2.2. Stay Cable Bridge (P12-P17)

I. QUANTITY SURVEYING FOR PIER No.12

1. CONCRETE

1.1) BEAM

V1 = (23*3*4) - (1.5*4/2)*4*2 = 252.0 m^3

1.2) COLUMN

v1 = {(4*4*19)-(1*1/2*19)*4}*2 = 532.0 m^3

v2 = 1.5*2*7*1 = 21.0 m^3

V2 = v1 + v2 = 553.0 m^3

1.3) FOOTING

v1 = {(10.5*2.5)+(4.2+10.5)/2*0.5}*18 = 538.7

v2 = 0.1*1.5*3*18 = 8.1

V3 = v1 - v2 = 530.6 m^3

2. FORM

2.1) BEAM

A1 = {(23*3 -(1.5*4/2)*2}*2+4*{1.5+SQRT(1.5^2+4^2)}*2 = 172.2 m^2

2.2) COLUMN

a1 = (1*4+2*4)*19*2 = 456.0 m^2

a2= 1.5*7*2 = 21.0 m^2

A2 = a1 + a2 = 477.0 m^2

2.3) FOOTING

A3= ([10.5+2.5*2+3.189*2+4.2])*18 +{(10.5*18)-(1.50^2*PI()/4*12)} = 637.2 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= ([10.5+18]*2)*3*2 = 342.0 m^2

3.2) 4m ≤ H ≤ 30m

A2= (23+4)*2*(19+3)*2 = 2376 m^2

4. SUPPORT

ALLOWABLE LOAD

P = {(7*3*4)+2*(4*3*4)}*2.5/{(7*4)+2*(4*4)} = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 2*4*4 = 32 m^2

V = 3*{(A1+A2)} = 180 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 1.5m

L = 81m

n = 12 nos

5.2) CONCRETE

v1 = 1.5^2*PI()/4*81 = 143.1 m^3

v2 = 0 = 0.0 m^3

V = v1+v2 = 143.1 m^3

5.3) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	31.682*12	=	380.2 m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	34.6*12	=	415.2 m
N>=40 (l_3)	$L_3 = l_3 * n$	=	14.718*12	=	176.6 m

5.4) EXCAVATED MATERIALS

v1 =	PI()* D^2/ 4 *L_1	=	PI()*1.5^2/4*380.2	= 671.8	m^3
v2 =	PI()*D^2/ 4 * (L_2+L_3)	=	PI()*1.5^2/4*(415.2+176.6)	= 1045.8	m^3
V1 =	v1+v2			= 1717.7	m^3

5.5) BACK FILL

V2 = PI()* D^2/ 4*n *L_4 = PI()*1.5^2/4*12*0.4 = 6.4 m^3

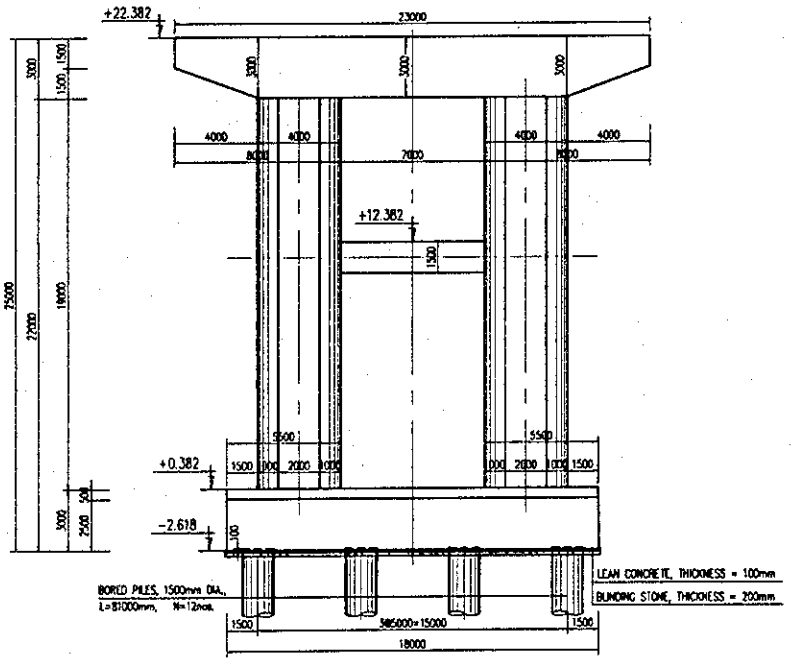
5.6) EXCESS SOIL

V3 = V1-V2 = (v1+v2)-V2 = 1711.3 m^3

GENERAL VIEW OF PIER No.12

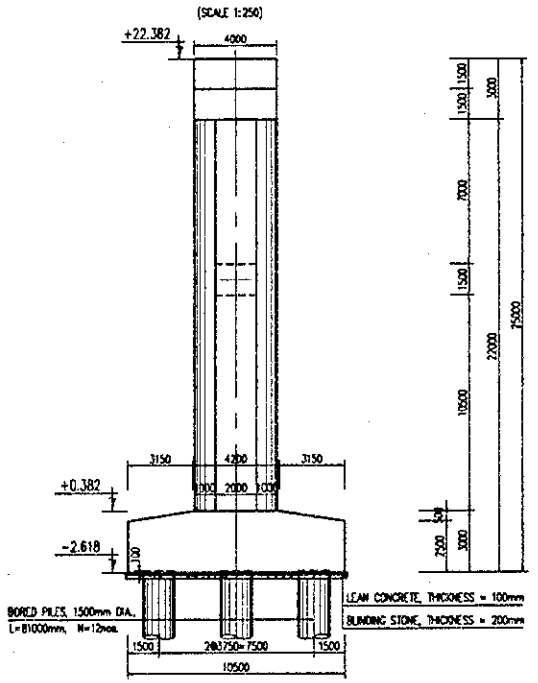
ELEVATION

(SCALE 1:250)



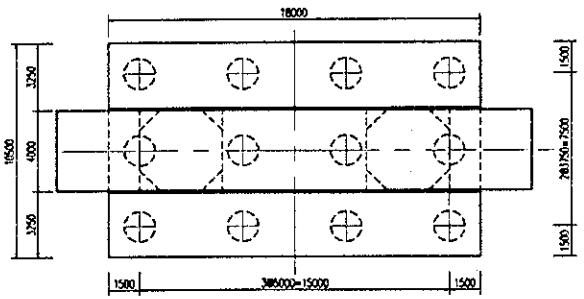
SIDE ELEVATION

(SCALE 1:250)



PLAN

(SCALE 1:250)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

6. EARTH WORK

6.1) EXCAVATION FOR FOUNDATION

A1 =	(11.5*2+1.75*2)/2*3.758	= 49.8	m^2
V1 =	A1*18 - PI()* D^2/ 4 *3.758*12	= 816.6	m^3

6.2) EXCESS SOIL

v1 =	FOOTING	= 530.6	m^3
v2 =	{(4*4*0.758)-(1*1/2*0.758)*4}*2	= 21.2	m^3
V2 =	v1+ v2	= 551.8	m^3

6.3) BLINDING CONCRETE CLASS G

V3 =	A1*0.3 - PI()D^2/4*0.3*12	= 8.6	m^3

6.4) BACK FILL

V =	V1 - V2 - V3	= 256.2	m^3

1. CONCRETE

		P12
BEAM	V1 (m^3)	252.0
COLUMN	V2 (m^3)	553.0
FOOTING	V3 (m^3)	530.6
TOTAL (m^3)		1335.6

2. FORM

		P12
BEAM	A1 (m^2)	172.2
COLUMN	A2 (m^2)	477.0
FOOTING	A3 (m^2)	637.2
TOTAL (m^2)		1286.4

3. SCAFFOLDING WORK

		P12
A (m^2)	H < 4m	342.0
	4m ≤ H < 30m	2376.0

4. SUPPORT

	P12
A1 (m^2)	28.0
A2 (m^2)	32.0
V (m^3)	180.0

5. CAST-IN-PLACE-CONCRETE PILE

		P12
PILE DIMENSION	D (m)	1.5
	L (m)	81.0
	n (nos.)	12.0
CONCRETE	V (m^3)	143.1
EXCAVATION LENGTH	N < 20 (l_1) (m)	31.6
	L_1 (m)	379.2
	20 ≤ N ≤ 40 (l_2) (m)	34.6
	L_2 (m)	415.2
	N ≥ 40 (l_3) (m)	14.8
	L_3 (m)	177.6
EXCAVATED MATERIALS	V1 (m^3)	1717.7
BACK FILL	V2 (m^3)	6.4
EXCESS SOIL	V3 (m^3)	1711.3

6. EARTH WORK

		P12
EXCAVATION FOR FOUNDATION	V1 (m^3)	816.6
EXCESS SOIL	V2 (m^3)	551.8
BLINDING CONCRETE	V3 (m^3)	8.6
BACK FILL	V (m^3)	256.2

7).REINFORCEMENT OF PIER 12

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
BEAM	S1	32	27350	31	847.9	5352.5
	S2	32	10170	62	630.5	3980.6
	S3	18	10172	75	762.9	1524.3
	S3-1	18	8864	40	354.6	708.4
	S4	32	29117	31	902.6	5698.3
	S5	20	25287	16	404.6	997.7
	S6	20	20467	18	368.4	908.5
	S7	18	4464	225	1004.4	2006.8
	S8-1	18	6888	300	2066.4	4128.7
	S8-2	18	6694	160	1071.0	2139.9
COLUMN	C1	32	25740	404	10399.0	65648.6
	C2	18	9143	584	5339.5	10668.3
	C3	18	8728	584	5097.2	10184.1
	C4	18	4408	296	1304.8	2606.9
	H1	32	15215	60	912.9	5763.1
	H2	16	5104	63	321.6	507.4
	H3	16	2408	189	455.1	718.2
	H4	16	3754	126	473.0	746.4
FOOTING	F1	32	20685	83	1716.9	10838.5
	F2	32	16673	143	2384.2	15051.7
	F3	32	11577	143	1655.5	10451.2
	F4-1	25	8514	4	34.1	131.2
	F4-2	25	11174	22	245.8	947.2
	F5-1	32	26735	37	989.2	6244.8
	F5-2	32	26271	46	1208.5	7629
	F6	25	19747	22	434.4	1673.9
	F7-1	22	6227	210	1307.7	3902.1
	F7-2	22	6627	122	808.5	2412.5
TOTAL	D=16(mm)				1972.0	(kg)
	D=18(mm)				33967.4	(kg)
	D=20(mm)				1906.2	(kg)
	D=22(mm)				6314.6	(kg)
	D=25(mm)				2752.3	(kg)
	D=32(mm)				136658.3	(kg)
	TOTAL				183570.8	(kg)

Summary of Quantity table of pier No.12

Items			Unit	Pier 12
Pile	Number of piles		Pile	12
	Total length bored piles D=1500mm Dia.		m	972.0
	Concrete piles class D		m^3	1717.7
	Renforcement	D10	kg	15224.4
		D16	kg	354.0
		D22	kg	5090.4
		D28	kg	100795.2
		D32	kg	73908.0
		Total	kg	195372.0
Pier	Concrete class E		m^3	1335.6
	Reinforcement	D16	kg	1972.0
		D18	kg	33967.4
		D20	kg	1906.2
		D22	kg	6314.6
		D25	kg	2752.3
		D32	kg	136658.3
		Total	kg	183570.8
	Form	Curve	m^2	0.0
		Flat	m^2	1286.4
	Scaffolding work	$H < 4m$	m^2	342.0
		$4m \leq H < 30m$	m^2	2376.0
	Support		m^3	180.0
	Earth work	Excavation for foundation	m^3	2534.3
		Excess soil	m^3	2263.1
		Blinding Concrete class G	m^3	8.6
		Back fill	m^3	262.6

II. QUANTITY SURVEYING FOR PIER No.13

1. CONCRETE

1.1) BEAM

V1 = ([15-2]*3*4) + ([2+4]*1/2)*3*2 = 174 m^3

1.2) COLUMN

v1 = {(4*4*21.6)-(1*1/2*21.6)*4}*2 = 604.8 m^3

v2 = 1.5*2*7*2 = 42.0 m^3

V2 = v1 + v2 = 646.8 m^3

1.3) FOOTING

v1 = {(10.5*2.5)+(4.2+10.5)/2*0.5}*18 = 538.7

v2 = 0.1*1.5*3*18 = 8.1

V3 = v1 - v2 = 530.6 m^3

2. FORM

2.1) BEAM

A1 = {(15-2)*2+(1+2+1)*2}*3 = 102 m^2

2.2) COLUMN

a1 = (1*4+2*4)*21.6*2 = 518.4 m^2

a2= 1.5*7*2 = 42.0 m^2

A2 = a1 + a2 = 560.4 m^2

2.3) FOOTING

A3= ([10.5+2.5*2+3.189*2+4.2])*18 +{(10.5*18)-(1.50^2*PI()/4*12)} = 637.2 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= ([10.5+18]*2)*3*2 = 342.0 m^2

3.2) 4m ≤ H ≤ 30m

A2= (15+4)*2*(21.6+3)*2 = 2657 m^2

4. SUPPORT

ALLOWABLE LOAD

P = (7*3*4)*2.5/(7*4) = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 0 = 0 m^2

V = 3*{(A1+A2)} = 84 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 1.5m

L = 82m

n = 12 nos

5.2) CONCRETE

v1 = 1.5^2*PI()/4*82 = 144.9 m^3

v2 = 0 = 0.0 m^3

V = v1+v2 = 144.9 m^3

5.3) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	31.94*12	=	383.28 m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	34.6*12	=	415.2 m
N>=40 (l_3)	$L_3 = l_3 * n$	=	15.46*12	=	185.52 m

5.4) EXCAVATED MATERIALS

v1 =	$PI()* D^2/ 4 *L_1$	=	PI()*1.5^2/4*383.28	= 677.3 m^3
v2 =	$PI()*D^2/ 4 * (L_2+L_3)$	=	PI()*1.5^2/4*(415.2+185.5)	= 1061.6 m^3
V1 =	v1+v2			= 1738.9 m^3

5.5) BACK FILL

V2 = $PI()* D^2/ 4*n *L_4$ = PI()*1.5^2/4*12*0.4 = 6.4 m^3

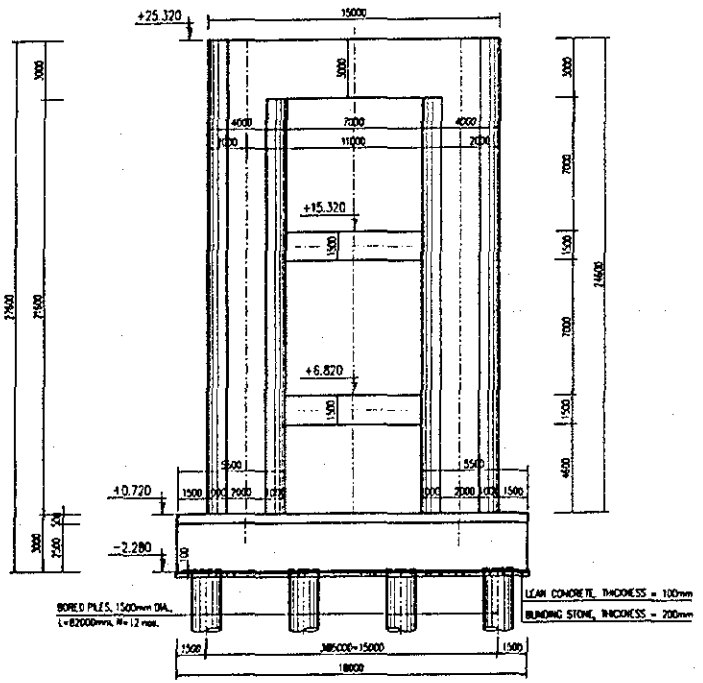
5.6) EXCESS SOIL

V3 = V1-V2 = (v1+v2)-V2 = 1732.5 m^3

GENERAL VIEW OF PIER No.13

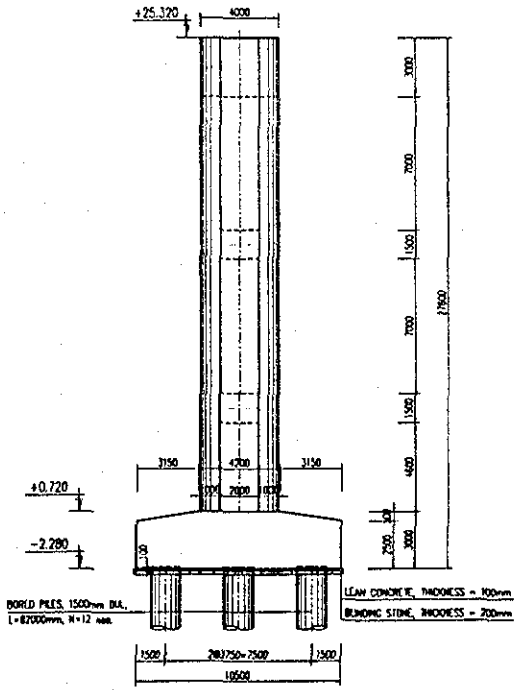
ELEVATION

(SCALE 1:250)



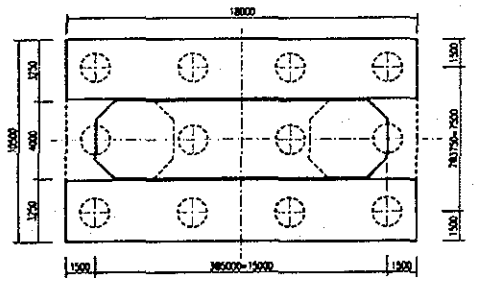
SIDE ELEVATION

(SCALE 1:250)



PLAN

(SCALE 1:250)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

6. EARTH WORK

6.1) EXCAVATION FOR FOUNDATION

A1 =	(11.5*2+1.75*2)/2*3.42	= 45.3	m^2
V1 =	A1*18 - PI()* D^2/ 4 *3.42 *12	= 743.1	m^3

6.2) EXCESS SOIL

v1 =	FOOTING	= 530.6	m^3
v2 =	{(4*4*0.42)-(1*1/2*0.42)*4}*2	= 11.8	m^3
V2 =	v1+ v2	= 542.3	m^3

6.3) BLINDING CONCRETE CLASS G

V3 =	A1*0.3 - PI()D^2/4*0.3*12	= 7.2	m^3

6.4) BACK FILL

V =	V1 - V2 - V3	= 193.6	m^3

1. CONCRETE

		P13
BEAM	V1 (m^3)	174.0
COLUMN	V2 (m^3)	646.8
FOOTING	V3 (m^3)	530.6
TOTAL (m^3)		1351.4

2. FORM

		P13
BEAM	A1 (m^2)	102.0
COLUMN	A2 (m^2)	560.4
FOOTING	A3 (m^2)	637.2
TOTAL (m^2)		1299.6

3. SCAFFOLDING WORK

		P13
A (m^2)	H < 4m	342.0
	4m ≤ H < 30m	2656.8

4. SUPPORT

	P13
A1 (m^2)	28.0
A2 (m^2)	0.0
V (m^3)	84.0

5. CAST-IN-PLACE-CONCRETE PILE

		P13
PILE DIMENSION	D (m)	1.5
	L (m)	82.0
	n (nos.)	12.0
CONCRETE	V (m^3)	144.9
EXCAVATION LENGTH	N < 20 (l_1) (m)	31.9
	L_1 (m)	383.3
	20 ≤ N ≤ 40 (l_2) (m)	34.6
	L_2 (m)	415.2
	N ≥ 40 (l_3) (m)	15.5
	L_3 (m)	185.5
EXCAVATED MATERIALS	V1 (m^3)	1738.9
BACK FILL	V2 (m^3)	6.4
EXCESS SOIL	V3 (m^3)	1732.5

6. EARTH WORK

		P13
EXCAVATION FOR FOUNDATION	V1 (m^3)	743.1
EXCESS SOIL	V2 (m^3)	542.3
BLINDING CONCRETE	V3 (m^3)	7.2
BACK FILL	V (m^3)	193.6

7).REINFORCEMENT OF PIER 13

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
BEAM	S1	32	17685	45	795.8	5024
	S1-1	32	16602	44	730.5	4611.6
	S2-1	18	10192	65	662.5	1323.6
	S2-2	18	4484	130	582.9	1164.7
	S2-3	18	3427	16	54.8	109.6
	S3	20	35350	19	671.7	1656.3
	S4	18	6870	300	2061.0	4117.9
COLUMN	C1	32	31380	404	12677.5	80033.2
	C2	18	9143	652	5961.2	11910.5
	C3	18	8728	652	5690.7	11369.9
	C4	18	4408	326	1437.0	2871.1
	H1	32	15215	120	1825.8	11526.3
	H2	16	5104	126	643.1	1014.8
	H3	16	2408	378	910.2	1436.3
	H4	16	3754	252	946.0	1492.8
FOOTING	F1	32	20685	83	1716.9	10838.5
	F2	32	16673	143	2384.2	15051.7
	F3	32	11577	143	1655.5	10451.2
	F4-1	25	8514	4	34.1	131.2
	F4-2	25	11174	22	245.8	947.2
	F5-1	32	26735	37	989.2	6244.8
	F5-2	32	26271	46	1208.5	7629
	F6	25	19747	22	434.4	1673.9
	F7-1	22	6227	210	1307.7	3902.1
	F7-2	22	6627	122	808.5	2412.5
TOTAL	D=16(mm)				3943.9	(kg)
	D=18(mm)				32867.3	(kg)
	D=20(mm)				1656.3	(kg)
	D=22(mm)				6314.6	(kg)
	D=25(mm)				2752.3	(kg)
	D=32(mm)				151410.3	(kg)
	TOTAL				198944.7	(kg)

Summary of Quantity table of pier No.13

Items			Unit	Pier 13
Pile	Number of piles		Pile	12
	Total length bored piles D=1500mm Dia.		m	984.0
	Concrete piles class D		m^3	1738.9
	Renforcement	D10	kg	15438.0
		D16	kg	354.0
		D22	kg	5090.4
		D28	kg	95698.8
		D32	kg	68979.6
		Total	kg	185560.8
Pier	Concrete class E		m^3	1351.4
	Reinforcement	D16	kg	3943.9
		D18	kg	32867.3
		D20	kg	1656.3
		D22	kg	6314.6
		D25	kg	2752.3
		D32	kg	151410.3
		Total	kg	198944.7
	Form	Curve	m^2	0.0
		Flat	m^2	1299.6
	Scaffolding work	H < 4m	m^2	342.0
		4m ≤ H < 30m	m^2	2656.8
	Support		m^3	84.0
	Earth work	Excavation for foundation	m^3	2482.0
		Excess soil	m^3	2274.8
		Blinding Concrete class G	m^3	7.2
		Back fill	m^3	200.0

III. QUANTITY SURVEYING FOR PIER No.14

1. CONCRETE

1.1) BEAM

V1 = ([15-2]*3*4) + ([2+4]*1/2)*3*2 = 174 m^3

1.2) COLUMN

v1 = {(4*4*24.48)-(1*1/2*24.48)*4}*2 = 685.4 m^3

v2 = 1.5*2*7*2 = 42.0 m^3

V2 = v1 + v2 = 727.4 m^3

1.3) FOOTING

v1 = {(10.5*2.5)+(4.2+10.5)/2*0.5}*18 = 538.7

v2 = 0.1*1.5*3*18 = 8.1

V3 = v1 - v2 = 530.6 m^3

2. FORM

2.1) BEAM

A1 = {(15-2)*2+(1+2+1)*2}*3 = 102 m^2

2.2) COLUMN

a1 = (1*4+2*4)*24.48*2 = 587.5 m^2

a2= 1.5*7*2 = 42.0 m^2

A2 = a1 + a2 = 629.5 m^2

2.3) FOOTING

A3= ([10.5+2.5*2+3.189*2+4.2])*18 +{(10.5*18)-(1.50^2*PI()/4*12)} = 637.2 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= ([10.5+18]*2)*3*2 = 342.0 m^2

3.2) 4m ≤ H ≤ 30m

A2= (15+4)*2*(24.48+3)*2 = 2968 m^2

4. SUPPORT

ALLOWABLE LOAD

P = (7*3*4)*2.5/(7*4) = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 0 = 0 m^2

V = 3*{(A1+A2)} = 84 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 1.5m

L = 82m

n = 12 nos

5.2) CONCRETE

v1 = 1.5^2*PI()/4*82 = 144.9 m^3

v2 = 0 = 0.0 m^3

V = v1+v2 = 144.9 m^3

5.3) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	31.94*12	= 383.28 m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	34.6*12	= 415.2 m
N>=40 (l_3)	$L_3 = l_3 * n$	=	15.46*12	= 185.52 m

5.4) EXCAVATED MATERIALS

v1 = PI()* D^2/ 4 *L_1	=	PI()*1.5^2/4*383.28	= 677.3 m^3
v2 = PI()*D^2/ 4 * (L_2+L_3)	=	PI()*1.5^2/4*(415.2+185.52)	= 1061.6 m^3
V1 = v1+v2			= 1738.9 m^3

5.5) BACK FILL

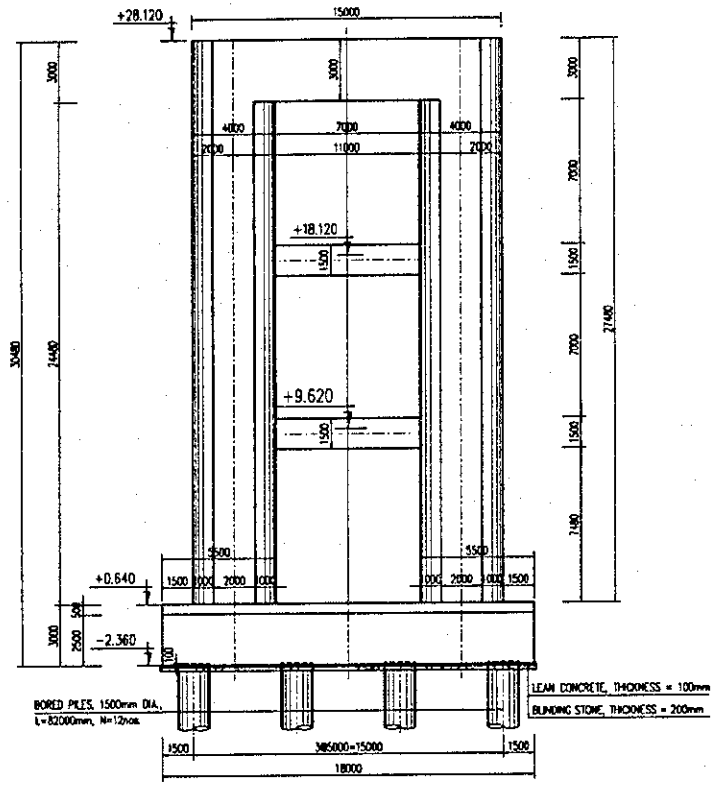
V2 = PI()* D^2/ 4*n *L_4 = PI()*1.5^2/4*12*0.4 = 6.4 m^3

5.6) EXCESS SOIL

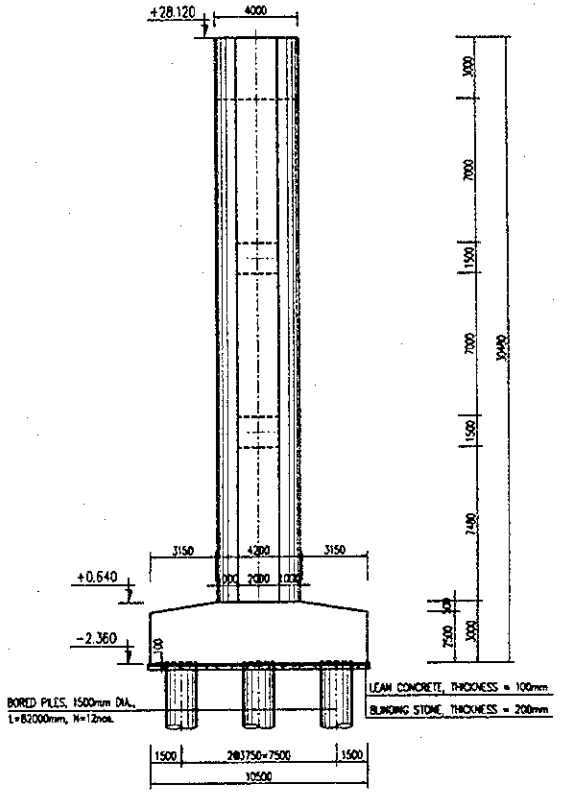
V3 = V1-V2 = (v1+v2)-V2 = 1732.5 m^3

GENERAL VIEW OF PIER No.14

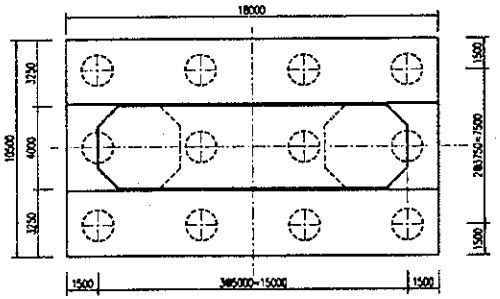
ELEVATION
(SCALE 1:250)



SIDE ELEVATION
(SCALE 1:250)



PLAN
(SCALE 1:250)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

6. EARTH WORK

6.1) EXCAVATION FOR FOUNDATION

A1 =	(11.5*2+1.75*2)/2*3.5	= 46.4	m^2
V1 =	A1*18 - PI()* D^2/ 4 *3.5 *12	= 760.5	m^3

6.2) EXCESS SOIL

v1 =	FOOTING	= 530.6	m^3
v2 =	{(4*4*0.5)-(1*1/2*0.5)*4}*2	= 14.0	m^3
V2 =	v1+ v2	= 544.6	m^3

6.3) BLINDING CONCRETE CLASS G

V3 =	A1*0.3 - PI()D^2/4*0.3*12	= 7.6	m^3

6.4) BACK FILL

V =	V1 - V2 - V3	= 208.4	m^3

1. CONCRETE

		P14
BEAM	V1 (m^3)	174.0
COLUMN	V2 (m^3)	727.4
FOOTING	V3 (m^3)	530.6
TOTAL (m^3)		1432.0

2. FORM

		P14
BEAM	A1 (m^2)	102.0
COLUMN	A2 (m^2)	629.5
FOOTING	A3 (m^2)	637.2
TOTAL (m^2)		1368.7

3. SCAFFOLIDING WORK

		P14
A (m^2)	H < 4m	342.0
	4m ≤ H < 30m	2967.8

4. SUPPORT

	P14
A1 (m^2)	28.0
A2 (m^2)	0.0
V (m^3)	84.0

5. CAST-IN-PLACE-CONCRETE PILE

		P14
PILE DIMENSION	D (m)	1.5
	L (m)	82.0
	n (nos.)	12.0
CONCRETE	V (m^3)	144.9
EXCAVATION LENGTH	N < 20 (l_1) (m)	31.9
	L_1 (m)	383.3
	20 ≤ N ≤ 40 (l_2) (m)	34.6
	L_2 (m)	415.2
	N ≥ 40 (l_3) (m)	15.5
	L_3 (m)	185.5
EXCAVATED MATERIALS	V1 (m^3)	1738.9
BACK FILL	V2 (m^3)	6.4
EXCESS SOIL	V3 (m^3)	1732.5

6. EARTH WORK

		P14
EXCAVATION FOR FOUNDATION	V1 (m^3)	760.5
EXCESS SOIL	V2 (m^3)	544.6
BLINDING CONCRETE	V3 (m^3)	7.6
BACK FILL	V (m^3)	208.4

7).REINFORCEMENT OF PIER 14

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGT (m)	TOTAL WEIGH (kg)
BEAM	S1	32	17685	45	795.8	5024
	S1-1	32	16602	44	730.5	4611.6
	S2-1	18	10192	65	662.5	1323.6
	S2-2	18	4484	130	582.9	1164.7
	S2-3	18	3427	16	54.8	109.6
	S3	20	35350	19	671.7	1656.3
	S4	18	6870	300	2061.0	4117.9
COLUMN	C1	32	34188	404	13812.0	87194.9
	C2	18	9143	732	6692.7	13372
	C3	18	8728	732	6388.9	12765
	C4	18	4408	366	1613.3	3223.4
	H1	32	15215	120	1825.8	11526.3
	H2	16	5104	126	643.1	1014.8
	H3	16	2408	378	910.2	1436.3
	H4	16	3904	252	983.8	1552.4
FOOTING	F1	32	20685	83	1716.9	10838.5
	F2	32	16673	143	2384.2	15051.7
	F3	32	11577	143	1655.5	10451.2
	F4-1	25	8514	4	34.1	131.2
	F4-2	25	11174	22	245.8	947.2
	F5-1	32	26735	37	989.2	6244.8
	F5-2	32	26271	46	1208.5	7629
	F6	25	19747	22	434.4	1673.9
	F7-1	25	6331	210	1329.5	5122.6
	F7-2	25	6731	122	821.2	3164
TOTAL	D=16(mm)				4003.5	(kg)
	D=18(mm)				36076.2	(kg)
	D=20(mm)				1656.3	(kg)
	D=25(mm)				11038.9	(kg)
	D=32(mm)				158572.0	(kg)
	TOTAL				211346.9	(kg)

Summary of Quantity table of pier No.14

Items			Unit	Pier 14
Pile	Number of piles		Pile	12
	Total length bored piles D=1500mm Dia.		m	984.0
	Concrete piles class D		m^3	1738.9
	Renforcement	D10	kg	15438.0
		D16	kg	354.0
		D22	kg	5090.4
		D28	kg	95698.8
		D32	kg	68979.6
		Total	kg	185560.8
Pier	Concrete class E		m^3	1432.0
	Reinforcement	D16	kg	4003.5
		D18	kg	36076.2
		D20	kg	1656.3
		D25	kg	11038.9
		D32	kg	158572.0
		Total	kg	211346.9
	Form	Curve	m^2	0.0
		Flat	m^2	1368.7
	Scaffoliding work	H < 4m	m^2	342.0
		4m ≤ H < 30m	m^2	2967.8
	Support		m^3	84.0
	Earth work	Excavation for foundation	m^3	2499.4
		Excess soil	m^3	2277.1
		Blinding Concrete class G	m^3	7.6
		Back fill	m^3	214.8

IV. QUANTITY SURVEYING FOR PIER No.15

1. CONCRETE

1.1) BEAM

V1 = ([15-2]*3*4) + ([2+4]*1/2)*3*2 = 174 m^3

1.2) COLUMN

v1 = {(4*4*21.12)-(1*1/2*21.12)*4}*2 = 591.4 m^3

v2 = 1.5*2*7*2 = 42.0 m^3

V2 v1 + v2 = 633.4 m^3

1.3) FOOTING

v1 = (24*19)*3.5-{(0.25^2*1.5)*[(24+19)*2]} = 1587.94

v2 = 18*PI()*2*2.2^2/4 = 136.8 m^3

V3 v1 - v2 = 1451.1 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*6)+([0.5+0.25]/2)*0.25 = 1.89 m^2

V4 = (4*1.89*2.29)+(36*1.89*1.99)+(4*1.89*1.48) = 163.9 m^3

2. FORM

2.1) BEAM

A1 = {(15-2)*2+(1+2+1)*2}*3 = 102 m^2

2.2) COLUMN

a1 = (1*4+2*4)*21.12*2 = 506.9 m^2

a2= 1.5*7*2 = 42.0 m^2

A2 a1 + a2 = 548.9 m^2

2.3) FOOTING

A3= ([24+19]*2)*3.5+{(24*19)-(2.2^2*PI()/4*18)} = 688.6 m^2

2.4) PRECAST SKIRTING UNIT

A4= {6+0.3*2+(0.25+2.45)}*4*(2.29+1.99*9+1.48) = 806.5 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= ([24+19]*2)*3.5*2 = 602.0 m^2

3.2) 4m ≤ H ≤ 30m

A2= (15+4)*2*(21.12+3)*2 = 2604.96 m^2

4. SUPPORT

ALLOWABLE LOAD

P = (7*3*4)*2.5/(7*4) = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 0 = 0 m^2

V = 3*{(A1+A2)} = 84 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 2.0m

L = 74m

n = 18 nos

5.2) CONCRETE

v1 = 2.2^2*PI()/4*42 = 159.7 m^3

v2 = 2.0^2*PI()/4*34 = 106.8 m^3

V = v1+v2 = 266.5 m^3

5.3) STEEL CASING (t=16mm)

W= (2.232^2-2.2^2)*PI()/4*7850*42 = 36724.7 kg

5.4) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	55.5*18	= 999	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	7*18	= 126	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	11.5*18	= 207	m

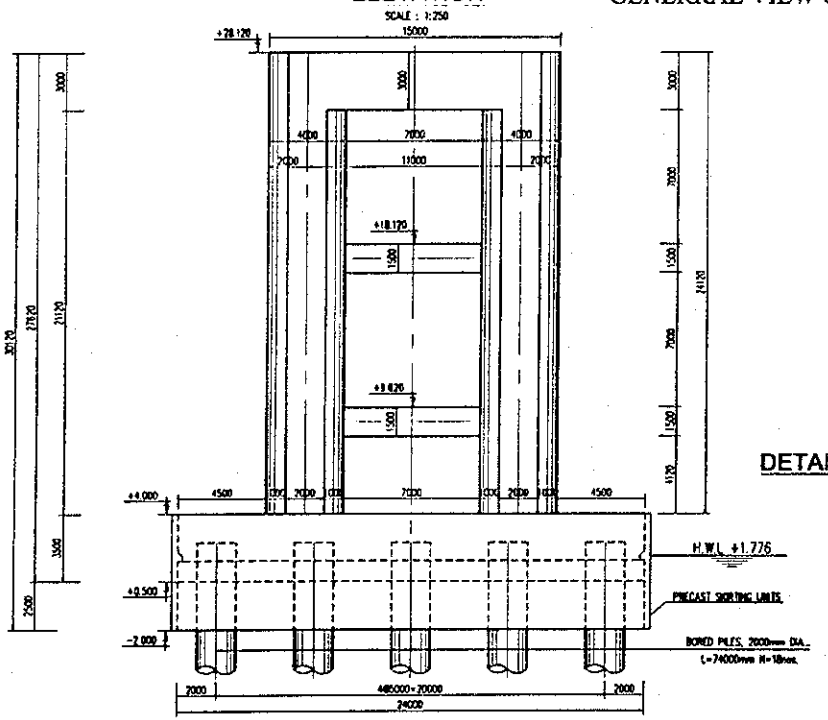
5.5) EXCAVATED MATERIALS

v1 = PI()* D_1^2/ 4 *L_1	=	PI()*2.2^2/4*999	= 3797.5	m^3
v2 = PI()*D^2/ 4 * (L_2+L_3)	=	PI()*2^2/4*(126+207)	= 1046.2	m^3
V = v1+v2			= 4843.7	m^3

GENERRAL VIEW OF PIER No.15

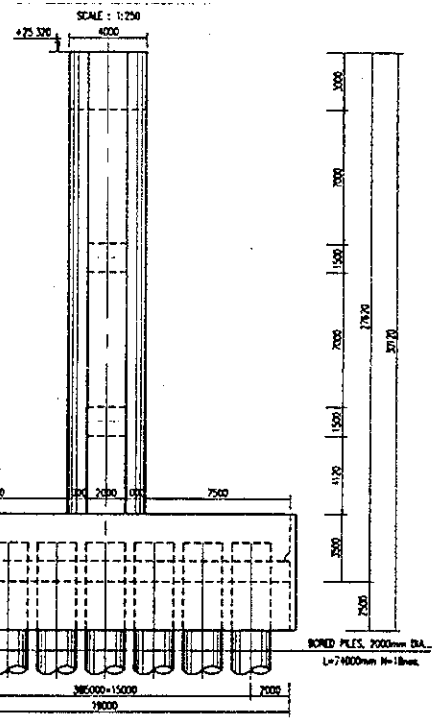
ELEVATION

SCALE : 1:250



SIDE ELEVATION

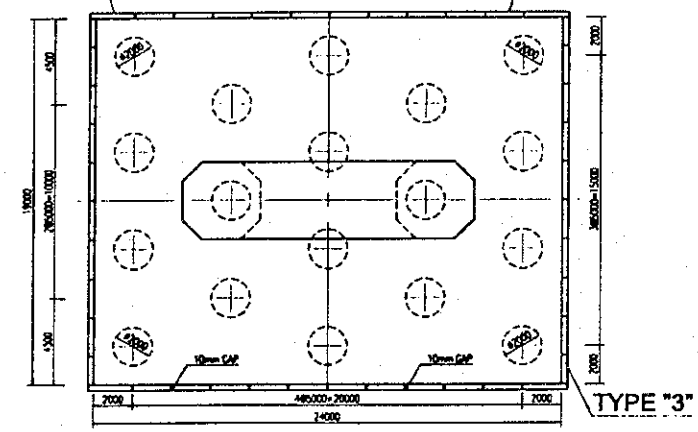
SCALE : 1:250



DETAIL "A"

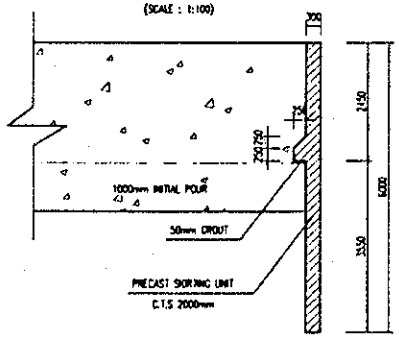
PLAN

SCALE : 1:250



DETAIL "A"

(SCALE : 1:100)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED

1. CONCRETE

		P15
BEAM	V1 (m^3)	174.0
COLUMN	V2 (m^3)	633.4
FOOTING	V3 (m^3)	1451.1
SKIRTING UNIT	V4 (m^3)	163.9
TOTAL (m^3)		2422.4

2. FORM

		P15
BEAM	A1 (m^2)	102.0
COLUMN	A2 (m^2)	548.9
FOOTING	A3 (m^2)	688.6
SKIRTING UNIT	A4 (m^2)	806.5
TOTAL (m^2)		2146.0

3. SCAFFOLDING WORK

		P15
A (m^2)	H < 4m	602.0
	4m ≤ H < 30m	2605.0

4. SUPPORT

	P15
A1 (m^2)	28.0
A2 (m^2)	0.0
V (m^3)	84.0

5. CAST-IN-PLACE-CONCRETE PILE

		P15
PILE DIMENSION	D (m)	2.0
	L (m)	74.0
	n (nos.)	18.0
CONCRETE	V (m^3)	266.5
EXCAVATION LENGTH	N < 20 (l_1) (m)	55.5
	L_1 (m)	999.0
	20 ≤ N ≤ 40 (l_2) (m)	7.0
	L_2 (m)	126.0
	N ≥ 40 (l_3) (m)	11.5
	L_3 (m)	207.0
EXCAVATED MATERIALS	V (m^3)	4843.7
STEEL CASING t=16mm	W(kg)	36724.7

6).REINFORCEMENT OF PIER 15

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
BEAM	S1	32	17685	45	795.8	5024.3
	S1-1	32	16853	44	741.5	4681.5
	S2-1	18	10192	65	662.5	1323.4
	S2-2	18	4484	130	582.9	1164.4
	S2-3	18	3750	16	60.0	119.9
	S3	20	35758	19	679.4	1675.5
	S4	18	6698	375	2511.8	5017.4
COLUMN	C1	32	28348	404	11452.6	72304.1
	C2	18	9143	625	5714.4	11414.9
	C3	18	8728	625	5455.0	10896.8
	C4	16	4408	328	1445.8	2282.0
	H1	32	16880	128	2160.6	13640.9
	H2	16	5036	126	634.5	1001.5
	H3	16	2398	378	906.4	1430.7
	H4	16	3648	252	919.3	1451.0
FOOTING	F1	28	21142	446	9429.3	45578.1
	F2	28	26400	274	7233.6	34964.7
	F3-1	28	1655	156	258.2	1248.0
	F3-2	28	3442	338	1163.4	5623.4
	F3-3	28	4155	104	432.1	2088.7
	F4-1	28	8442	286	2414.4	11670.4
	F4-2	28	6652	156	1037.7	5015.9
	F4-3	28	1652	208	343.6	1660.9
	F5	20	25150	24	603.6	1488.6
	F6	20	24900	6	149.4	368.4
	F7	20	4522	340	1537.5	3791.7
	F8	20	3975	336	1335.6	3293.8
	F9	20	3116	340	1059.4	2612.7
	F10	20	20150	24	483.6	1192.6
	F11	20	19900	6	119.4	294.5
	F12	18	4478	1665	7455.9	14893.7
	B1	28	3196	40	127.8	617.9
	B2	28	4443	200	888.6	4295.2
	B3	28	5689	480	2730.7	13199.3
PRECAST SKIRTING UNITS	P1	16	6200	872	5406.4	8533.1
	P2	16	2400	320	768.0	1212.2
	P3	16	1745	436	760.8	1200.8
	P4	16	2200	2880	6336.0	10000.3
	P5	16	1800	320	576.0	909.1
	P6	20	1700	2180	3706.0	9139.5
TOTAL	D=16(mm)				28020.7	(kg)
	D=18(mm)				44830.5	(kg)
	D=20(mm)				23857.3	(kg)
	D=25(mm)				0.0	(kg)
	D=28(mm)				125962.6	(kg)
	D=32(mm)				95650.8	(kg)
	TOTAL				318321.9	(kg)

Summary of Quantity table of pier No.15

Items			Unit	Pier 15
Pile			Pile	18
			m	1332.0
			m^3	4796.5
	Renforcement	D12	kg	48612.6
		D16	kg	968.4
		D22	kg	10542.6
		D25	kg	114723.0
		D32	kg	250903.8
		STEEL PLATE t=16mm	kg	661045.1
		Total	kg	1086795.5
Pier			m^3	2422.4
	Reinforcement	D16	kg	28020.7
		D18	kg	44830.5
		D20	kg	23857.3
		D25	kg	0.0
		D28	kg	125962.6
		D32	kg	95650.8
		Total	kg	318321.9
	Form	Curve	m^2	0.0
		Flat	m^2	2146.0
	Scaffolding work	H < 4m	m^2	602.0
		4m ≤ H < 30m	m^2	2605.0
			m^3	84.0
	Earth work	Excavation for foundation	m^3	4843.7

V. QUANTITY SURVEYING FOR PIER No.16

1. CONCRETE

1.1) BEAM

V1 = ([15-2]*3*4) + ([2+4]*1/2)*3*2 = 174 m^3

1.2) COLUMN

v1 = {(4*4*18.32)-(1*1/2*18.32)*4}*2 = 513.0 m^3

v2 = 1.5*2*7*1 = 21.0 m^3

V2 = v1 + v2 = 534.0 m^3

1.3) FOOTING

v1 = {(24*19)-(6^2/2)*4}*3.5-{(0.25^2*1.5)*[12*2+7*2+6*SQRT(2)*4]} = 1337.3 m^3

v2 = 16*PI()*2*2.2^2/4 = 121.6 m^3

V3 = v1 - v2 = 1215.6 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*6)+([0.5+0.25]/2)*0.25 = 1.89 m^2

V4 = (4*1.89*2.49)+(30*1.89*1.99) = 131.7 m^3

2. FORM

2.1) BEAM

A1 = {(15-2)*2+(1+2+1)*2}*3 = 102 m^2

2.2) COLUMN

a1 = (1*4+2*4)*18.32*2 = 439.7 m^2

a2= 1.5*7*2 = 21.0 m^2

A2 = a1 + a2 = 460.7 m^2

2.3) FOOTING

A3= {([24+19]*2)-(6*2+(6*SQRT(2)))*4}*3.5+{(24*19)-(2.2^2*PI()/4*16)} = 409.4 m^2

2.4) PRECAST SKIRTING UNIT

A4= {6+0.3*2+(0.25+2.45)}*4*(2.49+1.99*7.5) = 647.8 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= {([24+19]*2)-(6*2+(6*SQRT(2)))*4}*3.5*2 = 28.4 m^2

3.2) 4m ≤ H ≤ 30m

A2= (15+4)*2*(18.32+3)*2 = 2302.56 m^2

4. SUPPORT

ALLOWABLE LOAD

P = (7*3*4)*2.5/(7*4) = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 0 = 0 m^2

V = 3*{(A1+A2)} = 84 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 2.0m

L = 74m

n = 16 nos

5.2) CONCRETE

v1 = 2.2^2*PI()/4*42 = 159.7 m^3

v2 = 2.0^2*PI()/4*34 = 106.8 m^3

V = v1+v2 = 266.5 m^3

5.3) STEEL CASING (t=16mm)

W= (2.232^2-2.2^2)*PI()/4*7850*42 = 36724.7 kg

5.4) EXCAVATION LENGTH

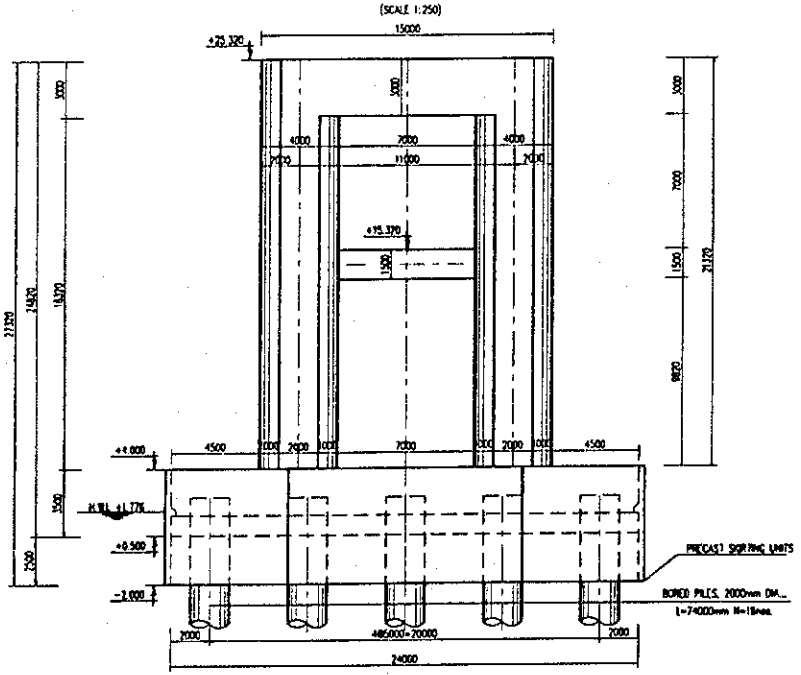
N<20 (l_1)	$L_1 = l_1 * n$	=	55.5*16	= 888	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	7*16	= 112	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	11.5*16	= 184	m

5.5) EXCAVATED MATERIALS

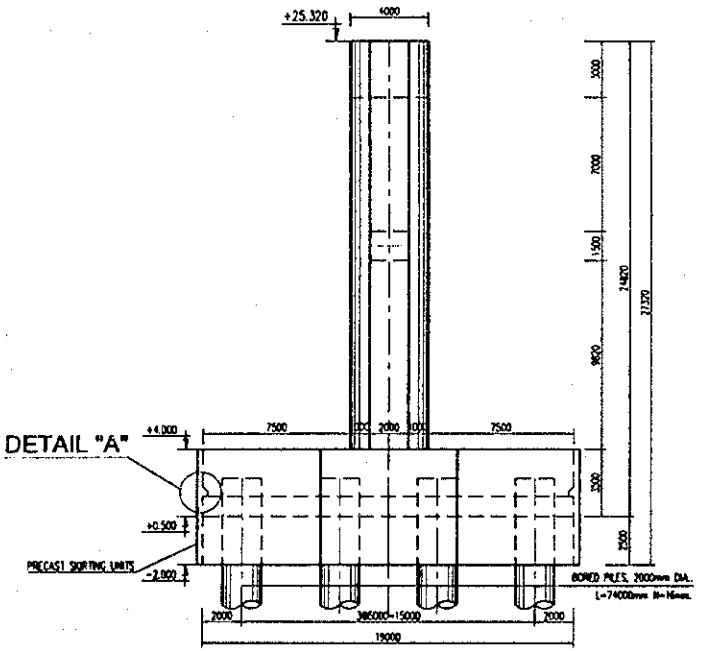
v1 =	$PI()* D_1^2/ 4 *L_1$	=	PI()*2.2^2/4*888	= 3375.6	m^3
v2 =	$PI()*D^2/ 4 * (L_2+L_3)$	=	PI()*2^2/4*(112+184)	= 929.9	m^3
V =	v1+v2			= 4305.5	m^3

GENERAL VIEW OF PIER No.16

ELEVATION
(SCALE 1:250)



SIDE ELEVATION
(SCALE 1:250)

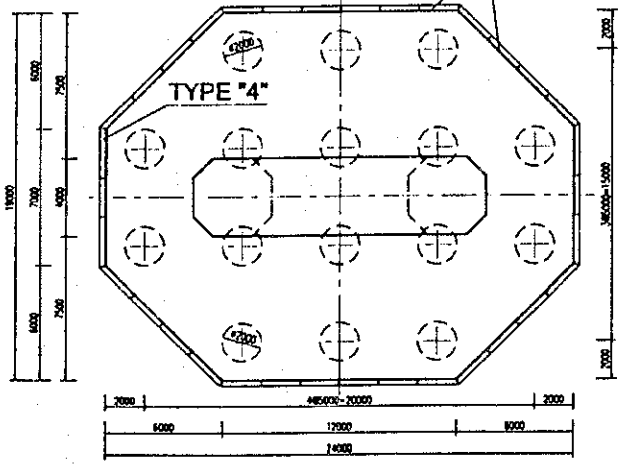


DETAIL "A"

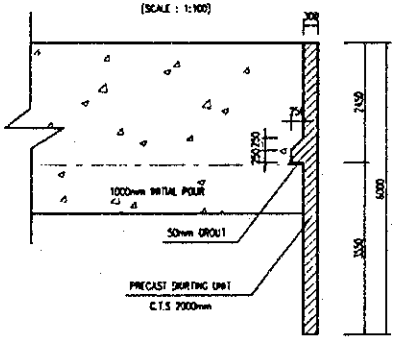
PLAN
(SCALE :1:750)

TYPE "5"

TYPE "4"



DETAIL "A"
(SCALE : 1:100)



NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

1. CONCRETE

		P16
BEAM	V1 (m^3)	174.0
COLUMN	V2 (m^3)	534.0
FOOTING	V3 (m^3)	1215.6
SKIRTING UNIT	V4 (m^3)	131.7
TOTAL (m^3)		2055.2

2. FORM

		P16
BEAM	A1 (m^2)	102.0
COLUMN	A2 (m^2)	460.7
FOOTING	A3 (m^2)	409.4
SKIRTING UNIT	A4 (m^2)	647.8
TOTAL (m^2)		1619.9

3. SCAFFOLDING WORK

		P16
A (m^2)	H < 4m	28.4
	4m ≤ H < 30m	2302.6

4. SUPPORT

	P16
A1 (m^2)	28.0
A2 (m^2)	0.0
V (m^3)	84.0

5. CAST-IN-PLACE-CONCRETE PILE

		P16
PILE DIMENSION	D (m)	2.0
	L (m)	74.0
	n (nos.)	16.0
CONCRETE	V (m^3)	266.5
EXCAVATION LENGTH	N < 20 (l_1) (m)	55.5
	L_1 (m)	888.0
	20 ≤ N ≤ 40 (l_2) (m)	7.0
	L_2 (m)	112.0
	N ≥ 40 (l_3) (m)	11.5
	L_3 (m)	184.0
EXCAVATED MATERIALS	V (m^3)	4305.5
STEEL CASING t=16mm	W(kg)	36724.7

6).REINFORCEMENT OF PIER 16

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
BEAM	S1	32	17685	45	795.8	5024.3
	S1-1	32	16853	44	741.5	4681.5
	S2-1	18	10192	65	662.5	1323.4
	S2-2	18	4484	130	582.9	1164.4
	S2-3	18	3750	16	60.0	119.9
	S3	20	35758	19	679.4	1675.5
	S4	18	6698	375	2511.8	5017.4
COLUMN	C1	32	26203	404	10586.0	66833.1
	C2	18	9143	576	5266.4	10520.0
	C3	18	8728	576	5027.3	10042.5
	C4	16	4408	288	1269.5	2003.7
	H1	32	16880	64	1080.3	6820.4
	H2	16	5036	63	317.3	500.8
	H3	16	2398	189	453.2	715.3
	H4	16	3648	126	459.6	725.5
FOOTING	F1	28	21142	202	4270.7	20643.0
	F1-1	28	14522.5	244	3543.5	17128.0
	F2	28	26400	120	3168.0	15313.0
	F2-1	28	19443	228	4433.0	21427.6
	F3-1	28	1655	156	258.2	1248.0
	F3-2	28	2955	104	307.3	1485.5
	F3-3	28	3442	286	984.4	4758.3
	F4-1	28	3442	312	1073.9	5190.9
	F4-2	28	2955	104	307.3	1485.5
	F4-3	28	1479	104	153.8	743.5
	F5	20	9702	60	582.1	1435.6
	F6	20	13217	30	396.5	977.9
	F7	20	4522	288	1302.3	3211.8
	F8	20	3975	284	1128.9	2784.0
	F9	20	3116	288	897.4	2213.1
	F10	20	8217	30	246.5	607.9
	F11	18	4478	1269	5682.6	11351.4
	B1	28	4443	152	675.3	3264.3
	B2	28	5689	440	2503.2	12099.4
PRECAST SKIRTING UNITS	P1	16	6200	696	4315.2	6810.8
	P2	16	2600	320	832.0	1313.2
	P3	16	1745	396	691.0	1090.7
	P4	16	2200	2400	5280.0	8333.6
	P5	20	1700	1984	3372.8	8317.8
TOTAL	D=16(mm)				21493.5	(kg)
	D=18(mm)				39539.0	(kg)
	D=20(mm)				21223.6	(kg)
	D=25(mm)				0.0	(kg)
	D=28(mm)				104786.9	(kg)
	D=32(mm)				83359.4	(kg)
	TOTAL				270402.4	(kg)

Summary of Quantity table of pier No.16

Items			Unit	Pier 16
Pile	Number of piles		Pile	16
	Total length bored piles D=2000mm Dia.		m	1184.0
	Concrete piles class D		m^3	4263.5
	Renforcement	D12	kg	43211.2
		D16	kg	860.8
		D22	kg	9371.2
		D25	kg	101976.0
		D32	kg	223025.6
		STEEL PLATE t=16mm	kg	587595.6
		Total	kg	966040.4
Pier	Concrete class E		m^3	2055.2
	Reinforcement	D16	kg	21493.5
		D18	kg	39539.0
		D20	kg	21223.6
		D25	kg	0.0
		D28	kg	104786.9
		D32	kg	83359.4
		Total	kg	270402.4
	Form	Curve	m^2	0.0
		Flat	m^2	1619.9
	Scaffolding work	H < 4m	m^2	28.4
		4m ≤ H < 30m	m^2	2302.6
	Support		m^3	84.0
	Earth work	Excavation for foundation	m^3	4305.5

VI. QUANTITY SURVEYING FOR PIER No.17

1. CONCRETE

1.1) BEAM

V1 = (23*3*4) - (1.5*4/2)*4*2 = 252.0 m^3

1.2) COLUMN

v1 = {(4*4*15.382)-(1*1/2*15.382)*4}*2 = 430.7 m^3

v2 = 1.5*2*7*1 = 21.0 m^3

V2 = v1 + v2 = 451.7 m^3

1.3) FOOTING

v1 = {(24*19)-(6^2/2)*4}*3.5-{(0.25^2*1.5)*[12*2+7*2+6*SQRT(2)*4]} = 1337.3 m^3

v2 = 16*PI()*2*2.2^2/4 = 121.6 m^3

V3 = v1 - v2 = 1215.6 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*6)+([0.5+0.25]/2)*0.25 = 1.89 m^2

V4 = (4*1.89*2.49)+(30*1.89*1.99) = 131.7 m^3

2. FORM

2.1) BEAM

A1 = {(23*3 -(1.5*4/2)*2}*2+4*{1.5+SQRT(1.5^2+4^2)}*2 = 172.2 m^2

2.2) COLUMN

a1 = (1*4+2*4)*15.382*2 = 369.2 m^2

a2= 1.5*7*2 = 21.0 m^2

A2 = a1 + a2 = 390.2 m^2

2.3) FOOTING

A3= {([24+19]*2)-(6*2+(6*SQRT(2)))*4}*3.5+{(24*19)-(2.2^2*PI()/4*16)} = 409.4 m^2

2.4) PRECAST SKIRTING UNIT

A4= {6+0.3*2+(0.25+2.45)}*4*(2.49+1.99*7.5) = 647.8 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= {([24+19]*2)-(6*2+(6*SQRT(2)))*4}*3.5*2 = 28.4 m^2

3.2) 4m ≤ H ≤ 30m

A2= (23+4)*2*(15.382+3)*2 = 1985.3 m^2

4. SUPPORT

ALLOWABLE LOAD

P = {(7*3*4)+2*(4*3*4)}*2.5/{(7*4)+2*(4*4)} = 7.5 t/m^2

A1 = 7*4 = 28 m^2

A2 = 2*4*4 = 32 m^2

V = 3*{(A1+A2)} = 180 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 2.0m

L = 74m

n = 16 nos

5.2) CONCRETE

v1 = 2.2^2*PI()/4*42 = 159.7 m^3

v2 = 2.0^2*PI()/4*34 = 106.8 m^3

V = v1+v2 = 266.5 m^3

5.3) STEEL CASING (t=16mm)

W= (2.232^2-2.2^2)*PI()/4*7850*42 = 36724.7 kg

5.4) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	55.5*16	= 888	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	7*16	= 112	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	11.5*16	= 184	m

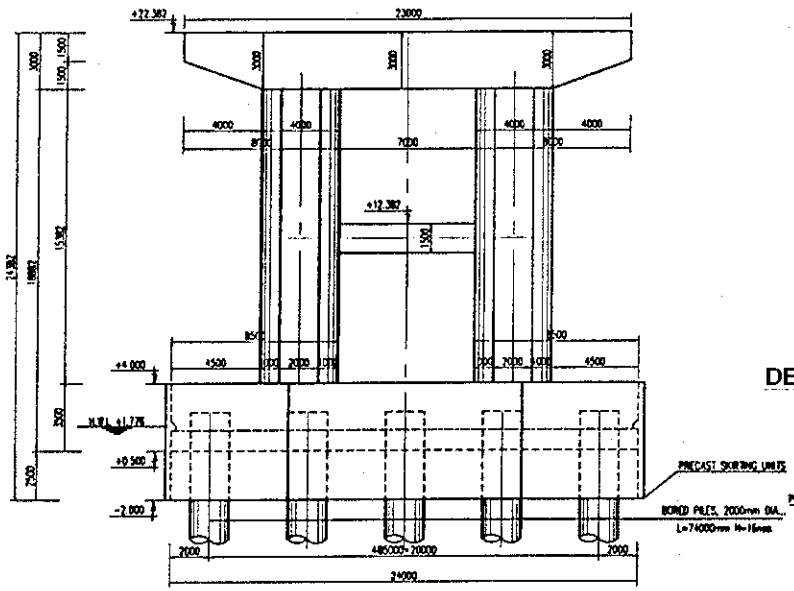
5.5) EXCAVATED MATERIALS

v1 =	PI()* D_1^2/ 4 *L_1	=	PI()*2.2^2/4*888	= 3375.6	m^3
v2 =	PI()*D^2/ 4 * (L_2+L_3)	=	PI()*2^2/4*(112+184)	= 929.9	m^3
V =	v1+v2			= 4305.5	m^3

GENERAL VIEW OF PIER No.17

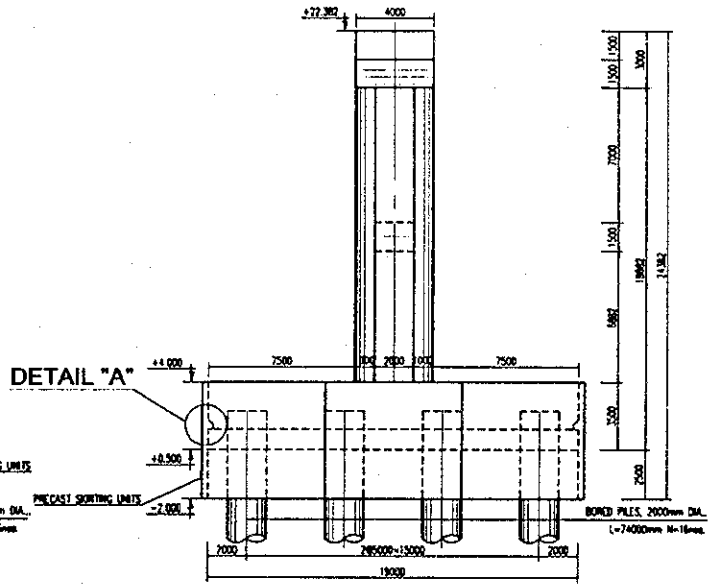
ELEVATION

(SCALE 1:250)



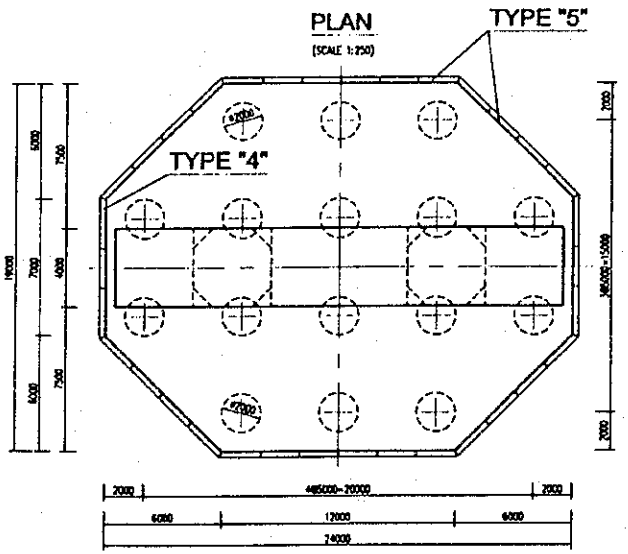
SIDE ELEVATION

(SCALE 1:250)



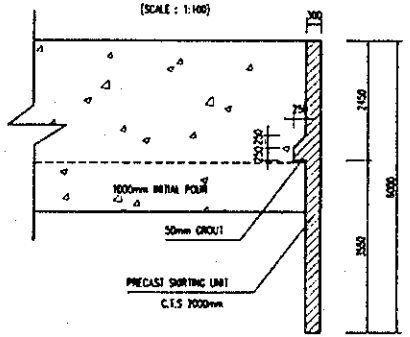
PLAN

(SCALE 1:250)



DETAIL "A"

(SCALE : 1:100)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

1. CONCRETE

		P17
BEAM	V1 (m^3)	252.0
COLUMN	V2 (m^3)	451.7
FOOTING	V3 (m^3)	1215.6
SKIRTING UNIT	V4 (m^3)	131.7
TOTAL (m^3)		2051.0

2. FORM

		P17
BEAM	A1 (m^2)	172.18
COLUMN	A2 (m^2)	390.17
FOOTING	A3 (m^2)	409.38
SKIRTING UNIT	A4 (m^2)	647.84
TOTAL (m^2)		1619.57

3. SCAFFOLDING WORK

		P17
A (m^2)	H < 4m	28.4
	4m ≤ H < 30m	1985.3

4. SUPPORT

	P17
A1 (m^2)	28.0
A2 (m^2)	32.0
V (m^3)	180.0

5. CAST-IN-PLACE-CONCRETE PILE

		P17
PILE DIMENSION	D (m)	2.0
	L (m)	74.0
	n (nos.)	16.0
CONCRETE	V (m^3)	266.5
EXCAVATION LENGTH	N < 20 (l_1) (m)	55.5
	L_1 (m)	888.0
	20 ≤ N ≤ 40 (l_2) (m)	7.0
	L_2 (m)	112.0
	N ≥ 40 (l_3) (m)	11.5
	L_3 (m)	184.0
EXCAVATED MATERIALS	V (m^3)	4305.5
STEEL CASING t=16mm	W(kg)	36724.7

6). REINFORCEMENT OF PIER 17

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGT (m)	TOTAL WEIGH (kg)
BEAM	S1	32	27350	31	847.9	5352.8
	S2	32	10170	62	630.5	3980.8
	S3	18	9692	75	726.9	1452.0
	S3-1	18	8668	40	346.7	692.6
	S4	32	30782	31	954.2	6024.5
	S5	20	23987	16	383.8	946.5
	S6	20	20304	18	365.5	901.3
	S7	18	4464	225	1004.4	2006.4
	S8-1	18	6888	300	2066.4	4127.8
	S8-2	18	6694	160	1071.0	2139.5
COLUMN	C1	32	23265	404	9399.1	59339.5
	C2	18	9143	500	4571.5	9131.9
	C3	18	8728	500	4364.0	8717.4
	C4	16	4408	256	1128.4	1781.1
	H1	32	16880	64	1080.3	6820.4
	H2	16	5036	63	317.3	500.8
	H3	16	2398	189	453.2	715.3
	H4	16	3648	126	459.6	725.5
FOOTING	F1	28	21142	202	4270.7	20643.0
	F1-1	28	14523	244	3543.5	17128.0
	F2	28	26400	120	3168.0	15313.0
	F2-1	28	19443	228	4433.0	21427.6
	F3-1	28	1655	156	258.2	1248.0
	F3-2	28	2955	104	307.3	1485.5
	F3-3	28	3442	286	984.4	4758.3
	F4-1	28	3442	312	1073.9	5190.9
	F4-2	28	2955	104	307.3	1485.5
	F4-3	28	1479	104	153.8	743.5
	F5	20	9702	60	582.1	1435.6
	F6	20	13217	30	396.5	977.9
	F7	20	4522	288	1302.3	3211.8
	F8	20	3975	284	1128.9	2784.0
	F9	20	3116	288	897.4	2213.1
	F10	20	8217	30	246.5	607.9
	F11	18	4478	1269	5682.6	11351.4
	B1	28	4443	152	675.3	3264.3
	B2	28	5689	440	2503.2	12099.4
PRECAST SKIRTING UNITS	P1	16	6200	696	4315.2	6810.8
	P2	16	2600	320	832.0	1313.2
	P3	16	1745	396	691.0	1090.7
	P4	16	2200	2400	5280.0	8333.6
	P5	20	1700	1984	3372.8	8317.8
TOTAL	D=16(mm)				21270.9	(kg)
	D=18(mm)				39619.1	(kg)
	D=20(mm)				21395.9	(kg)
	D=25(mm)				0.0	(kg)
	D=28(mm)				104786.9	(kg)
	D=32(mm)				81517.9	(kg)
	TOTAL				268590.7	(kg)

Summary of Quantity table of pier No.17

Items			Unit	Pier 17
Pile	Number of piles		Pile	16
	Total length bored piles D=2000mm Dia.		m	1184.0
	Concrete piles class D		m^3	4263.5
	Renforcement	D12	kg	44264.0
		D16	kg	860.8
		D22	kg	9371.2
		D28	kg	66886.4
		D32	kg	223025.6
		STEEL PLATE t=16mm	kg	587595.6
		Total	kg	932003.6
Pier	Concrete class E		m^3	2051.0
	Reinforcement	D16	kg	21270.9
		D18	kg	39619.1
		D20	kg	21395.9
		D25	kg	0.0
		D28	kg	104786.9
		D32	kg	81517.9
		Total	kg	268590.7
	Form	Curve	m^2	0.0
		Flat	m^2	1619.6
	Scaffolding work	H < 4m	m^2	28.4
		4m ≤ H < 30m	m^2	1985.3
	Support		m^3	180.0
	Earth work	Excavation for foundation	m^3	4305.5

VII . Summary of Quantity table of Supplemental Piers No.12(13, 14, 15,16, 17)

Items			Unit	Pier 12	Pier 13	Pier 14	Pier 15	Pier 16	Pier 17
Pile	Number of piles		Pile	12.0	12.0	12.0	18.0	16.0	16.0
	Total length bored piles D=1500mm Dia.		m	972.0	984.0	984.0	0.0	0.0	0.0
	Total length bored piles D=2000mm Dia.		m	0.0	0.0	0.0	1332.0	1184.0	1184.0
	Concrete piles class D		m^3	1717.7	1738.9	1738.9	4796.5	4263.5	4263.5
	Renforcement	D10	kg	15224.4	15438.0	15438.0	0.0	0.0	0.0
		D12	kg	0.0	0.0	0.0	48612.6	43211.2	44264.0
		D16	kg	354.0	354.0	354.0	968.4	860.8	860.8
		D22	kg	5090.4	5090.4	5090.4	10542.6	9371.2	9371.2
		D25	kg	0.0	0.0	0.0	114723.0	101976.0	0.0
		D28	kg	100795.2	95698.8	95698.8	0.0	0.0	66886.4
		D32	kg	73908.0	68979.6	68979.6	250903.8	223025.6	223025.6
		STEEL PLATE t =16mm	kg	0.0	0.0	0.0	661045.1	587595.6	587595.6
		Total	kg	195372.0	185560.8	185560.8	1086795.5	966040.4	932003.6
Pier	Concrete class E		m^3	1335.6	1351.4	1432.0	2422.4	2055.2	2051.0
	Reinforcement	D16	kg	1972.0	3943.9	4003.5	28020.7	21493.5	21270.9
		D18	kg	33967.4	32867.3	36076.2	44830.5	39539.0	39619.1
		D20	kg	1906.2	1656.3	1656.3	23857.3	21223.6	21395.9
		D22	kg	6314.6	6314.6	0.0	0.0	0.0	0.0
		D25	kg	2752.3	2752.3	11038.9	0.0	0.0	0.0
		D28	kg	0.0	0.0	0.0	125962.6	104786.9	104786.9
		D32	kg	136658.3	151410.3	158572.0	95650.8	83359.4	81517.9
		Total	kg	183570.8	198944.7	211346.9	318321.9	270402.4	268590.7
	Form	Curve	m^2	0.0	0.0	0.0	0.0	0.0	0.0
		Flat	m^2	1286.4	1299.6	1368.7	2146.0	1619.9	1619.6
	Scaffolding work	H < 4m	m^2	342.0	342.0	342.0	602.0	28.4	28.4
		4m ≤ H < 30m	m^2	2376.0	2656.8	2967.8	2605.0	2302.6	1985.3
	Support		m^3	180.0	84.0	84.0	84.0	84.0	180.0
	Earth work	Excavation for foundation	m^3	2534.3	2482.0	2499.4	4843.7	4305.5	4305.5
		Excess soil	m^3	2263.1	2274.8	2277.1	0.0	0.0	0.0
		Blinding Concrete class G	m^3	8.6	7.2	7.6	0.0	0.0	0.0
		Back fill	m^3	262.6	200.0	214.8	0.0	0.0	0.0

2.3. Stay Cable Bridge (North Pylon and South Pylon)

1. Summary of Quantity

Item			Work Item		Unit	Quantity			Remarks
						Northern	Southern	Total	
Pylon (Substructure)	Concrete	Class B	Pylon		cu.m	2,863.8	2,863.8	5,727.7	σ ck=40Mpa
	Form		Pylon		sq.m	1,636.0	1,636.0	3,272.0	
	Re-bar		Pylon	- D14	ton	0.0	0.0	0.0	
				D16 - D32	ton	96.8	96.8	193.7	
				D35 - D51	ton	236.6	236.6	473.2	
				Total	ton	333.4	333.4	666.9	
	PC Cable	31S15.2	Cross beam	31S15.2	ton	32.7	32.7	65.3	
	Structural Steel				ton	204.8	204.8	409.6	
Pile-cap	Concrete	Class D	Pile cap	In-situ	cu.m	14,746.6	13,880.9	28,627.5	
			Leveling Layer		cu.m		264.5	264.5	
			Pre-cast slab	Pre-cast	cu.m		588.9	588.9	σ ck=30Mpa
			Skirt unit	Pre-cast	cu.m		558.8	558.8	
			Total		cu.m	14,746.6	15,293.1	30,039.6	
		Class F	Leveling Concrete			331.2		331.2	σ ck=15Mpa
	Form		Pile cap	In-situ	sq.m	3,075.2	1,898.1	4,973.3	
			Pre-cast slab	Pre-cast	sq.m	2,289.6	2,289.6	4,579.3	
			Total		sq.m	5,364.9	4,187.7	9,552.6	
	Re-bar		Pile cap	- D14	ton	0.0	0.0	0.0	
				D16 - D32	ton	375.9	344.4	720.2	
				D35 - D51	ton	696.6	687.0	1,383.6	
				Total	ton	1,072.5	1,031.4	2,103.8	
			Pre-cast slab	- D14	ton		0.0	0.0	
				D16 - D32	ton		51.2	51.2	
				D35 - D51	ton		0.0	0.0	
				Total	ton		51.2	51.2	
			Skirt unit	- D14	ton		5.6	5.6	
				D16 - D32	ton		27.9	27.9	
				D35 - D51	ton		0.0	0.0	
				Total	ton		33.5	33.5	
			Total	- D14	ton	0.0	5.6	5.6	
				D16 - D32	ton	375.9	423.5	799.4	
				D35 - D51	ton	696.6	687.0	1,383.6	
				Total	ton	1,072.5	1,116.1	2,188.6	
	Structural Steel		Supporting Structure		ton		72.9	72.9	SS400
Pile	Composite Pile	Steel Pile L=53.000m	f=3.200m, t= 30mm		Nos	40.0	40.0	80.0	
			Concrete (Class D-2)		cu.m	16,416.7	16,416.7	32,833.4	
			Excavation		cu.m	17,050.0	10,616.1	27,666.1	
		Concrete Pile L=47.000m	f=3.000m		Nos	40.0	40.0	80.0	
			Concrete (Class D-2)		cu.m	13,288.9	13,288.9	26,577.8	
			Excavation	N<30	cu.m	5,513.5	3,392.9	8,906.4	
				N>30	cu.m	7,775.4	9,896.0	17,671.4	
				Total	cu.m	13,288.9	13,288.9	26,577.8	
			Re-bar	- D14	ton	1.7	1.7	3.4	
				D16 - D32	ton	294.6	294.6	589.2	
				D35 - D51	ton	550.3	550.3	1,100.6	
				Total	ton	846.6	846.6	1,693.2	
	Excavation				cu.m	3,955.7		3,955.7	

2. Pylon (Substructure)

Item	Formula	Quantity
1. Concrete	Class B	
	Concrete volume	
	Column	
	V1 = 1882.904 m3	
	Cross beam	
	V2 = 6.570 * 5.000 * 29.861 = 980.934 m3	
	Total	
	V = 1882.904 + 980.934 = 2863.838 m3	2,863.838 m3
2. Form		
	Form area	
	Column	
	A1 = 1141.188 m2	
	Cross beam	
	A2 = (6.570 + 5 * 2)* 29.861 = 494.797 m2	
	Total	
	A = 1141.188 + 494.797 = 1635.985 m3	1,635.985 m3
3. Re-bar	Total Weight of Re-Bar	

Dia.	Weight (kg)		Remarks
	Northern	Southern	
- D14	0	0	
D16 - D32	332.672	332.672	
D35 - D51	812.882	812.882	
Total	1,145.554	1,145.554	

Concrete Volume of Pylon

	Concrete Volume (m3)		
	Northern	Southern	Total
Super Structure	4,478.1	4,478.1	8,956.3
Substructure	1,838.7	1,838.7	3,677.3
Total	6,316.8	6,316.8	12,633.6

Weight of Substructure

Dia.	Weight (kg)		
	Northern	Southern	Total
- D14	0	0	0.0
D16 - D32	96,832	96,832	193,664.0
D35 - D51	236,609	236,609	473,218.0
Total	333,441	333,441	666,882.0

Total (Northrn + Southern) 666,882.0 kg

666.9 ton

Item	Formula	Quantity

4 PC Cable

Prestressing cable for Cross Beam of Pylon

Tendon Type 31S15.2 ‹gf/m

Unit Weight of Tendon = 34.131 ‹gf/m

Type of Tendon	Length (m)	nos.	Total Cable Length (m)	Weight (kgf)
1	39.859	10	398.590	13,604.3
2	39.911	22	878.042	29,968.5
		32		43,572.8

43.6 ton

5 Structual Steel

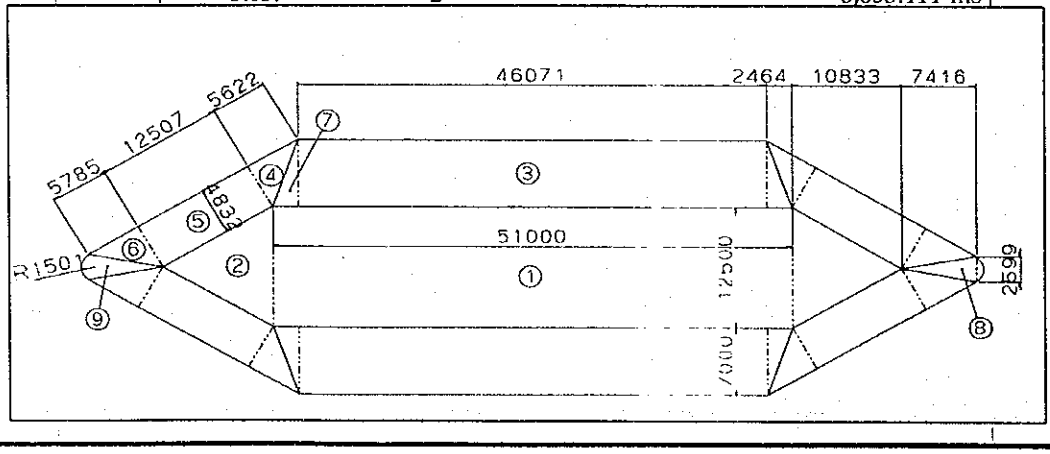
Type	Dimension	Length	Nos.	Weight	
	mm	mm		kg/m	kg
L	250×250×25	6,000	4	93.7	2,248.8
L	250×250×25	4,000	36	93.7	13,492.8
L	250×250×25	5,000	16	93.7	7,496.0
L	250×250×25	6,000	48	93.7	26,985.6
L	250×250×25	2,200	8	93.7	1,649.1
L	250×250×25	2,400	120	93.7	26,985.6
L	250×250×25	2,000	32	93.7	5,996.8
L	250×250×25	2,600	64	93.7	15,591.7
L	250×250×25	4,700	32	93.7	14,092.5
L	250×250×25	5,000	24	93.7	11,244.0
L	250×250×25	2,300	48	93.7	10,344.5
L	250×250×25	4,200	8	93.7	3,148.3
L	250×250×25	1,900	16	93.7	2,848.5
L	250×250×25	3,300	28	93.7	8,657.9
L	250×250×25	15,100	4	93.7	5,659.5
L	250×250×25	15,800	4	93.7	5,921.8
PL	1150×20	570	32	180.6	3,293.2
PL	1000×20	1,000	88	157.0	13,816.0
PL	1000×20	790	16	157.0	1,984.5
PL	1000×20	700	56	157.0	6,154.4
PL	1000×20	650	112	157.0	11,429.6
PL	1000×20	625	8	157.0	785.0
PL	950×20	850	8	149.2	1,014.2
PL	800×20	750	8	125.6	753.6
PL	500×20	250	80	78.5	1,570.0
PL	800×20	800	16	125.6	1,607.7

Total 204,771.6 = 204,772 kg

= 204.8 ton

3. Pile Cap

Item	Formula	Quantity
1. Northern		
1) In-situ Concrete Pile Cap Concrete		
h=0.0-6.0m		
A1 = 45.000 × 28.500 + 1/2 ×(4.332		
+ 28.500)× 20.946 × 2	=	1,970.199 m2
A2 = π × 2.5^2 × 2θ/360 − 1/2		
× 4.332 × 2.500 × cosθ	=	3.837 m2
θ = $\sin^{-1}$(4.332 / (2 × 2.5))	=	60.000 °
ΣA = 1970.199 + 3.837 × 2	=	1,977.873 m2
V = 1977.873 × 6	=	11,867.24 m3
h=6.0~9.0m		
(1)		
V = 12.500 × 51.000 × 3.000	=	1,912.500 m3
(2)		
V = 1/2 × 12.500 × 10.833 × 3	=	203.119 m3
(3)		
V = 1/2 × 7.000 × 3.000 × 46.071	=	483.746 m3
(4)		
V = 1/6 × 5.622 × 4.832 × 3	=	13.583 m3
(5)		
V = 1/2 × 4.832 × 3.000 × 12.507	=	90.651 m3
(6)		
V = 1/6 × 5.785 × 4.832 × 3	=	13.977 m3
(7)		
V = 1/3 × 2.464 × 3.000 × 7	=	17.248 m3
(8)		
V = 1/6 × 7.416 × 2.599 × 3	=	9.637 m3
(9)		
V = 1/3 × 3.037 × 3.000	=	3.037 m3
ΣV = 1912.500 × 1 + 203.119 × 2		
+ 483.746 × 2 + 13.583 × 4		
+ 90.651 × 4 + 13.977 × 4		
+ 17.248 × 4 + 9.637 × 2		
+ 3.037 × 2	=	3,853.414 m3



Item	Formula	Quantity
	Deduction for pile top Diameter φ= 3.200 m Embedment L= 3.000 m Nos. of pile N= 40	
	Vp = π × 1.600 × 3.000 × 40 = 965.097 m3	
	Notch A = 0.150 × 0.300 = 0.045 m2 V = 0.045 × 199.900 = 8.996 m3	
	Total concrete volume at pile cap V = 11867.24 + 3853.414 − 965.097 − 8.996 = 14,746.559 m3	14746.6 m3
2) Form		
	A1-1 = 1/2 ×(51.000 + 46.071)×(7.000^2 + 3.000^2) ^1/2 = 369.635 m2	
	A1-2 = 1/2 ×(23.914 + 12.507)×(4.832^2 + 3.000^2) ^1/2 = 103.573 m2	
	A1-3 =(π × 1.501 ×(3.000^2 + 1.501^2)^1/2) ×(60 / 360) = 2.636 m2	
	A1 = 4 × A1-1 + 4 × A1-2 + 2 × A1-3 = 1,898.104 m2	
	A2 = 196.188 × 6.000 = 1,177.128 m2	
	Total 3,075.232 m2	3075.2 m2
3) Re-Bar		

Dia.	Weight (kg) Pile Cap	Remarks
- D14	0	
D16 - D32	375,873	
D35 - D51	696,587	
Total	1,072,460	

	Total =	1,072,460 kg
		1,072.5 ton
5) Excavation	V = 1,977.873 × 2.000 =	3955.7 m3

Item	Formula	Quantity

2. Southern

1) In situ Concrete

h=0~6.0m

A1 = 45.000 * 28.500 + 1/2 *(4.332
+ 28.500)* 20.946 * 2 = 1,970.199

A2 = π * 2.5^2 * 20/360 − 1/2
* 4.332 * 2.500 * cosθ = 3.837

θ = sin-1 4.332 / (2 * 2.5))= 60.000 °

ΣA = 1970.199 + 3.837 * 2 = 1,977.873 m2

V = 1977.873 * 5.500 = 10,878.302 m3

h=6.0~9.0m

(1)
V = 12.500 × 51.000 × 3.000 = 1,912.500 m3

(2)
V = 1/2 × 12.500 × 10.833 × 3 = 203.119 m3

(3)
V = 1/2 × 7.000 × 3.000 × 46.071 = 483.746 m3

(4)
V = 1/6 × 5.622 × 4.832 × 3 = 13.583 m3

(5)
V = 1/2 × 4.832 × 3.000 × 12.507 = 90.651 m3

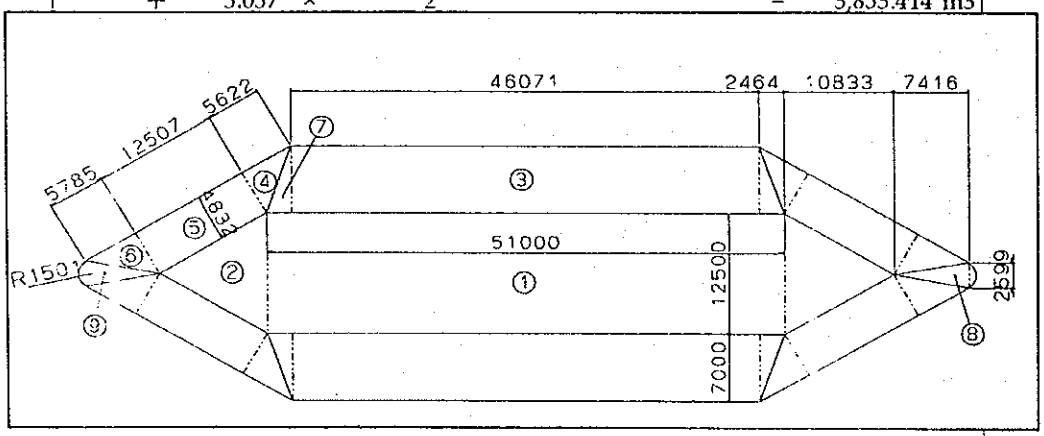
(6)
V = 1/6 × 5.785 × 4.832 × 3 = 13.977 m3

(7)
V = 1/3 × 2.464 × 3.000 × 7 = 17.248 m3

(8)
V = 1/6 × 7.416 × 2.599 × 3 = 9.637 m3

(9)
V = 1/3 × 3.037 × 3.000 = 3.037 m3

ΣV = 1912.500 × 1 + 203.119 × 2
+ 483.746 × 2 + 13.583 × 4
+ 90.651 × 4 + 13.977 × 4
+ 17.248 × 4 + 9.637 × 2
+ 3.037 × 2 = 3,853.414 m3



Item	Formula	Quantity

Deduction value of pile top

Diameter	φ=	3.200	m
Embedment	L=	2.500	m
Nos. of pile	N=	40	

Vp = π * 1.6^2 * 2.500 * 40 = 804.248 m3

Deduction value of pre-cast unit

Skirt unit (Small)

A1 = 0.150 *(0.850 + 0.400) = 0.188

Deduction value of notch

A2 = 0.150 * 0.300 = 0.045

ΣA = 0.188 + 0.045 = 0.233

L = 199.900

V = 0.233 * 199.900 = 46.577

Total concrete volume at pile cap

V = 10,878.30 + 3,853.414 — 804.248 — 46.577 = 13,880.89 m3 | 13,880.89 m3

Item	Formula										Quantity
2) Skirt Unit											
	Skirt Unit (Large)										
	Section area										
	A1	=	0.150	*	0.300				=	0.045	
	A2	= (	0.300	+	0.400	) *	6.000	* 1/2			
		-	0.100	*	0.500				=	2.050	
	A3	= (	0.300	+	0.150	) *	2.500	* 1/2	=	0.563	
	ΣA	=								2.658 m2	
	Concrete volume per one unit										
	V1	=	2.658	*	2.490				=	6.618 m3	
	Deduction of slit										
	V2	=	0.200	*	0.030	*(	5.701	+ 2.504	)		
		*	4						=	0.197 m3	
	ΣV	=								6.421 m3	
	Circumference length of pile cap										
	L	=(	23.347	+	24.235	)*	4	+ 5.658			
		*	2						=	201.644 m	
	Width of skirt per one unit										
	L1	=	2.490	+	0.010				=	2.500 m	
	Nos. of skirt										
	N	=	201.644	/	2.500				=	80.7 nos	
	Skirt unit (Large) Total quantity										
	Concrete										
	V	=	6.421	*	80.700				=	518.175 m3	518.175 m3

Item	Formula								Quantity
	Skirt unit (small)								
	Section area								
	A1	=	0.150	*	0.850		=	0.128 m2	
	A2	=	0.150	*	0.500		=	0.075 m2	
	ΣA	=					=	0.203 m2	
	Length								
	L	=(	23.273	+	24.161	)* 4 + 5.082			
		*	2				=	199.900 m	
	Concrete volume								
	V	=	0.203	*	199.900		=	40.580 m3	40.58 m3
	Skirt Unit Total								
	Concrete volume								
	V	=	518.175	+	40.580		=	558.755 m3	558.755 m3

Item	Formula										Quantity
3) Form	Form of Pyle cap in-situ concrete										
	A1	=	1/2	×(	51.000	+	46.071	)×(	7.000^2		
		+	3.000^2	)	^1/2				=	369.635 m2	
	A2	=	1/2	×(	23.914	+	12.507	)×(	4.832^2		
		+	3.000^2	)	^1/2				=	103.573 m2	
	A3	=(	π	×	1.501	×(	3.000^2	+	1.501^2	)^1/2)	
		×(	60	/	360	)			=	2.636 m2	
	ΣA	=	4 × A1-1	+	4 × A1-2	+	2 × A1-3		=	1,898.104 m2	1898.104 m2
	Form area per one unit										
	Skirt unit (large)										
	A1	=(	0.245	*	2.000	+	0.400	*	3.000		
		+	0.200	*	4.000	+	0.030	*	8.000	)	
		*(	5.701	+	2.504	)			=	22.400	
	A2	=	0.200	*	0.030	*	4.000	+	2.490		
		*	0.300						=	0.771	
	A3	=(	0.300	+	0.150	+	5.200	+	0.100		
		+	3.000	)*	2.490				=	21.788	
	A4	=(	2.658	—	4.350	*(	0.058	*	2.000		
		—	0.030	*	2.000	)+	0.500	*(	0.080		
		+	0.140	)*	0.050	*	2.000	)*	2.000	=	4.851
	A5	=	0.150	*	2.490				=	0.374	
	ΣA	=								50.184 m2	
	Form										
	A	=	50.184	*	80.700				=	4,049.849 m2	4049.849 m2
	Skirt unit (small)										
	A	=(	0.500	+	1.000	*	2	+	0.250		
		+	0.100	)*	199.900				=	569.715 m2	569.715 m2
	Total Form area										
	A	=	1898.104	+	569.715				=	2,467.819 m2	2467.819 m2
4) Re-Bar											

Dia.	Weight (kg)	
	Pile Cap	Skirt Unit
- D14	0	5,588
D16 - D32	344,367	27,938
D35 - D51	687,020	0
Total	1,031,387	33,526

Total	=	1,064,913 kg
		1,064.9 ton

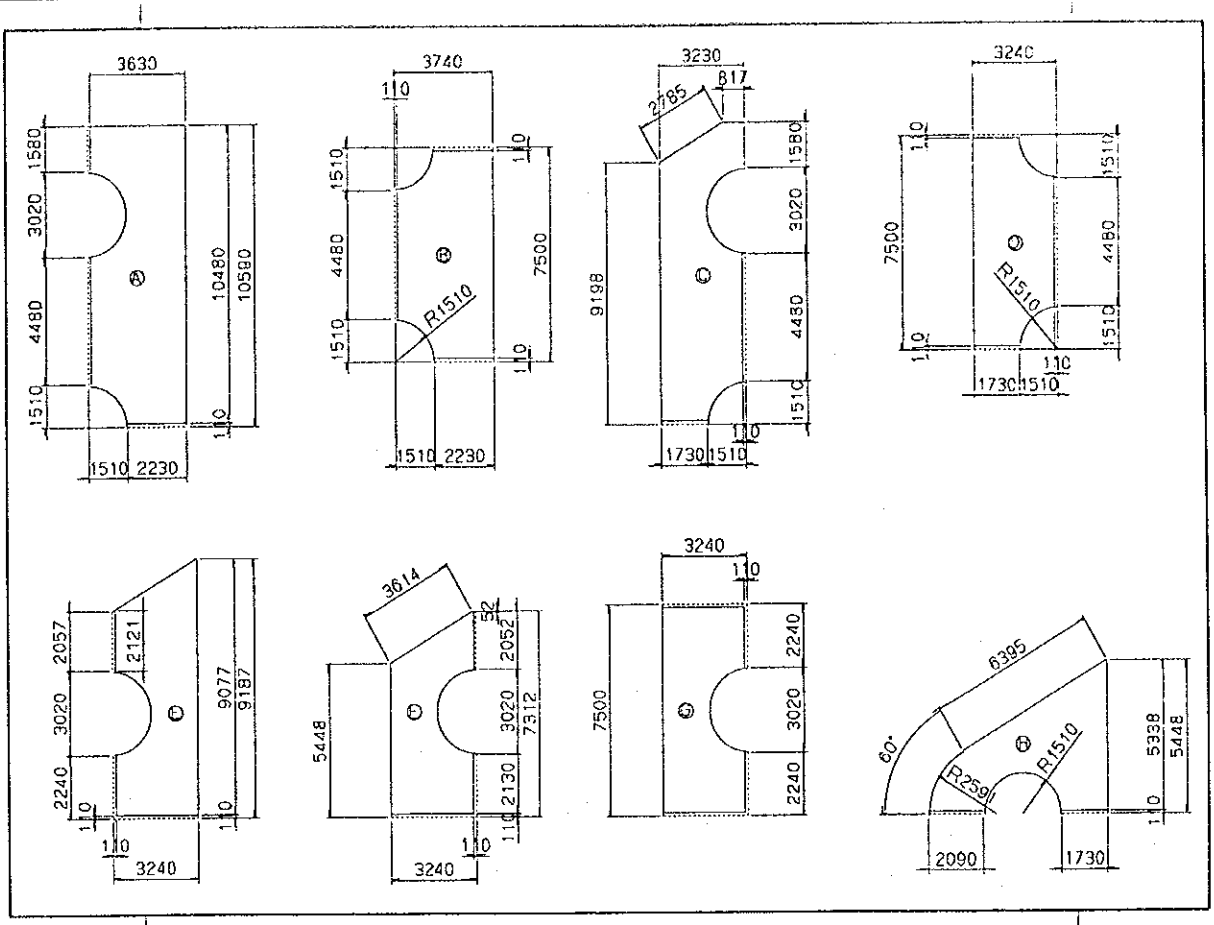
Item	Formula											Quantity
5) Pre-cast slab												
TYPE-A												
	Concrete volume											
	A1	=	3.740	×	10.590	−(	1.580	+	4.480			
		+	2.230	)×	0.110					=	38.695	
	Deduction of pile top											
	A2	=	π	×	1.510	×	0.750			=	5.372	
	ΣA	=	38.695	−	5.372					=	33.323	
	V	=	33.323	×	0.350					=	11.663 m3	11.663 m3
	Form											
	A1	=								=	33.323	
	Circumference											
	L	=	10.480	+	3.630	+	1.580	+	4.480			
		+	2.230	+	2 π	×	1.510	×	0.750	=	29.516	
	A2	=	29.516	×	0.350					=	10.331	
	ΣA	=	33.323	+	10.331					=	43.654 m2	43.654 m2
TYPE-B												
	Concrete volume											
	A1	=	3.740	×	7.500	−(	4.480	+	2.230			
		×	2	)×	0.110					=	27.067	
	Deduction of pile top											
	A2	=	π	×	1.510	×	0.500			=	3.582	
	ΣA	=	27.067	−	3.582					=	23.485	
	V	=	23.485	×	0.350					=	8.220 m3	8.220 m3
	Form											
	A1	=								=	23.485	
	Circumference											
	L	=	7.280	+	2.230	×	2	+	4.480			
		+	2 π	×	1.510	×	0.750			=	23.336 m	
	A2	=	23.336	×	0.350					=	8.168 m2	
	ΣA	=	23.485	+	8.168					=	31.653 m2	31.653 m2

Item	Formula											Quantity
TYPE-C												
	Concrete volume											
	A1	=	0.500	×(	10.590	+	9.198	)×	2.413			
		−(	1.730	+	4.480	)×	0.110	−	1.580			
		×	0.010							=	23.858	
	Deduction of pile top											
	A2	=	π	×	1.510	×	0.500			=	3.582	
	ΣA	=	23.858	−	3.582					=	20.276	
	V	=	20.276	×	0.350					=	7.097 m3	7.097 m3
	Form											
	A1	=								=	23.858	
	Circumference											
	L	=	9.088	+	2.785	+	0.817	+	1.580			
		+	4.480	+	1.730	+	2 π	×	1.510			
		×	0.750							=	27.596 m	
	A2	=	27.596	×	0.35					=	9.659 m2	
	ΣA	=	23.858	+	9.659					=	33.517 m2	33.517 m2
TYPE-D												
	Concrete volume											
	A1	=	3.24000	×	7.50000	−(	4.480	+	1.730			
		×	2	)×	0.110					=	23.427	
	Deduction of pile top											
	A2	=	π	×	1.510	×	0.500			=	3.582	
	ΣA	=	23.427	−	3.582					=	19.845	
	V	=	19.845	×	0.350					=	6.946 m3	6.946 m3
	Form											
	A1	=								=	19.845	
	Circumference											
	L	=	7.280	+	1.730	×	2	+	4.480			
		+	2 π	×	1.510	×	0.75			=	22.336 m	
	A2	=	22.336	×	0.350					=	7.818 m2	
	ΣA	=	19.845	+	7.818					=	27.663 m2	27.663 m2

Item	Formula											Quantity
TYPE-E												
	Concrete volume											
	A1	=	0.500	×(	7.317	+	9.187	)×	3.240			
		−(	2.057	+	2.240	+	3.140	)×	0.110	=	25.918	
	Deduction of pile top											
	A2	= π		×	1.510	×	0.500			=	3.582	
	ΣA	=	25.918	−	3.582					=	22.336	
	V	=	22.336	×	0.350					=	7.818 m3	7.818 m3
	Form											
	A1	=								=	22.336	
	Circumference											
	L	=	2.13	+	2.127	+	3.614	+	9.077			
		+	3.13	+ 2 π		×	1.510	×	0.500	=	24.822 m	
	A2	=	24.822	×	0.350					=	8.688 m2	
	ΣA	=	22.336	+	8.688					=	31.024 m2	31.024 m2
TYPE-F												
	Concrete volume											
	A1	=	0.500	×(	5.448	+	7.132	)×	3.240			
		−(	2.052	+	2.130	+	3.240	)×	0.110	=	19.563	
	Deduction of pile top											
	A2	=	π	×	1.510	×	0.500			=	3.582	
	ΣA	=	19.563	−	3.582					=	15.981	
	V	=	15.981	×	0.350					=	5.593 m3	5.593 m3
	Form											
	A1	=								=	15.981	
	Circumference											
	L	=	2.130	+	2.052	+	3.614	+	5.338			
		+	3.130	+ 2 π		×	1.510	×	0.500	=	21.008 m	
	A2	=	21.008	×	0.350					=	7.353 m2	
	ΣA	=	15.981	+	7.353					=	23.334 m2	23.334 m2

Item	Formula										Quantity
TYPE-G											
	Concrete volume										
	A1	=	7.500	×	3.240	−(	3.130	+	2.240		
		×	2	)×	0.110					=	23.463
	Deduction of pile top										
	A2	= π		×	1.510	×	0.500			=	3.582
	ΣA	=	23.463	−	3.582					=	19.881
	V	=	19.881	×	0.350					=	6.958 m3
											6.958 m3
	Form										
	A1	=								=	19.881
	Circumference										
	L	=	7.280	+	3.240	×	2	+	2.130		
		×	2	+	2 π	×	1.510	×	0.500	=	22.764 m
	A2	=	22.764	×	0.350					=	7.967 m2
	ΣA	=	19.881	+	7.967					=	27.848 m2
											27.848 m2
TYPE-H											
	Concrete volume										
	A1	=	0.500	×(	2.244	+	5.448	)×	5.534		
		+	π	×	2.591	×	60	/	360		
		−	0.500	×	2.244	×	2.591	×	60		
		−(	2.09	+	1.730	)×	0.110			=	27.147
	Deduction of pile top										
	A2	= π		×	1.510	×	0.500			=	3.582
	ΣA	=	27.147	−	3.582					=	23.565
	V	=	23.565	×	0.350					=	8.248 m3
											8.248 m3
	Form										
	A1	=								=	23.565
	Circumference										
	L	=	6.395	+	5.328	+	1.730	+	2.090		
		+	2 π	×	1.510	×	0.500	+	2 π		
		×	2.591	×	1/6					=	23.000 m
	A2	=	23.000	×	0.350					=	8.050 m2
	ΣA	=	23.565	+	8.050					=	31.615 m2
											31.615 m2

Item	Formula	Quantity



Concrete volume

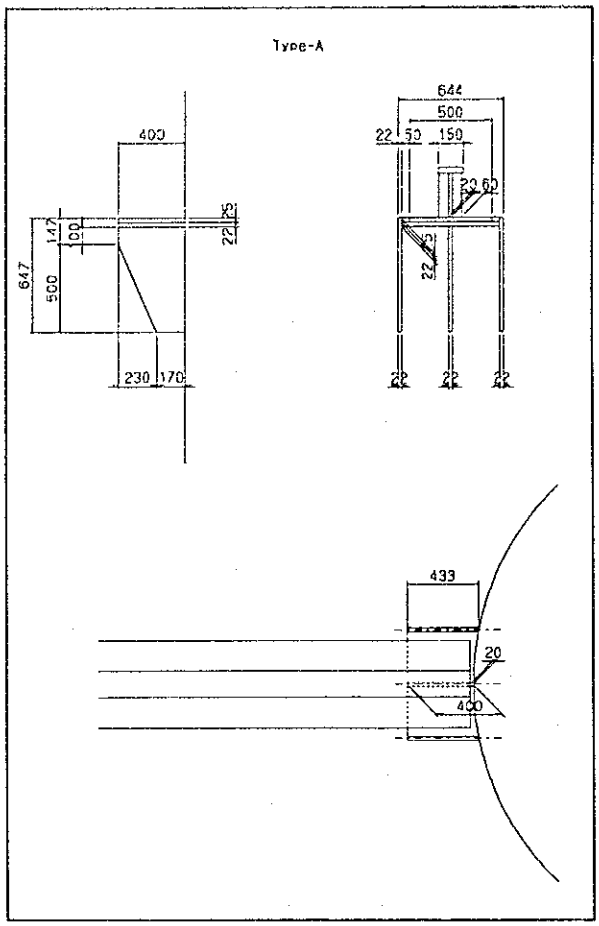
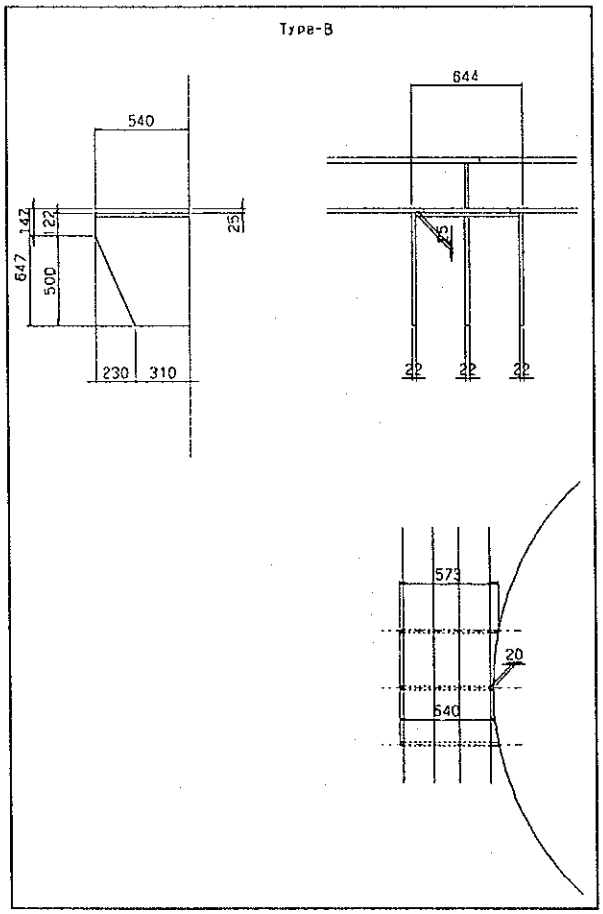
TYPE	Vi		Nos.		Vi*N	
A	11.663	×	24	=	279.912	
B	8.220	×	12	=	98.640	
C	7.097	×	4	=	28.388	
D	6.946	×	2	=	13.892	
E	7.818	×	8	=	62.544	
F	5.593	×	8	=	44.744	
G	6.958	×	4	=	27.832	
H	8.248	×	4	=	32.992	
ΣV =				=	588.944 m3	588.944 m3

Form

TYPE	Ai		Nos.		Ai*N	
A	43.654	×	24	=	1,047.696	
B	31.653	×	12	=	379.836	
C	33.517	×	4	=	134.068	
D	27.663	×	2	=	55.326	
E	31.024	×	8	=	248.192	
F	23.334	×	8	=	186.672	
G	27.848	×	4	=	111.392	
H	31.615	×	4	=	126.460	
ΣV =				=	2,289.642 m2	2289.642 m2

Item	Formula											Quantity
6) Leveling Layer Concrete												
	A1	=	0.220	×	4.500	×	51			=	50.490 m2	
	A2	=	0.220	×(	10.000	−	0.220	)×	6	=	12.910 m2	
	ΣA	=	50.490	+	12.910					=	63.400 m2	
	V1	=	63.400	×	0.350					=	22.190 m3	
	V2	=	1977.873	×	0.150					=	296.681 m3	
	Deduction of skirt unit (small type)											
	V	=	0.400	×	0.150	×	199.900			=	11.994 m3	
	Deduction of pile top											
	V	=	π	×	1.500	×	0.150	×	40	=	42.412 m3	
	Total											
	ΣV	=	22.190	+	296.681	−	11.994	−	42.412	=	264.465 m3	264.465 m3
	Re-bar											
	Pre-cast part											
	D16-D32											
	W	=	588.944	×	60	×	0.001			=	35.337 ton	35.337 ton
	In-situ concrete											
	D16-D32											
	W	=	264.465	×	60	×	0.001			=	15.868 ton	15.868 ton
	Total											D16-D32
	W	=	35.337	+	15.868					=	51.205 ton	51.205 ton

Item	Formula											Quantity
7) Structural Steel												
	Bracket－A											
	A	=	433	×	600	－(	π	×	3000			
		×	11.479	/	360	－	0.500	×	600			mm2
		×	3000	×	5.739	)				=	128,236	
	V	=	128236	×	22	×	1E-09			=	0.003	m3
	W	=	0.003	×	7.85					=	0.024	ton
	rib－1											
	A	=	0.5	×(	147	+	647	)×	230			mm2
		+	170	×	647					=	201,300	
	V	=	201300	×	22	×	1E-09			=	0.004	m3
	W	=	0.004	×	7.850					=	0.031	ton
	rib－2											
	A	=	0.5	×(	147	+	647	)×	230			mm2
		+	203	×	647					=	222,651	
	V	=	222651	×	22	×	1E-09			=	0.005	m3
	W	=	0.005	×	7.85	×	2			=	0.039	ton
												mm2
	A	=	500	×	400					=	200,000	
	V	=	200000	×	25	×	1E-09			=	0.005	m3
	W	=	0.005	×	7.850	×	2			=	0.039	ton
	Weight of bracket per one unit											
	W									=	0.133	ton
	Nos of bracket											
	N	=	94									
	Total											
	W	=	0.133	×	94					=	12.502	ton

Item	Formula	Quantity
Type-A		
Type-B		

Item	Formula									Quantity
Bracket−B										
A	=	547	×	600	−(π		×	3000		
	×	11.479	/	360	−	0.5	×	600		mm2
	×	3000	×	5.739	)				=	196,636
V	=	196635.9	×	22	×	1E-09			=	0.004 m3
W	=	0.004	×	7.85					=	0.031 ton
rib−1										
A	=	0.5	×(	147	+	647	)×	230		mm2
	+	310	×	647					=	291,880
V	=	291880	×	22	×	1E-09			=	0.006 m3
W	=	0.006	×	7.85					=	0.047 ton
rib−2										
A	=	0.5	×(	122	+	622	)×	230		mm2
	+	343	×	647					=	307,481
V	=	307481	×	22	×	1E-09			=	0.007 m3
W	=	0.007	×	7.85	×	2			=	0.055 ton
Weight of bracket per one unit										
W									=	0.133 ton
Nos of bracket										
N	=	16								
Total										
W	=	0.133	×	16					=	2.128 ton

Item	Formula										Quantity
Beam type-1											
Upper flange											mm2
A	=	4460	×	150					=		669,000
V	=	669000	×	25	×	1E-09			=		0.017 m3
W	=	0.017	×	7.85					=		0.133 ton
Lower flange											mm2
A	=	4460	×	500					=		2230000
V	=	2230000	×	25	×	1E-09			=		0.056 m3
W	=	0.056	×	7.85					=		0.44 ton
Web											mm2
A	=	4460	×	250					=		1115000
V	=	1115000	×	20	×	1E-09			=		0.022 m3
W	=	0.022	×	7.85					=		0.173 ton
Rib											mm2
A	=	0.5	×(	373	+	440	)×	100	=		40650
											mm3
V	=	40650	×	12					=		487800
N	=								=		14 nos
W	=	487800	×	14	×	1E-09	×	7.85	=		0.054 ton
Weight per one beam											
W	=	0.133	+	0.44	+	0.173	+	0.054	=		0.8 ton
Nos.											
N	=	45									
Total											
W	=	0.8	×	45					=		36 ton

Item	Formula	Quantity
Beam type 2-1		
Upper flange		mm2
A = 9960 × 150	=	1,494,000
V = 1494000 × 25 × 1E-09	=	0.037 m3
W = 0.037 × 7.85	=	0.29 ton
Lower flange		mm2
A = 9960 × 500	=	4,980,000
V = 4980000 × 25 × 1E-09	=	0.125 m3
W = 0.125 × 7.85	=	0.981 ton
Web		mm2
A = 9960 × 250	=	2,490,000
V = 2490000 × 20 × 1E-09	=	0.05 m3
W = 0.05 × 7.85	=	0.393 ton
Rib		mm2
A = 0.5 ×(373 + 440)× 100	=	40,650
		mm3
V = 40650 × 12	=	487,800
N =	=	32 nos
W = 487800 × 32 × 1E-09 × 7.85	=	0.123 ton
Weight per each beam		
W = 0.29 + 0.981 + 0.393 + 0.123	=	1.787 ton
Nos.		
N = 6		
Total		
W = 1.787 × 6	=	10.722 ton

Item	Formula										Quantity
	Beam type 2-2										
	Upper flange										mm2
	A	=	2155	×	150				=		323,250
	V	=	323250	×	25	×	1E-09		=		0.008 m3
	W	=	0.008	×	7.85				=		0.063 ton
	Lower flange										mm2
	A	=	1980	×	500				=		990,000
	V	=	990000	×	25	×	1E-09		=		0.025 m3
	W	=	0.025	×	7.85				=		0.196 ton
	Web										mm2
	A	=	2220	×	250				=		555,000
	V	=	555000	×	20	×	1E-09		=		0.011 m3
	W	=	0.011	×	7.85				=		0.086 ton
	Rib										mm2
	A	=	0.5	×(	373	+	440	)×	100	=	40,650
											mm3
	V	=	40650	×	12				=		487,800
	N	=							=		32 nos
	W	=	487800	×	6	×	1E-09	×	7.85	=	0.023 ton
	Weight per each beam										
	W	=	0.063	+	0.196	+	0.086	+	0.023	=	0.368 ton
	Nos										
	N	=	6								
	Total										
	W	=	0.368	×	6					=	2.208 ton
	Summation of Type 2 beam										
	W	=								=	12.93 ton

Item	Formula	Quantity
	Beam type-3	
	H shaped steel H-300-300	
	Unit weight	
	W0 = 93 kg/m	
	Length	
	L = 24.936 m	
	Weight per each beam	
	W = 24.936 × 93 × 0.001 = 2.319 ton	
	Nos.	
	N = 4	
	Total	
	W = 2.319 × 4 = 9.276 ton	
	Steel parts for Type-3 connection	
	[−300-90-12-16	
	Unit weight	
	W0 = 48.6 kg/m	
	Length	
	L = 1.120 m	
	Weight per each beam	
	W = 1.120 × 48.600 × 0.001 = 0.054 ton	
	Nos.	
	N = 2	
	Total	
	W = 0.054 × 2 = 0.108 ton	
	Summation of type-3	
	W = = 9.384 ton	
	Total weight of structural steel	
	W = 12.502 + 2.128 + 36.000 + 12.930 + 9.384 = 72.944 ton	

4. Composite Pile

Item	Formula	Quantity
1. Northern		
1) Steel Pile	L=53.00 m f = 3200 mm t=30 mm	
(1) Pile	N =	40 nos
(2) Concre	V = 3.140 × 3.140 × π/4 × 53.000 = 410.417 m3	
	Class D2 Total 410.417 × 40 =	16,416.680 m3
(3) Excavation		
	V = 3.200 × 3.200 × π/4 × 53.000 = 426.251 m3	
	Total 426.251 × 40 =	17,050.0 m3
(4) Steel	Rib-Plate 250×2450×16 N = 24 Nos/Pile	
	W = 76.9 × 24 = 1,845.6 kg	
	Backing Ring Support 77×9870×6 N = 1 Nos/Pile	
	W = 35.8 × 1 = 35.8 kg	
	Top Protect Plate 300×10081×9 N = 1 Nos/Pile	
	W = 213.7 × 1 = 213.7 kg	
(5) Field Welding	L = 3.140 × π × 2 = 19.7 m	
2) R.C Pile	L=47.00 m f = 3000 mm	
(1) Pile	N =	40 nos
(2) Concrete		
	V = 3.000 × 3.000 × π/4 × 47.000 = 332.223 m3	
	Class D2 Total 332.223 × 40 =	13,288.920 m3
(3) Excavation		
	N<30 V1 = 13,288.9 × 19.500 / 47.000 =	5,513.5 m3
	N>30 V2 = 13,288.9 × 27.500 / 47.000 =	7,775.4 m3
	Total =	13,288.9 m3
3) R.C Pile		

Dia.	Weight (kg)		Remarks
	par pile	Total	
- D14	42	1,693	
D16 - D32	7,366	294,620	
D35 - D51	13,757	550,296	
Total	21,165	846,610	

Total 846,610 kg

846.6 ton

Item	Formula	Quantity
2. Southern		
1) Steel Pile	L=53.00 m f = 3200 mm t=30 mm	
(1) Pile	N =	40 nos
(2) Concre	V = 3.140 × 3.140 × π/4 × 53.000 = 410.417 m3	
	Class D2 Total 410.417 × 40 =	16,416.680 m3
(3) Excavation		
	V = 3.200 × 3.200 × π/4 × 33.000 = 265.402 m3	
	Total 265.402 × 40 =	10,616.1 m3
(4) Steel	Rib-Plate 250×2450×16 N = 24 Nos/Pile	
	W = 76.9 × 24 = 1,845.6 kg	
	Backing Ring Support 77×9870×6 N = 1 Nos/Pile	
	W = 35.8 × 1 = 35.8 kg	
	Top Protect Plate 300×10081×9 N = 1 Nos/Pile	
	W = 213.7 × 1 = 213.7 kg	
(5) Field Welding	L = 3.140 × π × 2 = 19.7 m	
2) R.C Pile	L=47.00 m f = 3000 mm	
(1) Pile	N =	40 nos
(2) Concrete		
	V = 3.000 × 3.000 × π/4 × 47.000 = 332.223 m3	
	Class D2 Total 332.223 × 40 =	13,288.920 m3
(3) Excavation		
	N<30 V1 = 13,288.9 × 12.000 / 47.000 =	3,392.9 m3
	N>30 V2 = 13,288.9 × 35.000 / 47.000 =	9,896.0 m3
	Total =	13,288.9 m3
3) R.C Pile		

Dia.	Weight (kg)		Remarks
	par pile	Total	
- D14	42	1,693	
D16 - D32	7,366	294,620	
D35 - D51	13,757	550,296	
Total	21,165	846,610	

Total	846,610 kg
	846.6 ton

2.4. Approach Bridge (P36-P41)

I. QUANTITY SURVEYING FOR PIER No.36(41)

1. CONCRETE

1.1) BEAM

V1 (23*1.59*3) + (23+15.5)/2*1.25*3-(0.84*1.5*23) = 152.9 m^3

1.2) COLUMN

v1 12.5*3*1.48 = 55.5 m^3

v2 3^2*PI()/4*1.48 = 10.5 m^3

V2 = v1 + v2 = 66.0 m^3

1.3) FOOTING

v1 (18*10.5)*3-{(0.25^2*1.5)*[18+10.5]*2} = 561.7 m^3

v2 9*PI()*2*1.7^2/4 = 40.9 m^3

V3 = v1 - v2 = 520.8 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*5.5)+([0.5+0.25]/2)*0.25 = 1.74 m^2

V4 = (4*1.74*1.55)+(26*1.74*1.99) = 100.8 m^3

2. FORM

2.1) BEAM

A1 (15.5+23)/2*1.25*2+3*3.953*2+0.75*2*(23+1.5)+0.84*2*(23+1.5) = 149.8 m^2

2.2) COLUMN

a1 3*PI()*1.48 = 13.9 m^2

a2 (12.5+3)*2*1.48 = 45.9 m^2

A2 = a1 + a2 = 59.8 m^2

2.3) FOOTING

A3 (18+10.5)*2*3+{18*10.5-(1.5^2*PI()/4*9)} = 344.1 m^2

2.4) PRECAST SKIRTING UNIT

A4= {5.5+0.3*2+(0.25+2.00)}*4*(1.55+1.99*6.5) = 483.8 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= (18+10.5)*2*2*3 = 342 m^2

3.2) 4m ≤ H ≤ 30m

A2= (23+3)*2*2*(2.73+1.59) = 449.3 m^2

4. SUPPORT

ALLOWABLE LOAD

P {(2*3.75*1.25/2*3)+(3*1.59*3.75)*2-(0.84*1.5*3.75)*2}*2.5/2*(3.75*3.953) = 3.4 t/m^2

A1 = (2*1.25/2*3) = 3.8 m^2

A2 = (3*1.59)*2-(0.84*1.5)*2 = 7.02 m^2

V 3.75*{(A1+A2)} = 40.4 m^3

5. CAST-IN-PLACE-CONCRETE PILE

5.1) PILE DIMENSION

D = 1.5 m

L = 70 m

n = 9 nos

5.2) CONCRETE

v1 1.7^2*PI()/4*17 = 38.6 m^3

v2 1.50^2*PI()/4*55 = 97.2 m^3

V v1+v2 = 135.8 m^3

5.3) STEEL CASING (t=16mm)

W= (1.732^2-1.7^2)*PI()/4*7850*17 = 11510.8 kg

5.4) EXCAVATION LENGTH

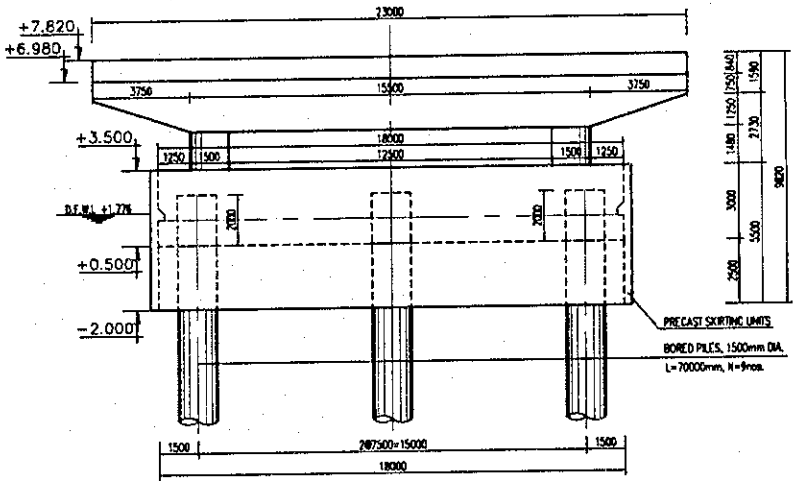
N<20 (l_1)	$L_1 = l_1 * n$	=	50.26*9	= 452.3	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	10.24*9	= 92.2	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	9.5*9	= 85.5	m

5.5) EXCAVATED MATERIALS

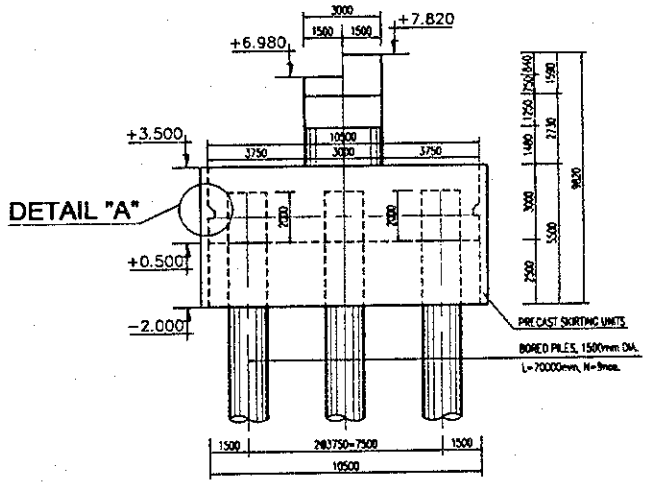
v1 PI()* D_1^2/ 4 *L_1	=	PI()*1.7^2/4*452.3	= 1026.7	m^3
v2 PI()*D^2/ 4 * (L_2+L_3)	=	PI()*1.5^2/4*(92.2+85.5)	= 314.0	m^3
V v1+v2			= 1340.7	m^3

GENERAL VIEW OF PIER No.36 & 41

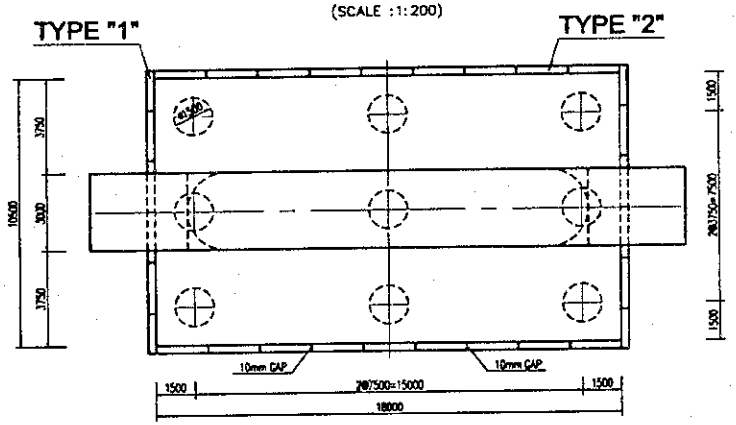
ELEVATION
(SCALE : 1:200)



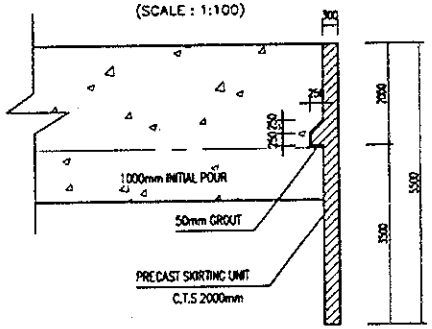
SIDE ELEVATION
(SCALE : 1:200)



PLAN
(SCALE : 1:200)



DETAIL "A"
(SCALE : 1:100)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

1. CONCRETE

		P36(41)
BEAM	V1 (m^3)	152.9
COLUMN	V2 (m^3)	66.0
FOOTING	V3 (m^3)	520.8
SKIRTING UNIT	V4 (m^3)	100.8
TOTAL (m^3)		840.5

2. FORM

		P36(41)
BEAM	A1 (m^2)	149.8
COLUMN	A2 (m^2)	59.8
FOOTING	A3 (m^2)	344.1
SKIRTING UNIT	A4 (m^2)	483.8
TOTAL (m^2)		1037.5

3. SCAFFOLDING WORK

		P36(41)
A (m^2)	H < 4m	342.0
	4m ≤ H < 30m	449.3

4. SUPPORT

	P36(41)
A1 (m^2)	3.8
A2 (m^2)	7.0
V (m^3)	40.4

5. CAST-IN-PLACE-CONCRETE PILE

		P36(41)
PILE DIMENSION	D (m)	1.5
	L (m)	70.0
	n (nos.)	9.0
CONCRETE	V (m^3)	135.8
EXCAVATION LENGTH	N < 20 (l_1) (m)	50.3
	L_1 (m)	452.3
	20 ≤ N ≤ 40 (l_2) (m)	10.2
	L_2 (m)	92.2
	N ≥ 40 (l_3) (m)	9.5
	L_3 (m)	85.5
EXCAVATED MATERIALS	V (m^3)	1340.7
STEEL CASING t=16mm	W(kg)	11510.8

6). REINFORCEMENT OF PIER 36(41)

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
BEAM	S1	32	25685	26	667.8	4215.8
	S2	32	6586	20	131.7	831.4
	S3	32	7426	20	148.5	937.5
	S4	18	4409	36	158.7	317.1
	S5	18	5997	105	629.7	1258.1
	S6	18	6122	36	220.4	440.4
	S7	18	8699	105	913.4	1825
	S8	16	23847	12	286.2	451.6
	S9	16	20181	18	363.3	573.3
	S10	16	3427	26	89.1	140.6
	S11	16	1949	12	23.4	36.9
	S12	18	7143	210	1500	2997
	S13	18	5463	210	1147.2	2292.1
	S14	18	2286	72	164.6	328.9
	S15	18	4566	72	328.8	656.9
COLUMN	C1	16	35744	8	286	451.3
	C2	32	4290	129	553.4	3493.6
	C3	32	3280	256	839.7	5301
	C4	32	5130	127	651.5	4112.9
	C5	16	3360	135	453.6	715.8
FOOTING	F1	32	11520	143	1647.4	10400
	F2	32	20725	83	1720.2	10859.6
	F3	32	11520	104	1198.1	7563.6
	F3-1	32	11480	39	447.7	2826.3
	F4	20	19190	22	422.2	1041.1
	F4-1	20	16910	21	355.1	875.7
	F5	20	19190	24	460.6	1135.8
	F6	20	18690	4	74.8	184.5
	F7	20	4450	116	516.2	1272.9
	F8	20	3540	112	396.5	977.8
	F9	20	3116	116	361.5	891.5
	F10	20	11000	24	264	651
	F11	20	10500	4	42	103.6
	F12	20	2440	700	1708	4211.9
	F13	20	1750	700	1225	3020.9
	F14	32	4670	112	523	3301.7
	F15	32	2800	28	78.4	494.9
	F16	32	3735	112	418.3	2640.7
PRECAST SKIRTING UNITS	P1	16	5310	584	3101	4893.4
	P2	16	1960	344	674.2	1063.9
	P3	16	1825	292	532.9	840.9
	P4	16	2360	2236	5277	8327.1
	P5	20	1700	876	1489.2	3672.4
TOTAL	D=16(mm)				17494.8	(kg)
	D=18(mm)				10115.5	(kg)
	D=20(mm)				18039.1	(kg)
	D=32(mm)				56979.0	(kg)
	TOTAL				102628.4	(kg)

Summary of Quantity table of pier No.36(41)

Items			Unit	Pier 36(41)
Pile	Number of piles		Pile	9
	Total length bored piles D=1500mm Dia.		m	630.0
	Concrete piles class D		m^3	1222.0
	Renforcement	D10	kg	10197.9
		D16	kg	320.4
		D22	kg	3758.4
		D25	kg	28681.2
		D28	kg	15661.8
		STEEL PLATE t=16mm	kg	103597.2
		Total	kg	162216.9
Pier	Concrete class E		m^3	840.5
	Reinforcement	D16	kg	17494.8
		D18	kg	10115.5
		D20	kg	18039.1
		D32	kg	56979.0
		Total	kg	102628.4
	Form	Curve	m^2	0.0
		Flat	m^2	1037.5
	Scaffolding work	H < 4m	m^2	342.0
		4m ≤ H < 30m	m^2	449.3
	Support		m^3	40.4
	Earth work	Excavation for foundation	m^3	1340.7

II. QUANTITY SURVEYING FOR PIER No.37(40)

1. CONCRETE

1.1) BEAM

V1 = 0 = 0.0 m^3

1.2) COLUMN

v1 = 11*3*3.42 = 112.9 m^3

v2 = 3^2*PI()/4*3.42 = 24.2 m^3

V2 = v1 + v2 = 137.0 m^3

1.3) FOOTING

v1 = (19*14)*3-{(0.25^2*1.5)*[19+14]*2} = 791.8 m^3

v2 = 9*PI()*2*2.2^2/4 = 68.4 m^3

V3 = v1 - v2 = 723.4 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*5.5)+([0.5+0.25]/2)*0.25 = 1.74 m^2

V4 = (4*1.74*2.77)+(28*1.74*1.99) = 116.2 m^3

2. FORM

2.1) BEAM

A1 = 0 = 0.0 m^2

2.2) COLUMN

a1 = 3*PI()*3.42 = 32.2 m^2

a2= (11+3)*2*3.42 = 95.8 m^2

A2 = a1 + a2 = 128.0 m^2

2.3) FOOTING

A3= (19+14)*2*3+{19*14-(2^2*PI()/4*9)} = 435.7 m^2

2.4) PRECAST SKIRTING UNIT

A4= {5.5+0.3*2+(0.25+2.00)}*4*(2.77+1.99*7) = 557.8 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= (19+14)*2*2*3 = 396 m^2

3.2) 4m ≤ H ≤ 30m

A2= (14+3)*2*2*3.42 = 232.6 m^2

4. CAST-IN-PLACE-CONCRETE PILE

4.1) PILE DIMENSION

D =	2	m
L =	78	m
n =	9	nos

4.2) CONCRETE

v1 =	2.2^2*PI()/4*17	= 64.6	m^3
v2 =	2.0^2*PI()/4*63	= 197.9	m^3
V =	v1+v2	= 262.5	m^3

4.3) STEEL CASING (t=16mm)

W=	(2.232^2-2.2^2)*PI()/4*7850*17	= 14864.8	kg

4.4) EXCAVATION LENGTH

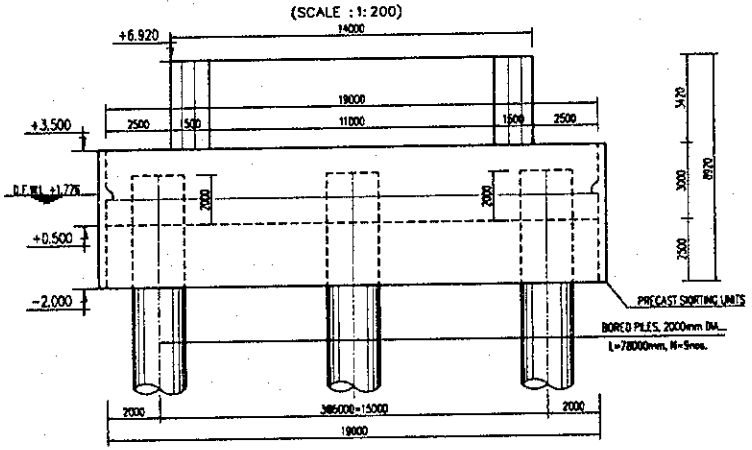
N<20 (l_1)	$L_1 = l_1 * n$	=	50.26*9	= 452.3	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	10.24*9	= 92.2	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	17.5*9	= 157.5	m

4.5) EXCAVATED MATERIALS

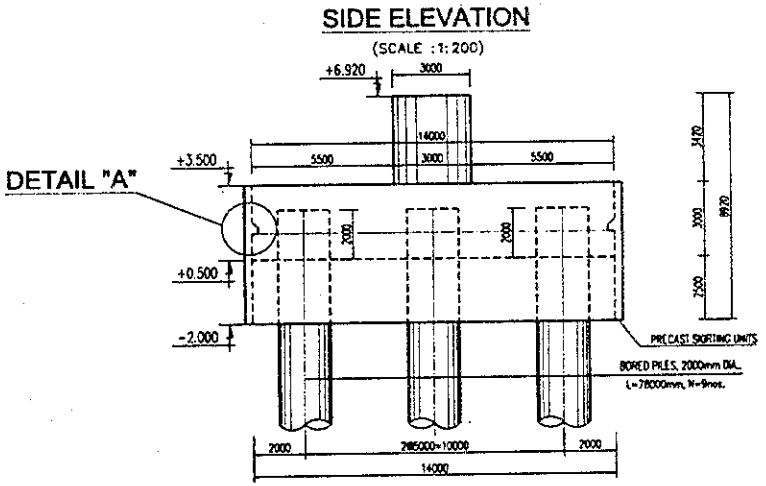
v1 =	$PI()* D_1^2 / 4 * L_1$	=	PI()*2.2^2/4*452.3	= 1719.5	m^3
v2 =	$PI()*D^2 / 4 * (L_2+L_3)$	=	PI()*2.0^2/4*(92.2+85.5)	= 784.3	m^3
V =	v1+v2			= 2503.8	m^3

GENERAL VIEW OF PIER No.37 & 40

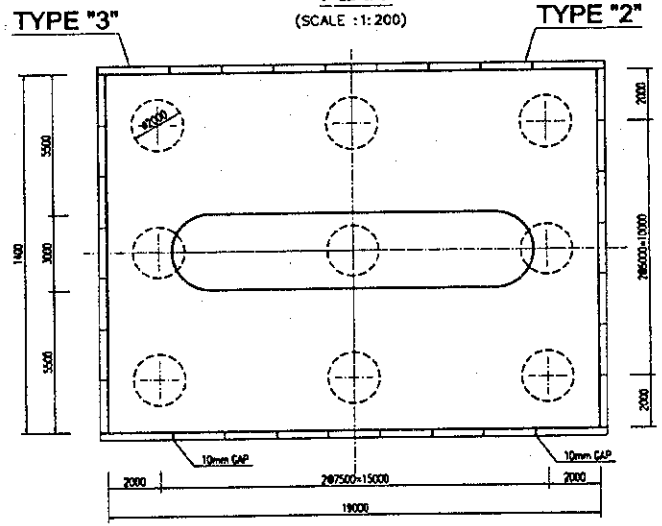
ELEVATION
(SCALE : 1: 200)



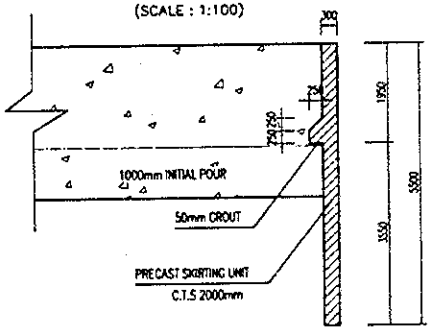
SIDE ELEVATION
(SCALE : 1: 200)



PLAN
(SCALE : 1: 200)



DETAIL "A"
(SCALE : 1:100)



NOTE:
ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

1. CONCRETE

		P37(40)
BEAM	V1 (m^3)	0.0
COLUMN	V2 (m^3)	137.0
FOOTING	V3 (m^3)	723.4
SKIRTING UNIT	V4 (m^3)	116.2
TOTAL (m^3)		976.7

2. FORM

		P37(40)
BEAM	A1 (m^2)	0.0
COLUMN	A2 (m^2)	128.0
FOOTING	A3 (m^2)	435.7
SKIRTING UNIT	A4 (m^2)	557.8
TOTAL (m^2)		1121.5

3. SCAFFOLDING WORK

		P37(40)
A (m^2)	H < 4m	396.0
	4m ≤ H < 30m	232.6

4. CAST-IN-PLACE-CONCRETE PILE

		P37(40)
PILE DIMENSION	D (m)	2.0
	L (m)	78.0
	n (nos.)	9.0
CONCRETE	V (m^3)	262.5
EXCAVATION LENGTH	N < 20 (l_1) (m)	50.3
	L_1 (m)	452.3
	20 ≤ N ≤ 40 (l_2) (m)	10.2
	L_2 (m)	92.2
	N ≥ 40 (l_3) (m)	17.5
	L_3 (m)	157.5
EXCAVATED MATERIALS	V (m^3)	2503.8
STEEL CASING t=16mm	W(kg)	14864.8

5). REINFORCEMENT OF PIER 37(40)

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGTH (m)	TOTAL WEIGH (kg)
COLUMN	C1	16	32744	17	556.6	878.3
	C2	32	4540	232	1053.3	6649.5
	C3	32	3730	232	865.4	5463.3
	C4	16	2260	230	519.8	820.2
	C5	16	14027	21	294.6	464.9
	C6	16	2590	109	282.3	445.5
FOOTING	F1	20	15150	77	1166.6	2876.8
	F2	20	20190	57	1150.8	2837.9
	F3	32	16685	100	1668.5	10533.2
	F3-1	32	13840	51	705.8	4455.7
	F4	32	21725	66	1433.9	9052.2
	F4-1	32	18752	51	956.4	6037.8
	F5	20	20190	24	484.6	1195
	F6	20	19690	4	78.8	194.3
	F7	20	4450	244	1085.8	2677.6
	F8	20	3540	240	849.6	2095.1
	F9	20	3116	244	760.3	1874.9
	F10	20	14500	24	348	858.2
	F11	20	14000	4	56	138.1
	F12	18	2405	999	2402.6	4800.4
	F13	18	1715	999	1713.3	3423.2
	F14	32	5975	160	956	6035.2
	F15	32	3340	40	133.6	843.4
	F16	32	4450	160	712	4494.9
PRECAST SKIRTING UNITS	P1	16	5700	104	592.8	935.4
	P2	16	2800	296	828.8	1307.8
	P3	16	1745	332	579.3	914.1
	P4	16	2200	2072	4558.4	7193.2
	P5	20	1700	1328	2257.6	5567.2
TOTAL	D=16(mm)				12959.4	(kg)
	D=18(mm)				8223.6	(kg)
	D=20(mm)				20315.1	(kg)
	D=32(mm)				53565.2	(kg)
	TOTAL				95063.3	(kg)

Summary of Quantity table of pier No.37(40)

Items			Unit	Pier 37(40)
Pile	Number of piles		Pile	9
	Total length bored piles D=2000mm Dia.		m	702.0
	Concrete piles class D		m^3	2362.9
	Renforcement	D12	kg	23713.2
		D16	kg	484.2
		D22	kg	5382.9
		D25	kg	57828.6
		D28	kg	27147.6
		STEEL PLATE t=16mm	kg	133782.9
		Total	kg	248339.4
Pier	Concrete class E		m^3	976.7
	Reinforcement	D16	kg	12959.4
		D18	kg	8223.6
		D20	kg	20315.1
		D32	kg	53565.2
		Total	kg	95063.3
	Form	Curve	m^2	0.0
		Flat	m^2	1121.5
	Scaffolding work	H < 4m	m^2	396.0
		4m ≤ H < 30m	m^2	232.6
	Earth work	Excavation for foundation	m^3	2503.8

III. QUANTITY SURVEYING FOR PIER No.38(39)

1. CONCRETE

1.1) BEAM

V1 = 0 = 0.0 m^3

1.2) COLUMN

v1 = 11*3*5.02 = 165.7 m^3

v2 = 3^2*PI()/4*5.02 = 35.5 m^3

V2 = v1 + v2 = 201.1 m^3

1.3) FOOTING

v1 = (24*14)*3-{(0.25^2*1.5)*[24+14]*2} = 1000.9 m^3

v2 = 15*PI()*2*2.2^2/4 = 114.0 m^3

V3 = v1 - v2 = 886.8 m^3

1.4) PRECAST SKIRTING UNIT

A = (0.3*5.5)+([0.5+0.25]/2)*0.25 = 1.74 m^2

V4 = (4*1.74*2.29)+(34*1.74*1.99) = 133.7 m^3

2. FORM

2.1) BEAM

A1 = 0 = 0.0 m^2

2.2) COLUMN

a1 = 3*PI()*5.02 = 47.3 m^2

a2= (11+3)*2*5.02 = 140.6 m^2

A2 = a1 + a2 = 187.9 m^2

2.3) FOOTING

A3= (24+14)*2*3+{24*14-(2.2^2*PI()/4*15)} = 507.0 m^2

2.4) PRECAST SKIRTING UNIT

A4= {5.5+0.3*2+(0.25+2.00)}*4*(2.29+1.99*8.5) = 641.4 m^2

3. SCAFFOLDING WORK

3.1) H<4m

A1= (24+14)*2*2*3 = 456 m^2

3.2) 4m ≤ H ≤ 30m

A2= (14+3)*2*2*5.02 = 341.4 m^2

4. CAST-IN-PLACE-CONCRETE PILE

4.1) PILE DIMENSION

D =	2	m
L =	74	m
n =	15	nos

4.2) CONCRETE

v1 =	2.2^2*PI()/4*17	= 64.6	m^3
v2 =	2.0^2*PI()/4*59	= 185.4	m^3
V =	v1+v2	= 250.0	m^3

4.3) STEEL CASING (t=16mm)

W= (2.232^2-2.2^2)*PI()/4*7850*17 = 14864.8 kg

4.4) EXCAVATION LENGTH

N<20 (l_1)	$L_1 = l_1 * n$	=	50.26*15	= 753.9	m
20=<N<40 (l_2)	$L_2 = l_2 * n$	=	10.24*15	= 153.6	m
N>=40 (l_3)	$L_3 = l_3 * n$	=	13.5*15	= 202.5	m

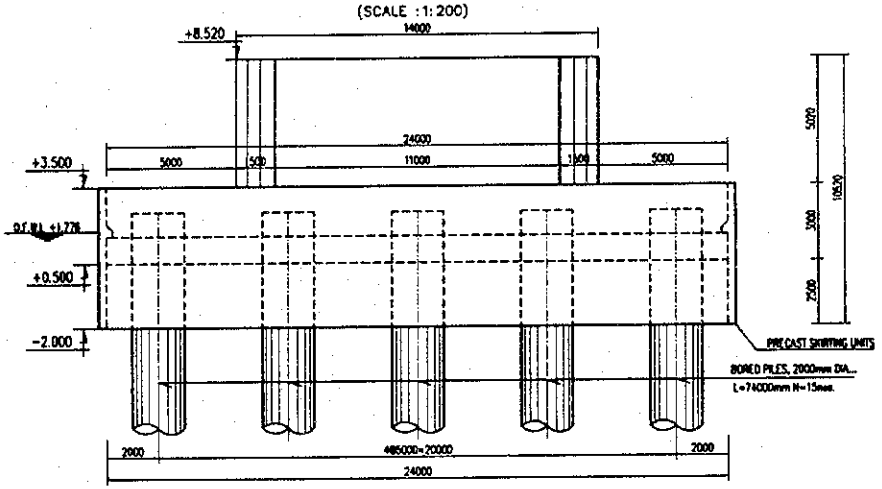
4.5) EXCAVATED MATERIALS

v1 =	$PI()* D_1^2 / 4 * L_1$	=	PI()*2.2^2/4*753.9	= 2865.8	m^3
v2 =	$PI()*D^2 / 4 * (L_2+L_3)$	=	PI()*2.0^2/4*(153.6+202.5)	= 1118.7	m^3
V =	v1+v2			= 3984.5	m^3

GENERAL VIEW OF PIER No.38 & 39

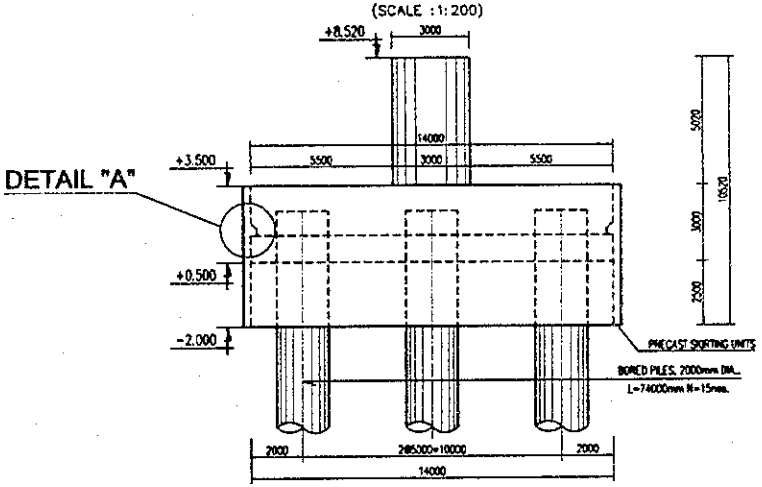
ELEVATION

(SCALE : 1:200)



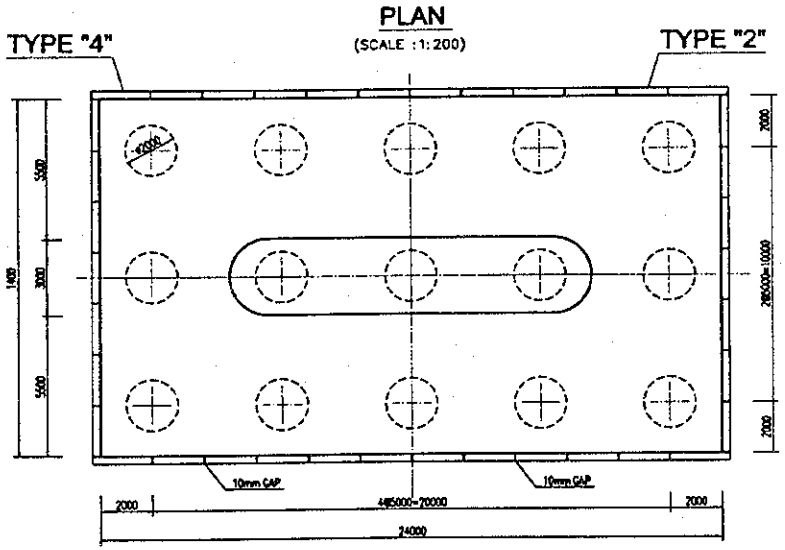
SIDE ELEVATION

(SCALE : 1:200)



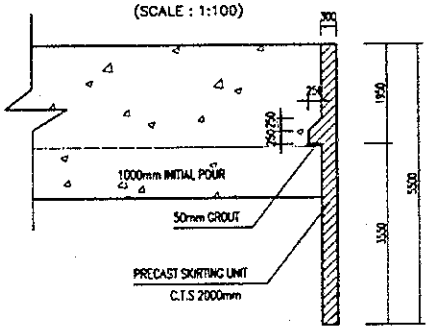
PLAN

(SCALE : 1:200)



DETAIL "A"

(SCALE : 1:100)



NOTE:

ALL DIMENSIONS ARE IN MILLIMETERS, UNLESS OTHERWISE INDICATED.

1. CONCRETE

		P38(39)
BEAM	V1 (m^3)	0.0
COLUMN	V2 (m^3)	201.1
FOOTING	V3 (m^3)	886.8
SKIRTING UNIT	V4 (m^3)	133.7
TOTAL (m^3)		1221.6

2. FORM

		P38(39)
BEAM	A1 (m^2)	0.0
COLUMN	A2 (m^2)	187.9
FOOTING	A3 (m^2)	507.0
SKIRTING UNIT	A4 (m^2)	641.4
TOTAL (m^2)		1336.3

3. SCAFFOLDING WORK

		P38(39)
A (m^2)	H < 4m	456.0
	4m ≤ H < 30m	341.4

4. CAST-IN-PLACE-CONCRETE PILE

		P38(39)
PILE DIMENSION	D (m)	2.0
	L (m)	74.0
	n (nos.)	15.0
CONCRETE	V (m^3)	250.0
EXCAVATION LENGTH	N < 20 (l_1) (m)	50.3
	L_1 (m)	753.9
	20 ≤ N ≤ 40 (l_2) (m)	10.2
	L_2 (m)	153.6
	N ≥ 40 (l_3) (m)	13.5
	L_3 (m)	202.5
EXCAVATED MATERIALS	V (m^3)	3984.5
STEEL CASING t=16mm	W(kg)	14864.8

5). REINFORCEMENT OF PIER 38(39)

DETAILED	No	D (mm)	LENGTH (m)	QUANTITY (nos)	TOTAL LENGT (m)	TOTAL WEIGH (kg)
COLUMN	C1	16	11344	46	521.8	823.6
	C2	16	6078	46	279.6	441.3
	C3	32	6140	232	1424.5	8993.2
	C4	32	3730	232	865.4	5463.3
	C5	16	3360	230	772.8	1219.7
	C6	16	13590	21	285.4	450.4
	C7	16	2590.5	109	282.4	445.7
FOOTING	F1	32	16548	297	4914.8	31028.5
	F1-1	32	3442	170	585.1	3694.2
	F1-2	32	1558	170	264.9	1672.2
	F2	32	28386	111	3150.8	19892.4
	F3	32	28318	60	1699.1	10726.9
	F3-1	32	3442	204	702.2	4433.0
	F3-2	32	1731	102	176.6	1114.7
	F4	20	25836	26	671.7	1656.6
	F5	20	25731	6	154.4	380.7
	F6	20	3961	304	1204.1	2969.6
	F7	20	3378	300	1013.4	2499.2
	F8	20	3116	304	947.3	2336.1
	F9	20	15150	20	303.0	747.2
	F10	20	15045	6	90.3	222.6
	F11	16	2130	1215	2588.0	4084.7
	F12	16	1880	1215	2284.2	3605.2
	B1	32	3348	40	133.9	845.5
	B2	32	4595	240	1102.8	6962.4
	B3	32	5841	320	1869.1	11800.4
PRECAST SKIRTING UNITS	P1	16	5700	768	4377.6	6909.3
	P2	16	2400	296	710.4	1121.2
	P3	16	1745	384	670.1	1057.6
	P4	16	2200	2516	5535.2	8736.4
	P5	20	1600	1456	2329.6	5745.1
TOTAL	D=16(mm)				28895.2	(kg)
	D=20(mm)				16557.2	(kg)
	D=32(mm)				106626.6	(kg)
	TOTAL				152079.0	(kg)

Summary of Quantity table of pier No.38(39)

Items			Unit	Pier 38(39)
Pile	Number of piles		Pile	15
	Total length bored piles D=2000mm Dia.		m	1110.0
	Concrete piles class D		m^3	3749.6
	Renforcement	D12	kg	37318.5
		D16	kg	807.0
		D22	kg	8280.0
		D25	kg	160635.0
		D28	kg	0.0
		STEEL PLATE t=16mm	kg	222971.5
		Total	kg	430012.0
Pier	Concrete class E		m^3	1221.6
	Reinforcement	D16	kg	28895.2
		D20	kg	16557.2
		D32	kg	106626.6
		Total	kg	152079.0
	Form	Curve	m^2	0.0
		Flat	m^2	1336.3
	Scaffolding work	H < 4m	m^2	456.0
		4m ≤ H < 30m	m^2	341.4
	Earth work	Excavation for foundation	m^3	3984.5

IV. Summary of Quantity table of Substream Piers No.36(37,38,39,40,41)

Items			Unit	Pier 36	Pier 37	Pier 38	Pier 39	Pier 40	Pier 41
Pile	Number of piles		Pile	9.0	9.0	15.0	15.0	9.0	9.0
	Total length bored piles D=1500mm Dia.		m	630.0	0.0	0.0	0.0	0.0	630.0
	Total length bored piles D=2000mm Dia.		m	0.0	702.0	1110.0	1110.0	702.0	0.0
	Concrete piles class D		m3	1222.0	2362.9	3749.6	3749.6	2362.9	1222.0
	Renforcement	D10	kg	10197.9	0.0	0.0	0.0	0.0	10197.9
		D12	kg	0.0	23713.2	37318.5	37318.5	23713.2	0.0
		D16	kg	320.4	484.2	807.0	807.0	484.2	320.4
		D22	kg	3758.4	5382.9	8280.0	8280.0	5382.9	3758.4
		D25	kg	28681.2	57828.6	160635.0	160635.0	57828.6	28681.2
		D28	kg	15661.8	27147.6	0.0	0.0	27147.6	15661.8
		STEEL PLATE t=16mm	kg	103597.2	133782.9	222971.5	222971.5	133782.9	103597.2
		Total	kg	162216.9	248339.4	430012.0	430012.0	248339.4	162216.9
Pier	Concrete class E		m3	840.5	976.7	1221.6	1221.6	976.7	840.5
	Reinforcement	D16	kg	17494.8	12959.4	28895.2	28895.2	12959.4	17494.8
		D18	kg	10115.5	8223.6	0.0	0.0	8223.6	10115.5
		D20	kg	18039.1	20315.1	16557.2	16557.2	20315.1	18039.1
		D32	kg	56979.0	53565.2	106626.6	106626.6	53565.2	56979.0
		Total	kg	102628.4	95063.3	152079.0	152079.0	95063.3	102628.4
	Form	Curve	m2	0.0	0.0	0.0	0.0	0.0	0.0
		Flat	m2	1037.5	1121.5	1336.3	1336.3	1121.5	1037.5
	Scaffolding work	H < 4m	m2	342.0	396.0	456.0	456.0	396.0	342.0
		4m ≤ H < 30m	m2	449.3	232.6	341.4	341.4	232.6	449.3
	Support		m3	40.4	0.0	0.0	0.0	0.0	40.4
	Earth work	Excavation for foundation	m3	1340.7	2503.8	3984.5	3984.5	2503.8	1340.7

JICA