รายการคำนวณโครงสร้าง

โครงการ	:	อาคารเก็บสินค้า คลอง 4 ถ. รังสิต-นครนายก อ.ธัญบุรี จ.ปทุมธานี
เจ้าของ	:	United Distribution Business Co., Ltd.
วิศวกรโครงสร้าง	:	พิบูล บุญส่ง สย. 3591

มีนาคม 2546

รายการคำนวณโครงสร้าง
อาคารเก็บสินค้า 1 ชั้น

1. ลักษณะอาคาร : อาคารโครงสร้างเหล็ก, โครงหลังคาเหล็ก, พื้น คสล., ผนังอิฐบล็อกและฐานรากวางบนเสาเข็มตอก

2. กำลังวัสดุที่ใช้ในการคำนวณออกแบบ :
   คอนกรีต fc' = 175 KSC. fc = 0.375 (fc') = 65 KSC.
   เหล็กเสริม กลม SR24, fy = 2,400 KSC.
   ข้ออ้อย SD30, fy = 3,000 KSC.
   SD40, fy = 4,000 KSC.
   R/C constant for working stress design
   fs = 1,500 KSC. J = 0.899 R = 8.82 KSC.
   fs = 1,200 KSC. J = 0.833 R = 10.07 KSC.
   : เหล็กรูปพรรณ Fy = 2,400 KSC.

3. น้ำหนักบรรทุกจร : พื้นที่เก็บสินค้า = 500 กก./ตร.ม.
   พื้นที่สำนักงาน = 300 กก./ตร.ม.

4. มาตรฐานการออกแบบ : ทฤษฎี Working Stress Design & Ultimate Strenth design ตามมาตรฐาน ACI 318, ว.ส.ท. และ พรบ. ควบคุมอาคาร พ.ศ 2522

5. วิธีวิเคราะห์โครงสร้าง : ใช้ Micro computer Program MFEAP-P1

6. ผู้คำนวณออกแบบ : นายพิบูล บุญส่ง สย. 3591

รวมรายการคำนวณ จำนวน 31 แผ่น

JOB.....

DESIGN.....

DATE.....

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Footing F1

Col. Load = (3.75 X 5.00 X 1,600) + (28.0 X 5.00 X 150)
= 50 t.

Ft. Wt = 0.60 X 0.60 X 0.60 X 2.4 = 0.5 t

Total = 50.5 t.

Use 1 - □ 0.30 X 0.30 X 21.0 M

Safe load = 50 t

Footing F2

Col. Load = 5.00 X 932 = 23.3 t

Ft. Wt = 0.5 t

Total = 24 t

Use 1 - □ 0.26 X 0.26 X 21.0 M

Safe Load = 35 t

Footing F3

Col. Load = 2.50 X 5.00 X 540 = 6.8 t

Ft. Wt = 0.5 t

Use 1 - I 0.22 X 0.22 X 21.0 M

Safe load = 20 t

Footing F4

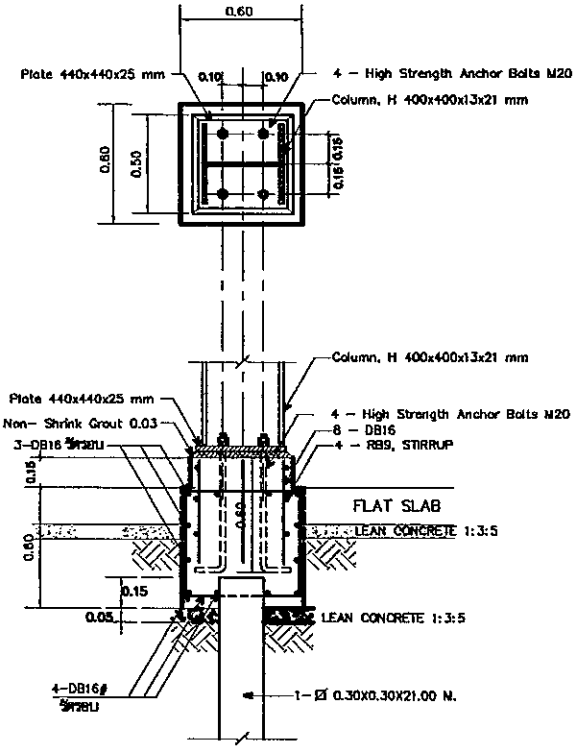
Col. Load = (7.50 X 5.00 X 1,000) = 60 t

Ft. Wt = 0.5 t

Total = 60.5 t

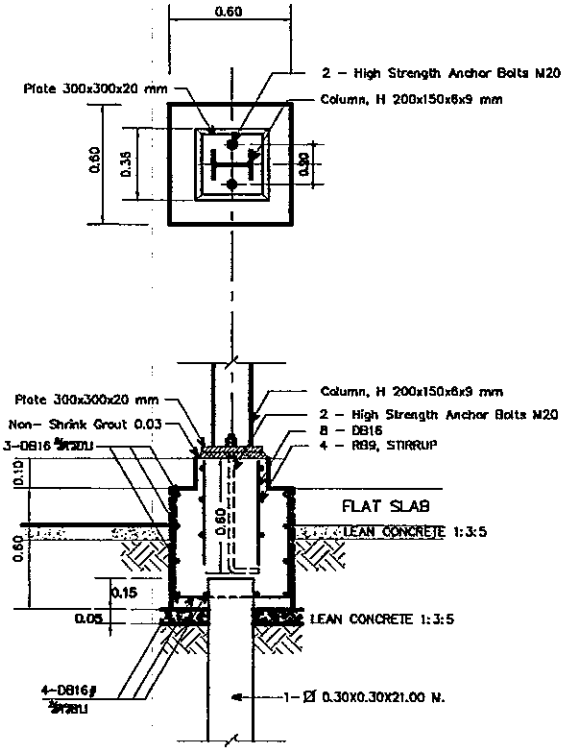
Use 1 - □ 0.35 X 0.35 X 21.0 M

Safe Load = 60 t



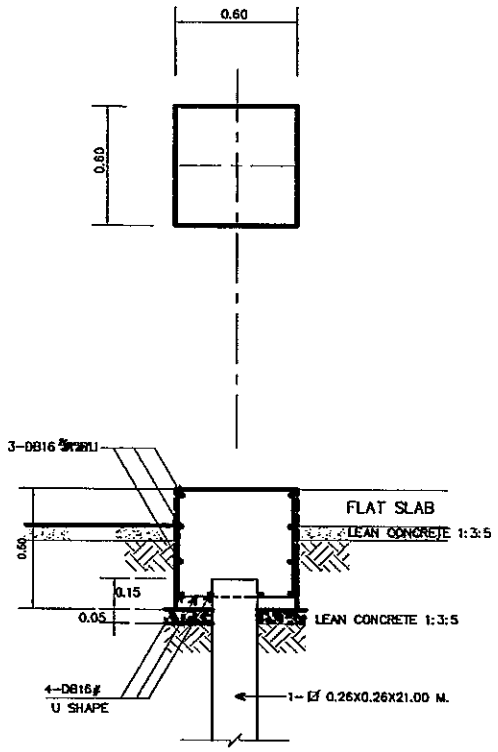
ขยายฐานราก F - 1/C -1

SCALE 1:20



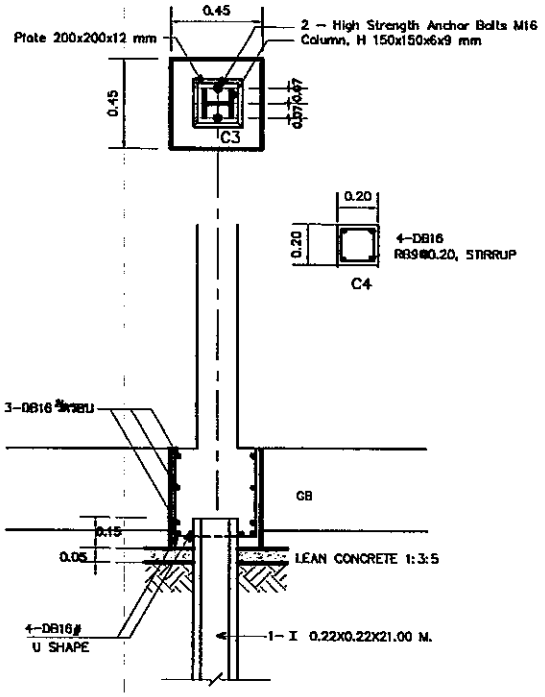
ขยายฐานราก F - 1/C -2

SCALE 1:20



ขยายฐานราก F - 2

SCALE 1:20



ขยายฐานราก F - 3/C - 3, C - 4

SCALE 1:20

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Flat Slab Design (L.L = 0.5 t/m²)

Design strip = 5.00 m. Span @ 5.00 m

Use t = 0.18 , d = 0.15

Load D.L = 0.18 X 2,400 = 432 Kg/m²

L.L = 500 Kg/m²

W = 932 "

Load on design strip = 5.00 X 932 = 4,660 Kg/m

Long Span M_{oe}^{-} = $\frac{1}{16}$ X 4,300 X 4.40² = 5,039 Kg-m

M_o^{+} = $\frac{1}{14}$ X 4,300 X 4.40² = 6,444 "

M_{oi}^{-} = $\frac{1}{10}$ X 4,300 X 4.40² = 9,022 "

Col. Strip M_e^{-} = M_{oe}^{-} = 5,039 "

A_{se}^{-} = 27.84 cm²/2.50 m = 11.14 cm², D16@0.15

M_s^{+} = 0.60 X M_o^{+} = 3,866 Kg-m

A_s^{+} = 19.10 cm²/2.50 m = 7.64 cm², D12@0.125

M_i^{-} = 0.75 M_{oi}^{-} = 6,766 Kg-m

A_{si}^{-} = 33.42 cm²/2.50 m = 13.36 cm², D16@0.15

Mid. Strip M_e^{-} = 0

M^{+} = 0.40 M_o^{+} = 2578 Kg-m

A_s^{+} = 12.42 cm²/2.50 m. = 5.09 cm², D12@0.20

M_i^{-} = 0.25 M_{oi}^{-} = 2,256 Kg-m

A_{si}^{-} = 11.13 cm²/2.50 m. = 4.46 cm², D12@0.20

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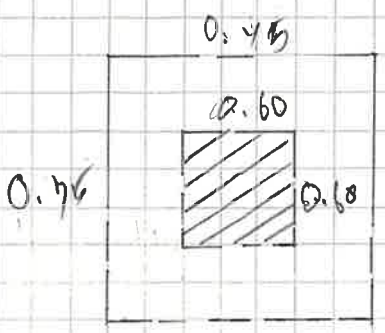
Punching shear Check



$\alpha_s = 40$

Slab $t = 0.18$, $d = 0.15$

$\beta_c = 0.60/0.60 = 1$

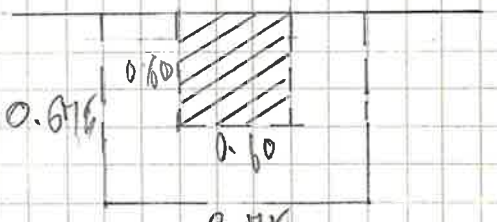
Factored load $= 1.7\,L.L + 1.4\,D.L$

$= 1,455$ Kg/m²

$$V_p = \frac{1,455 \times (2.5 - 0.975 \times 0.975)}{2 \times (975 + 975) \times 15} = 7.92 \text{ KSC}$$

$$\phi V_n = 0.85 \left(\frac{40 \times 15}{300} + 2\right) \times \sqrt{175} \times 0.265 = 11.92 \text{ KSC}$$

O.K.



$\alpha_s = 30$

Factored load $= 1,455$ Kg/m²

$$V_p = \frac{1455 \times (2.50 \times 5.00 - 0.675 \times 0.975)}{2 \times (675 + 975) \times 15}$$

$= 4.09$ KSC

$$\phi V_n = 0.85 \times 3.6 \times \sqrt{175} \times 0.265 = 10.93 \text{ KSC}$$

O.K.

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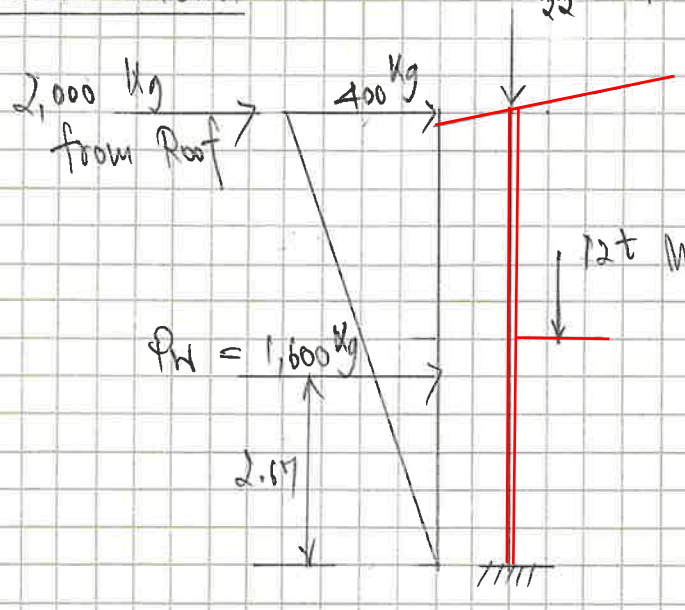
Main Column C1



H 400X400X13X21 mm

I_x = 66,600 cm^4, A = 218.7 cm^2

γ = 172 kg/m

i_x = 14.5 i_y = 10.1

$M_{base} = (2{,}000 \times 8.0) + (1{,}600 \times 2.67) = 20{,}272$ kg-m

$KL/r_{min} = 800/10.1 = 79.2$

F_a = 1,084 ksc, $f_a = 34{,}000/218.7 = 155.5$ ksc.

$f_b = MC/I = \frac{20{,}272 \times 100 \times 20}{66{,}600} = 609$ ksc

F_b = 1440 ksc.

$$f_a/F_a + f_b/F_b \leq 1.00$$

$$155.5/1{,}084 + 609/1{,}440 = 0.6 < 1.00 \quad \text{O.K.}$$

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Column C2

H 200X150X6X9 mm. $A = 39.01\ cm^2$

$W = 30.6$ Kg/m $I_x = 2,690\ cm^4$

$i_x = 8.30$ $i_y = 3.61$

$Kl/r = 400/3.61 = 111$

$F_a = 810$ KSC

$f_a = 16,400/39.01 = 420.5$ KSC < 810 KSC

O.K.

Column C3

H 200X200X8X12 mm, $A = 63.53\ cm^2$, $W = 49.9\ cm^2$.

$I_x = 4,720\ cm^4$ $i_x = 8.62$, $i_y = 5.02$

$Kl/i_y = 400/5.02 = 79.68$

$F_a = 1,046$ KSC

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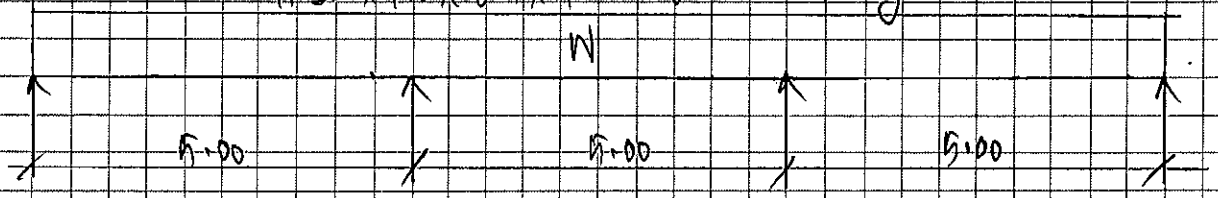
B-1

H 300 x 150 x 6.5 x 9 γ = 36.7 Kg/m



Load F.L. = 589 x 5.00 = 2,945 Kg/m

D.L = 37 Kg/m

W = 2,982 "

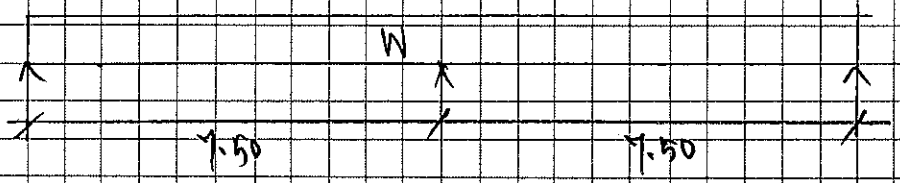
$\Delta_{max} = \frac{0.0069 \times 29.82 \times 500^4}{2.1 \times 10^6 \times 7210} = 0.85$ cm $< 500/360 = 1.39$ cm

O.K.

R_{max} = 1.10 x 2982 x 5.00

= 16,401 Kg

B-3



H 400 x 200 x 8 x 13, γ = 66 Kg/m, A = 84.12 cm^2

I_x = 23,700 cm^4

$\Delta_{max} = \frac{0.006 \times 29.82 \times 750^4}{2.1 \times 10^6 \times 23,700} = 1.13$ cm $< 750/360 = 2.08$ cm.

O.K.

R_{max} = 1.16 x 2982 x 7.50

= 25,945 Kg

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GB1

Load D.L = 0.25 X 0.60 X 2,400 = 360 Kg/m

S.L = $\frac{1140 \times 5.00 \left(3 - 0.83^2\right)}{3 \quad 2}$ = 2,195 "

W = 2,555 "

$M^- = \frac{1}{11} \times 2,555 \times 5.00^2$ = 4,094 Kg-m

$M^+ = \frac{1}{14} \times 2,555 \times 5.00^2$ = 4,563 "

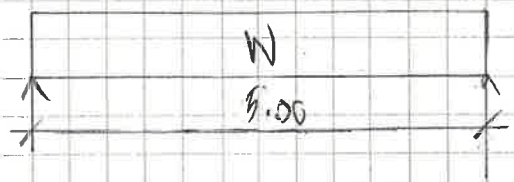
M_c = 4,563 Kg-m

A_s^- = 12.64 cm^2, 5-D20

A_s^+ = 8.12 cm^2, 3-D20

ϕ 9 @0.20

GB2



Load D.L = 0.25 X 0.50 X 2,400 = 240 Kg/m

S.L = $\frac{912 \times 5.00 \left(3 - 0.83^2\right)}{3 \quad 2}$ = 786 "

W = 1,226 "

$M^- = M^+ = \frac{1}{14} \times 1,226 \times 5.00^2$ = 2,189 Kg-m

$A_s^- = A_s^+$ = 5.18 cm^2, 3-D20

ϕ 9 @0.20

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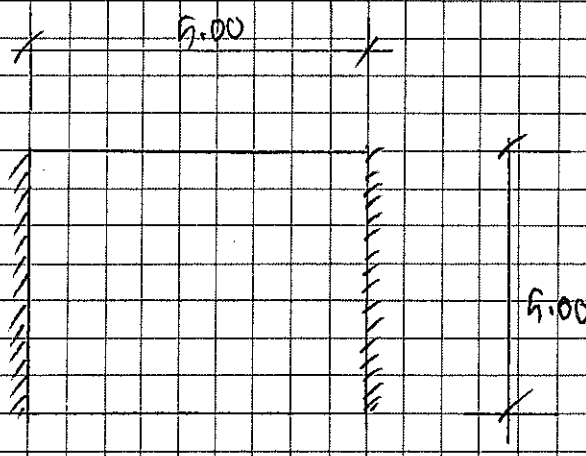
Slab (S1)



$t_{min} = \frac{5.0+5.0}{90} = 0.11$ m

use $t = 0.12$ m

$d = 0.10$ m

Load

D.L = 0.12 X 2,400 = 288 kg/m²

L.L = 200 "

W = 488 kg/m²

$M^{-}_{cont} = 0.041 \times 488 \times 5.00^2 = 500$ kg-m

$M^{+} = 0.031 \times 488 \times 5.00^2 = 378$ "

$A_s^{-} = 4.84$ cm², ϕ9 @0.10 = 6.36 cm².

$A_s^{+} = 3.88$ cm², ϕ9 @0.15 = 4.24 cm².

Slab (S2)

t = 0.15

Load

D.L = 0.15 X 2,400 = 360 kg/m²

L.L = 300 kg/m²

W = 660 "

$M^{-}_{cont} = 0.041 \times 660 \times 5.00^2 = 677$ kg-m

$M^{+} = 0.031 \times 660 \times 5.00^2 = 511$ "

$A_s^{-} = 5.02$ cm², ϕ9 @0.15

$A_s^{+} = 3.79$ cm², ϕ9 @0.20

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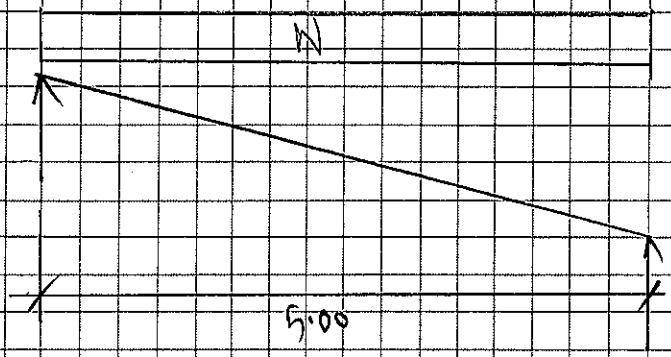
Ramp



$t = 0.15$

Load

D.L = $0.15 \times 2,400$ = 360 kg/m

L.L = 300

W = 760 kg/m

$M^{+} = \frac{1}{10} \times 760 \times 5.00^2$ = 1,900 kg-m

A_s = 11.25 cm^2 DB 16 @ 0.15

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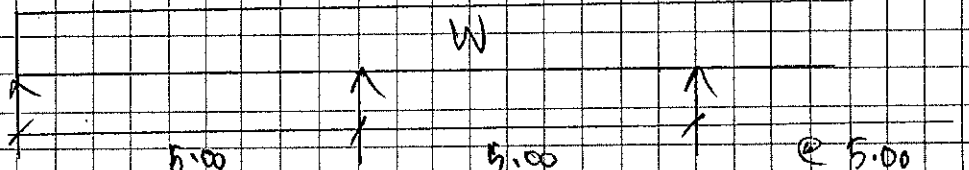
bbb)

Spacing @ 1.50 M

L 100x50x20x3.2 mm, I_x = 107 cm^4



Load Steel roof sheet = 6X1.50 = 9 Kg/M

L.L = 30X1.5 = 45 "

D.L = 5.2 "

W → ~65 "

$$\Delta_{max} = \frac{0.0065 \times 0.65 \times 500^4}{2.1 \times 10^6 \times 107} = 1.17 \text{ cm.} < \frac{500}{300} = 1.67 \text{ cm}$$

O.K.

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Truss T-1

Point load on each joint @ 1.00 m

$P = 35 \times 5.0 + (20 \times 2) + (1.5 \times 6.78) + (5.5 \times 5.00 / 1.50)$

$= 243$ Kg

Say 250 Kg

Upper & Lower Chords ϕ 6" X 4 mm $A = 34.79$ cm^2

$r = 5.60$ cm

Webs ϕ 3" X 3.2 mm $A = 4.35$ cm^2

$r = 2.59$ cm

Deflection

Max Δ = 1.10 cm $< 4,000/300 = 13.33$ cm.

Upper & Lower Chords, Max T = 867 Ksc $<$ 1,200 Ksc. O.K

Max C = - 898 Ksc

$KL/r = 102/5.60 = 17.41$

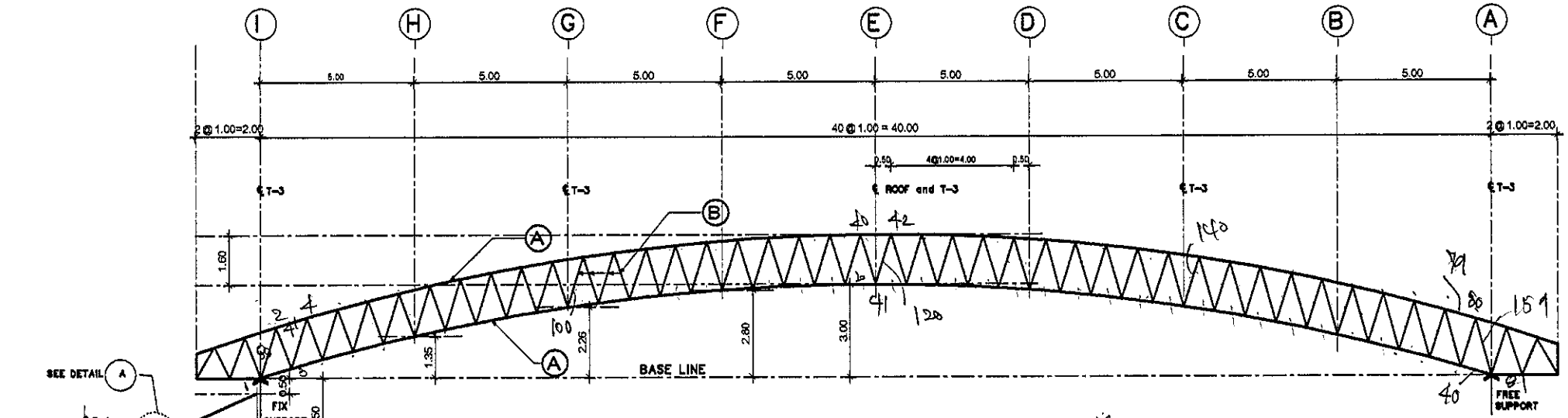
From Table, Fa = 1,380 Ksc $>$ Max. C O.K

Webs, Max T = 646 Ksc O.K.

Max C = - 744 Ksc

$KL/r = 172/2.59 = 66.4$

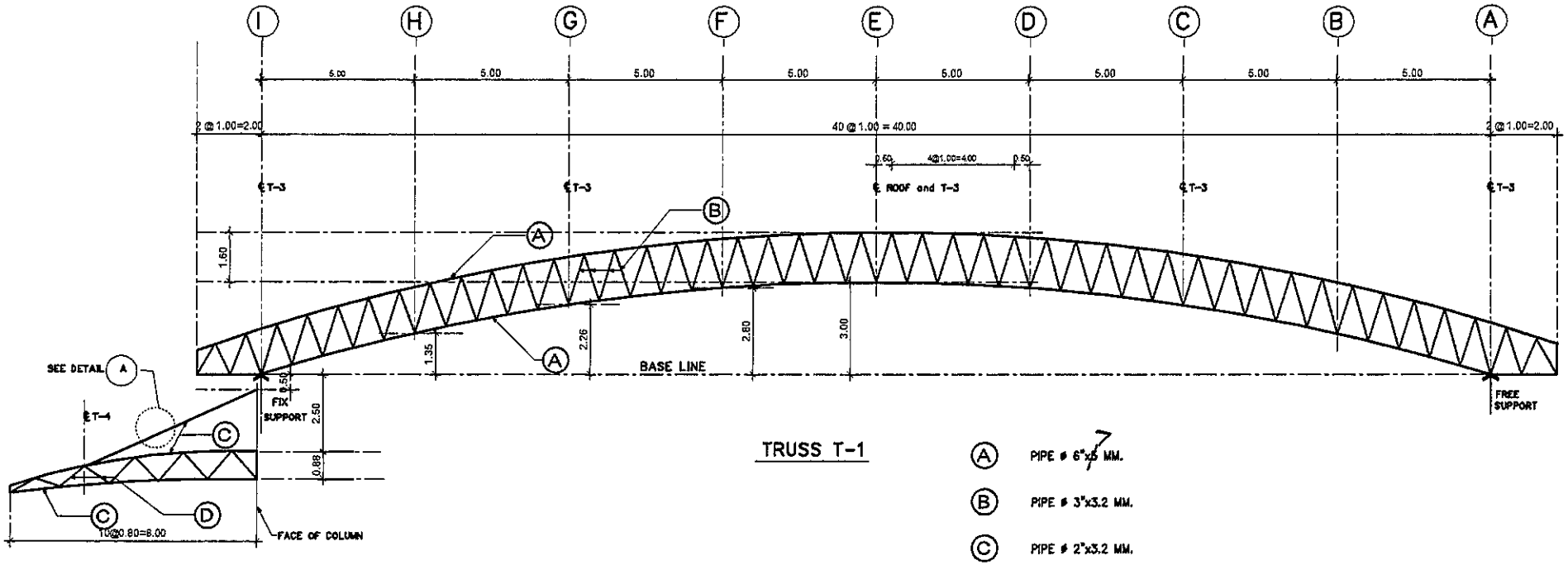
From Table, Fa = 1,170 Ksc $>$ Max C O.K.



TRUSS T-2

TRUSS T-1

(A)	PIPE ø 6"x5 MM.	A = 34.49	γ = 27.3 Kg/M
(B)	PIPE ø 3"x3.2 MM.	A = 7.35	γ = 5.77 "
(C)	PIPE ø 2"x3.2 MM.	A = 4.564	γ = 3.58 "
(D)	PIPE ø 1 1/2"x2.3 MM.		
(E)	PIPE ø 1"x2.3 MM.		



TRUSS T-2

TRUSS T-1

Ⓐ PIPE ø 6"x5 MM.

Ⓑ PIPE ø 3"x3.2 MM.

Ⓒ PIPE ø 2"x3.2 MM.

Ⓓ PIPE ø 1 1/2"x2.3 MM.

Ⓔ PIPE ø 1"x2.3 MM.

```
==========================================================================
     MICROFEAP-P1          DATE: 03-20-2003            <DATA> P.1
PROJECT  : UDC Storage                                   FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL                        ENGINEER: PB
==========================================================================


      ***********************************
      *                                 *
      * STRUCTURE DATA *
      *                                 *
      ***********************************
```

COORDINATE DATA (cm)			**BOUNDARY DATA**	
NODE	1-COOR	2-COOR	1-B	2-B
1	0.00	0.00	L	L
2	50.00	165.00		
3	100.00	15.00		
4	150.00	180.53		
5	200.00	30.00		
6	250.00	196.05		
7	300.00	45.00		
8	350.00	211.58		
9	400.00	60.00		
10	450.00	227.11		
11	500.00	75.00		
12	550.00	242.63		
13	600.00	90.00		
14	650.00	258.16		
15	700.00	105.00		
16	750.00	273.68		
17	800.00	120.00		
18	850.00	289.21		
19	900.00	135.00		
20	950.00	304.74		
21	1000.00	150.00		
22	1050.00	320.26		
23	1100.00	165.00		
24	1150.00	335.79		
25	1200.00	180.00		
26	1250.00	351.32		
27	1300.00	195.00		
28	1350.00	366.84		
29	1400.00	210.00		
30	1450.00	382.37		
31	1500.00	225.00		
32	1550.00	397.89		

MICROFEAP-P1 DATE: 03-20-2003 <DATA> P.2
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

NODE	**COORDINATE DATA (cm)** 1-COOR	2-COOR	**BOUNDARY DATA** 1-B	2-B
33	1600.00	240.00		
34	1650.00	413.42		
35	1700.00	255.00		
36	1750.00	428.95		
37	1800.00	270.00		
38	1850.00	444.47		
39	1900.00	285.00		
40	1950.00	460.00		
41	2000.00	300.00		
42	2050.00	460.00		
43	2100.00	285.00		
44	2150.00	444.47		
45	2200.00	270.00		
46	2250.00	428.95		
47	2300.00	255.00		
48	2350.00	413.42		
49	2400.00	240.00		
50	2450.00	397.89		
51	2500.00	225.00		
52	2550.00	382.37		
53	2600.00	210.00		
54	2650.00	366.84		
55	2700.00	195.00		
56	2750.00	351.32		
57	2800.00	180.00		
58	2850.00	335.79		
59	2900.00	165.00		
60	2950.00	320.26		
61	3000.00	150.00		
62	3050.00	304.74		
63	3100.00	135.00		
64	3150.00	289.21		
65	3200.00	120.00		
66	3250.00	273.68		
67	3300.00	105.00		
68	3350.00	258.16		
69	3400.00	90.00		
70	3450.00	242.63		
71	3500.00	75.00		
72	3550.00	227.11		
73	3600.00	60.00		
74	3650.00	211.58		

MICROFEAP-P1 DATE: 03-20-2003 <DATA> P.3
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

COORDINATE DATA (cm) **BOUNDARY DATA**

NODE	1-COOR	2-COOR	1-B	2-B
75	3700.00	45.00		
76	3750.00	196.05		
77	3800.00	30.00		
78	3850.00	180.53		
79	3900.00	15.00		
80	3950.00	165.00		
81	4000.00	0.00	F	L

ELEMENT DATA

ELEM	1-NODE	2-NODE	HINGE	MATERIAL
1	1	3		1
2	3	5		1
3	5	7		1
4	7	9		1
5	9	11		1
6	11	13		1
7	13	15		1
8	15	17		1
9	17	19		1
10	19	21		1
11	21	23		1
12	23	25		1
13	25	27		1
14	27	29		1
15	29	31		1
16	31	33		1
17	33	35		1
18	35	37		1
19	37	39		1
20	39	41		1
21	41	43		1
22	43	45		1
23	45	47		1
24	47	49		1
25	49	51		1
26	51	53		1
27	53	55		1
28	55	57		1
29	57	59		1
30	59	61		1

MICROFEAP-P1 DATE: 03-20-2003 <DATA> P.4
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

ELEMENT DATA

ELEM	1-NODE	2-NODE	HINGE	MATERIAL
31	61	63		1
32	63	65		1
33	65	67		1
34	67	69		1
35	69	71		1
36	71	73		1
37	73	75		1
38	75	77		1
39	77	79		1
40	79	81		1
41	2	4		1
42	4	6		1
43	6	8		1
44	8	10		1
45	10	12		1
46	12	14		1
47	14	16		1
48	16	18		1
49	18	20		1
50	20	22		1
51	22	24		1
52	24	26		1
53	26	28		1
54	28	30		1
55	30	32		1
56	32	34		1
57	34	36		1
58	36	38		1
59	38	40		1
60	40	42		1
61	42	44		1
62	44	46		1
63	46	48		1
64	48	50		1
65	50	52		1
66	52	54		1
67	54	56		1
68	56	58		1
69	58	60		1
70	60	62		1
71	62	64		1
72	64	66		1

MICROFEAP-P1 DATE: 03-20-2003 <DATA> P.5
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

ELEMENT DATA

ELEM	1-NODE	2-NODE	HINGE	MATERIAL
73	66	68		1
74	68	70		1
75	70	72		1
76	72	74		1
77	74	76		1
78	76	78		1
79	78	80		1
80	1	2		2
81	2	3		2
82	3	4		2
83	4	5		2
84	5	6		2
85	6	7		2
86	7	8		2
87	8	9		2
88	9	10		2
89	10	11		2
90	11	12		2
91	12	13		2
92	13	14		2
93	14	15		2
94	15	16		2
95	16	17		2
96	17	18		2
97	18	19		2
98	19	20		2
99	20	21		2
100	21	22		2
101	22	23		2
102	23	24		2
103	24	25		2
104	25	26		2
105	26	27		2
106	27	28		2
107	28	29		2
108	29	30		2
109	30	31		2
110	31	32		2
111	32	33		2
112	33	34		2
113	34	35		2
114	35	36		2

MICROFEAP-P1 DATE: 03-20-2003 <DATA> P.6
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

ELEMENT DATA

ELEM	1-NODE	2-NODE	HINGE	MATERIAL
115	36	37		2
116	37	38		2
117	38	39		2
118	39	40		2
119	40	41		2
120	41	42		2
121	42	43		2
122	43	44		2
123	44	45		2
124	45	46		2
125	46	47		2
126	47	48		2
127	48	49		2
128	49	50		2
129	50	51		2
130	51	52		2
131	52	53		2
132	53	54		2
133	54	55		2
134	55	56		2
135	56	57		2
136	57	58		2
137	58	59		2
138	59	60		2
139	60	61		2
140	61	62		2
141	62	63		2
142	63	64		2
143	64	65		2
144	65	66		2
145	66	67		2
146	67	68		2
147	68	69		2
148	69	70		2
149	70	71		2
150	71	72		2
151	72	73		2
152	73	74		2
153	74	75		2
154	75	76		2
155	76	77		2
156	77	78		2

```
================================================================================
     MICROFEAP-P1          DATE: 03-20-2003            <DATA> P.7
PROJECT  : UDC Storage                                    FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL                        ENGINEER: PB
================================================================================
**ELEMENT DATA**
ELEM    1-NODE    2-NODE     HINGE  MATERIAL
-----------------------------------------
 157        78        79                 2
 158        79        80                 2
 159        80        81                 2


**MATERIAL DATA**
MATE  E-MODULUS AXIAL-AREA
      (kg/cm^2)     (cm^2)
---------------------------
   1  2.100D+06  3.479D+01
   2  2.100D+06  7.350D+00

LOAD CASE #1 :
**NODAL FORCE DATA**
NODE      1-FORC      2-FORC
            (kg)        (kg)
-----------------------------
   2   0.000D+00  -2.500D+02
   4   0.000D+00  -2.500D+02
   6   0.000D+00  -2.500D+02
   8   0.000D+00  -2.500D+02
  10   0.000D+00  -2.500D+02
  12   0.000D+00  -2.500D+02
  14   0.000D+00  -2.500D+02
  16   0.000D+00  -2.500D+02
  18   0.000D+00  -2.500D+02
  20   0.000D+00  -2.500D+02
  22   0.000D+00  -2.500D+02
  24   0.000D+00  -2.500D+02
  26   0.000D+00  -2.500D+02
  28   0.000D+00  -2.500D+02
  30   0.000D+00  -2.500D+02
  32   0.000D+00  -2.500D+02
  34   0.000D+00  -2.500D+02
  36   0.000D+00  -2.500D+02
  38   0.000D+00  -2.500D+02
  40   0.000D+00  -2.500D+02
  42   0.000D+00  -2.500D+02
  44   0.000D+00  -2.500D+02
  46   0.000D+00  -2.500D+02
  48   0.000D+00  -2.500D+02
```

```
================================================================================
     MICROFEAP-P1          DATE: 03-20-2003            <DATA> P.8
PROJECT  : UDC Storage                                    FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL                        ENGINEER: PB
================================================================================
LOAD CASE #1 :
**NODAL FORCE DATA**
NODE       1-FORC       2-FORC
             (kg)         (kg)
------------------------------
  50    0.000D+00   -2.500D+02
  52    0.000D+00   -2.500D+02
  54    0.000D+00   -2.500D+02
  56    0.000D+00   -2.500D+02
  58    0.000D+00   -2.500D+02
  60    0.000D+00   -2.500D+02
  62    0.000D+00   -2.500D+02
  64    0.000D+00   -2.500D+02
  66    0.000D+00   -2.500D+02
  68    0.000D+00   -2.500D+02
  70    0.000D+00   -2.500D+02
  72    0.000D+00   -2.500D+02
  74    0.000D+00   -2.500D+02
  76    0.000D+00   -2.500D+02
  78    0.000D+00   -2.500D+02
  80    0.000D+00   -2.500D+02
```

```
==========================================================================
     MICROFEAP-P1          DATE: 03-20-2003            <COMB> P.1
PROJECT  : UDC Storage                                  FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL                        ENGINEER: PB
==========================================================================


      ****************************
      *                          *
      * COMBINATION *
      *                          *
      ****************************


DISPLACEMENT COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1
NODE        1-DISP        2-DISP
              (cm)          (cm)
------------------------------
   1   0.0000D+00   0.0000D+00
   2   1.1761D+00  -4.2026D-01
   3   1.2551D-01  -8.2176D-01
   4   1.2984D+00  -1.2367D+00
   5   2.5358D-01  -1.6323D+00
   6   1.4145D+00  -2.0392D+00
   7   3.8319D-01  -2.4264D+00
   8   1.5238D+00  -2.8229D+00
   9   5.1334D-01  -3.1992D+00
  10   1.6258D+00  -3.5829D+00
  11   6.4312D-01  -3.9462D+00
  12   1.7200D+00  -4.3149D+00
  13   7.7165D-01  -4.6631D+00
  14   1.8062D+00  -5.0149D+00
  15   8.9811D-01  -5.3461D+00
  16   1.8839D+00  -5.6793D+00
  17   1.0217D+00  -5.9917D+00
  18   1.9528D+00  -6.3045D+00
  19   1.1418D+00  -6.5967D+00
  20   2.0128D+00  -6.8876D+00
  21   1.2576D+00  -7.1580D+00
  22   2.0636D+00  -7.4258D+00
  23   1.3686D+00  -7.6732D+00
  24   2.1051D+00  -7.9166D+00
  25   1.4741D+00  -8.1400D+00
  26   2.1372D+00  -8.3580D+00
  27   1.5737D+00  -8.5562D+00
  28   2.1599D+00  -8.7479D+00
  29   1.6669D+00  -8.9203D+00
  30   2.1730D+00  -9.0849D+00
```

MICROFEAP-P1 DATE: 03-20-2003 <COMB> P.2
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

DISPLACEMENT COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

NODE	1-DISP (cm)	2-DISP (cm)	
31	1.7531D+00	-9.2307D+00	
32	2.1766D+00	-9.3677D+00	
33	1.8321D+00	-9.4863D+00	
34	2.1708D+00	-9.5952D+00	
35	1.9035D+00	-9.6863D+00	
36	2.1557D+00	-9.7667D+00	
37	1.9669D+00	-9.8300D+00	
38	2.1315D+00	-9.8818D+00	
39	2.0221D+00	-9.9171D+00	
40	2.0982D+00	-9.9401D+00	
41	2.0768D+00	-1.0000D+01	← Δmax
42	2.0554D+00	-9.9401D+00	
43	2.1315D+00	-9.9171D+00	
44	2.0222D+00	-9.8818D+00	
45	2.1868D+00	-9.8300D+00	
46	1.9979D+00	-9.7667D+00	
47	2.2502D+00	-9.6863D+00	
48	1.9828D+00	-9.5952D+00	
49	2.3216D+00	-9.4863D+00	
50	1.9771D+00	-9.3677D+00	
51	2.4005D+00	-9.2307D+00	
52	1.9807D+00	-9.0849D+00	
53	2.4868D+00	-8.9203D+00	
54	1.9938D+00	-8.7479D+00	
55	2.5800D+00	-8.5562D+00	
56	2.0164D+00	-8.3580D+00	
57	2.6795D+00	-8.1400D+00	
58	2.0485D+00	-7.9166D+00	
59	2.7851D+00	-7.6732D+00	
60	2.0900D+00	-7.4258D+00	
61	2.8961D+00	-7.1580D+00	
62	2.1409D+00	-6.8876D+00	
63	3.0119D+00	-6.5967D+00	
64	2.2009D+00	-6.3045D+00	
65	3.1319D+00	-5.9917D+00	
66	2.2698D+00	-5.6793D+00	
67	3.2556D+00	-5.3461D+00	
68	2.3475D+00	-5.0149D+00	
69	3.3820D+00	-4.6631D+00	
70	2.4336D+00	-4.3149D+00	

MICROFEAP-P1 DATE: 03-20-2003 <COMB> P.3
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

DISPLACEMENT COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

NODE	1-DISP (cm)	2-DISP (cm)
71	3.5106D+00	-3.9462D+00
72	2.5279D+00	-3.5829D+00
73	3.6403D+00	-3.1992D+00
74	2.6299D+00	-2.8229D+00
75	3.7705D+00	-2.4264D+00
76	2.7391D+00	-2.0392D+00
77	3.9001D+00	-1.6323D+00
78	2.8552D+00	-1.2367D+00
79	4.0282D+00	-8.2176D-01
80	2.9776D+00	-4.2026D-01
81	4.1537D+00	0.0000D+00

MICROFEAP-P1 DATE: 03-20-2003 <COMB> P.1
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

```
*****************************
*                           *
* COMBINATION *
*                           *
*****************************
```

STRESS COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

ELEM	MA	LENGTH (cm)	1-FORCE (kg)	2-FORCE (kg)	1-STRESS (kg/cm^2)	2-STRESS (kg/cm^2)
1	1	101.12	1.6051D+03	1.6051D+03	4.6136D+01	4.6136D+01
2	1	101.12	4.6391D+03	4.6391D+03	1.3335D+02	1.3335D+02
3	1	101.12	7.4937D+03	7.4937D+03	2.1540D+02	2.1540D+02
4	1	101.12	1.0170D+04	1.0170D+04	2.9234D+02	2.9234D+02
5	1	101.12	1.2671D+04	1.2671D+04	3.6422D+02	3.6422D+02
6	1	101.12	1.4998D+04	1.4998D+04	4.3109D+02	4.3109D+02
7	1	101.12	1.7151D+04	1.7151D+04	4.9299D+02	4.9299D+02

8	1	101.12	1.9134D+04	1.9134D+04	5.4999D+02	5.4999D+02
9	1	101.12	2.0948D+04	2.0948D+04	6.0212D+02	6.0212D+02
10	1	101.12	2.2594D+04	2.2594D+04	6.4943D+02	6.4943D+02
11	1	101.12	2.4074D+04	2.4074D+04	6.9198D+02	6.9198D+02
12	1	101.12	2.5390D+04	2.5390D+04	7.2980D+02	7.2980D+02
13	1	101.12	2.6543D+04	2.6543D+04	7.6294D+02	7.6294D+02
14	1	101.12	2.7534D+04	2.7534D+04	7.9145D+02	7.9145D+02
15	1	101.12	2.8366D+04	2.8366D+04	8.1536D+02	8.1536D+02
16	1	101.12	2.9040D+04	2.9040D+04	8.3473D+02	8.3473D+02
17	1	101.12	2.9558D+04	2.9558D+04	8.4961D+02	8.4961D+02
18	1	101.12	2.9920D+04	2.9920D+04	8.6001D+02	8.6001D+02
19	1	101.12	3.0128D+04	3.0128D+04	8.6601D+02	8.6601D+02
20	1	101.12	3.0185D+04	3.0185D+04	8.6763D+02	8.6763D+02
21	1	101.12	3.0185D+04	3.0185D+04	8.6763D+02	8.6763D+02
22	1	101.12	3.0129D+04	3.0129D+04	8.6601D+02	8.6601D+02
23	1	101.12	2.9920D+04	2.9920D+04	8.6001D+02	8.6001D+02
24	1	101.12	2.9558D+04	2.9558D+04	8.4961D+02	8.4961D+02
25	1	101.12	2.9040D+04	2.9040D+04	8.3473D+02	8.3473D+02
26	1	101.12	2.8366D+04	2.8366D+04	8.1536D+02	8.1536D+02
27	1	101.12	2.7535D+04	2.7535D+04	7.9145D+02	7.9145D+02
28	1	101.12	2.6543D+04	2.6543D+04	7.6293D+02	7.6293D+02
29	1	101.12	2.5390D+04	2.5390D+04	7.2980D+02	7.2980D+02
30	1	101.12	2.4074D+04	2.4074D+04	6.9198D+02	6.9198D+02

STRESS COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

ELEM	MA	LENGTH (cm)	1-FORCE (kg)	2-FORCE (kg)	1-STRESS (kg/cm^2)	2-STRESS (kg/cm^2)
31	1	101.12	2.2594D+04	2.2594D+04	6.4943D+02	6.4943D+02
32	1	101.12	2.0948D+04	2.0948D+04	6.0212D+02	6.0212D+02
33	1	101.12	1.9134D+04	1.9134D+04	5.4999D+02	5.4999D+02
34	1	101.12	1.7151D+04	1.7151D+04	4.9299D+02	4.9299D+02
35	1	101.12	1.4997D+04	1.4997D+04	4.3109D+02	4.3109D+02
36	1	101.12	1.2671D+04	1.2671D+04	3.6422D+02	3.6422D+02
37	1	101.12	1.0170D+04	1.0170D+04	2.9234D+02	2.9234D+02
38	1	101.12	7.4937D+03	7.4937D+03	2.1540D+02	2.1540D+02
39	1	101.12	4.6391D+03	4.6391D+03	1.3335D+02	1.3335D+02
40	1	101.12	1.6050D+03	1.6050D+03	4.6134D+01	4.6134D+01
41	1	101.20	-3.1271D+03	-3.1271D+03	-8.9886D+01	-8.9886D+01
42	1	101.20	-6.0736D+03	-6.0736D+03	-1.7458D+02	-1.7458D+02
43	1	101.20	-8.8412D+03	-8.8412D+03	-2.5413D+02	-2.5413D+02
44	1	101.20	-1.1432D+04	-1.1432D+04	-3.2859D+02	-3.2859D+02
45	1	101.20	-1.3847D+04	-1.3847D+04	-3.9802D+02	-3.9802D+02
46	1	101.20	-1.6089D+04	-1.6089D+04	-4.6245D+02	-4.6245D+02
47	1	101.20	-1.8159D+04	-1.8159D+04	-5.2195D+02	-5.2195D+02

48	1	101.20	-2.0058D+04	-2.0058D+04	-5.7655D+02	-5.7655D+02
49	1	101.20	-2.1789D+04	-2.1789D+04	-6.2631D+02	-6.2631D+02
50	1	101.20	-2.3354D+04	-2.3354D+04	-6.7127D+02	-6.7127D+02
51	1	101.20	-2.4752D+04	-2.4752D+04	-7.1147D+02	-7.1147D+02
52	1	101.20	-2.5987D+04	-2.5987D+04	-7.4698D+02	-7.4698D+02
53	1	101.20	-2.7061D+04	-2.7061D+04	-7.7783D+02	-7.7783D+02
54	1	101.20	-2.7973D+04	-2.7973D+04	-8.0406D+02	-8.0406D+02
55	1	101.20	-2.8727D+04	-2.8727D+04	-8.2571D+02	-8.2571D+02
56	1	101.20	-2.9322D+04	-2.9322D+04	-8.4284D+02	-8.4284D+02
57	1	101.20	-2.9763D+04	-2.9763D+04	-8.5549D+02	-8.5549D+02
58	1	101.20	-3.0048D+04	-3.0048D+04	-8.6369D+02	-8.6369D+02
59	1	101.20	-3.0180D+04	-3.0180D+04	-8.6750D+02	-8.6750D+02
60	1	100.00	-3.1250D+04	-3.1250D+04	-8.9825D+02	-8.9825D+02
61	1	101.20	-3.0180D+04	-3.0180D+04	-8.6750D+02	-8.6750D+02
62	1	101.20	-3.0048D+04	-3.0048D+04	-8.6369D+02	-8.6369D+02
63	1	101.20	-2.9762D+04	-2.9762D+04	-8.5549D+02	-8.5549D+02
64	1	101.20	-2.9323D+04	-2.9323D+04	-8.4285D+02	-8.4285D+02
65	1	101.20	-2.8727D+04	-2.8727D+04	-8.2571D+02	-8.2571D+02
66	1	101.20	-2.7973D+04	-2.7973D+04	-8.0405D+02	-8.0405D+02
67	1	101.20	-2.7061D+04	-2.7061D+04	-7.7783D+02	-7.7783D+02
68	1	101.20	-2.5987D+04	-2.5987D+04	-7.4698D+02	-7.4698D+02
69	1	101.20	-2.4752D+04	-2.4752D+04	-7.1148D+02	-7.1148D+02
70	1	101.20	-2.3353D+04	-2.3353D+04	-6.7127D+02	-6.7127D+02

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MaxC

MICROFEAP-P1 DATE: 03-20-2003 <COMB> P.3
PROJECT : UDC Storage FILENAME: T40
AUTHORITY: SUTHAS HAISIRIKUL ENGINEER: PB

STRESS COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

ELEM	MA	LENGTH (cm)	1-FORCE (kg)	2-FORCE (kg)	1-STRESS (kg/cm^2)	2-STRESS (kg/cm^2)
71	1	101.20	-2.1789D+04	-2.1789D+04	-6.2631D+02	-6.2631D+02
72	1	101.20	-2.0058D+04	-2.0058D+04	-5.7655D+02	-5.7655D+02
73	1	101.20	-1.8158D+04	-1.8158D+04	-5.2194D+02	-5.2194D+02
74	1	101.20	-1.6089D+04	-1.6089D+04	-4.6246D+02	-4.6246D+02
75	1	101.20	-1.3847D+04	-1.3847D+04	-3.9802D+02	-3.9802D+02
76	1	101.20	-1.1432D+04	-1.1432D+04	-3.2859D+02	-3.2859D+02
77	1	101.20	-8.8412D+03	-8.8412D+03	-2.5413D+02	-2.5413D+02
78	1	101.20	-6.0736D+03	-6.0736D+03	-1.7458D+02	-1.7458D+02
79	1	101.20	-3.1270D+03	-3.1270D+03	-8.9883D+01	-8.9883D+01
80	2	172.41	-5.4733D+03	-5.4733D+03	-7.4467D+02	-7.4467D+02
81	2	158.11	4.7522D+03	4.7522D+03	6.4656D+02	6.4656D+02
82	2	172.91	-5.1797D+03	-5.1797D+03	-7.0472D+02	-7.0472D+02
83	2	158.61	4.4850D+03	4.4850D+03	6.1021D+02	6.1021D+02
84	2	173.42	-4.8873D+03	-4.8873D+03	-6.6494D+02	-6.6494D+02
85	2	159.11	4.2189D+03	4.2189D+03	5.7400D+02	5.7400D+02
86	2	173.92	-4.5962D+03	-4.5962D+03	-6.2534D+02	-6.2534D+02
87	2	159.61	3.9538D+03	3.9538D+03	5.3793D+02	5.3793D+02

88	2	174.43	-4.3064D+03	-4.3064D+03	-5.8591D+02	-5.8591D+02
89	2	160.11	3.6897D+03	3.6897D+03	5.0200D+02	5.0200D+02
90	2	174.93	-4.0179D+03	-4.0179D+03	-5.4665D+02	-5.4665D+02
91	2	160.61	3.4266D+03	3.4266D+03	4.6620D+02	4.6620D+02
92	2	175.43	-3.7305D+03	-3.7305D+03	-5.0756D+02	-5.0756D+02
93	2	161.11	3.1645D+03	3.1645D+03	4.3055D+02	4.3055D+02
94	2	175.94	-3.4444D+03	-3.4444D+03	-4.6863D+02	-4.6863D+02
95	2	161.61	2.9034D+03	2.9034D+03	3.9502D+02	3.9502D+02
96	2	176.44	-3.1595D+03	-3.1595D+03	-4.2986D+02	-4.2986D+02
97	2	162.11	2.6432D+03	2.6432D+03	3.5962D+02	3.5962D+02
98	2	176.95	-2.8758D+03	-2.8758D+03	-3.9126D+02	-3.9126D+02
99	2	162.61	2.3841D+03	2.3841D+03	3.2436D+02	3.2436D+02
100	2	177.45	-2.5932D+03	-2.5932D+03	-3.5282D+02	-3.5282D+02
101	2	163.12	2.1258D+03	2.1258D+03	2.8923D+02	2.8923D+02
102	2	177.96	-2.3118D+03	-2.3118D+03	-3.1453D+02	-3.1453D+02
103	2	163.62	1.8686D+03	1.8686D+03	2.5423D+02	2.5423D+02
104	2	178.46	-2.0316D+03	-2.0316D+03	-2.7641D+02	-2.7641D+02
105	2	164.12	1.6122D+03	1.6122D+03	2.1935D+02	2.1935D+02
106	2	178.97	-1.7525D+03	-1.7525D+03	-2.3844D+02	-2.3844D+02
107	2	164.62	1.3567D+03	1.3567D+03	1.8459D+02	1.8459D+02
108	2	179.47	-1.4746D+03	-1.4746D+03	-2.0062D+02	-2.0062D+02
109	2	165.12	1.1022D+03	1.1022D+03	1.4996D+02	1.4996D+02
110	2	179.98	-1.1977D+03	-1.1977D+03	-1.6295D+02	-1.6295D+02

STRESS COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

ELEM	MA	LENGTH (cm)	1-FORCE (kg)	2-FORCE (kg)	1-STRESS (kg/cm^2)	2-STRESS (kg/cm^2)
111	2	165.62	8.4872D+02	8.4872D+02	1.1547D+02	1.1547D+02
112	2	180.49	-9.2187D+02	-9.2187D+02	-1.2542D+02	-1.2542D+02
113	2	166.12	5.9588D+02	5.9588D+02	8.1072D+01	8.1072D+01
114	2	180.99	-6.4725D+02	-6.4725D+02	-8.8062D+01	-8.8062D+01
115	2	166.63	3.4413D+02	3.4413D+02	4.6821D+01	4.6821D+01
116	2	181.50	-3.7358D+02	-3.7358D+02	-5.0827D+01	-5.0827D+01
117	2	167.13	9.3172D+01	9.3172D+01	1.2676D+01	1.2676D+01
118	2	182.00	-1.0106D+02	-1.0106D+02	-1.3750D+01	-1.3750D+01
119	2	167.63	4.6911D+03	4.6911D+03	6.3825D+02	6.3825D+02
120	2	167.63	4.6911D+03	4.6911D+03	6.3825D+02	6.3825D+02
121	2	182.00	-1.0106D+02	-1.0106D+02	-1.3750D+01	-1.3750D+01
122	2	167.13	9.3172D+01	9.3172D+01	1.2676D+01	1.2676D+01
123	2	181.50	-3.7357D+02	-3.7357D+02	-5.0826D+01	-5.0826D+01
124	2	166.63	3.4413D+02	3.4413D+02	4.6820D+01	4.6820D+01
125	2	180.99	-6.4725D+02	-6.4725D+02	-8.8061D+01	-8.8061D+01
126	2	166.12	5.9588D+02	5.9588D+02	8.1072D+01	8.1072D+01
127	2	180.49	-9.2187D+02	-9.2187D+02	-1.2542D+02	-1.2542D+02

128	2	165.62	8.4872D+02	8.4872D+02	1.1547D+02	1.1547D+02
129	2	179.98	-1.1977D+03	-1.1977D+03	-1.6295D+02	-1.6295D+02
130	2	165.12	1.1022D+03	1.1022D+03	1.4996D+02	1.4996D+02
131	2	179.47	-1.4746D+03	-1.4746D+03	-2.0062D+02	-2.0062D+02
132	2	164.62	1.3568D+03	1.3568D+03	1.8459D+02	1.8459D+02
133	2	178.97	-1.7525D+03	-1.7525D+03	-2.3844D+02	-2.3844D+02
134	2	164.12	1.6122D+03	1.6122D+03	2.1935D+02	2.1935D+02
135	2	178.46	-2.0316D+03	-2.0316D+03	-2.7641D+02	-2.7641D+02
136	2	163.62	1.8686D+03	1.8686D+03	2.5423D+02	2.5423D+02
137	2	177.96	-2.3118D+03	-2.3118D+03	-3.1453D+02	-3.1453D+02
138	2	163.12	2.1258D+03	2.1258D+03	2.8923D+02	2.8923D+02
139	2	177.45	-2.5932D+03	-2.5932D+03	-3.5282D+02	-3.5282D+02
140	2	162.61	2.3841D+03	2.3841D+03	3.2436D+02	3.2436D+02
141	2	176.95	-2.8758D+03	-2.8758D+03	-3.9126D+02	-3.9126D+02
142	2	162.11	2.6432D+03	2.6432D+03	3.5962D+02	3.5962D+02
143	2	176.44	-3.1595D+03	-3.1595D+03	-4.2986D+02	-4.2986D+02
144	2	161.61	2.9034D+03	2.9034D+03	3.9502D+02	3.9502D+02
145	2	175.94	-3.4444D+03	-3.4444D+03	-4.6862D+02	-4.6862D+02
146	2	161.11	3.1645D+03	3.1645D+03	4.3055D+02	4.3055D+02
147	2	175.43	-3.7305D+03	-3.7305D+03	-5.0756D+02	-5.0756D+02
148	2	160.61	3.4266D+03	3.4266D+03	4.6620D+02	4.6620D+02
149	2	174.93	-4.0179D+03	-4.0179D+03	-5.4665D+02	-5.4665D+02
150	2	160.11	3.6897D+03	3.6897D+03	5.0200D+02	5.0200D+02

STRESS COMBINATION <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

ELEM	MA	LENGTH (cm)	1-FORCE (kg)	2-FORCE (kg)	1-STRESS (kg/cm^2)	2-STRESS (kg/cm^2)
151	2	174.43	-4.3064D+03	-4.3064D+03	-5.8591D+02	-5.8591D+02
152	2	159.61	3.9538D+03	3.9538D+03	5.3793D+02	5.3793D+02
153	2	173.92	-4.5962D+03	-4.5962D+03	-6.2534D+02	-6.2534D+02
154	2	159.11	4.2189D+03	4.2189D+03	5.7400D+02	5.7400D+02
155	2	173.42	-4.8873D+03	-4.8873D+03	-6.6494D+02	-6.6494D+02
156	2	158.61	4.4850D+03	4.4850D+03	6.1021D+02	6.1021D+02
157	2	172.91	-5.1797D+03	-5.1797D+03	-7.0472D+02	-7.0472D+02
158	2	158.11	4.7522D+03	4.7522D+03	6.4656D+02	6.4656D+02
159	2	172.41	-5.4733D+03	-5.4733D+03	-7.4467D+02	-7.4467D+02

SUPPORT REACTIONS <2D-TRUSS SYSTEM>
LOAD FACTOR : 1

NODE	1-REACTION (kg)	2-REACTION (kg)
1	3.6814D-03	5.0000D+03

```
  81    0.0000D+00    5.0000D+03

 SUPPORT REACTIONS <2D-TRUSS SYSTEM>
 LOAD FACTOR : 1
 NODE    1-REACTION    2-REACTION
               (kg)          (kg)
 ------------------------------
    1    3.6814D-03    5.0000D+03
   81    0.0000D+00    5.0000D+03


 SUPPORT REACTIONS <2D-TRUSS SYSTEM>
 LOAD FACTOR : 1
 NODE    1-REACTION    2-REACTION
               (kg)          (kg)
 ------------------------------
    1    3.6814D-03    5.0000D+03
   81    0.0000D+00    5.0000D+03


 SUPPORT REACTIONS <2D-TRUSS SYSTEM>
 LOAD FACTOR : 1
 NODE    1-REACTION    2-REACTION
               (kg)          (kg)
 ------------------------------
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 SUPPORT REACTIONS <2D-TRUSS SYSTEM>
 LOAD FACTOR : 1
 NODE    1-REACTION    2-REACTION
               (kg)          (kg)
 ------------------------------
    1    3.6814D-03    5.0000D+03
   81    0.0000D+00    5.0000D+03


 SUPPORT REACTIONS <2D-TRUSS SYSTEM>
 LOAD FACTOR : 1
 NODE    1-REACTION    2-REACTION
               (kg)          (kg)
 ------------------------------
    1    3.6814D-03    5.0000D+03
   81    0.0000D+00    5.0000D+03
```