    164.7   -2079.37    -103.31       .00   .46    B
    7       .0      6.6    166.6   -2079.37      10.69       .00   .46    B
    8       .2      6.6    167.6   -2079.37      67.69       .00   .47    B
    9      -.6      6.1     -5.2    -1893.0     -166.5        .0   .03 1.06
2.78 -.51*
                    FUNSMOM          -673.4      -52.2                    .39
***** .49
   10      -.6      6.5     32.3    -2021.3     -169.8        .0   .09 1.16
2.97 -.51*
                    FUNSMOM          -720.4      -53.5                    .45
1.91  .55
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PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.3	4.5	166.0	-1439.5	-383.6	.0
2	-1.0	4.5	164.8	-1439.5	-304.7	.0
3	-.9	4.5	164.3	-1439.5	-270.9	.0
4	-.7	4.5	163.2	-1439.5	-198.8	.0
5	-.6	4.5	162.7	-1439.5	-162.8	.0
6	-.4	4.5	162.1	-1439.5	-126.7	.0
7	-.2	4.5	161.0	-1439.5	-54.6	.0
8	-.1	4.5	160.5	-1439.5	-18.6	.0
9	-1.7	4.2	-4.6	-1282.1	-169.0	320.5
10	6.9	4.5	29.9	-1360.8	-172.1	340.2

LOAD CASE - 2

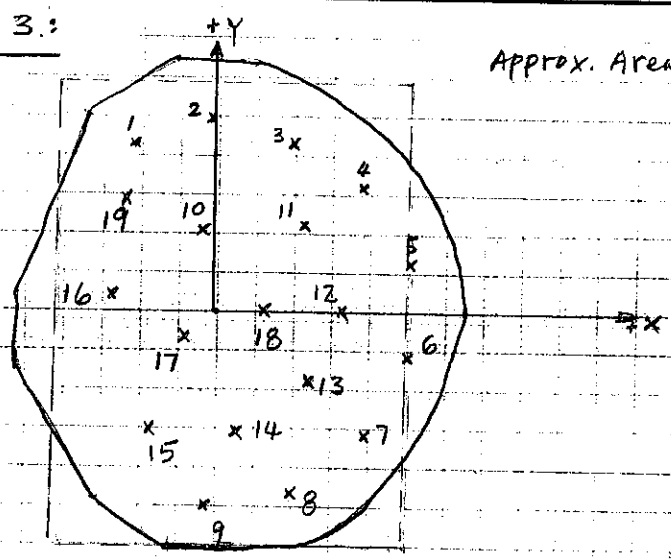
PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.6	6.6	157.6	-2079.4	-509.4	.0
2	-1.3	6.6	159.8	-2079.4	-384.8	.0
3	-1.1	6.6	160.7	-2079.4	-331.3	.0
4	-.7	6.6	162.7	-2079.4	-217.3	.0
5	-.5	6.6	163.7	-2079.4	-160.3	.0
6	-.4	6.6	164.7	-2079.4	-103.3	.0
7	.0	6.6	166.6	-2079.4	10.7	.0
8	.2	6.6	167.6	-2079.4	67.7	.0
9	-1.8	6.1	-4.9	-1836.5	-166.5	459.1
10	7.3	6.5	31.5	-1960.9	-169.8	490.2

EXXON PIER 6

COMPUTATION SHEET			Page 1 of ____
Subject Exxon-Constable Hook Pier #6		Project KVK Channel	
Computed by J. Chu	Date 10-9-2002	Checked by G.J.C.	Date 10/31/2003

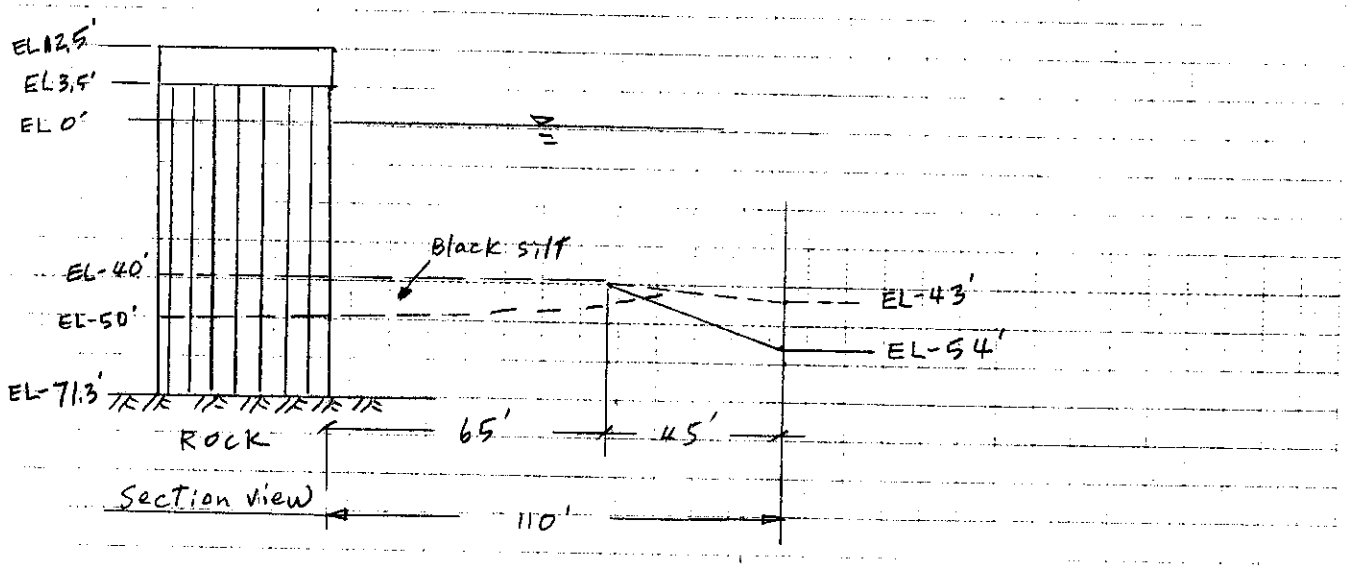
Facility No 3:

Approx. Area: 60×45 = 2700 ft²



Plan View

Pile No.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
X	-10.8	-1.75	10	19.75	25.25	25.25	19.75	10	+1.75	-1.5	11	16.5	11.5	2.5	-8.5	-14	-4.5	6	-12.1
Y	22.8	24.25	22	17	6	-6	-17	-23.5	-25.5	11	10.5	0	-9.5	-15.25	-14.75	2	-3	0	14.7



Section view

* EL-40 to EL-50 is Black silt

Assume no Lateral resistant

Red-brown sand start @ EL-50'

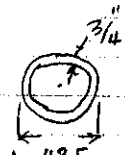
Use $N_H = 0.025$ K/in³

NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 2 of ____
Subject Exxon-Constable Hook Pier #6		Project KVK Channel	
Computed by J. CHU	Date 10-9-2002	Checked by G.J.C.	Date 10/31/2003

Properties (bearing pile)

42" ϕ Steel Pipe Pile w/ 3/4" THK wall



$I = \frac{\pi d_1^4}{64} - \frac{\pi d_2^4}{64}$

$= \frac{\pi(43.5)^4}{64} - \frac{\pi(42)^4}{64}$

$= 175762 - 152745$

$= 23017\ in^4$

$A = \frac{\pi d_1^2}{4} - \frac{\pi d_2^2}{4}$

$= 1486 - 1385$

$= 101\ in^2$

$E = 29{,}000\ ksi$ $\quad NH = 0.025\ k/in^3$

$I1 = 23017\ in^4 = I_2$ $\quad$ fixity = fixed

$S1 = 1058\ in^3 = S2$ $\quad C33 = 1$

$A = 101\ in^2$ $\quad B66 = 0$

$L = 75'$ $\quad L_u = 55'$ (Assume top of sideslope at face of structure)

Allowables:

$AC = 6 \times 101 = 606^K$ (Allow. comp. @ tip (Rock))

$AT = 303^K$

$ACC = F_{ac} A = 18 \times 101$

$= 1818^K$

$ATT = F_{aT} A = 18 \times 101$

$= 1818^K$

$AM1 = F_b \cdot S1 = F_b S2 = AM2$

$= 18 \times 1058 = 19044\ in\text{-}K$

$r = \sqrt{\frac{I}{A}} = \sqrt{\frac{23017}{101}} = 15$

$\frac{Kl}{r} = \frac{(1.0)(55)(12)}{15}$

$= 44$

$F_a = 18\ ksi$

Applied load:

$DL = 150 \times 9 = 1350\ psf$

$LL = 400\ psf$

Total Unif load = 1750 psf

Berthing load = 3000 plf

$V = 1750 \times 2700 = 4725^K$

$H_1 = 3000 \times 10 = 30^K$

Wave force = 2500 plf (Assume)

$H_2 = 2500 \times 60 = 150^K$

Total $H = H_1 + H_2 = 180^K$

Critical Buckling load: $\quad L_u = 55'$

Unsupported length $= L_T = L_u + L_f$

L_f = depth to fixity $= 1.8T$

$T = \sqrt[5]{\frac{EI}{NH}} = \sqrt[5]{\frac{29{,}000 \times 23017}{0.025}} = 121''$

$L_f = 1.8T = 1.8 \times 121 = 219'' = 18'$

$L_T = 55 + 18 = 73'$

$P_{cr} = \frac{\pi^2 EI}{(K L_T)^2} = \frac{\pi^2 (29{,}000)(23017)}{(1.0 \times 73 \times 12)^2} = 8584^K$

NAVY FORM 229 Apr 79

COMPUTATION SHEET			Page 3 of ____
Subject Exxon-Constable Hook Pier #6		Project KVK Channel	
Computed by J. CHU	Date 10-9-2002	Checked by G. J.C	Date 10/31/2003

Moment factors for fixed unsupported Piles:

$T_1 = 10'$ $L_u = 55'$

free standing length factor $(m) = L_u/T_1 = 55/10 = 5.5$

$H_1 = 0.38$ $M = KMF \cdot F = (T_1/H_1) \cdot F$

$KMF1 = T_1/H_1 = 10^{\times 12}/0.38 = 316'' = KMF2$

NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 4 of ____
Subject Exxon-Constable Hook Pier #6		Project KVK Channel	
Computed by J. CHU	Date 10-9-2002	Checked by G.J.C.	Date 10/31/2003

'CPGA' input data. 'Exxon1'

a) Exxon Pier #6 dredge line EL-54' Pile cap displ.

	E	I1	I2	A	C33	B66	List
b) Prop	29000	23017	23017	101	1	0	all

	PSoil	ESoil	Length	L	Lu	List
c) Soil	NH	0.025	L	75	55	all

d) fix all

	Shape	AC	AT	ACC	ATT	AM1	AM2	
g) Allow.	P	606	303	1818	1818	19044	19044	ALL

	MATL	CM1	CM2	PCR1	PCR2	ST	
j) Unsp	S	0.6	0.6	8584	8584	H	ALL

	KMF1U	KMF2U	List
l) FUNSMOM	316	316	all

P) PILE 1 -10.8 22.8 0 2 -1.75 24.25 0 3 10 22 0 4 19.75 17 0 5 25.25 6 0
6 25.25 -6.0. 7 19.75 -17.0. 8 10 -23.5 0 9 -1.75 -25.5 0 10 -1.5 11 0
11 11. 10.5 0 12 16.5 0.0. 13 11.5 -9.5.0 14 2.5 -15.25 0 15 -8.5 -14.75 0

Y) LOAD 1 30 0. 4725 0.0.0. 16 -14 2.0. 17 -4.5 -3.0. 18 6.0.0. 19 -12.1 14.7 0.

bb) FOUT 1 2 3 4 5 6 7 Exxon10

NANY FORM 229 Apr 79

wave + berthing load = 180 K

```
1000 EXXON PIER#6 DREDGE LINE EL.-54' PILE CAP DISPL.
1010 PRO 29000 23017 23017 101 1 0 ALL
1020 SOI NH .025 L 75 55 ALL
1030 FIX ALL
1040 ALL P 606 303 1818 1818 19044 19044 ALL
1050 UNS S .6 .6 8584 8584 H ALL
1060 FUN 316 316 ALL
1070 PIL 1 -10.8 22.8 0. 2 -1.75 24.25 0. 3 10. 22. 0. 4 19.75 17. 0.
1080 5 25.25 6. 0. 6 25.25 -6. 0. 7 19.75 -17. 0. 8 10. -23.5 0.
1090 9 -1.75 -25.5 0. 10 -1.5 11. 0. 11 11. 10.5 0. 12 16.5 0. 0.
1100 13 11.5 -9.5 0. 14 2.5 -15.25 0. 15 -8.5 -14.75 0. 16 -14. 2. 0.
1110 17 -4.5 -3. 0. 18 6. 0. 0. 19 -12.1 14.7 0.
1120 LOA 1 180. 0. 4725. 0. 0. 0.
1130 FOU 1 2 3 4 5 6 7 EXXON1O
1140 PFO ALL
1150 FPL N
```

```
 ********************************
 * CASE PROGRAM    #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
 * VERSION NUMBER # 1993/03/29   *  RUN DATE 15-OCT-2002   RUN TIME
08.20.41
 ********************************


 EXXON PIER#6 DREDGE LINE EL.-54' PILE CAP DISPL.


 THERE ARE   19 PILES AND
              1 LOAD CASES IN THIS RUN.

 ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX
                                        X          Y          Z
                                      -----      -----      -----
 WITH DIAGONAL COORDINATES =  (    -14.00 ,   -25.50 ,      .00 )
                              (     25.25 ,    24.25 ,      .00 )


*************************************************************************
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          PILE PROPERTIES AS INPUT


       E            I1            I2            A            C33
B66
      KSI          IN**4         IN**4         IN**2
   .29000E+05   .23017E+05   .23017E+05   .10100E+03   .10000E+01
.00000E+00

 THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          SOIL DESCRIPTIONS AS INPUT


    NH      ESOIL       LENGTH        L            LU
           K/IN**3                   FT           FT
           .25000E-01     L       .75000E+02   .55000E+02

 THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

     ALL


*************************************************************************
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          PILE GEOMETRY AS INPUT AND/OR GENERATED
```

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	-10.80	22.80	.00	V	.00	75.00	F
2	-1.75	24.25	.00	V	.00	75.00	F
3	10.00	22.00	.00	V	.00	75.00	F
4	19.75	17.00	.00	V	.00	75.00	F
5	25.25	6.00	.00	V	.00	75.00	F
6	25.25	-6.00	.00	V	.00	75.00	F
7	19.75	-17.00	.00	V	.00	75.00	F
8	10.00	-23.50	.00	V	.00	75.00	F
9	-1.75	-25.50	.00	V	.00	75.00	F
10	-1.50	11.00	.00	V	.00	75.00	F
11	11.00	10.50	.00	V	.00	75.00	F
12	16.50	.00	.00	V	.00	75.00	F
13	11.50	-9.50	.00	V	.00	75.00	F
14	2.50	-15.25	.00	V	.00	75.00	F
15	-8.50	-14.75	.00	V	.00	75.00	F
16	-14.00	2.00	.00	V	.00	75.00	F
17	-4.50	-3.00	.00	V	.00	75.00	F
18	6.00	.00	.00	V	.00	75.00	F
19	-12.10	14.70	.00	V	.00	75.00	F

						1425.00	

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APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	180.0	.0	4725.0	.0	.0	.0

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ORIGINAL PILE GROUP STIFFNESS MATRIX

.22120E+03	.00000E+00	.00000E+00	.00000E+00	.96966E+05
-.22003E+04				
.00000E+00	.22120E+03	.00000E+00	-.96966E+05	.00000E+00
.14334E+05				
.00000E+00	.00000E+00	.61834E+05	.61509E+06	-.40069E+07
.00000E+00				
.00000E+00	-.96966E+05	.61509E+06	.21402E+10	.17547E+09
-.62834E+07				
.96966E+05	.00000E+00	-.40069E+07	.17547E+09	.16424E+10
-.96456E+06				
-.22003E+04	.14334E+05	.00000E+00	-.62834E+07	-.96456E+06
.13123E+08				

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION
= 0.

****
****

PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	RAD
1	.7380E+00	-.2733E-01	.8823E-01	-.4060E-04	.1761E-03	.1471E-03

****
****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO
(F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	9.0	-.3	325.3	114.9	4089.6	.0	.54	.40
		FUNSMOM		9.7	1238.6			.24
2	9.0	-.1	260.7	33.4	4076.5	.0	.43	.36
		FUNSMOM		-13.0	1234.9			.21
3	9.0	.1	183.5	-72.5	4096.8	.0	.30	.32
		FUNSMOM		-42.6	1240.6			.17
4	9.1	.3	124.4	-160.3	4141.8	.0	.21	.29
		FUNSMOM		-67.1	1253.2			.14
5	9.4	.4	104.0	-209.8	4240.9	.0	.17	.29
		FUNSMOM		-80.9	1280.8			.13
6	9.6	.4	123.0	-209.8	4349.0	.0	.20	.31
		FUNSMOM		-80.9	1311.0			.14
7	9.8	.3	178.3	-160.3	4448.1	.0	.29	.34
		FUNSMOM		-67.1	1338.7			.17
8	10.0	.1	255.6	-72.5	4506.7	.0	.42	.38
		FUNSMOM		-42.6	1355.0			.21
9	10.0	-.1	339.6	33.4	4524.7	.0	.56	.43
		FUNSMOM		-13.0	1360.0			.26
10	9.3	-.1	280.0	31.1	4195.9	.0	.46	.38
		FUNSMOM		-13.7	1268.3			.22
11	9.3	.1	194.8	-81.5	4200.4	.0	.32	.33
		FUNSMOM		-45.1	1269.5			.18
12	9.5	.2	173.7	-131.0	4295.0	.0	.29	.33
		FUNSMOM		-58.9	1295.9			.17
13	9.7	.1	223.1	-86.0	4380.6	.0	.37	.36

		FUNSMOM		-46.4	1319.8			.19
14	9.8	-.1	294.1	-4.9	4432.4	.0	.49	.39
		FUNSMOM		-23.7	1334.3			.23
15	9.8	-.3	369.0	94.2	4427.9	.0	.61	.44
		FUNSMOM		3.9	1333.0			.27
16	9.4	-.4	380.2	143.7	4277.0	.0	.63	.44
		FUNSMOM		17.8	1290.9			.28
17	9.6	-.2	322.8	58.2	4322.0	.0	.53	.41
		FUNSMOM		-6.1	1303.5			.25
18	9.5	.0	245.9	-36.4	4295.0	.0	.41	.36
		FUNSMOM		-32.5	1295.9			.20
19	9.2	-.4	347.0	126.6	4162.6	.0	.57	.42
		FUNSMOM		13.0	1258.9			.26

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PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	9.0	-.3	325.3	114.9	4089.6	.0
2	9.0	-.1	260.7	33.4	4076.5	.0
3	9.0	.1	183.5	-72.5	4096.8	.0
4	9.1	.3	124.4	-160.3	4141.8	.0
5	9.4	.4	104.0	-209.8	4240.9	.0
6	9.6	.4	123.0	-209.8	4349.0	.0
7	9.8	.3	178.3	-160.3	4448.1	.0
8	10.0	.1	255.6	-72.5	4506.7	.0
9	10.0	-.1	339.6	33.4	4524.7	.0
10	9.3	-.1	280.0	31.1	4195.9	.0
11	9.3	.1	194.8	-81.5	4200.4	.0
12	9.5	.2	173.7	-131.0	4295.0	.0
13	9.7	.1	223.1	-86.0	4380.6	.0
14	9.8	-.1	294.1	-4.9	4432.4	.0
15	9.8	-.3	369.0	94.2	4427.9	.0
16	9.4	-.4	380.2	143.7	4277.0	.0
17	9.6	-.2	322.8	58.2	4322.0	.0
18	9.5	.0	245.9	-36.4	4295.0	.0
19	9.2	-.4	347.0	126.6	4162.6	.0

STANDARD TANK

COMPUTATION SHEET			Page 1 of ____
Subject Standard tank cleaning co Pier		Project KVK channel	
Computed by J. Chu	Date 9-13-2002	Checked by G.J.C.	Date 10/31/2002

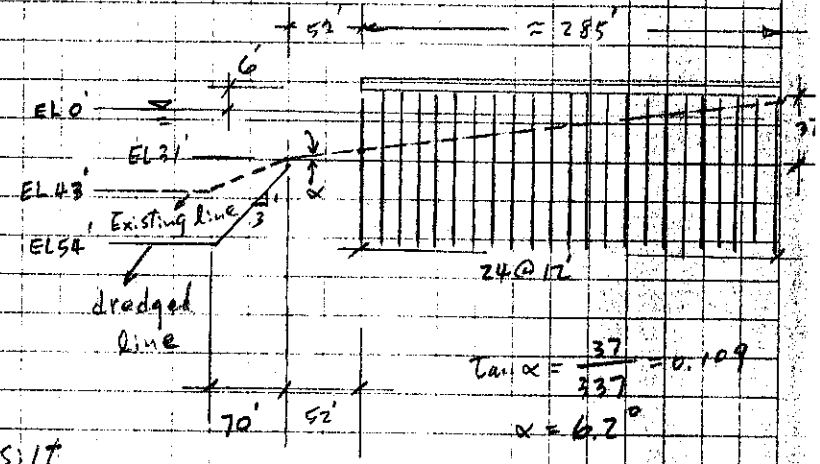
Facility No. 6: Standard Tank Cleaning Co. Pier

for purpose of easy analysis, use Half pier length (12 piles)

Average pile unsupported length $= (37-6)/2 = 15.5'$

from boring log KVK 98-11, top 15' of soil is black silt

use $NH = 5$ pci $= 0.005\ K/in^3$



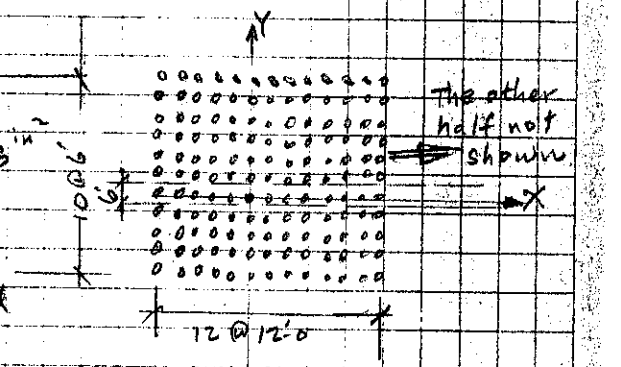
$\tan\alpha = \frac{37}{337} = 0.109$

$\alpha = 6.2°$

Section View

Assume All wood piles are 40' long.

12" Φ $\left(I = \frac{\pi d^4}{64} = \frac{\pi(12)^4}{64} = 1018\ in^4\right.$ $A = \frac{\pi(12)^2}{4} = 113\ in^2$



Plan View

properties:

$E = 1500\ ksi$ (1.5 E6 psi) fixity = fixed

$I1 = 1018\ in^4$ $C33 = 2.0$

$I2 = 1018\ in^4$ $B66 = 0$

$A = 113\ in^2$ $Lu = 15.5\ ft$

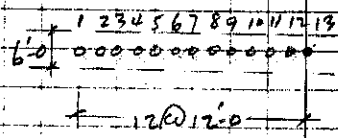
$L = 40\ ft$

$NH = 0.005\ K/in^3$

Applied load:

Vertical: 400 psf

Lateral: 3000 plf



$AC = 50^K$

$AT = 25^K$

$F_{ac} = 1000\ psi$

$ACC = F_{ac} \cdot A = 1.0 \times 113 = 113^K$

$ATT = F_{at} \cdot A = 2.0 \times 113 = 226^K$

Total $F_z = 6 \times 144 \times 400\ psf$
$= 346$ Kips.

$AM1 = F_b S1$ $S1 = \frac{I1}{c} = \frac{1018}{6} = 170\ in^3$

$= 2^{ksi} \times 170 = 340^{k\text{-}''}$
$= AM2$

$F_x = 3000 \times 6/2$
$= 9$ Kips.

NAVY FORM 229 Apr 79

COMPUTATION SHEET			Page 2 of ____
Subject Standard tank Cleaning co. Pier		Project KUK Channel	
Computed by J. CHU	Date 9-13-2002	Checked by G.J.C.	Date 10/31/2003

'CPGA' Input data calculation:

Critical buckling load computations (for dredge line EL. -49')

Unsupported length $L_T = L_u + L_f$ $L_u = 15.5'$

L_u = free standing length = 15.5

L_f = depth to fixity = 1.8T

$$T = 5\sqrt{\frac{EI}{NH}} = 5\sqrt{\frac{1500 \times 1018}{0.005}} = 50''$$

$= 4.2$ ft

$L_f = 1.8 \times 4.2 = 7.5$ ft $L_T = 15.5 + 7.5 = 23'$

$$P_{cr} = \frac{\pi^2 EI}{(KL_T)^2} \quad K = 1.0$$

$$= \frac{\pi^2 (1500 \times 1018)}{(1.0 \times 23 \times 12)^2} = 198^K$$

$$\frac{KL_T}{r} = \frac{(1.0)(23) \times 12}{\sqrt{1018/113}} = 92 < 100$$ OK to use moment magnifier method

Moment factors for fixed unsupported piles: $L_u = 15.5'$

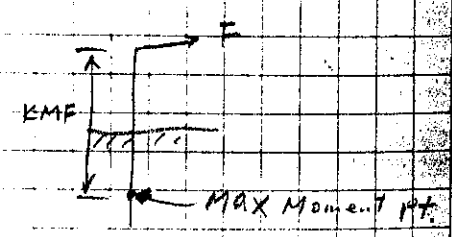
$T = 4.2'$

Free standing length factor $(m) = L_u/T$

$m = 15.5/4.2 = 3.7$ $(H) = 0.57$ (for fixed cap)

$M = (KMF) \cdot F = F\frac{T}{H}$

$KMF = \frac{T}{H} = \frac{4.2}{0.57} = 7.36' = 88''$



NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 3 of ____
Subject Standard tank cleaning Co. Pier		Project KVK Channel	
Computed by J. CHU	Date 9-13-2002	Checked by G.J.C.	Date 10/31/2003

'CPGA' program input data "STDTANK1"

a) st'd tank cleaning Co. Pier Dredge Line -43' Pile cap displ.

	E	I1	I2	A	C33	B66	LIST
b) Prop	1500	1018	1018	113	2	0	All

	PSoil	ESoil	Length	L	Lu	LIST
c) Soil	NH	0.005	L	40	15.5	All

d) FIX All

	Shape	AC	AI	ACC	ATT	AM1	AM2
g) Allow	R	50	25	113	226	340	340

	MATL	CM1	CM2	PCR1	PCR2	ST	
j) unsp	T	0.6	0.6	198	198	H	ALL

	KMF1U	KMF2U	LIST
l) FUNSMOM	88	88	ALL

P) PILE 1 -72 0.0. 2 -60. 0.0. 3 -48. 0. 0. 4 -36. 0.0. 5 -24. 0.0.
6 -12. 0.0. 7 0. 0.0. 8 12. 0.0. 9 24. 0.0. 10 36. 0.0. 11 48. 0.0.
12 60. 0.0. 13 72. 0.0.

y) LOAD 1 9. 0. 346. 0. 0. 0.

bb) FOUT 1 2 3 4 5 6 7 STDTANK10

ee) PFO ALL

gg) FPL N

For dredge line El -54' $L_u = 15.5 + \frac{54-43}{2} = \boxed{21'}$ (worst case)

critical buckling load:

$L_T = L_u + L_f$ $L_f = 1.8T$ $T = 4.2^{ft}$ $L_f = 7.5^{ft}$

$L_T = 21 + 7.5 = 28.5'$

$P_{cr} = \frac{\pi^2 EI}{(KL_T)^2} = \frac{\pi^2(1500 \times 1018)}{(1.0 \times 28.5 \times 12)^2} = \boxed{129^K}$ $\frac{KL_T}{r} = \frac{(0.8)(28.5)(12)}{\sqrt{1018/113}} = 92$

Moment factor for fixed unsup. piles: $L_u = 21'$

Free standing length factor $(n_1) = L_u/T = 21/4.2 = 5$

$H = 0.42$ (for fixed cap) $KMF = T/H = 4.2/0.42 = 10' = \boxed{120''}$

SQUARE 5 X 5 TO THE INCH
NAVY FORM 229 Apr 79

```
1000 ST'D TANK CLEANING CO. PIER, EXISTING DREDGE LINE EL. -43' PILE CAP DIS
1010 PRO 1500. 1018. 1018. 113 2 0 ALL
1020 SOI NH .005 L 40. 15.5 ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL
1050 UNS T .6 .6 198. 198. H ALL
1060 FUN 88. 88. ALL
1070 PIL 1 -72. 0. 0. 2 -60. 0. 0. 3 -48. 0. 0. 4 -36. 0. 0. 5 -24. 0. 0.
1080 6 -12. 0. 0. 7 0. 0. 0. 8 12. 0. 0. 9 24. 0. 0. 10 36. 0. 0.
1090 11 48. 0. 0. 12 60. 0. 0. 13 72. 0. 0.
1100 LOA 1 9. 0. 346. 0. 0. 0.
1110 FOU 1 2 3 4 5 6 7 TANK1O
1120 PFO ALL
1130 FPL N
```

```
 ********************************
 * CASE PROGRAM    #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
 * VERSION NUMBER # 1993/03/29    *  RUN DATE 16-SEP-2002   RUN TIME
11.18.59
 ********************************


 ST'D TANK CLEANING CO. PIER, EXISTING DREDGE LINE EL. -43' PILE CAP DIS


 THERE ARE   13 PILES AND
              1 LOAD CASES IN THIS RUN.

 ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX
                                        X          Y          Z
                                      -----      -----      -----
 WITH DIAGONAL COORDINATES = (     -72.00 ,       .00 ,      .00 )
                             (      72.00 ,       .00 ,      .00 )


*************************************************************************
*******

          PILE PROPERTIES AS INPUT


       E            I1            I2            A            C33
B66
      KSI          IN**4         IN**4         IN**2
   .15000E+04   .10180E+04   .10180E+04   .11300E+03   .20000E+01
.00000E+00

 THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          SOIL DESCRIPTIONS AS INPUT


    NH      ESOIL       LENGTH        L            LU
           K/IN**3                   FT           FT
           .50000E-02    L        .40000E+02    .15500E+02

 THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

     ALL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*******

          PILE GEOMETRY AS INPUT AND/OR GENERATED
```

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	-72.00	.00	.00	V	.00	40.00	F
2	-60.00	.00	.00	V	.00	40.00	F
3	-48.00	.00	.00	V	.00	40.00	F
4	-36.00	.00	.00	V	.00	40.00	F
5	-24.00	.00	.00	V	.00	40.00	F
6	-12.00	.00	.00	V	.00	40.00	F
7	.00	.00	.00	V	.00	40.00	F
8	12.00	.00	.00	V	.00	40.00	F
9	24.00	.00	.00	V	.00	40.00	F
10	36.00	.00	.00	V	.00	40.00	F
11	48.00	.00	.00	V	.00	40.00	F
12	60.00	.00	.00	V	.00	40.00	F
13	72.00	.00	.00	V	.00	40.00	F

						520.00	

****
****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	9.0	.0	346.0	.0	.0	.0

****
****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.11002E+02 .00000E+00 .00000E+00 .00000E+00 .15130E+04
.00000E+00
.00000E+00 .11002E+02 .00000E+00 -.15130E+04 .00000E+00
.11369E-12
.00000E+00 .00000E+00 .66171E+04 .00000E+00 .58208E-10
.00000E+00
.00000E+00 -.15130E+04 .00000E+00 .28068E+06 .00000E+00
-.29104E-10
.15130E+04 .00000E+00 .58208E-10 .00000E+00 .19213E+10
.00000E+00
.00000E+00 .11369E-12 .00000E+00 .14552E-10 .00000E+00
.31940E+07

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION
= 0.

****
****

PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	RAD
1	.8181E+00	.0000E+00	.5229E-01	.0000E+00	-.6442E-06	.0000E+00

****
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PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO
(F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.7	.0	26.3	.0	95.2	.0	.53	.70
		FUNSMOM		.0	34.3			.40
2	.7	.0	26.4	.0	95.2	.0	.53	.70
		FUNSMOM		.0	34.3			.40
3	.7	.0	26.4	.0	95.2	.0	.53	.70
		FUNSMOM		.0	34.3			.40
4	.7	.0	26.5	.0	95.2	.0	.53	.70
		FUNSMOM		.0	34.3			.40
5	.7	.0	26.5	.0	95.2	.0	.53	.71
		FUNSMOM		.0	34.3			.40
6	.7	.0	26.6	.0	95.2	.0	.53	.71
		FUNSMOM		.0	34.3			.41
7	.7	.0	26.6	.0	95.2	.0	.53	.71
		FUNSMOM		.0	34.3			.41
8	.7	.0	26.7	.0	95.2	.0	.53	.71
		FUNSMOM		.0	34.3			.41
9	.7	.0	26.7	.0	95.2	.0	.53	.71
		FUNSMOM		.0	34.3			.41
10	.7	.0	26.8	.0	95.2	.0	.54	.71
		FUNSMOM		.0	34.3			.41
11	.7	.0	26.8	.0	95.2	.0	.54	.72
		FUNSMOM		.0	34.3			.41
12	.7	.0	26.9	.0	95.2	.0	.54	.72
		FUNSMOM		.0	34.3			.41
13	.7	.0	26.9	.0	95.2	.0	.54	.72
		FUNSMOM		.0	34.3			.41

****
****

PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.7	.0	26.3	.0	95.2	.0
2	.7	.0	26.4	.0	95.2	.0
3	.7	.0	26.4	.0	95.2	.0
4	.7	.0	26.5	.0	95.2	.0
5	.7	.0	26.5	.0	95.2	.0
6	.7	.0	26.6	.0	95.2	.0
7	.7	.0	26.6	.0	95.2	.0
8	.7	.0	26.7	.0	95.2	.0
9	.7	.0	26.7	.0	95.2	.0
10	.7	.0	26.8	.0	95.2	.0
11	.7	.0	26.8	.0	95.2	.0
12	.7	.0	26.9	.0	95.2	.0
13	.7	.0	26.9	.0	95.2	.0

STDTANK2

```
1000 ST'D TANK CLEANING CO. PIER, EXISTING DREDGE LINE EL. -54' PILE CAP DISP.
1010 PRO 1500. 1018. 1018. 113 2 0 ALL
1020 SOI NH .005 L 40. 21. ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL
1050 UNS T .6 .6 129. 129. H ALL
1060 FUN 120. 120. ALL
1070 PIL 1 -72. 0. 0. 2 -60. 0. 0. 3 -48. 0. 0. 4 -36. 0. 0. 5 -24. 0. 0.
1080 6 -12. 0. 0. 7 0. 0. 0. 8 12. 0. 0. 9 24. 0. 0. 10 36. 0. 0.
1090 11 48. 0. 0. 12 60. 0. 0. 13 72. 0. 0.
1100 LOA 1 9. 0. 346. 0. 0. 0.
1110 FOU 1 2 3 4 5 6 7 TANK2O
1120 PFO ALL
1130 FPL N
```

```
 ********************************
 * CASE PROGRAM    #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
 * VERSION NUMBER # 1993/03/29    *  RUN DATE 16-SEP-2002   RUN TIME
11.45.51
 ********************************


 ST'D TANK CLEANING CO. PIER, EXISTING DREDGE LINE EL. -54' PILE CAP
DISP.


 THERE ARE   13 PILES AND
              1 LOAD CASES IN THIS RUN.

 ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX
                                        X          Y          Z
                                     -----      -----      -----
 WITH DIAGONAL COORDINATES = (     -72.00 ,       .00 ,      .00 )
                             (      72.00 ,       .00 ,      .00 )


*************************************************************************
*******

          PILE PROPERTIES AS INPUT


       E            I1            I2            A            C33
B66
      KSI          IN**4         IN**4         IN**2
   .15000E+04   .10180E+04   .10180E+04   .11300E+03   .20000E+01
.00000E+00

 THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          SOIL DESCRIPTIONS AS INPUT


    NH      ESOIL       LENGTH        L            LU
           K/IN**3                   FT           FT
           .50000E-02    L        .40000E+02   .21000E+02

 THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          PILE GEOMETRY AS INPUT AND/OR GENERATED
```

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	-72.00	.00	.00	V	.00	40.00	F
2	-60.00	.00	.00	V	.00	40.00	F
3	-48.00	.00	.00	V	.00	40.00	F
4	-36.00	.00	.00	V	.00	40.00	F
5	-24.00	.00	.00	V	.00	40.00	F
6	-12.00	.00	.00	V	.00	40.00	F
7	.00	.00	.00	V	.00	40.00	F
8	12.00	.00	.00	V	.00	40.00	F
9	24.00	.00	.00	V	.00	40.00	F
10	36.00	.00	.00	V	.00	40.00	F
11	48.00	.00	.00	V	.00	40.00	F
12	60.00	.00	.00	V	.00	40.00	F
13	72.00	.00	.00	V	.00	40.00	F

						520.00	

****
****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	9.0	.0	346.0	.0	.0	.0

****
****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.58836E+01 .00000E+00 .00000E+00 .00000E+00 .10023E+04
.00000E+00
.00000E+00 .58836E+01 .00000E+00 -.10023E+04 .00000E+00
.00000E+00
.00000E+00 .00000E+00 .60205E+04 .00000E+00 -.11642E-09
.00000E+00
.00000E+00 -.10023E+04 .00000E+00 .22924E+06 .00000E+00
.14552E-10
.10023E+04 .00000E+00 -.11642E-09 .00000E+00 .17480E+10
.00000E+00
.00000E+00 .00000E+00 .00000E+00 .14552E-10 .00000E+00
.17080E+07

LOAD CASE 1. NUMBER OF FAILURES = 13. NUMBER OF PILES IN TENSION
= 0.

****
****

if consider full pier length,

$D_x = 1.53/2 = 0.75''$

PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	RAD
1	.1530E+01	.0000E+00	.5747E-01	.0000E+00	-.8772E-06	.0000E+00

****
****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO (F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.7	.0	26.3	.0	117.9	.0	.53	9.39
*		FUNSMOM		.0	34.9			2.94
2	.7	.0	26.3	.0	117.9	.0	.53	10.36
*		FUNSMOM		.0	34.9			3.23
3	.7	.0	26.4	.0	117.9	.0	.53	11.56
*		FUNSMOM		.0	34.9			3.58
4	.7	.0	26.4	.0	117.9	.0	.53	13.09
*		FUNSMOM		.0	34.9			4.03
5	.7	.0	26.5	.0	117.9	.0	.53	15.09
*		FUNSMOM		.0	34.9			4.62
6	.7	.0	26.6	.0	117.9	.0	.53	17.82
*		FUNSMOM		.0	34.9			5.43
7	.7	.0	26.6	.0	117.9	.0	.53	21.78
*		FUNSMOM		.0	34.9			6.60
8	.7	.0	26.7	.0	117.9	.0	.53	28.05
*		FUNSMOM		.0	34.9			8.46
9	.7	.0	26.7	.0	117.9	.0	.53	39.45
*		FUNSMOM		.0	34.9			11.83
10	.7	.0	26.8	.0	117.9	.0	.54	66.73
*		FUNSMOM		.0	34.9			19.89

```
   11       .7       .0     26.8        .0      117.9        .0  .54*****
*
                   FUNSMOM            .0       34.9                 64.75
   12       .7       .0     26.9       .00     117.93       .00  .54    B
   13       .7       .0     27.0       .00     117.93       .00  .54    B


*************************************************************************
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```

PILE FORCES IN GLOBAL GEOMETRY

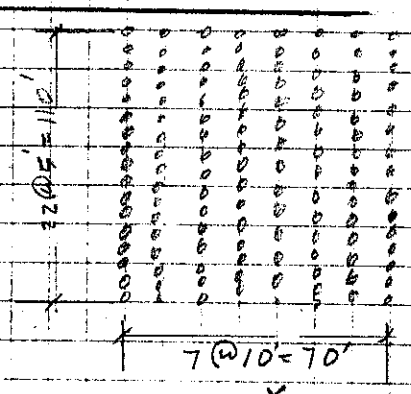
LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.7	.0	26.3	.0	117.9	.0
2	.7	.0	26.3	.0	117.9	.0
3	.7	.0	26.4	.0	117.9	.0
4	.7	.0	26.4	.0	117.9	.0
5	.7	.0	26.5	.0	117.9	.0
6	.7	.0	26.6	.0	117.9	.0
7	.7	.0	26.6	.0	117.9	.0
8	.7	.0	26.7	.0	117.9	.0
9	.7	.0	26.7	.0	117.9	.0
10	.7	.0	26.8	.0	117.9	.0
11	.7	.0	26.8	.0	117.9	.0
12	.7	.0	26.9	.0	117.9	.0
13	.7	.0	27.0	.0	117.9	.0

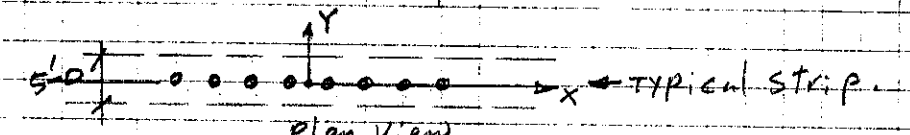
TEXACO PIERS

COMPUTATION SHEET			Page 1 of
Subject Texaco Pier 35		Project Newark Bay	
Computed by J. Chu	Date 9-17-2002	Checked by G.J.C.	Date 10/28/2002

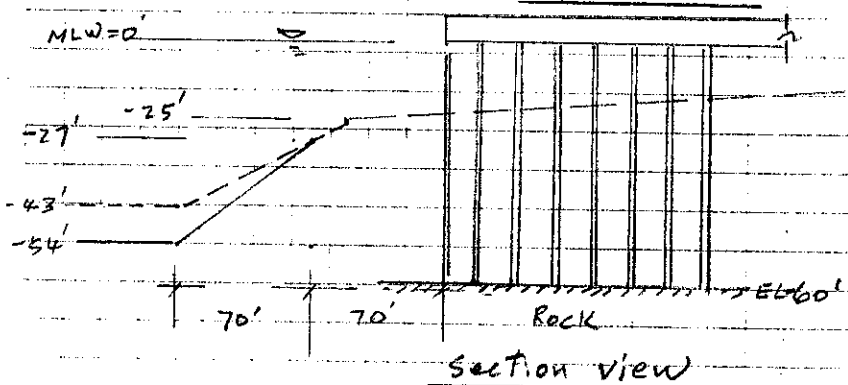
Facility No.7: Texaco Pier #35



Repeat 10 Times



Plan View



Section View

Assume 12"φ steel Pile 60' long. bearing on Rock bed.

Load: 1000 psf Vertical
3000 plf Horizontal

Applied load on first 8 piles:

Vertical $V = 1000 \times 70 \times 5 = 350^K$

Horizontal $H = 3000 \times 5 = 15^K$

Properties - 12"φ Extra Strong Pipe

$E = 29{,}000^{ksi}$ fixity = fixed

$I1 = 362^{in^4}$ C33 = 1

$I2 = 362^{in^4}$ B66 = 0

$A = 192^{in^2}$ $Lu = 25^{ft}$

$L = 60^{ft}$ $NH = 0.010\ kip/in^3$

SQUARE 5 X 5 TO THE INCH
NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 2 of
Subject Texaco Pier 35		Project Newark Bay	
Computed by J. CHU	Date 9-17-2002	Checked by G. J.C.	Date 10/29/2003

Allowables:

Allow comp. of steel pipe tip

$AC = 80^K < 10 \times 19.2 = 192^K$

$AT = 40^K$

$\frac{Kl}{r} = \frac{(1.0)(35)12}{4.33} = 97 \quad F_a = 13^{ksi}$

$ACC = F_{ac} \cdot A = 13 \times 19.2 = \boxed{250^K}$

$ATT = F_{at} \cdot A = 18 \times 19.2 = \boxed{346^K}$

$AM1 = F_b \cdot S1 = 18 \times \frac{362}{6} = \boxed{1086^{\prime\prime-K}}$

$= AM2$

Critical buckling load: for dredge line = 43'

$L_u = 25\,ft$

Unsupported length $L_T = L_u + L_f$

L_f = depth to fixity = 1.8T

$T = \sqrt[5]{\frac{EI}{NH}} = \sqrt[5]{\frac{29{,}000 \times 362}{0.010}} = 63.7'' = 5.3'$

$L_f = 1.8 \times 5.3 = 9.5' \qquad L_T = 25 + 9.5 = 34.5'$

$P_{cr} = \frac{\pi^2 EI}{(KL_T)^2} = \frac{\pi^2(29{,}000 \times 362)}{(1.0 \times 34.5 \times 12)^2} = \boxed{604^K} \qquad K = 1.0$

$\frac{Kl}{r} = \frac{(1.0)(35)(12)}{4.33} = 97 < 100$ OK to use moment magnifier method.

for dredge line = 54'

$L_u = 25 + 11/2 = 30.5'$

$L_T = L_u + L_f = 30.5 + 9.5 = 40'$

$P_{cr} = \frac{\pi^2(29{,}000)(362)}{(1.0)(40 \times 12)^2} = \boxed{450^K}$

SQUARE 5 X 5 TO THE INCH
NANY FORM 229 Apr 79

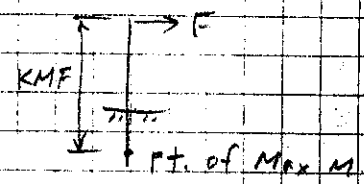
COMPUTATION SHEET			Page 3 of ____
Subject Texaco Pier 35		Project Newark Bay	
Computed by J. CHU	Date 9-17-2002	Checked by G.J.C.	Date 10/28/2003

Moment factors for fixed unsupported Piles

$T = 5.3'$ $\quad L_u = 25'$

Free standing length factor $(m) = L_u/T = 25/5.3 = 4.7$

$H = 0.45$ (fixed cap)



$M = KMF \cdot F = F\left(\frac{T}{H}\right)$

$KMF = \frac{T}{H} = \frac{5.3 \times 12}{0.45} = \boxed{141''}$

$T = 5.3$ $\quad L_u = 30.5'$

$(m) = 30.5/5.3 = 5.75$

$H = 0.36$ (fixed cap)

$KMF = \frac{T}{H} = \frac{5.3 \times 12}{0.36} = \boxed{176''}$

NAVY FORM 228 Apr 79

COMPUTATION SHEET			Page 4 of ____
Subject Texaco Pier 35		Project Newark Bay	
Computed by J. CHU	Date 9-17-2002	Checked by G. J.C.	Date 10/28/2003

"CPGA" Program input data "TexacoPier1"

a) Texaco Pier 35 dredge line -43' Pile cap displ.

	E	I1	I2	A	C33	B66	LIST
b) Prop	29000	362	362	19.2	1	0	All
	PSOIL	ESOIL	Length	L	LU	LIST	
c) Soil	NH	0.010	L	60	25	all	

d) Fix ALL

	Shape	AC	AT	ACC	ATT	AM1	AM2
g) Allow	R	80	40	250	346	1086	1086 ALL

j) UNSP	MATL	CM1	CM2	PCR1	PCR2	ST	
	S	0.6	0.6	604	604	H	ALL

l) FUNSMOM	KMF1U	KMF2U	LIST
	141	141	ALL

P) PILE 1 -35. 0. 0. 2 -25. 0. 0. 3 -15. 0. 0. 4 -5. 0. 0.

5. 5. 0. 0. 6 15. 0. 0. 7 25. 0. 0. 8 35. 0. 0.

y) LOAD 1 15. 0. 350. 0. 0. 0.

bb) FOUT 1 2 3 4 5 6 7 TexacoPier10

NANY FORM 229 Apr 79

```
1000 Texaco Pier 35 EXISTING DREDGE LINE EL. -43' PILE CAP DISP.
1010 PRO 29000. 362. 362. 19.2 1 0 ALL
1020 SOI NH .010 L 60. 25. ALL
1030 FIX ALL
1040 ALL R 80. 40. 250. 346. 1086. 1086. ALL
1050 UNS S .6 .6 604. 604. H ALL
1060 FUN 141. 141. ALL
1070 PIL 1 -35. 0. 0. 2 -25. 0. 0. 3 -15. 0. 0. 4 -5. 0. 0. 5 5. 0. 0.
1080 6 15. 0. 0. 7 25. 0. 0. 8 35. 0. 0.
1090 LOA 1 15. 0. 350. 0. 0. 0.
1100 FOU 1 2 3 4 5 6 7 Texaco1o
1110 PFO ALL
1120 FPL N
```

"Texaco 1o"

```
 ********************************
 * CASE PROGRAM    #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS
PROGRAM
 * VERSION NUMBER # 1993/03/29    *  RUN DATE 17-SEP-2002   RUN TIME
15.25.06
 ********************************


 TEXACO PIER 35 EXISTING DREDGE LINE EL. -43' PILE CAP DISP.


 THERE ARE     8 PILES AND
               1 LOAD CASES IN THIS RUN.

 ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX
                                        X          Y          Z
                                      -----      -----      -----
 WITH DIAGONAL COORDINATES = (     -35.00 ,       .00 ,      .00 )
                             (      35.00 ,       .00 ,      .00 )


*************************************************************************
*******

          PILE PROPERTIES AS INPUT


       E            I1            I2            A            C33
B66
      KSI          IN**4         IN**4         IN**2
   .29000E+05   .36200E+03   .36200E+03   .19200E+02   .10000E+01
.00000E+00

 THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          SOIL DESCRIPTIONS AS INPUT


    NH      ESOIL       LENGTH        L            LU
           K/IN**3                   FT           FT
           .10000E-01     L       .60000E+02    .25000E+02

 THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

     ALL


*************************************************************************
*******

          PILE GEOMETRY AS INPUT AND/OR GENERATED
```

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	-35.00	.00	.00	V	.00	60.00	F
2	-25.00	.00	.00	V	.00	60.00	F
3	-15.00	.00	.00	V	.00	60.00	F
4	-5.00	.00	.00	V	.00	60.00	F
5	5.00	.00	.00	V	.00	60.00	F
6	15.00	.00	.00	V	.00	60.00	F
7	25.00	.00	.00	V	.00	60.00	F
8	35.00	.00	.00	V	.00	60.00	F

						480.00	

****
****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	15.0	.0	350.0	.0	.0	.0

****
****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.13864E+02 .00000E+00 .00000E+00 .00000E+00 .28673E+04
.00000E+00
.00000E+00 .13864E+02 .00000E+00 -.28673E+04 .00000E+00
.11369E-12
.00000E+00 .00000E+00 .61867E+04 .00000E+00 .00000E+00
.00000E+00
.00000E+00 -.28673E+04 .00000E+00 .79695E+06 .00000E+00
-.29104E-10
.28673E+04 .00000E+00 .00000E+00 .00000E+00 .46851E+09
.00000E+00
.00000E+00 .11369E-12 .00000E+00 -.29104E-10 .00000E+00
.10481E+07

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION
= 0.

****
****

PILE CAP DISPLACEMENTS

LOAD CASE	DX	DY	DZ	RX	RY	RZ
	IN	IN	IN	RAD	RAD	

PROCTOR AND GAMBLE PIER

```
1000 PROCTOR AND GAMBLE PIER
1010 PRO 1500. 1018. 1018. 113. 1. 0. ALL
1020 SOI NH .75 LEN 45.0 31.0 ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL
1050 UNS T .6 .6 88. 88. N ALL
1060 PIL 1 0.0 0.0 0.0 5 8.0 0.0 0.0
1075 ROW X 4 1 3 AT 5.0
1080 ROW X 4 5 3 AT 5.0
1085 REP 6 5 AT 8.0
1090 LOA 1 25.0 0.0 244.0 0.0 0.0 0.0
1100 TOU 1 2 3 4 5
1110 FOU 1 2 3 4 5 PRT4
1120 PSO ALL
1130 PFO ALL
1140 FPL N
```

```
*********************************
* CASE PROGRAM    #  X0080      *  CPGA - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 1993/03/29   *  RUN DATE 31-OCT-2003   RUN TIME 09.37.54
*********************************
```

PROCTOR AND GAMBLE PIER

THERE ARE 28 PILES AND
1 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	.00 ,	.00 ,	.00)
(	23.00 ,	40.00 ,	.00)

****

PILE PROPERTIES AS INPUT

E	I1	I2	A	C33	B66
KSI	IN**4	IN**4	IN**2		
.15000E+04	.10180E+04	.10180E+04	.11300E+03	.10000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

NH	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.75000E+00	L	.45000E+02	.31000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE STIFFNESSES AS CALCULATED FROM PROPERTIES

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

1

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

2

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

3

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

4

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

5

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

6

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

7

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

8

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

9

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

10

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

11

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

12

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

13

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

14

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

15

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00

.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

16

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

17

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

18

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

19

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

20

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00

.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

21

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

22

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

23

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

24

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

25

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00

.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

26

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

27

.27703E+00	.00000E+00	.00000E+00	.00000E+00	.55990E+02	.00000E+00
.00000E+00	.27703E+00	.00000E+00	-.55990E+02	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.31389E+03	.00000E+00	.00000E+00	.00000E+00
.00000E+00	-.55990E+02	.00000E+00	.15095E+05	.00000E+00	.00000E+00
.55990E+02	.00000E+00	.00000E+00	.00000E+00	.15095E+05	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

28

****

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	.00	.00	.00	V	.00	45.00	F
2	5.00	.00	.00	V	.00	45.00	F
3	10.00	.00	.00	V	.00	45.00	F
4	15.00	.00	.00	V	.00	45.00	F
5	8.00	.00	.00	V	.00	45.00	F
6	13.00	.00	.00	V	.00	45.00	F
7	18.00	.00	.00	V	.00	45.00	F
8	23.00	.00	.00	V	.00	45.00	F
9	8.00	8.00	.00	V	.00	45.00	F
10	13.00	8.00	.00	V	.00	45.00	F
11	18.00	8.00	.00	V	.00	45.00	F
12	23.00	8.00	.00	V	.00	45.00	F
13	8.00	16.00	.00	V	.00	45.00	F
14	13.00	16.00	.00	V	.00	45.00	F
15	18.00	16.00	.00	V	.00	45.00	F
16	23.00	16.00	.00	V	.00	45.00	F
17	8.00	24.00	.00	V	.00	45.00	F
18	13.00	24.00	.00	V	.00	45.00	F

				PRT4			
19	18.00	24.00	.00	V	.00	45.00	F
20	23.00	24.00	.00	V	.00	45.00	F
21	8.00	32.00	.00	V	.00	45.00	F
22	13.00	32.00	.00	V	.00	45.00	F
23	18.00	32.00	.00	V	.00	45.00	F
24	23.00	32.00	.00	V	.00	45.00	F
25	8.00	40.00	.00	V	.00	45.00	F
26	13.00	40.00	.00	V	.00	45.00	F
27	18.00	40.00	.00	V	.00	45.00	F
28	23.00	40.00	.00	V	.00	45.00	F

						1260.00	

****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	25.0	.0	244.0	.0	.0	.0

****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.77567E+01	.00000E+00	.00000E+00	.00000E+00	.15677E+04	-.15957E+04
.00000E+00	.77567E+01	.00000E+00	-.15677E+04	.00000E+00	.13364E+04
.00000E+00	.00000E+00	.87889E+04	.18080E+07	-.15142E+07	.00000E+00
.00000E+00	-.15677E+04	.18080E+07	.63684E+09	-.33629E+09	-.27009E+06
.15677E+04	.00000E+00	-.15142E+07	-.33629E+09	.31077E+09	-.32250E+06
-.15957E+04	.13364E+04	.00000E+00	-.27009E+06	-.32250E+06	.83557E+06

LOAD CASE 1. NUMBER OF FAILURES = 12. NUMBER OF PILES IN TENSION = 10.

****

PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.6903E+01	-.3223E+01	.1713E+00	-.1257E-03	.6832E-03	.1856E-01

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO
(F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PRT4

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF	ASC KSI	AST KSI
1	2.0	-.9	53.8	178.57	396.82	.00	1.08	B		
2	2.0	-.6	40.9	116.21	396.82	.00	.82	B		
3	2.0	-.3	28.0	53.86	396.82	.00	.56	B		
4	2.0	.0	15.2	-8.5	396.8	.0	.30	2.39		*
5	2.0	-.4	33.2	78.80	396.82	.00	.66	B		
6	2.0	-.1	20.3	16.4	396.8	.0	.41	9.37		*
7	2.0	.2	7.5	-45.9	396.8	.0	.15	1.24		*
8	2.0	.5	-5.4	-108.3	396.8	.0	.22	1.23		*
9	1.5	-.4	29.4	78.80	297.05	.00	.59	B		
10	1.5	-.1	16.5	16.4	297.1	.0	.33	2.26		*
11	1.5	.2	3.7	-45.9	297.1	.0	.07	.92		
12	1.5	.5	-9.2	-108.3	297.1	.0	.37	.97		
13	1.0	-.4	25.6	78.80	197.29	.00	.51	B		
14	1.0	-.1	12.7	16.4	197.3	.0	.25	.94		
15	1.0	.2	-.1	-45.9	197.3	.0	.00	.60		
16	1.0	.5	-13.0	-108.3	197.3	.0	.52	.72		
17	.5	-.4	21.8	78.8	97.5	.0	.44	28.39		*
18	.5	-.1	9.0	16.4	97.5	.0	.18	.37		
19	.5	.2	-3.9	-45.9	97.5	.0	.16	.33		
20	.5	.5	-16.8	-108.3	97.5	.0	.67	.50		
21	.0	-.4	18.0	78.8	-2.2	.0	.36	.93		
22	.0	-.1	5.2	16.4	-2.2	.0	.10	.09		
23	.0	.2	-7.7	-45.9	-2.2	.0	.31	.17		
24	.0	.5	-20.6	-108.3	-2.2	.0	.82	.41		
25	-.5	-.4	14.3	78.8	-102.0	.0	.29	.77		
26	-.5	-.1	1.4	16.4	-102.0	.0	.03	.32		
27	-.5	.2	-11.5	-45.9	-102.0	.0	.46	.38		
28	-.5	.5	-24.3	-108.3	-102.0	.0	.97	.55		

ELIZABETH MARINA

BULKHEAD 1

ELIZABETH SECT. 1

```
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1
'ARTHUR KILL CHANNEL - DREDGE EL. -54'
'CONCEPTUAL DESIGN - TOP RIP RAP EL. -10'
CONTROL  ANCHORED  ANALYSIS  1.00
WALL  10   2 -27  29000000  184.2
SURFACE RIGHTSIDE  2   0   10
            100   10
SURFACE LEFTSIDE  3   0  -10
            25.7  -19
            35  -28
SOIL RIGHTSIDE  STRENGTHS  1
  130   130   30   0   15   0     0
SOIL LEFTSIDE  STRENGTHS  1
  150   150   35   0   15   0     0
WATER ELEVATIONS  62.4   0   0
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 16:05:22

****

* INPUT DATA *

****

I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL - DREDGE EL. -54'

'CONCEPTUAL DESIGN - TOP RIP RAP EL. -10'

II.--CONTROL

ANCHORED WALL ANALYSIS

FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00

III.--WALL DATA

ELEVATION AT TOP OF WALL = 10.00 FT.

ELEVATION AT ANCHOR = 2.00 FT.

ELEVATION AT BOTTOM OF WALL = -27.00 FT.

WALL MODULUS OF ELASTACITY = 2.900E+07 PSI.

WALL MOMENT OF INERTIA = 184.20 IN^4.

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	10.00
100.00	10.00

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	-10.00
25.70	-19.00
35.00	-28.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT

LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> ACT.	<-FACTOR-> PASS.
130.00	130.00	30.00	0.00	15.00	0.00			DEF	DEF

V.B.--LEFTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT

LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> ACT.	<-FACTOR-> PASS.
150.00	150.00	35.00	0.00	15.00	0.00			DEF	DEF

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)

RIGHTSIDE ELEVATION = 0.00 (FT)

LEFTSIDE ELEVATION = 0.00 (FT)

NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS

NONE

VIII.--HORIZONTAL LOADS

NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 16:05:26

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****************************
* SUMMARY OF RESULTS FOR   *
* ANCHORED WALL ANALYSIS   *
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```

I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL - DREDGE EL. -54'

'CONCEPTUAL DESIGN - TOP RIP RAP EL. -10'

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION DOES NOT EXIST AT ALL ELEVATIONS. SEE COMPLETE OUTPUT.

METHOD	:	FREE EARTH	FIXED EARTH
PASSIVE FACTOR OF SAFETY	:	2.20	1.29
MAXIMUM BENDING MOMENT (LB-FT)	:	-3.0437E+04	-1.6519E+04
AT ELEVATION (FT)	:	-9.70	-7.27
MAXIMUM DEFLECTION (IN.)	:	7.5900E-01	-2.7073E-01
AT ELEVATION (FT)	:	-11.00	10.00
ANCHOR FORCE (LB)	:	6.4835E+03	5.1579E+03

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 16:05:26

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****************************
*  COMPLETE RESULTS FOR  *
* ANCHORED WALL ANALYSIS *
*  BY FREE EARTH METHOD  *
****************************
```

I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL - DREDGE EL. -54'

'CONCEPTUAL DESIGN - TOP RIP RAP EL. -10'

II.--RESULTS (ANCHOR FORCE= 6484. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	NET DEFLECTION (IN)	PRESSURE (PSF)
10.00	0.0000E+00	0.	-6.9370E-01	0.00
9.00	6.3081E+00	19.	-6.0741E-01	37.85
8.00	5.0464E+01	76.	-5.2111E-01	75.70
7.00	1.7032E+02	170.	-4.3479E-01	113.55
6.00	4.0372E+02	303.	-3.4842E-01	151.39
5.00	7.8851E+02	473.	-2.6191E-01	189.24
4.00	1.3625E+03	681.	-1.7514E-01	227.09
3.00	2.1637E+03	927.	-8.7923E-02	264.94
2.00	3.2297E+03	1211.	0.0000E+00	302.79
2.00	3.2297E+03	-5272.	0.0000E+00	302.79
1.00	-1.8849E+03	-4951.	8.8627E-02	340.64
0.00	-6.6597E+03	-4593.	1.7665E-01	373.94
-1.00	-1.1062E+04	-4207.	2.6253E-01	398.16
-2.00	-1.5067E+04	-3799.	3.4485E-01	417.85
-3.00	-1.8654E+04	-3372.	4.2230E-01	437.53
-4.00	-2.1804E+04	-2924.	4.9373E-01	457.21
-5.00	-2.4496E+04	-2457.	5.5812E-01	476.89
-6.00	-2.6712E+04	-1970.	6.1459E-01	496.57
-7.00	-2.8430E+04	-1464.	6.6244E-01	516.25
-8.00	-2.9633E+04	-938.	7.0111E-01	535.93
-9.00	-3.0300E+04	-392.	7.3020E-01	555.61
-10.00	-3.0411E+04	173.	7.4951E-01	575.29
-11.00	-2.9961E+04	715.	7.5900E-01	507.38
-12.00	-2.9004E+04	1188.	7.5880E-01	439.46
-13.00	-2.7608E+04	1594.	7.4924E-01	371.54
-14.00	-2.5840E+04	1931.	7.3076E-01	303.62
-15.00	-2.3768E+04	2201.	7.0392E-01	235.70
-16.00	-2.1461E+04	2402.	6.6940E-01	167.78
-17.00	-1.8986E+04	2536.	6.2795E-01	99.86
-18.00	-1.6411E+04	2602.	5.8036E-01	31.94
-18.47	-1.5185E+04	2610.	5.5608E-01	0.00
-19.00	-1.3804E+04	2600.	5.2745E-01	-35.97

-20.00	-1.1233E+04	2530.	4.7009E-01	-103.89
-21.00	-8.7664E+03	2392.	4.0908E-01	-171.81
-22.00	-6.4712E+03	2187.	3.4523E-01	-239.73
-23.00	-4.4157E+03	1913.	2.7929E-01	-307.65
-24.00	-2.6679E+03	1571.	2.1191E-01	-375.57
-25.00	-1.2958E+03	1162.	1.4365E-01	-443.83
-26.00	-3.7375E+02	665.	7.4966E-02	-550.05
-27.00	-2.6312E+00	59.	6.1439E-03	-661.39
-27.09	0.0000E+00	0.	0.0000E+00	-660.13

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
10.00	0.	0.	0.	0.	0.
9.00	0.	0.	0.	38.	253.
8.00	0.	0.	0.	76.	507.
7.00	0.	0.	0.	114.	760.
6.00	0.	0.	0.	151.	1013.
5.00	0.	0.	0.	189.	1267.
4.00	0.	0.	0.	227.	1520.
3.00	0.	0.	0.	265.	1774.
2.00	0.	0.	0.	303.	2027.
1.00	0.	0.	0.	341.	2280.
0.00	0.	0.	0.	374.	2503.
-1.00	0.	0.	0.	398.	2665.
-2.00	0.	0.	0.	418.	2797.
-3.00	0.	0.	0.	438.	2929.
-4.00	0.	0.	0.	457.	3061.
-5.00	0.	0.	0.	477.	3192.
-6.00	0.	0.	0.	497.	3324.
-7.00	0.	0.	0.	516.	3456.
-8.00	0.	0.	0.	536.	3588.
-9.00	0.	0.	0.	556.	3720.
-10.00	0.	0.	0.	575.	3851.
-11.00	0.	88.	18.	595.	3983.
-12.00	0.	175.	35.	615.	4115.
-13.00	0.	263.	53.	634.	4247.
-14.00	0.	350.	71.	654.	4378.
-15.00	0.	438.	88.	674.	4510.
-16.00	0.	526.	106.	693.	4642.
-17.00	0.	613.	123.	713.	4774.
-18.00	0.	701.	141.	733.	4905.
-18.47	0.	742.	149.	742.	4967.
-19.00	0.*	788.	159.	752.	5037.

-20.00	0.*	876.	176.	772.	5169.
-21.00	0.*	964.	194.	792.	5301.
-22.00	0.*	1051.	212.	811.	5432.
-23.00	0.*	1139.	229.	831.	5564.
-24.00	0.*	1226.	247.	851.	5696.
-25.00	0.*	1314.	264.	871.	5828.
-26.00	0.*	1440.	282.	890.	5959.
-27.00	0.*	1571.	300.	910.	6091.
-28.00	0.*	1577.	317.	930.	6223.

* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE

AT THIS ELEVATION.

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 16:05:26

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*  COMPLETE RESULTS FOR  *
* ANCHORED WALL ANALYSIS *
*  BY FIXED EARTH METHOD *
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I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL - DREDGE EL. -54'

'CONCEPTUAL DESIGN - TOP RIP RAP EL. -10'

II.--RESULTS (ANCHOR FORCE= 5158. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	NET DEFLECTION (IN)	PRESSURE (PSF)
10.00	0.0000E+00	0.	-2.7073E-01	0.00
9.00	6.3081E+00	19.	-2.3730E-01	37.85
8.00	5.0464E+01	76.	-2.0388E-01	75.70
7.00	1.7032E+02	170.	-1.7043E-01	113.55
6.00	4.0372E+02	303.	-1.3693E-01	151.39
5.00	7.8851E+02	473.	-1.0329E-01	189.24
4.00	1.3625E+03	681.	-6.9395E-02	227.09
3.00	2.1637E+03	927.	-3.5051E-02	264.94
2.00	3.2297E+03	1211.	0.0000E+00	302.79
2.00	3.2297E+03	-3947.	0.0000E+00	302.79
1.00	-5.5936E+02	-3625.	3.5826E-02	340.64
0.00	-4.0086E+03	-3268.	7.1480E-02	373.94
-1.00	-7.0853E+03	-2882.	1.0585E-01	398.16
-2.00	-9.7647E+03	-2474.	1.3793E-01	417.85
-3.00	-1.2026E+04	-2046.	1.6687E-01	437.53
-4.00	-1.3850E+04	-1599.	1.9193E-01	457.21

-5.00	-1.5217E+04	-1132.	2.1253E-01	476.89
-6.00	-1.6107E+04	-645.	2.2821E-01	496.57
-7.00	-1.6500E+04	-138.	2.3869E-01	516.25
-8.00	-1.6377E+04	388.	2.4386E-01	535.93
-9.00	-1.5718E+04	933.	2.4374E-01	555.61
-10.00	-1.4504E+04	1499.	2.3854E-01	575.29
-11.00	-1.2740E+04	2008.	2.2868E-01	442.86
-12.00	-1.0532E+04	2385.	2.1470E-01	310.44
-13.00	-8.0146E+03	2629.	1.9732E-01	178.01
-14.00	-5.3189E+03	2741.	1.7736E-01	45.58
-14.34	-4.3739E+03	2748.	1.7005E-01	0.00
-15.00	-2.5776E+03	2720.	1.5568E-01	-86.85
-16.00	7.6859E+01	2567.	1.3316E-01	-219.28
-17.00	2.5120E+03	2281.	1.1066E-01	-351.71
-18.00	4.5955E+03	1863.	8.8961E-02	-484.14
-19.00	6.2668E+03	1529.	6.8739E-02	-184.55
-20.00	7.7084E+03	1359.	5.0538E-02	-155.61
-21.00	8.9232E+03	1004.	3.4826E-02	-554.27
-22.00	9.6287E+03	386.	2.1985E-02	-682.64
-23.00	9.6499E+03	-366.	1.2241E-02	-821.05
-24.00	8.8483E+03	-1262.	5.5970E-03	-970.45
-25.00	7.0742E+03	-2313.	1.7886E-03	-1131.89
-26.00	4.1659E+03	-3532.	2.3813E-04	-1306.58
-27.00	0.0000E+00	-4918.	0.0000E+00	-1493.92

III.--WATER AND SOIL PRESSURES

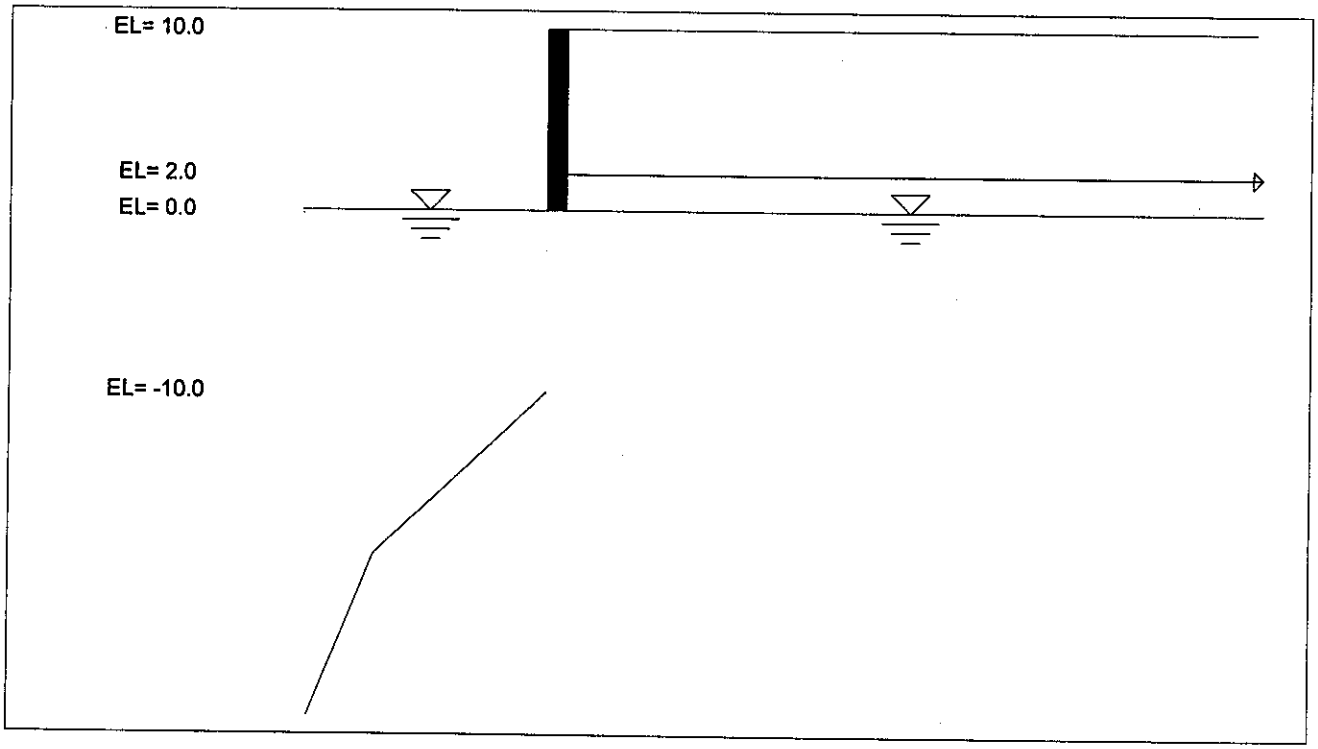
		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
10.00	0.	0.	0.	0.	
9.00	0.	0.	0.	38.	422.
8.00	0.	0.	0.	76.	844.
7.00	0.	0.	0.	114.	1266.
6.00	0.	0.	0.	151.	1687.
5.00	0.	0.	0.	189.	2109.
4.00	0.	0.	0.	227.	2531.
3.00	0.	0.	0.	265.	2953.
2.00	0.	0.	0.	303.	3375.
1.00	0.	0.	0.	341.	3797.
0.00	0.	0.	0.	374.	4168.
-1.00	0.	0.	0.	398.	4438.
-2.00	0.	0.	0.	418.	4657.
-3.00	0.	0.	0.	438.	4876.
-4.00	0.	0.	0.	457.	5096.
-5.00	0.	0.	0.	477.	5315.
-6.00	0.	0.	0.	497.	5534.
-7.00	0.	0.	0.	516.	5754.
-8.00	0.	0.	0.	536.	5973.
-9.00	0.	0.	0.	556.	6193.
-10.00	0.	0.	0.	575.	6412.
-11.00	0.	152.	18.	595.	6631.
-12.00	0.	304.	35.	615.	6851.
-13.00	0.	456.	53.	634.	7070.
-14.00	0.	608.	71.	654.	7289.
-14.34	0.	661.	77.	661.	7365.
-15.00	0.	761.	88.	674.	7509.
-16.00	0.	913.	106.	693.	7728.
-17.00	0.	1065.	123.	713.	7947.
-18.00	0.	1217.	141.	733.	8167.
-19.00	0.*	937.	159.	752.	8386.

-20.00	0.*	928.	176.	772.	8605.
-21.00	0.*	1346.	194.	792.	8825.
-22.00	0.*	1494.	212.	811.	9044.
-23.00	0.*	1652.	229.	831.	9263.
-24.00	0.*	1821.	247.	851.	9483.
-25.00	0.*	2002.	264.	871.	9702.
-26.00	0.*	2197.	282.	890.	9922.
-27.00	0.*	2406.	300.	910.	10141.

* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE
AT THIS ELEVATION.

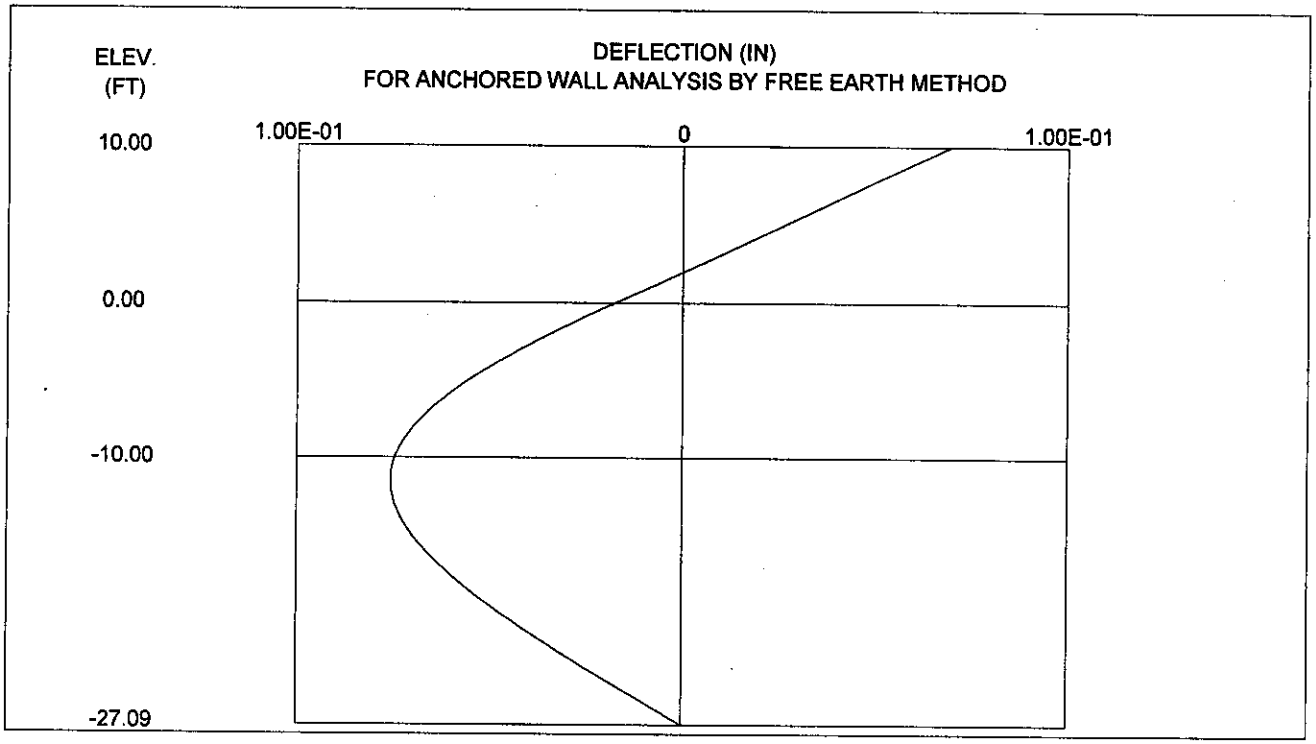
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL - DREDGE EL. -54'



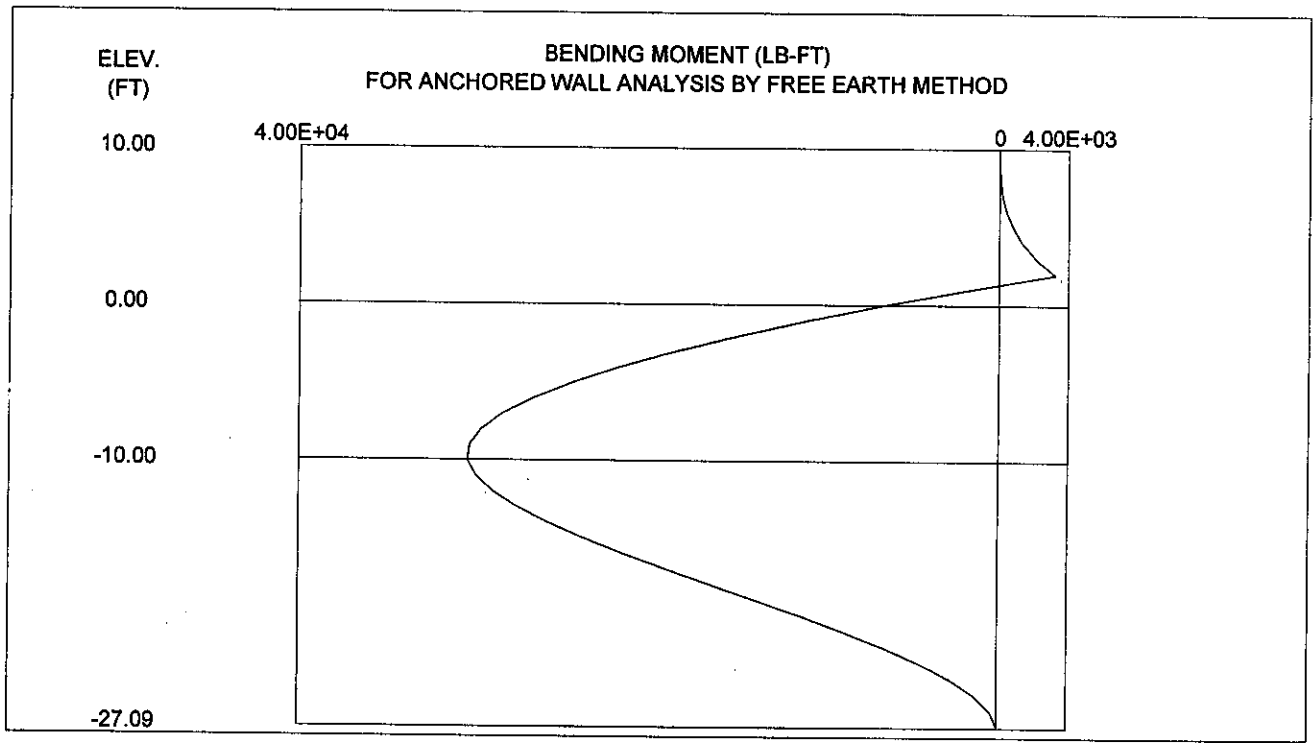
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



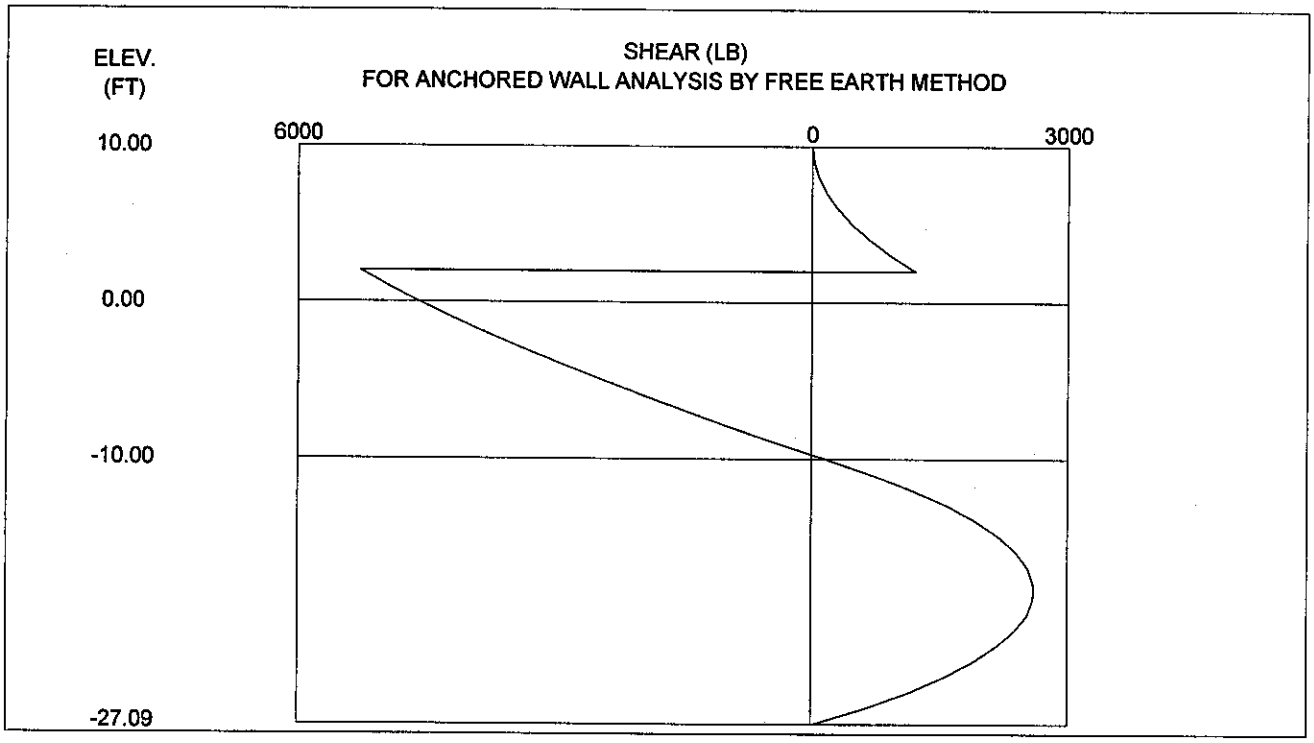
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



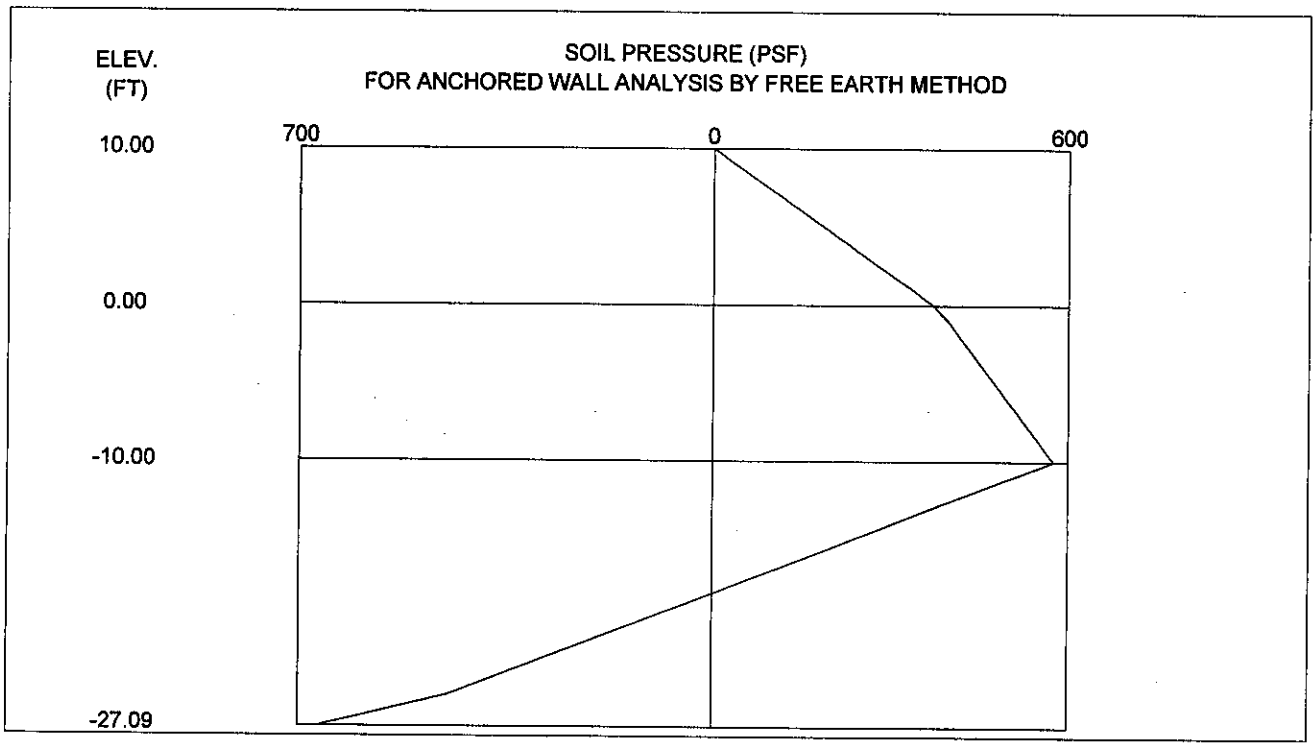
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



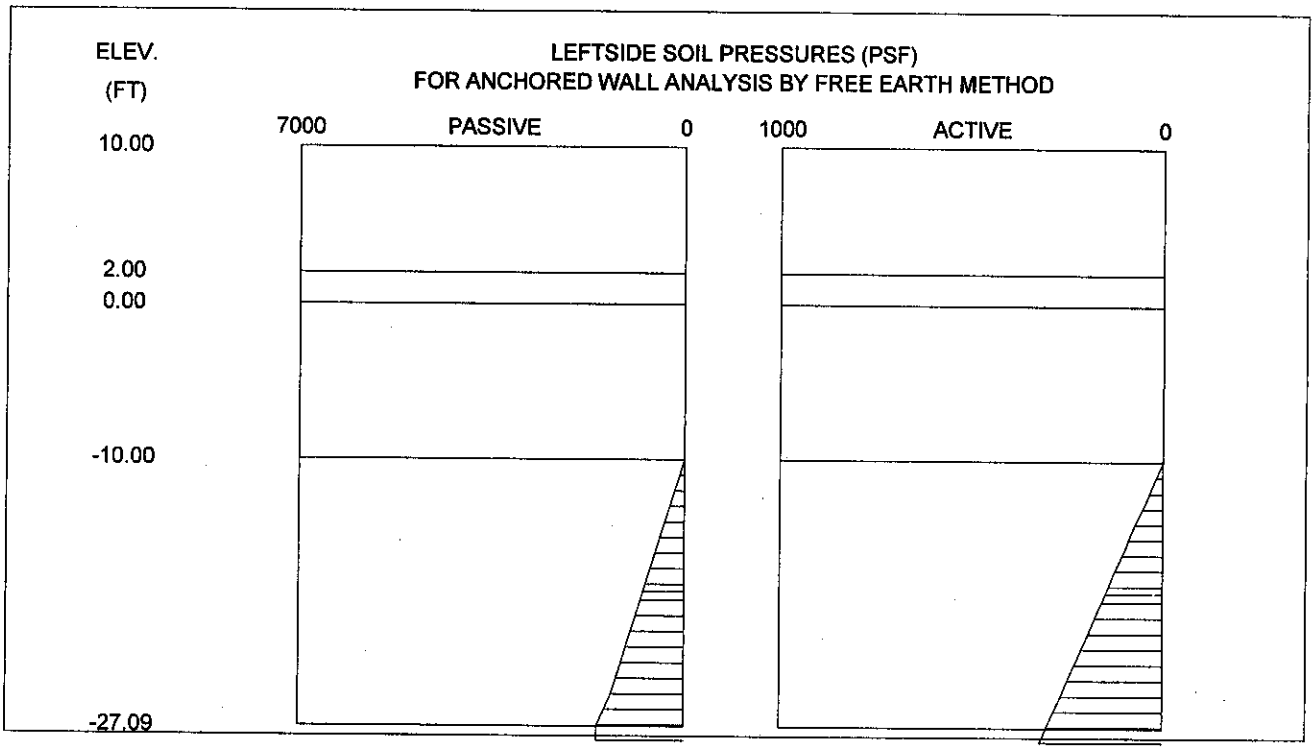
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



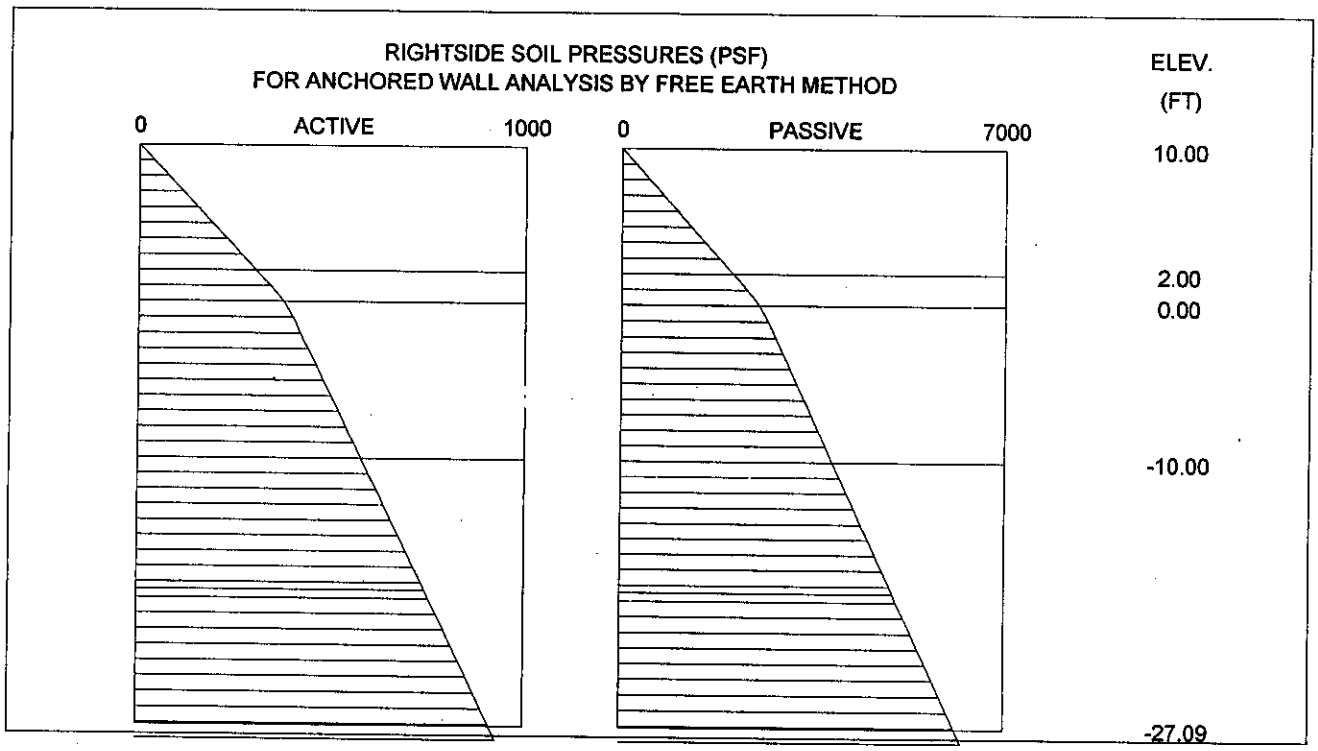
'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



'ELIZABETH MARINA SHEET PILE AT SECTION 1-1

'ARTHUR KILL CHANNEL -DREDGE EL -54'



ELIZABETH 2-2

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'ELIZABETH MARINA SHEET PILE AT SECTION 2-2
'ARTHUR KILL CHANNEL DREDGE EL. -54'
'CONCEPTUAL DESIGN TOP RIP RAP EL. -10'
CONTROL  ANCHORED  ANALYSIS  1.00
WALL  10   2 -27  29000000  184.2
SURFACE RIGHTSIDE  2   0   10
            100   10
SURFACE LEFTSIDE  4   0  -10
            25  -15
            50  -30
            75  -37
SOIL RIGHTSIDE  STRENGTHS  1
  130   130   30   0   15   0     0
SOIL LEFTSIDE  STRENGTHS  1
  150   150   35   0   15   0     0
WATER ELEVATIONS  62.4   0   0
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 17-OCTOBER-2003 TIME: 8:55:40

****

* INPUT DATA *

****

I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'

'CONCEPTUAL DESIGN TOP RIP RAP EL. -10'

II.--CONTROL

ANCHORED WALL ANALYSIS

FACTOR OF SAFETY FOR ACTIVE PRESSURES = 1.00

III.--WALL DATA

ELEVATION AT TOP OF WALL = 10.00 FT.

ELEVATION AT ANCHOR = 2.00 FT.

ELEVATION AT BOTTOM OF WALL = -27.00 FT.

WALL MODULUS OF ELASTACITY = 2.900E+07 PSI.

WALL MOMENT OF INERTIA = 184.20 IN^4.

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	10.00
100.00	10.00

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	-10.00
25.00	-15.00
50.00	-30.00
75.00	-37.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT

LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> ACT.	<-FACTOR-> PASS.
130.00	130.00	30.00	0.00	15.00	0.00			DEF	DEF

V.B.--LEFTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT

LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> ACT.	<-FACTOR-> PASS.
150.00	150.00	35.00	0.00	15.00	0.00			DEF	DEF

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)

RIGHTSIDE ELEVATION = 0.00 (FT)

LEFTSIDE ELEVATION = 0.00 (FT)

NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS

NONE

VIII.--HORIZONTAL LOADS

NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 17-OCTOBER-2003 TIME: 8:55:45

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* SUMMARY OF RESULTS FOR   *
* ANCHORED WALL ANALYSIS   *
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I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'

'CONCEPTUAL DESIGN TOP RIP RAP EL. -10'

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION DOES NOT EXIST AT ALL ELEVATIONS. SEE COMPLETE OUTPUT.

METHOD	:	FREE EARTH	FIXED EARTH
PASSIVE FACTOR OF SAFETY	:	3.00	1.67
MAXIMUM BENDING MOMENT (LB-FT)	:	-2.9239E+04	-1.5599E+04
AT ELEVATION (FT)	:	-9.52	-7.07
MAXIMUM DEFLECTION (IN.)	:	7.2178E-01	-2.4723E-01
AT ELEVATION (FT)	:	-11.00	10.00
ANCHOR FORCE (LB)	:	6.3802E+03	5.0576E+03

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 17-OCTOBER-2003 TIME: 8:55:45

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****************************
*  COMPLETE RESULTS FOR  *
* ANCHORED WALL ANALYSIS *
*  BY FREE EARTH METHOD  *
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I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'

'CONCEPTUAL DESIGN TOP RIP RAP EL. -10'

II.--RESULTS (ANCHOR FORCE= 6380. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	NET DEFLECTION (IN)	PRESSURE (PSF)
10.00	0.0000E+00	0.	-6.6327E-01	0.00
9.00	6.3081E+00	19.	-5.8078E-01	37.85
8.00	5.0464E+01	76.	-4.9828E-01	75.70
7.00	1.7032E+02	170.	-4.1577E-01	113.55
6.00	4.0372E+02	303.	-3.3320E-01	151.39
5.00	7.8851E+02	473.	-2.5050E-01	189.24
4.00	1.3625E+03	681.	-1.6753E-01	227.09
3.00	2.1637E+03	927.	-8.4119E-02	264.94
2.00	3.2297E+03	1211.	0.0000E+00	302.79
2.00	3.2297E+03	-5169.	0.0000E+00	302.79
1.00	-1.7817E+03	-4847.	8.4828E-02	340.64

0.00	-6.4532E+03	-4490.	1.6909E-01	373.94
-1.00	-1.0752E+04	-4104.	2.5127E-01	398.16
-2.00	-1.4654E+04	-3696.	3.2999E-01	417.85
-3.00	-1.8138E+04	-3268.	4.0398E-01	437.53
-4.00	-2.1184E+04	-2821.	4.7211E-01	457.21
-5.00	-2.3773E+04	-2354.	5.3340E-01	476.89
-6.00	-2.5885E+04	-1867.	5.8701E-01	496.57
-7.00	-2.7501E+04	-1361.	6.3227E-01	516.25
-8.00	-2.8601E+04	-835.	6.6864E-01	535.93
-9.00	-2.9164E+04	-289.	6.9577E-01	555.61
-10.00	-2.9172E+04	277.	7.1348E-01	575.29
-11.00	-2.8622E+04	810.	7.2178E-01	492.15
-12.00	-2.7579E+04	1261.	7.2082E-01	409.01
-13.00	-2.6128E+04	1628.	7.1096E-01	325.86
-14.00	-2.4350E+04	1913.	6.9265E-01	242.72
-15.00	-2.2330E+04	2114.	6.6648E-01	159.58
-16.00	-2.0135E+04	2277.	6.3308E-01	167.78
-17.00	-1.7785E+04	2411.	5.9318E-01	99.86
-18.00	-1.5336E+04	2477.	5.4752E-01	31.94
-18.47	-1.4168E+04	2485.	5.2429E-01	0.00
-19.00	-1.2854E+04	2475.	4.9691E-01	-35.97
-20.00	-1.0408E+04	2405.	4.4213E-01	-103.89
-21.00	-8.0662E+03	2267.	3.8399E-01	-171.81
-22.00	-5.8962E+03	2062.	3.2323E-01	-239.73
-23.00	-3.9658E+03	1788.	2.6056E-01	-307.65
-24.00	-2.3431E+03	1446.	1.9660E-01	-375.57
-25.00	-1.0960E+03	1037.	1.3186E-01	-443.49
-26.00	-2.9239E+02	559.	6.6767E-02	-511.41
-27.00	-1.6612E-01	14.	1.5605E-03	-579.33
-27.02	0.0000E+00	0.	0.0000E+00	-580.95

III.--WATER AND SOIL PRESSURES

		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
10.00	0.	0.	0.	0.	0.
9.00	0.	0.	0.	38.	211.
8.00	0.	0.	0.	76.	421.
7.00	0.	0.	0.	114.	632.
6.00	0.	0.	0.	151.	843.
5.00	0.	0.	0.	189.	1054.
4.00	0.	0.	0.	227.	1264.
3.00	0.	0.	0.	265.	1475.
2.00	0.	0.	0.	303.	1686.
1.00	0.	0.	0.	341.	1896.
0.00	0.	0.	0.	374.	2082.
-1.00	0.	0.	0.	398.	2217.
-2.00	0.	0.	0.	418.	2326.
-3.00	0.	0.	0.	438.	2436.
-4.00	0.	0.	0.	457.	2545.
-5.00	0.	0.	0.	477.	2655.
-6.00	0.	0.	0.	497.	2764.
-7.00	0.	0.	0.	516.	2874.
-8.00	0.	0.	0.	536.	2984.
-9.00	0.	0.	0.	556.	3093.
-10.00	0.	0.	0.	575.	3203.
-11.00	0.	103.	19.	595.	3312.
-12.00	0.	206.	38.	615.	3422.
-13.00	0.	308.	57.	634.	3531.
-14.00	0.	411.	75.	654.	3641.
-15.00	0.	514.	94.	674.	3750.
-16.00	0.	526.	113.	693.	3860.
-17.00	0.	613.	132.	713.	3970.
-18.00	0.	701.	151.	733.	4079.
-18.47	0.	742.	160.	742.	4131.
-19.00	0.	788.	170.	752.	4189.

-20.00	0.*	876.	189.	772.	4298.
-21.00	0.*	964.	207.	792.	4408.
-22.00	0.*	1051.	226.	811.	4517.
-23.00	0.*	1139.	245.	831.	4627.
-24.00	0.*	1226.	264.	851.	4737.
-25.00	0.*	1314.	283.	871.	4846.
-26.00	0.*	1402.	302.	890.	4956.
-27.00	0.*	1489.	321.	910.	5065.
-28.00	0.*	1577.	339.	930.	5175.

* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE
AT THIS ELEVATION.

ELIZABETH MARINA

BULKHEAD 2

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS

BY CLASSICAL METHODS

DATE: 17-OCTOBER-2003 TIME: 8:55:45

```
****************************
*  COMPLETE RESULTS FOR  *
* ANCHORED WALL ANALYSIS *
*  BY FIXED EARTH METHOD *
****************************
```

I.--HEADING

'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'

'CONCEPTUAL DESIGN TOP RIP RAP EL. -10'

II.--RESULTS (ANCHOR FORCE= 5058. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	NET DEFLECTION (IN)	PRESSURE (PSF)
10.00	0.0000E+00	0.	-2.4723E-01	0.00
9.00	6.3081E+00	19.	-2.1674E-01	37.85
8.00	5.0464E+01	76.	-1.8625E-01	75.70
7.00	1.7032E+02	170.	-1.5575E-01	113.55
6.00	4.0372E+02	303.	-1.2518E-01	151.39
5.00	7.8851E+02	473.	-9.4481E-02	189.24
4.00	1.3625E+03	681.	-6.3521E-02	227.09
3.00	2.1637E+03	927.	-3.2114E-02	264.94
2.00	3.2297E+03	1211.	0.0000E+00	302.79
2.00	3.2297E+03	-3846.	0.0000E+00	302.79
1.00	-4.5904E+02	-3525.	3.2894E-02	340.64
0.00	-3.8079E+03	-3167.	6.5649E-02	373.94
-1.00	-6.7844E+03	-2781.	9.7182E-02	398.16
-2.00	-9.3634E+03	-2373.	1.2653E-01	417.85
-3.00	-1.1525E+04	-1946.	1.5286E-01	437.53
-4.00	-1.3248E+04	-1498.	1.7548E-01	457.21

-5.00	-1.4515E+04	-1031.	1.9382E-01	476.89
-6.00	-1.5304E+04	-545.	2.0748E-01	496.57
-7.00	-1.5597E+04	-38.	2.1620E-01	516.25
-8.00	-1.5374E+04	488.	2.1989E-01	535.93
-9.00	-1.4615E+04	1034.	2.1862E-01	555.61
-10.00	-1.3300E+04	1599.	2.1264E-01	575.29
-11.00	-1.1438E+04	2102.	2.0237E-01	429.99
-12.00	-9.1450E+03	2459.	1.8842E-01	284.69
-13.00	-6.5677E+03	2671.	1.7151E-01	139.39
-13.96	-3.9626E+03	2738.	1.5329E-01	0.00
-14.00	-3.8511E+03	2738.	1.5248E-01	-5.92
-15.00	-1.1403E+03	2659.	1.3221E-01	-151.22
-16.00	1.4192E+03	2435.	1.1156E-01	-296.52
-17.00	3.6822E+03	2066.	9.1363E-02	-441.83
-18.00	5.5033E+03	1552.	7.2346E-02	-587.13
-19.00	6.7374E+03	892.	5.5094E-02	-732.43
-20.00	7.3680E+03	474.	4.0003E-02	-103.89
-21.00	7.7786E+03	336.	2.7292E-02	-171.81
-22.00	7.9774E+03	10.	1.7091E-02	-479.25
-23.00	7.7326E+03	-516.	9.4581E-03	-573.55
-24.00	6.9140E+03	-1137.	4.3114E-03	-668.77
-25.00	5.4266E+03	-1854.	1.3832E-03	-764.94
-26.00	3.1739E+03	-2668.	1.8990E-04	-862.63
-27.00	5.8262E+01	-3580.	8.2918E-10	-962.21
-28.00	0.0000E+00	-3596.	0.0000E+00	-963.86

III.--WATER AND SOIL PRESSURES

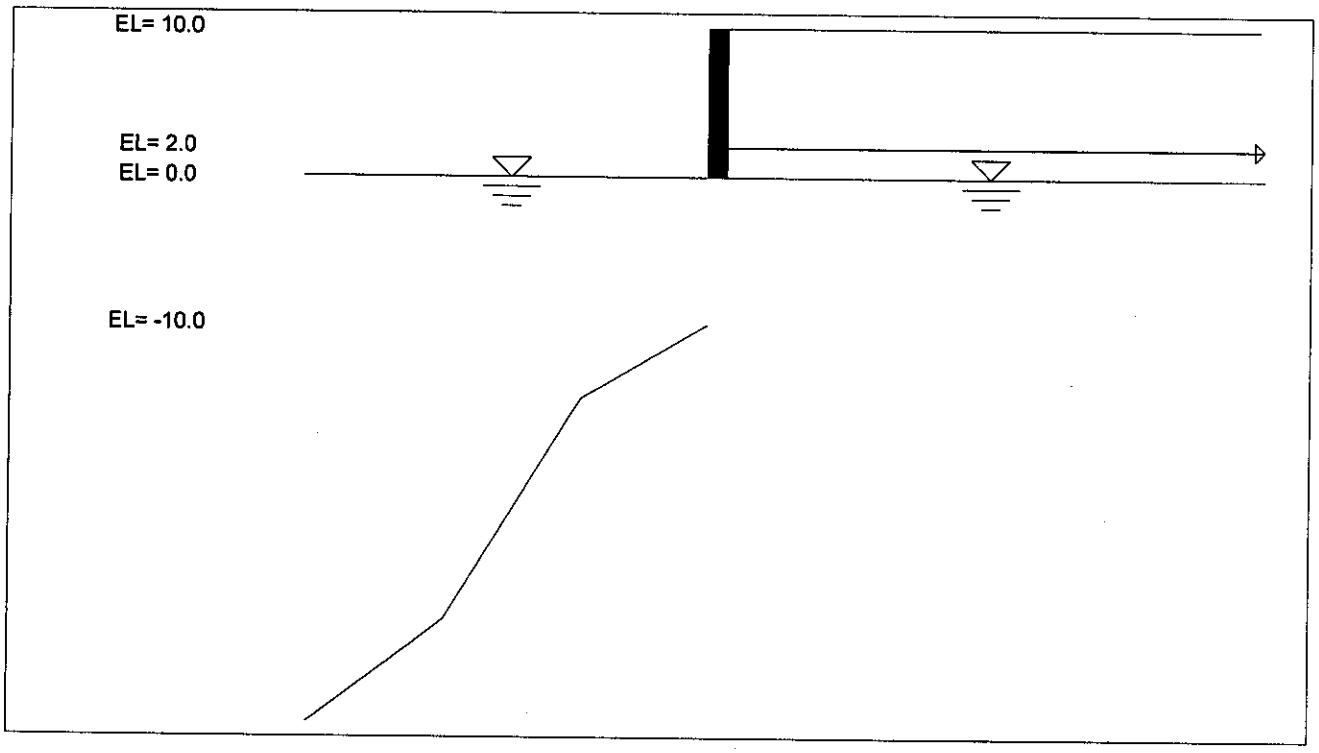
		<----------SOIL PRESSURES---------->			
	WATER	<----LEFTSIDE----->		<---RIGHTSIDE---->	
ELEVATION	PRESSURE	PASSIVE	ACTIVE	ACTIVE	PASSIVE
(FT)	(PSF)	(PSF)	(PSF)	(PSF)	(PSF)
10.00	0.	0.	0.	0.	0.
9.00	0.	0.	0.	38.	317.
8.00	0.	0.	0.	76.	634.
7.00	0.	0.	0.	114.	951.
6.00	0.	0.	0.	151.	1268.
5.00	0.	0.	0.	189.	1585.
4.00	0.	0.	0.	227.	1902.
3.00	0.	0.	0.	265.	2218.
2.00	0.	0.	0.	303.	2535.
1.00	0.	0.	0.	341.	2852.
0.00	0.	0.	0.	374.	3131.
-1.00	0.	0.	0.	398.	3334.
-2.00	0.	0.	0.	418.	3499.
-3.00	0.	0.	0.	438.	3664.
-4.00	0.	0.	0.	457.	3828.
-5.00	0.	0.	0.	477.	3993.
-6.00	0.	0.	0.	497.	4158.
-7.00	0.	0.	0.	516.	4323.
-8.00	0.	0.	0.	536.	4488.
-9.00	0.	0.	0.	556.	4652.
-10.00	0.	0.	0.	575.	4817.
-11.00	0.	165.	19.	595.	4982.
-12.00	0.	330.	38.	615.	5147.
-13.00	0.	495.	57.	634.	5312.
-13.96	0.	653.	75.	653.	5470.
-14.00	0.	660.	75.	654.	5476.
-15.00	0.	825.	94.	674.	5641.
-16.00	0.	990.	113.	693.	5806.
-17.00	0.	1155.	132.	713.	5971.
-18.00	0.	1320.	151.	733.	6136.
-19.00	0.	1485.	170.	752.	6300.

-20.00	0.*	876.	189.	772.	6465.
-21.00	0.*	964.	207.	792.	6630.
-22.00	0.*	1291.	226.	811.	6795.
-23.00	0.*	1405.	245.	831.	6960.
-24.00	0.*	1520.	264.	851.	7124.
-25.00	0.*	1635.	283.	871.	7289.
-26.00	0.*	1753.	302.	890.	7454.
-27.00	0.*	1872.	321.	910.	7619.
-28.00	0.*	1994.	339.	930.	7784.

* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE
AT THIS ELEVATION.

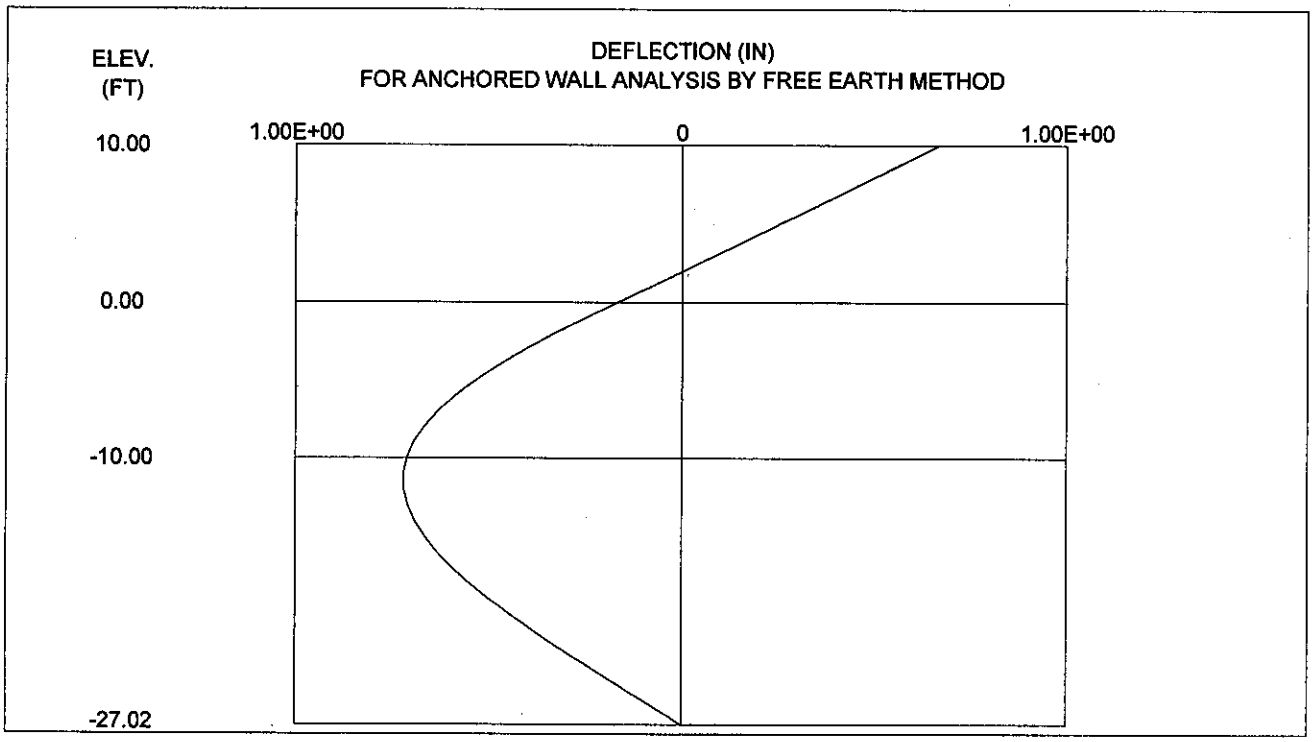
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



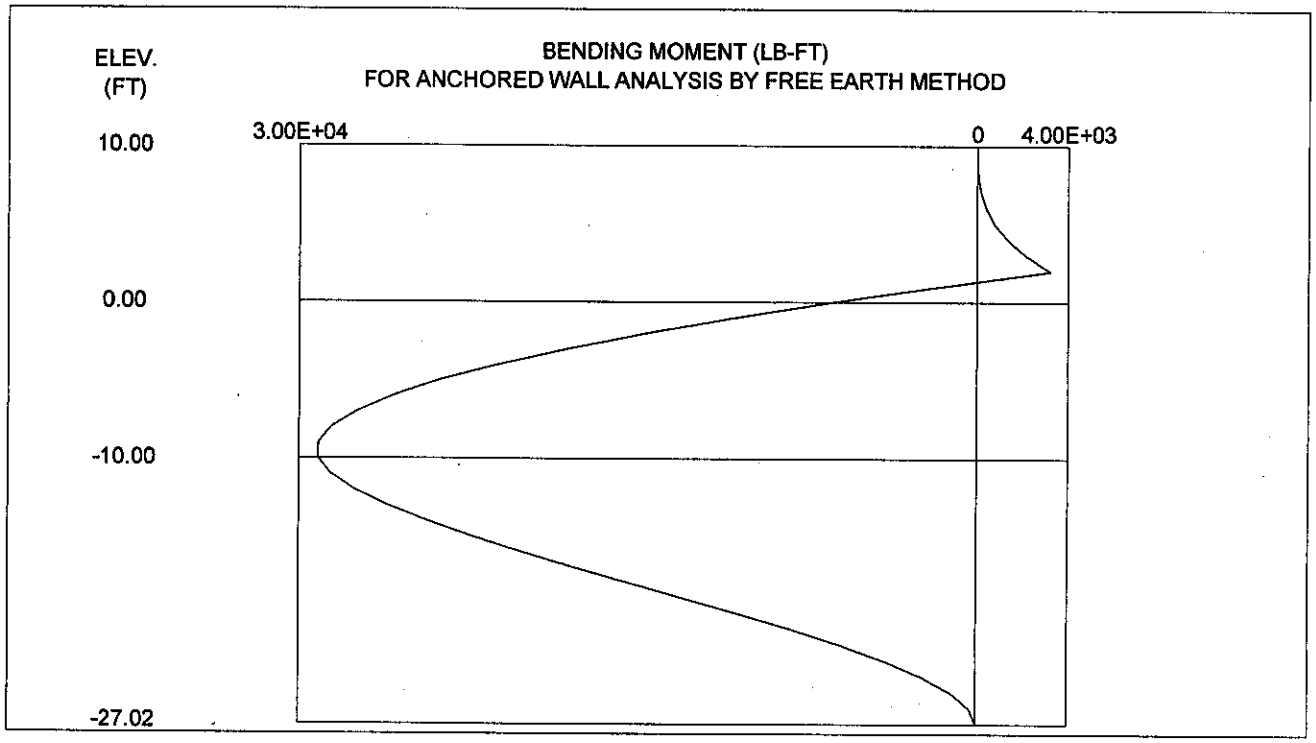
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



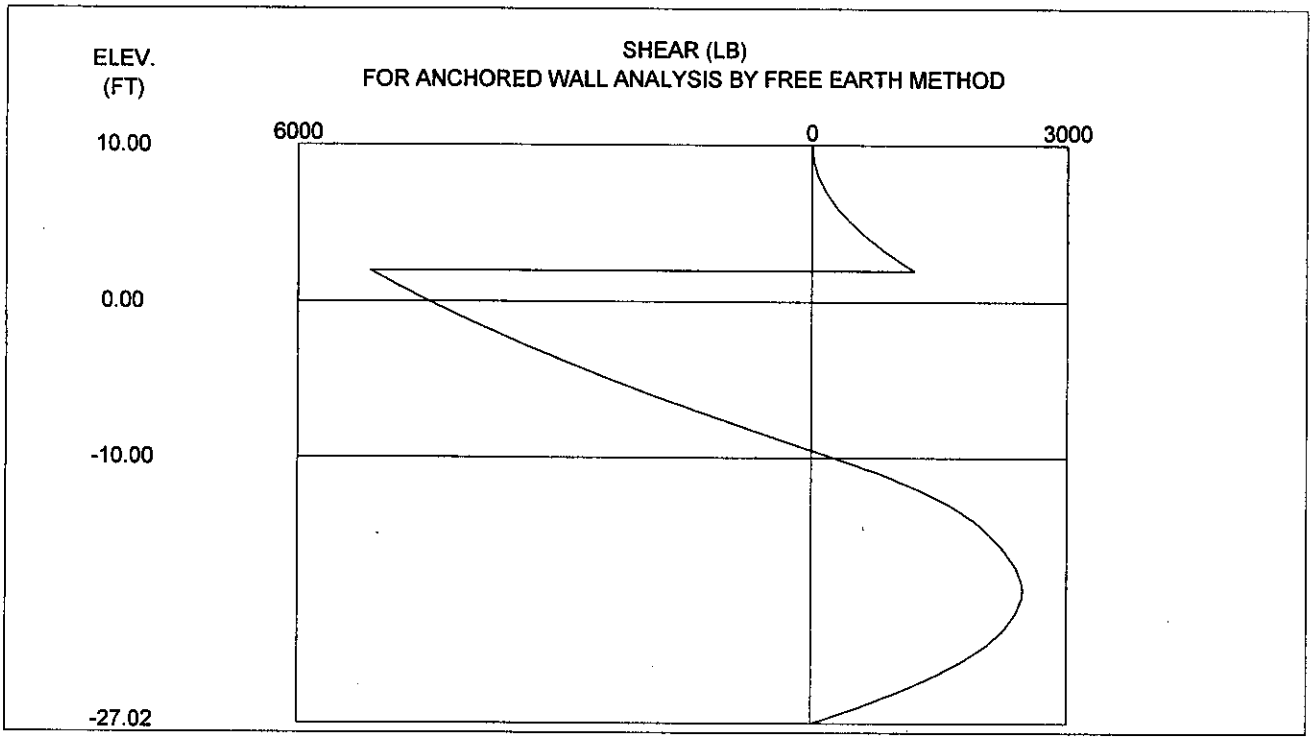
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



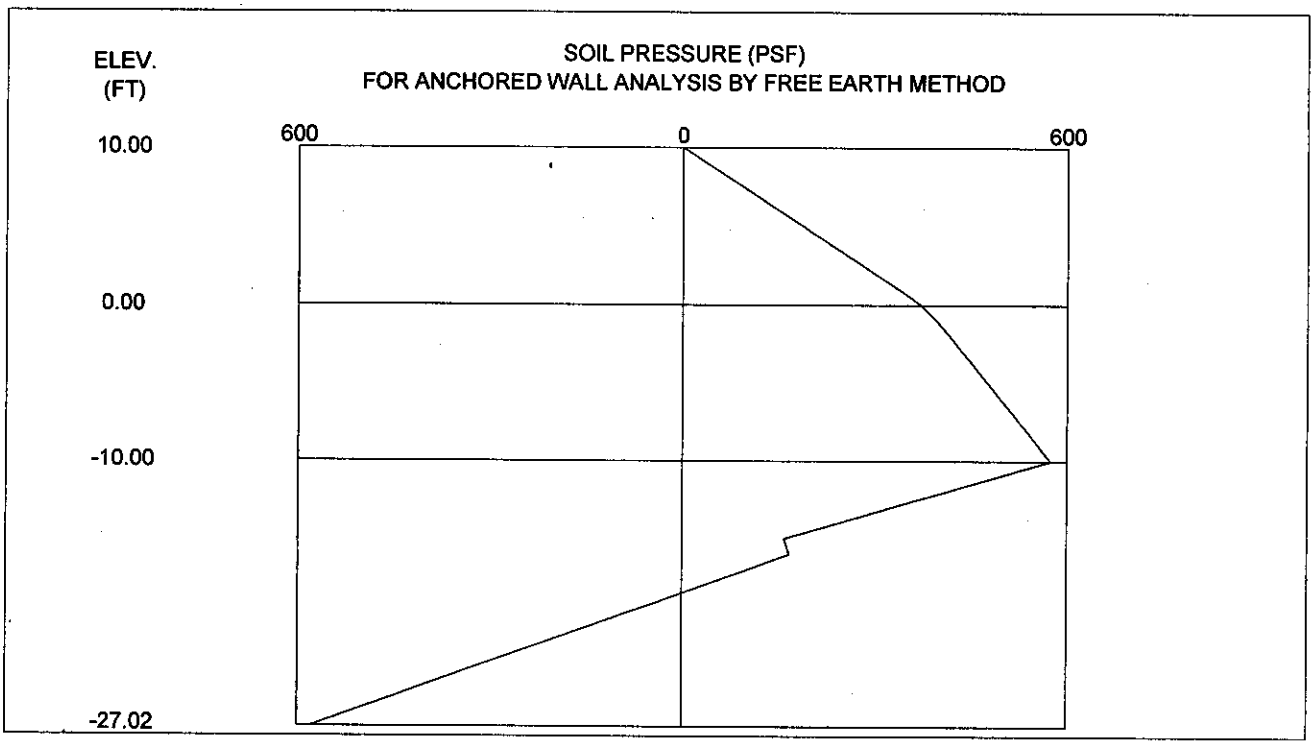
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



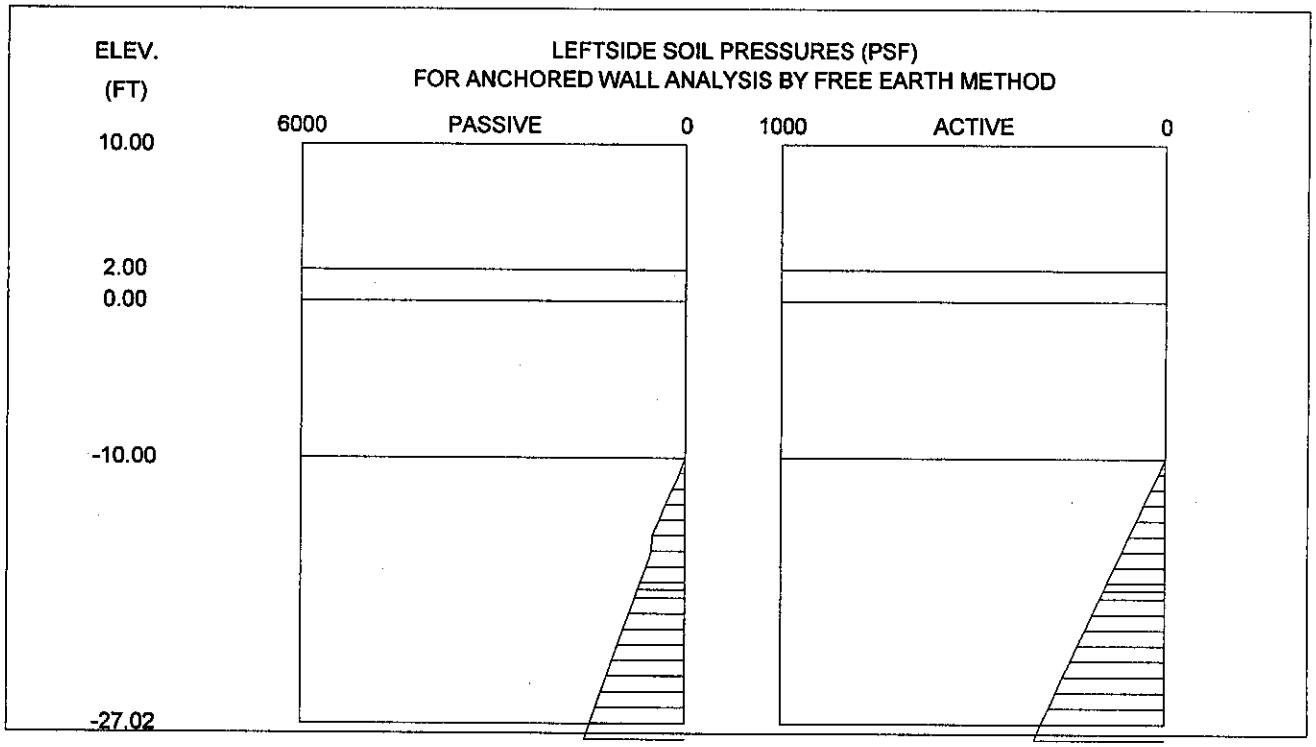
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



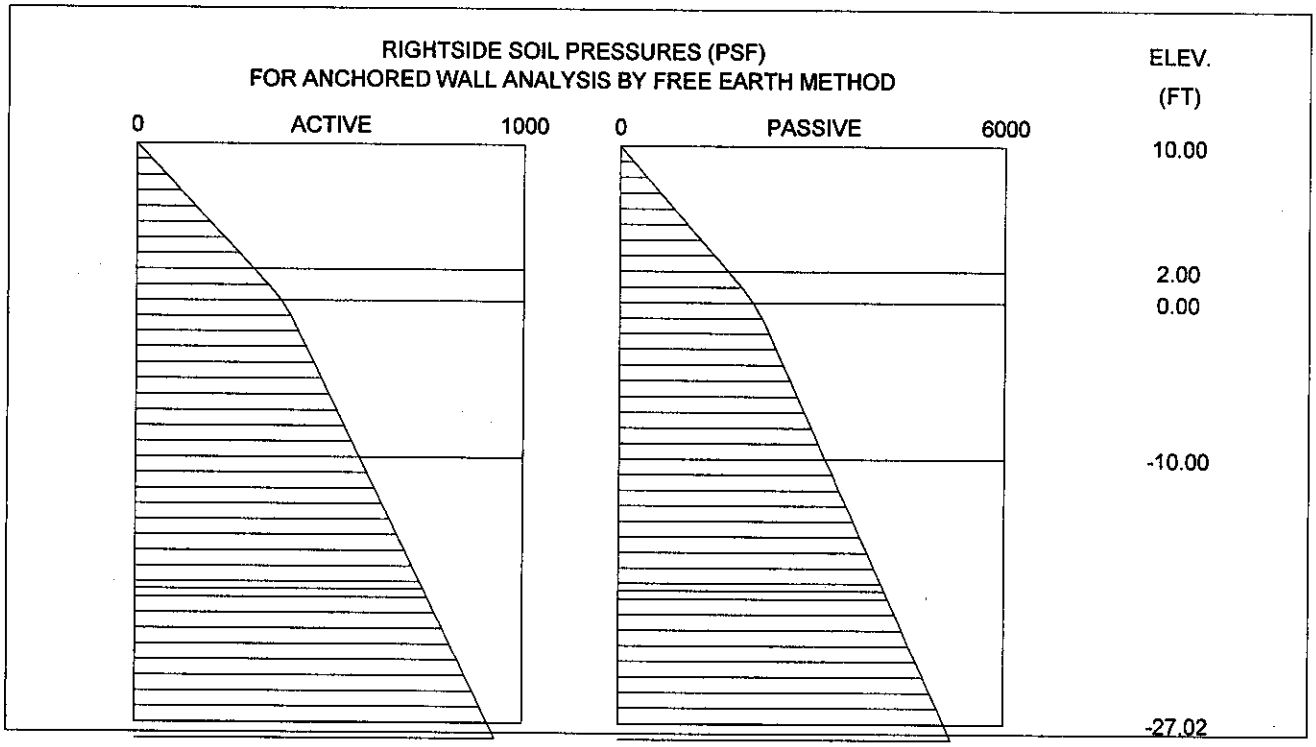
'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'



'ELIZABETH MARINA SHEET PILE AT SECTION 2-2

'ARTHUR KILL CHANNEL DREDGE EL. -54'

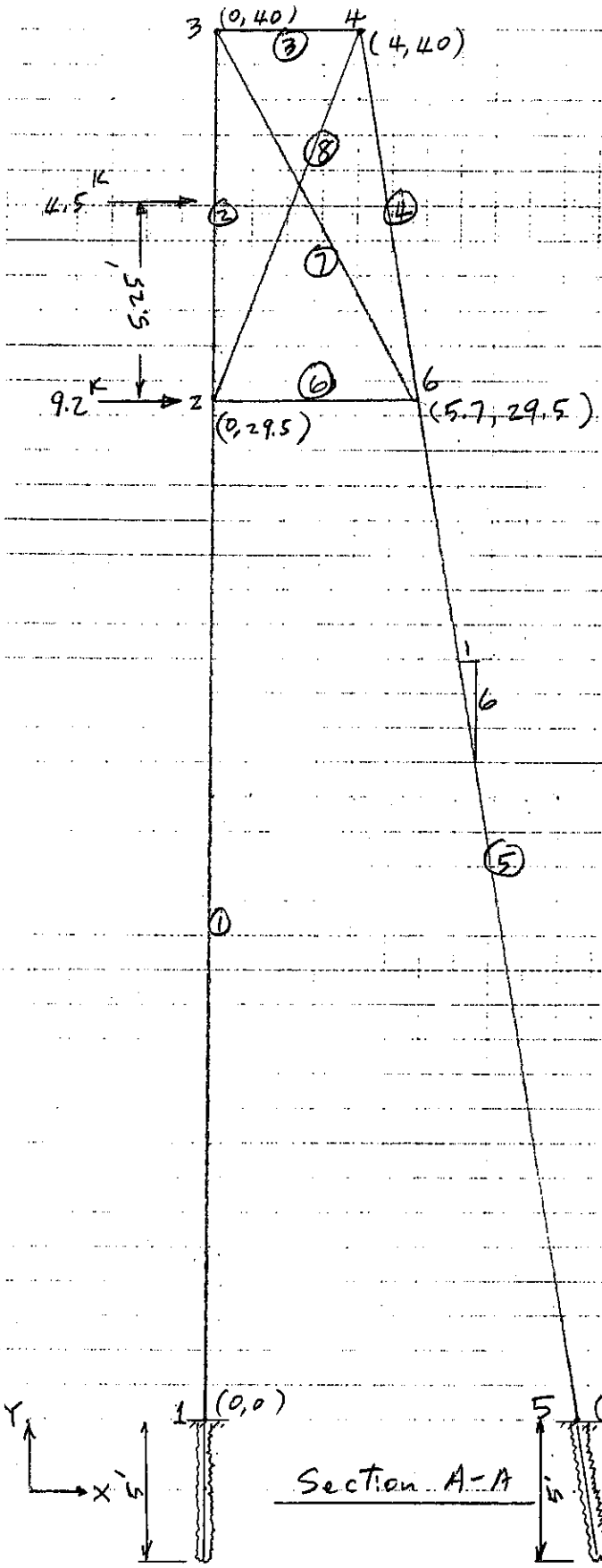


ELIZABETH MARINA

WAVE SCREEN

COMPUTATION SHEET			Page 1 of ____
Subject Elizabeth Marina Wavescreen Struct.		Project Arthur Kill Channel	
Computed by J. Chu	Date Nov. 18 2002	Checked by G.J.C.	Date 10/1/2003

Facility No. 11: Eliz. Marina Wavescreen Conceptual Design.



member: ① ② ④ ⑤ pipe 12" × 0.375"

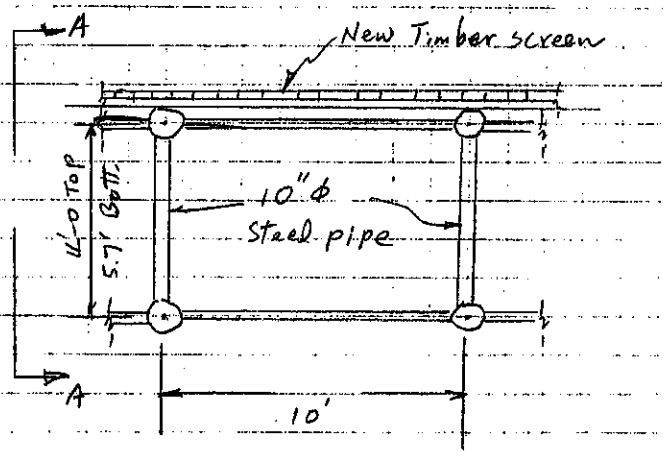
③ ⑥ pipe 10" × 0.365"

⑦ ⑧ pipe 4" × 0.237"

Load:

@ jt 2 $F_x = 9.2^K$ *

@ Mid span mem ② $F_x = 4.5^K$ *



plan

* from 'Feasibility Report for N.Y. and N.J. Harbor Navigation Study' Appendix-G Structural Sep. 1999 PA NY NJ Site #3 Sheet 5

NANY FORM 229 Apr 79

```
TAAD PLANE ELIZABETH MARINA WAVE SCREEN STRUCTURE
TART JOB INFORMATION
OB NAME N.Y.&N.J. Harbor Deepening
OB CLIENT Port Authority
NGINEER NAME Jim Chu
NGINEER DATE 15-Nov-02
ND JOB INFORMATION
NPUT WIDTH 79
NIT FEET KIP
OINT COORDINATES
 0 0 0; 2 0 29.5 0; 3 0 40 0; 4 4 40 0; 5 10.5 0 0; 6 5.69606 29.5627 0;
EMBER INCIDENCES
 1 2; 2 2 3; 3 3 4; 4 4 6; 5 6 5; 6 2 6; 7 3 6; 8 4 2;
EMBER PROPERTY AMERICAN
 8 TABLE ST PIPS40
 2 4 5 TABLE ST PIPS120
 6 TABLE ST PIPS100
NIT INCHES KIP
ONSTANTS
 29000 MEMB 1 TO 8
OISSON 0.3 MEMB 1 TO 8
ENSITY 0.000283 MEMB 1 TO 8
LPHA 6.5e-006 MEMB 1 TO 8
NIT FEET KIP
UPPORTS
 5 FIXED

OAD 1 DL
ELFWEIGHT Y -1
OAD 2 WAVELOAD
OINT LOAD
 FX 9.2
EMBER LOAD
 CON GX 4.5 5.25 0
OAD COMB 3 DL+WAVELOAD
 1.0 2 1.0
ERFORM ANALYSIS PRINT STATICS CHECK
OAD LIST 3
RINT ANALYSIS RESULTS
ARAMETER
ODE AISC
YLD 5184 ALL
Y 29.5 MEMB 1 2 4 5
Z 0 MEMB 1 2 4 5
SY 0 MEMB 1 2 4 5
MY 0.85 MEMB 1 2 4 5
RACK 1 ALL
HECK CODE ALL
INISH
```

```
**************************************************
*                                                *
*           STAAD.Pro                            *
*           Version  2002    Bld 1003            *
*           Proprietary Program of               *
*           Research Engineers,  Intl.           *
*           Date=    DEC  2, 2002                *
*           Time=    11:12:22                    *
*                                                *
*      USER ID: USACE                            *
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```
 1. STAAD PLANE ELIZABETH MARINA WAVE SCREEN STRUCTURE
 2. START JOB INFORMATION
 3. JOB NAME N.Y.N.J. HARBOR DEEPENING
 4. JOB CLIENT PORT AUTHORITY
 5. ENGINEER NAME JIM CHU
 6. ENGINEER DATE 15-NOV-02
 7. END JOB INFORMATION
 8. INPUT WIDTH 79
 9. UNIT FEET KIP
10. JOINT COORDINATES
11. 1 0 0 0; 2 0 29.5 0; 3 0 40 0; 4 4 40 0; 5 10.5 0 0; 6 5.69606 29.5627 0
12. MEMBER INCIDENCES
13. 1 1 2; 2 2 3; 3 3 4; 4 4 6; 5 6 5; 6 2 6; 7 3 6; 8 4 2
14. MEMBER PROPERTY AMERICAN
15. 7 8 TABLE ST PIPS40
16. 1 2 4 5 TABLE ST PIPS120
17. 3 6 TABLE ST PIPS100
18. UNIT INCHES KIP
19. CONSTANTS
20. E 29000 MEMB 1 TO 8
21. POISSON 0.3 MEMB 1 TO 8
22. DENSITY 0.000283 MEMB 1 TO 8
23. ALPHA 6.5E-006 MEMB 1 TO 8
24. UNIT FEET KIP
25. SUPPORTS
26. 1 5 FIXED
28. LOAD 1 DL
29. SELFWEIGHT Y -1
30. LOAD 2 WAVELOAD
31. JOINT LOAD
32. 2 FX 9.2
33. MEMBER LOAD
34. 2 CON GX 4.5 5.25 0
35. LOAD COMB 3 DL+WAVELOAD
36. 1 1.0 2 1.0
37. PERFORM ANALYSIS PRINT STATICS CHECK
```

P R O B L E M S T A T I S T I C S

```
NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =     6/     8/     2
ORIGINAL/FINAL BAND-WIDTH=     4/     4/     12 DOF
TOTAL PRIMARY LOAD CASES =    2, TOTAL DEGREES OF FREEDOM =     12
SIZE OF STIFFNESS MATRIX =       1 DOUBLE  KILO-WORDS
REQRD/AVAIL. DISK SPACE  =    12.0/  6906.3 MB,  EXMEM =  857.7 MB
```

```
***TOTAL APPLIED LOAD ( KIP  FEET ) SUMMARY (LOADING    1 )
    SUMMATION FORCE-X =        0.00
    SUMMATION FORCE-Y =       -4.63
    SUMMATION FORCE-Z =        0.00

   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=         -16.15


***TOTAL REACTION LOAD( KIP  FEET ) SUMMARY (LOADING     1 )
    SUMMATION FORCE-X =        0.00
    SUMMATION FORCE-Y =        4.63
    SUMMATION FORCE-Z =        0.00

   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=          16.15


MAXIMUM DISPLACEMENTS ( INCH /RADIANS) (LOADING      1)
          MAXIMUMS    AT NODE
   X = -3.35636E-02       2
   Y = -6.38089E-03       6
   Z =  0.00000E+00       0
   RX=  0.00000E+00       0
   RY=  0.00000E+00       0
   RZ= -7.41807E-05       3


***TOTAL APPLIED LOAD ( KIP  FEET ) SUMMARY (LOADING    2 )
    SUMMATION FORCE-X =       13.70
    SUMMATION FORCE-Y =        0.00
    SUMMATION FORCE-Z =        0.00

   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=        -427.78


***TOTAL REACTION LOAD( KIP  FEET ) SUMMARY (LOADING     2 )
    SUMMATION FORCE-X =      -13.70
    SUMMATION FORCE-Y =        0.00
    SUMMATION FORCE-Z =        0.00

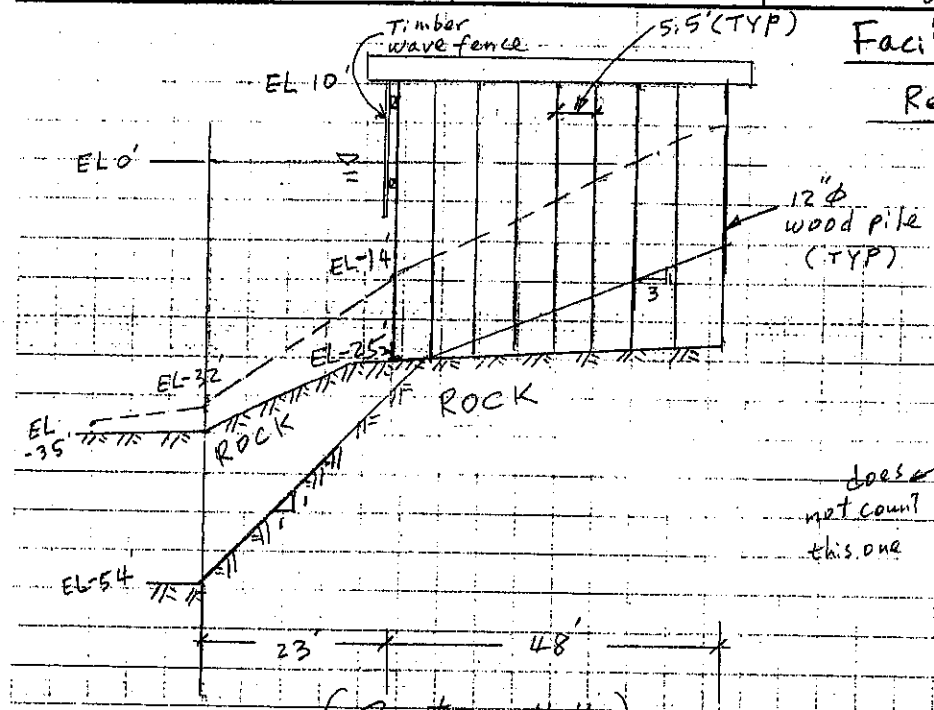
   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=         427.78
```

ELIZABETH MARINA

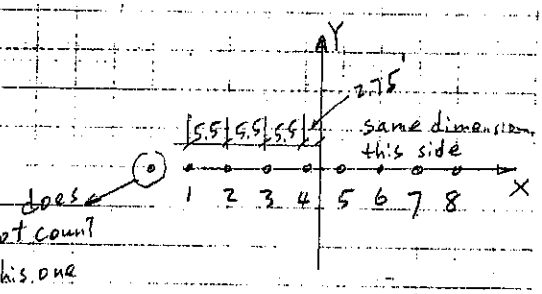
RECREATION PIER

COMPUTATION SHEET			Page 1 of ____
Subject Elizabeth Marina Recreation Pier		Project Arthur Kill Channel	
Computed by J. CHU	Date 10-2-2002	Checked by SOD	Date 10/31/03

Facility No. 12: Eliz. Marina Recreation Pier



(Section 4-4)



Average pile embed length after dredge: $(2+13)/2 = 7'$

$L = 35'$ $L_u = 24'$

$I = \pi d^4/64 = 1018\ in^4$ $A = \pi d^2/4 = 113\ in^2$

Properties:

$E = 1500\ ksi$ fixity = fixed

$I1 = 1018\ in^4$ C33 = 1

$I2 = 1018\ in^4$ B66 = 0

$A = 113\ in^2$ $L_u = 24'$

$L = 43'$

$NH = 0.10\ k/in^3$

$AC = 50^k$

$AT = 25^k$

$ACC = 1.0 \times 113 = 113^k$

$ATT = 2.0 \times 113 = 226^k$

$AM1 = AM2 = 2.0 \times 170 = 340^{k-in}$

$S = I/c = 1018/6 = 170\ in^3$

Assume wave load $= 2500\#/'$

APPlied loads

Vertical: $F_z = 300 \times 10 \times 48 = 144^k$

Horizontal

$F_x = 2500\#/' \times 10' = 25^k$

NAVY FORM 229 Apr 79

COMPUTATION SHEET			Page 2 of ____
Subject Elizabeth Marina Recreation Pier		Project Arthur Kill Channel	
Computed by J. CHU	Date 10-3-2002	Checked by SOD	Date 10/31/2002

'CPGA' Input data calculation:

critical buckling load: (for dredge EL-54')

unsupported length = $L_T = L_u + L_f$ $\quad L_u = 28'$

L_f = depth to fixity = 1.8 T

$$T = \sqrt[5]{\frac{EI}{NH}} = \sqrt[5]{\frac{1500 \times 1018}{0.010}} = 43'' = 3.6'$$

$$L_f = 1.8 \times 3.6 = 6.5' \quad \therefore L_T = 34.5'$$

$$P_{cr} = \frac{\pi^2 EI}{(K L_T)^2} = \frac{\pi^2 \times 1500 \times 1018}{(1.0)(34.5)^2(12)^2} = 88^K$$

Moment factor for fixed unsupported Piles: $L_u = 28'$

$T = 3.6'$ free standing length factor $= (m) = L_u/T = 28/3.6 = 7.8$

$H = 0.27$ (for fixed)

$KMF1 = KMF2 = T/H = 3.6/0.27 = 160''$

NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 3 of ____
Subject Elizabeth Marina Recreation Pier		Project Arther Kill Channel	
Computed by J. CHU	Date 10-3-2002	Checked by G.J.C.	Date 10/31/2003

'cPGA' Program Input Data

a) Elizabeth Marina Recreation Pier - wood Pile cap displ. dredge El. -54'

	E	I1	E2	A	C33	B66	List
b) Prop	1500	1018	1018	113	1.0	0	all

	Psoil	Esoil	Length	L	Lu	List
c) Soil	NH	0.01	L	35	28	all

d) fix all

	Shape	AC	AT	ACC	ATT	AM1	AM2	LIST
g) Allow	R	50	25	113	226	340	340	all

	Mtl	CM1	CM2	PCR1	PCR2	ST	List
j) UNSP	T	0.6	0.6	88	88	H	all

	KMF1U	KMF2	LIST
l) FUNSMOM	160	160	all

P) Pile 1. -19.25 0 0 2 -13.75 0. 3. -8.25. 0.0 4 -2.75 0.0 5 2.75, 0.0,

y) Load 1 25. 0. 144. 0. 0. 0. 6 8.25 0 0 7 13.75 0 0 8 19.25 0.0.

bb) FOUT 1 2 3 4 5 6 7 Liz Pier 1 0

ee) PFO ALL

gg) FPL N

NAVY FORM 229 Apr 79

```
1000 elizabeth marina recreation pier wood pile cap displ
1010 PRO 1500. 1018. 1018. 113 1 0 ALL
1020 SOI NH .1 L 35 24 ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL

1050 UNS T .6 .6 88. 88. H ALL
1060 FUN 160. 160. ALL
1070 PIL 1 -19.25 0. 0.
1085 ROW X 35 1 34 AT 5.5
1087 REP 8 7 AT 5.5
1090 LOA 1 25. 0. 144. 0. 0. 0.

1100 FOU 1 2 3 4 5 6 7 lizpier1
1110 PFO ALL
1130 FPL N
```

LIZPIER1

```
*********************************
* CASE PROGRAM    #  X0080      *  CPGA - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 1993/03/29   *  RUN DATE 29-OCT-2003   RUN TIME 16.13.47
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ELIZABETH MARINA RECREATION PIER WOOD PILE CAP DISPL

THERE ARE 280 PILES AND
1 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-19.25 ,	.00 ,	.00)
(	167.75 ,	38.50 ,	.00)

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PILE PROPERTIES AS INPUT

E	I1	I2	A	C33	B66
KSI	IN**4	IN**4	IN**2		
.15000E+04	.10180E+04	.10180E+04	.11300E+03	.10000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

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SOIL DESCRIPTIONS AS INPUT

NH	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.10000E+00	L	.35000E+02	.24000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

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PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X	Y	Z	BATTER	ANGLE	LENGTH	FIXITY
	FT	FT	FT			FT	
1	-19.25	.00	.00	V	.00	35.00	F
2	-13.75	.00	.00	V	.00	35.00	F
3	-8.25	.00	.00	V	.00	35.00	F
4	-2.75	.00	.00	V	.00	35.00	F
5	2.75	.00	.00	V	.00	35.00	F
6	8.25	.00	.00	V	.00	35.00	F
7	13.75	.00	.00	V	.00	35.00	F
8	19.25	.00	.00	V	.00	35.00	F
9	24.75	.00	.00	V	.00	35.00	F

10	30.25	.00	.00	V	.00	35.00	F
11	35.75	.00	.00	V	.00	35.00	F
12	41.25	.00	.00	V	.00	35.00	F
13	46.75	.00	.00	V	.00	35.00	F
14	52.25	.00	.00	V	.00	35.00	F
15	57.75	.00	.00	V	.00	35.00	F
16	63.25	.00	.00	V	.00	35.00	F
17	68.75	.00	.00	V	.00	35.00	F
18	74.25	.00	.00	V	.00	35.00	F
19	79.75	.00	.00	V	.00	35.00	F
20	85.25	.00	.00	V	.00	35.00	F
21	90.75	.00	.00	V	.00	35.00	F
22	96.25	.00	.00	V	.00	35.00	F
23	101.75	.00	.00	V	.00	35.00	F
24	107.25	.00	.00	V	.00	35.00	F
25	112.75	.00	.00	V	.00	35.00	F
26	118.25	.00	.00	V	.00	35.00	F
27	123.75	.00	.00	V	.00	35.00	F
28	129.25	.00	.00	V	.00	35.00	F
29	134.75	.00	.00	V	.00	35.00	F
30	140.25	.00	.00	V	.00	35.00	F
31	145.75	.00	.00	V	.00	35.00	F
32	151.25	.00	.00	V	.00	35.00	F
33	156.75	.00	.00	V	.00	35.00	F
34	162.25	.00	.00	V	.00	35.00	F
35	167.75	.00	.00	V	.00	35.00	F
36	-19.25	5.50	.00	V	.00	35.00	F
37	-13.75	5.50	.00	V	.00	35.00	F
38	-8.25	5.50	.00	V	.00	35.00	F
39	-2.75	5.50	.00	V	.00	35.00	F
40	2.75	5.50	.00	V	.00	35.00	F
41	8.25	5.50	.00	V	.00	35.00	F
42	13.75	5.50	.00	V	.00	35.00	F
43	19.25	5.50	.00	V	.00	35.00	F
44	24.75	5.50	.00	V	.00	35.00	F
45	30.25	5.50	.00	V	.00	35.00	F
46	35.75	5.50	.00	V	.00	35.00	F
47	41.25	5.50	.00	V	.00	35.00	F
48	46.75	5.50	.00	V	.00	35.00	F
49	52.25	5.50	.00	V	.00	35.00	F
50	57.75	5.50	.00	V	.00	35.00	F
51	63.25	5.50	.00	V	.00	35.00	F
52	68.75	5.50	.00	V	.00	35.00	F
53	74.25	5.50	.00	V	.00	35.00	F
54	79.75	5.50	.00	V	.00	35.00	F
55	85.25	5.50	.00	V	.00	35.00	F
56	90.75	5.50	.00	V	.00	35.00	F
57	96.25	5.50	.00	V	.00	35.00	F
58	101.75	5.50	.00	V	.00	35.00	F
59	107.25	5.50	.00	V	.00	35.00	F
60	112.75	5.50	.00	V	.00	35.00	F
61	118.25	5.50	.00	V	.00	35.00	F
62	123.75	5.50	.00	V	.00	35.00	F
63	129.25	5.50	.00	V	.00	35.00	F
64	134.75	5.50	.00	V	.00	35.00	F
65	140.25	5.50	.00	V	.00	35.00	F
66	145.75	5.50	.00	V	.00	35.00	F
67	151.25	5.50	.00	V	.00	35.00	F
68	156.75	5.50	.00	V	.00	35.00	F
69	162.25	5.50	.00	V	.00	35.00	F
70	167.75	5.50	.00	V	.00	35.00	F
71	-19.25	11.00	.00	V	.00	35.00	F
72	-13.75	11.00	.00	V	.00	35.00	F

73	-8.25	11.00	.00	V	.00	35.00	F
74	-2.75	11.00	.00	V	.00	35.00	F
75	2.75	11.00	.00	V	.00	35.00	F
76	8.25	11.00	.00	V	.00	35.00	F
77	13.75	11.00	.00	V	.00	35.00	F
78	19.25	11.00	.00	V	.00	35.00	F
79	24.75	11.00	.00	V	.00	35.00	F
80	30.25	11.00	.00	V	.00	35.00	F
81	35.75	11.00	.00	V	.00	35.00	F
82	41.25	11.00	.00	V	.00	35.00	F
83	46.75	11.00	.00	V	.00	35.00	F
84	52.25	11.00	.00	V	.00	35.00	F
85	57.75	11.00	.00	V	.00	35.00	F
86	63.25	11.00	.00	V	.00	35.00	F
87	68.75	11.00	.00	V	.00	35.00	F
88	74.25	11.00	.00	V	.00	35.00	F
89	79.75	11.00	.00	V	.00	35.00	F
90	85.25	11.00	.00	V	.00	35.00	F
91	90.75	11.00	.00	V	.00	35.00	F
92	96.25	11.00	.00	V	.00	35.00	F
93	101.75	11.00	.00	V	.00	35.00	F
94	107.25	11.00	.00	V	.00	35.00	F
95	112.75	11.00	.00	V	.00	35.00	F
96	118.25	11.00	.00	V	.00	35.00	F
97	123.75	11.00	.00	V	.00	35.00	F
98	129.25	11.00	.00	V	.00	35.00	F
99	134.75	11.00	.00	V	.00	35.00	F
100	140.25	11.00	.00	V	.00	35.00	F
101	145.75	11.00	.00	V	.00	35.00	F
102	151.25	11.00	.00	V	.00	35.00	F
103	156.75	11.00	.00	V	.00	35.00	F
104	162.25	11.00	.00	V	.00	35.00	F
105	167.75	11.00	.00	V	.00	35.00	F
106	-19.25	16.50	.00	V	.00	35.00	F
107	-13.75	16.50	.00	V	.00	35.00	F
108	-8.25	16.50	.00	V	.00	35.00	F
109	-2.75	16.50	.00	V	.00	35.00	F
110	2.75	16.50	.00	V	.00	35.00	F
111	8.25	16.50	.00	V	.00	35.00	F
112	13.75	16.50	.00	V	.00	35.00	F
113	19.25	16.50	.00	V	.00	35.00	F
114	24.75	16.50	.00	V	.00	35.00	F
115	30.25	16.50	.00	V	.00	35.00	F
116	35.75	16.50	.00	V	.00	35.00	F
117	41.25	16.50	.00	V	.00	35.00	F
118	46.75	16.50	.00	V	.00	35.00	F
119	52.25	16.50	.00	V	.00	35.00	F
120	57.75	16.50	.00	V	.00	35.00	F
121	63.25	16.50	.00	V	.00	35.00	F
122	68.75	16.50	.00	V	.00	35.00	F
123	74.25	16.50	.00	V	.00	35.00	F
124	79.75	16.50	.00	V	.00	35.00	F
125	85.25	16.50	.00	V	.00	35.00	F
126	90.75	16.50	.00	V	.00	35.00	F
127	96.25	16.50	.00	V	.00	35.00	F
128	101.75	16.50	.00	V	.00	35.00	F
129	107.25	16.50	.00	V	.00	35.00	F
130	112.75	16.50	.00	V	.00	35.00	F
131	118.25	16.50	.00	V	.00	35.00	F
132	123.75	16.50	.00	V	.00	35.00	F
133	129.25	16.50	.00	V	.00	35.00	F
134	134.75	16.50	.00	V	.00	35.00	F
135	140.25	16.50	.00	V	.00	35.00	F

136	145.75	16.50	.00	V	.00	35.00	F
137	151.25	16.50	.00	V	.00	35.00	F
138	156.75	16.50	.00	V	.00	35.00	F
139	162.25	16.50	.00	V	.00	35.00	F
140	167.75	16.50	.00	V	.00	35.00	F
141	-19.25	22.00	.00	V	.00	35.00	F
142	-13.75	22.00	.00	V	.00	35.00	F
143	-8.25	22.00	.00	V	.00	35.00	F
144	-2.75	22.00	.00	V	.00	35.00	F
145	2.75	22.00	.00	V	.00	35.00	F
146	8.25	22.00	.00	V	.00	35.00	F
147	13.75	22.00	.00	V	.00	35.00	F
148	19.25	22.00	.00	V	.00	35.00	F
149	24.75	22.00	.00	V	.00	35.00	F
150	30.25	22.00	.00	V	.00	35.00	F
151	35.75	22.00	.00	V	.00	35.00	F
152	41.25	22.00	.00	V	.00	35.00	F
153	46.75	22.00	.00	V	.00	35.00	F
154	52.25	22.00	.00	V	.00	35.00	F
155	57.75	22.00	.00	V	.00	35.00	F
156	63.25	22.00	.00	V	.00	35.00	F
157	68.75	22.00	.00	V	.00	35.00	F
158	74.25	22.00	.00	V	.00	35.00	F
159	79.75	22.00	.00	V	.00	35.00	F
160	85.25	22.00	.00	V	.00	35.00	F
161	90.75	22.00	.00	V	.00	35.00	F
162	96.25	22.00	.00	V	.00	35.00	F
163	101.75	22.00	.00	V	.00	35.00	F
164	107.25	22.00	.00	V	.00	35.00	F
165	112.75	22.00	.00	V	.00	35.00	F
166	118.25	22.00	.00	V	.00	35.00	F
167	123.75	22.00	.00	V	.00	35.00	F
168	129.25	22.00	.00	V	.00	35.00	F
169	134.75	22.00	.00	V	.00	35.00	F
170	140.25	22.00	.00	V	.00	35.00	F
171	145.75	22.00	.00	V	.00	35.00	F
172	151.25	22.00	.00	V	.00	35.00	F
173	156.75	22.00	.00	V	.00	35.00	F
174	162.25	22.00	.00	V	.00	35.00	F
175	167.75	22.00	.00	V	.00	35.00	F
176	-19.25	27.50	.00	V	.00	35.00	F
177	-13.75	27.50	.00	V	.00	35.00	F
178	-8.25	27.50	.00	V	.00	35.00	F
179	-2.75	27.50	.00	V	.00	35.00	F
180	2.75	27.50	.00	V	.00	35.00	F
181	8.25	27.50	.00	V	.00	35.00	F
182	13.75	27.50	.00	V	.00	35.00	F
183	19.25	27.50	.00	V	.00	35.00	F
184	24.75	27.50	.00	V	.00	35.00	F
185	30.25	27.50	.00	V	.00	35.00	F
186	35.75	27.50	.00	V	.00	35.00	F
187	41.25	27.50	.00	V	.00	35.00	F
188	46.75	27.50	.00	V	.00	35.00	F
189	52.25	27.50	.00	V	.00	35.00	F
190	57.75	27.50	.00	V	.00	35.00	F
191	63.25	27.50	.00	V	.00	35.00	F
192	68.75	27.50	.00	V	.00	35.00	F
193	74.25	27.50	.00	V	.00	35.00	F
194	79.75	27.50	.00	V	.00	35.00	F
195	85.25	27.50	.00	V	.00	35.00	F
196	90.75	27.50	.00	V	.00	35.00	F
197	96.25	27.50	.00	V	.00	35.00	F
198	101.75	27.50	.00	V	.00	35.00	F

199	107.25	27.50	.00	V	.00	35.00	F
200	112.75	27.50	.00	V	.00	35.00	F
201	118.25	27.50	.00	V	.00	35.00	F
202	123.75	27.50	.00	V	.00	35.00	F
203	129.25	27.50	.00	V	.00	35.00	F
204	134.75	27.50	.00	V	.00	35.00	F
205	140.25	27.50	.00	V	.00	35.00	F
206	145.75	27.50	.00	V	.00	35.00	F
207	151.25	27.50	.00	V	.00	35.00	F
208	156.75	27.50	.00	V	.00	35.00	F
209	162.25	27.50	.00	V	.00	35.00	F
210	167.75	27.50	.00	V	.00	35.00	F
211	-19.25	33.00	.00	V	.00	35.00	F
212	-13.75	33.00	.00	V	.00	35.00	F
213	-8.25	33.00	.00	V	.00	35.00	F
214	-2.75	33.00	.00	V	.00	35.00	F
215	2.75	33.00	.00	V	.00	35.00	F
216	8.25	33.00	.00	V	.00	35.00	F
217	13.75	33.00	.00	V	.00	35.00	F
218	19.25	33.00	.00	V	.00	35.00	F
219	24.75	33.00	.00	V	.00	35.00	F
220	30.25	33.00	.00	V	.00	35.00	F
221	35.75	33.00	.00	V	.00	35.00	F
222	41.25	33.00	.00	V	.00	35.00	F
223	46.75	33.00	.00	V	.00	35.00	F
224	52.25	33.00	.00	V	.00	35.00	F
225	57.75	33.00	.00	V	.00	35.00	F
226	63.25	33.00	.00	V	.00	35.00	F
227	68.75	33.00	.00	V	.00	35.00	F
228	74.25	33.00	.00	V	.00	35.00	F
229	79.75	33.00	.00	V	.00	35.00	F
230	85.25	33.00	.00	V	.00	35.00	F
231	90.75	33.00	.00	V	.00	35.00	F
232	96.25	33.00	.00	V	.00	35.00	F
233	101.75	33.00	.00	V	.00	35.00	F
234	107.25	33.00	.00	V	.00	35.00	F
235	112.75	33.00	.00	V	.00	35.00	F
236	118.25	33.00	.00	V	.00	35.00	F
237	123.75	33.00	.00	V	.00	35.00	F
238	129.25	33.00	.00	V	.00	35.00	F
239	134.75	33.00	.00	V	.00	35.00	F
240	140.25	33.00	.00	V	.00	35.00	F
241	145.75	33.00	.00	V	.00	35.00	F
242	151.25	33.00	.00	V	.00	35.00	F
243	156.75	33.00	.00	V	.00	35.00	F
244	162.25	33.00	.00	V	.00	35.00	F
245	167.75	33.00	.00	V	.00	35.00	F
246	-19.25	38.50	.00	V	.00	35.00	F
247	-13.75	38.50	.00	V	.00	35.00	F
248	-8.25	38.50	.00	V	.00	35.00	F
249	-2.75	38.50	.00	V	.00	35.00	F
250	2.75	38.50	.00	V	.00	35.00	F
251	8.25	38.50	.00	V	.00	35.00	F
252	13.75	38.50	.00	V	.00	35.00	F
253	19.25	38.50	.00	V	.00	35.00	F
254	24.75	38.50	.00	V	.00	35.00	F
255	30.25	38.50	.00	V	.00	35.00	F
256	35.75	38.50	.00	V	.00	35.00	F
257	41.25	38.50	.00	V	.00	35.00	F
258	46.75	38.50	.00	V	.00	35.00	F
259	52.25	38.50	.00	V	.00	35.00	F
260	57.75	38.50	.00	V	.00	35.00	F
261	63.25	38.50	.00	V	.00	35.00	F

LIZPIER1

262	68.75	38.50	.00	V	.00	35.00	F
263	74.25	38.50	.00	V	.00	35.00	F
264	79.75	38.50	.00	V	.00	35.00	F
265	85.25	38.50	.00	V	.00	35.00	F
266	90.75	38.50	.00	V	.00	35.00	F
267	96.25	38.50	.00	V	.00	35.00	F
268	101.75	38.50	.00	V	.00	35.00	F
269	107.25	38.50	.00	V	.00	35.00	F
270	112.75	38.50	.00	V	.00	35.00	F
271	118.25	38.50	.00	V	.00	35.00	F
272	123.75	38.50	.00	V	.00	35.00	F
273	129.25	38.50	.00	V	.00	35.00	F
274	134.75	38.50	.00	V	.00	35.00	F
275	140.25	38.50	.00	V	.00	35.00	F
276	145.75	38.50	.00	V	.00	35.00	F
277	151.25	38.50	.00	V	.00	35.00	F
278	156.75	38.50	.00	V	.00	35.00	F
279	162.25	38.50	.00	V	.00	35.00	F
280	167.75	38.50	.00	V	.00	35.00	F

						9800.00	

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APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	25.0	.0	144.0	.0	.0	.0

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ORIGINAL PILE GROUP STIFFNESS MATRIX

.13402E+03	.00000E+00	.00000E+00	.00000E+00	.22541E+05	-.30958E+05
.00000E+00	.13402E+03	.00000E+00	-.22541E+05	.00000E+00	.11941E+06
.00000E+00	.00000E+00	.11300E+06	.26103E+08	-.10068E+09	.00000E+00
.00000E+00	-.22541E+05	.26103E+08	.86191E+10	-.23258E+11	-.20084E+08
.22541E+05	.00000E+00	-.10068E+09	-.23258E+11	.13992E+12	-.52070E+07
-.30958E+05	.11941E+06	.00000E+00	-.20084E+08	-.52070E+07	.17615E+09

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 89.

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PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.2074E+00	-.8435E-01	.6449E-02	-.1287E-04	.2472E-05	.9224E-04

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PILE FORCES IN LOCAL GEOMETRY

LIZPIER1

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO (F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.1	.0	2.8	8.3	16.7	.0	.06	.08
		FUNSMOM		.3	.8			.03
2	.1	.0	2.8	7.8	16.7	.0	.06	.08
		FUNSMOM		.3	.8			.03
3	.1	.0	2.7	7.3	16.7	.0	.05	.08
		FUNSMOM		.3	.8			.03
4	.1	.0	2.6	6.8	16.7	.0	.05	.08
		FUNSMOM		.3	.8			.03
5	.1	.0	2.6	6.3	16.7	.0	.05	.08
		FUNSMOM		.3	.8			.03
6	.1	.0	2.5	5.8	16.7	.0	.05	.07
		FUNSMOM		.2	.8			.02
7	.1	.0	2.4	5.3	16.7	.0	.05	.07
		FUNSMOM		.2	.8			.02
8	.1	.0	2.4	4.8	16.7	.0	.05	.07
		FUNSMOM		.2	.8			.02
9	.1	.0	2.3	4.4	16.7	.0	.05	.07
		FUNSMOM		.2	.8			.02
10	.1	.0	2.2	3.9	16.7	.0	.04	.07
		FUNSMOM		.1	.8			.02
11	.1	.0	2.2	3.4	16.7	.0	.04	.07
		FUNSMOM		.1	.8			.02
12	.1	.0	2.1	2.9	16.7	.0	.04	.07
		FUNSMOM		.1	.8			.02
13	.1	.0	2.0	2.4	16.7	.0	.04	.07
		FUNSMOM		.1	.8			.02
14	.1	.0	2.0	1.9	16.7	.0	.04	.07
		FUNSMOM		.0	.8			.02
15	.1	.0	1.9	1.4	16.7	.0	.04	.07
		FUNSMOM		.0	.8			.02
16	.1	.0	1.8	.9	16.7	.0	.04	.07
		FUNSMOM		.0	.8			.02
17	.1	.0	1.8	.4	16.7	.0	.04	.07
		FUNSMOM		.0	.8			.02
18	.1	.0	1.7	-.1	16.7	.0	.03	.06
		FUNSMOM		-.1	.8			.02
19	.1	.0	1.6	-.5	16.7	.0	.03	.06
		FUNSMOM		-.1	.8			.02
20	.1	.0	1.6	-1.0	16.7	.0	.03	.06
		FUNSMOM		-.1	.8			.02
21	.1	.0	1.5	-1.5	16.7	.0	.03	.06
		FUNSMOM		-.1	.8			.02
22	.1	.0	1.5	-2.0	16.7	.0	.03	.06
		FUNSMOM		-.2	.8			.02
23	.1	.0	1.4	-2.5	16.7	.0	.03	.06
		FUNSMOM		-.2	.8			.01
24	.1	.0	1.3	-3.0	16.7	.0	.03	.06
		FUNSMOM		-.2	.8			.01
25	.1	.0	1.3	-3.5	16.7	.0	.03	.06
		FUNSMOM		-.2	.8			.01

26	.1	.0	1.2	-4.0	16.7	.0	.02	.06
		FUNSMOM		-.2	.8			.01
27	.1	.0	1.1	-4.5	16.7	.0	.02	.06
		FUNSMOM		-.3	.8			.01
28	.1	.0	1.1	-5.0	16.7	.0	.02	.06
		FUNSMOM		-.3	.8			.01
29	.1	.0	1.0	-5.4	16.7	.0	.02	.06
		FUNSMOM		-.3	.8			.01
30	.1	.0	.9	-5.9	16.7	.0	.02	.06
		FUNSMOM		-.3	.8			.01
31	.1	.0	.9	-6.4	16.7	.0	.02	.06
		FUNSMOM		-.4	.8			.01
32	.1	.0	.8	-6.9	16.7	.0	.02	.06
		FUNSMOM		-.4	.8			.01
33	.1	.0	.7	-7.4	16.7	.0	.01	.06
		FUNSMOM		-.4	.8			.01
34	.1	.0	.7	-7.9	16.7	.0	.01	.06
		FUNSMOM		-.4	.8			.01
35	.1	.0	.6	-8.4	16.7	.0	.01	.06
		FUNSMOM		-.5	.8			.01
36	.1	.0	2.5	8.3	16.3	.0	.05	.08
		FUNSMOM		.3	.8			.02
37	.1	.0	2.4	7.8	16.3	.0	.05	.07
		FUNSMOM		.3	.8			.02
38	.1	.0	2.4	7.3	16.3	.0	.05	.07
		FUNSMOM		.3	.8			.02
39	.1	.0	2.3	6.8	16.3	.0	.05	.07
		FUNSMOM		.3	.8			.02
40	.1	.0	2.2	6.3	16.3	.0	.04	.07
		FUNSMOM		.3	.8			.02
41	.1	.0	2.2	5.8	16.3	.0	.04	.07
		FUNSMOM		.2	.8			.02
42	.1	.0	2.1	5.3	16.3	.0	.04	.07
		FUNSMOM		.2	.8			.02
43	.1	.0	2.0	4.8	16.3	.0	.04	.07
		FUNSMOM		.2	.8			.02
44	.1	.0	2.0	4.4	16.3	.0	.04	.07
		FUNSMOM		.2	.8			.02
45	.1	.0	1.9	3.9	16.3	.0	.04	.07
		FUNSMOM		.1	.8			.02
46	.1	.0	1.8	3.4	16.3	.0	.04	.07
		FUNSMOM		.1	.8			.02
47	.1	.0	1.8	2.9	16.3	.0	.04	.06
		FUNSMOM		.1	.8			.02
48	.1	.0	1.7	2.4	16.3	.0	.03	.06
		FUNSMOM		.1	.8			.02
49	.1	.0	1.6	1.9	16.3	.0	.03	.06
		FUNSMOM		.0	.8			.02
50	.1	.0	1.6	1.4	16.3	.0	.03	.06
		FUNSMOM		.0	.8			.02
51	.1	.0	1.5	.9	16.3	.0	.03	.06
		FUNSMOM		.0	.8			.02
52	.1	.0	1.4	.4	16.3	.0	.03	.06
		FUNSMOM		.0	.8			.02
53	.1	.0	1.4	-.1	16.3	.0	.03	.06
		FUNSMOM		-.1	.8			.01
54	.1	.0	1.3	-.5	16.3	.0	.03	.06
		FUNSMOM		-.1	.8			.01
55	.1	.0	1.2	-1.0	16.3	.0	.02	.06
		FUNSMOM		-.1	.8			.01
56	.1	.0	1.2	-1.5	16.3	.0	.02	.06
		FUNSMOM		-.1	.8			.01
57	.1	.0	1.1	-2.0	16.3	.0	.02	.06

		FUNSMOM		-.2	.8			.01
58	.1	.0	1.0	-2.5	16.3	.0	.02	.06
		FUNSMOM		-.2	.8			.01
59	.1	.0	1.0	-3.0	16.3	.0	.02	.06
		FUNSMOM		-.2	.8			.01
60	.1	.0	.9	-3.5	16.3	.0	.02	.06
		FUNSMOM		-.2	.8			.01
61	.1	.0	.8	-4.0	16.3	.0	.02	.06
		FUNSMOM		-.2	.8			.01
62	.1	.0	.8	-4.5	16.3	.0	.02	.06
		FUNSMOM		-.3	.8			.01
63	.1	.0	.7	-5.0	16.3	.0	.01	.06
		FUNSMOM		-.3	.8			.01
64	.1	.0	.6	-5.4	16.3	.0	.01	.06
		FUNSMOM		-.3	.8			.01
65	.1	.0	.6	-5.9	16.3	.0	.01	.06
		FUNSMOM		-.3	.8			.01
66	.1	.0	.5	-6.4	16.3	.0	.01	.06
		FUNSMOM		-.4	.8			.01
67	.1	.0	.4	-6.9	16.3	.0	.01	.06
		FUNSMOM		-.4	.8			.01
68	.1	.0	.4	-7.4	16.3	.0	.01	.06
		FUNSMOM		-.4	.8			.01
69	.1	.0	.3	-7.9	16.3	.0	.01	.06
		FUNSMOM		-.4	.8			.01
70	.1	.0	.3	-8.4	16.3	.0	.01	.06
		FUNSMOM		-.5	.8			.00
71	.1	.0	2.1	8.3	15.8	.0	.04	.07
		FUNSMOM		.3	.8			.02
72	.1	.0	2.1	7.8	15.8	.0	.04	.07
		FUNSMOM		.3	.8			.02
73	.1	.0	2.0	7.3	15.8	.0	.04	.07
		FUNSMOM		.3	.8			.02
74	.1	.0	2.0	6.8	15.8	.0	.04	.07
		FUNSMOM		.3	.8			.02
75	.1	.0	1.9	6.3	15.8	.0	.04	.07
		FUNSMOM		.3	.8			.02
76	.1	.0	1.8	5.8	15.8	.0	.04	.07
		FUNSMOM		.2	.8			.02
77	.1	.0	1.8	5.3	15.8	.0	.04	.06
		FUNSMOM		.2	.8			.02
78	.1	.0	1.7	4.8	15.8	.0	.03	.06
		FUNSMOM		.2	.8			.02
79	.1	.0	1.6	4.4	15.8	.0	.03	.06
		FUNSMOM		.2	.8			.02
80	.1	.0	1.6	3.9	15.8	.0	.03	.06
		FUNSMOM		.1	.8			.02
81	.1	.0	1.5	3.4	15.8	.0	.03	.06
		FUNSMOM		.1	.8			.02
82	.1	.0	1.4	2.9	15.8	.0	.03	.06
		FUNSMOM		.1	.8			.01
83	.1	.0	1.4	2.4	15.8	.0	.03	.06
		FUNSMOM		.1	.8			.01
84	.1	.0	1.3	1.9	15.8	.0	.03	.06
		FUNSMOM		.0	.8			.01
85	.1	.0	1.2	1.4	15.8	.0	.02	.06
		FUNSMOM		.0	.8			.01
86	.1	.0	1.2	.9	15.8	.0	.02	.06
		FUNSMOM		.0	.8			.01
87	.1	.0	1.1	.4	15.8	.0	.02	.06
		FUNSMOM		.0	.8			.01
88	.1	.0	1.0	-.1	15.8	.0	.02	.06
		FUNSMOM		-.1	.8			.01

89	.1	.0	1.0	-.5	15.8	.0	.02	.05
		FUNSMOM		-.1	.8			.01
90	.1	.0	.9	-1.0	15.8	.0	.02	.05
		FUNSMOM		-.1	.8			.01
91	.1	.0	.8	-1.5	15.8	.0	.02	.05
		FUNSMOM		-.1	.8			.01
92	.1	.0	.8	-2.0	15.8	.0	.02	.05
		FUNSMOM		-.2	.8			.01
93	.1	.0	.7	-2.5	15.8	.0	.01	.05
		FUNSMOM		-.2	.8			.01
94	.1	.0	.6	-3.0	15.8	.0	.01	.05
		FUNSMOM		-.2	.8			.01
95	.1	.0	.6	-3.5	15.8	.0	.01	.05
		FUNSMOM		-.2	.8			.01
96	.1	.0	.5	-4.0	15.8	.0	.01	.05
		FUNSMOM		-.2	.8			.01
97	.1	.0	.4	-4.5	15.8	.0	.01	.05
		FUNSMOM		-.3	.8			.01
98	.1	.0	.4	-5.0	15.8	.0	.01	.05
		FUNSMOM		-.3	.8			.01
99	.1	.0	.3	-5.4	15.8	.0	.01	.05
		FUNSMOM		-.3	.8			.01
100	.1	.0	.2	-5.9	15.8	.0	.00	.05
		FUNSMOM		-.3	.8			.00
101	.1	.0	.2	-6.4	15.8	.0	.00	.05
		FUNSMOM		-.4	.8			.00
102	.1	.0	.1	-6.9	15.8	.0	.00	.05
		FUNSMOM		-.4	.8			.00
103	.1	.0	.0	-7.4	15.8	.0	.00	.05
		FUNSMOM		-.4	.8			.00
104	.1	.0	.0	-7.9	15.8	.0	.00	.05
		FUNSMOM		-.4	.8			.00
105	.1	.0	-.1	-8.4	15.8	.0	.00	.05
		FUNSMOM		-.5	.8			.00
106	.1	.0	1.8	8.3	15.3	.0	.04	.07
		FUNSMOM		.3	.8			.02
107	.1	.0	1.7	7.8	15.3	.0	.03	.07
		FUNSMOM		.3	.8			.02
108	.1	.0	1.7	7.3	15.3	.0	.03	.06
		FUNSMOM		.3	.8			.02
109	.1	.0	1.6	6.8	15.3	.0	.03	.06
		FUNSMOM		.3	.8			.02
110	.1	.0	1.5	6.3	15.3	.0	.03	.06
		FUNSMOM		.3	.8			.02
111	.1	.0	1.5	5.8	15.3	.0	.03	.06
		FUNSMOM		.2	.8			.02
112	.1	.0	1.4	5.3	15.3	.0	.03	.06
		FUNSMOM		.2	.8			.01
113	.1	.0	1.3	4.8	15.3	.0	.03	.06
		FUNSMOM		.2	.8			.01
114	.1	.0	1.3	4.4	15.3	.0	.03	.06
		FUNSMOM		.2	.8			.01
115	.1	.0	1.2	3.9	15.3	.0	.02	.06
		FUNSMOM		.1	.8			.01
116	.1	.0	1.1	3.4	15.3	.0	.02	.06
		FUNSMOM		.1	.8			.01
117	.1	.0	1.1	2.9	15.3	.0	.02	.06
		FUNSMOM		.1	.8			.01
118	.1	.0	1.0	2.4	15.3	.0	.02	.05
		FUNSMOM		.1	.8			.01
119	.1	.0	.9	1.9	15.3	.0	.02	.05
		FUNSMOM		.0	.8			.01
120	.1	.0	.9	1.4	15.3	.0	.02	.05

		FUNSMOM		.0	.8			.01
121	.1	.0	.8	.9	15.3	.0	.02	.05
		FUNSMOM		.0	.8			.01
122	.1	.0	.8	.4	15.3	.0	.02	.05
		FUNSMOM		.0	.8			.01
123	.1	.0	.7	-.1	15.3	.0	.01	.05
		FUNSMOM		-.1	.8			.01
124	.1	.0	.6	-.5	15.3	.0	.01	.05
		FUNSMOM		-.1	.8			.01
125	.1	.0	.6	-1.0	15.3	.0	.01	.05
		FUNSMOM		-.1	.8			.01
126	.1	.0	.5	-1.5	15.3	.0	.01	.05
		FUNSMOM		-.1	.8			.01
127	.1	.0	.4	-2.0	15.3	.0	.01	.05
		FUNSMOM		-.2	.8			.01
128	.1	.0	.4	-2.5	15.3	.0	.01	.05
		FUNSMOM		-.2	.8			.01
129	.1	.0	.3	-3.0	15.3	.0	.01	.05
		FUNSMOM		-.2	.8			.00
130	.1	.0	.2	-3.5	15.3	.0	.00	.05
		FUNSMOM		-.2	.8			.00
131	.1	.0	.2	-4.0	15.3	.0	.00	.05
		FUNSMOM		-.2	.8			.00
132	.1	.0	.1	-4.5	15.3	.0	.00	.05
		FUNSMOM		-.3	.8			.00
133	.1	.0	.0	-5.0	15.3	.0	.00	.05
		FUNSMOM		-.3	.8			.00
134	.1	.0	.0	-5.4	15.3	.0	.00	.05
		FUNSMOM		-.3	.8			.00
135	.1	.0	-.1	-5.9	15.3	.0	.00	.05
		FUNSMOM		-.3	.8			.00
136	.1	.0	-.2	-6.4	15.3	.0	.01	.05
		FUNSMOM		-.4	.8			.00
137	.1	.0	-.2	-6.9	15.3	.0	.01	.05
		FUNSMOM		-.4	.8			.00
138	.1	.0	-.3	-7.4	15.3	.0	.01	.05
		FUNSMOM		-.4	.8			.00
139	.1	.0	-.4	-7.9	15.3	.0	.01	.05
		FUNSMOM		-.4	.8			.00
140	.1	.0	-.4	-8.4	15.3	.0	.02	.05
		FUNSMOM		-.5	.8			.00
141	.1	.0	1.5	8.3	14.8	.0	.03	.06
		FUNSMOM		.3	.7			.02
142	.1	.0	1.4	7.8	14.8	.0	.03	.06
		FUNSMOM		.3	.7			.01
143	.1	.0	1.3	7.3	14.8	.0	.03	.06
		FUNSMOM		.3	.7			.01
144	.1	.0	1.3	6.8	14.8	.0	.03	.06
		FUNSMOM		.3	.7			.01
145	.1	.0	1.2	6.3	14.8	.0	.02	.06
		FUNSMOM		.3	.7			.01
146	.1	.0	1.1	5.8	14.8	.0	.02	.06
		FUNSMOM		.2	.7			.01
147	.1	.0	1.1	5.3	14.8	.0	.02	.06
		FUNSMOM		.2	.7			.01
148	.1	.0	1.0	4.8	14.8	.0	.02	.05
		FUNSMOM		.2	.7			.01
149	.1	.0	.9	4.4	14.8	.0	.02	.05
		FUNSMOM		.2	.7			.01
150	.1	.0	.9	3.9	14.8	.0	.02	.05
		FUNSMOM		.1	.7			.01
151	.1	.0	.8	3.4	14.8	.0	.02	.05
		FUNSMOM		.1	.7			.01

152	.1	.0	.7	2.9	14.8	.0	.01	.05
		FUNSMOM		.1	.7			.01
153	.1	.0	.7	2.4	14.8	.0	.01	.05
		FUNSMOM		.1	.7			.01
154	.1	.0	.6	1.9	14.8	.0	.01	.05
		FUNSMOM		.0	.7			.01
155	.1	.0	.5	1.4	14.8	.0	.01	.05
		FUNSMOM		.0	.7			.01
156	.1	.0	.5	.9	14.8	.0	.01	.05
		FUNSMOM		.0	.7			.01
157	.1	.0	.4	.4	14.8	.0	.01	.05
		FUNSMOM		.0	.7			.01
158	.1	.0	.3	-.1	14.8	.0	.01	.05
		FUNSMOM		-.1	.7			.01
159	.1	.0	.3	-.5	14.8	.0	.01	.05
		FUNSMOM		-.1	.7			.00
160	.1	.0	.2	-1.0	14.8	.0	.00	.05
		FUNSMOM		-.1	.7			.00
161	.1	.0	.1	-1.5	14.8	.0	.00	.05
		FUNSMOM		-.1	.7			.00
162	.1	.0	.1	-2.0	14.8	.0	.00	.04
		FUNSMOM		-.2	.7			.00
163	.1	.0	.0	-2.5	14.8	.0	.00	.04
		FUNSMOM		-.2	.7			.00
164	.1	.0	-.1	-3.0	14.8	.0	.00	.04
		FUNSMOM		-.2	.7			.00
165	.1	.0	-.1	-3.5	14.8	.0	.00	.05
		FUNSMOM		-.2	.7			.00
166	.1	.0	-.2	-4.0	14.8	.0	.01	.05
		FUNSMOM		-.2	.7			.00
167	.1	.0	-.2	-4.5	14.8	.0	.01	.05
		FUNSMOM		-.3	.7			.00
168	.1	.0	-.3	-5.0	14.8	.0	.01	.05
		FUNSMOM		-.3	.7			.00
169	.1	.0	-.4	-5.4	14.8	.0	.02	.05
		FUNSMOM		-.3	.7			.00
170	.1	.0	-.4	-5.9	14.8	.0	.02	.05
		FUNSMOM		-.3	.7			.00
171	.1	.0	-.5	-6.4	14.8	.0	.02	.05
		FUNSMOM		-.4	.7			.00
172	.1	.0	-.6	-6.9	14.8	.0	.02	.05
		FUNSMOM		-.4	.7			.01
173	.1	.0	-.6	-7.4	14.8	.0	.03	.05
		FUNSMOM		-.4	.7			.01
174	.1	.0	-.7	-7.9	14.8	.0	.03	.05
		FUNSMOM		-.4	.7			.01
175	.1	.0	-.8	-8.4	14.8	.0	.03	.05
		FUNSMOM		-.5	.7			.01
176	.1	.0	1.1	8.3	14.3	.0	.02	.06
		FUNSMOM		.3	.7			.01
177	.1	.0	1.1	7.8	14.3	.0	.02	.06
		FUNSMOM		.3	.7			.01
178	.1	.0	1.0	7.3	14.3	.0	.02	.06
		FUNSMOM		.3	.7			.01
179	.1	.0	.9	6.8	14.3	.0	.02	.05
		FUNSMOM		.3	.7			.01
180	.1	.0	.9	6.3	14.3	.0	.02	.05
		FUNSMOM		.3	.7			.01
181	.1	.0	.8	5.8	14.3	.0	.02	.05
		FUNSMOM		.2	.7			.01
182	.1	.0	.7	5.3	14.3	.0	.01	.05
		FUNSMOM		.2	.7			.01
183	.1	.0	.7	4.8	14.3	.0	.01	.05

		FUNSMOM		.2	.7			.01
184	.1	.0	.6	4.4	14.3	.0	.01	.05
		FUNSMOM		.2	.7			.01
185	.1	.0	.5	3.9	14.3	.0	.01	.05
		FUNSMOM		.1	.7			.01
186	.1	.0	.5	3.4	14.3	.0	.01	.05
		FUNSMOM		.1	.7			.01
187	.1	.0	.4	2.9	14.3	.0	.01	.05
		FUNSMOM		.1	.7			.01
188	.1	.0	.3	2.4	14.3	.0	.01	.05
		FUNSMOM		.1	.7			.01
189	.1	.0	.3	1.9	14.3	.0	.01	.04
		FUNSMOM		.0	.7			.00
190	.1	.0	.2	1.4	14.3	.0	.00	.04
		FUNSMOM		.0	.7			.00
191	.1	.0	.1	.9	14.3	.0	.00	.04
		FUNSMOM		.0	.7			.00
192	.1	.0	.1	.4	14.3	.0	.00	.04
		FUNSMOM		.0	.7			.00
193	.1	.0	.0	-.1	14.3	.0	.00	.04
		FUNSMOM		-.1	.7			.00
194	.1	.0	-.1	-.5	14.3	.0	.00	.04
		FUNSMOM		-.1	.7			.00
195	.1	.0	-.1	-1.0	14.3	.0	.01	.04
		FUNSMOM		-.1	.7			.00
196	.1	.0	-.2	-1.5	14.3	.0	.01	.04
		FUNSMOM		-.1	.7			.00
197	.1	.0	-.3	-2.0	14.3	.0	.01	.04
		FUNSMOM		-.2	.7			.00
198	.1	.0	-.3	-2.5	14.3	.0	.01	.04
		FUNSMOM		-.2	.7			.00
199	.1	.0	-.4	-3.0	14.3	.0	.02	.04
		FUNSMOM		-.2	.7			.00
200	.1	.0	-.5	-3.5	14.3	.0	.02	.05
		FUNSMOM		-.2	.7			.00
201	.1	.0	-.5	-4.0	14.3	.0	.02	.05
		FUNSMOM		-.2	.7			.00
202	.1	.0	-.6	-4.5	14.3	.0	.02	.05
		FUNSMOM		-.3	.7			.00
203	.1	.0	-.7	-5.0	14.3	.0	.03	.05
		FUNSMOM		-.3	.7			.01
204	.1	.0	-.7	-5.4	14.3	.0	.03	.05
		FUNSMOM		-.3	.7			.01
205	.1	.0	-.8	-5.9	14.3	.0	.03	.05
		FUNSMOM		-.3	.7			.01
206	.1	.0	-.9	-6.4	14.3	.0	.03	.05
		FUNSMOM		-.4	.7			.01
207	.1	.0	-.9	-6.9	14.3	.0	.04	.05
		FUNSMOM		-.4	.7			.01
208	.1	.0	-1.0	-7.4	14.3	.0	.04	.05
		FUNSMOM		-.4	.7			.01
209	.1	.0	-1.1	-7.9	14.3	.0	.04	.05
		FUNSMOM		-.4	.7			.01
210	.1	.0	-1.1	-8.4	14.3	.0	.04	.05
		FUNSMOM		-.5	.7			.01
211	.1	.0	.8	8.3	13.8	.0	.02	.05
		FUNSMOM		.3	.7			.01
212	.1	.0	.7	7.8	13.8	.0	.01	.05
		FUNSMOM		.3	.7			.01
213	.1	.0	.6	7.3	13.8	.0	.01	.05
		FUNSMOM		.3	.7			.01
214	.1	.0	.6	6.8	13.8	.0	.01	.05
		FUNSMOM		.3	.7			.01

215	.1	.0	.5	6.3	13.8	.0	.01	.05
		FUNSMOM		.3	.7			.01
216	.1	.0	.4	5.8	13.8	.0	.01	.05
		FUNSMOM		.2	.7			.01
217	.1	.0	.4	5.3	13.8	.0	.01	.05
		FUNSMOM		.2	.7			.01
218	.1	.0	.3	4.8	13.8	.0	.01	.05
		FUNSMOM		.2	.7			.00
219	.1	.0	.3	4.4	13.8	.0	.01	.04
		FUNSMOM		.2	.7			.00
220	.1	.0	.2	3.9	13.8	.0	.00	.04
		FUNSMOM		.1	.7			.00
221	.1	.0	.1	3.4	13.8	.0	.00	.04
		FUNSMOM		.1	.7			.00
222	.1	.0	.1	2.9	13.8	.0	.00	.04
		FUNSMOM		.1	.7			.00
223	.1	.0	.0	2.4	13.8	.0	.00	.04
		FUNSMOM		.1	.7			.00
224	.1	.0	-.1	1.9	13.8	.0	.00	.04
		FUNSMOM		.0	.7			.00
225	.1	.0	-.1	1.4	13.8	.0	.01	.04
		FUNSMOM		.0	.7			.00
226	.1	.0	-.2	.9	13.8	.0	.01	.04
		FUNSMOM		.0	.7			.00
227	.1	.0	-.3	.4	13.8	.0	.01	.04
		FUNSMOM		.0	.7			.00
228	.1	.0	-.3	-.1	13.8	.0	.01	.04
		FUNSMOM		-.1	.7			.00
229	.1	.0	-.4	-.5	13.8	.0	.02	.04
		FUNSMOM		-.1	.7			.00
230	.1	.0	-.5	-1.0	13.8	.0	.02	.04
		FUNSMOM		-.1	.7			.00
231	.1	.0	-.5	-1.5	13.8	.0	.02	.04
		FUNSMOM		-.1	.7			.00
232	.1	.0	-.6	-2.0	13.8	.0	.02	.04
		FUNSMOM		-.2	.7			.00
233	.1	.0	-.7	-2.5	13.8	.0	.03	.04
		FUNSMOM		-.2	.7			.01
234	.1	.0	-.7	-3.0	13.8	.0	.03	.04
		FUNSMOM		-.2	.7			.01
235	.1	.0	-.8	-3.5	13.8	.0	.03	.05
		FUNSMOM		-.2	.7			.01
236	.1	.0	-.9	-4.0	13.8	.0	.03	.05
		FUNSMOM		-.2	.7			.01
237	.1	.0	-.9	-4.5	13.8	.0	.04	.05
		FUNSMOM		-.3	.7			.01
238	.1	.0	-1.0	-5.0	13.8	.0	.04	.05
		FUNSMOM		-.3	.7			.01
239	.1	.0	-1.1	-5.4	13.8	.0	.04	.05
		FUNSMOM		-.3	.7			.01
240	.1	.0	-1.1	-5.9	13.8	.0	.05	.05
		FUNSMOM		-.3	.7			.01
241	.1	.0	-1.2	-6.4	13.8	.0	.05	.05
		FUNSMOM		-.4	.7			.01
242	.1	.0	-1.3	-6.9	13.8	.0	.05	.05
		FUNSMOM		-.4	.7			.01
243	.1	.0	-1.3	-7.4	13.8	.0	.05	.05
		FUNSMOM		-.4	.7			.01
244	.1	.0	-1.4	-7.9	13.8	.0	.06	.05
		FUNSMOM		-.4	.7			.01
245	.1	.0	-1.5	-8.4	13.8	.0	.06	.05
		FUNSMOM		-.5	.7			.01
246	.1	.0	.4	8.3	13.3	.0	.01	.05

		FUNSMOM		.3	.7			.01
247	.1	.0	.4	7.8	13.3	.0	.01	.05
		FUNSMOM		.3	.7			.01
248	.1	.0	.3	7.3	13.3	.0	.01	.05
		FUNSMOM		.3	.7			.00
249	.1	.0	.2	6.8	13.3	.0	.00	.05
		FUNSMOM		.3	.7			.00
250	.1	.0	.2	6.3	13.3	.0	.00	.04
		FUNSMOM		.3	.7			.00
251	.1	.0	.1	5.8	13.3	.0	.00	.04
		FUNSMOM		.2	.7			.00
252	.1	.0	.0	5.3	13.3	.0	.00	.04
		FUNSMOM		.2	.7			.00
253	.1	.0	.0	4.8	13.3	.0	.00	.04
		FUNSMOM		.2	.7			.00
254	.1	.0	-.1	4.4	13.3	.0	.00	.04
		FUNSMOM		.2	.7			.00
255	.1	.0	-.2	3.9	13.3	.0	.01	.04
		FUNSMOM		.1	.7			.00
256	.1	.0	-.2	3.4	13.3	.0	.01	.04
		FUNSMOM		.1	.7			.00
257	.1	.0	-.3	2.9	13.3	.0	.01	.04
		FUNSMOM		.1	.7			.00
258	.1	.0	-.4	2.4	13.3	.0	.01	.04
		FUNSMOM		.1	.7			.00
259	.1	.0	-.4	1.9	13.3	.0	.02	.04
		FUNSMOM		.0	.7			.00
260	.1	.0	-.5	1.4	13.3	.0	.02	.04
		FUNSMOM		.0	.7			.00
261	.1	.0	-.6	.9	13.3	.0	.02	.04
		FUNSMOM		.0	.7			.00
262	.1	.0	-.6	.4	13.3	.0	.02	.04
		FUNSMOM		.0	.7			.00
263	.1	.0	-.7	-.1	13.3	.0	.03	.04
		FUNSMOM		-.1	.7			.00
264	.1	.0	-.8	-.5	13.3	.0	.03	.04
		FUNSMOM		-.1	.7			.01
265	.1	.0	-.8	-1.0	13.3	.0	.03	.04
		FUNSMOM		-.1	.7			.01
266	.1	.0	-.9	-1.5	13.3	.0	.04	.04
		FUNSMOM		-.1	.7			.01
267	.1	.0	-.9	-2.0	13.3	.0	.04	.04
		FUNSMOM		-.2	.7			.01
268	.1	.0	-1.0	-2.5	13.3	.0	.04	.04
		FUNSMOM		-.2	.7			.01
269	.1	.0	-1.1	-3.0	13.3	.0	.04	.04
		FUNSMOM		-.2	.7			.01
270	.1	.0	-1.1	-3.5	13.3	.0	.05	.05
		FUNSMOM		-.2	.7			.01
271	.1	.0	-1.2	-4.0	13.3	.0	.05	.05
		FUNSMOM		-.2	.7			.01
272	.1	.0	-1.3	-4.5	13.3	.0	.05	.05
		FUNSMOM		-.3	.7			.01
273	.1	.0	-1.3	-5.0	13.3	.0	.05	.05
		FUNSMOM		-.3	.7			.01
274	.1	.0	-1.4	-5.4	13.3	.0	.06	.05
		FUNSMOM		-.3	.7			.01
275	.1	.0	-1.5	-5.9	13.3	.0	.06	.05
		FUNSMOM		-.3	.7			.01
276	.1	.0	-1.5	-6.4	13.3	.0	.06	.05
		FUNSMOM		-.4	.7			.01
277	.1	.0	-1.6	-6.9	13.3	.0	.06	.05
		FUNSMOM		-.4	.7			.01

278	.1	.0	-1.7	-7.4	13.3	.0	.07	.05
		FUNSMOM		-.4	.7			.01
279	.1	.0	-1.7	-7.9	13.3	.0	.07	.05
		FUNSMOM		-.4	.7			.01
280	.1	.0	-1.8	-8.4	13.3	.0	.07	.05
		FUNSMOM		-.5	.7			.01

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PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.1	.0	2.8	8.3	16.7	.0
2	.1	.0	2.8	7.8	16.7	.0
3	.1	.0	2.7	7.3	16.7	.0
4	.1	.0	2.6	6.8	16.7	.0
5	.1	.0	2.6	6.3	16.7	.0
6	.1	.0	2.5	5.8	16.7	.0
7	.1	.0	2.4	5.3	16.7	.0
8	.1	.0	2.4	4.8	16.7	.0
9	.1	.0	2.3	4.4	16.7	.0
10	.1	.0	2.2	3.9	16.7	.0
11	.1	.0	2.2	3.4	16.7	.0
12	.1	.0	2.1	2.9	16.7	.0
13	.1	.0	2.0	2.4	16.7	.0
14	.1	.0	2.0	1.9	16.7	.0
15	.1	.0	1.9	1.4	16.7	.0
16	.1	.0	1.8	.9	16.7	.0
17	.1	.0	1.8	.4	16.7	.0
18	.1	.0	1.7	-.1	16.7	.0
19	.1	.0	1.6	-.5	16.7	.0
20	.1	.0	1.6	-1.0	16.7	.0
21	.1	.0	1.5	-1.5	16.7	.0
22	.1	.0	1.5	-2.0	16.7	.0
23	.1	.0	1.4	-2.5	16.7	.0
24	.1	.0	1.3	-3.0	16.7	.0
25	.1	.0	1.3	-3.5	16.7	.0
26	.1	.0	1.2	-4.0	16.7	.0
27	.1	.0	1.1	-4.5	16.7	.0
28	.1	.0	1.1	-5.0	16.7	.0
29	.1	.0	1.0	-5.4	16.7	.0
30	.1	.0	.9	-5.9	16.7	.0
31	.1	.0	.9	-6.4	16.7	.0
32	.1	.0	.8	-6.9	16.7	.0
33	.1	.0	.7	-7.4	16.7	.0
34	.1	.0	.7	-7.9	16.7	.0
35	.1	.0	.6	-8.4	16.7	.0
36	.1	.0	2.5	8.3	16.3	.0
37	.1	.0	2.4	7.8	16.3	.0
38	.1	.0	2.4	7.3	16.3	.0
39	.1	.0	2.3	6.8	16.3	.0
40	.1	.0	2.2	6.3	16.3	.0
41	.1	.0	2.2	5.8	16.3	.0
42	.1	.0	2.1	5.3	16.3	.0
43	.1	.0	2.0	4.8	16.3	.0
44	.1	.0	2.0	4.4	16.3	.0

45	.1	.0	1.9	3.9	16.3	.0
46	.1	.0	1.8	3.4	16.3	.0
47	.1	.0	1.8	2.9	16.3	.0
48	.1	.0	1.7	2.4	16.3	.0
49	.1	.0	1.6	1.9	16.3	.0
50	.1	.0	1.6	1.4	16.3	.0
51	.1	.0	1.5	.9	16.3	.0
52	.1	.0	1.4	.4	16.3	.0
53	.1	.0	1.4	-.1	16.3	.0
54	.1	.0	1.3	-.5	16.3	.0
55	.1	.0	1.2	-1.0	16.3	.0
56	.1	.0	1.2	-1.5	16.3	.0
57	.1	.0	1.1	-2.0	16.3	.0
58	.1	.0	1.0	-2.5	16.3	.0
59	.1	.0	1.0	-3.0	16.3	.0
60	.1	.0	.9	-3.5	16.3	.0
61	.1	.0	.8	-4.0	16.3	.0
62	.1	.0	.8	-4.5	16.3	.0
63	.1	.0	.7	-5.0	16.3	.0
64	.1	.0	.6	-5.4	16.3	.0
65	.1	.0	.6	-5.9	16.3	.0
66	.1	.0	.5	-6.4	16.3	.0
67	.1	.0	.4	-6.9	16.3	.0
68	.1	.0	.4	-7.4	16.3	.0
69	.1	.0	.3	-7.9	16.3	.0
70	.1	.0	.3	-8.4	16.3	.0
71	.1	.0	2.1	8.3	15.8	.0
72	.1	.0	2.1	7.8	15.8	.0
73	.1	.0	2.0	7.3	15.8	.0
74	.1	.0	2.0	6.8	15.8	.0
75	.1	.0	1.9	6.3	15.8	.0
76	.1	.0	1.8	5.8	15.8	.0
77	.1	.0	1.8	5.3	15.8	.0
78	.1	.0	1.7	4.8	15.8	.0
79	.1	.0	1.6	4.4	15.8	.0
80	.1	.0	1.6	3.9	15.8	.0
81	.1	.0	1.5	3.4	15.8	.0
82	.1	.0	1.4	2.9	15.8	.0
83	.1	.0	1.4	2.4	15.8	.0
84	.1	.0	1.3	1.9	15.8	.0
85	.1	.0	1.2	1.4	15.8	.0
86	.1	.0	1.2	.9	15.8	.0
87	.1	.0	1.1	.4	15.8	.0
88	.1	.0	1.0	-.1	15.8	.0
89	.1	.0	1.0	-.5	15.8	.0
90	.1	.0	.9	-1.0	15.8	.0
91	.1	.0	.8	-1.5	15.8	.0
92	.1	.0	.8	-2.0	15.8	.0
93	.1	.0	.7	-2.5	15.8	.0
94	.1	.0	.6	-3.0	15.8	.0
95	.1	.0	.6	-3.5	15.8	.0
96	.1	.0	.5	-4.0	15.8	.0
97	.1	.0	.4	-4.5	15.8	.0
98	.1	.0	.4	-5.0	15.8	.0
99	.1	.0	.3	-5.4	15.8	.0
100	.1	.0	.2	-5.9	15.8	.0
101	.1	.0	.2	-6.4	15.8	.0
102	.1	.0	.1	-6.9	15.8	.0
103	.1	.0	.0	-7.4	15.8	.0
104	.1	.0	.0	-7.9	15.8	.0
105	.1	.0	-.1	-8.4	15.8	.0
106	.1	.0	1.8	8.3	15.3	.0
107	.1	.0	1.7	7.8	15.3	.0

108	.1	.0	1.7	7.3	15.3	.0
109	.1	.0	1.6	6.8	15.3	.0
110	.1	.0	1.5	6.3	15.3	.0
111	.1	.0	1.5	5.8	15.3	.0
112	.1	.0	1.4	5.3	15.3	.0
113	.1	.0	1.3	4.8	15.3	.0
114	.1	.0	1.3	4.4	15.3	.0
115	.1	.0	1.2	3.9	15.3	.0
116	.1	.0	1.1	3.4	15.3	.0
117	.1	.0	1.1	2.9	15.3	.0
118	.1	.0	1.0	2.4	15.3	.0
119	.1	.0	.9	1.9	15.3	.0
120	.1	.0	.9	1.4	15.3	.0
121	.1	.0	.8	.9	15.3	.0
122	.1	.0	.8	.4	15.3	.0
123	.1	.0	.7	-.1	15.3	.0
124	.1	.0	.6	-.5	15.3	.0
125	.1	.0	.6	-1.0	15.3	.0
126	.1	.0	.5	-1.5	15.3	.0
127	.1	.0	.4	-2.0	15.3	.0
128	.1	.0	.4	-2.5	15.3	.0
129	.1	.0	.3	-3.0	15.3	.0
130	.1	.0	.2	-3.5	15.3	.0
131	.1	.0	.2	-4.0	15.3	.0
132	.1	.0	.1	-4.5	15.3	.0
133	.1	.0	.0	-5.0	15.3	.0
134	.1	.0	.0	-5.4	15.3	.0
135	.1	.0	-.1	-5.9	15.3	.0
136	.1	.0	-.2	-6.4	15.3	.0
137	.1	.0	-.2	-6.9	15.3	.0
138	.1	.0	-.3	-7.4	15.3	.0
139	.1	.0	-.4	-7.9	15.3	.0
140	.1	.0	-.4	-8.4	15.3	.0
141	.1	.0	1.5	8.3	14.8	.0
142	.1	.0	1.4	7.8	14.8	.0
143	.1	.0	1.3	7.3	14.8	.0
144	.1	.0	1.3	6.8	14.8	.0
145	.1	.0	1.2	6.3	14.8	.0
146	.1	.0	1.1	5.8	14.8	.0
147	.1	.0	1.1	5.3	14.8	.0
148	.1	.0	1.0	4.8	14.8	.0
149	.1	.0	.9	4.4	14.8	.0
150	.1	.0	.9	3.9	14.8	.0
151	.1	.0	.8	3.4	14.8	.0
152	.1	.0	.7	2.9	14.8	.0
153	.1	.0	.7	2.4	14.8	.0
154	.1	.0	.6	1.9	14.8	.0
155	.1	.0	.5	1.4	14.8	.0
156	.1	.0	.5	.9	14.8	.0
157	.1	.0	.4	.4	14.8	.0
158	.1	.0	.3	-.1	14.8	.0
159	.1	.0	.3	-.5	14.8	.0
160	.1	.0	.2	-1.0	14.8	.0
161	.1	.0	.1	-1.5	14.8	.0
162	.1	.0	.1	-2.0	14.8	.0
163	.1	.0	.0	-2.5	14.8	.0
164	.1	.0	-.1	-3.0	14.8	.0
165	.1	.0	-.1	-3.5	14.8	.0
166	.1	.0	-.2	-4.0	14.8	.0
167	.1	.0	-.2	-4.5	14.8	.0
168	.1	.0	-.3	-5.0	14.8	.0
169	.1	.0	-.4	-5.4	14.8	.0
170	.1	.0	-.4	-5.9	14.8	.0

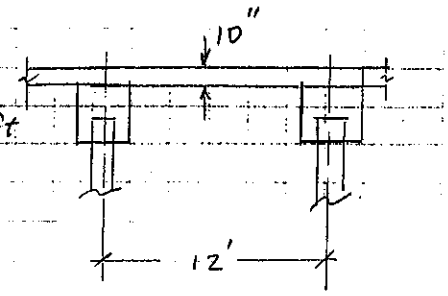
171	.1	.0	-.5	-6.4	14.8	.0
172	.1	.0	-.6	-6.9	14.8	.0
173	.1	.0	-.6	-7.4	14.8	.0
174	.1	.0	-.7	-7.9	14.8	.0
175	.1	.0	-.8	-8.4	14.8	.0
176	.1	.0	1.1	8.3	14.3	.0
177	.1	.0	1.1	7.8	14.3	.0
178	.1	.0	1.0	7.3	14.3	.0
179	.1	.0	.9	6.8	14.3	.0
180	.1	.0	.9	6.3	14.3	.0
181	.1	.0	.8	5.8	14.3	.0
182	.1	.0	.7	5.3	14.3	.0
183	.1	.0	.7	4.8	14.3	.0
184	.1	.0	.6	4.4	14.3	.0
185	.1	.0	.5	3.9	14.3	.0
186	.1	.0	.5	3.4	14.3	.0
187	.1	.0	.4	2.9	14.3	.0
188	.1	.0	.3	2.4	14.3	.0
189	.1	.0	.3	1.9	14.3	.0
190	.1	.0	.2	1.4	14.3	.0
191	.1	.0	.1	.9	14.3	.0
192	.1	.0	.1	.4	14.3	.0
193	.1	.0	.0	-.1	14.3	.0
194	.1	.0	-.1	-.5	14.3	.0
195	.1	.0	-.1	-1.0	14.3	.0
196	.1	.0	-.2	-1.5	14.3	.0
197	.1	.0	-.3	-2.0	14.3	.0
198	.1	.0	-.3	-2.5	14.3	.0
199	.1	.0	-.4	-3.0	14.3	.0
200	.1	.0	-.5	-3.5	14.3	.0
201	.1	.0	-.5	-4.0	14.3	.0
202	.1	.0	-.6	-4.5	14.3	.0
203	.1	.0	-.7	-5.0	14.3	.0
204	.1	.0	-.7	-5.4	14.3	.0
205	.1	.0	-.8	-5.9	14.3	.0
206	.1	.0	-.9	-6.4	14.3	.0
207	.1	.0	-.9	-6.9	14.3	.0
208	.1	.0	-1.0	-7.4	14.3	.0
209	.1	.0	-1.1	-7.9	14.3	.0
210	.1	.0	-1.1	-8.4	14.3	.0
211	.1	.0	.8	8.3	13.8	.0
212	.1	.0	.7	7.8	13.8	.0
213	.1	.0	.6	7.3	13.8	.0
214	.1	.0	.6	6.8	13.8	.0
215	.1	.0	.5	6.3	13.8	.0
216	.1	.0	.4	5.8	13.8	.0
217	.1	.0	.4	5.3	13.8	.0
218	.1	.0	.3	4.8	13.8	.0
219	.1	.0	.3	4.4	13.8	.0
220	.1	.0	.2	3.9	13.8	.0
221	.1	.0	.1	3.4	13.8	.0
222	.1	.0	.1	2.9	13.8	.0
223	.1	.0	.0	2.4	13.8	.0
224	.1	.0	-.1	1.9	13.8	.0
225	.1	.0	-.1	1.4	13.8	.0
226	.1	.0	-.2	.9	13.8	.0
227	.1	.0	-.3	.4	13.8	.0
228	.1	.0	-.3	-.1	13.8	.0
229	.1	.0	-.4	-.5	13.8	.0
230	.1	.0	-.5	-1.0	13.8	.0
231	.1	.0	-.5	-1.5	13.8	.0
232	.1	.0	-.6	-2.0	13.8	.0
233	.1	.0	-.7	-2.5	13.8	.0

234	.1	.0	-.7	-3.0	13.8	.0
235	.1	.0	-.8	-3.5	13.8	.0
236	.1	.0	-.9	-4.0	13.8	.0
237	.1	.0	-.9	-4.5	13.8	.0
238	.1	.0	-1.0	-5.0	13.8	.0
239	.1	.0	-1.1	-5.4	13.8	.0
240	.1	.0	-1.1	-5.9	13.8	.0
241	.1	.0	-1.2	-6.4	13.8	.0
242	.1	.0	-1.3	-6.9	13.8	.0
243	.1	.0	-1.3	-7.4	13.8	.0
244	.1	.0	-1.4	-7.9	13.8	.0
245	.1	.0	-1.5	-8.4	13.8	.0
246	.1	.0	.4	8.3	13.3	.0
247	.1	.0	.4	7.8	13.3	.0
248	.1	.0	.3	7.3	13.3	.0
249	.1	.0	.2	6.8	13.3	.0
250	.1	.0	.2	6.3	13.3	.0
251	.1	.0	.1	5.8	13.3	.0
252	.1	.0	.0	5.3	13.3	.0
253	.1	.0	.0	4.8	13.3	.0
254	.1	.0	-.1	4.4	13.3	.0
255	.1	.0	-.2	3.9	13.3	.0
256	.1	.0	-.2	3.4	13.3	.0
257	.1	.0	-.3	2.9	13.3	.0
258	.1	.0	-.4	2.4	13.3	.0
259	.1	.0	-.4	1.9	13.3	.0
260	.1	.0	-.5	1.4	13.3	.0
261	.1	.0	-.6	.9	13.3	.0
262	.1	.0	-.6	.4	13.3	.0
263	.1	.0	-.7	-.1	13.3	.0
264	.1	.0	-.8	-.5	13.3	.0
265	.1	.0	-.8	-1.0	13.3	.0
266	.1	.0	-.9	-1.5	13.3	.0
267	.1	.0	-.9	-2.0	13.3	.0
268	.1	.0	-1.0	-2.5	13.3	.0
269	.1	.0	-1.1	-3.0	13.3	.0
270	.1	.0	-1.1	-3.5	13.3	.0
271	.1	.0	-1.2	-4.0	13.3	.0
272	.1	.0	-1.3	-4.5	13.3	.0
273	.1	.0	-1.3	-5.0	13.3	.0
274	.1	.0	-1.4	-5.4	13.3	.0
275	.1	.0	-1.5	-5.9	13.3	.0
276	.1	.0	-1.5	-6.4	13.3	.0
277	.1	.0	-1.6	-6.9	13.3	.0
278	.1	.0	-1.7	-7.4	13.3	.0
279	.1	.0	-1.7	-7.9	13.3	.0
280	.1	.0	-1.8	-8.4	13.3	.0

COMPUTATION SHEET			Page 2 of ____
Subject Elizabeth Marina Recreation Pier		Project Arthur Kill Channel	
Computed by J. CHU	Date 10/1/2003	Checked by G.J.C.	Date 10/31/2003

Pier Deck: use 10" min thickness for emergency vehicle traffic, w/ 3" conc. cover over rebar.

use $w = 200$ psf LL on 12'x12' grid.



DL $M_{max} = \frac{10}{12}(0.150)(12)^2/10 \times 1.4 = 2.5$ k-ft/ft

LL $= 0.2 \times 12^2/10 \times 1.7 = 4.9$ k-'/'

Total $= 7.4$ k-'/'

$M_{max} = \phi A_s f_y d \left(1 - 0.59\, \rho f_y / f_c'\right)$ (ρbd)

$(12)(7.4)^{k-''} = 0.9\rho(60)(12'')(6.5)^2(1 - 0.59\rho\, 60/4)$

$\rho^2 - .113\rho + 0.000366 = 0$

$\rho = 0.00334$

$\rho_{max} = 0.75\rho_b = 0.75 \times 0.0285 = 0.0213$

$\rho_{min} = 200/f_y = 200/60{,}000 = 0.0033$

$\therefore A_s = 0.00334(6.5)(12) = 0.26$ in²/ft

use 1 #5 @ 12" $A_s = 0.31$ in²/ft

NANY FORM 229 Apr 79

```
STAAD PLANE
START JOB INFORMATION
JOB NAME N.Y.N.J. Harbor Dredging
JOB CLIENT Port  Authority
JOB PART Elizabeth  City Marina Recreational Pier
ENGINEER NAME Jim Chu
ENGINEER DATE 04-Nov-02
END JOB INFORMATION
INPUT WIDTH 79
UNIT FEET KIP
JOINT COORDINATES
1 0 0 0; 2 0 40 0; 3 12 40 0; 4 12 5 0; 5 24 40 0; 6 24 5 0; 7 36 40 0;
8 36 5 0; 9 48 40 0; 10 48 5 0;
MEMBER INCIDENCES
1 1 2; 2 2 3; 3 3 4; 4 3 5; 5 5 6; 6 5 7; 7 7 8; 8 7 9; 9 9 10;
START USER TABLE
TABLE 1
UNIT INCHES KIP
PIPE
PIPX120
14.75 13.75 22.32 22.32
END
UNIT INCHES KIP
MEMBER PROPERTY AMERICAN
2 4 6 8 PRIS YD 24 ZD 24
MEMBER PROPERTY AMERICAN
1 3 5 7 9 UPTABLE 1 PIPX120
UNIT FEET KIP
SUPPORTS
1 FIXED
4 FIXED
6 FIXED
3 FIXED
10 FIXED
UNIT INCHES KIP
CONSTANTS
E 3150 MEMB 2 4 6 8
E 29000 MEMB 1 3 5 7 9
POISSON 0.3 MEMB 1 3 5 7 9
DENSITY 0.000283 MEMB 1 3 5 7 9
ALPHA 6.5e-006 MEMB 1 3 5 7 9
POISSON 0.17 MEMB 2 4 6 8
DENSITY 8.68e-005 MEMB 2 4 6 8
ALPHA 5.5e-006 MEMB 2 4 6 8
LOAD 1 DL+LL+WAVE LOAD
UNIT FEET KIP
MEMBER LOAD
2 4 6 8 UNI GY -3.075
JOINT LOAD
2 FX 28
PERFORM ANALYSIS PRINT STATICS CHECK
PRINT MEMBER FORCES ALL
PRINT SUPPORT REACTION LIST 1 4 6 8 10
LOAD LIST ALL
START CONCRETE DESIGN
CODE ACI
FYMAIN 8640 MEMB 2 4 6 8
FC 576 MEMB 2 4 6 8
TRACK 2 MEMB 2 4 6 8
CLT 0.125 MEMB 2 4 6 8
CLB 0.125 MEMB 2 4 6 8
CLS 0.125 MEMB 2 4 6 8
DESIGN BEAM 2 4 6 8
END CONCRETE DESIGN
```

```
PARAMETER
CODE AISC
FYLD 5184 MEMB 1 3 5 7 9
TRACK 1 MEMB 1 3 5 7 9
CHECK CODE MEMB 1 3 5 7 9
FINISH
```

```
**************************************************
*                                                *
*           STAAD.Pro                            *
*           Version  2002    Bld 1003            *
*           Proprietary Program of               *
*           Research Engineers,  Intl.           *
*           Date=    NOV 18, 2002                *
*           Time=    10:40:52                    *
*                                                *
*      USER ID: USACE                            *
**************************************************
```

```
 1. STAAD PLANE
 2. START JOB INFORMATION
 3. JOB NAME N.Y.N.J. HARBOR DREDGING
 4. JOB CLIENT PORT  AUTHORITY
 5. JOB PART ELIZABETH  CITY MARINA RECREATIONAL PIER
 6. ENGINEER NAME JIM CHU
 7. ENGINEER DATE 04-NOV-02
 8. END JOB INFORMATION
 9. INPUT WIDTH 79
10. UNIT FEET KIP
11. JOINT COORDINATES
12. 1 0 0 0; 2 0 40 0; 3 12 40 0; 4 12 5 0; 5 24 40 0; 6 24 5 0; 7 36 40 0
13. 8 36 5 0; 9 48 40 0; 10 48 5 0
14. MEMBER INCIDENCES
15. 1 1 2; 2 2 3; 3 3 4; 4 3 5; 5 5 6; 6 5 7; 7 7 8; 8 7 9; 9 9 10
16. START USER TABLE
17. TABLE 1
18. UNIT INCHES KIP
19. PIPE
20. PIPX120
21. 14.75 13.75 22.32 22.32
22. END
23. UNIT INCHES KIP
24. MEMBER PROPERTY AMERICAN
25. 2 4 6 8 PRIS YD 24 ZD 24
26. MEMBER PROPERTY AMERICAN
27. 1 3 5 7 9 UPTABLE 1 PIPX120
28. UNIT FEET KIP
29. SUPPORTS
30. 1 FIXED
31. 4 FIXED
32. 6 FIXED
33. 8 FIXED
34. 10 FIXED
35. UNIT INCHES KIP
36. CONSTANTS
37. E 3150 MEMB 2 4 6 8
38. E 29000 MEMB 1 3 5 7 9
39. POISSON 0.3 MEMB 1 3 5 7 9
40. DENSITY 0.000283 MEMB 1 3 5 7 9
41. ALPHA 6.5E-006 MEMB 1 3 5 7 9
```

```
42. POISSON 0.17 MEMB 2 4 6 8
43. DENSITY 8.68E-005 MEMB 2 4 6 8
44. ALPHA 5.5E-006 MEMB 2 4 6 8
45. LOAD 1 DL+LL+WAVE LOAD
46. UNIT FEET KIP
47. MEMBER LOAD
48. 2 4 6 8 UNI GY -3.075
49. JOINT LOAD
50. 2 FX 28
51. PERFORM ANALYSIS PRINT STATICS CHECK
```

```
      P R O B L E M   S T A T I S T I C S
      -----------------------------------

NUMBER OF JOINTS/MEMBER+ELEMENTS/SUPPORTS =    10/     9/     5
ORIGINAL/FINAL BAND-WIDTH=     2/     2/      6 DOF
TOTAL PRIMARY LOAD CASES =    1, TOTAL DEGREES OF FREEDOM =     15
SIZE OF STIFFNESS MATRIX =       1 DOUBLE  KILO-WORDS
REQRD/AVAIL. DISK SPACE  =    12.0/  6906.1 MB,  EXMEM =  877.8 MB
```

```
***TOTAL APPLIED LOAD ( KIP  FEET ) SUMMARY (LOADING    1 )
    SUMMATION FORCE-X =       28.00
    SUMMATION FORCE-Y =     -147.60
    SUMMATION FORCE-Z =        0.00

   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=       -4662.40


***TOTAL REACTION LOAD( KIP  FEET ) SUMMARY (LOADING     1 )
    SUMMATION FORCE-X =      -28.00
    SUMMATION FORCE-Y =      147.60
    SUMMATION FORCE-Z =        0.00

   SUMMATION OF MOMENTS AROUND THE ORIGIN-
   MX=           0.00  MY=           0.00  MZ=        4662.40


MAXIMUM DISPLACEMENTS ( INCH /RADIANS) (LOADING      1)
          MAXIMUMS    AT NODE
   X =  2.31553E+00       2
   Y = -2.69389E-02       3
   Z =  0.00000E+00       0
   RX=  0.00000E+00       0
   RY=  0.00000E+00       0
   RZ= -7.42908E-04       2


************ END OF DATA FROM INTERNAL STORAGE ************


 52. PRINT MEMBER FORCES ALL
```

MEMBER END FORCES STRUCTURE TYPE = PLANE

ALL UNITS ARE -- KIP FEET

MEMBER	LOAD	JT	AXIAL	SHEAR-Y	SHEAR-Z	TORSION	MOM-Y	MOM-Z
1	1	1	4.80	3.81	0.00	0.00	0.00	78.38
		2	-4.80	-3.81	0.00	0.00	0.00	74.12
2	1	2	24.19	4.80	0.00	0.00	0.00	-74.12
		3	-24.19	32.10	0.00	0.00	0.00	-89.67
3	1	3	41.64	6.06	0.00	0.00	0.00	105.55
		4	-41.64	-6.06	0.00	0.00	0.00	106.63
4	1	3	18.13	9.54	0.00	0.00	0.00	-15.87
		5	-18.13	27.36	0.00	0.00	0.00	-91.10
5	1	5	37.56	6.05	0.00	0.00	0.00	105.30
		6	-37.56	-6.05	0.00	0.00	0.00	106.47
6	1	5	12.07	10.19	0.00	0.00	0.00	-14.20
		7	-12.07	26.71	0.00	0.00	0.00	-84.86
7	1	7	34.72	6.07	0.00	0.00	0.00	105.66
		8	-34.72	-6.07	0.00	0.00	0.00	106.63
8	1	7	6.01	8.02	0.00	0.00	0.00	-20.79
		9	-6.01	28.88	0.00	0.00	0.00	-104.37
9	1	9	28.88	6.01	0.00	0.00	0.00	104.37
		10	-28.88	-6.01	0.00	0.00	0.00	105.97

********** END OF LATEST ANALYSIS RESULT **********

53. PRINT SUPPORT REACTION LIST 1 4 6 8 10

SUPPORT REACTIONS -UNIT KIP FEET STRUCTURE TYPE = PLANE

JOINT	LOAD	FORCE-X	FORCE-Y	FORCE-Z	MOM-X	MOM-Y	MOM Z
1	1	-3.81	4.80	0.00	0.00	0.00	78.38
4	1	-6.06	41.64	0.00	0.00	0.00	106.63
6	1	-6.05	37.56	0.00	0.00	0.00	106.47
8	1	-6.07	34.72	0.00	0.00	0.00	106.63
10	1	-6.01	28.88	0.00	0.00	0.00	105.97

********** END OF LATEST ANALYSIS RESULT **********

```
54. LOAD LIST ALL
55. START CONCRETE DESIGN
56. CODE ACI
57. FYMAIN 8640 MEMB 2 4 6 8
58. FC 576 MEMB 2 4 6 8
59. TRACK 2 MEMB 2 4 6 8
60. CLT 0.125 MEMB 2 4 6 8
61. CLB 0.125 MEMB 2 4 6 8
62. CLS 0.125 MEMB 2 4 6 8
63. DESIGN BEAM 2 4 6 8
```

B E A M N O. 2 D E S I G N R E S U L T S - FLEXURE

LEN - 12.00FT. FY - 60000. FC - 4000. SIZE - 24.00 X 24.00 INCHES

LEVEL	HEIGHT FT.	HEIGHT IN.	BAR INFO	FROM FT.	FROM IN.	TO FT.	TO IN.	ANCHOR STA	ANCHOR END
1	0 +	2-3/8	4-NUM.6	0 +	0-0/0	9 +	9-0/0	YES	NO

```
|-------------------------------------------------------------|
|   CRITICAL POS MOMENT=     77.57 KIP-FT  AT  2.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 20.98 INCH           |
|-------------------------------------------------------------|
```

Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

2	1 +	9-3/8	4-NUM.6	6 +	2-1/4	12 +	0-0/0	NO	YES

```
|-------------------------------------------------------------|
|   CRITICAL NEG MOMENT=     89.67 KIP-FT  AT 12.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 27.75 INCH           |
|-------------------------------------------------------------|
```

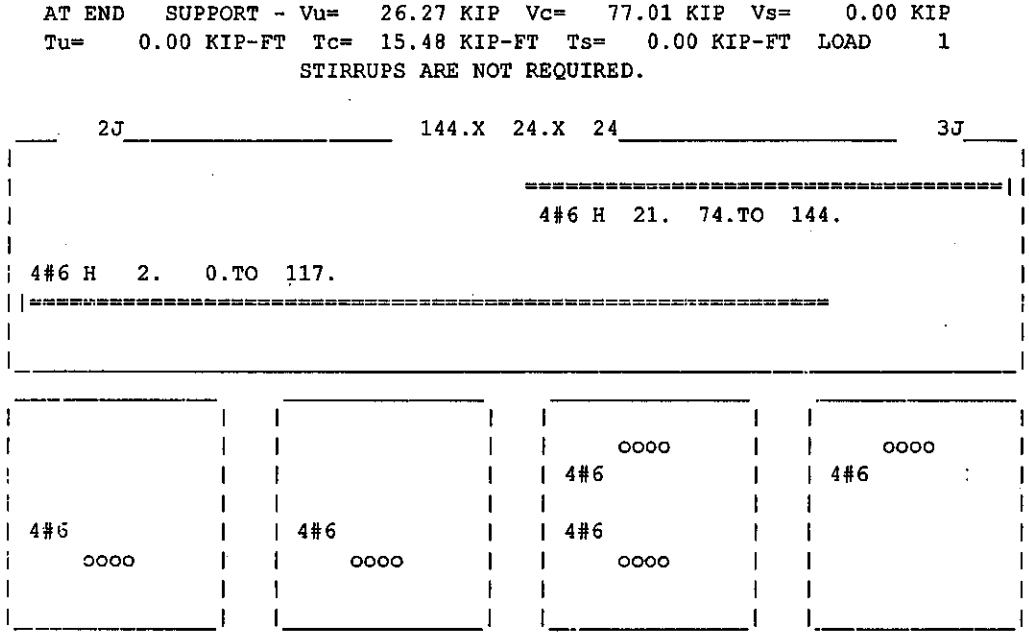
Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

REQUIRED REINF. STEEL SUMMARY :

SECTION (FEET)	REINF STEEL(+VE/-VE) (SQ. INCH)		MOMENTS(+VE/-VE) (KIP-FEET)		LOAD(+VE/-VE)	
0.00	0.779/	0.000	74.12/	0.00	1/	0
1.00	0.814/	0.000	77.39/	0.00	1/	0
2.00	0.816/	0.000	77.57/	0.00	1/	0
3.00	0.785/	0.000	74.69/	0.00	1/	0
4.00	0.721/	0.000	68.72/	0.00	1/	0
5.00	0.625/	0.000	59.69/	0.00	1/	0
6.00	0.497/	0.000	47.58/	0.00	1/	0
7.00	0.338/	0.000	32.39/	0.00	1/	0
8.00	0.147/	0.000	14.13/	0.00	1/	0
9.00	0.000/	0.075	0.00/	7.21	0/	1
10.00	0.000/	0.330	0.00/	31.62	0/	1
11.00	0.000/	0.619	0.00/	59.11	0/	1
12.00	0.000/	0.945	0.00/	89.67	0/	1

B E A M N O. 2 D E S I G N R E S U L T S - SHEAR

```
AT START SUPPORT - Vu=    1.03 KIP  Vc=   63.95 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
AT END   SUPPORT - Vu=   26.27 KIP  Vc=   77.01 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
```




```
D E A M  N O.    4 D E S I G N  R E S U L T S -  FLEXURE

LEN -  12.00FT.  FY - 60000.  FC - 4000.  SIZE - 24.00 X 24.00 INCHES

LEVEL    HEIGHT     BAR INFO      FROM            TO          ANCHOR
         FT.   IN.               FT.    IN.    FT.    IN.   STA  END

  1    0 + 2-3/8    4-NUM.6      0 + 0-0/0      8 + 9-0/0    YES  NO
|-----------------------------------------------------------------|
|   CRITICAL POS MOMENT=     30.64 KIP-FT  AT  3.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 20.98 INCH           |
|-----------------------------------------------------------------|

   Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

  2    1 + 9-3/8    4-NUM.6      5 + 2-1/4     12 + 0-0/0    NO   YES
|-----------------------------------------------------------------|
|   CRITICAL NEG MOMENT=     91.10 KIP-FT  AT 12.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 27.75 INCH           |
|-----------------------------------------------------------------|
```

Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

REQUIRED REINF. STEEL SUMMARY :

SECTION (FEET)	REINF STEEL(+VE/-VE) (SQ. INCH)		MOMENTS(+VE/-VE) (KIP-FEET)		LOAD(+VE/-VE)	
0.00	0.165/	0.000	15.87/	0.00	1/	0
1.00	0.249/	0.000	23.87/	0.00	1/	0
2.00	0.300/	0.000	28.80/	0.00	1/	0
3.00	0.319/	0.000	30.64/	0.00	1/	0
4.00	0.307/	0.000	29.42/	0.00	1/	0
5.00	0.262/	0.000	25.12/	0.00	1/	0
6.00	0.184/	0.000	17.74/	0.00	1/	0
7.00	0.076/	0.000	7.29/	0.00	1/	0
8.00	0.000/	0.065	0.00/	6.24	0/	1
9.00	0.000/	0.238	0.00/	22.84	0/	1
10.00	0.000/	0.444	0.00/	42.52	0/	1
11.00	0.000/	0.685	0.00/	65.27	0/	1
12.00	0.000/	0.960	0.00/	91.10	0/	1

B E A M N O. 4 D E S I G N R E S U L T S - SHEAR

AT START SUPPORT - Vu= 3.71 KIP Vc= 65.87 KIP Vs= 0.00 KIP
Tu= 0.00 KIP-FT Tc= 15.48 KIP-FT Ts= 0.00 KIP-FT LOAD 1
STIRRUPS ARE NOT REQUIRED.
AT END SUPPORT - Vu= 21.53 KIP Vc= 69.36 KIP Vs= 0.00 KIP
Tu= 0.00 KIP-FT Tc= 15.48 KIP-FT Ts= 0.00 KIP-FT LOAD 1
STIRRUPS ARE NOT REQUIRED.

```
___ 3J_____________ 144.X 24.X 24_____________ 5J____
|                                                    |
|                          ==========================|
|                           4#6 H 21. 62.TO 144.     |
|                                                    |
| 4#6 H 2. 0.TO 105.                                 |
|=================================                   |
|                                                    |
|____________________________________________________|
 _____________   _____________   _____________   _____________
|             | |             | |             | |             |
|             | |             | |    oooo     | |    oooo     |
|             | |             | | 4#6         | | 4#6         |
|             | |             | |             | |             |
| 4#6         | | 4#6         | | 4#6         | |             |
|    oooo     | |    oooo     | |    oooo     | |             |
|             | |             | |             | |             |
|_____________| |_____________| |_____________| |_____________|
```

```
==================================================================

      B E A M  N O.    6 D E S I G N  R E S U L T S -  FLEXURE

LEN -  12.00FT.  FY - 60000.  FC - 4000.  SIZE - 24.00 X 24.00 INCHES

LEVEL    HEIGHT     BAR INFO       FROM            TO          ANCHOR
       FT.    IN.                FT.     IN.     FT.     IN.   STA  END
------------------------------------------------------------------

  1    0 + 2-3/8    4-NUM.6      0 + 0-0/0      8 + 9-0/0    YES  NO
|-----------------------------------------------------------------|
|   CRITICAL POS MOMENT=      30.95 KIP-FT  AT  3.00 FT, LOAD    1|
|   REQD STEEL=  1.72 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 20.98 INCH           |
|-----------------------------------------------------------------|

   Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

  2    1 + 9-3/8    4-NUM.6      5 + 2-1/4     12 + 0-0/0    NO   YES
|-----------------------------------------------------------------|
|   CRITICAL NEG MOMENT=      84.86 KIP-FT  AT 12.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 27.75 INCH           |
|-----------------------------------------------------------------|

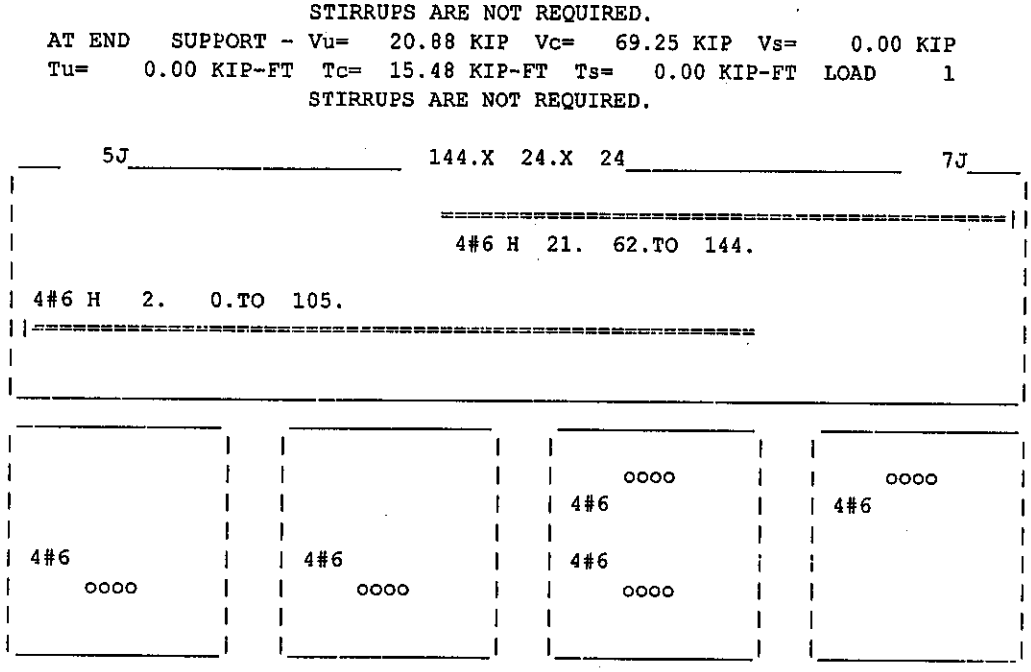
   Cracked Moment of Inertia Iz at above location = 4881.09 inch^4
```

REQUIRED REINF. STEEL SUMMARY :

SECTION (FEET)	REINF STEEL(+VE/-VE) (SQ. INCH)		MOMENTS(+VE/-VE) (KIP-FEET)		LOAD(+VE/-VE)	
0.00	0.148/	0.000	14.20/	0.00	1/	0
1.00	0.238/	0.000	22.86/	0.00	1/	0
2.00	0.296/	0.000	28.44/	0.00	1/	0
3.00	0.323/	0.000	30.95/	0.00	1/	0
4.00	0.317/	0.000	30.38/	0.00	1/	0
5.00	0.278/	0.000	26.74/	0.00	1/	0
6.00	0.208/	0.000	20.02/	0.00	1/	0
7.00	0.106/	0.000	10.23/	0.00	1/	0
8.00	0.000/	0.027	0.00/	2.64	0/	1
9.00	0.000/	0.193	0.00/	18.58	0/	1
10.00	0.000/	0.392	0.00/	37.60	0/	1
11.00	0.000/	0.626	0.00/	59.69	0/	1
12.00	0.000/	0.893	0.00/	84.86	0/	1

```
      B E A M  N O.    6 D E S I G N  R E S U L T S - SHEAR
```

```
AT START SUPPORT - Vu=    4.37 KIP  Vc=   65.68 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
AT END   SUPPORT - Vu=   20.88 KIP  Vc=   69.25 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
```




```
D E A M  N O.     8 D E S I G N  R E S U L T S -  FLEXURE

LEN -  12.00FT.  Fy - 60000.  FC - 4000.  SIZE - 24.00 X 24.00 INCHES

LEVEL    HEIGHT      BAR INFO       FROM            TO        ANCHOR
         FT.   IN.                 FT.    IN.    FT.    IN.   STA  END
-------------------------------------------------------------------------

  1    0 + 2-3/8    4-NUM.6      0 + 0-0/0      8 + 9-0/0    YES  NO
|-----------------------------------------------------------------|
|   CRITICAL POS MOMENT=     31.02 KIP-FT  AT  3.00 FT, LOAD    1|
|   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 20.98 INCH           |
|-----------------------------------------------------------------|

   Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

  2    1 + 9-3/8    4-NUM.6      5 + 2-1/4     12 + 0-0/0    NO   YES
|-----------------------------------------------------------------|
|   CRITICAL NEG MOMENT=    104.37 KIP-FT  AT 12.00 FT, LOAD    1|
!   REQD STEEL=  1.73 IN2, ROW=0.0033, ROWMX=0.0214 ROWMN=0.0033 |
|   MAX/MIN/ACTUAL BAR SPACING= 19.25/ 1.75/ 6.42 INCH           |
|   BASIC/REQD. DEVELOPMENT LENGTH = 16.70/ 27.75 INCH           |
|-----------------------------------------------------------------|
```

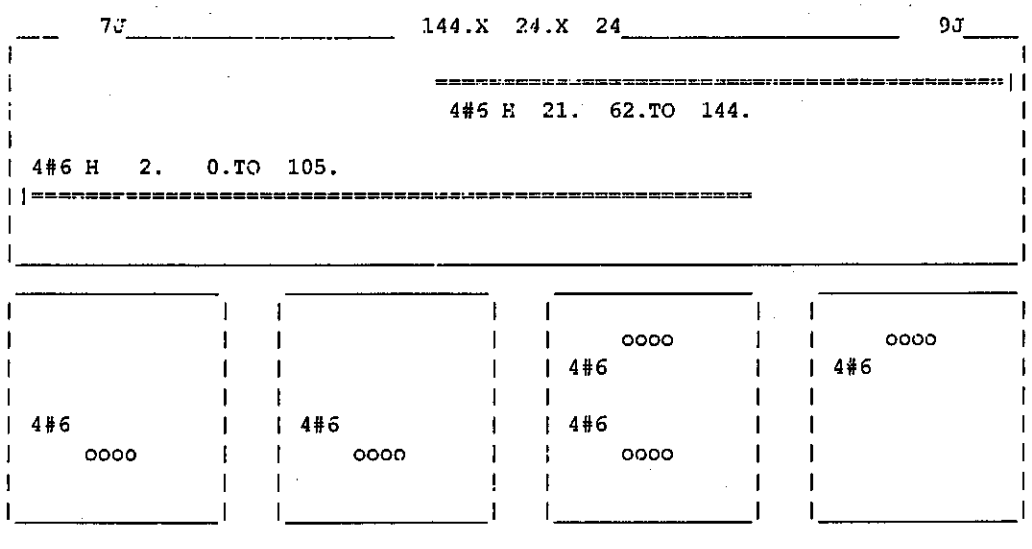
Cracked Moment of Inertia Iz at above location = 4881.09 inch^4

REQUIRED REINF. STEEL SUMMARY :

SECTION (FEET)	REINF STEEL(+VE/-VE) (SQ. INCH)		MOMENTS(+VE/-VE) (KIP-FEET)		LOAD(+VE/-VE)	
0.00	0.216/	0.000	20.79/	0.00	1/	0
1.00	0.284/	0.000	27.28/	0.00	1/	0
2.00	0.320/	0.000	30.68/	0.00	1/	0
3.00	0.323/	0.000	31.02/	0.00	1/	0
4.00	0.295/	0.000	28.27/	0.00	1/	0
5.00	0.234/	0.000	22.46/	0.00	1/	0
6.00	0.141/	0.000	13.56/	0.00	1/	0
7.00	0.017/	0.000	1.59/	0.00	1/	0
8.00	0.000/	0.140	0.00/	13.45	0/	1
9.00	0.000/	0.329	0.00/	31.57	0/	1
10.00	0.000/	0.552	0.00/	52.76	0/	1
11.00	0.000/	0.810	0.00/	77.03	0/	1
12.00	0.000/	1.103	0.00/	104.37	0/	1

B E A M N O. 8 D E S I G N R E S U L T S - SHEAR

```
AT START SUPPORT - Vu=    2.19 KIP  Vc=   64.49 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
AT END   SUPPORT - Vu=   23.05 KIP  Vc=   67.44 KIP  Vs=    0.00 KIP
Tu=    0.00 KIP-FT  Tc=  15.48 KIP-FT  Ts=   0.00 KIP-FT  LOAD     1
                    STIRRUPS ARE NOT REQUIRED.
```



**********END OF BEAM DESIGN**********

```
64. END CONCRETE DESIGN
65. PARAMETER
66. CODE AISC
67. FYLD 5184 MEMB 1 3 5 7 9
68. TRACK 1 MEMB 1 3 5 7 9
69. CHECK CODE MEMB 1 3 5 7 9
```

STAAD.Pro CODE CHECKING - (AISC)
****

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION
1	UPT PIPX120	PASS	AISC- H1-3	0.529	1
		4.80 C	0.00	78.38	0.00

MEM= 1, UNIT KIP-INCH, L= 480.0 AX= 22.38 SZ= 77.1 SY= 77.1
KL/R-Y= 95.2 CB= 1.00 YLD= 36.00 ALLOWABLE STRESSES: FCZ= 23.76
FTZ= 23.76 FCY= 23.76 FTY= 23.76 FA= 13.57 FT= 21.60 FV= 14.40

3	UPT PIPX120	PASS	AISC- H1-3	0.822	1
		41.64 C	0.00	106.63	35.00

MEM= 3, UNIT KIP-INCH, L= 420.0 AX= 22.38 SZ= 77.1 SY= 77.1
KL/R-Y= 83.3 CB= 1.00 YLD= 36.00 ALLOWABLE STRESSES: FCZ= 23.76
FTZ= 23.76 FCY= 23.76 FTY= 23.76 FA= 14.98 FT= 21.60 FV= 14.40

5	UPT PIPX120	PASS	AISC- H1-3	0.809	1
		37.56 C	0.00	106.47	35.00

MEM= 5, UNIT KIP-INCH, L= 420.0 AX= 22.38 SZ= 77.1 SY= 77.1
KL/R-Y= 83.3 CB= 1.00 YLD= 36.00 ALLOWABLE STRESSES: FCZ= 23.76
FTZ= 23.76 FCY= 23.76 FTY= 23.76 FA= 14.98 FT= 21.60 FV= 14.40

7	UPT PIPX120	PASS	AISC- H1-3	0.802	1
		34.72 C	0.00	106.63	35.00

MEM= 7, UNIT KIP-INCH, L= 420.0 AX= 22.38 SZ= 77.1 SY= 77.1
KL/R-Y= 83.3 CB= 1.00 YLD= 36.00 ALLOWABLE STRESSES: FCZ= 23.76
FTZ= 23.76 FCY= 23.76 FTY= 23.76 FA= 14.98 FT= 21.60 FV= 14.40

9	UPT PIPX120	PASS	AISC- H1-3	0.780	1
		28.88 C	0.00	105.97	35.00

ALL UNITS ARE - KIP FEET (UNLESS OTHERWISE NOTED)

MEMBER	TABLE	RESULT/ FX	CRITICAL COND/ MY	RATIO/ MZ	LOADING/ LOCATION

```
 ----------------------------------------------------------------------
| MEM=     9, UNIT KIP-INCH,  L= 420.0  AX= 22.38  SZ=  77.1  SY=  77.1 |
| KL/R-Y=  83.3  CB=  1.00  YLD= 36.00  ALLOWABLE STRESSES:  FCZ= 23.76 |
| FTZ= 23.76  FCY= 23.76  FTY= 23.76  FA= 14.98  FT= 21.60  FV= 14.40  |
 ----------------------------------------------------------------------
```

70. FINISH

********** END OF THE STAAD.Pro RUN **********

**** DATE= NOV 18,2002 TIME= 10:40:53 ****

```
**********************************************************
*     For questions on STAAD.Pro, please contact :       *
*  By Email - North America  : support@reiusa.com        *
*  By Email - International  : support@reiworld.com       *
*  Tel. (USA) : 714-974-2500 ; Fax (USA) : 714-974-4771 *
**********************************************************
```

ELIZABETH MARINA

WALKWAY

COMPUTATION SHEET			Page 1 of ____
Subject Elizabeth Marina wood pile walkway		Project Arther Kill Channel	
Computed by J. CHU	Date 10-29-2002	Checked by SOD	Date 10/31/03

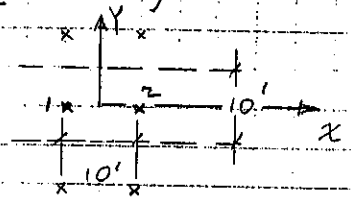
Analysis is based on assumption that no rip rap is in front of wood pile. (all dark-Gray silt, and Sand)

~~Total Length of wood pile = 40'~~

pile dia, $\phi = 12''$ $\left(I = \pi d^4/64 = \frac{\pi (12)^4}{64} = 1018\ in^4 \right.$

$\left. A = \pi d^2/4 = \pi (12)^2/4 = 113\ in^2 \right)$

properties:



$E = 1.5E6$ psi fixity = fixed

$I1 = I2 = 1018\ in^4$ C33 = 1 (bearing pile)

$A = 113\ in^2$ B66 = 0

$L = 40\ ft$ $Lu = 25\ ft$

$NH = 0.010\ K/in^3$

$AC = 50^K$

$AT = 25^K$

$ACC = F_{ac} \cdot A = 1.0 \times 113 = 113^K$

$ATT = F_{aT} \cdot A = 2.0 \times 113 = 226^K$

$AM1 = AM2$

$= F_b \cdot S1 = 2\ ksi \times 170\ in^3 = 340\ K\text{-}''$ $S1 = I/c = 1018/6 = 170\ in^3$

Applied load:

Vertical = 150 psf

Lateral = 3 klf

Total $F_z = 10' \times 10' \times 150\ psf = 15^K$

$F_x = 3^K$

Critical buckling load (after dredge depth = -54')

unsupported length = $L_T = Lu + L_f$ $Lu = 25'$

L_f = Depth to fixity = 1.8 T

$$T = \sqrt[5]{\frac{EI}{NH}} = \sqrt[5]{\frac{1500\ ksi \times 1018\ in^4}{0.010\ K/in^3}} = 43.3\ in = 3.6\ ft$$

$L_f = 1.8T = 1.8 \times 3.6 = 6.5'$

$L_T = 25 + 6.5 = 31.5'$

$$P_{cr} = \frac{\pi^2 EI}{(KL_T)^2} = \frac{\pi^2 (1500)(1018)}{(1.0 \times 31.5 \times 12)^2} = 105^K$$

NAVY FORM 229 Apr 79

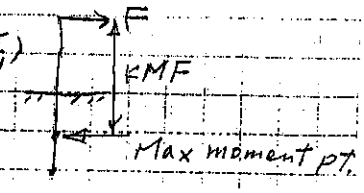
COMPUTATION SHEET			Page 2 of
Subject Elizabeth Marina wood pile walkway		Project Arther Kill channel	
Computed by J. CHU	Date 10-29-2002	Checked by SOD	Date 10/31/03

Moment factors for fixed unsupported Piles = $L_u = 25'$

$T = 3.6^{ft}$

free standing length factor (m) $= L_u/T = 25/3.6 = 6.9$

$H = 0.3$ (for fixed cap) $M = F(KMF) = F(\frac{T}{H})$



$KMF = T/H = 3.6/0.3 = 12' = 144''$

'CPGA' Input data ..... 'LizWalk1'

a) Elizabeth Marina walkway pier wood pile cap ... displ. dredge EL -54'

	E	I1	I2	A	C33	B66	List
b) Prop.	1500	1018	1018	113	1	0	all

	Psoil	Esoil	Length	L	Lu	List
c) Soil	NH	0.010	L	40	25	all

d) fix all

	shape	AC	AT	ACC	ATT	AM1	AM2	List
g) Allow	R	50	25	113	226	340	340	ALL

	MAT'L	CM1	CM2	PCR1	PCR2	ST	List
j) UNSP	T	0.6	0.6	105	105	H	all

	KMF1U	KMF2U	List
l) FUNSMOM	144	144	all

p) Pile 1 -5. 0. 0. 25. 0. 0.

y) Load 1 3. 0. 15. 0. 0. 0.

bb) FOUT 1 2 3 4 5 6 7 LIZWALK10

ee) PFO ALL

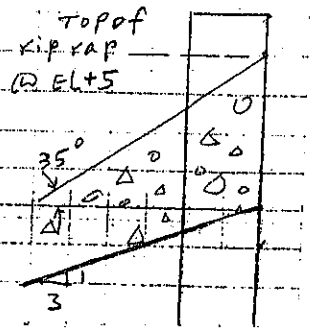
gg) FPL N

NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 3 of ____
Subject Elizabeth Marine wood pile walkway		Project Arthur Kill Channel	
Computed by J. CHU	Date 10-29-2002	Checked by SOD	Date 10/31/03

due to excessive displ. (> 4") in 'Lizwalk1' run,

to stabilize the walkway, use rip rap in front of wood pile. leave only $L_u = 10'$



recalculate the critical buckling load:

unsupported length $= L_T = L_u + L_f$ $\quad L_u = 10'$

L_f = Depth to fixity $= 1.8T$ where $T = 3.6'$

$= 6.5'$

$\therefore L_T = 10 + 6.5 = 16.5'$

$$P_{cr} = \frac{\pi^2 EI}{(K L_T)^2} = \frac{\pi^2 (1500)(1018)}{(1.0 \times 16.5 \times 12)^2} = 384^K$$

Moment factors for fixed unsupported piles: $L_u = 10'$

$T = 3.6'$

free standing length factor $(m) = L_u/T = 10/3.6 = 2.8$

$H = 0.72$ (for fixed cap)

$KMF = T/H = 3.6/0.72 = 5' = 60''$

New 'CGPA' data: $L_u = 10'$ $\quad PCR1 = 384^K = PCR2$

('Lizwalk2') $\quad KMF1U = 60'' = KMF2U$

NANY FORM 229 Apr 79

D:\program file\case\CPGA\Lizwalk1.txt

lizwalk1

```
1000 liz.marina walkway woodpile cap displ. dredge el.-54'w/top rip rap el.5'
1010 PRO 1500. 1018. 1018. 113 1 0 ALL
1020 SOI NH .01 L 40. 25. ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL
1050 UNS T .6 .6 105. 105. H ALL
1060 FUN 144. 144. ALL
1070 PIL 1 -5. 0. 0. 2 5. 0. 0.
1080 LOA 1 3. 0. 15. 0. 0. 0.
1090 FOU 1 2 3 4 5 6 7 lizwalk1o
1100 PFO ALL
1110 FPL N
```

$L_u = 10'$

lizwalk1

```
1000 elizabeth marina wood pile walkway
1010 PRO 1500. 1018. 1018. 113 1 0 ALL
1020 SOI NH .01 L 40 10 ALL
1030 FIX ALL
1040 ALL R 50. 25. 113. 226. 340. 340. ALL

1050 UNS T .6 .6 105. 105. H ALL
1060 FUN 144. 144. ALL
1070 PIL 1 -5.0 0. 2 25. 0. 0.
1080 LOAD 1 3. 0. 15. 0. 0. 0.
1085 ROW X 10 1 9 AT 10.0
1087 REP 2 1 AT 10.0
1100 FOU 1 2 3 4 5 6 7 lizwalk1
1110 PFO ALL
1130 FPL N
```

ANALYSIS IS BASED ON NO DREDGING TAKING PLACE. NO RIP RAP IS NEEDED.

TOTAL LENGTH OF PILE = 40'

UNBRACED LENGTH = 10'

LIZWALK1

```
*********************************
* CASE PROGRAM    #  X0080       *  CPGA - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 1993/03/29    *  RUN DATE 31-OCT-2003   RUN TIME 08.18.17
*********************************
```

ELIZABETH MARINA WOOD PILE WALKWAY

THERE ARE 20 PILES AND
1 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-5.00 ,	.00 ,	2.00)
(	85.00 ,	10.00 ,	2.00)

****

PILE PROPERTIES AS INPUT

E	I1	I2	A	C33	B66
KSI	IN**4	IN**4	IN**2		
.15000E+04	.10180E+04	.10180E+04	.11300E+03	.10000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

NH	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.10000E-01	L	.40000E+02	.10000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X	Y	Z	BATTER	ANGLE	LENGTH	FIXITY
	FT	FT	FT			FT	
1	-5.00	.00	2.00	V	.00	40.00	F
2	5.00	.00	2.00	V	.00	40.00	F
3	15.00	.00	2.00	V	.00	40.00	F
4	25.00	.00	2.00	V	.00	40.00	F
5	35.00	.00	2.00	V	.00	40.00	F
6	45.00	.00	2.00	V	.00	40.00	F
7	55.00	.00	2.00	V	.00	40.00	F
8	65.00	.00	2.00	V	.00	40.00	F
9	75.00	.00	2.00	V	.00	40.00	F

LIZWALK1

10	85.00	.00	2.00	V	.00	40.00	F
11	-5.00	10.00	2.00	V	.00	40.00	F
12	5.00	10.00	2.00	V	.00	40.00	F
13	15.00	10.00	2.00	V	.00	40.00	F
14	25.00	10.00	2.00	V	.00	40.00	F
15	35.00	10.00	2.00	V	.00	40.00	F
16	45.00	10.00	2.00	V	.00	40.00	F
17	55.00	10.00	2.00	V	.00	40.00	F
18	65.00	10.00	2.00	V	.00	40.00	F
19	75.00	10.00	2.00	V	.00	40.00	F
20	85.00	10.00	2.00	V	.00	40.00	F

						800.00	

****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	3.0	.0	15.0	.0	.0	.0

****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.44391E+02	.00000E+00	.00000E+00	.00000E+00	.54560E+04	-.26634E+04
.00000E+00	.44391E+02	.00000E+00	-.54560E+04	.00000E+00	.21307E+05
.00000E+00	.00000E+00	.70625E+04	.42375E+06	-.33900E+07	.00000E+00
.00000E+00	-.54560E+04	.42375E+06	.51676E+08	-.20340E+09	-.26189E+07
.54560E+04	.00000E+00	-.33900E+07	-.20340E+09	.24671E+10	-.32736E+06
-.26634E+04	.21307E+05	.00000E+00	-.26189E+07	-.32736E+06	.15821E+08

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 6.

****

PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.6857E-01	-.2023E-01	.8142E-02	-.3518E-04	.8140E-05	.3313E-04

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO
(F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LIZWALK1

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.2	.0	3.0	3.7	15.3	.0	.06	.07
		FUNSMOM		-2.1	-6.9			.05
2	.2	.0	2.7	2.8	15.3	.0	.05	.07
		FUNSMOM		-1.7	-6.9			.04
3	.2	.0	2.4	1.9	15.3	.0	.05	.07
		FUNSMOM		-1.3	-6.9			.04
4	.2	.0	2.0	1.0	15.3	.0	.04	.06
		FUNSMOM		-.9	-6.9			.04
5	.2	.0	1.7	.2	15.3	.0	.03	.06
		FUNSMOM		-.5	-6.9			.04
6	.2	.0	1.3	-.7	15.3	.0	.03	.06
		FUNSMOM		-.1	-6.9			.03
7	.2	.0	1.0	-1.6	15.3	.0	.02	.05
		FUNSMOM		.3	-6.9			.03
8	.2	.0	.6	-2.5	15.3	.0	.01	.05
		FUNSMOM		.7	-6.9			.03
9	.2	.0	.3	-3.3	15.3	.0	.01	.05
		FUNSMOM		1.1	-6.9			.02
10	.2	.0	-.1	-4.2	15.3	.0	.00	.05
		FUNSMOM		1.5	-6.9			.02
11	.1	.0	1.6	3.7	14.5	.0	.03	.06
		FUNSMOM		-2.1	-6.5			.03
12	.1	.0	1.2	2.8	14.5	.0	.02	.05
		FUNSMOM		-1.7	-6.5			.03
13	.1	.0	.9	1.9	14.5	.0	.02	.05
		FUNSMOM		-1.3	-6.5			.03
14	.1	.0	.5	1.0	14.5	.0	.01	.05
		FUNSMOM		-.9	-6.5			.02
15	.1	.0	.2	.2	14.5	.0	.00	.04
		FUNSMOM		-.5	-6.5			.02
16	.1	.0	-.2	-.7	14.5	.0	.01	.04
		FUNSMOM		-.1	-6.5			.02
17	.1	.0	-.5	-1.6	14.5	.0	.02	.05
		FUNSMOM		.3	-6.5			.02
18	.1	.0	-.9	-2.5	14.5	.0	.03	.05
		FUNSMOM		.7	-6.5			.02
19	.1	.0	-1.2	-3.3	14.5	.0	.05	.05
		FUNSMOM		1.1	-6.5			.02
20	.1	.0	-1.5	-4.2	14.5	.0	.06	.05
		FUNSMOM		1.5	-6.5			.03

****

PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.2	.0	3.0	3.7	15.3	.0
2	.2	.0	2.7	2.8	15.3	.0
3	.2	.0	2.4	1.9	15.3	.0
4	.2	.0	2.0	1.0	15.3	.0
5	.2	.0	1.7	.2	15.3	.0

6	.2	.0	1.3	-.7	15.3	.0
7	.2	.0	1.0	-1.6	15.3	.0
8	.2	.0	.6	-2.5	15.3	.0
9	.2	.0	.3	-3.3	15.3	.0
10	.2	.0	-.1	-4.2	15.3	.0
11	.1	.0	1.6	3.7	14.5	.0
12	.1	.0	1.2	2.8	14.5	.0
13	.1	.0	.9	1.9	14.5	.0
14	.1	.0	.5	1.0	14.5	.0
15	.1	.0	.2	.2	14.5	.0
16	.1	.0	-.2	-.7	14.5	.0
17	.1	.0	-.5	-1.6	14.5	.0
18	.1	.0	-.9	-2.5	14.5	.0
19	.1	.0	-1.2	-3.3	14.5	.0
20	.1	.0	-1.5	-4.2	14.5	.0

CHEVRON PLANT

BULKHEAD 1

CHEVRON #1

```
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF
CONTROL  CANTILEVER  ANALYSIS  2.00
WALL   15      -4   29000000   406.5
SURFACE RIGHTSIDE   2    0    15
                  275    15
SURFACE LEFTSIDE   2    0    10
                  30   -12
SOIL RIGHTSIDE  STRENGTHS   1
   110    110    32    0    15    0       0
SOIL LEFTSIDE  STRENGTHS   1
   145    145    35    0    15    0       0
WATER ELEVATIONS   62.4    0    0
VERTICAL STRIP  RIGHTSIDE   1    25    275    1000
FINISHED
```

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 8:46:25

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****************
*  INPUT DATA  *
****************
```

I.--HEADING
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--CONTROL
CANTILEVER WALL ANALYSIS
FACTOR OF SAFETY FOR ACTIVE PRESSURES = 2.00

III.--WALL DATA
ELEVATION AT TOP OF WALL = 15.00 FT.
ELEVATION AT BOTTOM OF WALL = -4.00 FT.
WALL MODULUS OF ELASTACITY = 2.900E+07 PSI.
WALL MOMENT OF INERTIA = 406.50 IN^4.

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	15.00
275.00	15.00

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	10.00
30.00	-12.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
110.00	110.00	32.00	0.00	15.00	0.00			DEF	DEF

V.B.--LEFTSIDE

LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
145.00	145.00	35.00	0.00	15.00	0.00			DEF	DEF

VI.--WATER DATA

UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 0.00 (FT)
LEFTSIDE ELEVATION = 0.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS

VII.A.--VERTICAL LINE LOADS

NONE

VII.B.--VERTICAL UNIFORM LOADS

NONE

VII.C.--VERTICAL STRIP LOADS

VII.C.1.--RIGHTSIDE

<-DIST. FROM WALL->

START (FT)	END (FT)	STRIP LOAD (PSF)
25.00	275.00	1000.00

VII.C.2.--LEFTSIDE

NONE

VII.D.--VERTICAL RAMP LOADS

NONE

VII.E.--VERTICAL TRIANGULAR LOADS

NONE

VII.F.--VERTICAL VARIABLE LOADS

NONE

VIII.--HORIZONTAL LOADS

NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 8:48:59

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****************************
*  SUMMARY OF RESULTS FOR  *
* CANTILEVER WALL ANALYSIS *
****************************
```

I.--HEADING
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION DOES NOT EXIST
AT ALL ELEVATIONS. SEE COMPLETE OUTPUT.

PASSIVE FACTOR OF SAFETY	:	3.60
MAX. BEND. MOMENT (LB-FT)	:	7.5641E+03
AT ELEVATION (FT)	:	2.09
MAXIMUM DEFLECTION (IN.)	:	1.1494E-01
AT ELEVATION (FT)	:	15.00

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 8:48:59

```
****************************
*   COMPLETE RESULTS FOR   *
* CANTILEVER WALL ANALYSIS *
****************************
```

I.--HEADING
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--RESULTS0. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	DEFLECTION (IN)	NET PRESSURE (PSF)
15.00	0.0000E+00	0.	1.1494E-01	0.00
14.00	9.0741E+00	27.	1.0522E-01	54.44
13.00	7.2592E+01	109.	9.5512E-02	108.89
12.00	2.4500E+02	245.	8.5812E-02	163.33
11.00	5.8074E+02	436.	7.6150E-02	217.78
10.00	1.1343E+03	681.	6.6576E-02	272.22
9.00	1.9358E+03	907.	5.7171E-02	181.67
8.00	2.9191E+03	1044.	4.8052E-02	91.11
7.00	3.9934E+03	1090.	3.9362E-02	0.55
6.99	4.0001E+03	1090.	3.9311E-02	0.00
6.00	5.0683E+03	1045.	3.1258E-02	-90.00
5.00	6.0532E+03	910.	2.3895E-02	-180.56
4.00	6.8576E+03	684.	1.7417E-02	-271.11
3.00	7.3908E+03	367.	1.1942E-02	-361.67
2.00	7.5624E+03	-39.	7.5451E-03	-452.22
1.00	7.2817E+03	-537.	4.2514E-03	-542.78
0.00	6.4570E+03	-1129.	2.0184E-03	-641.06
-1.00	4.9990E+03	-1796.	7.2411E-04	-692.37
-1.40	4.2274E+03	-2076.	4.2533E-04	-715.92
-2.00	2.8941E+03	-2285.	1.5427E-04	23.09
-3.00	8.2585E+02	-1647.	8.9605E-06	1252.15
-3.91	0.0000E+00	0.	0.0000E+00	2369.91

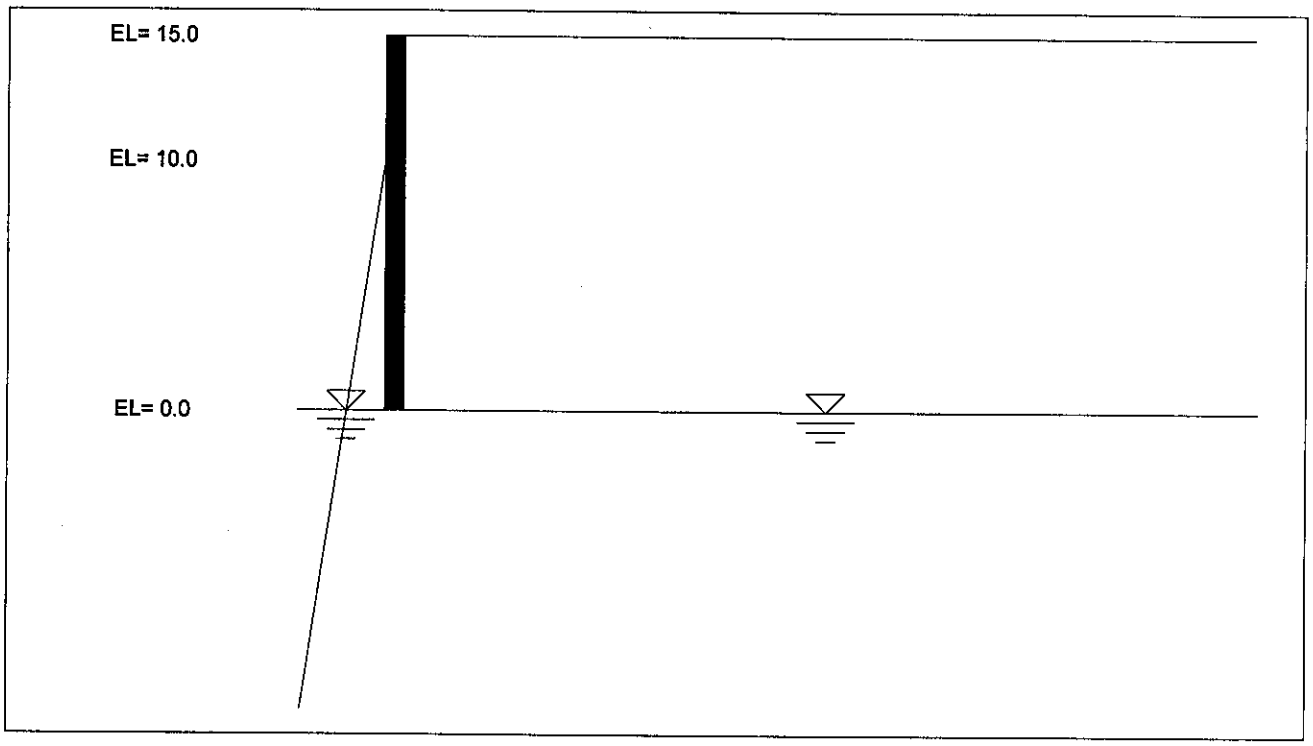
III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
15.00	0.	0.	0.	0.	0.
14.00	0.	0.	0.	54.	169.
13.00	0.	0.	0.	109.	338.
12.00	0.	0.	0.	163.	506.
11.00	0.	0.	0.	218.	675.
10.00	0.	0.	0.	272.	844.
9.00	0.*	145.	46.	327.	1013.
8.00	0.*	290.	91.	381.	1181.
7.00	0.*	435.	137.	436.	1350.
6.99	0.*	436.	137.	436.	1351.
6.00	0.*	580.	182.	490.	1519.
5.00	0.*	725.	228.	544.	1688.
4.00	0.*	870.	273.	599.	1856.
3.00	0.	1015.	319.	653.	2025.
2.00	0.	1160.	365.	708.	2194.
1.00	0.*	1305.	410.	762.	2363.
0.00	0.*	1450.	449.	809.	2507.
-1.00	0.*	1533.	474.	840.	2604.
-1.40	0.*	1566.	482.	850.	2645.
-2.00	0.*	1615.	493.	864.	2707.
-3.00	0.*	1698.	512.	887.	2851.
-3.91	0.*	1780.	530.	911.	2903.
-5.00	0.*	1863.	549.	1012.	3038.

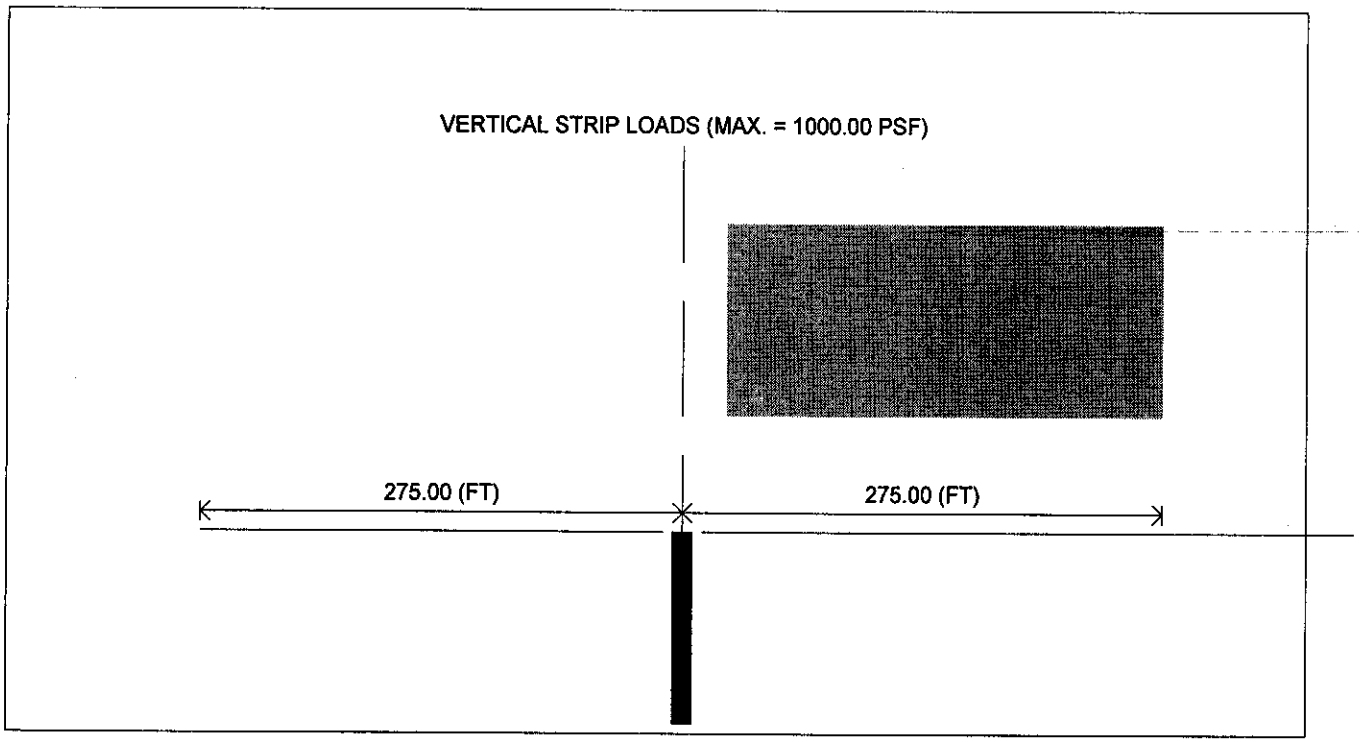
* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE AT THIS ELEVATION.

'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'

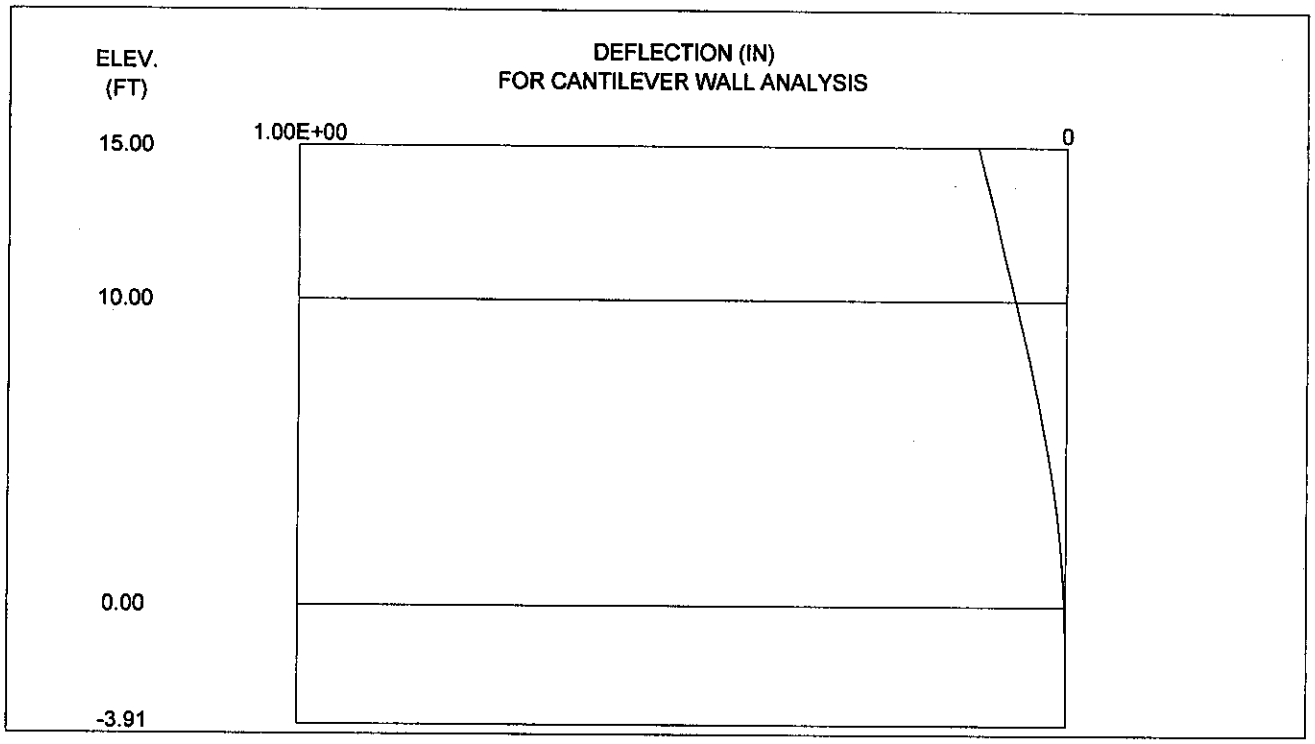


'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



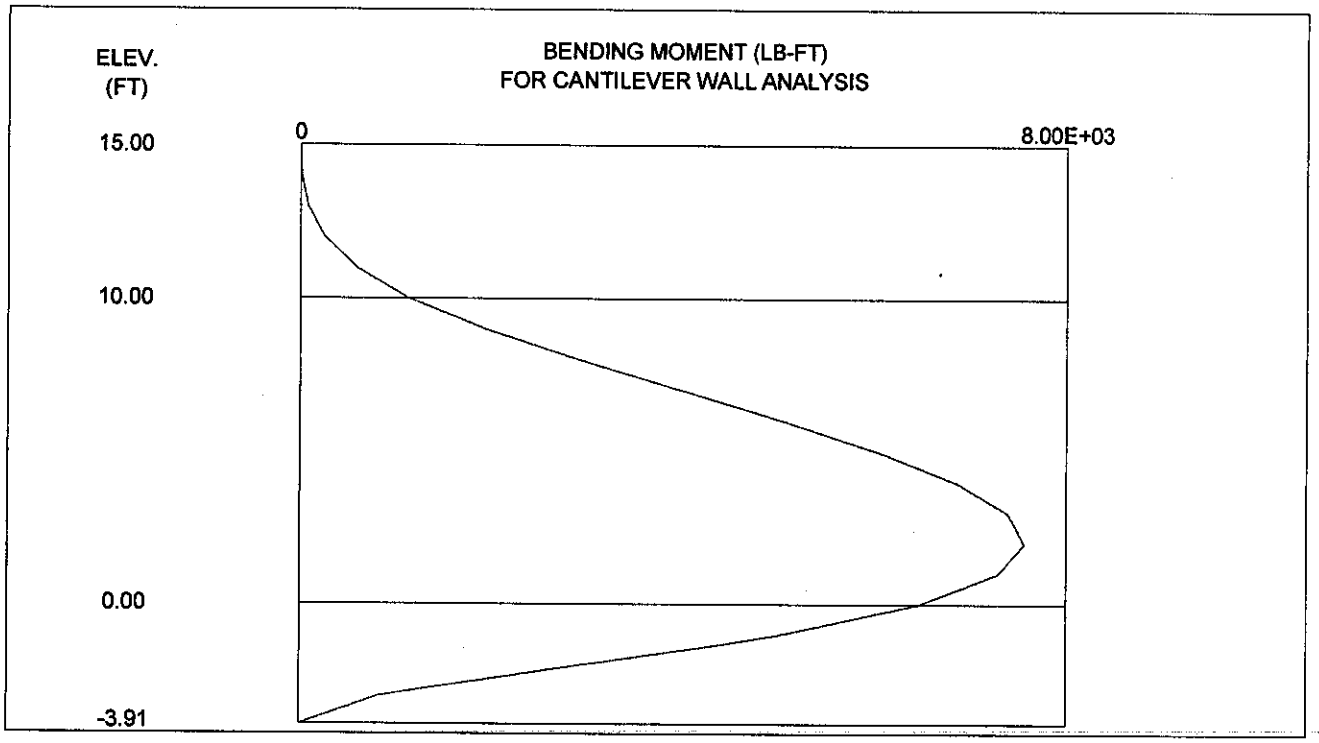
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



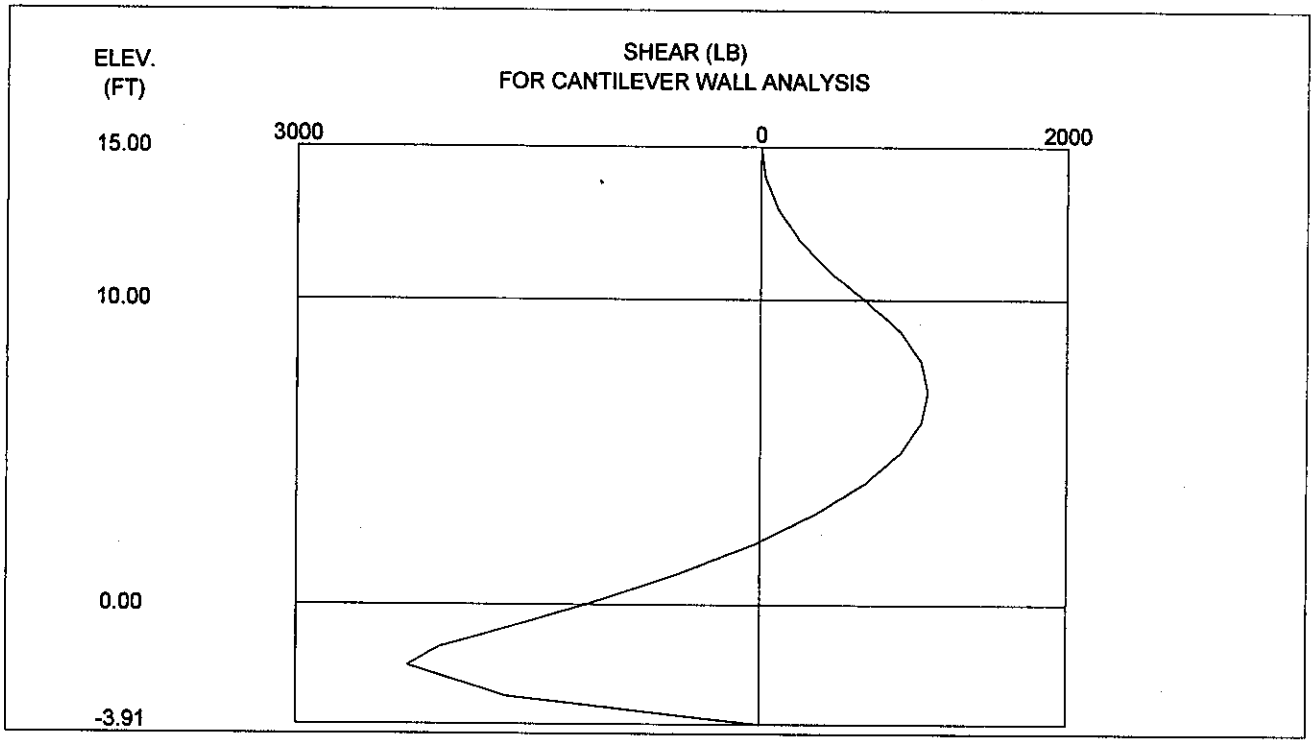
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



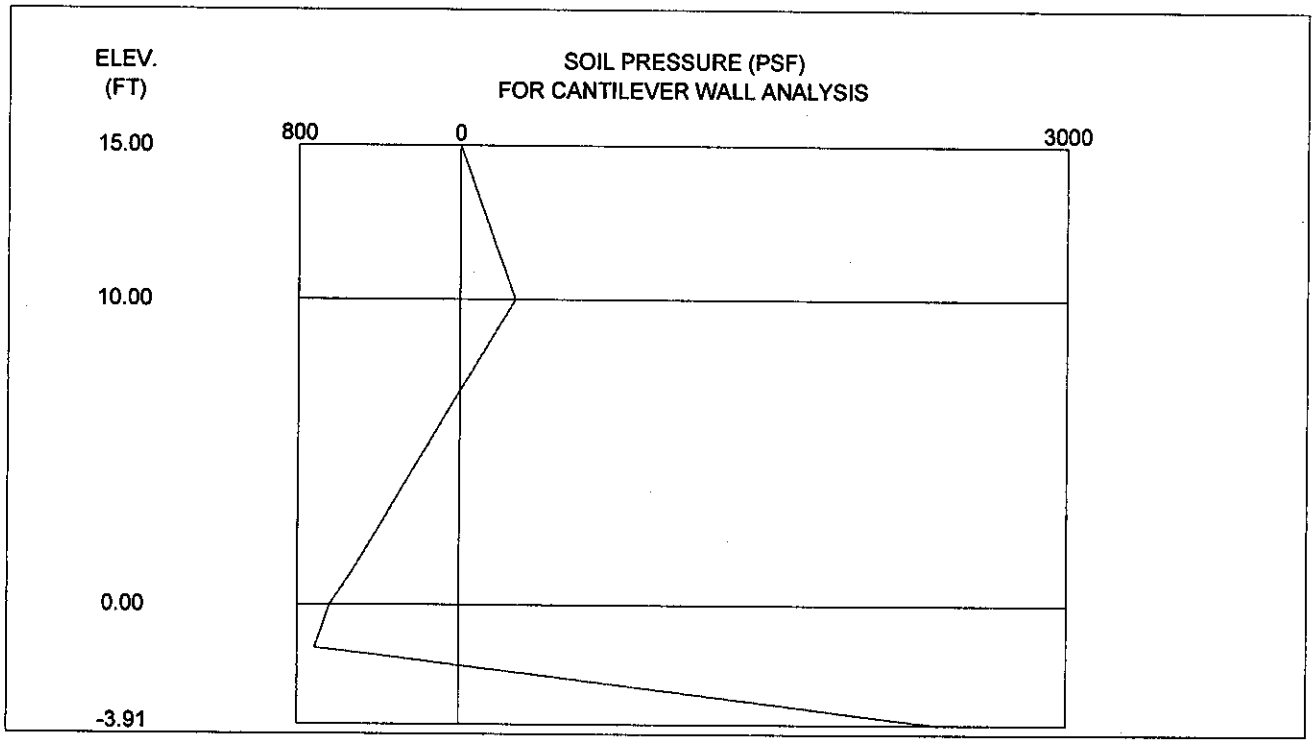
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



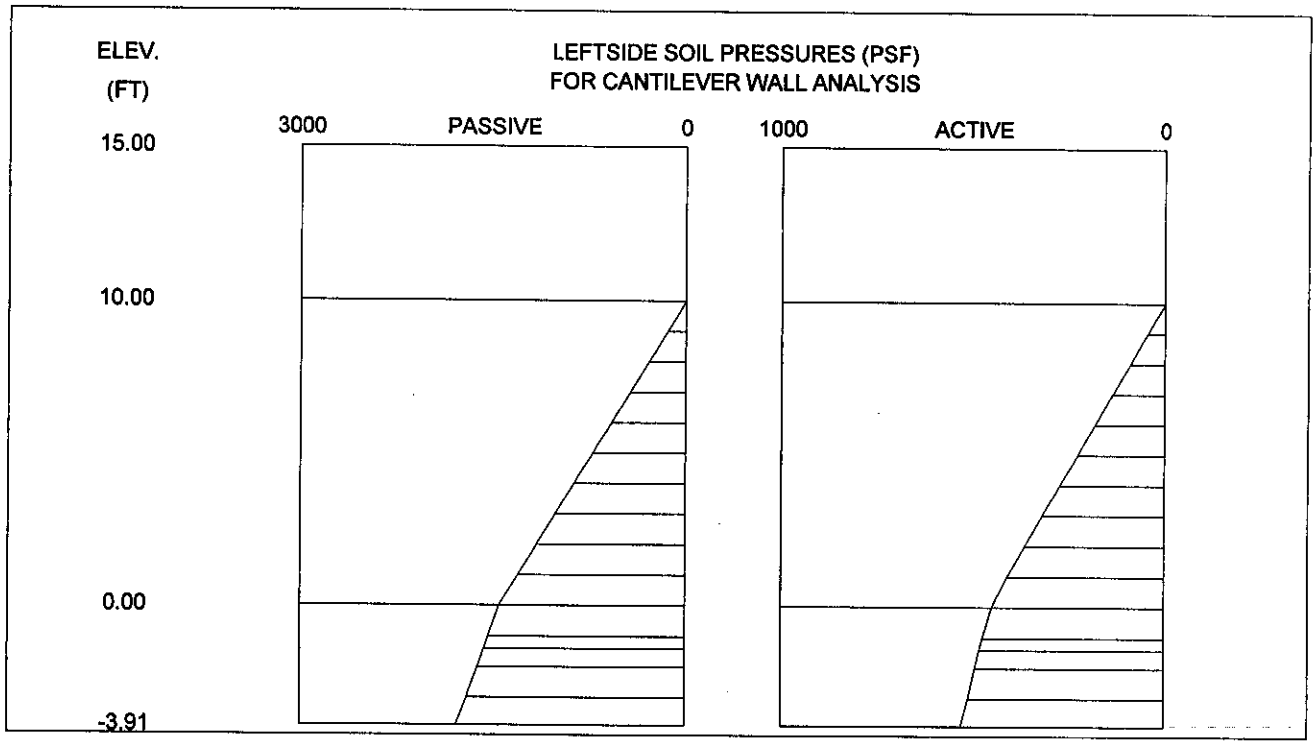
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



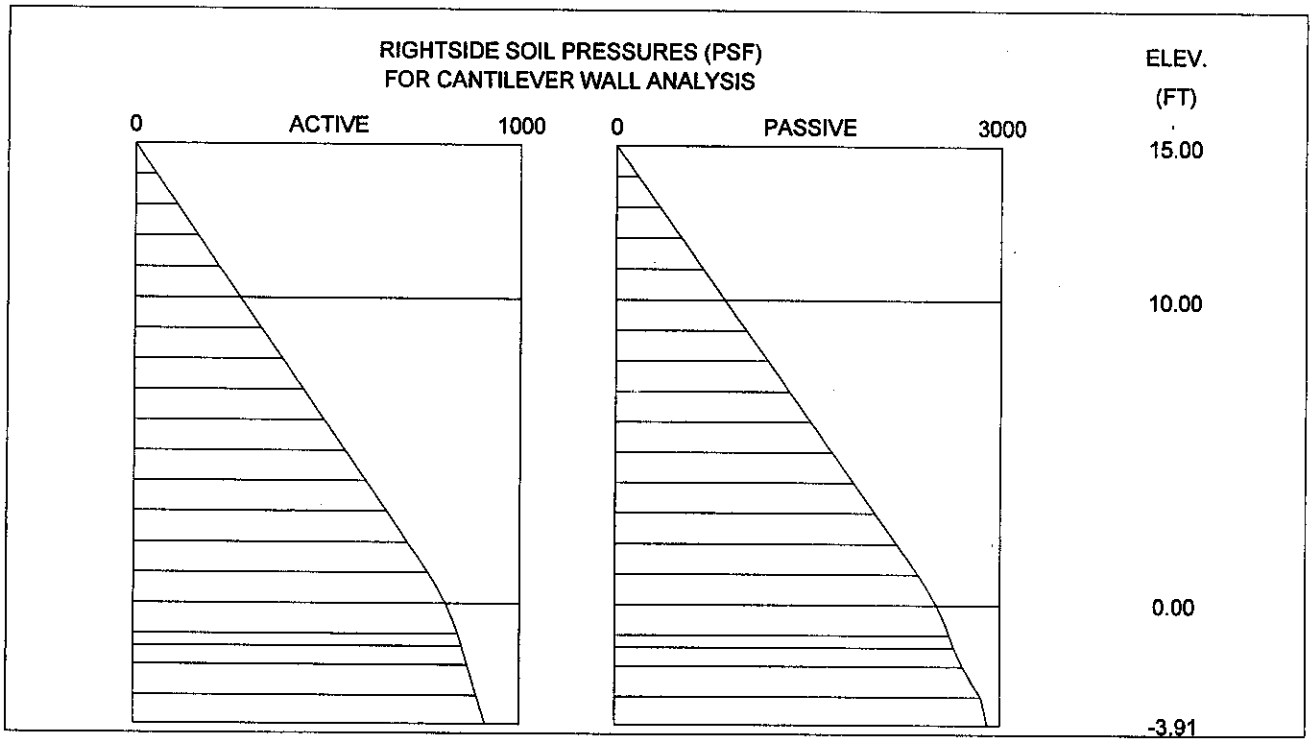
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



CHEVRON PLANT

BULKHEAD 2

CHEVRON #2

```
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF
CONTROL    CANTILEVER    ANALYSIS    2.00
WALL    15       -4  29000000  406.5
SURFACE RIGHTSIDE    2    0    15
                275    15
SURFACE LEFTSIDE    4    0    10
                15   -15
                40   -29
                65   -35
SOIL RIGHTSIDE   STRENGTHS    1
  110    110    32    0    15    0      0
SOIL LEFTSIDE   STRENGTHS    1
  145    145    35    0    15    0      0
WATER ELEVATIONS    62.4    0    0
VERTICAL STRIP  RIGHTSIDE    1    25    275    1000
FINISHED
```

CHEVRON #2

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 11:08:06

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****************
*  INPUT DATA  *
****************
```

I.--HEADING
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--CONTROL
CANTILEVER WALL ANALYSIS
FACTOR OF SAFETY FOR ACTIVE PRESSURES = 2.00

III.--WALL DATA
ELEVATION AT TOP OF WALL = 15.00 FT.
ELEVATION AT BOTTOM OF WALL = -4.00 FT.
WALL MODULUS OF ELASTACITY = 2.900E+07 PSI.
WALL MOMENT OF INERTIA = 406.50 IN^4.

IV.--SURFACE POINT DATA

IV.A.--RIGHTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	15.00
275.00	15.00

IV.B.--LEFTSIDE

DIST. FROM WALL (FT)	ELEVATION (FT)
0.00	10.00
15.00	-15.00
40.00	-29.00
65.00	-35.00

V.--SOIL LAYER DATA

V.A.--RIGHTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
110.00	110.00	32.00	0.00	15.00	0.00			DEF	DEF

V.B.--LEFTSIDE
LEVEL 2 FACTOR OF SAFETY FOR ACTIVE PRESSURE = DEFAULT
LEVEL 2 FACTOR OF SAFETY FOR PASSIVE PRESSURE = DEFAULT

SAT. WGHT. (PCF)	MOIST WGHT. (PCF)	ANGLE OF INTERNAL FRICTION (DEG)	COH-ESION (PSF)	ANGLE OF WALL FRICTION (DEG)	ADH-ESION (PSF)	<--BOTTOM--> ELEV. (FT)	SLOPE (FT/FT)	<-SAFETY-> <-FACTOR-> ACT.	PASS.
145.00	145.00	35.00	0.00	15.00	0.00			DEF	DEF

VI.--WATER DATA
UNIT WEIGHT = 62.40 (PCF)
RIGHTSIDE ELEVATION = 0.00 (FT)
LEFTSIDE ELEVATION = 0.00 (FT)
NO SEEPAGE

VII.--VERTICAL SURCHARGE LOADS

VII.A.--VERTICAL LINE LOADS
NONE

VII.B.--VERTICAL UNIFORM LOADS
NONE

VII.C.--VERTICAL STRIP LOADS

VII.C.1.--RIGHTSIDE
<-DIST. FROM WALL->

START (FT)	END (FT)	STRIP LOAD (PSF)
25.00	275.00	1000.00

VII.C.2.--LEFTSIDE
NONE

VII.D.--VERTICAL RAMP LOADS
NONE

VII.E.--VERTICAL TRIANGULAR LOADS
NONE

VII.F.--VERTICAL VARIABLE LOADS

NONE

VIII.--HORIZONTAL LOADS NONE

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHORED OR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 11:09:53

```
****************************
*  SUMMARY OF RESULTS FOR  *
* CANTILEVER WALL ANALYSIS *
****************************
```

I.--HEADING

'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--SUMMARY

RIGHTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

LEFTSIDE SOIL PRESSURES DETERMINED BY SWEEP SEARCH WEDGE METHOD.

*****WARNING: STANDARD WEDGE SOLUTION DOES NOT EXIST
AT ALL ELEVATIONS. SEE COMPLETE OUTPUT.

PASSIVE FACTOR OF SAFETY	:	4.00
MAX. BEND. MOMENT (LB-FT)	:	7.5641E+03
AT ELEVATION (FT)	:	2.09
MAXIMUM DEFLECTION (IN.)	:	1.1494E-01
AT ELEVATION (FT)	:	15.00

PROGRAM CWALSHT-DESIGN/ANALYSIS OF ANCHOREDOR CANTILEVER SHEET PILE WALLS
BY CLASSICAL METHODS

DATE: 16-OCTOBER-2003 TIME: 11:09:53

```
****************************
*   COMPLETE RESULTS FOR   *
* CANTILEVER WALL ANALYSIS *
****************************
```

I.--HEADING
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'
'RIP RAP SLOPE 35 DEG. BLDG. SURCHARGE 1000 PSF

II.--RESULTS0. (LB))

ELEVATION (FT)	BENDING MOMENT (LB-FT)	SHEAR (LB)	DEFLECTION (IN)	NET PRESSURE (PSF)
15.00	0.0000E+00	0.	1.1494E-01	0.00
14.00	9.0741E+00	27.	1.0522E-01	54.44
13.00	7.2592E+01	109.	9.5510E-02	108.89
12.00	2.4500E+02	245.	8.5810E-02	163.33
11.00	5.8074E+02	436.	7.6148E-02	217.78
10.00	1.1343E+03	681.	6.6574E-02	272.22
9.00	1.9358E+03	907.	5.7169E-02	181.67
8.00	2.9191E+03	1044.	4.8051E-02	91.11
7.00	3.9934E+03	1090.	3.9361E-02	0.55
6.99	4.0001E+03	1090.	3.9309E-02	0.00
6.00	5.0683E+03	1045.	3.1257E-02	-90.00
5.00	6.0532E+03	910.	2.3894E-02	-180.56
4.00	6.8576E+03	684.	1.7417E-02	-271.11
3.00	7.3908E+03	367.	1.1941E-02	-361.67
2.00	7.5624E+03	-39.	7.5444E-03	-452.22
1.00	7.2817E+03	-537.	4.2508E-03	-542.78
0.00	6.4570E+03	-1129.	2.0180E-03	-641.06
-1.00	4.9990E+03	-1796.	7.2385E-04	-692.37
-1.40	4.2250E+03	-2077.	4.2441E-04	-715.98
-2.00	2.8939E+03	-2285.	1.5415E-04	22.68
-3.00	8.2517E+02	-1647.	8.9391E-06	1253.54
-3.91	0.0000E+00	0.	0.0000E+00	2371.93

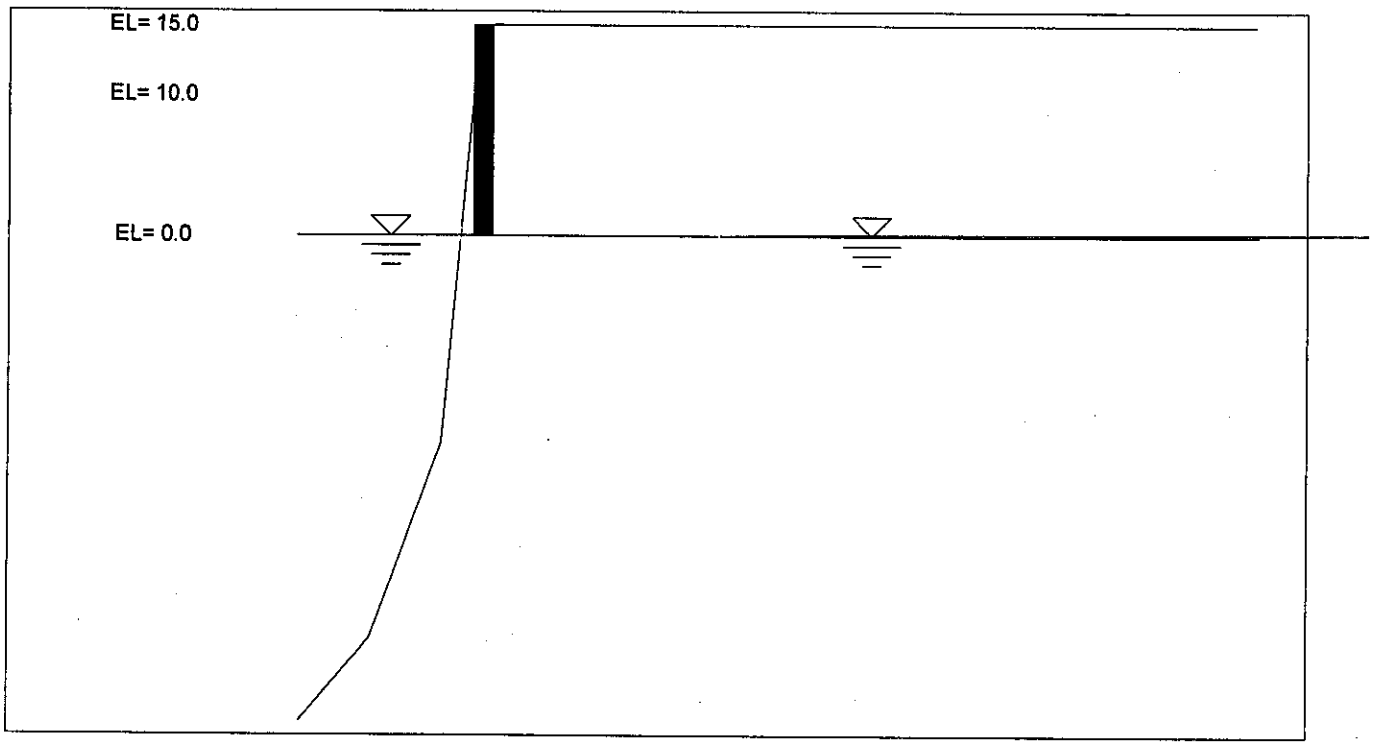
III.--WATER AND SOIL PRESSURES

ELEVATION (FT)	WATER PRESSURE (PSF)	<----------SOIL PRESSURES----------> <----LEFTSIDE-----> PASSIVE (PSF)	ACTIVE (PSF)	<---RIGHTSIDE----> ACTIVE (PSF)	PASSIVE (PSF)
15.00	0.	0.	0.	0.	0.
14.00	0.	0.	0.	54.	161.
13.00	0.	0.	0.	109.	323.
12.00	0.	0.	0.	163.	484.
11.00	0.	0.	0.	218.	646.
10.00	0.	0.	0.	272.	807.
9.00	0.*	145.	35.	327.	969.
8.00	0.*	290.	69.	381.	1130.
7.00	0.*	435.	104.	436.	1292.
6.99	0.*	436.	104.	436.	1293.
6.00	0.*	580.	138.	490.	1453.
5.00	0.*	725.	173.	544.	1615.
4.00	0.*	870.	207.	599.	1776.
3.00	0.*	1015.	242.	653.	1938.
2.00	0.*	1160.	276.	708.	2099.
1.00	0.*	1305.	311.	762.	2261.
0.00	0.*	1450.	339.	809.	2399.
-1.00	0.*	1533.	355.	840.	2492.
-1.40	0.*	1566.	358.	850.	2527.
-2.00	0.*	1615.	364.	864.	2580.
-3.00	0.*	1698.	373.	887.	2700.
-3.91	0.*	1780.	382.	911.	2758.
-5.00	0.*	1863.	391.	1012.	2878.

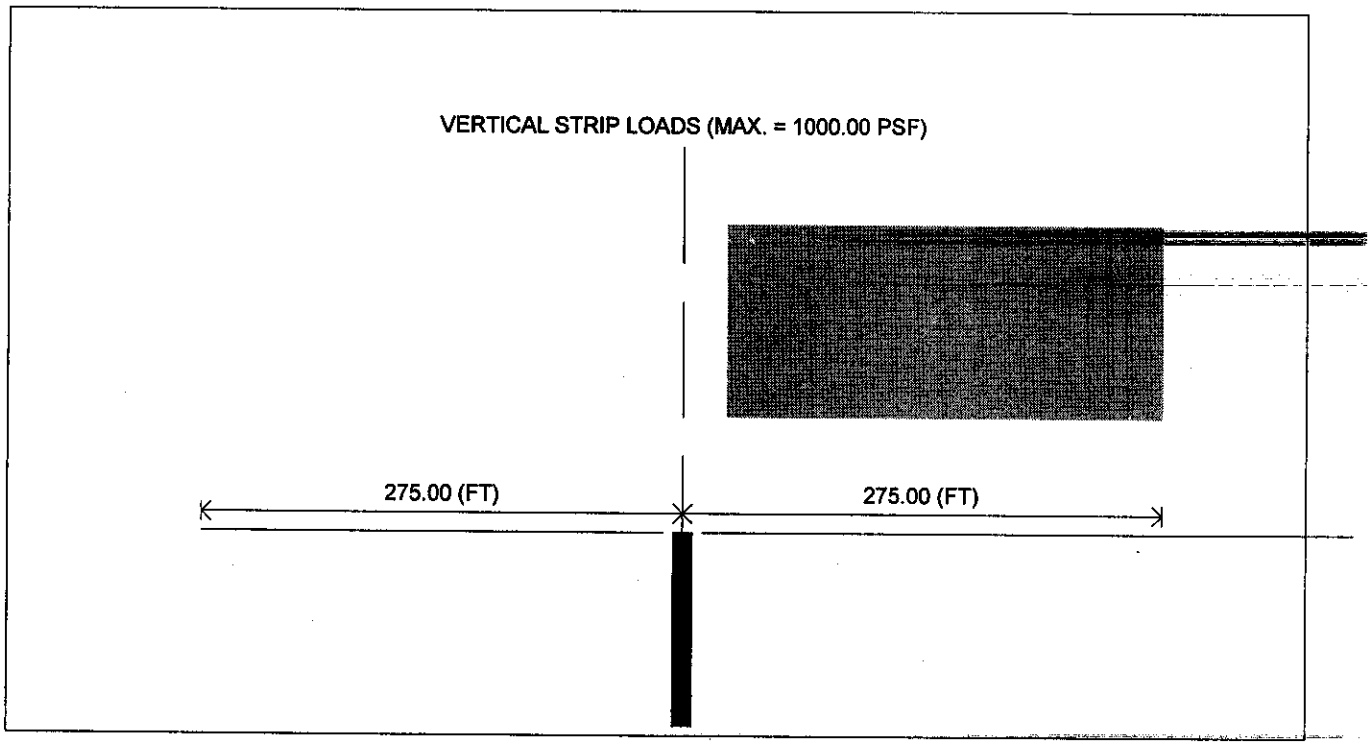
* STANDARD WEDGE SOLUTION DOES NOT EXIST FOR INDICATED PRESSURE AT THIS ELEVATION.

'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'

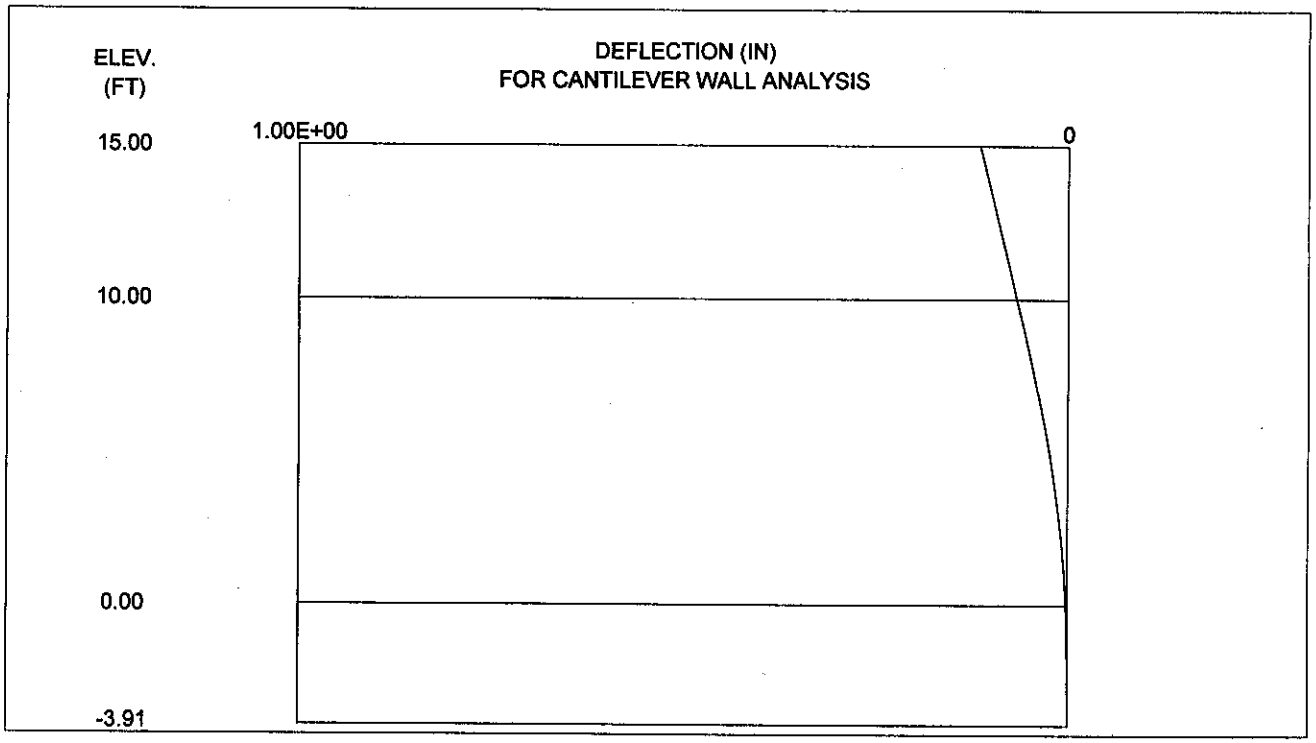


'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE
'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



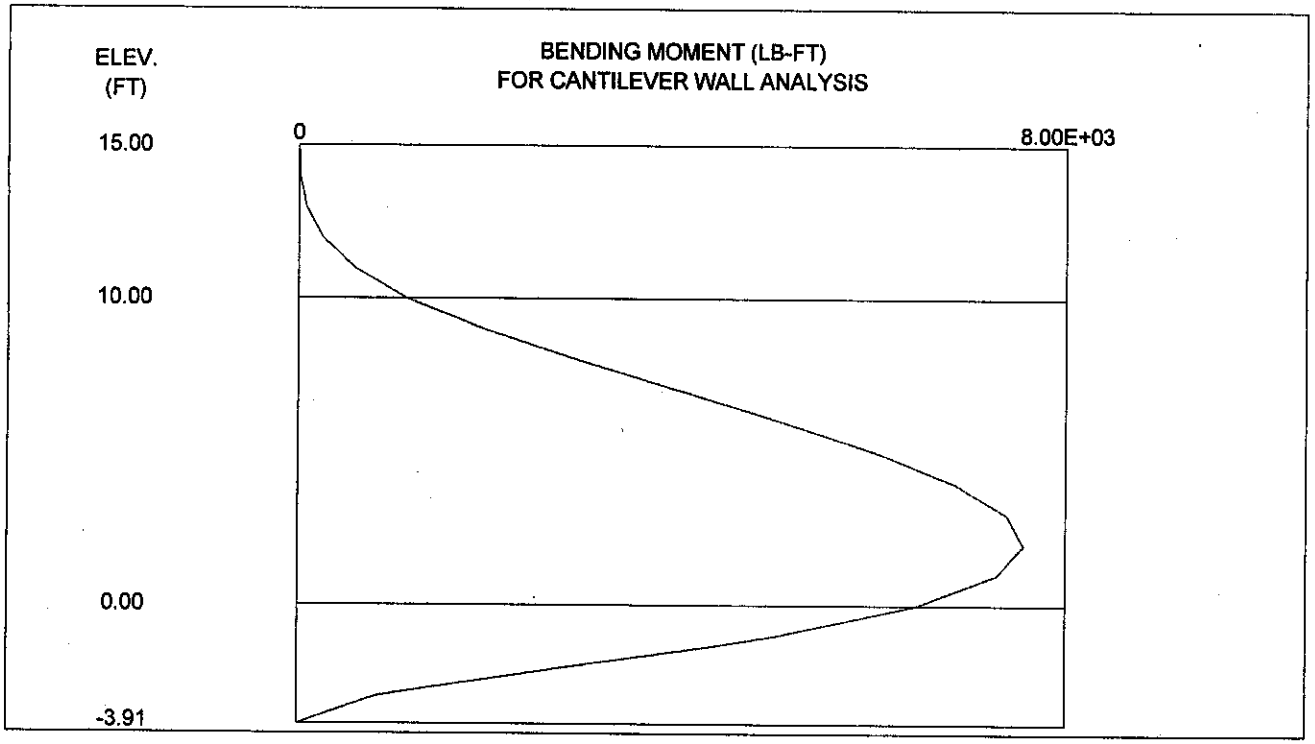
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



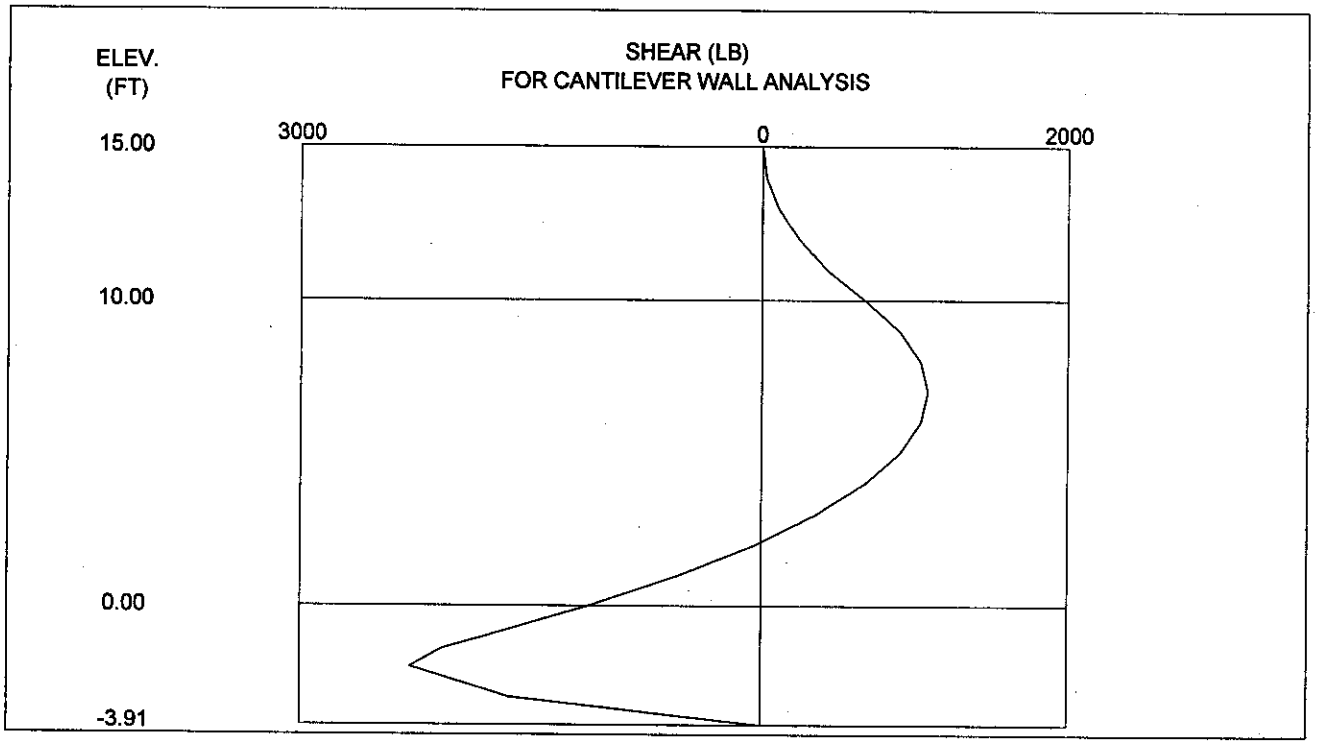
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

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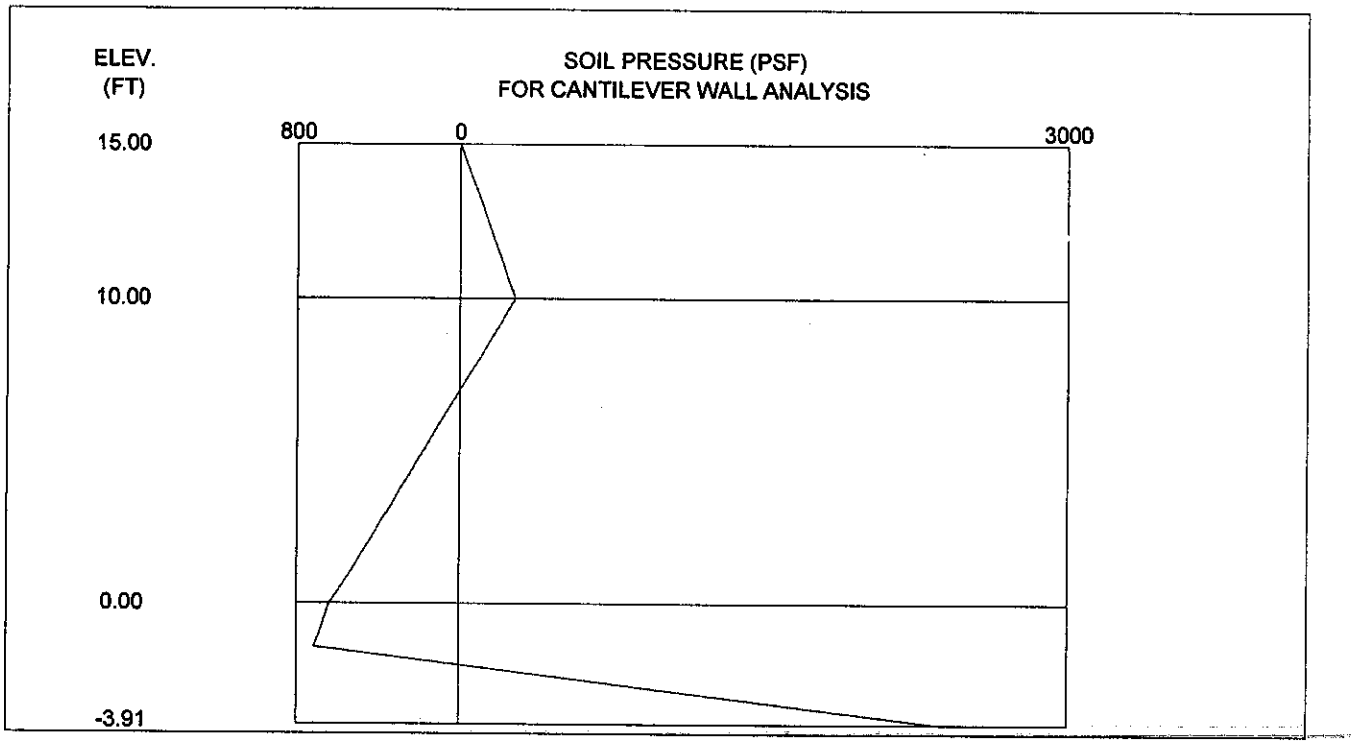
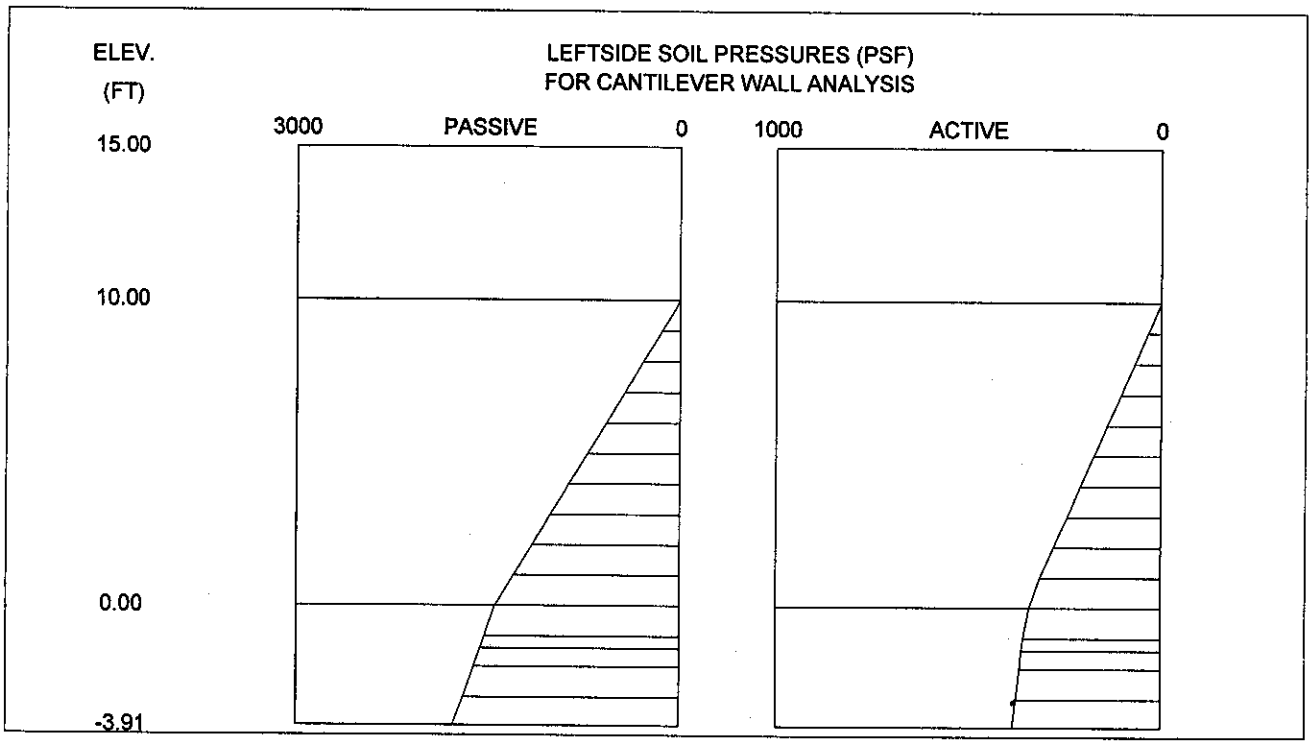


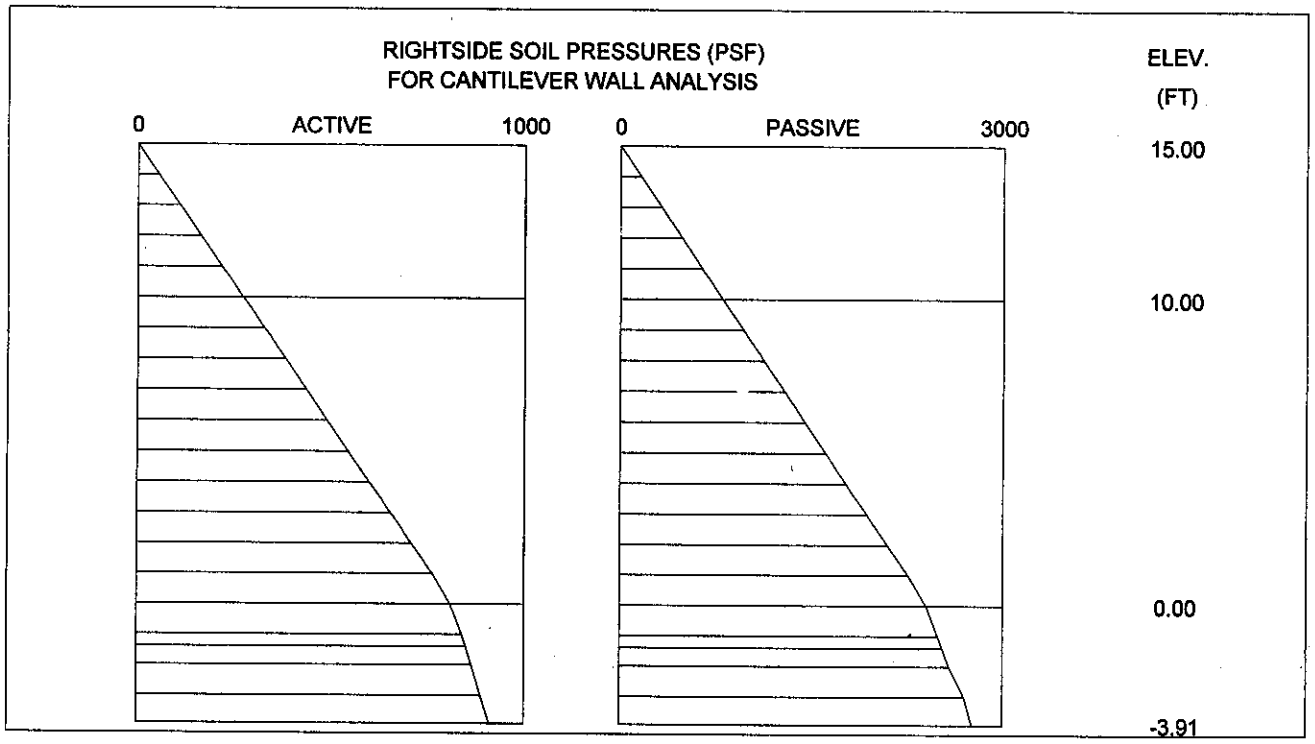
'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



'CHEVERON LUBRICANTS PLANT STEEL SHEET PILE

'ARTHUR KILL CHANNEL DREDGE LINE EL. -54'



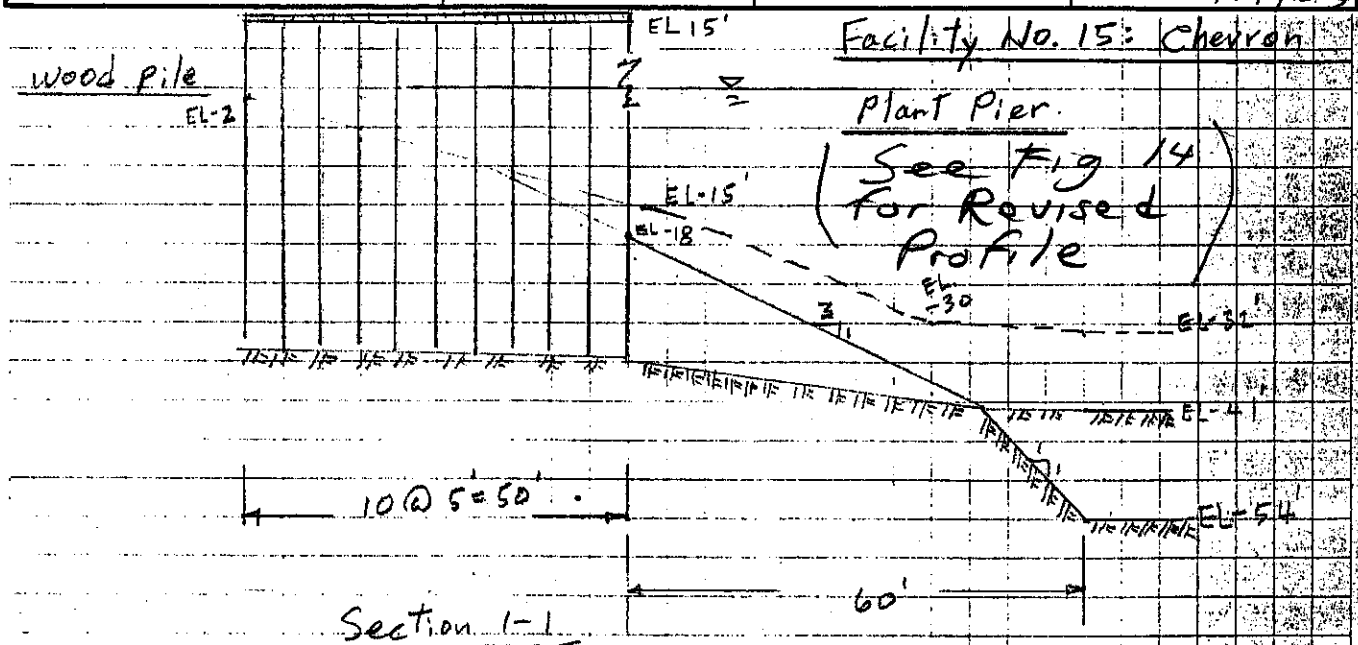
CHEVRON PLANT

LUBRICANT PLANT PIER

COMPUTATION SHEET

Page 1 of

Subject: Chevron lubricant plant wharf		Project: Arthur Kill channel	
Computed by: J. CHU	Date: 9-25-2002	Checked by: SOD	Date: 10/31/03



Section 1-1

Assume: wood pile $\phi = 12''$ first row of pile is broken.
so, first row is not considered in analysis.
after dredge, average mud line EL. $= \frac{-2+(-18)}{2} = -10'$

$L_u = 15 + 10 = 25'$ $\quad L = 50'$

$I = \pi d^4/64 = \frac{\pi(12)^4}{64} = 1018\ in^4$ $\quad A = \pi(12)^2/4 = 113\ in^2$

Properties:

$E = 1500\ ksi$ $\quad$ fixity = fixed

$I1 = 1018\ in^4$ $\quad C33 = 1.0$

$I2 = 1018\ in^4$ $\quad B66 = 0$

$A = 113\ in^2$ $\quad L_u = 25'$

$L = 50'$

$NH = 0.1\ k/in^3$ / k/in^2

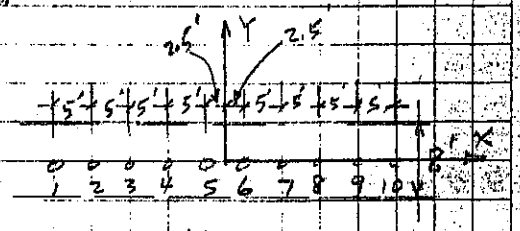
$AC = 50^k$

$AT = 25^k$

$ACC = F_{ac} \cdot A = 1.0 \times 113 = 113^k$

$ATT = F_{aT} A = 2.0 \times 113 = 226^k$

$AM1 = F_b \cdot S1 = 2.0 \times 170 = 340^{k-in} = AM2$ $\quad S1 = \frac{I1}{c} = 1018/6 = 170\ in^3$



Plan

Applied load

Vertical: $F_z = 500 \times 8 \times 50 = 200^k$

Horizontal $F_x = 3000 \times 8 = 24^k$

NAVY FORM 229 Apr 79

COMPUTATION SHEET			Page 2 of ____
Subject Chevron lubricants plant wharf		Project Arthur Kill Channel	
Computed by J. CHU	Date 9-25-2002	Checked by G.J.C.	Date 10/3/2002

'CPGA' Input data Calculation:

Critical buckling load computation: (For dredge line EL-54')

$L_u = 25'$

Unsupported length = $L_T = L_u + L_f$

L_f = depth to fixity = 1.8T

$$T = \sqrt[5]{\frac{EI}{NH}} = \sqrt[5]{\frac{1500 \times 1018}{0.005}} = 50'' = 4.2^{ft}$$

$L_f = 1.8 \times 4.2 = 7.5^{ft}$ $\quad L_T = 25 + 7.5 = 32.5'$

$$P_{cr} = \frac{\pi^2 EI}{(KL_T)^2} = \frac{\pi^2 (1500)(1018)}{(1.0)(32.5)^2(12)^2} \boxed{= 99^K}$$

$$\frac{KL_T}{r} = \frac{(1.0)(32.5)(12)}{(1018/113)^{1/2}} = 130$$

Moment factors for fixed unsupported piles: $L_u = 25'$

$T = 4.2'$ free standing length factor = $(m) = L_u/T = 25/4.2 = 5.9$

$(H) = 0.35$ (for fixed)

$KMF1 = KMF2 = T/H = 4.2'/0.35 = 12' = 144''$

NANY FORM 229 Apr 79

COMPUTATION SHEET			Page 3 of ____
Subject Chevron lubricant plant wharf		Project Arthur Kill Channel	
Computed by J. CHU	Date 9-28-2002	Checked by G.J.C.	Date 10/31/2003

'CPGA' program Input Data

a) Chevron lubricant plant wharf wood pile cap displ. dredge El -54'

	E	I1	I2	A	C33	B66	List
b) Prop	1500	1018	1018	113	1.0	0	all

	Psoil	Esoil	Length	L	Lu	List
c) Soil	NH	0.1	L	50	25	all

d) fix All

	shape	AC	AT	ACC	ATT	AM1	AM2	List
g) Allow	R	50	25	113	226	340	340	all

	Mt'L	CM1	CM2	PCR1	PCR2	ST	List
j) UNSP	T	0.6	0.6	99	99	H	all

	KMF1U	KMF2U	List
l) FUNSMOM	144	144	ALL

p) PILE 1 -22.5 0 0 2 -17.5 0 0 3 -12.5 0 0 4 -7.5 0 0

5 -2.5 0 0 6 2.5 0 0 7 7.5 0 0 8 12.5 0 0 9 17.5 0 0

10 22.5 0 0

y) Load 1 24. 0. 200. 0. 0. 0.

bb) FOUT 1 2 3 4 5 6 7 Chevron10

ee) PFO ALL

gg) FPL N

NAVY FORM 229 Apr 79

```
*********************************
* CASE PROGRAM    #  X0080      *  CPGA - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 1993/03/29   *  RUN DATE 29-OCT-2003   RUN TIME 14.29.36
*********************************
```

CHEVRON LUBRICANT PLANT WHARF WOOD PILE CAP DISPL.

THERE ARE 50 PILES AND
1 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-22.50 ,	.00 ,	.00)
(	22.50 ,	20.00 ,	.00)

****

PILE PROPERTIES AS INPUT

E	I1	I2	A	C33	B66
KSI	IN**4	IN**4	IN**2		
.15000E+04	.10180E+04	.10180E+04	.11300E+03	.10000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

NH	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.10000E+00	L	.50000E+02	.25000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X	Y	Z	BATTER	ANGLE	LENGTH	FIXITY
	FT	FT	FT			FT	
1	-22.50	.00	.00	V	.00	50.00	F
2	-17.50	.00	.00	V	.00	50.00	F
3	-12.50	.00	.00	V	.00	50.00	F
4	-7.50	.00	.00	V	.00	50.00	F
5	-2.50	.00	.00	V	.00	50.00	F
6	2.50	.00	.00	V	.00	50.00	F
7	7.50	.00	.00	V	.00	50.00	F
8	12.50	.00	.00	V	.00	50.00	F
9	17.50	.00	.00	V	.00	50.00	F

10	22.50	.00	.00	V	.00	50.00	F
11	-22.50	5.00	.00	V	.00	50.00	F
12	-17.50	5.00	.00	V	.00	50.00	F
13	-12.50	5.00	.00	V	.00	50.00	F
14	-7.50	5.00	.00	V	.00	50.00	F
15	-2.50	5.00	.00	V	.00	50.00	F
16	2.50	5.00	.00	V	.00	50.00	F
17	7.50	5.00	.00	V	.00	50.00	F
18	12.50	5.00	.00	V	.00	50.00	F
19	17.50	5.00	.00	V	.00	50.00	F
20	22.50	5.00	.00	V	.00	50.00	F
21	-22.50	10.00	.00	V	.00	50.00	F
22	-17.50	10.00	.00	V	.00	50.00	F
23	-12.50	10.00	.00	V	.00	50.00	F
24	-7.50	10.00	.00	V	.00	50.00	F
25	-2.50	10.00	.00	V	.00	50.00	F
26	2.50	10.00	.00	V	.00	50.00	F
27	7.50	10.00	.00	V	.00	50.00	F
28	12.50	10.00	.00	V	.00	50.00	F
29	17.50	10.00	.00	V	.00	50.00	F
30	22.50	10.00	.00	V	.00	50.00	F
31	-22.50	15.00	.00	V	.00	50.00	F
32	-17.50	15.00	.00	V	.00	50.00	F
33	-12.50	15.00	.00	V	.00	50.00	F
34	-7.50	15.00	.00	V	.00	50.00	F
35	-2.50	15.00	.00	V	.00	50.00	F
36	2.50	15.00	.00	V	.00	50.00	F
37	7.50	15.00	.00	V	.00	50.00	F
38	12.50	15.00	.00	V	.00	50.00	F
39	17.50	15.00	.00	V	.00	50.00	F
40	22.50	15.00	.00	V	.00	50.00	F
41	-22.50	20.00	.00	V	.00	50.00	F
42	-17.50	20.00	.00	V	.00	50.00	F
43	-12.50	20.00	.00	V	.00	50.00	F
44	-7.50	20.00	.00	V	.00	50.00	F
45	-2.50	20.00	.00	V	.00	50.00	F
46	2.50	20.00	.00	V	.00	50.00	F
47	7.50	20.00	.00	V	.00	50.00	F
48	12.50	20.00	.00	V	.00	50.00	F
49	17.50	20.00	.00	V	.00	50.00	F
50	22.50	20.00	.00	V	.00	50.00	F

						2500.00	

****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	24.0	.0	200.0	.0	.0	.0

****

ORIGINAL PILE GROUP STIFFNESS MATRIX

.21555E+02	.00000E+00	.00000E+00	.00000E+00	.37547E+04	-.25866E+04
.00000E+00	.21555E+02	.00000E+00	-.37547E+04	.00000E+00	-.14211E-13
.00000E+00	.00000E+00	.14125E+05	.16950E+07	.00000E+00	.00000E+00
.00000E+00	-.37547E+04	.16950E+07	.30597E+09	.00000E+00	.00000E+00

.37547E+04	.00000E+00	.00000E+00	.00000E+00	.42039E+09	-.45056E+06
-.25866E+04	-.14211E-13	.00000E+00	.00000E+00	-.45056E+06	.11058E+07

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 15.

****

PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.1550E+01	-.4102E-01	.4242E-01	-.2355E-03	-.9960E-05	.3621E-02

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO (F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.7	-.4	11.2	72.4	116.2	.0	.22	.63
		FUNSMOM		11.7	20.1			.19
2	.7	-.3	11.4	56.1	116.2	.0	.23	.61
		FUNSMOM		8.9	20.1			.19
3	.7	-.2	11.6	39.8	116.2	.0	.23	.60
		FUNSMOM		6.0	20.1			.19
4	.7	-.1	11.7	23.4	116.2	.0	.23	.59
		FUNSMOM		3.2	20.1			.19
5	.7	.0	11.9	7.1	116.2	.0	.24	.59
		FUNSMOM		.4	20.1			.19
6	.7	.0	12.1	-9.2	116.2	.0	.24	.60
		FUNSMOM		-2.4	20.1			.19
7	.7	.1	12.2	-25.5	116.2	.0	.24	.62
		FUNSMOM		-5.3	20.1			.20
8	.7	.2	12.4	-41.8	116.2	.0	.25	.66
		FUNSMOM		-8.1	20.1			.21
9	.7	.3	12.6	-58.1	116.2	.0	.25	.70
		FUNSMOM		-10.9	20.1			.21
10	.7	.4	12.7	-74.4	116.2	.0	.25	.75
		FUNSMOM		-13.8	20.1			.23
11	.6	-.4	7.2	72.4	99.9	.0	.14	.43
		FUNSMOM		11.7	17.3			.13
12	.6	-.3	7.4	56.1	99.9	.0	.15	.40
		FUNSMOM		8.9	17.3			.12
13	.6	-.2	7.6	39.8	99.9	.0	.15	.38
		FUNSMOM		6.0	17.3			.12
14	.6	-.1	7.7	23.4	99.9	.0	.15	.37
		FUNSMOM		3.2	17.3			.12

15	.6	.0	7.9	7.1	99.9	.0	.16	.36
		FUNSMOM		.4	17.3			.12
16	.6	.0	8.1	-9.2	99.9	.0	.16	.37
		FUNSMOM		-2.4	17.3			.12
17	.6	.1	8.2	-25.5	99.9	.0	.16	.38
		FUNSMOM		-5.3	17.3			.13
18	.6	.2	8.4	-41.8	99.9	.0	.17	.40
		FUNSMOM		-8.1	17.3			.13
19	.6	.3	8.6	-58.1	99.9	.0	.17	.43
		FUNSMOM		-10.9	17.3			.14
20	.6	.4	8.8	-74.4	99.9	.0	.18	.46
		FUNSMOM		-13.8	17.3			.15
21	.5	-.4	3.2	72.4	83.6	.0	.06	.35
		FUNSMOM		11.7	14.4			.08
22	.5	-.3	3.4	56.1	83.6	.0	.07	.33
		FUNSMOM		8.9	14.4			.08
23	.5	-.2	3.6	39.8	83.6	.0	.07	.30
		FUNSMOM		6.0	14.4			.08
24	.5	-.1	3.7	23.4	83.6	.0	.07	.29
		FUNSMOM		3.2	14.4			.08
25	.5	.0	3.9	7.1	83.6	.0	.08	.28
		FUNSMOM		.4	14.4			.08
26	.5	.0	4.1	-9.2	83.6	.0	.08	.28
		FUNSMOM		-2.4	14.4			.08
27	.5	.1	4.3	-25.5	83.6	.0	.09	.29
		FUNSMOM		-5.3	14.4			.08
28	.5	.2	4.4	-41.8	83.6	.0	.09	.31
		FUNSMOM		-8.1	14.4			.09
29	.5	.3	4.6	-58.1	83.6	.0	.09	.34
		FUNSMOM		-10.9	14.4			.09
30	.5	.4	4.8	-74.4	83.6	.0	.10	.37
		FUNSMOM		-13.8	14.4			.10
31	.4	-.4	-.8	72.4	67.3	.0	.03	.29
		FUNSMOM		11.7	11.6			.05
32	.4	-.3	-.6	56.1	67.3	.0	.02	.26
		FUNSMOM		8.9	11.6			.05
33	.4	-.2	-.4	39.8	67.3	.0	.02	.23
		FUNSMOM		6.0	11.6			.04
34	.4	-.1	-.2	23.4	67.3	.0	.01	.21
		FUNSMOM		3.2	11.6			.04
35	.4	.0	-.1	7.1	67.3	.0	.00	.20
		FUNSMOM		.4	11.6			.03
36	.4	.0	.1	-9.2	67.3	.0	.00	.20
		FUNSMOM		-2.4	11.6			.04
37	.4	.1	.3	-25.5	67.3	.0	.01	.21
		FUNSMOM		-5.3	11.6			.04
38	.4	.2	.4	-41.8	67.3	.0	.01	.24
		FUNSMOM		-8.1	11.6			.05
39	.4	.3	.6	-58.1	67.3	.0	.01	.27
		FUNSMOM		-10.9	11.6			.05
40	.4	.4	.8	-74.4	67.3	.0	.02	.30
		FUNSMOM		-13.8	11.6			.06
41	.3	-.4	-4.7	72.4	50.9	.0	.19	.28
		FUNSMOM		11.7	8.8			.06
42	.3	-.3	-4.6	56.1	50.9	.0	.18	.24
		FUNSMOM		8.9	8.8			.06
43	.3	-.2	-4.4	39.8	50.9	.0	.18	.21
		FUNSMOM		6.0	8.8			.05
44	.3	-.1	-4.2	23.4	50.9	.0	.17	.18
		FUNSMOM		3.2	8.8			.05
45	.3	.0	-4.1	7.1	50.9	.0	.16	.17
		FUNSMOM		.4	8.8			.04
46	.3	.0	-3.9	-9.2	50.9	.0	.16	.17

		FUNSMOM		-2.4	8.8			.04
47	.3	.1	-3.7	-25.5	50.9	.0	.15	.18
		FUNSMOM		-5.3	8.8			.05
48	.3	.2	-3.6	-41.8	50.9	.0	.14	.21
		FUNSMOM		-8.1	8.8			.05
49	.3	.3	-3.4	-58.1	50.9	.0	.14	.24
		FUNSMOM		-10.9	8.8			.06
50	.3	.4	-3.2	-74.4	50.9	.0	.13	.28
		FUNSMOM		-13.8	8.8			.06

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PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.7	-.4	11.2	72.4	116.2	.0
2	.7	-.3	11.4	56.1	116.2	.0
3	.7	-.2	11.6	39.8	116.2	.0
4	.7	-.1	11.7	23.4	116.2	.0
5	.7	.0	11.9	7.1	116.2	.0
6	.7	.0	12.1	-9.2	116.2	.0
7	.7	.1	12.2	-25.5	116.2	.0
8	.7	.2	12.4	-41.8	116.2	.0
9	.7	.3	12.6	-58.1	116.2	.0
10	.7	.4	12.7	-74.4	116.2	.0
11	.6	-.4	7.2	72.4	99.9	.0
12	.6	-.3	7.4	56.1	99.9	.0
13	.6	-.2	7.6	39.8	99.9	.0
14	.6	-.1	7.7	23.4	99.9	.0
15	.6	.0	7.9	7.1	99.9	.0
16	.6	.0	8.1	-9.2	99.9	.0
17	.6	.1	8.2	-25.5	99.9	.0
18	.6	.2	8.4	-41.8	99.9	.0
19	.6	.3	8.6	-58.1	99.9	.0
20	.6	.4	8.8	-74.4	99.9	.0
21	.5	-.4	3.2	72.4	83.6	.0
22	.5	-.3	3.4	56.1	83.6	.0
23	.5	-.2	3.6	39.8	83.6	.0
24	.5	-.1	3.7	23.4	83.6	.0
25	.5	.0	3.9	7.1	83.6	.0
26	.5	.0	4.1	-9.2	83.6	.0
27	.5	.1	4.3	-25.5	83.6	.0
28	.5	.2	4.4	-41.8	83.6	.0
29	.5	.3	4.6	-58.1	83.6	.0
30	.5	.4	4.8	-74.4	83.6	.0
31	.4	-.4	-.8	72.4	67.3	.0
32	.4	-.3	-.6	56.1	67.3	.0
33	.4	-.2	-.4	39.8	67.3	.0
34	.4	-.1	-.2	23.4	67.3	.0
35	.4	.0	-.1	7.1	67.3	.0
36	.4	.0	.1	-9.2	67.3	.0
37	.4	.1	.3	-25.5	67.3	.0
38	.4	.2	.4	-41.8	67.3	.0
39	.4	.3	.6	-58.1	67.3	.0
40	.4	.4	.8	-74.4	67.3	.0
41	.3	-.4	-4.7	72.4	50.9	.0

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42	.3	-.3	-4.6	56.1	50.9	.0
43	.3	-.2	-4.4	39.8	50.9	.0
44	.3	-.1	-4.2	23.4	50.9	.0
45	.3	.0	-4.1	7.1	50.9	.0
46	.3	.0	-3.9	-9.2	50.9	.0
47	.3	.1	-3.7	-25.5	50.9	.0
48	.3	.2	-3.6	-41.8	50.9	.0
49	.3	.3	-3.4	-58.1	50.9	.0
50	.3	.4	-3.2	-74.4	50.9	.0

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*********************************
* CASE PROGRAM    #  X0080      *  CPGA - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 1993/03/29   *  RUN DATE 29-OCT-2003   RUN TIME 14.29.36
*********************************
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CHEVRON LUBRICANT PLANT WHARF WOOD PILE CAP DISPL.

THERE ARE 50 PILES AND
1 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-22.50 ,	.00 ,	.00)
(	22.50 ,	20.00 ,	.00)

****

PILE PROPERTIES AS INPUT

E KSI	I1 IN**4	I2 IN**4	A IN**2	C33	B66
.15000E+04	.10180E+04	.10180E+04	.11300E+03	.10000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

NH	ESOIL K/IN**3	LENGTH	L FT	LU FT
	.10000E+00	L	.50000E+02	.25000E+02

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	-22.50	.00	.00	V	.00	50.00	F
2	-17.50	.00	.00	V	.00	50.00	F
3	-12.50	.00	.00	V	.00	50.00	F
4	-7.50	.00	.00	V	.00	50.00	F
5	-2.50	.00	.00	V	.00	50.00	F
6	2.50	.00	.00	V	.00	50.00	F
7	7.50	.00	.00	V	.00	50.00	F
8	12.50	.00	.00	V	.00	50.00	F
9	17.50	.00	.00	V	.00	50.00	F

10	22.50	.00	.00	V	.00	50.00	F
11	-22.50	5.00	.00	V	.00	50.00	F
12	-17.50	5.00	.00	V	.00	50.00	F
13	-12.50	5.00	.00	V	.00	50.00	F
14	-7.50	5.00	.00	V	.00	50.00	F
15	-2.50	5.00	.00	V	.00	50.00	F
16	2.50	5.00	.00	V	.00	50.00	F
17	7.50	5.00	.00	V	.00	50.00	F
18	12.50	5.00	.00	V	.00	50.00	F
19	17.50	5.00	.00	V	.00	50.00	F
20	22.50	5.00	.00	V	.00	50.00	F
21	-22.50	10.00	.00	V	.00	50.00	F
22	-17.50	10.00	.00	V	.00	50.00	F
23	-12.50	10.00	.00	V	.00	50.00	F
24	-7.50	10.00	.00	V	.00	50.00	F
25	-2.50	10.00	.00	V	.00	50.00	F
26	2.50	10.00	.00	V	.00	50.00	F
27	7.50	10.00	.00	V	.00	50.00	F
28	12.50	10.00	.00	V	.00	50.00	F
29	17.50	10.00	.00	V	.00	50.00	F
30	22.50	10.00	.00	V	.00	50.00	F
31	-22.50	15.00	.00	V	.00	50.00	F
32	-17.50	15.00	.00	V	.00	50.00	F
33	-12.50	15.00	.00	V	.00	50.00	F
34	-7.50	15.00	.00	V	.00	50.00	F
35	-2.50	15.00	.00	V	.00	50.00	F
36	2.50	15.00	.00	V	.00	50.00	F
37	7.50	15.00	.00	V	.00	50.00	F
38	12.50	15.00	.00	V	.00	50.00	F
39	17.50	15.00	.00	V	.00	50.00	F
40	22.50	15.00	.00	V	.00	50.00	F
41	-22.50	20.00	.00	V	.00	50.00	F
42	-17.50	20.00	.00	V	.00	50.00	F
43	-12.50	20.00	.00	V	.00	50.00	F
44	-7.50	20.00	.00	V	.00	50.00	F
45	-2.50	20.00	.00	V	.00	50.00	F
46	2.50	20.00	.00	V	.00	50.00	F
47	7.50	20.00	.00	V	.00	50.00	F
48	12.50	20.00	.00	V	.00	50.00	F
49	17.50	20.00	.00	V	.00	50.00	F
50	22.50	20.00	.00	V	.00	50.00	F

						2500.00	

****

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	24.0	.0	200.0	.0	.0	.0

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ORIGINAL PILE GROUP STIFFNESS MATRIX

.21555E+02	.00000E+00	.00000E+00	.00000E+00	.37547E+04	-.25866E+04
.00000E+00	.21555E+02	.00000E+00	-.37547E+04	.00000E+00	-.14211E-13
.00000E+00	.00000E+00	.14125E+05	.16950E+07	.00000E+00	.00000E+00
.00000E+00	-.37547E+04	.16950E+07	.30597E+09	.00000E+00	.00000E+00

.37547E+04	.00000E+00	.00000E+00	.00000E+00	.42039E+09	-.45056E+06
-.25866E+04	-.14211E-13	.00000E+00	.00000E+00	-.45056E+06	.11058E+07

LOAD CASE 1. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 15.

****

PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.1550E+01	-.4102E-01	.4242E-01	-.2355E-03	-.9960E-05	.3621E-02

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CBF BASED ON MOMENTS DUE TO (F3*EMIN) FOR CONCRETE PILES
B INDICATES BUCKLING CONTROLS

LOAD CASE - 1

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF
1	.7	-.4	11.2	72.4	116.2	.0	.22	.63
		FUNSMOM		11.7	20.1			.19
2	.7	-.3	11.4	56.1	116.2	.0	.23	.61
		FUNSMOM		8.9	20.1			.19
3	.7	-.2	11.6	39.8	116.2	.0	.23	.60
		FUNSMOM		6.0	20.1			.19
4	.7	-.1	11.7	23.4	116.2	.0	.23	.59
		FUNSMOM		3.2	20.1			.19
5	.7	.0	11.9	7.1	116.2	.0	.24	.59
		FUNSMOM		.4	20.1			.19
6	.7	.0	12.1	-9.2	116.2	.0	.24	.60
		FUNSMOM		-2.4	20.1			.19
7	.7	.1	12.2	-25.5	116.2	.0	.24	.62
		FUNSMOM		-5.3	20.1			.20
8	.7	.2	12.4	-41.8	116.2	.0	.25	.66
		FUNSMOM		-8.1	20.1			.21
9	.7	.3	12.6	-58.1	116.2	.0	.25	.70
		FUNSMOM		-10.9	20.1			.21
10	.7	.4	12.7	-74.4	116.2	.0	.25	.75
		FUNSMOM		-13.8	20.1			.23
11	.6	-.4	7.2	72.4	99.9	.0	.14	.43
		FUNSMOM		11.7	17.3			.13
12	.6	-.3	7.4	56.1	99.9	.0	.15	.40
		FUNSMOM		8.9	17.3			.12
13	.6	-.2	7.6	39.8	99.9	.0	.15	.38
		FUNSMOM		6.0	17.3			.12
14	.6	-.1	7.7	23.4	99.9	.0	.15	.37
		FUNSMOM		3.2	17.3			.12

15	.6	.0	7.9	7.1	99.9	.0	.16	.36
		FUNSMOM		.4	17.3			.12
16	.6	.0	8.1	-9.2	99.9	.0	.16	.37
		FUNSMOM		-2.4	17.3			.12
17	.6	.1	8.2	-25.5	99.9	.0	.16	.38
		FUNSMOM		-5.3	17.3			.13
18	.6	.2	8.4	-41.8	99.9	.0	.17	.40
		FUNSMOM		-8.1	17.3			.13
19	.6	.3	8.6	-58.1	99.9	.0	.17	.43
		FUNSMOM		-10.9	17.3			.14
20	.6	.4	8.8	-74.4	99.9	.0	.18	.46
		FUNSMOM		-13.8	17.3			.15
21	.5	-.4	3.2	72.4	83.6	.0	.06	.35
		FUNSMOM		11.7	14.4			.08
22	.5	-.3	3.4	56.1	83.6	.0	.07	.33
		FUNSMOM		8.9	14.4			.08
23	.5	-.2	3.6	39.8	83.6	.0	.07	.30
		FUNSMOM		6.0	14.4			.08
24	.5	-.1	3.7	23.4	83.6	.0	.07	.29
		FUNSMOM		3.2	14.4			.08
25	.5	.0	3.9	7.1	83.6	.0	.08	.28
		FUNSMOM		.4	14.4			.08
26	.5	.0	4.1	-9.2	83.6	.0	.08	.28
		FUNSMOM		-2.4	14.4			.08
27	.5	.1	4.3	-25.5	83.6	.0	.09	.29
		FUNSMOM		-5.3	14.4			.08
28	.5	.2	4.4	-41.8	83.6	.0	.09	.31
		FUNSMOM		-8.1	14.4			.09
29	.5	.3	4.6	-58.1	83.6	.0	.09	.34
		FUNSMOM		-10.9	14.4			.09
30	.5	.4	4.8	-74.4	83.6	.0	.10	.37
		FUNSMOM		-13.8	14.4			.10
31	.4	-.4	-.8	72.4	67.3	.0	.03	.29
		FUNSMOM		11.7	11.6			.05
32	.4	-.3	-.6	56.1	67.3	.0	.02	.26
		FUNSMOM		8.9	11.6			.05
33	.4	-.2	-.4	39.8	67.3	.0	.02	.23
		FUNSMOM		6.0	11.6			.04
34	.4	-.1	-.2	23.4	67.3	.0	.01	.21
		FUNSMOM		3.2	11.6			.04
35	.4	.0	-.1	7.1	67.3	.0	.00	.20
		FUNSMOM		.4	11.6			.03
36	.4	.0	.1	-9.2	67.3	.0	.00	.20
		FUNSMOM		-2.4	11.6			.04
37	.4	.1	.3	-25.5	67.3	.0	.01	.21
		FUNSMOM		-5.3	11.6			.04
38	.4	.2	.4	-41.8	67.3	.0	.01	.24
		FUNSMOM		-8.1	11.6			.05
39	.4	.3	.6	-58.1	67.3	.0	.01	.27
		FUNSMOM		-10.9	11.6			.05
40	.4	.4	.8	-74.4	67.3	.0	.02	.30
		FUNSMOM		-13.8	11.6			.06
41	.3	-.4	-4.7	72.4	50.9	.0	.19	.28
		FUNSMOM		11.7	8.8			.06
42	.3	-.3	-4.6	56.1	50.9	.0	.18	.24
		FUNSMOM		8.9	8.8			.06
43	.3	-.2	-4.4	39.8	50.9	.0	.18	.21
		FUNSMOM		6.0	8.8			.05
44	.3	-.1	-4.2	23.4	50.9	.0	.17	.18
		FUNSMOM		3.2	8.8			.05
45	.3	.0	-4.1	7.1	50.9	.0	.16	.17
		FUNSMOM		.4	8.8			.04
46	.3	.0	-3.9	-9.2	50.9	.0	.16	.17

		FUNSMOM		-2.4	8.8			.04
47	.3	.1	-3.7	-25.5	50.9	.0	.15	.18
		FUNSMOM		-5.3	8.8			.05
48	.3	.2	-3.6	-41.8	50.9	.0	.14	.21
		FUNSMOM		-8.1	8.8			.05
49	.3	.3	-3.4	-58.1	50.9	.0	.14	.24
		FUNSMOM		-10.9	8.8			.06
50	.3	.4	-3.2	-74.4	50.9	.0	.13	.28
		FUNSMOM		-13.8	8.8			.06

****

PILE FORCES IN GLOBAL GEOMETRY

LOAD CASE - 1

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.7	-.4	11.2	72.4	116.2	.0
2	.7	-.3	11.4	56.1	116.2	.0
3	.7	-.2	11.6	39.8	116.2	.0
4	.7	-.1	11.7	23.4	116.2	.0
5	.7	.0	11.9	7.1	116.2	.0
6	.7	.0	12.1	-9.2	116.2	.0
7	.7	.1	12.2	-25.5	116.2	.0
8	.7	.2	12.4	-41.8	116.2	.0
9	.7	.3	12.6	-58.1	116.2	.0
10	.7	.4	12.7	-74.4	116.2	.0
11	.6	-.4	7.2	72.4	99.9	.0
12	.6	-.3	7.4	56.1	99.9	.0
13	.6	-.2	7.6	39.8	99.9	.0
14	.6	-.1	7.7	23.4	99.9	.0
15	.6	.0	7.9	7.1	99.9	.0
16	.6	.0	8.1	-9.2	99.9	.0
17	.6	.1	8.2	-25.5	99.9	.0
18	.6	.2	8.4	-41.8	99.9	.0
19	.6	.3	8.6	-58.1	99.9	.0
20	.6	.4	8.8	-74.4	99.9	.0
21	.5	-.4	3.2	72.4	83.6	.0
22	.5	-.3	3.4	56.1	83.6	.0
23	.5	-.2	3.6	39.8	83.6	.0
24	.5	-.1	3.7	23.4	83.6	.0
25	.5	.0	3.9	7.1	83.6	.0
26	.5	.0	4.1	-9.2	83.6	.0
27	.5	.1	4.3	-25.5	83.6	.0
28	.5	.2	4.4	-41.8	83.6	.0
29	.5	.3	4.6	-58.1	83.6	.0
30	.5	.4	4.8	-74.4	83.6	.0
31	.4	-.4	-.8	72.4	67.3	.0
32	.4	-.3	-.6	56.1	67.3	.0
33	.4	-.2	-.4	39.8	67.3	.0
34	.4	-.1	-.2	23.4	67.3	.0
35	.4	.0	-.1	7.1	67.3	.0
36	.4	.0	.1	-9.2	67.3	.0
37	.4	.1	.3	-25.5	67.3	.0
38	.4	.2	.4	-41.8	67.3	.0
39	.4	.3	.6	-58.1	67.3	.0
40	.4	.4	.8	-74.4	67.3	.0
41	.3	-.4	-4.7	72.4	50.9	.0

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42	.3	-.3	-4.6	56.1	50.9	.0
43	.3	-.2	-4.4	39.8	50.9	.0
44	.3	-.1	-4.2	23.4	50.9	.0
45	.3	.0	-4.1	7.1	50.9	.0
46	.3	.0	-3.9	-9.2	50.9	.0
47	.3	.1	-3.7	-25.5	50.9	.0
48	.3	.2	-3.6	-41.8	50.9	.0
49	.3	.3	-3.4	-58.1	50.9	.0
50	.3	.4	-3.2	-74.4	50.9	.0

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