(A0006892)

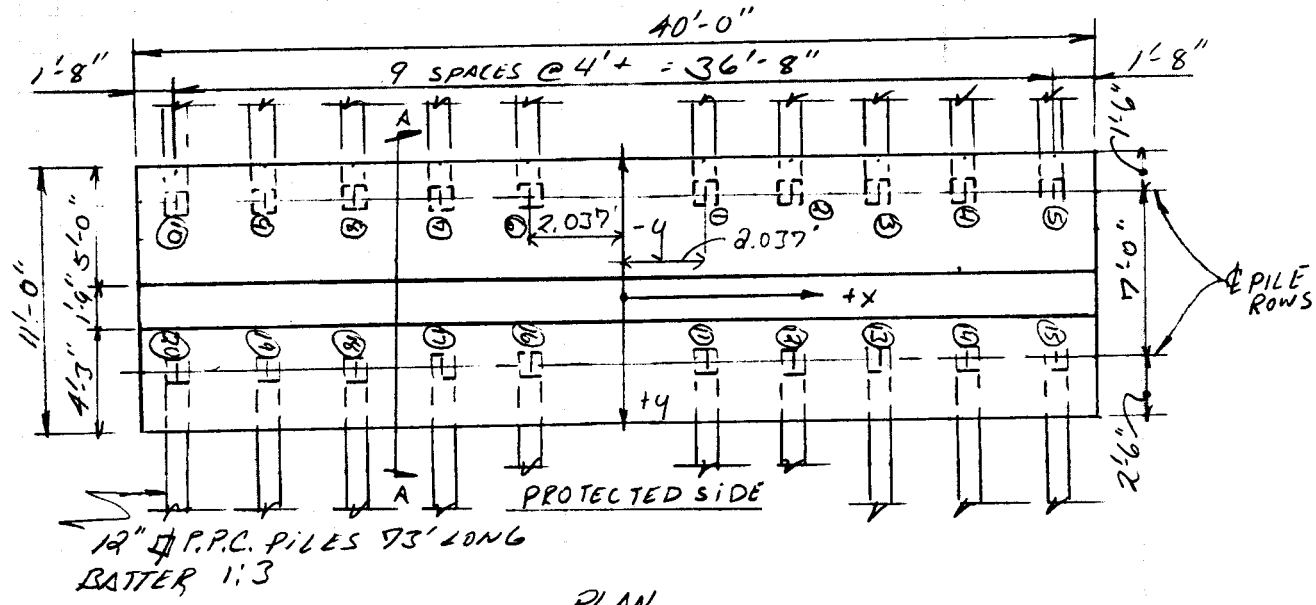
Burk-Kleinpeter, Inc.
Engineers, Architects, Planners, Environmental Scientists
4176 Canal Street, New Orleans, LA 70119

CANAL ST. CANAL PUMP STATION

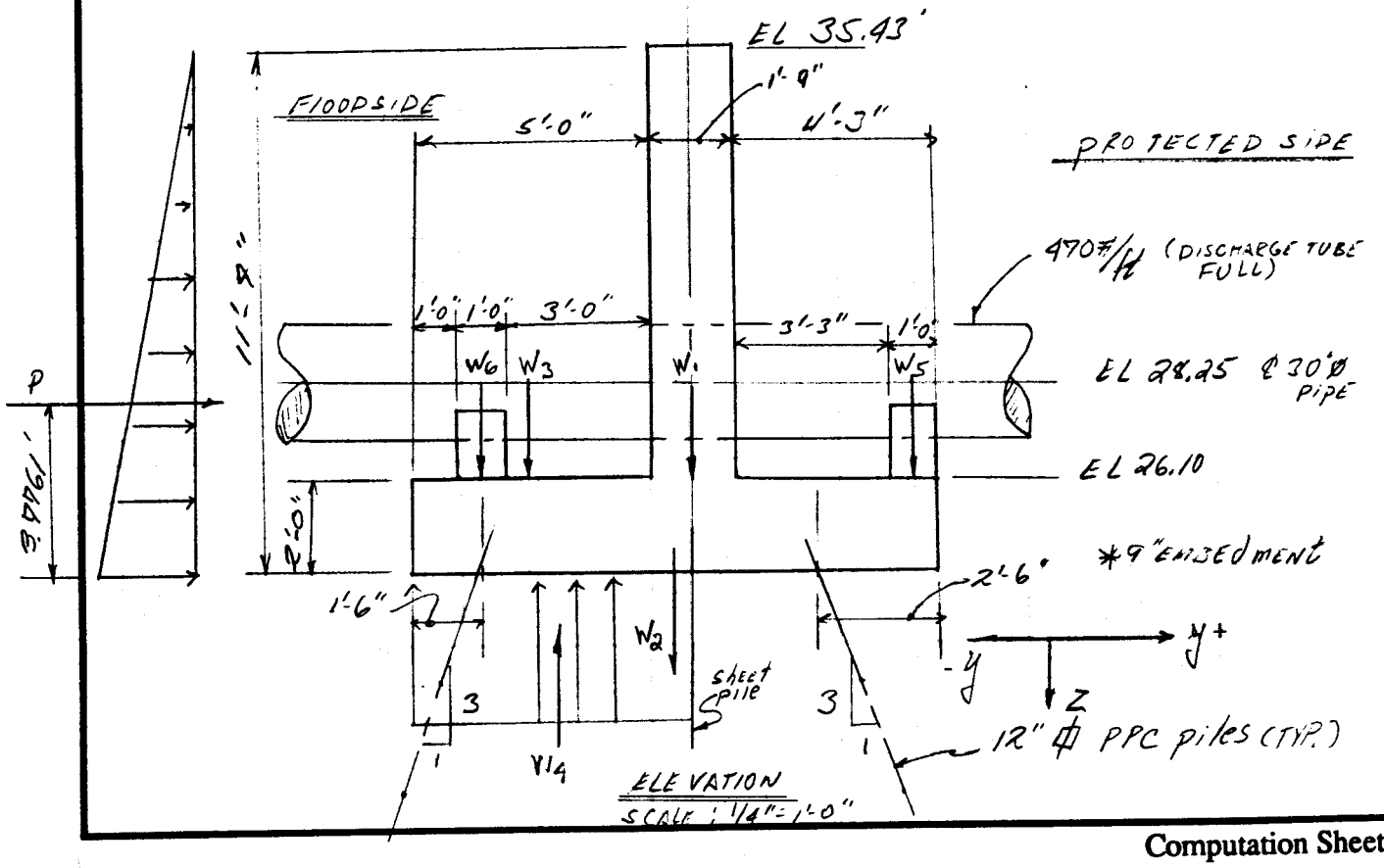
Job No.	Design By:	Date:	Checked By:	Page / of
9104	R.A.G.	Aug/91		1 / 10

Given: (from previous analysis)

* TEE WALL



PLAN
SCALE: 1/8" = 1'-0"



ELEVATION
SCALE: 1/4" = 1'-0"

Load Determinations: (unfactored)

$W_1 = 1.75' \times 9.33' \times 40' \times 150\#/ft^3 = 98^K \downarrow$ stem

$W_2 = 2' \times 11' \times 40' \times 150\#/ft^3 = 132^K \downarrow$ slab

$W_3 = 5' \times 9.33' \times 40' \times 62.4\#/ft^3 = 116.4^K \downarrow H_2O$

$W_4 = 11.33 \times 62.4\#/ft^3 \times 40 \times 5.875 = 166^K \uparrow$

$W_5 = W_6 =$ pipe saddle + equivalent pipe load (4 pipes required)

pipe saddle $= 1.5' \times 1' \times 150\#/ft^3 \times 3.5' \times 4 = 3.2^K \downarrow$

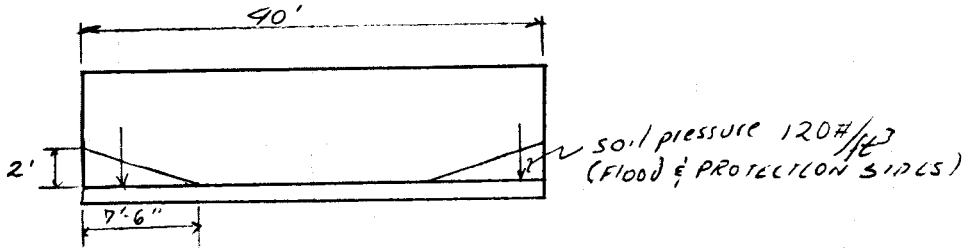
W5 equivalent pipe load $= 470\#/ft \times 15' \times 4 = 28^K \downarrow$ (protected side)

$W_5 = 3.2^K + 28^K = 31.2^K \downarrow$

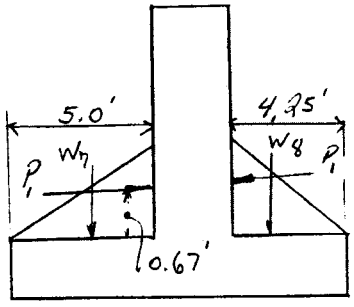
W_6 equivalent pipe load $= 470\#/ft \times 17' \times 4 = 32^K \downarrow$ (Floodside)

$W_6 = 3.2^K + 32^K = 35.2^K \downarrow$

$P = 62.4\#/ft^3 \times 40' \times (11.33)^2/2 = 160.2^K \rightarrow$



F.S. P.S.



$P_1 = 120\#/ft^3 \times 7.5' \times (2)^2/2 = 1.8^K$ @ 0.67' VARIES W/ DECREASE IN DEPTH

$W_7 = 120\#/ft^3 \times 5' \times (2)^2/2 = 1.2^K$ @ 1.67' " " "

$W_8 = 120\#/ft^3 \times 4.25' \times (2)^2/2 = 1.02^K$ @ 1.42'

CASE I (Fully Loaded)

$P_Z = W_1 + W_2 + W_3 - W_4 + W_5 + W_6 + W_7 + W_8 =$
$98 + 132 + 116.4 - 166 + 31.2 + 35.2 + 1.2 + 1.02 = 249^K \downarrow$ ✓

(+) $M_y = W_2 \times 0.375 + W_3 \times 3.375 - W_4 \times 2.9375 - W_5 \times 4.625'$
$+ W_6 \times 4.375 + W_7 \times 2.55' - W_8 \times 2.3' - P \times 3.78$
$132 \times 0.375 + 116.4 \times 3.375 - 166 \times 2.9375 - 31.2 \times 4.625$
$+ 35.2 \times 4.375 + 1.2 \times 2.55 - 1.02 \times 2.3 - 160.2 \times 3.78$
$M_x = 640.4'^K$) ✓

$P_y = 160.2^K \rightarrow$ ✓

CASE II ($W_4, W_6, W_7 = 0$)

$P_z = 379^K$ ↓

$M_x = 310'^K$ ↻

$P_y = 160.2^K$ →

CASE III (Pumps not in place) $W_5 = 3.2^K$ $W_6 = 0$

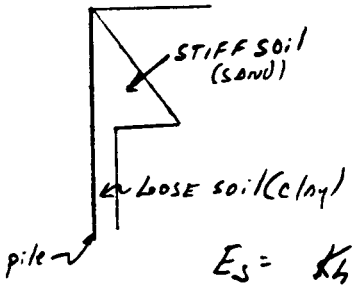
$P_z = 186^K$ ↓

$M_x = 665'^K$ ↻

$P_y = 160.2^K$ →

Based on soil Report from Eustis:

pile tip 73 $K_h(B)/_{CD}$ = 2760 psi (see bottom of page)



B = 12in (width)
C = 0.3 (cyclic loading)
D = Group efficiency factor
ps = 78 = 84 ∴ D = √0.85

$E_s = K_h(B) = 2760 \times 0.3 \times 0.85 = 703.8$ psi

$AC = 50^K$ $AT = 25^K$ $L_u = 0'$

Based on Gulf Coast Pile-STRESS: 6-½" 250^K 12" # PCP

$P_B = 151.2^K$ FPC = 0.868 Ksi (17.37% Losses)

$P_o = 537^K$ $M_o = 331 in^K$ $M_B = 959 in^K$ $P_T = 491.92^K$

$E = 4074$ Ksi $I_x = I_y = 1728 in^4$ $A = 144 in^2$

* Assume pinned *

* Note $K_h(B)/_{CD} = 2760 = (3840 + 1920 + 2520)/3$ 667@73' is to conservative pile will fail in bending

* For Abbreviations see CPGA program *

Determine FPC: ✓

TOTAL LOSSES = ES + SR$_1$ + C + SH + SR$_2$

7791 + 6009 + 3273 + 4430 + 8891 = 30,394 psi

17.37% Losses + 83.63% 100%

∴ Design load after losses is 83.63% of tensioning load
Strands tensioned to 70% of ultimate

Design Load = 250^k × 0.7 × 0.8363 × 6 strands × 0.144 = 126.4486^k

FPC = 126.4486 / 144 = 0.878 ksi use 0.868 ksi

Determine IPC:

Tensioning Load: 250^k × 0.7 × 6 × 0.144 = 151.2^k

(Initial Prestress) = IP = 151.2 / 144 = 1.050 ksi

Assume 5% immediate losses due to ES

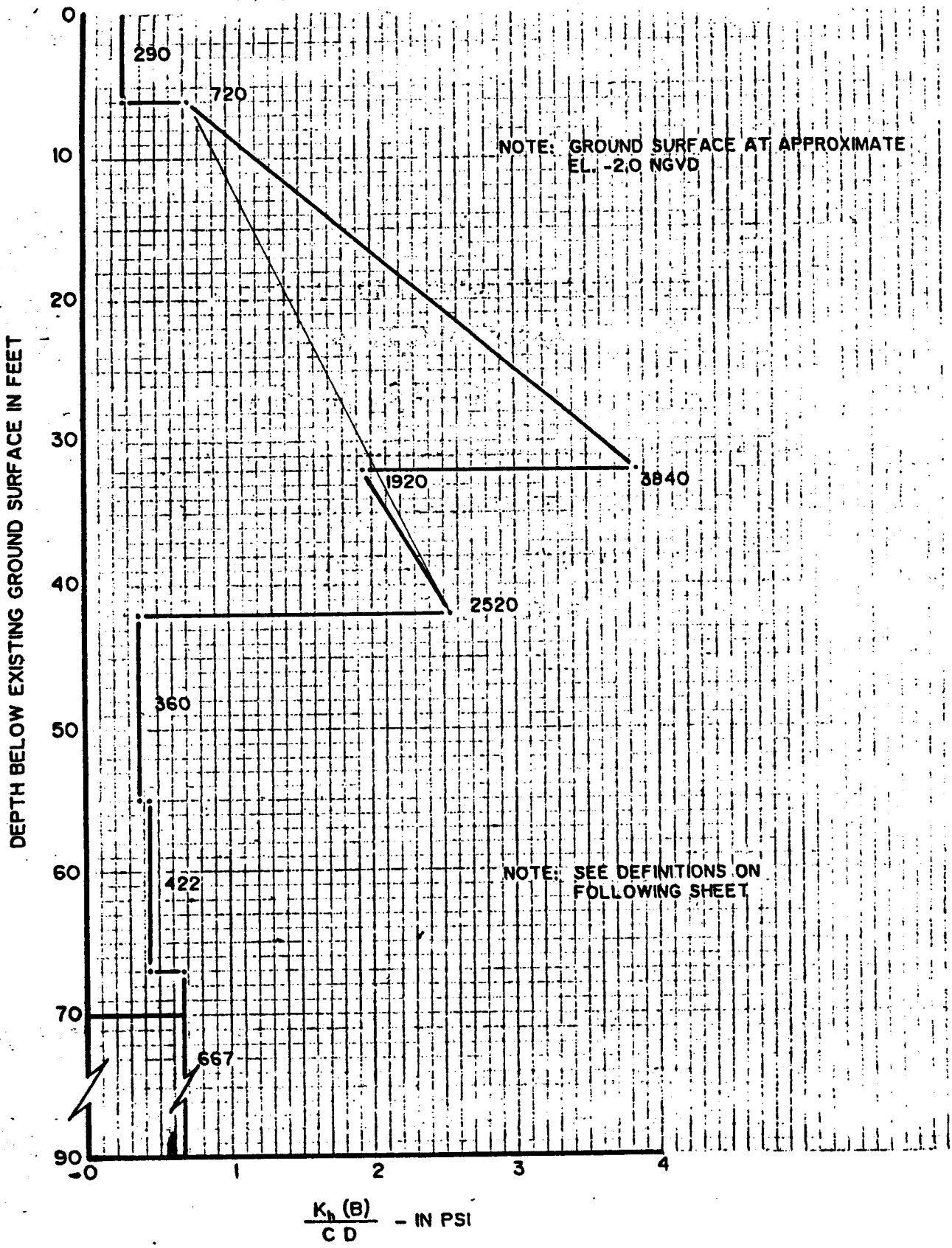
IPC = 0.95 × 1.05 = 0.9975 ksi

Determine FR:

FR = 0.35 f'_c = 0.35 × 5 = 1.75 ksi

FT = 0

5A/K



MODULUS OF HORIZONTAL SUBGRADE REACTION

JEFFERSON PARISH
PUMP STATION AT CANAL STREET CANAL
METAIRIE, LOUISIANA

Enclosure 1

EUSTIS ENGINEERING

DEFINITIONS

K_h (PCI) = MODULUS OF HORIZONTAL SUBGRADE REACTION

CLAY : $K_h = \frac{C\,D}{B}(0.2222 q_u)$

SAND : $K_h = \frac{C\,D}{B}(Z\,\eta_h)$

q_u (PSF) = UNCONFINED COMPRESSION SHEAR STRENGTH

B (IN.) = WIDTH OR DIAMETER OF PILE

C = 0.3 (CYCLIC LOADING); 1.0 (INITIAL LOADING)

D = GROUP EFFICIENCY FACTOR

PS	D
8B	1.0
7B	0.85
6B	0.7
5B	0.55
4B	0.4
3B	0.25

η_h (PCI) = COEFFICIENT OF HORIZONTAL SUBGRADE REACTION

= 5 (LOOSE SAND); 10 (DENSE SAND)

PS (IN.) = PILE SPACING IN DIRECTION OF LOAD

Z (IN.) = DEPTH BELOW EQUIVALENT GROUND

5C/K

STEEL PIPE AND PRECAST CONCRETE PILE LOAD CAPACITIES FOR SUPPORT OF DISCHARGE PIPES

TYPE AND SIZE OF PILE	PILE TIP ELEVATION IN FEET NGVD	ESTIMATED ALLOWABLE SINGLE PILE LOAD CAPACITY IN TONS FACTOR OF SAFETY=2
12-In. Diameter Open-End Steel Pipe	-70	38
	-80	49
	-90	59
14-In. Diameter Open-End Steel Pipe	-70	44
	-80	57
	-90	69
12-In. Square Precast Concrete	-70	50 100K
	-80	62
	-90	75
14-In. Square Precast Concrete	-70	57 114K
	-80	73
	-90	88

PILE LOAD CAPACITIES

JEFFERSON PARISH
PUMP STATION AT CANAL STREET CANAL
METAIRIE, LOUISIANA

EUSTIS ENGINEERING

FIGURE 2

50/K

GULF COAST PRE-STRESS, INC.

Pass Christian, Mississippi

12" PILE DESIGN

AREA CONC (Ac) = 144 si

CONCRETE RELEASE STRENGTH (f'cI) 4000 psi

CONCRETE DESIGN STRENGTH (F'c) 5000 psi

6-1/2" 250k S/R Strand

As 0.144

ULTIMATE 250 k

LOSSES 70%

P= 151.200 k P_B

CALCULATE RESIDUAL STRESSES (Losses calculated per "Recommendations for Estimating Prestress Losses" PCI Committee on prestress loss as published in PCI Journal July / August 1975. TOTAL LOSS = ES + CR + SH + RET

ELASTIC SHORTENING .63fs = 10% LOSSES (STRESS RELIEVED STRAND)

ES =fcr(Es/Eci) USE 9.25 % LOSSES LOW RELAXATION STRANDS

fcI = 4000 Eci = 33fci^1/2*W^3/2 = 3.64E+06

W = 145 Es = 28 x 10^6

6 -1/2" 250k S/R Strand

ES = (779) psi

STEEL RELAXATION (RET_1) fpy = 0.90fpu (Low-Relaxation Strand)

(1st 18 hours) fpy = 0.85fpu (Stress Relieved Strand)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Low-Relaxation Strand)

RET = fst{[log24t-log24t1]/10}*[fst/fpy-0.55] (Stress-Relieved Strand)

RET = (6009) 175000 - 6009 = 168991 psi for 6-1/2" 250k S/R Strand

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CREEP CR = (UCR)(SCF)(MCF)*(PCR)(fc)

UCR = 63-20Ec/10^6=>11 (use 11)

MCF = Accelerated Cure = 1

Volumn to surface Ratio

SCF = 3

PCR = 0.35

6 -1/2" 250k S/R Strand

CRc = (3273)

SHRINKAGE SH = (USH)(SSF)(PSH) = (4430) psi

USH = 27,000-3000Ec/10^6 = 12000

SSF Effect.Size and Shape= 0.879

PSH = (Shrink. Coeff.30 days) = 0.42

STEEL RELAXATION (RET_2)

(30 days)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Low-Relaxation Strands)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Stress-Relieved Strands)

RET = (6891) 6 -1/2" 250k S/R Strand

TOTAL LOSSES = ES + RET_1 + RET_2 + CR + SH

6 -1/2" 250k S/R Strand

Losses = 30,393 psi 30,394

Losses = 17.37% 83.63% Tension Load

EFFECTIVE PRESTRESS AFTER ALL LOSSES

Using 6 -1/2" 250k S/R Strand fpc = 868 psi = FPC = 0.868

12" PILE DESIGN

Prestressed with 6-1/2" 250k S/R Strand

IRECT LOAD:

N = (.33f'c - 0.27 fpc) Ac

N = 1416 * Ac
N = 204 kips or
N = 102 tons

NOMINAL STRENGTH:

Pn = (.85f'c - 0.60fpc) Ac

Pn= 537 kips P_o
FACTOR OF SAFETY = 2.63

MOMENT CAPACITY:

Ac = 144 si
I = 1,728 in^4
I/c= 288 in^3

Allowable tension = 4*sqrt(F'c) = 282.84 psi

M=fc I/c= 931 in.-kips M_o

NOMINAL MOMENT STRENGTH:

MOMENT Mn = 0.37t Aps Fpu (solid piles)
Aps= 0.864 si (area tendons)

Fpu= 250 ksi (ult. strength of the tendons)

Mn= 959 in.-kips M_s
FACTOR OF SAFETY = 2.89

TENSILE CAPACITY OF PILE

Effective Prestress fpc = 868.00 psi
Area of Concrete Ac = 144 si
Tensile Capacity of Pile = fpc + 6*sqrt(f'c) * Ac = 191.92 kips or P_T
Tensile Capacity of Pile = 96 tons

ALLOWABLE UNSUPPORTED LENGTH: (piles fixed at both ends)

h/r = 60 r = 3.46 in.
lu = 60r/0.5
lu = 415.69 in. = 34.64 ft.

MAXIMUM LENGTH FOR 2-POINT & 3-POINT HANDLING:

W = 150 lbs/ft.
f'ci = 4000 psi
S = I/c = 288 in^3
fpc = 868 psi

Allowable tension for 2-POINT = 6*sqrt(f'ci)
Allowable tension for 3-POINT = 3*sqrt(f'ci)
fs (2-POINT LIFT) = f + 6*sqrt(f'ci) = 1247 psi
fs (3-POINT LIFT) = f + 3*sqrt(f'ci) = 1058 psi
l = sqrt(fs * S / 1.5*6*W)
L =< 79 ft. for 2-POINT HANDLING
L =< 116 ft. for 3-POINT HANDLING

5F/K

* TEE3

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**************************
* CORPS PROGRAM  #  X0080 *   CP04 - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 86/09/02-0 *   RUN DATE 09-04-91    RUN TIME 09:36:17
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CANAL STREET CANAL PUMP STATION (Tpewall) By Roy A. Glapion August 91

THERE ARE 20 PILES AND
            3 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-18.33 ,	-4.38 ,	.00)
(	18.33 ,	2.63 ,	.00)

****

PILE PROPERTIES AS INPUT

E	I1	I2	A	CSA	Pee
K/SI	IN**4	IN**4	IN**2		
.40740E+04	.17280E+04	.17280E+04	.14400E+03	.2X.000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

FS	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.26350E+00	L	.73000E+02	.00000E+00

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE STIFFNESSES AS CALCULATED FROM PROPERTIES

.27987E+07	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.27987E+07	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.13394E+04	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.01000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THESE MATRIX APPLIES TO THE FOLLOWING PILES -

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	2.04	-4.38	.00	3.00	180.00	73.00	F
2	6.11	-4.38	.00	3.00	180.00	73.00	F
3	10.18	-4.38	.00	3.00	180.00	73.00	F
4	14.26	-4.38	.00	3.00	180.00	73.00	F
5	18.33	-4.38	.00	3.00	180.00	73.00	F
6	-2.04	-4.38	.00	3.00	180.00	73.00	F
7	-6.11	-4.38	.00	3.00	180.00	73.00	F
8	-10.18	-4.38	.00	3.00	180.00	73.00	F
9	-14.26	-4.38	.00	3.00	180.00	73.00	F
10	-18.33	-4.38	.00	3.00	180.00	73.00	F
11	2.04	2.63	.00	3.00	90.00	73.00	F
12	6.11	2.63	.00	3.00	90.00	73.00	F
13	10.18	2.63	.00	3.00	90.00	73.00	F
14	14.26	2.63	.00	3.00	90.00	73.00	F
15	18.33	2.63	.00	3.00	90.00	73.00	F
16	-2.04	2.63	.00	3.00	90.00	73.00	F
17	-6.11	2.63	.00	3.00	90.00	73.00	F
18	-10.18	2.63	.00	3.00	90.00	73.00	F
19	-14.26	2.63	.00	3.00	90.00	73.00	F
20	-18.33	2.63	.00	3.00	90.00	73.00	F
						1460.00	

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	.0	160.2	249.0	640.4	.0	.0
2	.0	160.2	379.0	810.0	.0	.0
3	.0	160.2	184.0	660.0	.0	.0

ORIGINAL PILE GROUP STIFFNESS MATRIX

.10712E+04	.57324E-04	-.39342E+04	.20655E+06	.78125E-02	.74726E+05
.57324E-04	.10712E+04	.39342E+04	.12393E+06	-.78125E-02	.15625E-01
-.39342E+04	.39342E+04	.24165E+05	-.25373E+06	.31250E-01	-.20655E+06
.20655E+06	.12393E+06	-.25373E+06	.45291E+08	-.25000E+01	.10844E+08
.78125E-02	-.78125E-02	.31250E-01	.30000E+01	.47648E+09	-.77574E+08
.74726E+05	.78125E-02	-.20655E+06	.10844E+08	-.77574E+08	.44559E+13

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

LOAD CASE 2. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 0.

LOAD CASE 3. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 0.

PILE CAP DISPLACEMENTS

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.1030E-02	.1351E+00	-.1452E-01	-.2863E-03	.1577E-06	.9685E-06
2	.5335E-01	.1163E+00	.7416E-03	-.4873E-03	.8166E-05	.5914E-04
3	-.1377E-01	.1549E+00	-.2315E-01	-.3114E-03	-.2107E-05	-.1094E-04

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CSF 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	CSF	AFC KSI	AST KSI
1	.0	-3.6	.2	-96.9	.8	.0	.00	.93	1.34	.53
2	.0	-3.8	.2	-96.9	.8	.0	.00	.93	1.34	.53
3	.0	-3.8	.2	-96.9	.8	.0	.00	.93	1.34	.53
4	.0	-3.8	.2	-97.0	.8	.0	.00	.93	1.34	.53
5	.0	-3.8	.1	-97.0	.8	.0	.00	.93	1.34	.53
6	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
7	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
8	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
9	.0	-3.8	.2	-96.7	.9	.0	.00	.93	1.34	.53
10	.0	-3.8	.2	-96.7	.9	.0	.00	.93	1.34	.53
11	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
12	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
13	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
14	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
15	3.8	.0	27.4	-.7	-97.4	.0	.27	.61	1.53	.72
16	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
17	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
18	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72
19	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72
20	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72

LOAD CASE - 2

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CSF	AFC KSI	AST KSI
1	-1.7	-3.3	9.5	-64.3	44.0	.0	.09	.84	1.71	.45
2	-1.7	-3.4	9.0	-64.0	43.7	.0	.09	.85	1.71	.45
3	-1.7	-3.4	8.5	-67.8	43.8	.0	.08	.81	1.81	.47
4	-1.7	-3.5	8.0	-89.5	43.7	.0	.08	.87	1.73	.46
5	-1.7	-3.6	7.5	-91.3	43.6	.0	.07	.88	1.93	.47
6	-1.7	-3.2	10.0	-82.5	44.1	.0	.10	.83	1.61	.43
7	-1.7	-3.2	10.5	-80.7	44.2	.0	.11	.82	1.58	.42
8	-1.7	-3.1	11.0	-79.0	44.3	.0	.11	.82	1.57	.42
9	-1.7	-3.0	11.5	-77.2	44.3	.0	.12	.80	1.55	.41
10	-1.7	-2.9	12.0	-75.5	44.4	.0	.12	.79	1.53	.41
11	-1.7	-1.4	27.3	-.7	-97.2	.0	.27	.61	1.53	.72

11	3.3	-1.4	31.5	-37.1	-85.0	.0	.32	.57	1.62	.65
12	3.4	-1.4	30.0	-37.1	-86.6	.0	.32	.57	1.65	.66
14	3.5	-1.4	30.6	-37.1	-85.6	.0	.33	.57	1.66	.66
15	3.5	-1.4	30.1	-37.1	-90.3	.0	.33	.56	1.67	.66
16	3.2	-1.4	30.4	-37.1	-84.5	.0	.30	.57	1.67	.67
17	3.1	-1.4	29.9	-37.1	-79.9	.0	.30	.58	1.64	.67
18	3.0	-1.4	29.4	-37.1	-78.0	.0	.29	.58	1.64	.67
19	3.0	-1.4	28.9	-37.1	-76.3	.0	.29	.58	1.77	.68
20	2.9	-1.4	28.3	-37.1	-74.5	.0	.28	.58	1.58	.69

LOAD CASE - 3

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CBF	AXI /SQ	AXI NOT
1	.4	-4.3	-2.4	-110.6	-11.4	.0	.05	.76	1.60	.41
2	.4	-4.3	-2.3	-110.3	-11.3	.0	.05	.96	1.40	.43
3	.4	-4.3	-2.2	-107.9	-11.3	.0	.04	.95	1.40	.43
4	.4	-4.3	-2.1	-109.4	-11.3	.0	.04	.94	1.40	.43
5	.4	-4.3	-1.9	-109.0	-11.3	.0	.04	.94	1.41	.44
6	.4	-4.3	-2.6	-111.3	-11.4	.0	.05	.97	1.41	.42
7	.4	-4.4	-2.7	-111.7	-11.4	.0	.05	.97	1.41	.42
8	.4	-4.4	-2.8	-112.2	-11.4	.0	.06	.98	1.41	.41
9	.4	-4.4	-3.0	-112.6	-11.4	.1	.06	.95	1.41	.43
10	.4	-4.4	-3.1	-113.1	-11.5	.0	.06	.99	1.41	.42
11	4.4	.4	23.7	9.6	-112.6	.0	.24	.70	1.54	.61
12	4.4	.4	23.5	9.6	-112.1	.0	.24	.70	1.54	.61
13	4.4	.4	23.4	9.6	-111.7	.0	.23	.70	1.55	.61
14	4.3	.4	23.3	9.6	-111.2	.0	.23	.70	1.58	.61
15	4.3	.4	23.1	9.6	-110.8	.0	.23	.70	1.56	.61
16	4.4	.4	23.6	9.6	-113.0	.0	.24	.70	1.59	.61
17	4.4	.4	23.9	9.6	-113.5	.0	.24	.70	1.55	.61
18	4.4	.4	24.1	9.6	-113.9	.0	.24	.70	1.55	.61
19	4.5	.4	24.2	9.6	-114.1	.0	.24	.70	1.56	.61
20	4.5	.4	24.4	9.6	-114.6	.0	.24	.70	1.77	.61

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	.0	3.5	.2	.0	.0	.0
2	.0	3.8	.2	.0	.0	.0
3	.0	3.8	.2	.0	.0	.0
4	.0	3.8	.2	.0	.0	.0
5	.0	3.9	.1	.0	.0	.0
6	.0	3.8	.2	.0	.0	.0
7	.0	3.8	.2	.0	.0	.0
8	.0	3.8	.2	.0	.0	.0
9	.0	3.8	.2	.0	.0	.0
10	.0	3.8	.2	.0	.0	.0
11	.0	12.2	24.7	.0	.0	.0
12	.0	12.2	24.7	.0	.0	.0
13	.0	12.2	24.7	.0	.0	.0
14	.0	12.3	24.7	.0	.0	.0
15	.0	12.3	24.8	.0	.0	.0
16	.0	12.2	24.7	.0	.0	.0
17	.0	12.2	24.7	.0	.0	.0
18	.0	12.2	24.7	.0	.0	.0
19	.0	12.2	24.7	.0	.0	.0
20	.0	12.2	24.7	.0	.0	.0

18	.0	12.2	24.7	.0	.0	.0
19	.0	12.2	24.7	.0	.0	.0
20	.0	12.2	24.7	.0	.0	.0
		160.2 K	249 K			

55/K

LOAD CASE - 2

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.4	3.3	9.5	.0	.0	.0
2	-1.2	3.4	9.1	.0	.0	.0
3	-1.1	3.4	8.6	.0	.0	.0
4	-.9	3.5	8.1	.0	.0	.0
5	-.7	3.6	7.6	.0	.0	.0
6	-1.5	3.2	10.0	.0	.0	.0
7	-1.7	3.2	10.5	.0	.0	.0
8	-1.8	3.1	11.0	.0	.0	.0
9	-2.0	3.0	11.5	.0	.0	.0
10	-2.2	2.9	12.0	.0	.0	.0
11	1.4	12.9	28.4	.0	.0	.0
12	1.4	13.1	28.8	.0	.0	.0
13	1.4	13.3	29.3	.0	.0	.0
14	1.4	13.6	29.8	.0	.0	.0
15	1.4	13.8	30.3	.0	.0	.0
16	1.4	12.6	27.9	.0	.0	.0
17	1.4	12.4	27.4	.0	.0	.0
18	1.4	12.2	26.9	.0	.0	.0
19	1.4	11.9	26.4	.0	.0	.0
20	1.4	11.7	25.9	.0	.0	.0
	-0.5 K	160.1 K	379 K			

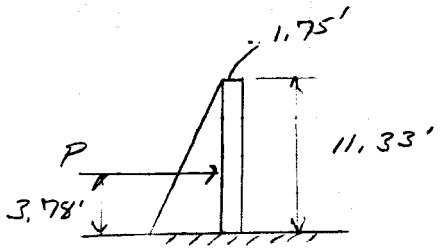
LOAD CASE - 3

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.4	4.3	-2.5	.0	.0	.0
2	.3	4.3	-2.3	.0	.0	.0
3	.3	4.3	-2.2	.0	.0	.0
4	.2	4.3	-2.1	.0	.0	.0
5	.2	4.3	-2.0	.0	.0	.0
6	.4	4.3	-2.4	.0	.0	.0
7	.4	4.4	-2.7	.0	.0	.0
8	.5	4.4	-2.8	.0	.0	.0
9	.5	4.4	-3.0	.0	.0	.0
10	.6	4.4	-3.1	.0	.0	.0
11	-.4	11.7	21.1	.0	.0	.0
12	-.4	11.6	20.9	.0	.0	.0
13	-.4	11.5	20.8	.0	.0	.0
14	-.4	11.5	20.7	.0	.0	.0
15	-.4	11.4	20.6	.0	.0	.0
16	-.4	11.7	21.2	.0	.0	.0
17	-.4	11.6	21.3	.0	.0	.0
18	-.4	11.8	21.4	.0	.0	.0
19	-.4	11.9	21.6	.0	.0	.0
20	-.4	12.0	21.7	.0	.0	.0
	-0.2 K	160.3 K	186 K			

& TEBWALL3 5K/K

```
1000 CANAL STREET CANAL PUMP STATION (Tebwall) By Roy A. Blapson August 4,
1010 PRO 4074 1728 1728 144 2.0 0 ALL
1020 SOI ES 0.7038 L 73 0 ALL
1030 PIN ALL
1040 DLS S 100 50 537.0 191.92 151.70 959.0 331.0 H 12 ALL
1050 ASC S 144 288 0.87 0.9975 1.75 0 ALL
1070 BAT 3.0 ALL
1090 ANG 180 1 TO 10
1084 ANG 90 11 TO 20
1100 PIL 1 2.037 -4.375 0
1110 PIL 11 2.037 2.625 0
1112 PIL 6 -2.037 -4.375 0
1114 PIL 16 -2.037 2.625 0
1120 ROW X 5 1 4 AT 4.0740
1130 ROW X 5 11 4 AT 4.0740
1131 ROW X 5 6 4 AT -4.0740
1134 ROW X 5 16 4 AT -4.0740
1140 LOA 1 C 160.2 249 640.4 0 0
1150 LOA 2 0 160.2 379 310 0 0
1170 LOA 3 0 160.2 186 665 0 0
1175 FDU 1 2 3 4 5 6 7 TEES
1190 PNO 1
1200 PFO ALL
1210 TPL N
```

Flexure:



$P/_{\text{Slot wall}} =$

$$62.4\#/_{ft^3} \times 1' \times (11.33)^2/2 = 4^K$$

$$M_u = 1.7 \times 4^K \times 3.78' = 25.7'^K \approx 26'^K$$

$f'_c = 3000 psi$
$f_y = 60 ksi$

$$K = M_u \times 12{,}000 / \phi b d^2$$

$\phi = 0.9$
$b = 12 in$
$J = 18.56$
Assume 2" cover + #7 BARS

$$K = 26'^K \times 12{,}000 / 0.9 \times 12 \times (18.56)^2 = 84 psi < K_{min}$$

$$P_{min} = 0.0033 = 200/f_y$$

$$A_s = p b d = 0.0033 \times 12 \times 17.56 = 0.695 in^2/ft$$ Slot wall

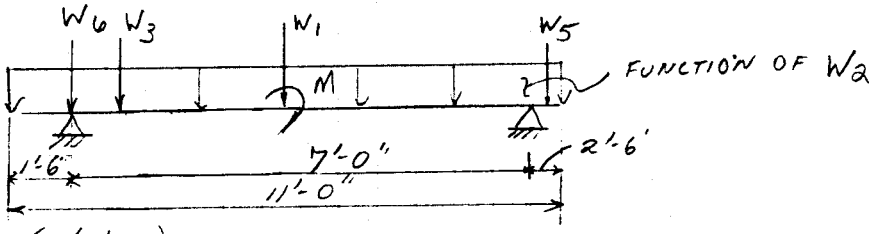
Use #7 BARS @ 9" O.C $A_s = 0.80 in^2/ft$ reqd.

Horizontal: Assume #5 bars Use #5 @ 7" O.C.

S/G Design: Thickness = 2'-0" $d = 24" - 3 - \frac{7}{8} \times \frac{1}{2} = 20.56$

min steel = $A_s = 0.0033 \times 12 \times 20.56 = 0.814$ in²/ft of s/g

use # 8 @ 9" o.c. $A_s = 1.05$ in²/ft of s/g (min.)



Refer to pg. 2 (4' strip) NTS

$W_1 = 98^k/40 = 2.45^k$ DL ↓ x (1.4) = 3.43^k x 4 = 13.72^k

$W_2 = 132^k/40 \times 11 = 0.3^k/ft$ DL ↓ x (1.4) = 0.42^k = 1.68^k

$W_3 = 116.4/5 \times 40 = 0.6^k/ft$ LL over 5' ↓ x (1.7) = 1.02 k/ft = 4.08 k/ft

$W_4 = 166^k/40 \times 5.875 = 0.71^k/ft$ LL 4 over 5.875' x (1.7) = 1.21 k/ft = 4.84 k/ft

W_5 = 1 support : 1 pipe $31.2^k/4 = 7.8^k \times (1.4) = 10.9^k = 43.6^k$

W_6 = 1 support : 1 pipe $35.2^k/4 = 8.8^k \times (1.4) = 12.3^k = 49.2^k$

$M_4 = 160.3^k/40 \times 3.78' = 15.1^{1k} \times (1.7) = 26^{1k} = 104^{1k}$

* Assume W_7, W_8 : P = 0

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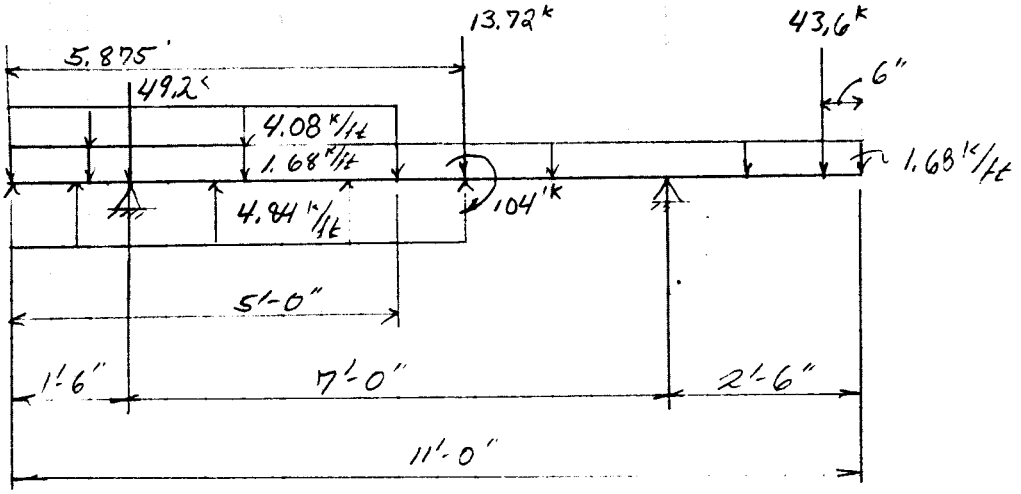
Case I (fully loaded)



f'_c = 3000psi

E = 3160 Ksi

E = 455,040 Ksf $I = \frac{1}{12} 1 \times (2)^3 = 0.667 ft^4$ very conservative

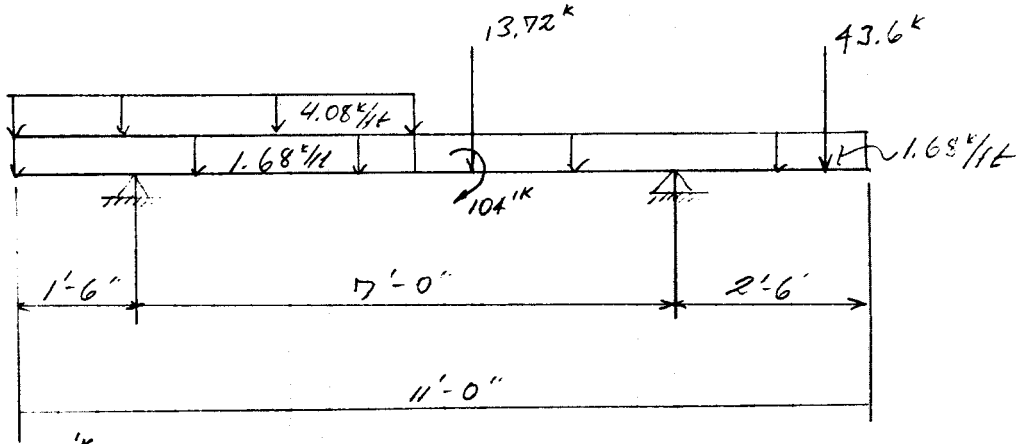
max. M_y = -97.917'k @ x = 5.82' $K = \frac{97.917'k \times 12{,}000}{0.9 \times 48 \times (20.5)^2} = <K_{min}$

max. V_y = 47.751k

max. R_y = 87.124k

$\rho = 0.0033$

Case II $W_4 = 0$ $W_6 = 0$ $W_7 = 0$ $W_8 = 0$ $P_1 = 0$



max. M_y = -91.122'k

max. V_y = 47.75k

max. R_y = 92.96k

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$M_{y\,max} = 97^{IK}$ use 100^{IK}
$V_{y\,max} = 47.5^{K}$ use 50^{K}
$R_{y\,max} = 92.9^{K}$ use 94^{K}

Flexure:

$M_y = 100^{IK}$ $b = 48''$ cover $= 3''$ Assume #8 BARS

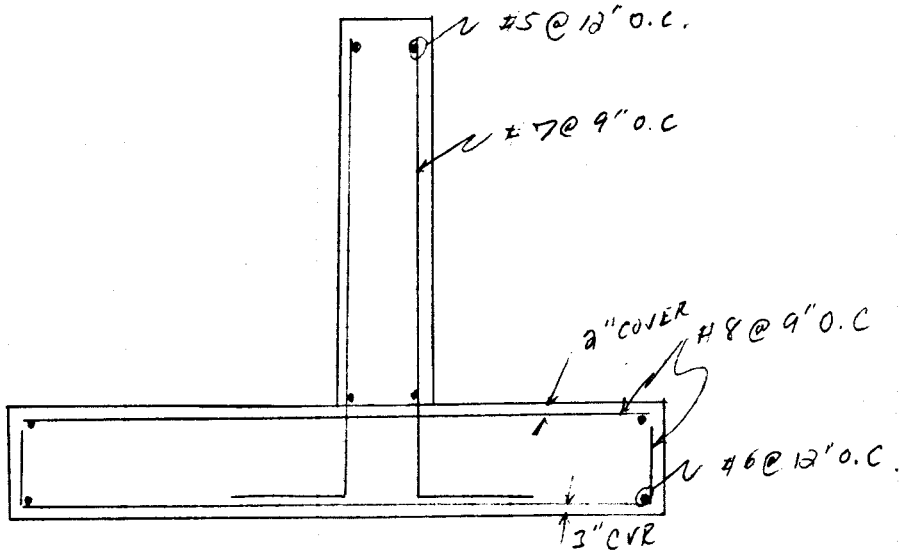
$d = 24' - 3' - \frac{1}{2}' = 20.5''$

$K = \frac{100^{IK} \times 12000}{0.9 \times 48 \times 20.5^2} = 66 << K_{min}$

$A_s = 0.0033 \times 48'' \times 20.5 = 3.247\ in^2/4ft = 0.81\ in^2/ft$

use #8 @ 9" O.C $A_s = 1.05\ in^2/ft$ T.B controlled

use #6 @ 12" Long Direction



CASE I

9A/E

****** BEAM ****** INPUT DATA

NO. OF SPANS = 3
NO. OF SUPPORTS = 2
NO. OF CONCENTRATED LOADS = 3
NO. OF DISTRIBUTED LOAD AREAS= 3
NO. OF CONCENTRATED COUPLES = 1

MODULUS OF ELASTICITY,E = 45N040
MOMENT OF INERTIA, I = .667

LEFT END IS FREE
RIGHT END IS FREE

BEAM LENGTH = 11
LENGTH SPAN 1 = 1.5
LENGTH SPAN 2 = 7
LENGTH SPAN 3 = 2.5

SUPPORT NO. 1 AT X = 1.5
SUPPORT NO. 2 AT X = 8.5

CONCENTRATED LOAD NO. 1 IS 45.200 AT X = 1.5
CONCENTRATED LOAD NO. 2 IS 13.720 AT X = 5.575
CONCENTRATED LOAD NO. 3 IS 43.6[illegible] AT X = 10.5

DISTRIBUTED LOAD NO. 1 IS 1.760 AT X = 0
TO 1.745 AT X = 5
DISTRIBUTED LOAD NO. 2 IS 1.655 AT X = [illegible]
TO 1.493 AT X = 10
DISTRIBUTED LOAD NO. 3 IS -4.840 AT X = 0
TO -4.840 AT X = 2.875

CONCENTRATED COUPLE NO. 1 IS 104.00[illegible] AT X = 5.575

****** BEAM ****** SUMMARY OF RESULTS

SUPPORT REACTIONS

R(1) =	29.841	AT X =	1.500
R(2) =	87.124	AT X =	8.500

M(O) = 0
M(L) = 0

CRITICAL VALUES

SHEAR(MAX) =	47.751	AT X =	5.329
SHEAR(MIN) =	-39.275	AT X =	8.471
MOMENT(MAX) =	4.751	AT X =	5.832
MOMENT(MIN) =	-97.917	AT X =	5.824
SLOPE(MAX) =	4.583E-04	AT X =	0.000
SLOPE(MIN) =	-9.247E-04	AT X =	10.941
DEFL(MAX) =	0.001070	AT X =	5.000
DEFL(MIN) =	-0.002110	AT X =	11.000

******* BEAM *******

RESULTS

X	SHEAR	MOMENT	SLOPE(RAD)	DEFLECTION
0.000	-0.000	-0.000	4.553E-04	-0.000687
1.000	-0.920	-0.460	4.578E-04	-0.000229
2.000	-21.199	-11.520	4.463E-04	0.000224
3.000	-23.119	-33.179	3.729E-04	0.000642
4.000	-33.039	-55.758	2.247E-04	0.000948
5.000	-23.959	-79.257	4.496E-06	0.001070
6.000	-35.124	0.611	-2.519E-04	0.000934
7.000	-36.804	-35.354	-3.087E-04	0.000663
8.000	-38.484	-72.998	-4.867E-04	0.000274
9.000	45.960	-68.760	-7.557E-04	-0.000348
10.000	45.200	-22.640	-9.059E-04	-0.001190
11.000	0.000	0.000	-9.247E-04	-0.002110

CASE II 90/F

****** BEAM ****** INPUT DATA

NO. OF SPANS = 3
NO. OF SUPPORTS = 3
NO. OF CONCENTRATED LOADS = 2
NO. OF DISTRIBUTED LOAD AREAS= 2
NO. OF CONCENTRATED COUPLES = 1

MODULUS OF ELASTICITY,E = 455040
MOMENT OF INERTIA, I = .667

LEFT END IS FREE
RIGHT END IS FREE

BEAM LENGTH = 11
LENGTH SPAN 1 = 1.5
LENGTH SPAN 2 = 7
LENGTH SPAN 3 = 2.5

SUPPORT NO. 1 AT X = 1.5
SUPPORT NO. 2 AT X = 8.5

CONCENTRATED LOAD NO. 1 IS 13.720 AT X = 5.875
CONCENTRATED LOAD NO. 2 IS 43.600 AT X = 10.5

DISTRIBUTED LOAD NO. 1 IS 5.760 AT X = 0
TO 5.760 AT X = 5
DISTRIBUTED LOAD NO. 2 IS 1.650 AT X = 5
TO 1.650 AT X = 11

CONCENTRATED COUPLE NO. 1 IS 104.030 AT X = 5.875

******* BEAM ******* SUMMARY OF RESULTS

SUPPORT REACTIONS

R(1) = 3.236 AT X = 1.500
R(2) = 92.964 AT X = 8.500

N(O) = 0
N(L) = 0

CRITICAL VALUES

SHEAR(MAX)	=	47.751	AT X =	8.529
SHEAR(MIN)	=	-45.114	AT X =	6.471
MOMENT(MAX)	=	20.017	AT X =	5.661
MOMENT(MIN)	=	-91.122	AT X =	6.471
SLOPE(MAX)	=	3.405E-04	AT X =	0.000
SLOPE(MIN)	=	-8.324E-04	AT X =	11.000
DEFL(MAX)	=	0.007779	AT X =	5.057
DEFL(MIN)	=	-0.001804	AT X =	11.000

****/** BEAM ******* RESULTS

X	SHEAR	MOMENT	SLOPE(RAD)	DEFLECTION
0.000	-0.001	-0.003	3.408E-04	-0.000507
1.000	-5.760	-2.880	3.377E-04	-0.000167
2.000	-8.284	-9.903	3.169E-04	0.000142
3.000	-14.044	-21.065	2.674E-04	0.000457
4.000	-15.804	-37.987	1.717E-04	0.000681
5.000	-25.564	-46.673	1.077E-05	0.000779
6.000	-40.764	-15.209	-1.897E-04	0.000478
7.000	-42.644	-44.555	-2.080E-04	0.000391
8.000	-44.324	-70.078	-3.665E-04	0.000215
9.000	45.940	-85.760	-6.334E-04	-0.000259
10.000	45.250	-22.440	-7.835E-04	-0.000704
11.000	0.002	0.000	-8.024E-04	-0.001068

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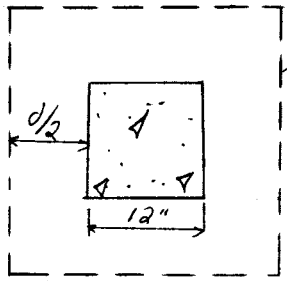
$R_{u_{max}} = 94^{K}$ $\quad d = 20.5" - 6" = 14.5$



$b_o = 4 \times (12 + 14.5) = 106$

$$V_u \leq \phi \times 4 \sqrt{f'c}\, b_o d$$

$$0.85 \times 4 \sqrt{3000}\ 106 \times 14.5 = 286^{K} \text{ o.k.}$$

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CANAL ST. CANAL PUMP STATION

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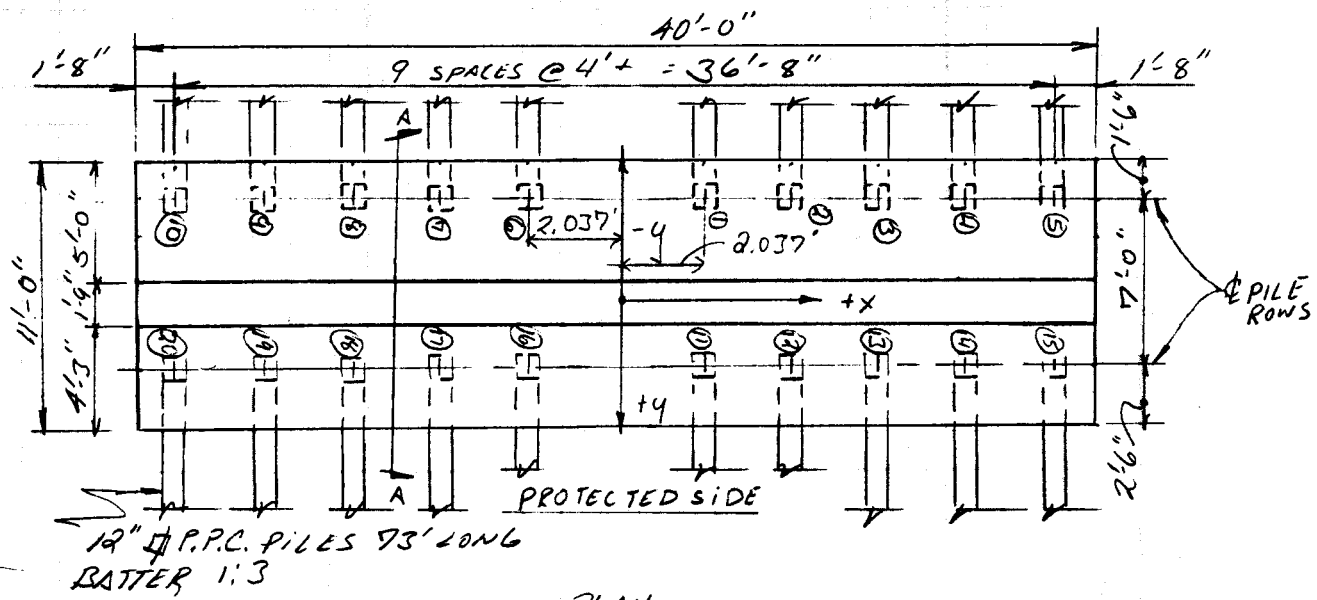
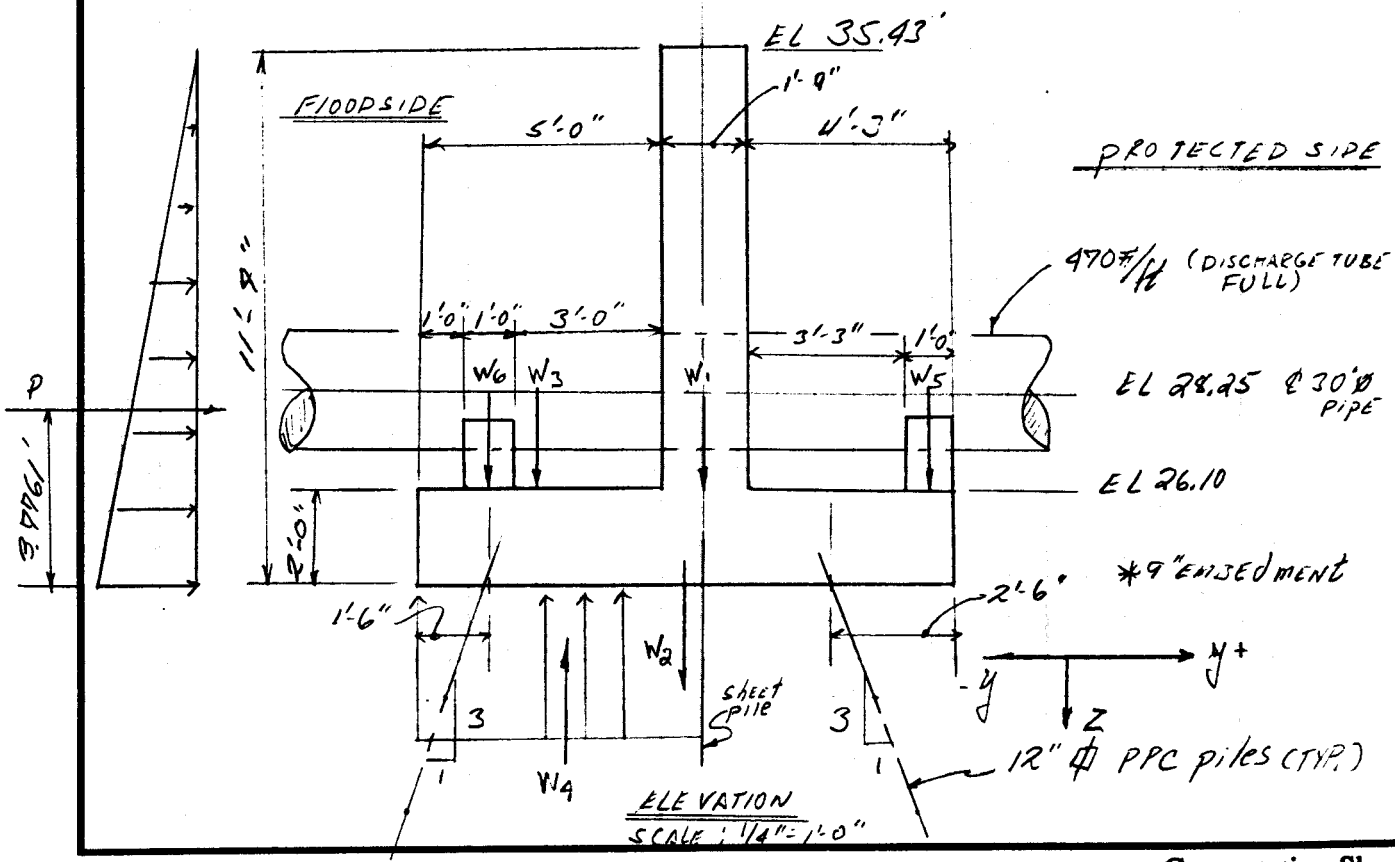
Given: (from previous analysis)

* TEE WALL



PLAN
SCALE: 1/8" = 1'-0"



ELEVATION
SCALE: 1/4" = 1'-0"

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Canal St. Canal Pump Station

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Load Determinations: (Unfactored)

$W_1 = 1.75' \times 9.33' \times 40' \times 150\#/ft^3 = 98^K \downarrow$ stem

$W_2 = 2' \times 11' \times 40' \times 150\#/ft^3 = 132^K \downarrow$ slab

$W_3 = 5' \times 9.33' \times 40' \times 62.4\#/ft^3 = 116.4^K \downarrow H_2O$

$W_4 = 11.33 \times 62.4\#/ft^3 \times 40 \times 5.875 = 166^K \uparrow$

$W_5 = W_6 =$ pipe saddle + equivalent pipe load (4 pipes required)

pipe saddle $= 1.5' \times 1' \times 150\#/ft^3 \times 3.5' \times 4 = 3.2^K \downarrow$

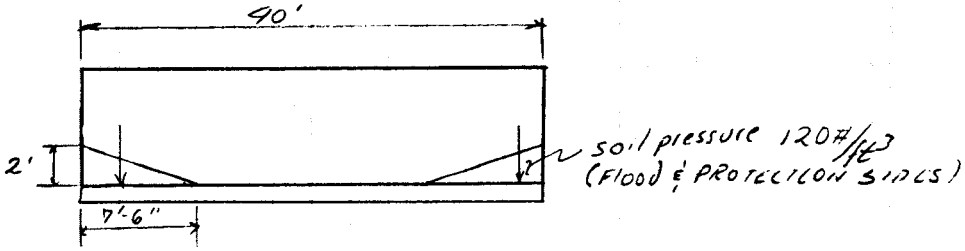
W5 equivalent pipe load $= 470\#/ft \times 15' \times 4 = 28^K \downarrow$ (protected side)

$W_5 = 3.2^K + 28^K = 31.2^K \downarrow$

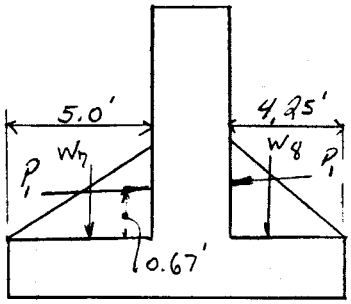
W_6 equivalent pipe load $= 470\#/ft \times 17' \times 4 = 32^K \downarrow$ (Flood side)

$W_6 = 3.2^K + 32^K = 35.2^K \downarrow$

$P = 62.4\#/ft^3 \times 40' \times (11.33)^2/2 = 160.2^K \rightarrow$



F.S. P.S.



$P_1 = 120\#/ft^3 \times 7.5' \times (2)^2/2 = 1.8^K$ @ 0.67' VARIES W/ DECREASE IN DEPTH

$W_7 = 120\#/ft^3 \times 5' \times (2)^2/2 = 1.2^K$ @ 1.67' " "

$W_8 = 120\#/ft^3 \times 4.25' \times (2)^2/2 = 1.02^K$ @ 1.42'

CASE I (Fully Loaded)

$P_Z = W_1 + W_2 + W_3 - W_4 + W_5 + W_6 + W_7 + W_8 =$
$98 + 132 + 116.4 - 166 + 31.2 + 35.2 + 1.2 + 1.02 = 249^K \downarrow$

$\circlearrowleft + M_y = W_2 \times 0.375 + W_3 \times 3.375 - W_4 \times 2.9375 - W_5 \times 4.625'$
$+ W_6 \times 4.375 + W_7 \times 2.55' - W_8 \times 2.3' - P \times 3.78$

$132 \times 0.375 + 116.4 \times 3.375 - 166 \times 2.9375 - 31.2 \times 4.625$
$+ 35.2 \times 4.375 + 1.2 \times 2.55 - 1.02 \times 2.3 - 160.2 \times 3.78$

$M_x = 640.41^K) \blacktriangleleft$

$P_y = 160.2^K \rightarrow \blacktriangleleft$

CASE II ($W_4, W_6, W_7 = 0$)

$P_z = 379^K$ ↓

$M_x = 310'^K$ ↻

$P_y = 160.2^K$ →

CASE III (Pumps not in place) $W_5 = 3.2^K$ $W_6 = 0$

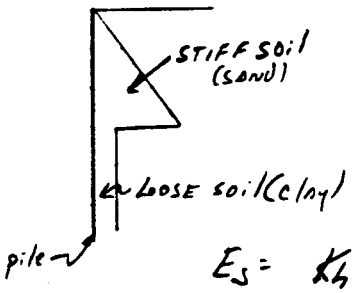
$P_z = 186^K$ ↓

$M_x = 665'^K$ ↻

$P_y = 160.2^K$ →

Based on soil REPORT from Eustis:

pile tip 73 $Kh(B)/CD$ = 2760 psi (see bottom of page)



B = 12in (width)
C = 0.3 (cyclic loading)
D = Group efficiency factor
PS = 78 = 84 ∴ D = √0.85

$E_s = K_h(B) = 2760 \times 0.3 \times 0.85 = 703.8$ psi

$AC = 50^K$ $AT = 25^K$ $L_u = 0'$

Based on Gulf Coast Pre-stress: 6-½" 250ᴷ 12"ϕ PCP

$P_B = 151.2^K$ FPC = 0.868 Ksi (17.37% Losses)

$P_0 = 537^K$ $M_0 = 331 in^K$ $M_B = 959 in^K$ $P_T = 191.92^K$

$E = 4074$ Ksi $I_x = I_y = 1728 in^4$ $A = 144 in^2$

* Assume pinned *

* Note $Kh(B)/CD = 2760 = (3840+1920+2520)/3$ 667@73' is to conservative pile will fail in bending

* For Abbreviations see CPGA program *

Determine FPC: ✓

Total Losses = ES + SR$_1$ + C + SH + SR$_2$

7791 + 6009 + 3273 + 4430 + 8891 = 30,394 psi

17.37% Losses + 83.63% 100%

∴ Design Load after losses is 83.63% of tensioning Load
Strands tensioned to 70% of ultimate

Design Load = 250^k × 0.7 × 0.8363 × 6 STRANDS × 0.144 = 126.4486^k

FPC = 126.4486 / 144 = 0.878 Ksi use 0.868 Ksi

Determine IPC:

Tensioning Load = 250^k × 0.7 × 6 × 0.144 = 151.2^k

(Initial Prestress) = IP = 151.2 / 144 = 1.050 Ksi

Assume 5% immediate losses due to ES

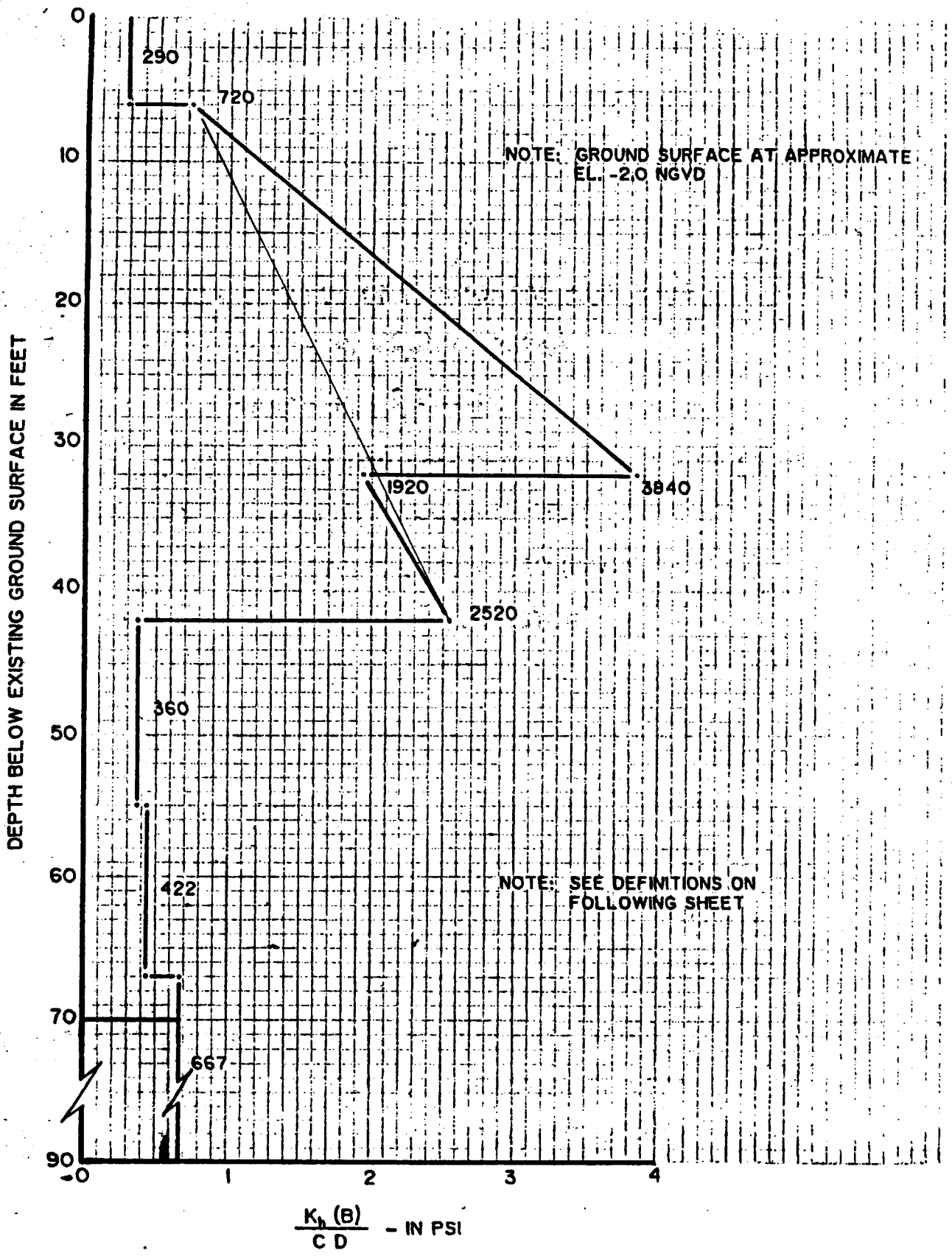
IPC = 0.95 × 1.05 = 0.9975 Ksi

Determine FA:

FA = 0.35 f'c = 0.35 × 5 = 1.75 Ksi

FT = 0

5A/K



MODULUS OF HORIZONTAL SUBGRADE REACTION

JEFFERSON PARISH
PUMP STATION AT CANAL STREET CANAL
METAIRIE, LOUISIANA

EUSTIS ENGINEERING

Enclosure 1

DEFINITIONS

K_h (PCI) = MODULUS OF HORIZONTAL SUBGRADE REACTION

CLAY : $K_h = \frac{C\,D}{B}(0.2222 q_u)$

SAND : $K_h = \frac{C\,D}{B}(Z\,\eta_h)$

q_u (PSF) = UNCONFINED COMPRESSION SHEAR STRENGTH

B (IN.) = WIDTH OR DIAMETER OF PILE

C = 0.3 (CYCLIC LOADING); 1.0 (INITIAL LOADING)

D = GROUP EFFICIENCY FACTOR

PS	D
8B	1.0
7B	0.85
6B	0.7
5B	0.55
4B	0.4
3B	0.25

η_h (PCI) = COEFFICIENT OF HORIZONTAL SUBGRADE REACTION

= 5 (LOOSE SAND); 10 (DENSE SAND)

PS (IN.) = PILE SPACING IN DIRECTION OF LOAD

Z (IN.) = DEPTH BELOW EQUIVALENT GROUND

50/K

STEEL PIPE AND PRECAST CONCRETE PILE LOAD CAPACITIES FOR SUPPORT OF DISCHARGE PIPES

TYPE AND SIZE OF PILE	PILE TIP ELEVATION IN FEET NGVD	ESTIMATED ALLOWABLE SINGLE PILE LOAD CAPACITY IN TONS FACTOR OF SAFETY=2
12-In. Diameter Open-End Steel Pipe	-70	38
	-80	49
	-90	59
14-In. Diameter Open-End Steel Pipe	-70	44
	-80	57
	-90	69
12-In. Square Precast Concrete	-70	50 100K
	-80	62
	-90	75
14-In. Square Precast Concrete	-70	57 114K
	-80	73
	-90	88

PILE LOAD CAPACITIES

JEFFERSON PARISH
PUMP STATION AT CANAL STREET CANAL
METAIRIE, LOUISIANA

EUSTIS ENGINEERING

FIGURE 2

50/K

GULF COAST PRE-STRESS, INC.

Pass Christian, Mississippi

12" PILE DESIGN — AREA CONC (Ac) = 144 si

CONCRETE RELEASE STRENGTH (f'cI) 4000 psi

CONCRETE DESIGN STRENGTH (F'c) 5000 psi

6-1/2" 250k S/R Strand

As 0.144

ULTIMATE 250 k

LOSSES 70%

P= 151.200 k P_B

CALCULATE RESIDUAL STRESSES (Losses calculated per "Recommendations for Estimating Prestress Losses" PCI Committee on prestress loss as published in PCI Journal July / August 1975. TOTAL LOSS = ES + CR + SH + RET

ELASTIC SHORTENING .63fs = 10% LOSSES (STRESS RELIEVED STRAND)

ES =fcr(Es/Eci) USE 9.25 % LOSSES LOW RELAXATION STRANDS

fcI = 4000 Eci = 33fci^1/2*W^3/2 = 3.64E+06

W = 145 Es = 28 x 10^6

6 -1/2" 250k S/R Strand

ES = (779) psi

STEEL RELAXATION (RET_1) fpy = 0.90fpu (Low-Relaxation Strand)

(1st 18 hours) fpy = 0.85fpu (Stress Relieved Strand)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Low-Relaxation Strand)

RET = fst{[log24t-log24t1]/10}*[fst/fpy-0.55] (Stress-Relieved Strand)

RET = (6009) 175000 - 6009 = 168991 psi for 6-1/2" 250k S/R Strand

---

CREEP CR = (UCR)(SCF)(MCF)*(PCR)(fc)

UCR = 63-20Ec/10^6=>11 (use 11)

MCF = Accelerated Cure = 1

Volumn to surface Ratio

SCF = 3

PCR = 0.35

6 -1/2" 250k S/R Strand

CRc = (3273)

SHRINKAGE SH = (USH)(SSF)(PSH) = (4430) psi

USH = 27,000-3000Ec/10^6 = 12000

SSF Effect.Size and Shape= 0.879

PSH = (Shrink. Coeff.30 days) = 0.42

STEEL RELAXATION (RET_2)

(30 days)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Low-Relaxation Strands)

RET = fst{[log24t-log24t1]/45}*[fst/fpy-0.55] (Stress-Relieved Strands)

RET = (6891) 6 -1/2" 250k S/R Strand

TOTAL LOSSES = ES + RET_1 + RET_2 + CR + SH

6 -1/2" 250k S/R Strand

Losses = 30,393 psi 30,394

Losses = 17.37% 83.63% Tension Load

EFFECTIVE PRESTRESS AFTER ALL LOSSES

Using 6 -1/2" 250k S/R Strand fpc = 868 psi = FPC = 0.868

12" PILE DESIGN

Prestressed with 6-1/2" 250k S/R Strand

DIRECT LOAD:

N = (.33f'c - 0.27 fpc) Ac

N = 1416 * Ac
N = 204 kips or
N = 102 tons

NOMINAL STRENGTH:

Pn = (.85f'c - 0.60fpc) Ac

Pn = 537 kips P_o
FACTOR OF SAFETY = 2.63

MOMENT CAPACITY:

Ac = 144 si
I = 1,728 in^4
I/c= 288 in^3

Allowable tension = 4*sqrt(F'c) = 282.84 psi

M=fc I/c= 931 in.-kips M_o

NOMINAL MOMENT STRENGTH:

MOMENT Mn = 0.37t Aps Fpu (solid piles)

Aps= 0.864 si (area tendons)

Fpu= 250 ksi (ult. strength of the tendons)

Mn= 959 in.-kips M_o
FACTOR OF SAFETY = 2.89

TENSILE CAPACITY OF PILE

Effective Prestress fpc = 868.00 psi
Area of Concrete Ac = 144 si
Tensile Capacity of Pile = fpc + 6*sqrt(f'c) * Ac = 191.92 kips or P_T
Tensile Capacity of Pile = 96 tons

ALLOWABLE UNSUPPORTED LENGTH: (piles fixed at both ends)

h/r = 60 r = 3.46 in.
lu = 60r/0.5
lu = 415.69 in. = 34.64 ft.

MAXIMUM LENGTH FOR 2-POINT & 3-POINT HANDLING:

W = 150 lbs/ft.
f'ci = 4000 psi
S = I/c = 288 in^3
fpc = 868 psi

Allowable tension for 2-POINT = 6*sqrt(f'ci)
Allowable tension for 3-POINT = 3*sqrt(f'ci)
fs (2-POINT LIFT) = f + 6*sqrt(f'ci) = 1247 psi
fs (3-POINT LIFT) = f + 3*sqrt(f'ci) = 1058 psi
l = sqrt(fs * S / 1.5*6*W)
L =< 79 ft. for 2-POINT HANDLING
L =< 116 ft. for 3-POINT HANDLING

5F/K

* TEE3

```
**********************************
* CORPS PROGRAM  #  X0080       *  CPG4 - CASE PILE GROUP ANALYSIS PROGRAM
* VERSION NUMBER # 86/09/02-C   *  RUN DATE 09-04-91     RUN TIME 09:36:17
**********************************
```

CANAL STREET CANAL PUMP STATION (Trewall) By Roy A. Glapion August 91

THERE ARE 20 PILES AND
            3 LOAD CASES IN THIS RUN.

ALL PILE COORDINATES ARE CONTAINED WITHIN A BOX

	X	Y	Z
WITH DIAGONAL COORDINATES = (	-18.33 ,	-4.38 ,	.00)
(	18.33 ,	2.63 ,	.00)

****

PILE PROPERTIES AS INPUT

E	I1	I2	A	CCS	R=A
KSI	IN**4	IN**4	IN**2		
.40740E+04	.17280E+04	.17280E+04	.14400E+03	.20000E+01	.00000E+00

THESE PILE PROPERTIES APPLY TO THE FOLLOWING PILES -

ALL

****

SOIL DESCRIPTIONS AS INPUT

ES	ESOIL	LENGTH	L	LU
	K/IN**3		FT	FT
	.70350E+00	L	.73000E+02	.00000E+00

THIS SOIL DESCRIPTION APPLIES TO THE FOLLOWING PILES -

ALL

****

PILE STIFFNESSES AS CALCULATED FROM PROPERTIES

.27987E+02	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.27987E+02	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.13394E+04	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00
.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00	.00000E+00

THIS MATRIX APPLIES TO THE FOLLOWING PILES -

PILE GEOMETRY AS INPUT AND/OR GENERATED

NUM	X FT	Y FT	Z FT	BATTER	ANGLE	LENGTH FT	FIXITY
1	2.04	-4.38	.00	3.00	180.00	73.00	P
2	6.11	-4.38	.00	3.00	180.00	73.00	P
3	10.18	-4.38	.00	3.00	180.00	73.00	P
4	14.24	-4.38	.00	3.00	180.00	73.00	P
5	18.33	-4.38	.00	3.00	180.00	73.00	P
6	-2.04	-4.38	.00	3.00	180.00	73.00	P
7	-6.11	-4.38	.00	3.00	180.00	73.00	P
8	-10.18	-4.38	.00	3.00	180.00	73.00	P
9	-14.26	-4.38	.00	3.00	180.00	73.00	P
10	-18.33	-4.38	.00	3.00	180.00	73.00	P
11	2.04	2.63	.00	3.00	90.00	73.00	P
12	6.11	2.63	.00	3.00	90.00	73.00	P
13	10.18	2.63	.00	3.00	90.00	73.00	P
14	14.26	2.63	.00	3.00	90.00	73.00	P
15	18.33	2.63	.00	3.00	90.00	73.00	P
16	-2.04	2.63	.00	3.00	90.00	73.00	P
17	-6.11	2.63	.00	3.00	90.00	73.00	P
18	-10.18	2.63	.00	3.00	90.00	73.00	P
19	-14.26	2.63	.00	3.00	90.00	73.00	P
20	-18.33	2.63	.00	3.00	90.00	73.00	P
						1460.00	

APPLIED LOADS

LOAD CASE	PX K	PY K	PZ K	MX FT-K	MY FT-K	MZ FT-K
1	.0	160.2	249.0	640.4	.0	.0
2	.0	160.2	379.0	310.0	.0	.0
3	.0	160.2	156.0	665.0	.0	.0

ORIGINAL PILE GROUP STIFFNESS MATRIX

.10712E+04	.57324E-04	-.39342E+04	.20655E+06	.78125E-02	.74726E+05
.57324E-04	.18712E+04	.39342E+04	.12393E+06	-.78125E-02	.15625E-01
-.39342E+04	.39342E+04	.24165E+05	-.25373E+06	.31250E-01	-.20655E+06
.20655E+06	.12393E+06	-.25373E+06	.45291E+08	-.25000E+01	.10844E+08
.78125E-02	-.78125E-02	.31250E-01	.30000E+01	.47648E+09	-.77574E+08
.74726E+05	.78125E-02	-.20655E+06	.10844E+09	-.77574E+08	.41559E+08

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

LOAD CASE 2. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 0.

LOAD CASE 3. NUMBER OF FAILURES = 0. NUMBER OF PILES IN TENSION = 10.

PILE CAP DISPLACEMENTS

5H/K

LOAD CASE	DX IN	DY IN	DZ IN	RX RAD	RY RAD	RZ RAD
1	.1030E-02	.1351E+00	-.1452E-01	-.2863E-03	.1577E-06	.4881E-04
2	.5335E-01	.1163E+00	.7416E-03	-.4873E-03	.8166E-05	.5116E-04
3	-.1377E-01	.1549E+00	-.2315E-01	-.3114E-03	-.2107E-05	-.1294E-04

****

PILE FORCES IN LOCAL GEOMETRY

M1 & M2 NOT AT PILE HEAD FOR PINNED PILES
* INDICATES PILE FAILURE
# INDICATES CSF 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	CSF	AFS KSI	AST KSI
1	.0	-3.6	.2	-96.9	.8	.0	.00	.93	1.34	.53
2	.0	-3.8	.2	-96.9	.8	.0	.00	.93	1.34	.53
3	.0	-3.8	.2	-96.9	.8	.0	.00	.93	1.34	.53
4	.0	-3.8	.2	-97.0	.8	.0	.00	.93	1.34	.53
5	.0	-3.8	.1	-97.0	.8	.0	.00	.93	1.34	.53
6	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
7	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
8	.0	-3.8	.2	-96.8	.9	.0	.00	.93	1.34	.53
9	.0	-3.8	.2	-96.7	.9	.0	.00	.93	1.34	.53
10	.0	-3.8	.2	-96.7	.9	.0	.00	.92	1.34	.53
11	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
12	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
13	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
14	3.8	.0	27.3	-.7	-97.3	.0	.27	.61	1.53	.72
15	3.8	.0	27.4	-.7	-97.4	.0	.27	.61	1.53	.72
16	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
17	3.8	.0	27.3	-.7	-97.2	.0	.27	.61	1.53	.72
18	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72
19	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72
20	3.8	.0	27.3	-.7	-97.1	.0	.27	.61	1.53	.72

LOAD CASE - 2

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CSF	AFS KSI	AST KSI
1	-1.7	-3.3	9.5	-84.3	44.0	.0	.09	.84	1.51	.45
2	-1.7	-3.4	9.0	-86.0	43.9	.0	.09	.85	1.51	.46
3	-1.7	-3.4	8.5	-87.8	43.8	.0	.08	.86	1.51	.47
4	-1.7	-3.5	8.0	-89.5	43.7	.0	.08	.87	1.52	.48
5	-1.7	-3.6	7.5	-91.3	43.6	.0	.07	.88	1.53	.49
6	-1.7	-3.2	10.0	-82.5	44.1	.0	.10	.83	1.51	.44
7	-1.7	-3.2	10.5	-80.7	44.2	.0	.11	.82	1.50	.43
8	-1.7	-3.1	11.0	-79.0	44.3	.0	.11	.81	1.50	.42
9	-1.7	-3.0	11.5	-77.2	44.3	.0	.12	.80	1.49	.41
10	-1.7	-2.9	12.0	-75.5	44.4	.0	.12	.79	1.49	.40

12	3.3	-1.4	31.5	-37.1	-85.0	.0	.32	.57	1.64	.66	51
13	3.4	-1.4	32.0	-37.1	-86.6	.0	.32	.57	1.65	.66	K
14	3.5	-1.4	32.6	-37.1	-88.2	.0	.33	.57	1.66	.66	
15	3.5	-1.4	33.1	-37.1	-89.3	.0	.33	.56	1.67	.66	
16	3.2	-1.4	30.4	-37.1	-81.5	.0	.30	.57	1.62	.67	
17	3.1	-1.4	29.9	-37.1	-79.8	.0	.30	.56	1.61	.67	
18	3.0	-1.4	29.4	-37.1	-78.0	.0	.29	.56	1.60	.67	
19	3.0	-1.4	28.9	-37.1	-76.3	.0	.29	.56	1.59	.68	
20	2.9	-1.4	28.3	-37.1	-74.5	.0	.28	.56	1.58	.68	

LOAD CASE - 3

PILE	F1 K	F2 K	F3 K	M1 IN-K	M2 IN-K	M3 IN-K	ALF	CRF	ASC KSI	AST KSI
1	.4	-4.3	-2.4	-110.8	-11.4	.0	.05	.96	1.42	.43
2	.4	-4.3	-2.3	-110.3	-11.3	.0	.05	.96	1.41	.43
3	.4	-4.3	-2.2	-109.9	-11.3	.0	.04	.95	1.40	.43
4	.4	-4.3	-2.1	-109.4	-11.3	.0	.04	.94	1.41	.44
5	.4	-4.3	-1.9	-109.0	-11.3	.0	.04	.94	1.40	.44
6	.4	-4.3	-2.6	-111.3	-11.4	.0	.05	.97	1.41	.43
7	.4	-4.4	-2.7	-111.7	-11.4	.0	.05	.97	1.41	.43
8	.4	-4.4	-2.8	-112.2	-11.4	.0	.06	.98	1.41	.42
9	.4	-4.4	-3.0	-112.6	-11.4	.0	.06	.98	1.41	.42
10	.4	-4.4	-3.1	-113.1	-11.5	.0	.06	.99	1.41	.42
11	4.4	.4	23.7	9.6	-112.6	.0	.24	.70	1.59	.61
12	4.4	.4	23.5	9.6	-112.1	.0	.24	.70	1.58	.61
13	4.4	.4	23.4	9.6	-111.7	.0	.23	.70	1.57	.61
14	4.3	.4	23.3	9.6	-111.2	.0	.23	.70	1.57	.61
15	4.3	.4	23.1	9.6	-110.8	.0	.23	.70	1.56	.61
16	4.4	.4	23.8	9.6	-113.0	.0	.24	.70	1.59	.61
17	4.4	.4	23.9	9.6	-113.5	.0	.24	.70	1.59	.61
18	4.4	.4	24.1	9.6	-113.9	.0	.24	.70	1.59	.61
19	4.5	.4	24.2	9.6	-114.3	.0	.24	.70	1.60	.61
20	4.5	.4	24.4	9.6	-114.6	.0	.24	.70	1.60	.61

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	.0	3.8	.2	.0	.0	.0
2	.0	3.8	.2	.0	.0	.0
3	.0	3.8	.2	.0	.0	.0
4	.0	3.8	.2	.0	.0	.0
5	.0	3.8	.1	.0	.0	.0
6	.0	3.8	.2	.0	.0	.0
7	.0	3.8	.2	.0	.0	.0
8	.0	3.8	.2	.0	.0	.0
9	.0	3.8	.2	.0	.0	.0
10	.0	3.8	.2	.0	.0	.0
11	.0	12.2	24.7	.0	.0	.0
12	.0	12.2	24.7	.0	.0	.0
13	.0	12.2	24.7	.0	.0	.0
14	.0	12.3	24.7	.0	.0	.0
15	.0	12.3	24.8	.0	.0	.0
16	.0	12.2	24.7	.0	.0	.0
17	.0	12.2	24.7	.0	.0	.0

18	.0	12.3	24.7	.0	.0	.0
19	.0	12.5	24.7	.0	.0	.0
20	.0	12.7	24.7	.0	.0	.0
		160.2K	249K			

55/K

LOAD CASE - 2

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	-1.4	3.3	9.5	.0	.0	.0
2	-1.2	3.4	9.1	.0	.0	.0
3	-1.1	3.4	8.6	.0	.0	.0
4	-.9	3.5	8.1	.0	.0	.0
5	-.7	3.6	7.6	.0	.0	.0
6	-1.5	3.2	10.0	.0	.0	.0
7	-1.7	3.2	10.5	.0	.0	.0
8	-1.8	3.1	11.0	.0	.0	.0
9	-2.0	3.0	11.5	.0	.0	.0
10	-2.2	2.9	12.0	.0	.0	.0
11	1.4	12.9	28.4	.0	.0	.0
12	1.4	13.1	28.8	.0	.0	.0
13	1.4	13.3	29.3	.0	.0	.0
14	1.4	13.6	29.8	.0	.0	.0
15	1.4	13.8	30.3	.0	.0	.0
16	1.4	12.6	27.9	.0	.0	.0
17	1.4	12.4	27.4	.0	.0	.0
18	1.4	12.2	26.9	.0	.0	.0
19	1.4	11.9	26.4	.0	.0	.0
20	1.4	11.7	25.9	.0	.0	.0
	-0.5K	160.1K	379K			

LOAD CASE - 3

PILE	PX K	PY K	PZ K	MX IN-K	MY IN-K	MZ IN-K
1	.4	4.3	-2.5	.0	.0	.0
2	.3	4.3	-2.3	.0	.0	.0
3	.3	4.3	-2.2	.0	.0	.0
4	.2	4.3	-2.1	.0	.0	.0
5	.2	4.3	-2.0	.0	.0	.0
6	.4	4.3	-2.4	.0	.0	.0
7	.4	4.4	-2.7	.0	.0	.0
8	.5	4.4	-2.8	.0	.0	.0
9	.5	4.4	-3.0	.0	.0	.0
10	.6	4.4	-3.1	.0	.0	.0
11	-.4	11.7	21.1	.0	.0	.0
12	-.4	11.6	20.9	.0	.0	.0
13	-.4	11.5	20.8	.0	.0	.0
14	-.4	11.5	20.7	.0	.0	.0
15	-.4	11.4	20.6	.0	.0	.0
16	-.4	11.7	21.2	.0	.0	.0
17	-.4	11.8	21.3	.0	.0	.0
18	-.4	11.8	21.4	.0	.0	.0
19	-.4	11.9	21.6	.0	.0	.0
20	-.4	12.0	21.7	.0	.0	.0
	-0.2K	160.3K	186K			

TEEWALL3 5K/K

```
1000 CANAL STREET CANAL PUMP STATION (Teewall) By Roy A. Slapion August 9,
1010 PRO 4074 1723 1728 144 2.0 0 ALL
1020 SOI ES 0.7038 L 73 0 ALL
1030 PIN ALL
1040 DLS S 100 50 537.0 191.92 151.20 959.0 331.0 H 12 ALL
1050 ASC S 144 288 0.87 0.9975 1.75 0 ALL
1070 BAT 3.0 ALL
1080 ANG 180 1 TO 10
1084 ANG 90 11 TO 20
1100 PIL 1 2.037 -4.375 0
1110 PIL 11 2.037 2.625 0
1112 PIL 6 -2.037 -4.375 0
1114 PIL 16 -2.037 2.625 0
1120 ROW X 5 1 4 AT 4.0740
1130 ROW X 5 11 4 AT 4.0740
1132 ROW X 5 6 4 AT -4.0740
1134 ROW X 5 16 4 AT -4.0740
1150 LOA 1 C 160.2 249 640.4 0 0
1160 LOA 2 C 160.2 379 310 0 0
1170 LOA 3 C 160.2 186 665 0 0
1180 FOU 1 2 3 4 5 6 7 TEE3
1190 PSO 1
1200 PFO ALL
1210 FPL N
```

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CANAL STREET CANAL PUMP STATION

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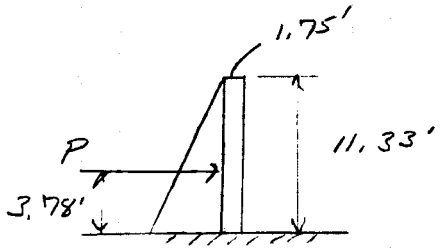
Flexure:



$P/_{\text{Sq ft wall}} = 62.4\#/_{ft^3} \times 1' \times (11.33)^2/2 = 4^K$

$M_u = 1.7 \times 4^K \times 3.78' = 25.7'^K \approx 26'^K$

$f'_c = 3000 psi$
$f_y = 60 ksi$

$K = M_u \times 12{,}000 / \phi b d^2$

$\phi = 0.9$
$b = 12 in$
$d = 18.56$
Assume 2" cover + #7 BARS

$K = 26'^K \times 12{,}000 / 0.9 \times 12 \times (18.56)^2 = 84 psi < K_{min}$

$\rho_{min} = 0.0033 = 200/f_y$

$A_s = \rho b d = 0.0033 \times 12 \times 17.56 = 0.695 in^2/ft$

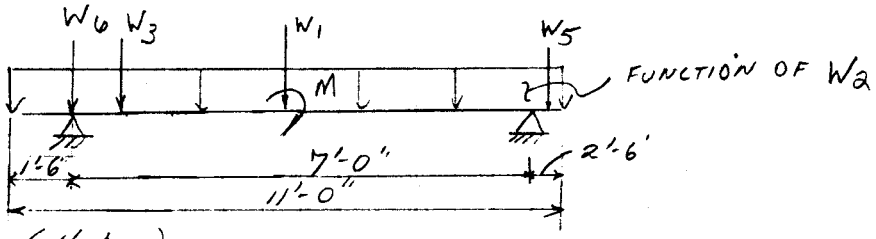
Use #7 BARS @ 9" O.C $A_s = 0.80 in^2/ft$ verz.

Horizontal: Assume #5 bars use #5 @ 7' O.C.

S/L Design: Thickness = 2'-0" $d = 24" - 3 - \frac{7}{8} \times \frac{1}{2} = 20.56$

min steel: $A_s = 0.0033 \times 12 \times 20.56 = 0.814$ in²/ft of slab

use # 8 @ 9" o.c. $A_s = 1.05$ in²/ft of slab (min.)



Refer to pg. 2 (4' strip) NTS

$W_1 = 98^k/40 = 2.45^k$ DL ↓ x (1.4) = 3.43^k x 4 = 13.72 k

$W_2 = 132^k/40 \times 11 = 0.3^k/ft$ DL ↓ x (1.4) = 0.42 k = 1.68 k

$W_3 = 116.4/5 \times 40 = 0.6^k/ft$ LL over 5' ↓ x (1.7) = 1.02 k/ft = 4.08 k/ft

$W_4 = 166^k/40 \times 5.875 = 0.71^k/ft$ LL ↑ over 5.875' x (1.7) = 1.21 k/ft = 4.84 k/ft

W_5 = 1 support : 1 pipe $31.2^k/4 = 7.8^k \times (1.4) = 10.9^k = 43.6^k$

W_6 = 1 support : 1 pipe $352^k/4 = 8.8^k \times (1.4) = 12.3^k = 49.2^k$

$M_4 = 160.3^k/40 \times 3.78' = 15.1^{lk} \times (1.7) = 26^{lk} = 104^{lk}$

* Assume W_7, W_8 : P.P.

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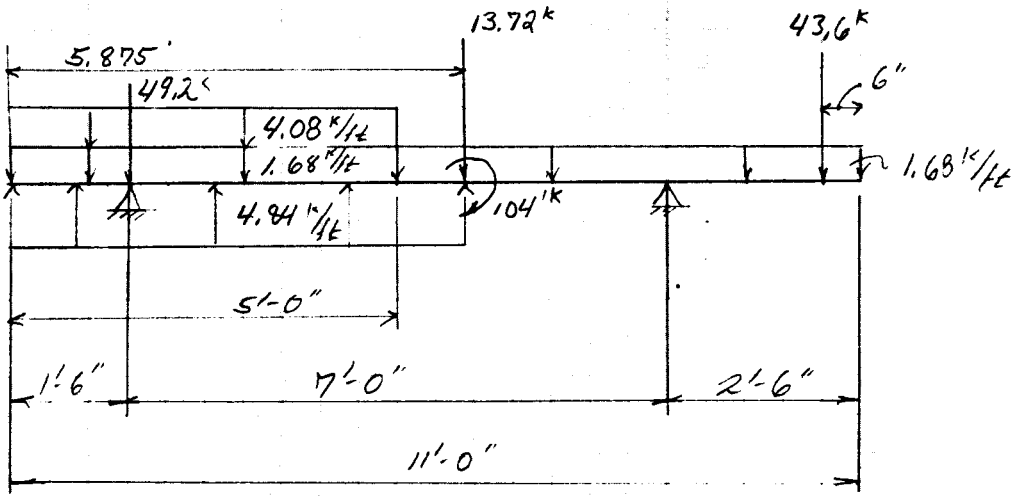
CASE I (fully loaded)



f'_c = 3000psi

E = 3160 ksi

E = 455,040 ksf $\quad I = \frac{1}{12} 1 \times (2)^3 = 0.667 ft^4$ very conservative

max. M_y = -97.917'ᵏ @ X = 5.82'

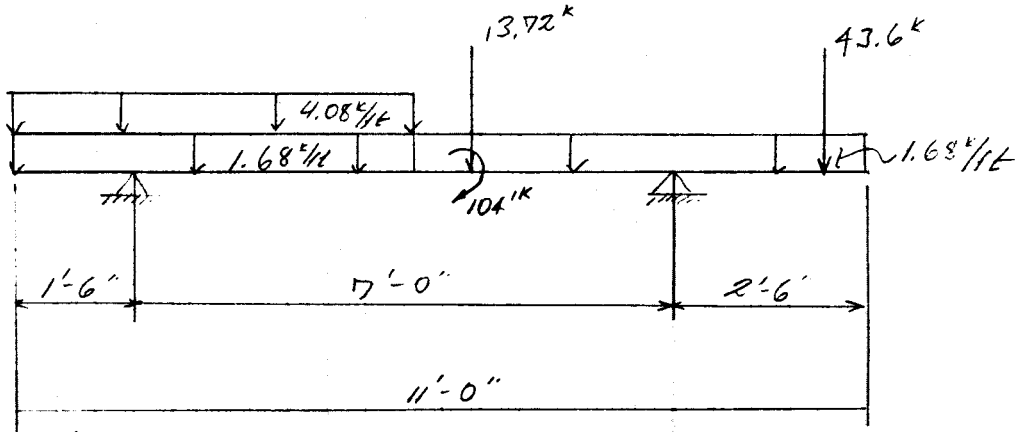
max. V_y = 47.751ᵏ

max. R_y = 87.124ᵏ

$K = \frac{97.917 \times 12{,}000}{0.9 \times 48 \times (20.5)^2} = K_{min}$

$\rho = 0.0033$

CASE II $\quad W_4 = 0 \quad W_6 = 0 \quad W_7 = 0 \quad W_8 = 0 \quad P_1 = 0$



max. M_y = -91.122'ᵏ

max. V_y = 47.75ᵏ

max. R_y = 92.96ᵏ

$M_{y\,max}$ = 97 ^{1K} use 100 ^{1K}
$V_{y\,max}$ = 47.5 ^{K} use 50 ^{K}
$R_{y\,max}$ = 92.9 ^{K} use 94 ^{K}

Flexure:

$M_y = 100^{1K}$ $b = 48"$ cover = 3" Assume #8 BARS

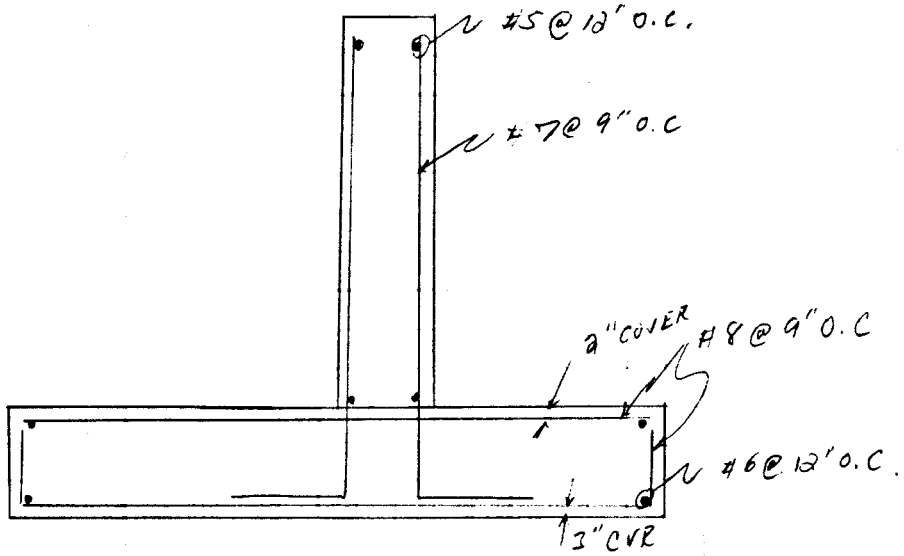
$d = 24' - 3" - \frac{1}{2}" = 20.5"$

$K = \frac{100^{1K} \times 12000}{0.9 \times 48 \times 20.5^2} = 66 << K_{min}$

$A_s = 0.0033 \times 48" \times 20.5 = 3.247\ in^2/4ft = 0.81\ in^2/ft$

use #8 @ 9" O.C $A_s = 1.05\ in^2/ft$ T.B controlling

use #6 @ 12" Long Direction



CASE I

9A/F

****** BEAM ****** INPUT DATA

NO. OF SPANS = 3
NO. OF SUPPORTS = 2
NO. OF CONCENTRATED LOADS = 3
NO. OF DISTRIBUTED LOAD AREAS= 3
NO. OF CONCENTRATED COUPLES = 1

MODULUS OF ELASTICITY,E = 455040
MOMENT OF INERTIA, I = .667

LEFT END IS FREE
RIGHT END IS FREE

BEAM LENGTH = 11
LENGTH SPAN 1 = 1.5
LENGTH SPAN 2 = 7
LENGTH SPAN 3 = 2.5

SUPPORT NO. 1 AT X = 1.5
SUPPORT NO. 2 AT X = 8.5

CONCENTRATED LOAD NO. 1 IS 49.200 AT X = 1.5
CONCENTRATED LOAD NO. 2 IS 13.720 AT X = 5.875
CONCENTRATED LOAD NO. 3 IS 43.600 AT X = 10.5

DISTRIBUTED LOAD NO. 1 IS 5.760 AT X = 0
TO 5.760 AT X = 5
DISTRIBUTED LOAD NO. 2 IS 1.680 AT X = 5
TO 1.680 AT X = 11
DISTRIBUTED LOAD NO. 3 IS -4.840 AT X = 0
TO -4.840 AT X = 5.875

CONCENTRATED COUPLE NO. 1 IS 104.000 AT X = 5.875

SUPPORT REACTIONS

R(1) =	29.841	AT X =	1.500
R(2) =	87.124	AT X =	8.500

M(O) = 0
M(L) = 0

CRITICAL VALUES

SHEAR(MAX) =	47.751	AT X =	0.529
SHEAR(MIN) =	-39.275	AT X =	8.471
MOMENT(MAX) =	4.731	AT X =	5.682
MOMENT(MIN) =	-97.917	AT X =	5.824
SLOPE(MAX) =	4.5832-04	AT X =	0.000
SLOPE(MIN) =	-9.2475-04	AT X =	10.941
DEFL(MAX) =	0.001070	AT X =	5.000
DEFL(MIN) =	-0.002110	AT X =	11.000

******* BEAM *******

RESULTS

X	SHEAR	MOMENT	SLOPE(RAD)	DEFLECTION
0.000	-0.000	-0.000	4.583E-04	-0.000687
1.000	-0.920	-0.460	4.578E-04	-0.000229
2.000	-21.199	-11.529	4.463E-04	0.000226
3.000	-22.119	-33.179	3.729E-04	0.000642
4.000	-23.039	-55.758	2.267E-04	0.000948
5.000	-23.959	-79.257	4.496E-06	0.001070
6.000	-35.124	0.611	-2.519E-04	0.000934
7.000	-36.804	-35.354	-3.087E-04	0.000663
8.000	-38.484	-72.998	-4.867E-04	0.000276
9.000	46.960	-66.760	-7.557E-04	-0.000346
10.000	45.280	-22.640	-9.058E-04	-0.001199
11.000	0.002	0.000	-9.247E-04	-0.002110

CASE II 90/F

****** BEAM ****** INPUT DATA

NO. OF SPANS = 3
NO. OF SUPPORTS = 2
NO. OF CONCENTRATED LOADS = 2
NO. OF DISTRIBUTED LOAD AREAS= 2
NO. OF CONCENTRATED COUPLES = 1

MODULUS OF ELASTICITY,E = 455040
MOMENT OF INERTIA, I = .667

LEFT END IS FREE
RIGHT END IS FREE

BEAM LENGTH = 11
LENGTH SPAN 1 = 1.5
LENGTH SPAN 2 = 7
LENGTH SPAN 3 = 2.5

SUPPORT NO. 1 AT X = 1.5
SUPPORT NO. 2 AT X = 8.5

CONCENTRATED LOAD NO. 1 IS 13.720 AT X = 5.875
CONCENTRATED LOAD NO. 2 IS 43.600 AT X = 10.5

DISTRIBUTED LOAD NO. 1 IS 5.760 AT X = 0
TO 5.760 AT X = 5
DISTRIBUTED LOAD NO. 2 IS 1.680 AT X = 5
TO 1.680 AT X = 11

CONCENTRATED COUPLE NO. 1 IS 104.000 AT X = 5.875

******* BEAM ******* SUMMARY OF RESULTS

SUPPORT REACTIONS

R(1) =	3.236	AT X =	1.500
R(2) =	92.564	AT X =	8.500

M(O) = 0
M(L) = 0

CRITICAL VALUES

SHEAR(MAX) =	47.731	AT X =	8.529
SHEAR(MIN) =	-45.114	AT X =	8.471
MOMENT(MAX) =	20.017	AT X =	5.000
MOMENT(MIN) =	-91.122	AT X =	8.471
SLOPE(MAX) =	3.403E-04	AT X =	0.000
SLOPE(MIN) =	-8.324E-04	AT X =	11.000
DEFL(MAX) =	0.000779	AT X =	5.059
DEFL(MIN) =	-0.001804	AT X =	11.000

****** BEAM ******

RESULTS

X	SHEAR	MOMENT	SLOPE(RAD)	DEFLECTION
0.000	-0.001	-0.000	3.408E-04	-0.000507
1.000	-5.760	-2.880	3.377E-04	-0.000167
2.000	-8.284	-9.902	3.169E-04	0.000162
3.000	-14.044	-21.065	2.674E-04	0.000457
4.000	-19.804	-37.989	1.717E-04	0.000691
5.000	-25.564	-60.673	1.077E-05	0.000779
6.000	-40.964	15.209	-1.897E-04	0.000678
7.000	-42.644	-26.595	-2.080E-04	0.000471
8.000	-44.324	-70.078	-3.668E-04	0.000215
9.000	46.960	-68.760	-6.334E-04	-0.000285
10.000	45.280	-22.640	-7.835E-04	-0.001006
11.000	0.002	0.000	-8.024E-04	-0.001504

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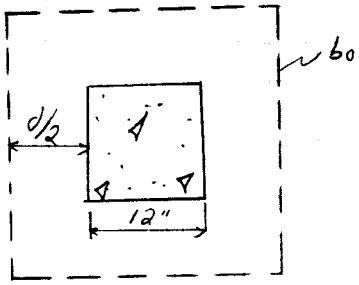
$R_{y_{MAX}} = 94^K$ $\quad d = 20.5" - 6" = 14.5$



$b_o = 4 \times (12 + 14.5) = 106$

$V_y \leq \phi \times 4 \sqrt{f'c}\, b_o d$

$0.85 \times 4 \sqrt{3000}\ 106 \times 14.5 = 286^k$ OK