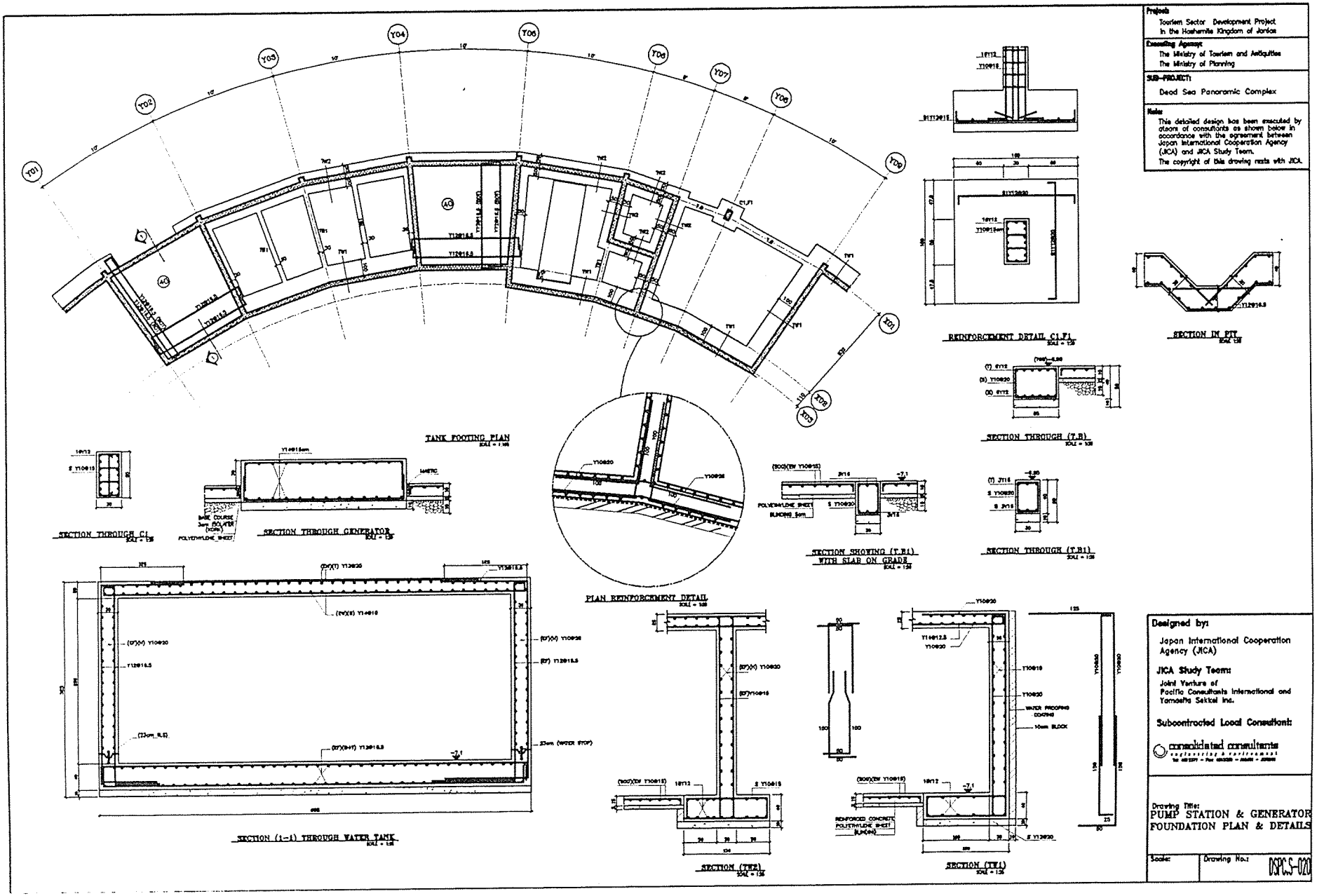
Structural Calculations

OF

GENERATOR AND WATER TANK

هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٢٠٧٤٦ عمان - الأردن



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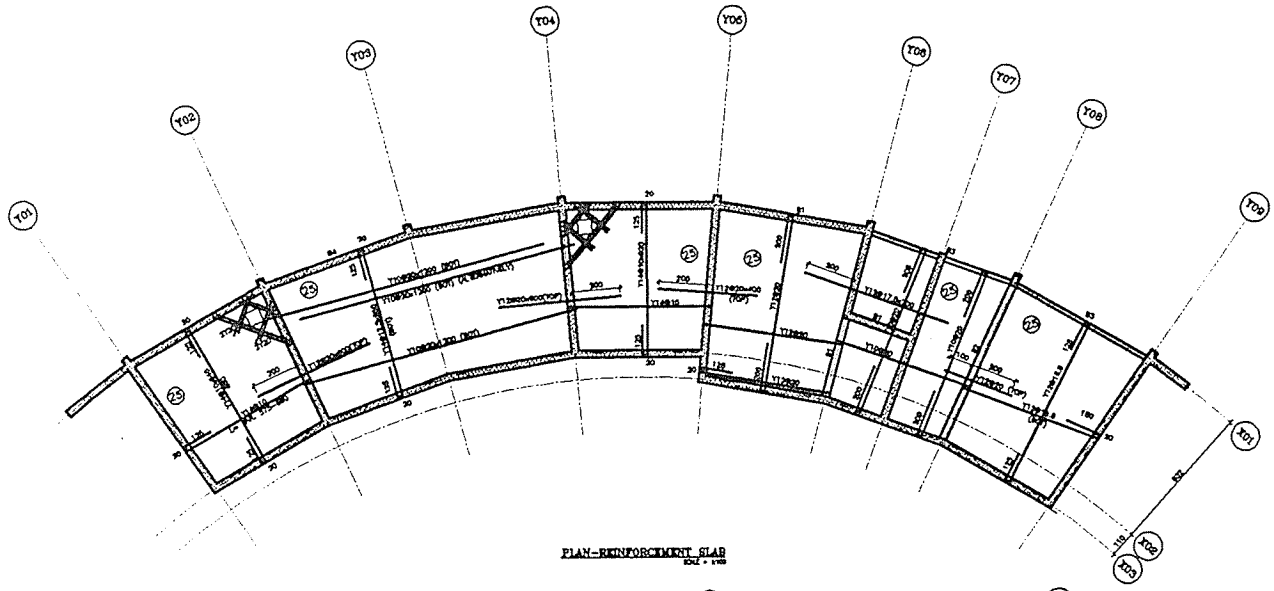
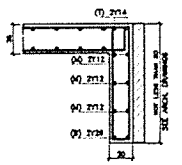
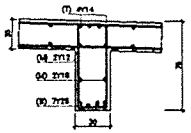


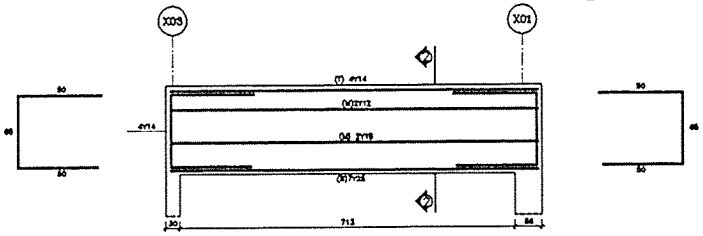
PLAN-REINFORCEMENT SLAB



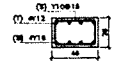
SECTION THROUGH R1



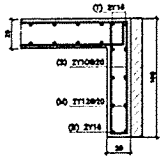
SECTION (2-2) THROUGH R2



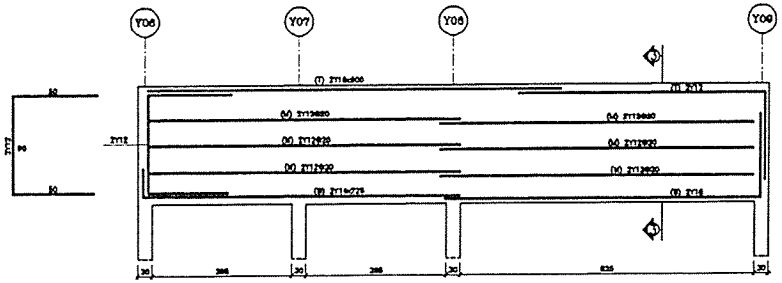
LONGITUDINAL SECTION THROUGH R2



SECTION THROUGH R4



SECTION (3-3) THROUGH R3



LONGITUDINAL SECTION THROUGH R3

Project:
Tourism Sector Development Project
in the Hashemite Kingdom of Jordan

Executing Agency:
The Ministry of Tourism and Antiquities
The Ministry of Planning

SUB-PROJECT:
Dead Sea Panoramic Complex

Note:
This detailed design has been executed by staffs of consultants as shown below in accordance with the agreement between Japan International Cooperation Agency (JICA) and JICA Study Team.

Designed by:
Japan International Cooperation Agency (JICA)

JICA Study Team:
Joint Venture of
Pacific Consultants International and Yamashita Sekkei Inc.

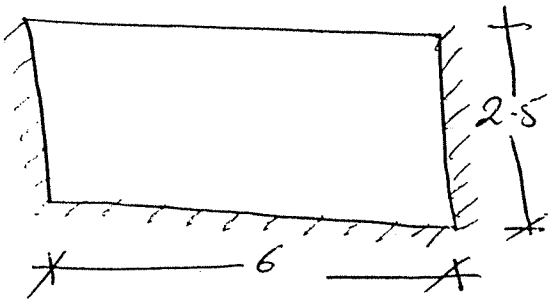
Subcontracted Local Consultant:
consolidated consultants
engineering & environment

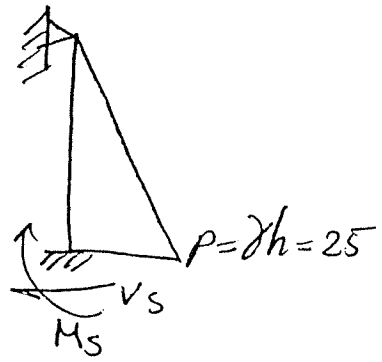
Drawing Title:
PUMP STATION & GENERATOR
REINFORCEMENT OF SLAB PLAN & DETAILS

Scale:

Drawing No.: DSPC-S-021

Design of water Tank:-





$l_A/l_b = 6/2.5 = 2.4 > 2$ one way

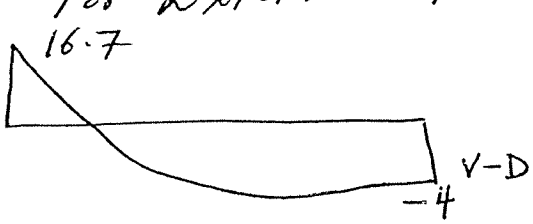
$V_s = 25$ KN

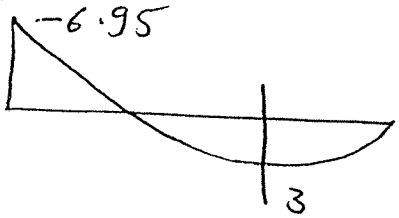
$M_s = 10.4$ KN-m

From Appendix

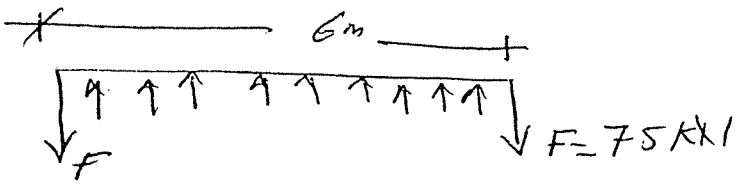
USE Φ12@15

For Exterior $P = \gamma h K_a$ USE Φ12@15





For Corners



$A_s = \frac{7.5}{1.3} = 5.77 cm^2/m$

allowable stress $A_s = 2.885 cm^2/m$ / Face

USE Φ10 @ 20/side

For Top Slab:-

weight of Sand $= 16.4 \times 1.4 \times 0.1 = 2.3$ KN/m²

" " Tiling $= 23 \times 0.06 \times 1.4 = 1.932$ KN/m²

$\Sigma w_u = 8.6$ KN/m²

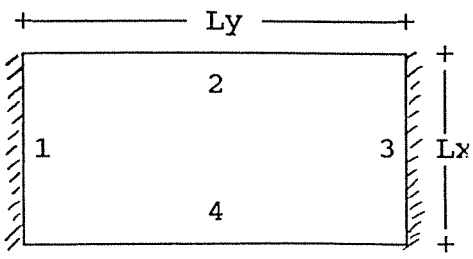
Live Load $= 1.6 \times 2 = 3.2$

Total $= 3.2 + 8.6 = 11.8$

weight of slab $= 0.2 \times 25 \times 1.4$

Total $= 11.8 + 0.2 \times 25 \times 1.4 = 18.8$ KN/m²

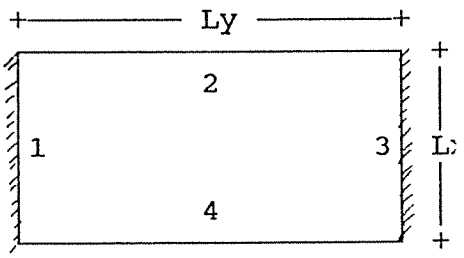
RECTANGULAR PANELS SUPPORTED ON FOUR SIDES

fcu = 25 MPa fy = 414 MPa Lx = 5.725 metres Ly = 6 metres w = 18.8 kN/m^2 h = 250 mm	SIDE 1 Continuous SIDE 2 Free SIDE 3 Continuous SIDE 4 Free	

	M	d	R	x/d	p	p'	As	As'
SIDE 1	-27.9	200	0.70	0.07	0.20	0.00	401	0
SIDE 2	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE 3	-27.9	200	0.70	0.07	0.20	0.00	401	0
SIDE 4	+0.0	200	0.00	0.00	0.00	0.00	0	0
SPAN x	+24.6	200	0.62	0.06	0.18	0.00	352	0
SPAN y	+21.0	200	0.52	0.05	0.15	0.00	298	0

OTHER 2 3 4ANOTHER 5 6 7 OTHER 8
h PANEL Material FINISH

RECTANGULAR PANELS SUPPORTED ON FOUR SIDES

fcu = 25 MPa fy = 414 MPa Lx = 6 metres Ly = 7.3 metres w = 18.8 kN/m^2 h = 250 mm	SIDE 1 Continuous SIDE 2 Free SIDE 3 Continuous SIDE 4 Free	

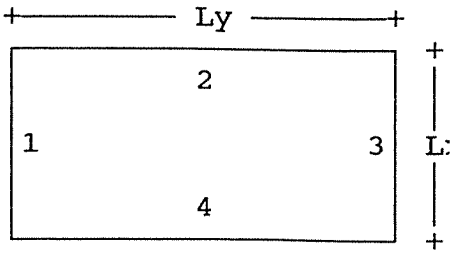
	M	d	R	x/d	p	p'	As	As'
SIDE 1	-30.7	200	0.77	0.08	0.22	0.00	442	0
SIDE 2	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE 3	-30.7	200	0.77	0.08	0.22	0.00	442	0
SIDE 4	+0.0	200	0.00	0.00	0.00	0.00	0	0
SPAN x	+38.9	200	0.97	0.10	0.28	0.00	567	0
SPAN y	+23.0	200	0.58	0.06	0.16	0.00	328	0

1 OTHER 2 3 4ANOTHER 5 6 7 OTHER 8
h PANEL Material FINISH

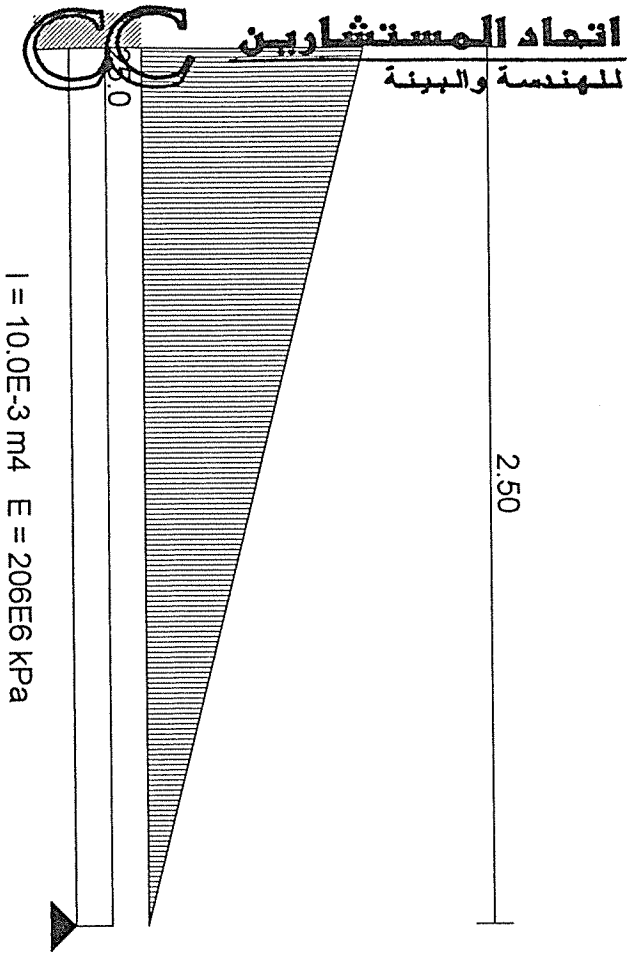
هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٣٠٧٤٦ عمان - الأردن

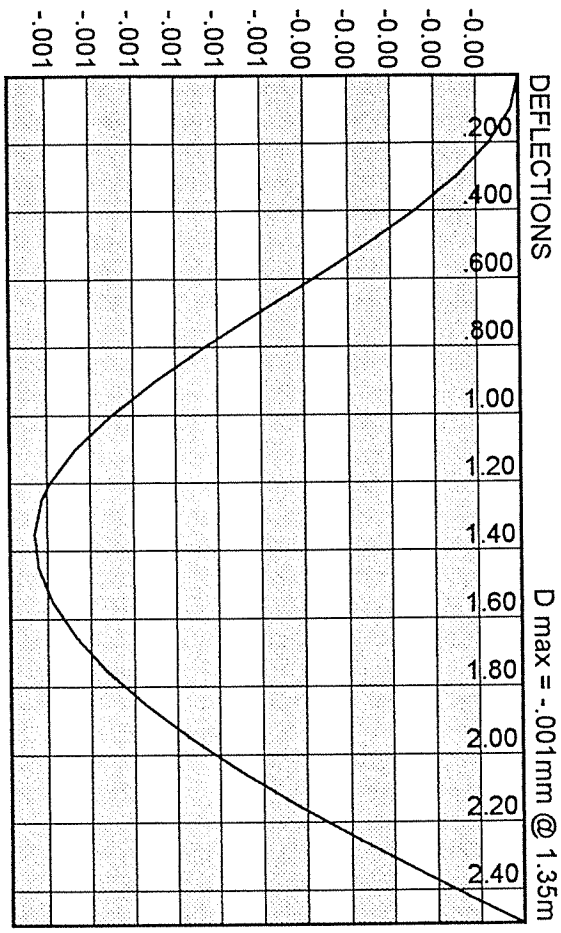
Tank Slab

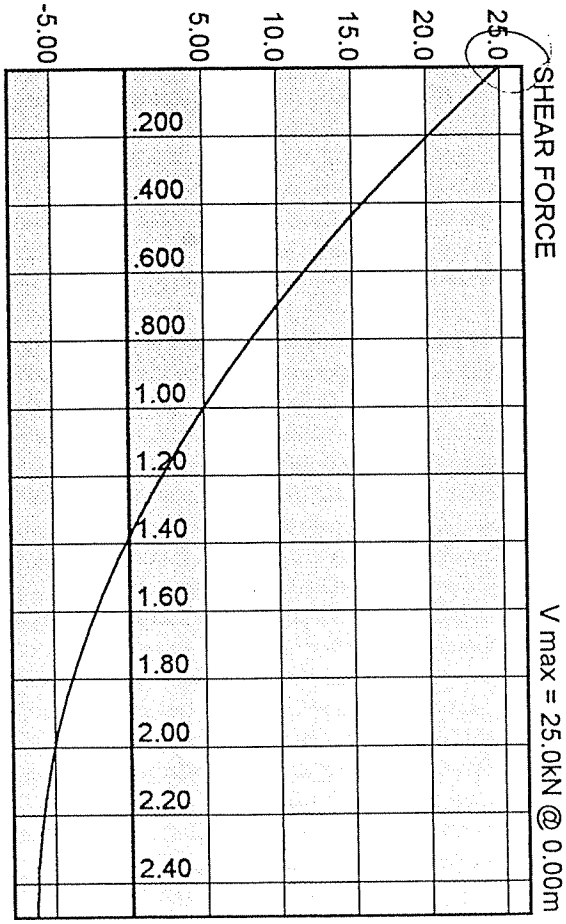
RECTANGULAR PANELS SUPPORTED ON FOUR SIDES

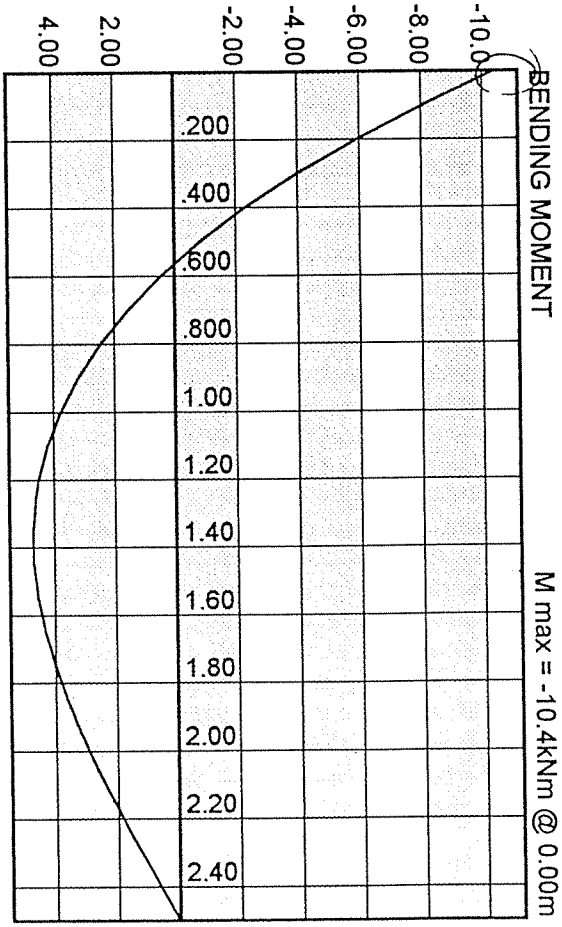
fcu = 25 MPa fy = 414 MPa Lx = 6 metres Ly = 6.3 metres w = 18.8 kN/m^2 h = 250 mm	SIDE 1 Free SIDE 2 Free SIDE 3 Continuous SIDE 4 Free	

		M	d	R	x/d	p	p'	As	As'
SIDE	1	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE	2	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE	3	-39.3	200	0.98	0.10	0.29	0.00	572	0
SIDE	4	+0.0	200	0.00	0.00	0.00	0.00	0	0
SPAN	x	+32.7	200	0.82	0.08	0.24	0.00	472	0
SPAN	y	+29.4	200	0.74	0.08	0.21	0.00	423	0









هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٣٠٧٤٦ عمان - الأردن

Analysis settings

The following additional **Settings** can be made on the **Input** page:

- **E** modulus : Young's modulus for the beam (kPa).

Material	E modulus (kPa)
Timber	5E6 to 15E6
Concrete (normal strength)	25E6 to 35E6
Aluminium	± 70E6
Structural steel	± 205E6

- **K modulus** : Foundation modulus (kN/m³).

Soil type	K modulus (kN/m³)
Clay	
Stiff	16E3 to 32E3
Very stiff	32E3 to 64E3
Hard	48E3 to 96E3
Sand	
Loose	6E3 to 19E3
Medium	19E3 to 96E3
Dense	96E3 to 300E3

- **Allow negative pressure :**
- **Yes** : Enable **full adhesion** between beam and elastic medium.
- **No** : Allow **uplift**, i.e. zero adhesion between beam and elastic medium.

Note

- The **foundation modulus**, Km, is multiplied with the **support width** to obtain the **support stiffness** per unit length of the beam. Enter a zero value for no foundation stiffness, i.e. a **gap** in the elastic medium.

Design OF TANK WALL

Project name:

Date : *01/02/00*

Calculated moment

$M_{(calc.)}$ =	10.4	(KN.m)

Determination the depth of the neutral axis

h =	300	(mm)
d =	250	(mm)
b =	1000	(mm)
f_{st} =	130	(N/mm2)
f_{cc} =	11	(N/mm2)
Es/Ec =	15	
x =	139.830508	(mm)

Checking the moment of resistance of the concrete

$M_{(res.)}$ =	156.420569	(KN.m)

Calculation the area of tension steel

As(Requ.) =	393.333333	(mm2)
As(Min.) =	750	(mm2)
Assume d =	10	(mm)

Use	6	Ø	12	/m

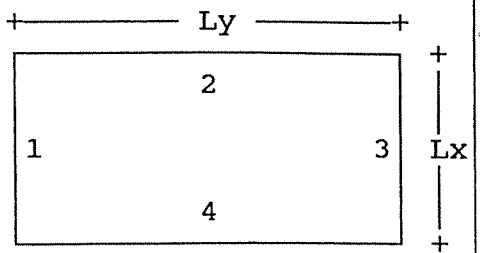
As(Prov.)=	471.238905	(mm2)

Cracking check

r =	0.0015708
x =	152.151794 (mm)

$f_{ct(calc.)}$ =	0.66432732	(N/mm2)	<	$f_{ct(Table)}$ =	1.84	(N/mm2) O.K

WATER TANK) || RECTANGULAR PANELS SUPPORTED ON FOUR SIDES ||

fcu = 25 MPa fy = 414 MPa Lx = 5.725 metres Ly = 6 metres w = 16.98 kN/m^2 h = 250 mm	SIDE 1 Continuous SIDE 2 Free SIDE 3 Free SIDE 4 Free	

	M	d	R	x/d	p	p'	As	As'
SIDE 1	-32.3	200	0.81	0.08	0.23	0.00	466	0
SIDE 2	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE 3	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE 4	+0.0	200	0.00	0.00	0.00	0.00	0	0
SPAN x	+26.8	200	0.67	0.07	0.19	0.00	384	0
SPAN y	+24.2	200	0.61	0.06	0.17	0.00	346	0

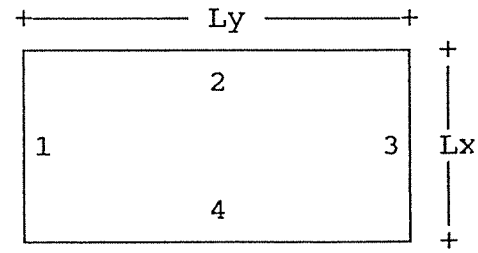
$M_{max} = 26.8$

USE Φ12@17.5Cm (For crack section)

For -ve $A_s = 466\ mm^2/m$

USE Φ10@15Cm

|| RECTANGULAR PANELS SUPPORTED ON FOUR SIDES || (Pumping Room)

fcu = 25 MPa fy = 414 MPa Lx = 6 metres Ly = 12 metres w = 16.98 kN/m^2 h = 250 mm	SIDE 1 Continuous SIDE 2 Free SIDE 3 Continuous SIDE 4 Free	

	M	d	R	x/d	p	p'	As	As'
SIDE 1	-27.7	200	0.69	0.07	0.20	0.00	398	0
SIDE 2	+0.0	200	0.00	0.00	0.00	0.00	0	0
SIDE 3	-27.7	200	0.69	0.07	0.20	0.00	398	0
SIDE 4	+0.0	200	0.00	0.00	0.00	0.00	0	0
SPAN x	+61.3	200	1.53	0.16	0.46	0.00	920	0
SPAN y	+20.8	200	0.52	0.05	0.15	0.00	296	0

هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٣٠٧٤٦ عمان - الأردن

PANS Bent and Beam Analysis Program V4.1 SPANS
SPANS Prepared by H. Saffarini 2/2/93 SPANS

ESIGN OF ONE WAY SLAB

Number of spans = 1 Number of load cases = 1

pan	Length	Width	Depth	Flange thickness	Flange width
1	6.000	1.000	0.250	0.000	1.000

Load case number : 1

pan	UDL	Load 1		Load 2		Load 3		Load 4		Load 5	
		Val	Dis	Val	Dis	Val	Dis	Val	Dis	Val	Dis
1	16.98	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Line Load From Length Intensity

Support	Width	Redistribution
1	0.000	0 %
2	0.000	0 %

nvelope

Span	lft BM	span BM	rgt BM	lft SF	rgt SF
1	0.0	76.4	-0.0	50.9	-50.9

Required Steel Areas (mm square)

Span	Top L	Bot L	Top M	Bot M	Top R	Bot R
1	327	0	0	1085	327	0

Maximum Spacing of Shear Stirrups in mm

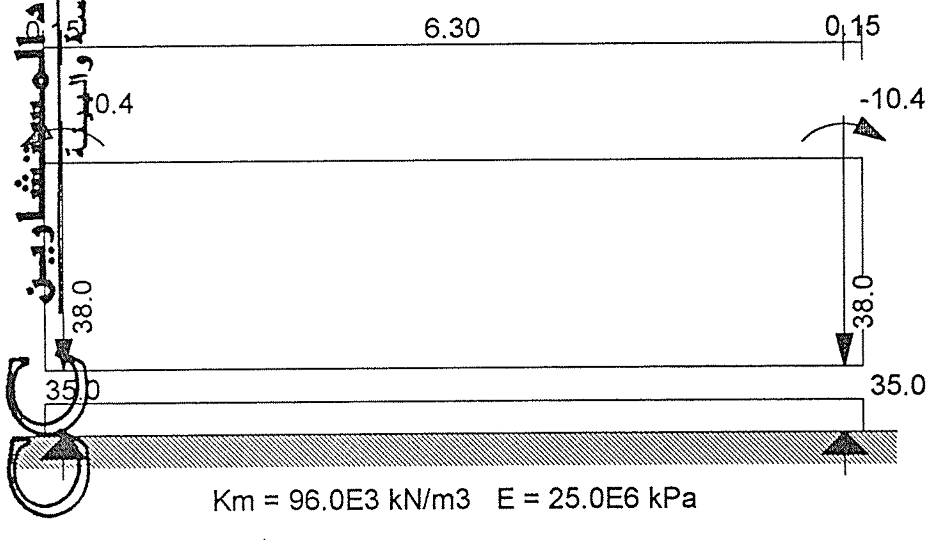
Span	leg	L-zone	spacing	dia.	R-zone	spacing	dia.	Rest-spc	dia.
1	6	1.50	161	8	1.50	161	8	161	8

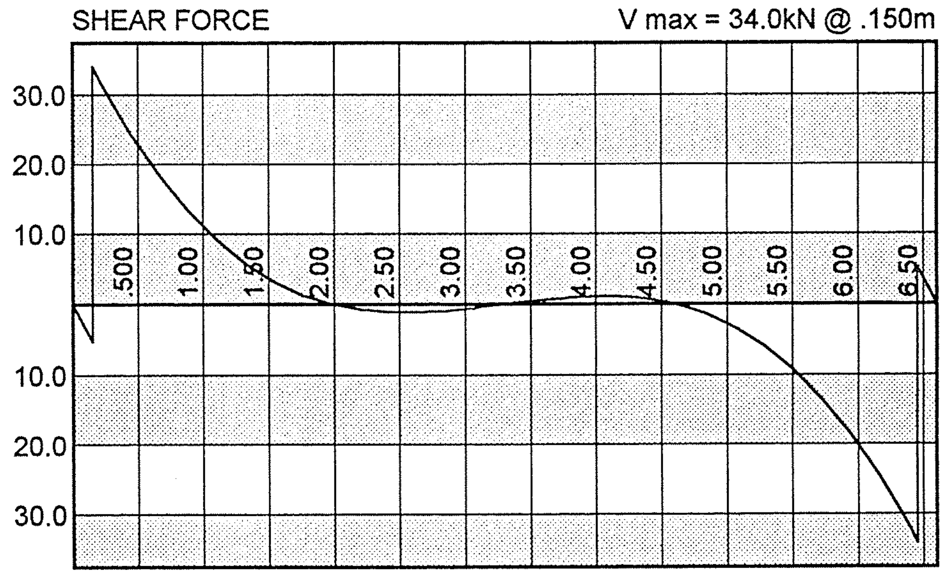
Span 1
Span/Depth 27.9
llowable 30.8

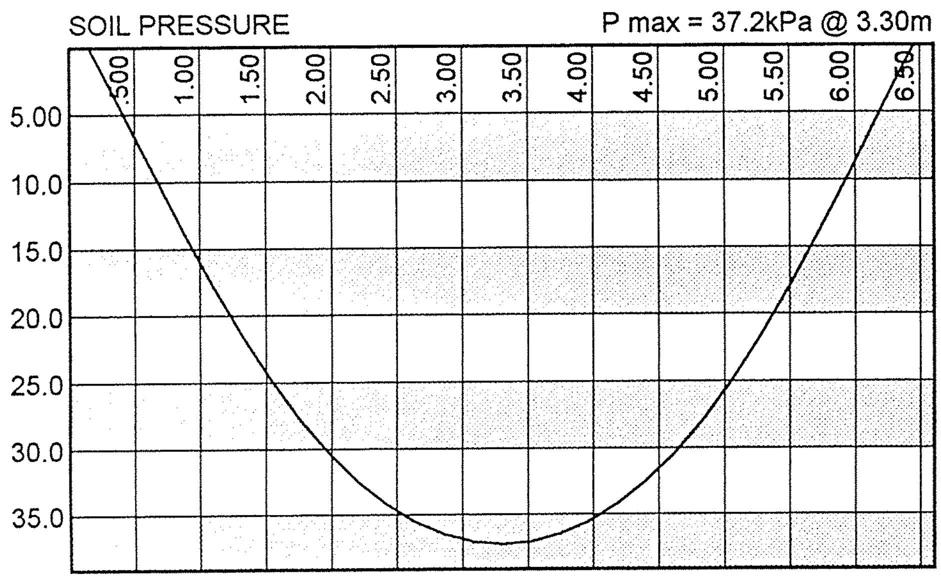
327	0	327 Requ. Top
0 Φ 0	5 Φ 12	5 Φ 12
5 Φ 12	0 Φ 0	0 Φ 0
565	565	565 Prov. Top

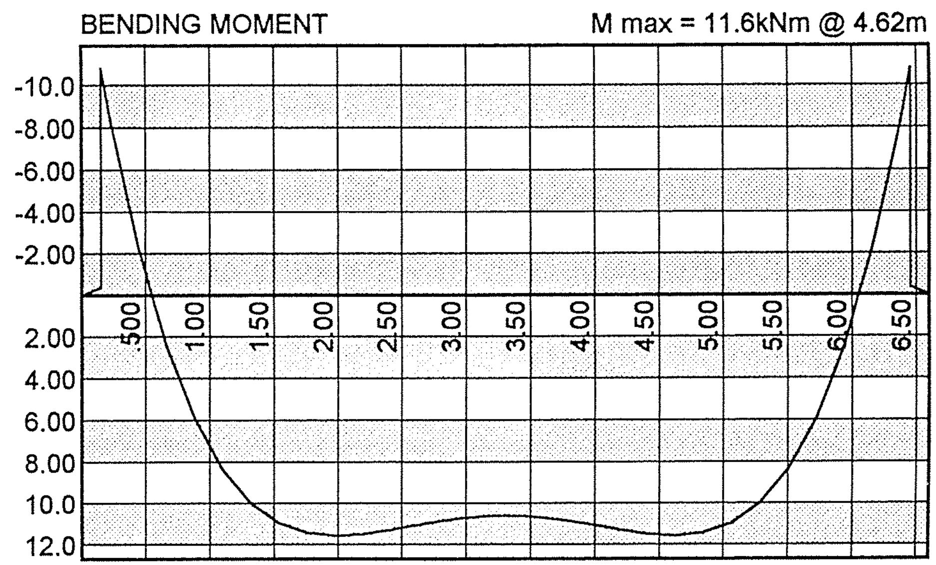
span 1

0	1085	0 Requ. Bot
0 Φ 0	8 Φ 14	0 Φ 0
0 Φ 0	0 Φ 0	0 Φ 0
0	1231	0 Prov. Bot









M-ve = 10.4 M+ve = 11.6 kN-m
T = 25 KN

Section Design for Crack Widths : TANK BOTTOM SLAB

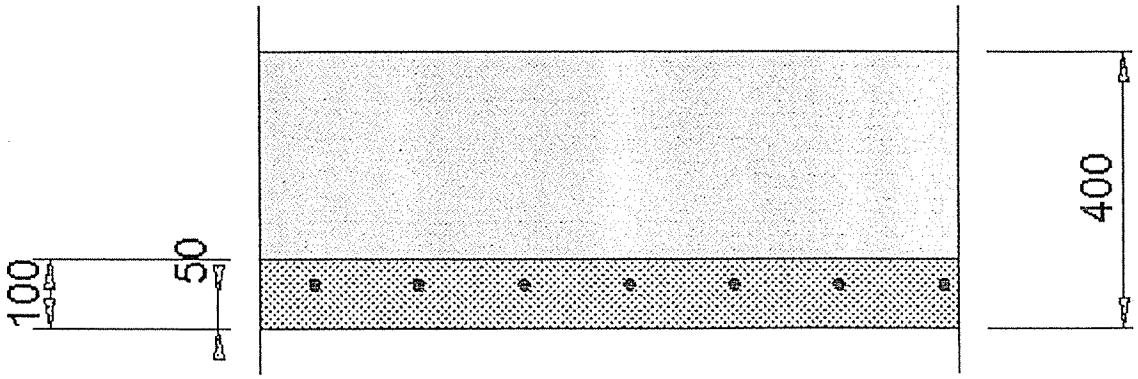
Input Data

Slab or Beam Depth h (mm)	400
Surface zone depth he (mm)	100
Beam width b (mm)	500
Cover c (mm)	50
Thermal expansion coefficient	12E-6
Restraint Factor R	0.5
Design Crack Width (mm)	.2
fcu (MPa)	25
fy (MPa)	414

Load Cases

LC no.	Designation	T1 (°C)	T2 (°C)	SLS Tensile Force (kN)	Force ULS factor	SLS Moment (kNm)	Moment ULS factor
1	DL	20	22.5	12.5	1.6	11.6	1.6

BS8007 - 1987



CROSS - SECTION

Output for Load Case 1:DL

LOAD CASE 1:DL	Optimum				User
Configurations	1	2	3	4	
Bars	Y16@275	Y20@300	Y25@300	Y32@300	Y12@ 18
Crack width (M+T+T2) (mm)	0.10	0.09	0.07	0.05	0.01
Crack width (T1 only) (mm)	0.09	0.08	0.06	0.05	0.01
Crack width (T1+T2) (mm)	0.19	0.16	0.13	0.10	0.02
Reinforcement Area (mm²/m)	731	1047	1636	2681	6463
Steel Stress (MPa)	64	45	30	19	8
Mu capacity (kNm/m)	62.3	79.6	121.0	190.6	477.7
Tu capacity (kN/m)	68.0	86.0	132.0	210.0	516.0
Concrete Tensile strength fct = 1.15 MPa			Critical load case:LC 1		
fct/fb = 0.67 ; fb = bond strength	Ro critical = 0.64				

Retaining Wall Design : Propped cantilever exam

Input Data

Wall Dimensions				Live Loads		General Parameters		Design Parameters	
H1 (m)	3	C (m)	0.4	W (kN/m²)	2	Soil Frict (°)	35	SF Overt.	1.5
H2 (m)	.5	F (m)		P (kN)		Fill slope (°)		SF Slip	1.5
H3 (m)		xf (m)	0.00	xp (m)		Wall Frict (°)	12	DL Factor	1.2
Hw (m)		At (m)	.3	L (kN/m)	38.6	Conc Density	25	LL Factor	1.6
Hr (m)		Ab (m)	.3	xl (m)	.15	Soil Density	20	Pmax (kPa)	250
B (m)	1	Cover: wall	50	Lh (kN/m)		fcu (MPa)	25		
D (m)		Cover: base	50	x (m)		fy (MPa)	414		

Seepage allowed

Theory : Coulomb
Wall type : Propped cantilever

SEISMIC ANALYSIS SETTINGS:

Seismic Analysis ON/OFF:ON

Hor Accel. (g)	.15
Vert Accel. (g)	.05
Include LL's	Y

VALUES OF PRESSURE COEFFICIENTS:

Active Pressure coefficient Ka :0.25
Passive Pressure coefficient Kp :5.76
Seismic Active Pressure coefficient Kas :0.33
Seismic Passive Pressure coefficient Kps :2.58
Base frictional constant μ :0.70

FORCES ACTING ON THE WALL:

	FORCES (kN) and their LEVER ARMS (m)			
Description	F Horizontal left (+)	Lever arm	F Vertical down (+)	Lever arm
Destabilizing forces:				
Total Active pressure Pa	29.875	1.196	6.185	1.300
Siesmic component of Pa	7.046	1.800	1.498	1.300
As a result of surcharge w	1.843	1.500	0.392	1.300
Siesmic wall inertia	4.400	1.500		
Stabilizing forces:				
Passive pressure on base Pp	-6.445	0.167		
Siesmic component of Pp	7.953	0.300		
Weight of the wall + base			30.875	0.950
Weight of soil on the base			1.900	0.500
Line load of 38.60 kN/m on backfill			38.600	1.150
UDL of 2.0 kN/m2			0.000	1.300

FORCES ACTING ON THE WALL:

Description	FORCES (kN) and their LEVER ARMS (m) F Horizontal left (+)	Lever arm	F Vertical down (+)	Lever arm
Destabilizing forces:				
Total Active pressure Pa	29.875	1.196	6.185	1.300
Siesmic component of Pa	7.046	1.800	1.498	1.300
As a result of surcharge w	1.843	1.500	0.392	1.300
Siesmic wall inertia	4.400	1.500		
Stabilizing forces:				
Passive pressure on base Pp	-6.445	0.167		
Siesmic component of Pp	7.953	0.300		
Weight of the wall + base			30.875	0.950
Weight of soil on the base			1.900	0.500
Line load of 38.60 kN/m on backfill			38.600	1.150
UDL of 2.0 kN/m2			0.000	1.300

EQUILIBRIUM CALCULATIONS AT SLS

1.Force Equilibrium

Sum of Vertical forces Pv :	76.0 kN
Frictional resistance Pfric :	53.2 kN
Passive Pressure on shear key :	0.0 kN
Passive pressure on base :	6.4 kN
Horizontal reaction at top :	10.1 kN
=> Horizontal resistance Fr :	77.8 kN

Horizontal sliding force Fh : 36.1 kN

Safety factor against overall sliding = Fr/Fh = 2.15

Reaction at base : 26.0 kN
Resistance at base : 59.7 kN
Safety factor against base sliding = Fr(base)/R(base) = 2.60

SOIL PRESSURES UNDER BASE

Maximum pressure :122.4 kPa
Minimum pressure : 0 kPa at 0.1 m from left hand side of base.
Maximum pressure occurs at right hand side of base

WALL MOMENTS (ULS) AND REINFORCEMENT TO BS8110 - 1997

Position from base top (m)	Moment (kNm)	Front Reinforcing (mm^2/m)	Back Reinforcing (mm^2/m)	Nominal (0.13%) (mm^2/m)
0.00	6.92	0.00	77.13	390.00
0.05	5.67	0.00	63.23	390.00
0.10	4.47	0.00	49.87	390.00
0.16	3.33	0.00	37.11	390.00
0.21	2.24	0.00	24.96	390.00
0.26	1.20	0.00	13.41	390.00
0.31	0.22	0.00	2.46	390.00
0.36	-0.71	7.91	0.00	390.00
0.42	-1.59	17.69	0.00	390.00
0.47	-2.41	26.91	0.00	390.00
0.52	-3.19	35.55	0.00	390.00
0.57	-3.91	43.64	0.00	390.00
0.62	-4.59	51.18	0.00	390.00
0.68	-5.22	58.17	0.00	390.00
0.73	-5.80	64.62	0.00	390.00
0.78	-6.33	70.55	0.00	390.00
0.83	-6.81	75.95	0.00	390.00
0.88	-7.25	80.84	0.00	390.00
0.94	-7.64	85.22	0.00	390.00
0.99	-7.99	89.10	0.00	390.00
1.04	-8.29	92.48	0.00	390.00
1.09	-8.55	95.38	0.00	390.00
1.14	-8.77	97.79	0.00	390.00
1.20	-8.94	99.74	0.00	390.00
1.25	-9.08	101.22	0.00	390.00
1.30	-9.17	102.24	0.00	390.00
1.35	-9.22	102.81	0.00	390.00
1.40	-9.23	102.94	0.00	390.00
1.46	-9.20	102.63	0.00	390.00
1.51	-9.14	101.89	0.00	390.00
1.56	-9.03	100.73	0.00	390.00
1.61	-8.89	99.16	0.00	390.00
1.66	-8.71	97.18	0.00	390.00
1.72	-8.50	94.79	0.00	390.00
1.77	-8.25	92.02	0.00	390.00
1.82	-7.97	88.86	0.00	390.00
1.87	-7.65	85.31	0.00	390.00
1.92	-7.30	81.40	0.00	390.00
1.98	-6.92	77.13	0.00	390.00
2.03	-6.50	72.49	0.00	390.00
2.08	-6.05	67.51	0.00	390.00
2.13	-5.58	62.18	0.00	390.00
2.18	-5.07	56.52	0.00	390.00
2.24	-4.53	50.53	0.00	390.00
2.29	-3.96	44.22	0.00	390.00
2.34	-3.37	37.59	0.00	390.00
2.39	-2.75	30.66	0.00	390.00
2.44	-2.10	23.42	0.00	390.00
2.50	-1.43	15.90	0.00	390.00

2.60	0.00	0.00	0.00	390.00

BASE MOMENTS (ULS) AND REINFORCEMENT TO BS8110 - 1997

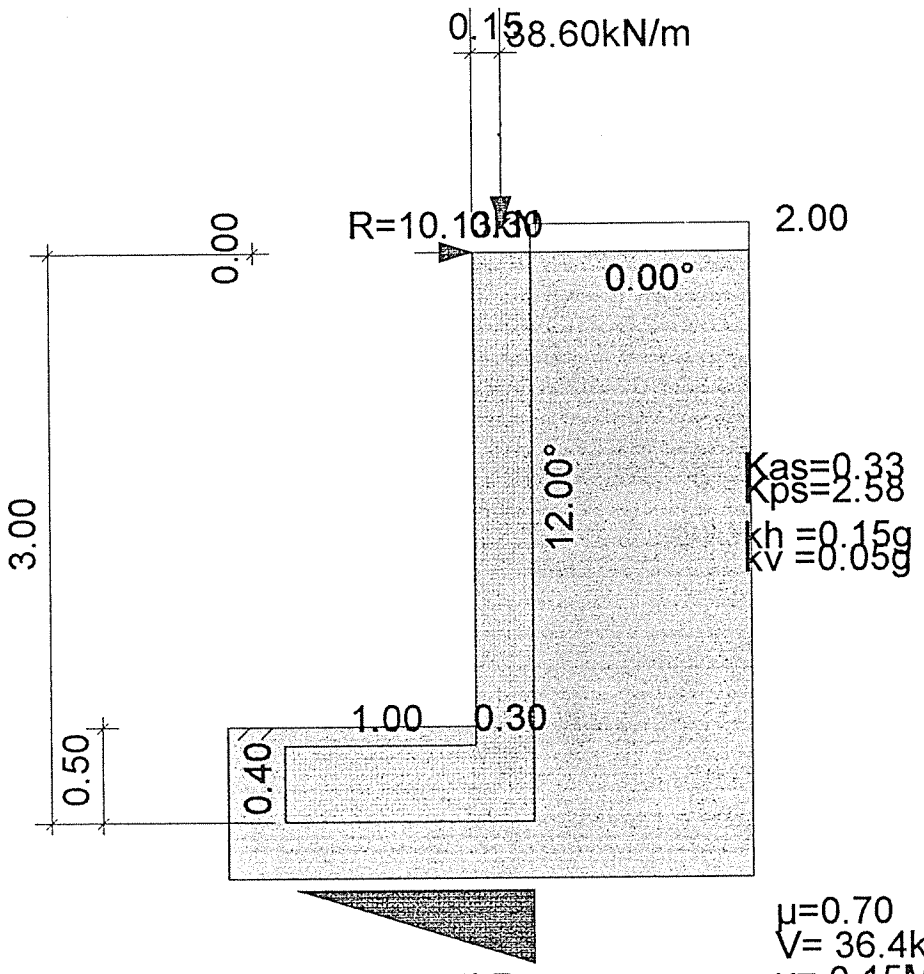
Position from left (m)	Moment (kNm)	Top Reinforcing (mm^2/m)	Bot Reinforcing (mm^2/m)	Nominal (0.13%) (mm^2/m)
0.03	-0.00	0.00	0.00	520.00
0.05	-0.01	0.00	0.08	520.00
0.08	-0.04	0.00	0.31	520.00
0.10	-0.09	0.00	0.69	520.00
0.13	-0.16	0.00	1.22	520.00
0.16	-0.24	0.00	1.91	520.00
0.18	-0.35	0.00	2.76	520.00
0.21	-0.48	0.00	3.75	520.00
0.23	-0.62	0.00	4.90	520.00
0.26	-0.79	0.00	6.20	520.00
0.29	-0.97	0.00	7.66	520.00
0.31	-1.18	0.00	9.26	520.00
0.34	-1.40	0.00	11.02	520.00
0.36	-1.64	0.00	12.94	520.00
0.39	-1.91	0.00	15.01	520.00
0.42	-2.19	0.00	17.23	520.00
0.44	-2.49	0.00	19.60	520.00
0.47	-2.81	0.00	22.12	520.00
0.49	-3.15	0.00	24.80	520.00
0.52	-3.51	0.00	27.64	520.00
0.55	-3.89	0.00	30.62	520.00
0.57	-4.29	0.00	33.76	520.00
0.60	-4.71	0.00	37.05	520.00
0.62	-5.14	0.00	40.50	520.00
0.65	-5.60	0.00	44.10	520.00
0.68	-6.08	0.00	47.85	520.00
0.70	-6.57	0.00	51.75	520.00
0.73	-7.09	0.00	55.81	520.00
0.75	-7.62	0.00	60.02	520.00
0.78	-8.18	0.00	64.38	520.00
0.81	-8.75	0.00	68.90	520.00
0.83	-9.35	0.00	73.57	520.00
0.86	-9.96	0.00	78.39	520.00
0.88	-10.59	0.00	83.37	520.00
0.91	-11.24	0.00	88.50	520.00
0.94	-11.91	0.00	93.78	520.00
0.96	-12.60	0.00	99.22	520.00
0.99	-13.31	0.00	104.81	520.00
1.01	-14.04	0.00	110.55	520.00
1.04	-14.79	0.00	116.44	520.00
1.07	-15.56	0.00	122.49	520.00
1.09	-16.35	0.00	128.69	520.00
1.12	-17.16	0.00	135.05	520.00
1.14	-17.98	0.00	141.55	520.00
1.17	-18.83	0.00	148.21	520.00
1.20	-19.03	0.00	149.77	520.00
1.22	-1.79	14.12	0.00	520.00
1.25	-1.35	10.61	0.00	520.00
1.27	-0.86	6.79	0.00	520.00
1.30	-0.49	3.82	0.00	520.00

SHEAR CHECK AT WALL-BASE JUNCTION TO BS8110 - 1997

Shear force at bottom of wall V = 36.4 kN
Shear stress at bottom of wall v = 0.15 MPa OK
Allowable shear stress vc = 1.04 MPa (based on Wall tensile reinf.)

Sketch of Wall

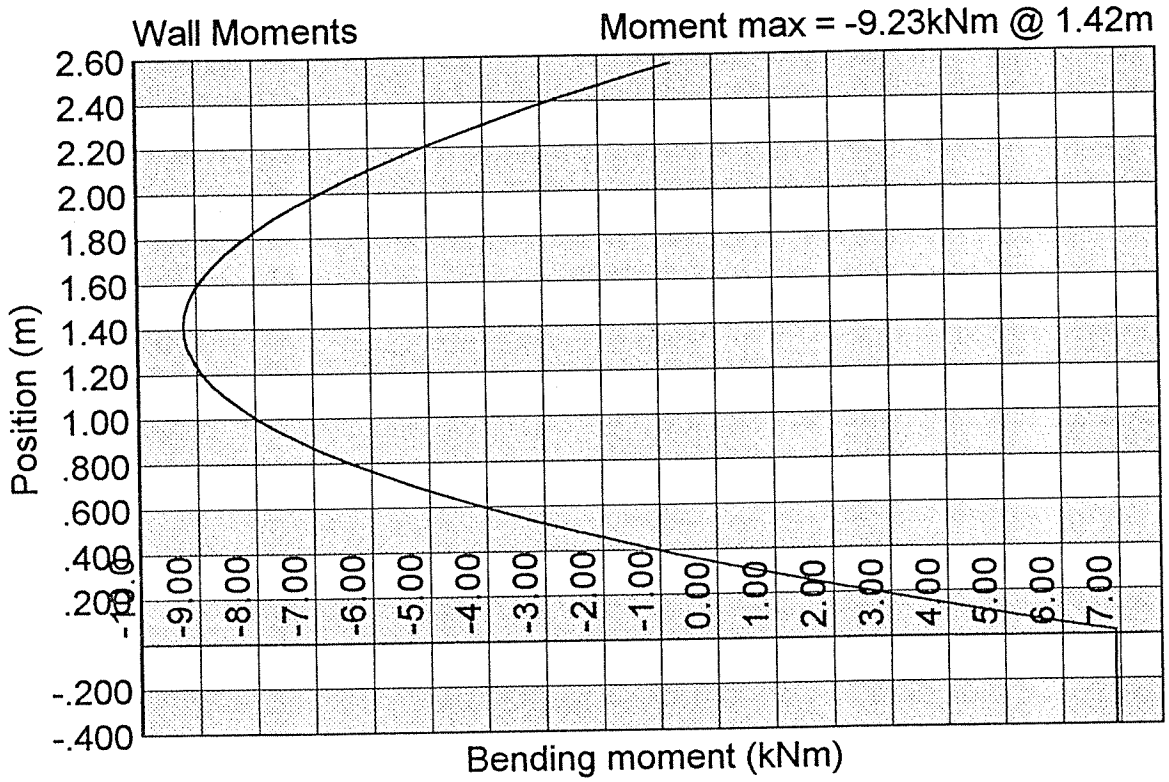
Design code: BS8110 - 1997



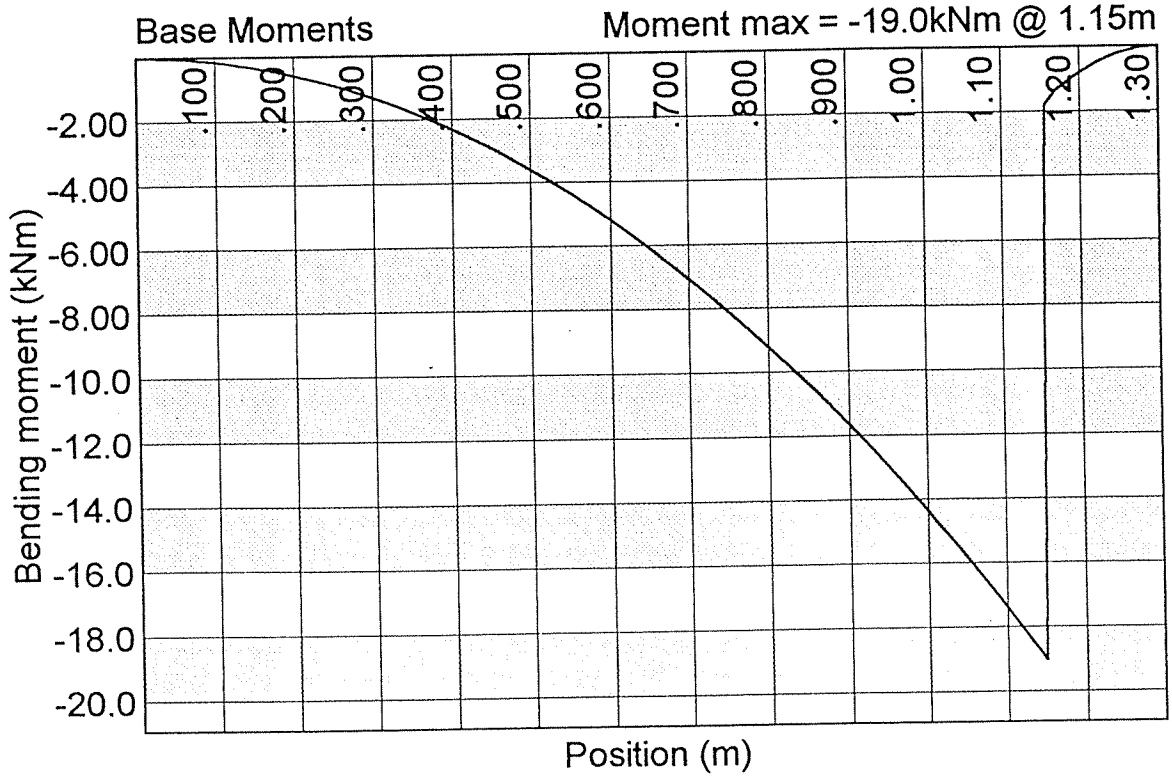
Wall type: Propped cantilever
Theory: Coulomb

Sliding FOS = 2.15

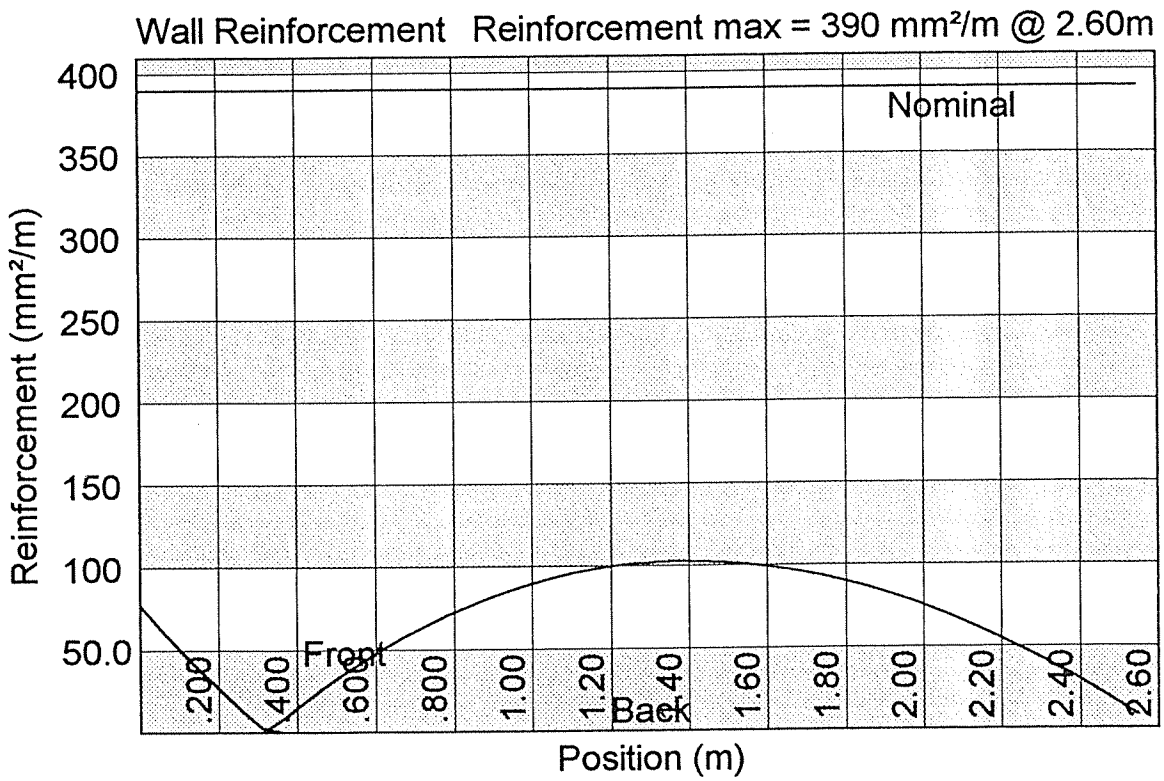
Wall Bending Moments



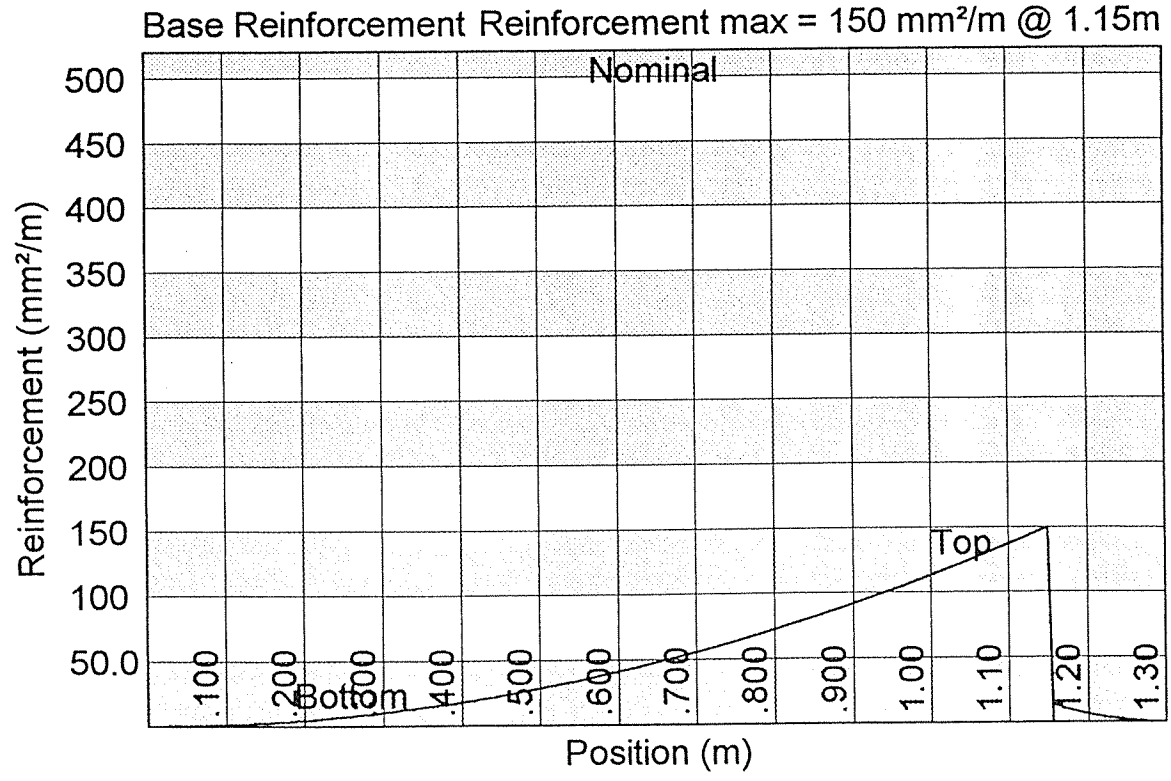
Base Bending Moments



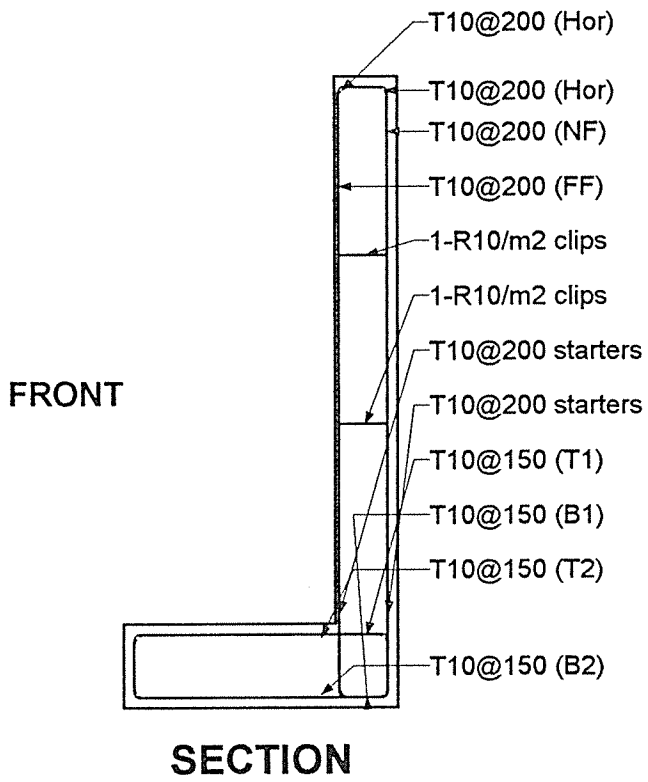
Wall Reinforcement



Base Reinforcement



Schematic Reinforcement



PROKON Software Consultants (Pty) Ltd Internet: http://www.prokon.com E-Mail: mail@prokon.com	Job Number		Sheet
	Job Title		
	Client		
	Calcs by	Checked by	Date

Retaining Wall Design : Propped cantilever exam

Input Data

Wall Dimensions				Live Loads		General Parameters		Design Parameters	
H1 (m)	5.2	C (m)	0.4	W (kN/m²)		Soil Frict (°)	35	SF Overt.	1.5
H2 (m)	.5	F (m)		P (kN)	100	Fill slope (°)		SF Slip	1.5
H3 (m)	4.7	xf (m)		xp (m)	.15	Wall Frict (°)	12	DL Factor	1.4
Hw (m)		At (m)	.3	L (kN/m)		Conc Density	25	LL Factor	1.6
Hr (m)		Ab (m)	.3	xl (m)		Soil Density	20	Pmax (kPa)	250
B (m)	.5	Cover: wall	50	Lh (kN/m)		fcu (MPa)	25		
D (m)	.5	Cover: base	50	x (m)		fy (MPa)	414		

Seepage allowed

Theory : Coulomb
Wall type : Propped cantilever

SEISMIC ANALYSIS SETTINGS:

Seismic Analysis ON/OFF:ON

Hor Accel. (g)	.15
Vert Accel. (g)	.05
Include LL's	Y

VALUES OF PRESSURE COEFFICIENTS:

```
          Active Pressure coefficient Ka :0.25
        Passive Pressure coefficient Kp :5.76
 Seismic Active Pressure coefficient Kas :0.33
Seismic Passive Pressure coefficient Kps :2.58
              Base frictional constant μ :0.70
```

FORCES ACTING ON THE WALL:

Description	F Horizontal left (+)	Lever arm	F Vertical down (+)	Lever arm
	FORCES (kN) and their LEVER ARMS (m)			
Destabilizing forces:				
Total Active pressure Pa	0.938	0.282	0.172	0.800
Siesmic component of Pa	0.196	0.300	0.042	0.800
Siesmic wall inertia	6.633	2.600		
Stabilizing forces:				
Passive pressure on base Pp	-6.445	0.167		
Siesmic component of Pp	7.953	0.300		
Weight of the wall + base			46.550	0.650
Weight of soil on the base			1.900	0.650
Point load of 100.00 kN on backfill			100.000	0.650

EQUILIBRIUM CALCULATIONS AT SLS

1.Force Equilibrium

```
    Sum of Vertical forces Pv :  66.9 kN
  Frictional resistance Pfric :  46.8 kN
Passive Pressure on shear key :   0.0 kN
     Passive pressure on base :   6.4 kN
   Horizontal reaction at top :   2.5 kN
  => Horizontal resistance Fr :  63.7 kN
  Horizontal sliding force Fh :   7.6 kN
```

Safety factor against overall sliding = Fr/Fh = 8.42

Reaction at base : 5.1 kN
Resistance at base : 53.3 kN
Safety factor against base sliding = Fr(base)/R(base) = 12.02

SOIL PRESSURES UNDER BASE

Maximum pressure : 64.0 kPa
Minimum pressure :-60.2 kPa
Maximum pressure occurs at left hand side of base

WALL MOMENTS (ULS) AND REINFORCEMENT TO BS8110 - 1997

Position from base top (m)	Moment (kNm)	Front Reinforcing (mm^2/m)	Back Reinforcing (mm^2/m)	Nominal (0.13%) (mm^2/m)
0.00	3.92	0.00	43.71	390.00
0.10	3.43	0.00	38.24	390.00
0.19	2.96	0.00	33.06	390.00
0.29	2.52	0.00	28.06	390.00
0.38	2.08	0.00	23.24	390.00
0.48	1.67	0.00	18.60	390.00
0.58	1.27	0.00	14.15	390.00
0.67	0.89	0.00	9.88	390.00
0.77	0.52	0.00	5.80	390.00
0.86	0.17	0.00	1.90	390.00
0.96	-0.16	1.82	0.00	390.00
1.06	-0.48	5.35	0.00	390.00
1.15	-0.78	8.70	0.00	390.00
1.25	-1.06	11.87	0.00	390.00
1.34	-1.33	14.85	0.00	390.00
1.44	-1.58	17.65	0.00	390.00
1.54	-1.82	20.27	0.00	390.00
1.63	-2.04	22.70	0.00	390.00
1.73	-2.24	24.95	0.00	390.00
1.82	-2.42	27.01	0.00	390.00
1.92	-2.59	28.90	0.00	390.00
2.02	-2.74	30.59	0.00	390.00
2.11	-2.88	32.11	0.00	390.00
2.21	-3.00	33.44	0.00	390.00
2.30	-3.10	34.59	0.00	390.00
2.40	-3.19	35.55	0.00	390.00
2.50	-3.26	36.33	0.00	390.00
2.59	-3.31	36.93	0.00	390.00
2.69	-3.35	37.34	0.00	390.00
2.78	-3.37	37.57	0.00	390.00
2.88	-3.37	37.62	0.00	390.00
2.98	-3.36	37.48	0.00	390.00
3.07	-3.33	37.16	0.00	390.00
3.17	-3.29	36.66	0.00	390.00
3.26	-3.23	35.97	0.00	390.00
3.36	-3.15	35.10	0.00	390.00
3.46	-3.05	34.04	0.00	390.00
3.55	-2.94	32.80	0.00	390.00
3.65	-2.81	31.38	0.00	390.00
3.74	-2.67	29.78	0.00	390.00
3.84	-2.51	27.99	0.00	390.00
3.94	-2.33	26.01	0.00	390.00
4.03	-2.14	23.86	0.00	390.00
4.13	-1.93	21.52	0.00	390.00
4.22	-1.70	18.99	0.00	390.00
4.32	-1.46	16.29	0.00	390.00
4.42	-1.20	13.40	0.00	390.00
4.51	-0.93	10.32	0.00	390.00
4.61	-0.63	7.07	0.00	390.00
4.70	-0.33	3.62	0.00	390.00
4.80	0.00	0.00	0.00	390.00

BASE MOMENTS (ULS) AND REINFORCEMENT TO BS8110 - 1997

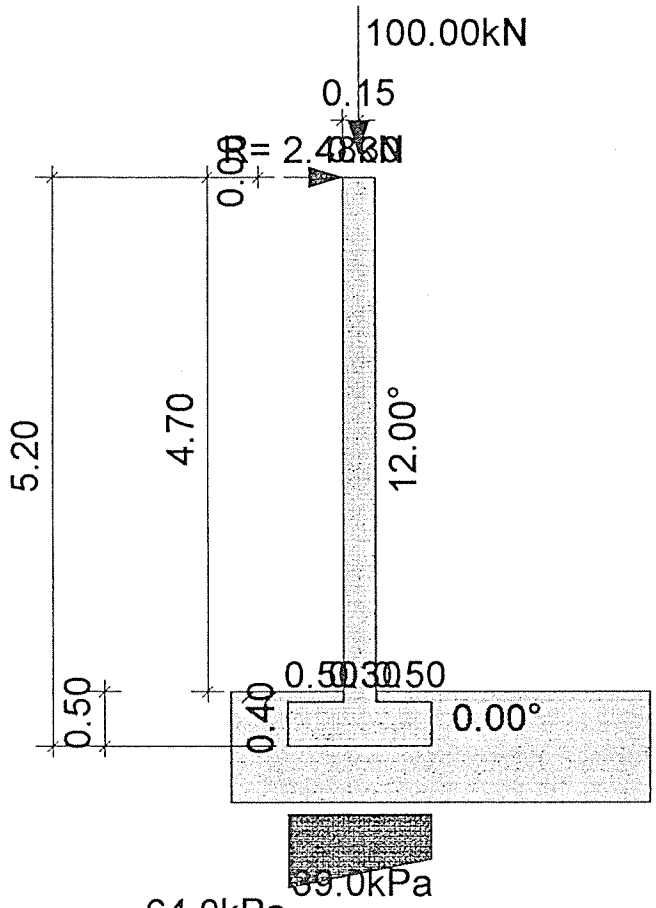
Position from left (m)	Moment (kNm)	Top Reinforcing (mm^2/m)	Bot Reinforcing (mm^2/m)	Nominal (0.13%) (mm^2/m)
0.03	-0.00	0.00	0.00	520.00
0.05	-0.02	0.00	0.19	520.00
0.08	-0.10	0.00	0.75	520.00
0.10	-0.22	0.00	1.70	520.00
0.13	-0.38	0.00	3.02	520.00
0.16	-0.60	0.00	4.71	520.00
0.18	-0.86	0.00	6.79	520.00
0.21	-1.17	0.00	9.24	520.00
0.23	-1.53	0.00	12.06	520.00
0.26	-1.94	0.00	15.27	520.00
0.29	-2.39	0.00	18.85	520.00
0.31	-2.90	0.00	22.81	520.00
0.34	-3.45	0.00	27.14	520.00
0.36	-4.05	0.00	31.85	520.00
0.39	-4.69	0.00	36.94	520.00
0.42	-5.39	0.00	42.41	520.00
0.44	-6.13	0.00	48.25	520.00
0.47	-6.92	0.00	54.47	520.00
0.49	-7.76	0.00	61.07	520.00
0.52	-8.64	0.00	68.04	520.00
0.55	-9.58	0.00	75.39	520.00
0.57	-10.56	0.00	83.12	520.00
0.60	-11.59	0.00	91.22	520.00
0.62	-12.67	0.00	99.70	520.00
0.65	-13.79	0.00	108.56	520.00
0.68	-14.96	117.80	0.00	520.00
0.70	-9.86	77.58	0.00	520.00
0.73	-14.96	117.80	0.00	520.00
0.75	-14.96	117.80	0.00	520.00
0.78	-9.86	77.58	0.00	520.00
0.81	-9.08	71.50	0.00	520.00
0.83	-8.34	65.66	0.00	520.00
0.86	-7.63	60.08	0.00	520.00
0.88	-6.95	54.74	0.00	520.00
0.91	-6.31	49.65	0.00	520.00
0.94	-5.69	44.81	0.00	520.00
0.96	-5.11	40.22	0.00	520.00
0.99	-4.56	35.87	0.00	520.00
1.01	-4.04	31.78	0.00	520.00
1.04	-3.55	27.93	0.00	520.00
1.07	-3.09	24.33	0.00	520.00
1.09	-2.66	20.98	0.00	520.00
1.12	-2.27	17.87	0.00	520.00
1.14	-1.91	15.02	0.00	520.00
1.17	-1.58	12.41	0.00	520.00
1.20	-1.28	10.05	0.00	520.00
1.22	-1.01	7.94	0.00	520.00
1.25	-0.77	6.08	0.00	520.00
1.27	-0.57	4.47	0.00	520.00
1.30	-0.39	3.10	0.00	520.00

SHEAR CHECK AT WALL-BASE JUNCTION TO BS8110 - 1997

Shear force at bottom of wall V = 8.7 kN
Shear stress at bottom of wall v = 0.04 MPa OK
Allowable shear stress vc = 1.04 MPa (based on Wall tensile reinf.)

Sketch of Wall

Design code: BS8110 - 1997

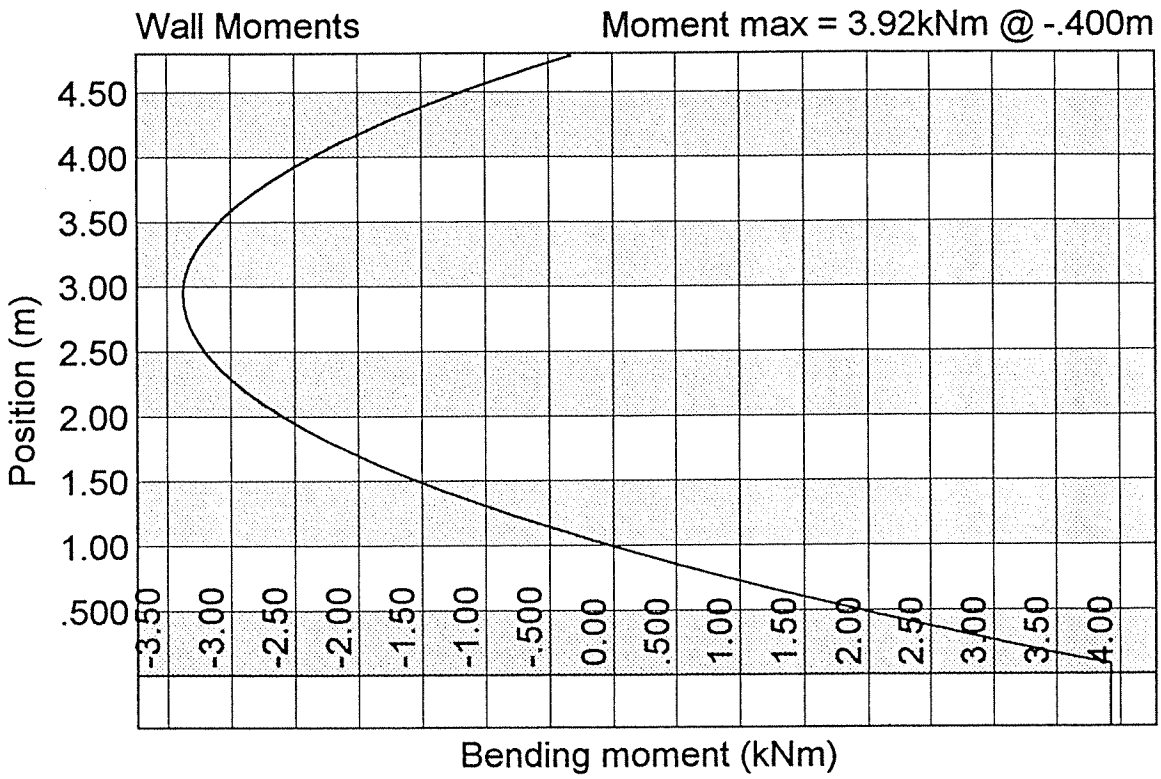


Kas=0.33
Kps=2.58
kh =0.15g
kv =0.05g

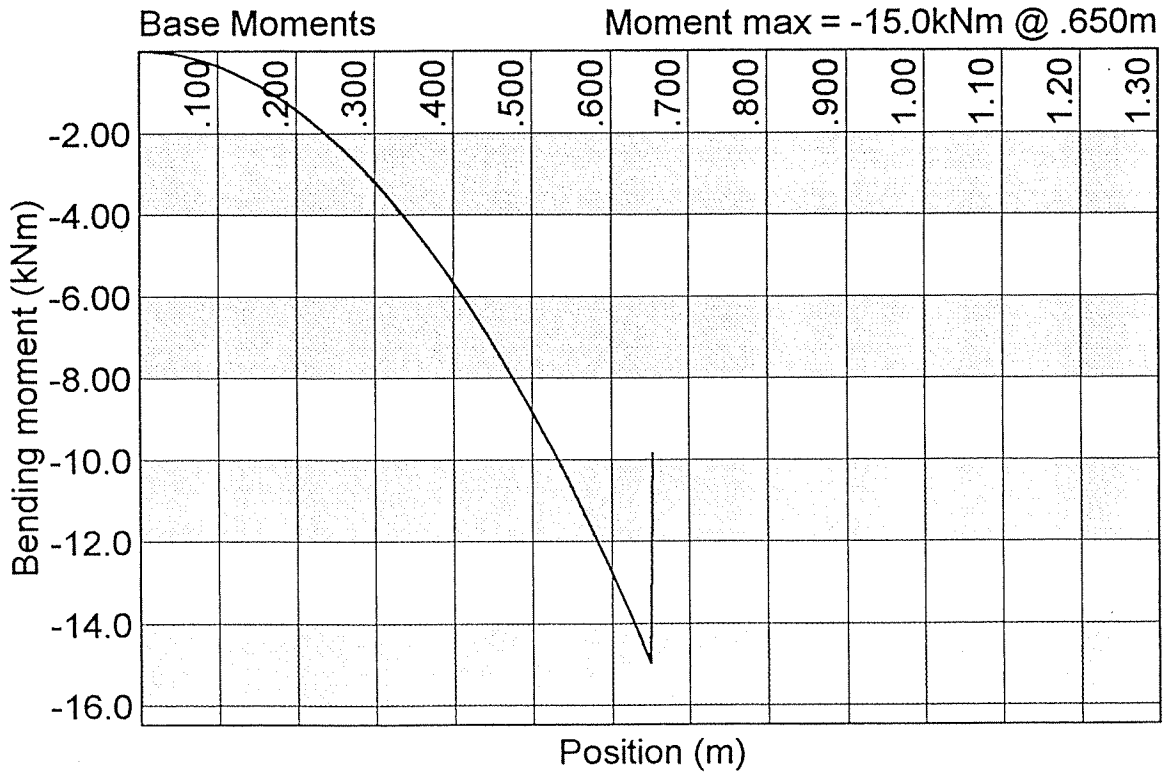
μ=0.70
V= 8.7kN
v= 0.04MPa
vc= 1.04MPa

Wall type: Propped cantilever
Theory: Coulomb

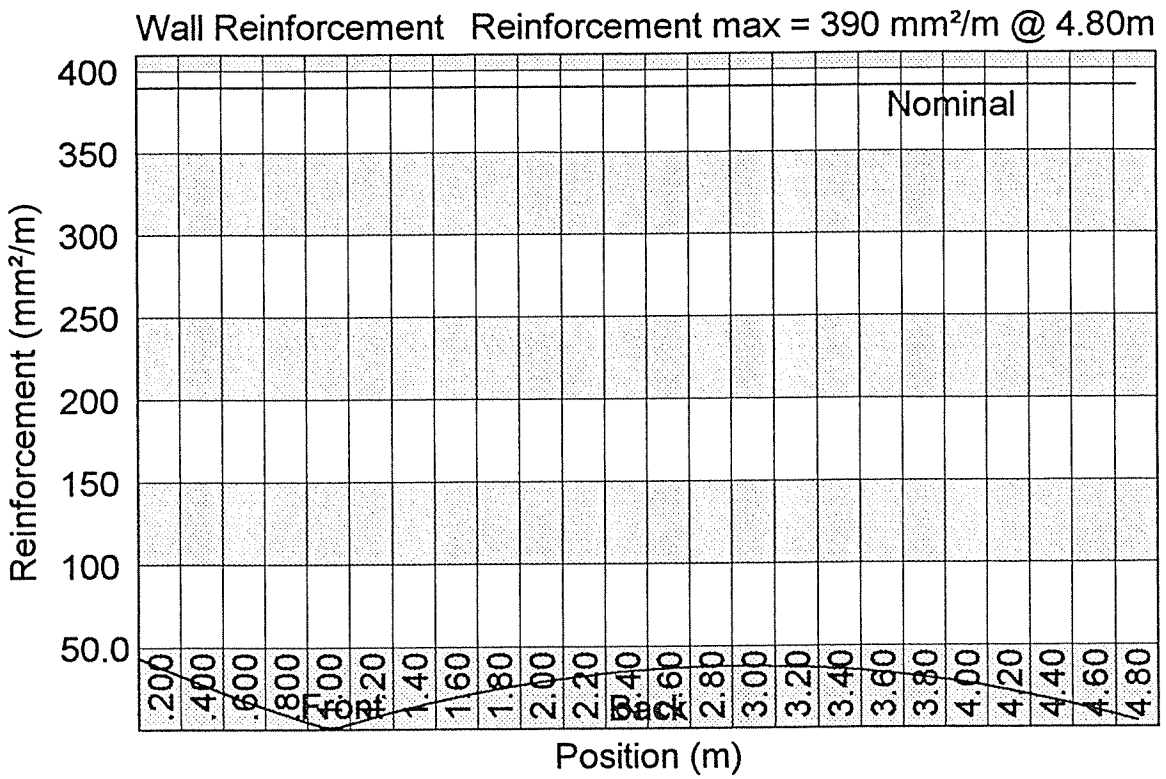
Wall Bending Moments



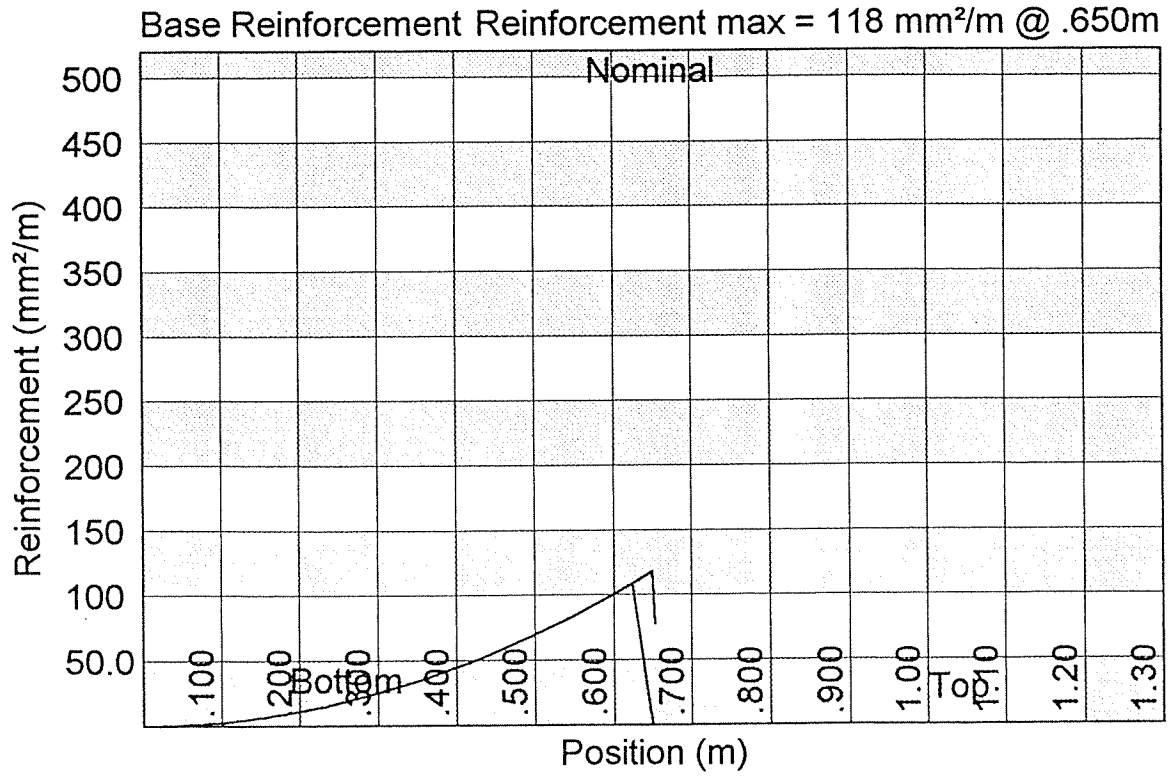
Base Bending Moments



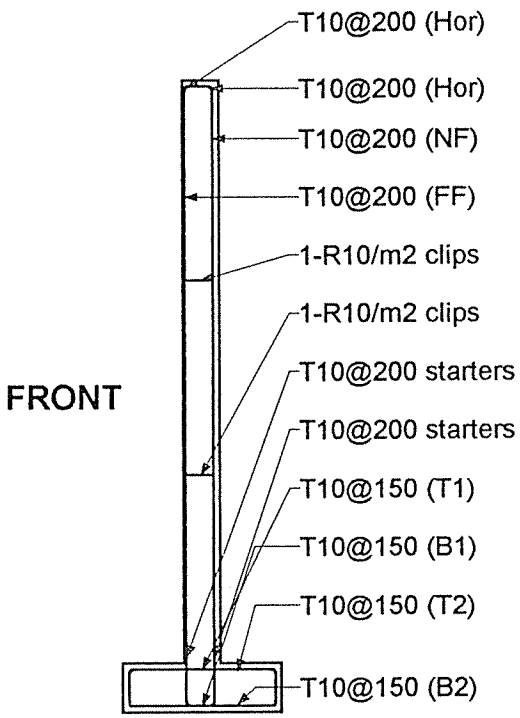
Wall Reinforcement



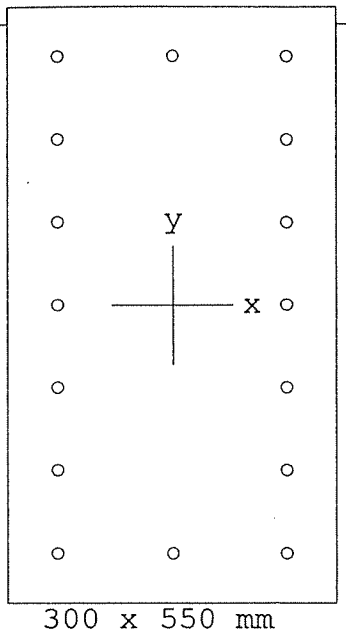
Base Reinforcement



Schematic Reinforcement



SECTION



f'c = 21 MPa

fy = 414 MPa

Confinement: Spiral

clr cover = 40 mm

spacing = 64 mm

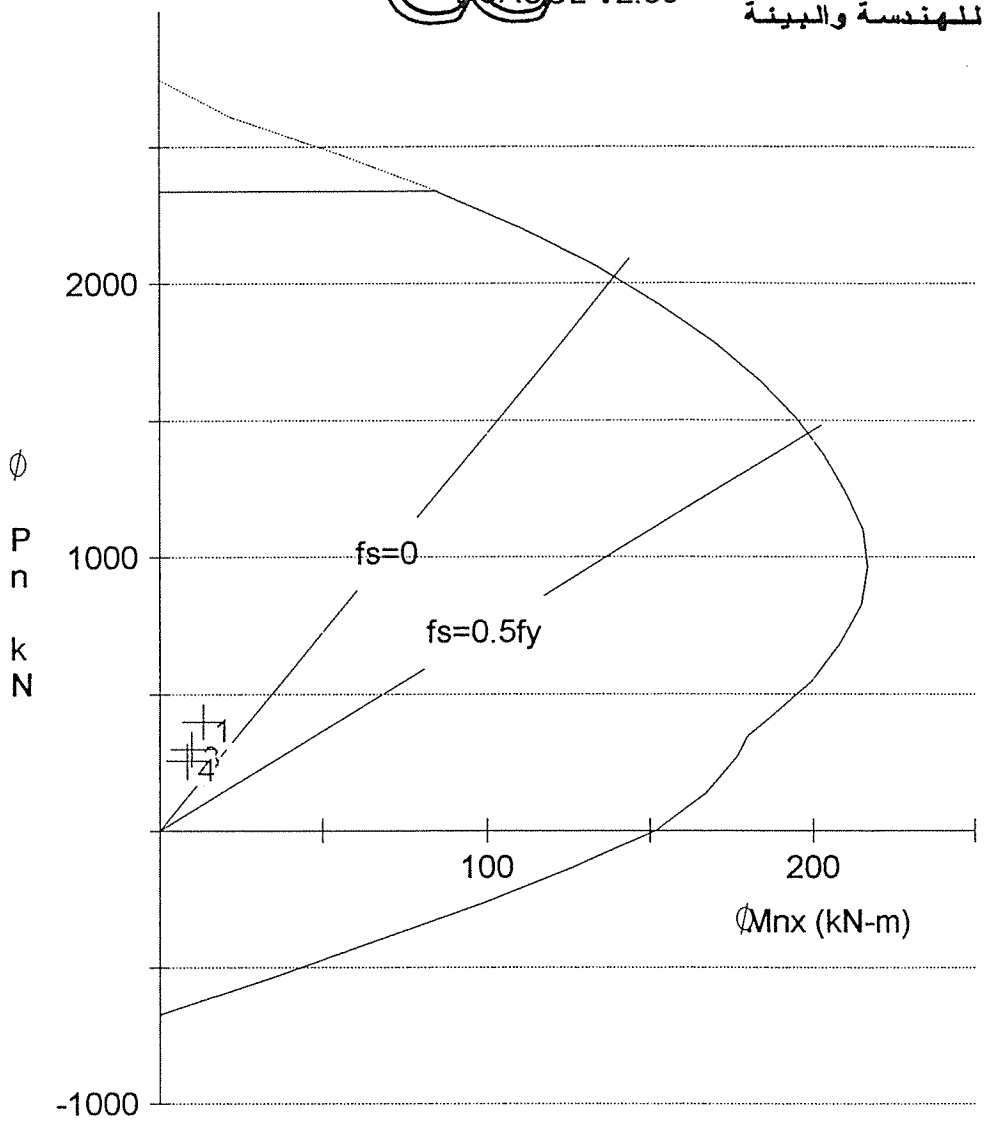
16 N-12 at 1.10%

As = 1808 mm^2

Ix = 4.159e+009 mm^4

Iy = 1.238e+009 mm^4

Xo = 0 mm



File name: C:\COMPTRC1.COL

Project: DEAD SEA COMPLEX

Column Id: TRANSFORMER COL.

Engineer: HASSAN AL-KHAMRAH

Date: 12/2/2000 Time: 15:11:53

Code: ACI 318-89

Units: Metric

Material Properties:

Ec = 23168 MPa eu = 0.003 mm/mm

fc = 17.65 MPa Es = 199955 MPa

Beta1 = 0.85

Stress Profile: Block

phi(c) = 0.75, phi(b) = 0.90

X-axis slenderness is considered; k(b) = 1.00 k(s) = 1.20

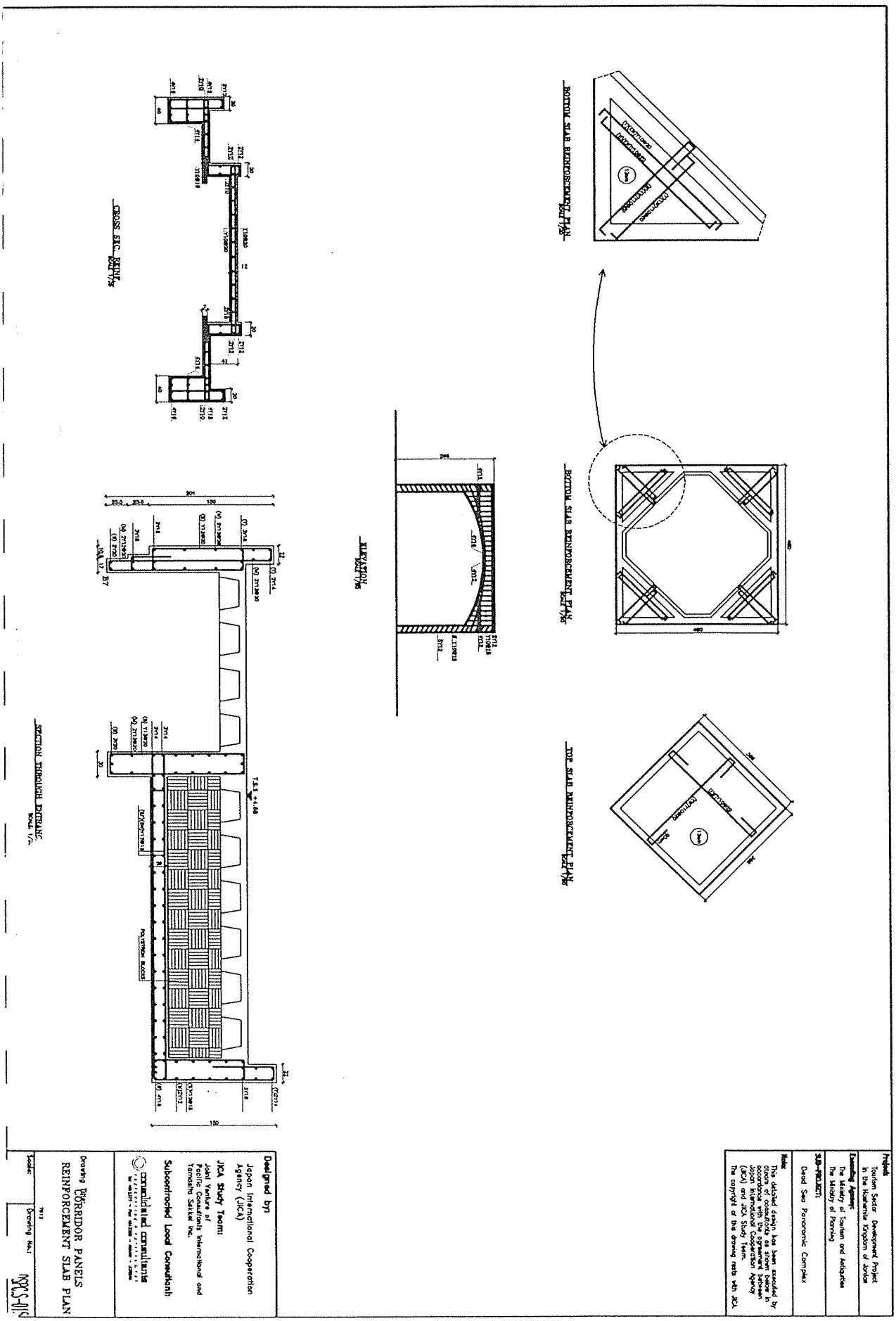
Structural Calculations

OF

CORRIDOR PANELS

هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٣٠٧٤٦ عمان - الأردن

:\jica-dead sea\DRAFTING\PHASE2\STRUC\DSPC-S015.dwg



Design of Exterior Interance Panels:-

weight/m^2 = 0.12 X25X1.4 = 4.2 KN/m^2

Finishing = 0.03X22X1.4 = 0.924 KN/m^2

Live load = 2X1.6 = 3.2 KN/m^2

Total Load = 4.2+0.924+3.2 = 8.325 KN/m^2

Total Load of Panel = 2.4x2.4x8.325
≈ 47.95 KN/s

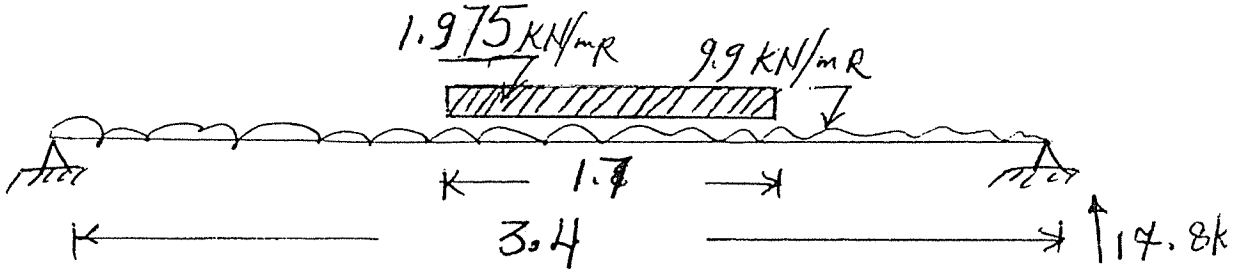
weight on Beam from slab = 47.95/(4x2.4)
≈ 5 KNs/mR

weight of Beam s/mR = 0.2(0.18+0.12+0.28+0.12)x25x1.4
≈ 4.9 KN/mR

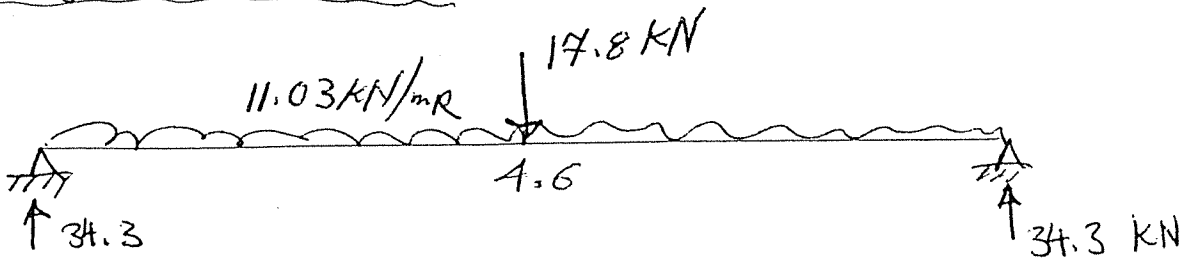
Σ Load /Interior Beam = 4.9+5 = 9.9 KN/mR

Design of Top Beam:-

load from Bottom slab = 1/3 x1.8x0.8 (25x0.12) x1.4/1.8
≈ 1.12 KN/mR + LL = 1.972



Design of Bottom slab Beam:-



O.w (Beam) = 0.6X0.3X25X1.4 = 6.3 KN/mR

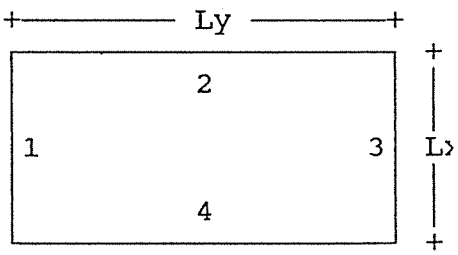
weight from slab = 2/3 X1.8X0.8 (0.12X25) X1.4/(1.2X2)
+ 0.2X0.12X25X1.4
≈ 2.52 KN/mR

Finishing = 0.6X0.03X22X1.4 + 2/3 (1.8X0.8) X22X(1.4/2.4)X0.03
≈ 0.924 KN/mR

Total/mR = 9.75 KN/mR + 1.28 = 11.03 KN/mR

Live Load = 2/3 X1.8X0.8X2X1.6/2.4
≈ 1.28 KN/m2

RECTANGULAR PANELS SUPPORTED ON FOUR SIDES

fcu = 25 MPa fy = 414 MPa Lx = 2.4 metres Ly = 2.4 metres w = 8.325 kN/m^2 h = 120 mm	SIDE 1 Free SIDE 2 Free SIDE 3 Free SIDE 4 Free	

		M	d	R	x/d	p	p'	As	As'
SIDE	1	+0.0	90	0.00	0.00	0.00	0.00	0	0
SIDE	2	+0.0	90	0.00	0.00	0.00	0.00	0	0
SIDE	3	+0.0	90	0.00	0.00	0.00	0.00	0	0
SIDE	4	+0.0	90	0.00	0.00	0.00	0.00	0	0
SPAN	x	+2.6	90	0.33	0.03	0.09	0.00	83	0
SPAN	y	+2.7	90	0.33	0.03	0.09	0.00	84	0

SPANS Bent and Beam Analysis Program V4.1 SPANS
SPANS Prepared by H. Saffarini 2/2/93 SPANS

coordor-top beam

Number of spans = 1 Number of load cases = 1

Span	Length	Width	Depth	Flange thickness	Flange width
1	3.400	0.200	0.700	0.000	0.200

Load case number : 1

Span	UDL	Load 1		Load 2		Load 3		Load 4		Load 5	
		Val	Dis	Val	Dis	Val	Dis	Val	Dis	Val	Dis
1	9.90	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Span	Line Load	From	Length	Intensity	
1	1	0.85	1.70	1.98	0.00

Support	Width	Redistribution
1	0.000	0 %
2	0.000	0 %

Envelope

Span	lft BM	span BM	rgt BM	lft SF	rgt SF
1	0.0	16.4	0.0	18.5	-18.5

Required Steel Areas (mm square)

Span	Top L	Bot L	Top M	Bot M	Top R	Bot R
1	202	0	0	202	202	0

Maximum Spacing of Shear Stirrups in mm

Span	leg	L-zone	spacing	dia.	R-zone	spacing	dia.	Rest-spc	dia.
1	2	0.85	437	8	0.85	437	8	437	8

Span 1
Span/Depth 5.1
Allowable 42.1

202	0	202 Requ. Top
0 Φ 12	2 Φ 12	0 Φ 0
0 Φ 16	0 Φ 0	2 Φ 16
226	226	402 Prov. Top
	span 1	
0	202	0 Requ. Bot
0 Φ 0	2 Φ 16	0 Φ 0
0 Φ 0	0 Φ 0	0 Φ 0
0	402	0 Prov. Bot

SPANS Bent and Beam Analysis Program V4.1 SPANS
SPANS Prepared by H. Saffarini 2/2/93 SPANS

coordor-top beam

Number of spans = 1 Number of load cases = 1

Span	Length	Width	Depth	Flange thickness	Flange width
1	4.600	0.600	0.300	0.000	0.600

Load case number : 1

Span	UDL	Load 1		Load 2		Load 3		Load 4		Load 5	
		Val	Dis	Val	Dis	Val	Dis	Val	Dis	Val	Dis
1	11.03	17.8	2.3	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Span Line Load From Length Intensity

Support	Width	Redistribution
1	0.000	0 %
2	0.000	0 %

Envelope

Span	lft BM	span BM	rgt BM	lft SF	rgt SF
1	-0.0	49.6	-0.0	34.3	-34.3

Required Steel Areas (mm square)

Span	Top L	Bot L	Top M	Bot M	Top R	Bot R
1	242	0	0	555	242	0

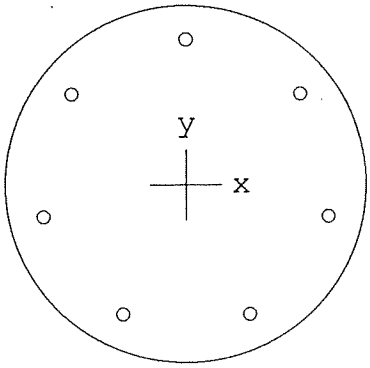
Maximum Spacing of Shear Stirrups in mm

Span	leg	L-zone	spacing	dia.	R-zone	spacing	dia.	Rest-spc	dia.
1	2	1.15	146	8	1.15	146	8	146	8

Span 1
Span/Depth 17.4
Allowable 33.2

242	0	242	Requ. Top
0 Φ 12	4 Φ 12	0 Φ 0	
0 Φ 16	0 Φ 0	4 Φ 12	
452	452	452	Prov. Top
	span 1		
0	555	0	Requ. Bot
0 Φ 0	4 Φ 14	0 Φ 14	
0 Φ 0	0 Φ 0	0 Φ 0	
0	615	0	Prov. Bot

هاتف: ٦٤٤٠٨٨، ٦١٢٣٧٧ فاكس: ٦١٢٣٨٠ ص.ب ٨٣٠٧٤٦ عمان - الأردن



400 mm diam.

c = 21 MPa

fy = 414 MPa

Confinement: Spiral

clr cover = 30 mm

spacing = 125 mm

7 N-15 at 1.11%

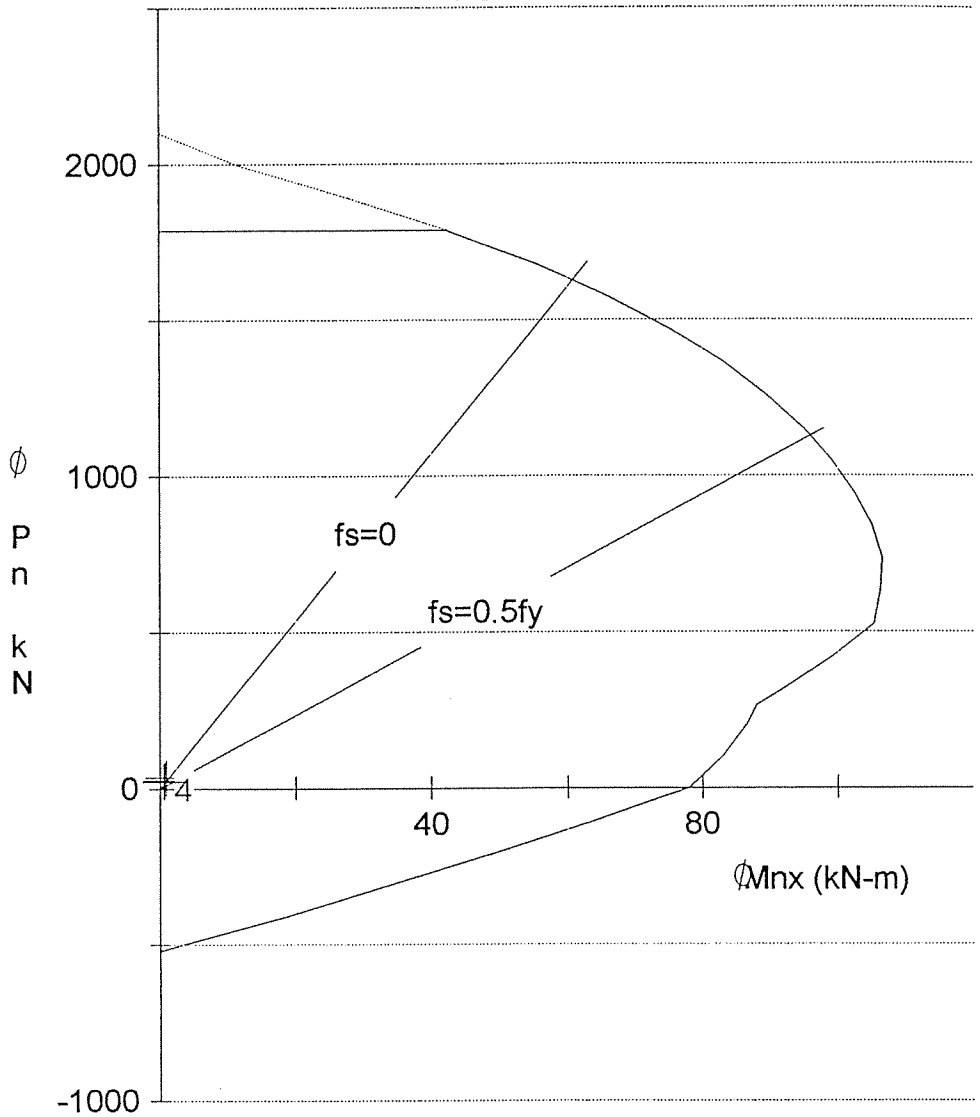
As = 1400 mm^2

Ix = 1.257e+009 mm^4

Iy = 1.257e+009 mm^4

Xo = 0 mm

Yo = 0 mm



Licensed To: Licensee name not yet specified.

File name: C:\UNPILE.COL

Project: Dead Sea Complex

Column Id: 400 mm column

Engineer: Hassan Anas

Date: 15/1/2000 Time: 15:11:53

Code: ACI 318-89

Units: Metric

Material Properties:

Ec = 23168 MPa eu = 0.003 mm/mm

fc = 17.65 MPa Es = 199955 MPa

Betal = 0.85

Stress Profile: Block

phi(c) = 0.75, phi(s) = 0.90

X-axis slenderness is considered; k(b) = 1.00 k(s) = 1.20

هاتف: ٦٤٤٠٨٨ - ٦١٢٢٧٧ فاكس: ٦١٢٢٨٠ ص.ب ٨٢٠٧٤٦ عمان - الأردن

Concrete Base Design :

Input Data

Base Length A (m)		1
Base Width B (m)		1
Column(s)	Col 1	Col 2
C (m)	0.4	
D (m)		
E (m)		
F (m)		
Stub column height X (m)		1
Base Depth Y (m)		.4
Soil Cover Z (m)		0.8
Concrete Density (kN/m3)		25
Soil Density (kN/m3)		20
Soil friction angle (°)		35
Base friction constant		1.4
Reinf. depth top X (mm)		50
Reinf. depth top Y (mm)		50
Reinf. depth bottom X (mm)		50
Reinf. depth bottom Y (mm)		50
Min Load Factor: self weight		1.5

Allow Bearing Press. (kN/m²)	250
S.F. Overturning (ULS)	1
S.F. Slip (ULS)	1.5
fcu base (MPa)	25
fcu columns (MPa)	25
fy (MPa)	414

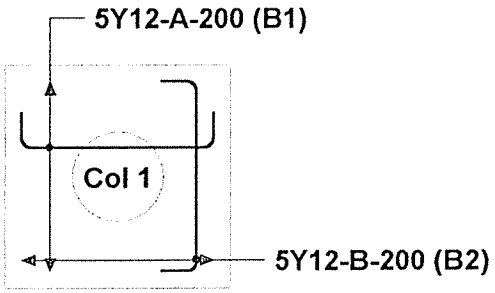
		Loads						
Load Case	Column no.	LF min	LF max	P (kN)	Hx (kN)	Hy (kN)	Mx (kNm)	My (kNm)
1	1	1	1	35				

Output for Load Case 1

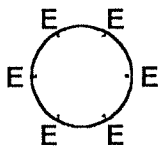
OUTPUT FOR LOAD CASE 1	
Max. soil pressure (kPa)	62.44
SF overturning (SLS)	>100
SF overturning (ULS)	>100
Safety Factor slip (ULS)	>100
Safety Factor uplift (ULS)	>100
BOTTOM:	
Design moment X (kNm)	1.67
Reinforcement X (mm²/m)	13
Design moment Y (kNm)	1.67
Reinforcement Y (mm²/m)	13
TOP:	
Design moment X (kNm)	0.00
Reinforcement X (mm²/m)	0
Design moment Y (kNm)	0.00
Reinforcement Y (mm²/m)	0
Linear shear X (kN)	0.000
vc X (MPa)	0.347
Linear shear Y (kN)	0.000
vc Y (MPa)	0.347
Linear shear other (kN)	0.000
Punching shear (kN)	0.000
vc Punch	0.347

PROKON Software Consultants (Pty) Ltd Internet: http://www.prokon.com E-Mail : mail@prokon.com	Job Number		Sheet
	Job Title		
	Client		
	Calcs by	Checked by	Date

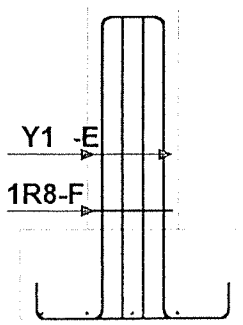
Schematic reinforcement of Base



PLAN

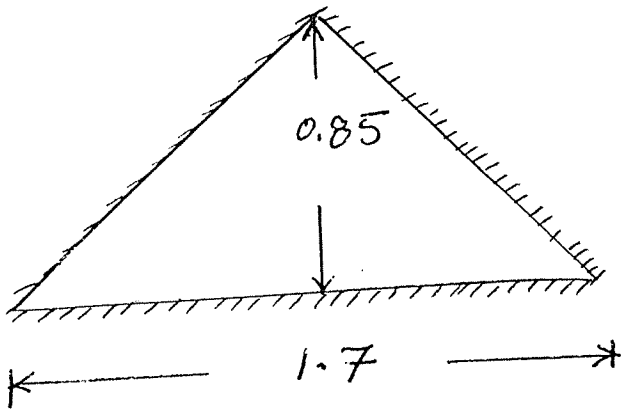


Section:Column 1



SECTION

Design of Lower Traingular slab :-



$w_u = 8.325\ KN/m^2$

$l_x/l_y = 1.7/0.85 \approx 2.0$

$M_x = \alpha_x P \rightarrow \alpha_x = 0.0324$

$M_y = \alpha_y P \rightarrow \alpha_y = 0.0377$

$P = \frac{1}{2} P\, l_x\, l_y = \frac{1}{2} \times 8.325 \times 1.7 \times 0.85 = 6.0148$

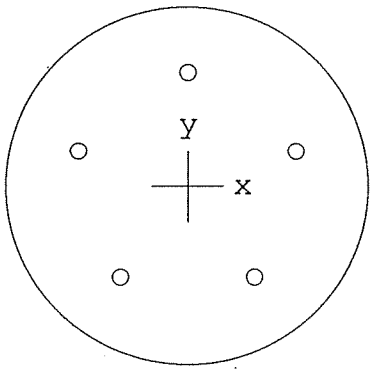
$\therefore M_x = 0.0324 \times 6.0148 = 0.195\ KN-m$

$M_y = 0.0377 \times 6.0148 = 0.2267\ KN-m$

USE Min Reinf $= 0.002 \times 100 \times 10 = 2 cm^2/m$

USE $\Phi 10 @ 20$

CH



250 mm diam.

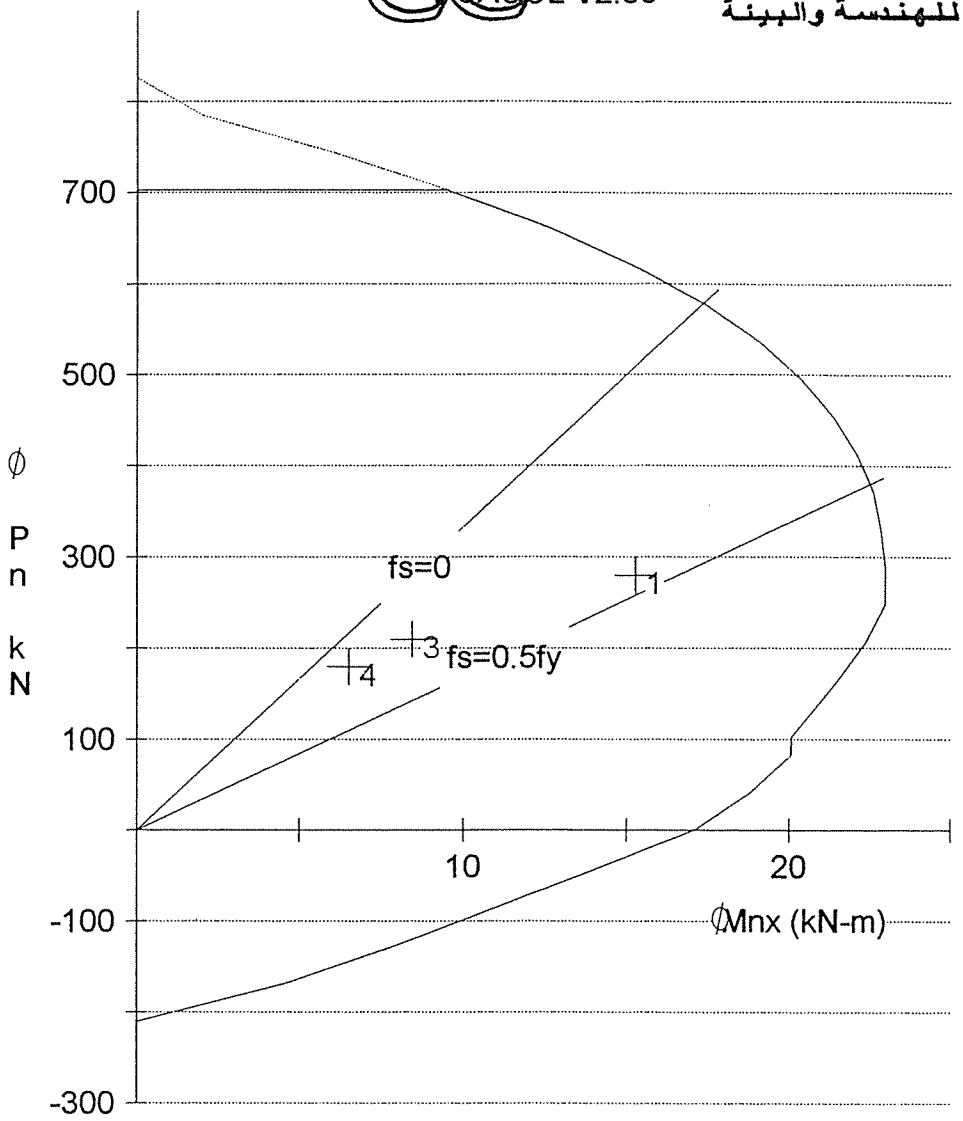
f'c = 21 MPa

fy = 414 MPa

Confinement: Spiral
clr cover = 40 mm
spacing = 81 mm
5 N-12 at 1.15%
As = 565 mm^2

Ix = 1.917e+008 mm^4
Iy = 1.917e+008 mm^4

Xo = 0 mm



censed To: Licensee name not yet specified.

File name: C:\COMCOC4.COL

Project: DEAD SEA COMPLEX

Column Id: 500 mm INTERIOR COL.

Engineer: HASSAN AL-KHAMRAH

Date: 5/2/2000 Time: 15:11:53

Code: ACI 318-89

Units: Metric

Material Properties:

Ec = 23168 MPa eu = 0.003 mm/mm

fc = 17.65 MPa Es = 199955 MPa

Betal = 0.85

Stress Profile: Block

phi(c) = 0.75, phi(b) = 0.90

X-axis slenderness is considered; k(b) = 1.00 k(s) = 1.20