TYPE OF WORK : GUARD FENCE (1/2)

LOCATION :

PER 6.00m

CALCULATION	RESULT
• STEEL PIPE φ75 (3.0 inch) t = 3.2mm , W = 5.77 kgf/m	
n = 3 , L = 1.50 m/pipe	
W_1 = 3 pipes × 1.50 × 5.77 = 25.650	
• STEEL PIPE φ50 (2.0 inch) t = 2.3mm , W = 2.63 kgf/m	
n = 2 × 3 = 6 , L = 2.00 m/pile	
W_2 = 6 pipes × 2.00 × 2.63 = 31.560	
• ROUND BAR φ16 , W = 1.58 kgf/m	
n = 3 × 9 = 27 , L = 1.10 m/ber	
W_3 = 27 bers × 1.10 × 1.58 = 46.926	
TOTAL (ΣW) = 104.136 kgf	0.104 tf
• GALVANIZED COAT	
A_1 = π × 0.075 × 1.50 × 3 pipes = 1.060	
A_2 = π × 0.05 × 2.00 × 6 pipes = 1.885	
A_3 = π × 0.016 × 1.10 × 27 bers = 1.493	
TOTAL = 4.438	4.438 m^2

TYPE OF WORK : GUARD FENCE (3/2)

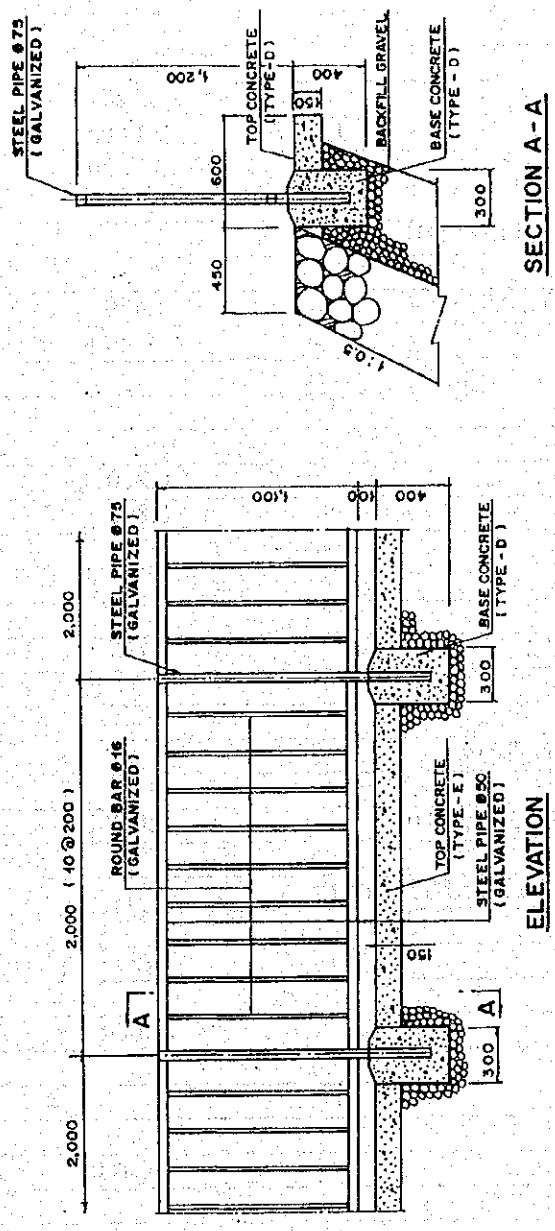
LOCATION : PER 6.00 m

CALCULATION	RESULT
• BASE CONCRETE (TYPE-D)	
$n = 3$	
$V = 0.30 \times 0.30 \times 0.40 - \pi/4 \times 0.075^2 \times 0.30 = 0.035$	
$\Sigma V = 0.035 \times 3 = 0.105$	$0.105\ m^3$
• FORM FOR BASE CONCRETE (H<4.0m)	
$n = 3$	
$A = 0.30 \times 0.40 \times 4 = 0.480$	
$\Sigma V = 0.480 \times 3 = 1.440$	$1.440\ m^2$

TYPE OF WORK : GUARD FENCE

LOCATION :

EXPLANATORY DRAWING



2.7 Earth Retaining Type (Wet Stone Masonry Type)

TYPE OF WORK : EARTH RETAINING WALL (WET STONE MASONRY TYPE)
H = 3.0 m
LOCATION : TOLL ROAD ~ WF.175R +16.94 m
:

CALCULATION		RESULT
STRUCTURAL EXCAVATION		
1. A = 4.00 x 0.28 / 2	= 0.560	
2. A = (3.20 + 4.00) x 0.70 / 2	= 2.520	
TOTAL A	= 3.080 m^2	
V = 3.080 x 40.00	= 123.200	123.200 m^3
BACKFILL WITH SELECTED SOIL		
A = 3.080 – (1.60 + 2.00) x 0.90 / 2	= 1.460	
V = 1.460 x 40.00	= 58.400	58.400 m^3
GRAVEL BEDDING		
A = (2.00 + 0.10 x 2) x 0.1	= 0.220	
V = 0.22 x 40.00	= 8.800	8.800 m^3
WET STONE MASONRY		
A = (0.50 + 2.00) x 3.00 / 2	= 3.750	
V = 3.75 x 40.00	= 150.000	150.000 m^3
CEMENT MORTAR POINTING		
A = (0.50 + 1.00 + 0.50 + 2.50) x 40.0	= 180.000	180.000 m^2
JOINT FILLER, t = 10.0 mm ELASTIC TYPE		
a = (0.50 + 2.00) x 3.00 / 2	= 3.750 m^2/place	
n = 4 places		
A = 3.75 x 4	= 15.000	15.000 m^2
SCAFFOLDING		
A = (3.00 + 3.354) x 40.0 m	= 254.160	254.160 m^2
FORMWORK		
A_1 = (3.00 + $\sqrt{3.0^2 + 1.5^2}$) x 40.0 m	= 254.164	
A_2 = (0.50 + 2.00) x 3.00 / 2 x 5	= 18.750	
TOTAL A	= 272.914	272.914 m^2

TYPE OF WORK : EARTH RETAINING WALL (WET STONE MASONRY TYPE)
H = 2.0 m
LOCATION : TOLL ROAD ~ WF.175R +16.94 m
:

CALCULATION		RESULT
STRUCTURAL EXCAVATION		
1. A = 3.30 x 0.20 / 2	= 0.330	
2. A = (3.30 + 2.70) x 0.60 / 2	= 1.800	
TOTAL A	= 2.130 m^2	
V = 2.130 x 25.00	= 53.250	53.250 m^3
BACKFILL WITH SELECTED SOIL		
A = 1.80 – (1.25 + 1.50) x 0.60 / 2	= 0.975	
V = 0.975 x 25.00	= 24.375	24.375 m^3
GRAVEL BEDDING		
A = (2.00 + 0.10 x 2) x 0.1	= 0.220	
V = 0.22 x 25.00	= 5.500	5.500 m^3
WET STONE MASONRY		
A = (0.50 + 1.50) x 2.00 / 2	= 2.000	
V = 2.00 x 25.00	= 50.000	50.000 m^3
CEMENT MORTAR POINTING		
A = (1.50 + 0.50 + 1.60) x 25.0	= 90.000	90.000 m^2
JOINT FILLER, t = 10.0 mm ELASTIC TYPE		
a = (0.50 + 1.50) x 2.00 / 2	= 2.000 m^2/place	
n = 3 places		
A = 2.00 x 3	= 6.000	6.000 m^2
FORMWORK		
$A_1 = (2.00 + \sqrt{1.0^2 + 2.0^2}) \times 25.0$ m	= 105.902	
A_2 = (0.50 + 1.50) x 2.00 / 2 x 3	= 6.000	
TOTAL A	= 111.902	111.902 m^2

2.8 PILE TYPE GROIN

TYPE OF WORK : RC PILE SECTION 200 x 200

LOCATION : WF. 127L ~ WF. 132L , WF 143L ~ WF 146L

CALCULATION	RESULT

RC PILE SECTION 200x200

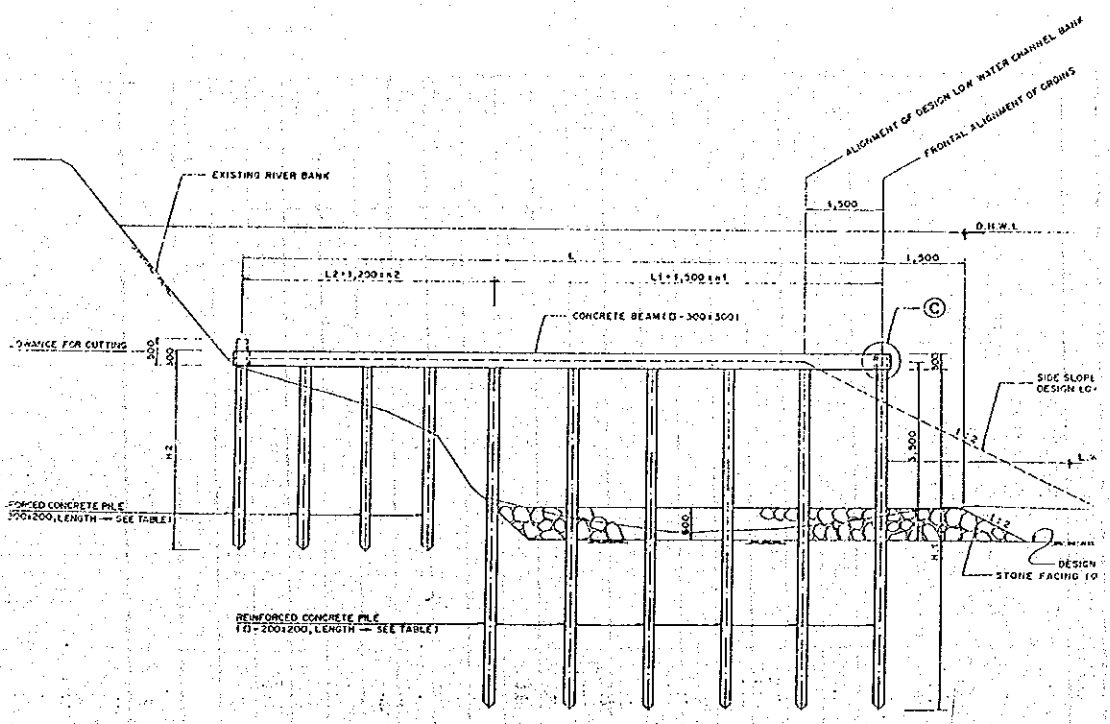
LOCATION	NUMBER OF PILE		PILE LENGTH							
	n1	n2	DESIGN LENGTH H1(m)	SPARE LENGTH (m)	NECESSARY LENGTH (m)	DESIGN LENGTH H2(m)	SPARE LENGTH (m)	NECESSARY LENGTH (m)	TOTAL LENGTH (m)
WF.127L	3	2	6.80	1.00	8.00	4.80	1.00	6.00	72.00
WF.127L+25.0m	4	3	6.80	1.00	8.00	4.30	1.00	6.00	100.00
WF.128L	5	3	6.80	1.00	8.00	3.80	1.00	5.00	110.00
WF.128L+25.0m	3	2	7.30	1.00	9.00	4.30	1.00	6.00	78.00
WF.129L	1	2	7.30	1.00	9.00	4.30	1.00	6.00	42.00
WF.129L+25.0m	2	2	7.30	1.00	9.00	4.30	1.00	6.00	60.00
WF.130L	2	2	7.30	1.00	9.00	3.80	1.00	5.00	56.00
WF.130L+25.0m	2	3	7.30	1.00	9.00	3.80	1.00	5.00	66.00
WF.131L	8	0	6.80	1.00	8.00	0.00			128.00
WF.131L+25.0m	4	3	6.80	1.00	8.00	3.80	1.00	5.00	94.00
WF.132L	3	3	6.80	1.00	8.00	3.80	1.00	5.00	78.00
WF.143L	1	3	6.30	1.00	8.00	3.80	1.00	5.00	46.00
WF.143L+25.0m	2	3	6.80	1.00	8.00	3.80	1.00	5.00	62.00
WF.144L	3	3	7.30	1.00	9.00	3.80	1.00	5.00	84.00
WF.144L+25.0m	5	3	7.30	1.00	9.00	3.80	1.00	5.00	120.00
WF.145L	8	3	7.30	1.00	9.00	3.80	1.00	5.00	174.00
WF.145L+25.0m	5	3	7.30	1.00	9.00	3.80	1.00	5.00	120.00
WF.146L	1	2	6.80	1.00	8.00	3.80	1.00	5.00	36.00
								TOTAL	**1526.00**

1526.00 m

TYPE OF WORK : PILE TYPE GROIN
: RC PILE SECTION 200 x 200

LOCATION : WF. 127L ~ WF. 132L , WF. 143L ~ WF. 146L

EXPLANATORY DRAWING



DATA ON CONCRETE PILE

LOCATION	n1	n2	L1 (m)	L2 (m)	L (m)	H1 (m)	H2 (m)
WF127L	3	2	4.5	2.4	6.9	6.5	4.5
+25m	4	3	6.0	3.6	9.6	6.5	4.0
WF128L	5	3	7.5	3.6	11.1	6.5	3.5
+25m	3	2	4.5	2.4	6.9	7.0	4.0
WF129L	1	2	1.5	2.4	3.9	7.0	4.0
+25m	2	2	3.0	2.4	5.4	7.0	4.0
WF130L	2	2	3.0	2.4	5.4	7.0	3.5
+25m	2	3	4.5	2.4	6.9	7.0	3.5
WF131L	8	–	12.0	–	12.0	6.5	–
+25m	4	3	6.0	3.6	9.6	6.5	3.5
WF132L	3	3	4.5	3.6	8.1	6.5	3.5
WF143L	1	3	1.5	3.6	5.1	6.0	3.5
+25m	2	3	3.0	3.6	6.6	6.5	3.5
WF144L	3	3	4.5	3.6	8.1	7.0	3.5
+25m	5	3	7.5	3.6	11.1	7.0	3.5
WF145L	8	3	12.0	3.6	15.6	7.0	3.5
+25m	5	3	7.5	3.6	11.1	7.0	3.5
WF146L	1	2	1.5	2.4	3.9	6.5	3.5

PILE TYPE GROIN

TYPE OF WORK : DRIVING RC PILE

LOCATION : WF. 127L ~ WF.132L , WF.143L ~ WF.146L

CALCULATION

DRIVING RC PILE

LOCATION	NUMBER OF PILE n1	NUMBER OF PILE n2	DESIGN LENGTH H1(m)	HEIGHT OF PILE ABOVE GROUND LEVEL (m)	DEPTH OF DRIVING PILE (m)	DESIGN LENGTH H2(m)	HEIGHT OF PILE ABOVE GROUND LEVEL (m)	DEPTH OF DRIVING PILE (m)	TOTAL LENGTH (m)
WF.127L	3	2	6.50	3.50	3.00	4.50	1.05	3.45	31.80
WF.127L+25.0m	4	3	6.50	3.50	3.00	4.00	1.05	2.95	41.70
WF.128L	5	3	6.50	3.50	3.00	3.50	1.25	2.25	43.50
WF.128L+25.0m	3	2	7.00	3.50	3.50	4.00	0.90	3.10	33.40
WF.129L	1	2	7.00	3.50	3.50	4.00	0.80	3.20	19.80
WF.129L+25.0m	2	2	7.00	3.50	3.50	4.00	0.35	3.65	28.60
WF.130L	2	2	7.00	3.50	3.50	3.50	0.35	3.15	26.60
WF.130L+25.0m	2	3	7.00	3.50	3.50	3.50	0.35	3.15	32.90
WF.131L	8	0	6.50	3.50	3.00	0.00			48.00
WF.131L+25.0m	4	3	6.50	3.50	3.00	3.50	0.85	2.65	39.90
WF.132L	3	3	6.50	3.50	3.00	3.50	0.45	3.05	36.30
WF.143L	1	3	6.00	2.05	3.95	3.50	0.80	2.70	24.10
WF.143L+25.0m	2	3	6.50	3.50	3.00	3.50	0.75	2.75	28.50
WF.144L	3	3	7.00	3.50	3.50	3.50	0.75	2.75	37.50
WF.144L+25.0m	5	3	7.00	3.50	3.50	3.50	0.90	2.60	50.60
WF.145L	8	3	7.00	3.50	3.50	3.50	1.10	2.40	70.40
WF.145L+25.0m	5	3	7.00	3.50	3.50	3.50	1.25	2.25	48.50
WF.146L	1	2	6.50	2.35	4.15	3.50	0.80	2.70	19.10
								TOTAL	**661.20**

RESULT

661.20 m

TYPE OF WORK : PILE TYPE GROIN : CUTTING PILE HEAD

LOCATION : WF.127L ~ WF.132L , WF.143L ~ WF.146L

CALCULATION

LOCATION	NUMBER OF PILE		CUTTING PILE HEAD								TOTAL VOLUME (m)
	n1	n2	NECESSARY LENGTH (m)	DESIGN LENGTH H1(m)	VOLUME OF CUTTING PILE HEAD (m^3)	NECESSARY LENGTH (m)	DESIGN LENGTH H2(m)	VOLUME OF CUTTING PILE HEAD (m^3)			
WF.127L	3	2	8.00	6.50	0.060	6.00	4.50	0.060			0.600
WF.127L+25.0m	4	3	8.00	6.50	0.060	6.00	4.00	0.080			0.960
WF.128L	5	3	8.00	6.50	0.060	5.00	3.50	0.060			0.960
WF.128L+25.0m	3	2	9.00	7.00	0.080	6.00	4.00	0.080			0.800
WF.129L	1	2	9.00	7.00	0.080	6.00	4.00	0.080			0.480
WF.129L+25.0m	2	2	9.00	7.00	0.080	6.00	4.00	0.080			0.640
WF.130L	2	2	9.00	7.00	0.080	5.00	3.50	0.060			0.560
WF.130L+25.0m	2	3	9.00	7.00	0.080	5.00	3.50	0.060			0.680
WF.131L	8	0	8.00	6.50	0.060		0.00				0.960
WF.131L+25.0m	4	3	8.00	6.50	0.060	5.00	3.50	0.060			0.840
WF.132L	3	3	8.00	6.50	0.060	5.00	3.50	0.060			0.720
WF.143L	1	3	8.00	6.00	0.080	5.00	3.50	0.060			0.520
WF.143L+25.0m	2	3	8.00	6.50	0.060	5.00	3.50	0.060			0.600
WF.144L	3	3	9.00	7.00	0.080	5.00	3.50	0.060			0.840
WF.144L+25.0m	5	3	9.00	7.00	0.080	5.00	3.50	0.060			1.160
WF.145L	8	3	9.00	7.00	0.080	5.00	3.50	0.060			1.640
WF.145L+25.0m	5	3	9.00	7.00	0.080	5.00	3.50	0.060			1.160
WF.146L	1	2	8.00	6.50	0.060	5.00	3.50	0.060			0.360
								TOTAL			14.480

RESULT

14.480 m^3

TYPE OF WORK : PILE TYPE GROIN
: CONCRETE (TYPE - C1)

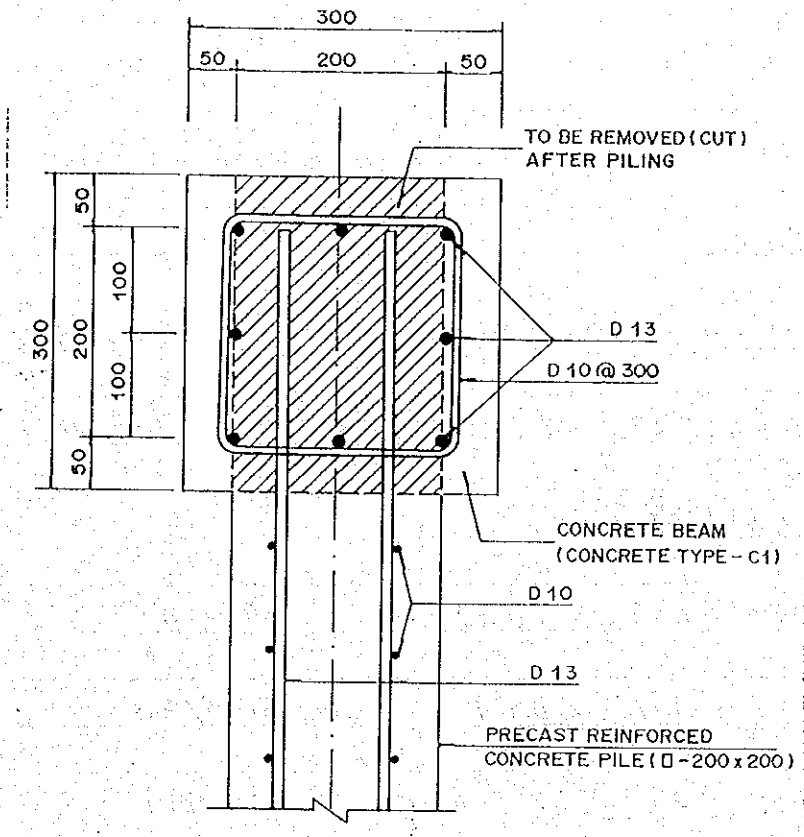
LOCATION : WF. 127L ~ WF. 132L , WF. 143L ~ WF. 146L

CALCULATION	RESULT
• CONCRETE (TYPE - C1)	
LENGTH OF CONCRETE BEAM : $L_1' = 8.48$ m (AVERAGE)	
" : $L_2' = 1.50$ m	
$V_1 = \{(0.30 \times 0.30) \times 8.48 \times 2\} \times 18$ places = 27.475	
$V_2 = \{(0.30 \times 0.30) \times 1.50 \times 2\} \times 18$ places = 4.860	
TOTAL = 32.335	32.335 m^3
• FORM ($H < 4.0$m)	
$A_1 = \{0.30 \times 8.48 \times 3 \times 2\} \times 18$ places = 274.752	
$A_2 = \{0.30 \times 1.50 \times 3 \times 2\} \times 18$ places = 48.600	
TOTAL = 323.352	323.352 m^2
• SUPPORTING	
CONCRETE BEAM $L_1 = 5.17$ m (AVERAGE)	
" $L_2 = 3.31$ m (")	
$V_1 = (5.17 \times 3.21 \times 1.00) \times 2 \times 18$ places = 597.445	
$V_2 = (3.31 \times 0.66 \times 1.00) \times 2 \times 18$ places = 78.646	
$V_3 = (1.50 \times 3.21 \times 1.00) \times 18$ places = 86.670	
$V_4 = (1.50 \times 0.66 \times 1.00) \times 18$ places = 17.820	
TOTAL = 780.581	780.581 m^3

TYPE OF WORK : PILE TYPE GROIN
: CONCRETE (TYPE-C1)

LOCATION : WF.127L ~ WF.132L , WF.143L ~ WF.146L

EXPLANATORY DRAWING



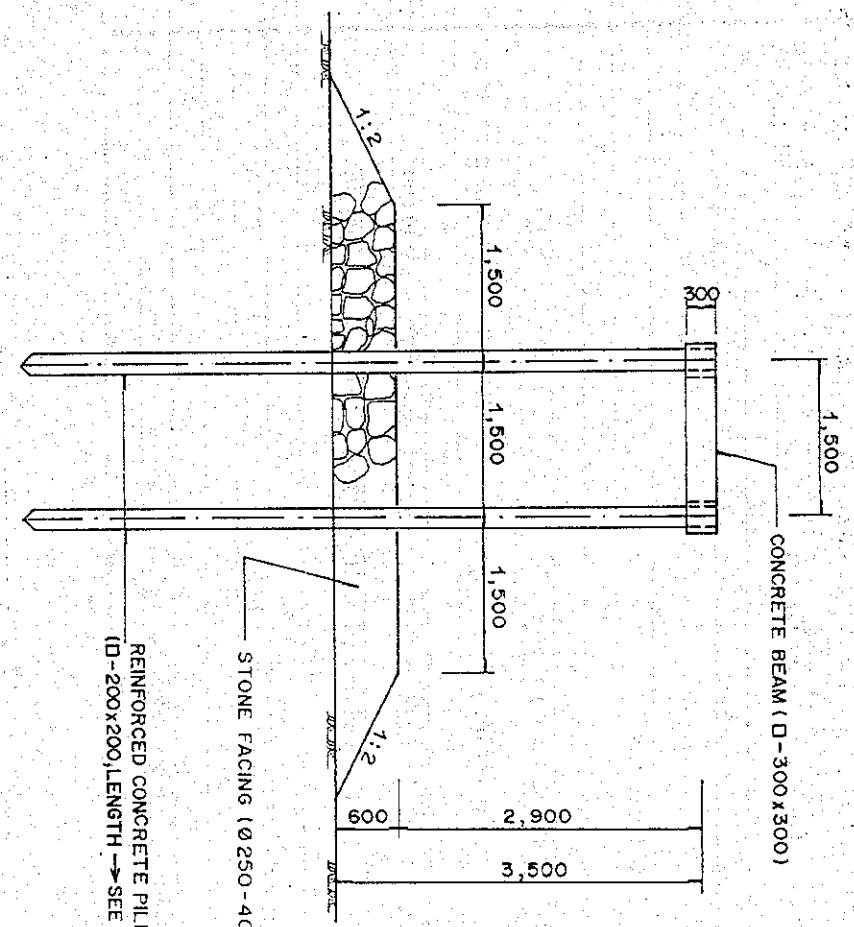
TYPE OF WORK : PILE TYPE GROIN
: REINFORCING BAR

LOCATION : WF. 127L ~ WF. 132L, WF. 143L ~ WF. 146L

CALCULATION	RESULT
LENGTH OF CONCRETE BEAM : $L_1' = 8.48$ m (Average)	
" : $L_2' = 1.50$ m	
Φ13 (W = 1.04 kgf/m)	
$n_1 = 8$ Bars	
$W_1 = (8.48 - 0.05 \times 2) \times 8\text{Bars} \times 2 \times 1.04 = 139.443$	
$W_2 = (1.50 + 0.25 \times 2) \times 8\text{ Bars} \times 2 \times 1.04 = 33.280$	
Φ10 (W = 0.617 kgf/m)	
$n_2 = (8.48 - 0.05 \times 2) \div 0.30 + 1 = 29$ Bars	
$L_2 = 0.20 \times 4 + 15 \times 0.01 = 0.950$ m/Bar	
$W_3 = 0.950 \times 29 \times 2 \times 0.617 = 33.997$	
$n_3 = (1.50 + 0.25 \times 2) \div 0.30 + 1 = 8$ Bars	
$W_4 = 0.950 \times 8 \times 2 \times 0.617 = 9.378$	
$W' = 216.098$ kgf $= 0.216$ tf/place	
$W = 0.216$ tf/place $\times$ 18 places $= 3.888$	3.888 tf

PILE TYPE GROIN

TYPE OF WORK :	STONE FACING
LOCATION :	WF. 127L ~ WF. 132L , WF. 143L ~ WF. 146L



CALCULATION	RESULT
CONCRETE BEAM L_1 = 5.17 m (Average)	
$V_1 = (4.50 + 6.90) \times 1/2 \times 0.60 \times 1.20 \times 1/3 = 1.368$	
$V_2 = (4.50 + 6.90) \times 1/2 \times 0.60 \times (5.17 + 1.50)$	
$= 22.811$	
$V = 24.179\ m^3/place$	
$V' = 24.179\ m^3/place \times 18\ places = 435.222$	$435.2\ m^3$

2.9 Riverbed Protection around Bridge Piers

TYPE OF WORK : RIVERBED PROTECTION AROUND BRIDGE PIERS
LOCATION : NORTH RING ROAD BRIDGE

CALCULATION			RESULT
BACKFILL WITH SELECTED SOIL			
A = (0.50 + 1.00) x ½ x 0.50	=	0.375 m^2	
V = 0.375 x (10.00 x + 30.00 x 2)	=	30.000	30.0 m^3
STRUCTURAL EXCAVATION			
A = (5.00 + 5.50) x ½ x 0.50 x 2	=	5.250 m^2	
V = 5.20 x (30.00 + 1.00 x 2) – (11.00 x 1.00 x 0.50) x 2	=	157.00	157.0 m^3
GABION MATTRESS			
V_1 = (4.50 x 0.50 x 240.00) x 2	=	108.000	
V_2 = (10.5 x 0.50 x 30.00) x 2	=	31.500	139.500 m^3
RIPRAP MOUND			
A_1 = (05.10 + 2.50) x ½ x 1.30	=	4.940 m^2	
A_2 = (4.10 + 2.50) x ½ x 0.80	=	2.640 m^2	
V_1 = (4.940 + 2.640) x 24.00	=	30.000	
V_2 = (4.940 + 2.640 + 6.30) x (10.00 + 2.50 x 2)	=	208.200	
TOTAL	=	390.120	390.120 m^3

TYPE OF WORK :
LOCATION : RAILWAY BRIDGE

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
1) (0.5 + 5.6) x 0.6 : 2	=	3.18	
2) (2.0 + 2.6) x 0.6 : 2	=	1.38	
V_1 = (14.25 + 4.5 : 2 x 2) x 3.18	=	59.625	
V_2 = 1.38 x 14.25	=	19.665	
V = (V_1 + V_2) x 2	=	158.58	158.580 m^3
BACKFILL WITH SELECTED SOIL			
A_1 = (5.0 + 1.1) x 0.6 : 2 x 4	=	1.920	
V_1 = 0.480 x 12.0 m x 2	=	44.640	44.640 m^3

TYPE OF WORK :
LOCATION : RAILWAY BRIDGE

CALCULATION				RESULT
CONCRETE BLOCK				
UPPER				
N_1 = 2 x 6 + 4 + 2		=	18	
N_2 = 6 x 9 - 4		=	50	
N_3 = n_1 - 1	= 18 - 1	=	17	
N_4 = 19 x 6		=	114	
N_5 = n_3		=	17	
N_6 = n_2		=	50	
N_7 = n_1		=	18	
N_8 = n_4		=	114	
N_9 = 4 x 4		=	16	
	Σn	=	414	
TOTAL	$N_1 = \Sigma n \times 2$	=	828	828
CONCRETE BROCK				
LOWER				
N = 4 x 4 + 6 + 2 x 15 + 4 + 7 + 7 + 3		=	73	
N_2 = 73 x 2		=	146	
TOTAL $N_1 + N_2$ = 828 + 146		=	974	974

TYPE OF WORK :
LOCATION : RAILWAY BRIDGE

CALCULATION			RESULT
GRAVEL BEDDING			
N = 828			
V^1 = 0.75 x 0.75 x 0.10	=	0.056 m^3/Block	
V = 0.056 x 828	=	46.368	46.368
FILTER CLOTH (Geotextile sheet)			
A = 0.75 x 0.75	=	0.563 m^2/Block	
$\sum A$ = 0.563 x 828	=	466.164	466.164 m^2
RUBBLE STONE FILLING			
M = 0.3 x 0.3 x 0.5	=	0.045 m^3	
V = 0.045 x 974	=	43.83 m^3	43.830 m^3
CONCRETE FILLING			
A = 0.75 x 0.375 : 2 + 0.75 x 1.50 : 2 + (0.75 + 0.5) x 1.125 : 2	=	1.407	
A = 1.407 x 4	=	5.628	
V^1 = 5.628 x 0.5 x 2	=	5.628	
V = 5.628 x 2 places	=	11.256	11.256 m^3

PER 1 PIECE

TYPE OF WORK :	CONCRETE BLOCK (W = 0.5 t/piece)
LOCATION :	

CALCULATION	RESULT
· CONCRETE (TYPE - D)	
V = (0.74 × 0.74 × 0.50) − (0.30 × 0.30 × 0.50)	
= 0.229	0.229 m^3
· FORM (H < 4.0 m)	
A_1 = 0.74 × 0.50 × 4 = 1.480	
A_2 = 0.30 × 0.50 × 4 = 0.600	
TOTAL = 2.080	2.080 m^2
· REINFORCING BAR	
D13 (w = 1.04 kg/m)	
n = 8 Bars	
L = 0.65 m/Bar	
W = 8 × 0.65 × 1.04 = 5.408	5.408 kg

TYPE OF WORK : NATIONAL ROAD BRIDGE - A
LOCATION : A

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
A_1 = (5.0 + 5.6) x 0.6 : 2 x 2	=	6.360 m^2	
V_1 = 6.360 x 12.0 m	=	76.320 m^3	
A_2 = (0.5 + 1.1) x 0.6 : 2	=	0.480 m^2	
V_2 = 0.480 x 12.0 x 2	=	11.52 m^3	
V = V_1 + V_2	=	87.84	87.84 m^3
BACKFILL WITH SELECTED SOIL			
A_1 = (0.5 + 1.1) x 0.6 : 2	=	0.480	
V = 0.480 x 12.0 x 8	=	23.04	23.04 m^3
GABION MATTRESS, FILTER CLOTH			
1) GABION MATTRESS			
3.0 x 1.5 x 0.5 TYPE			
n = 30			
V = 3.0 x 1.5 x 0.5 x 30	=	67.5	67.5 m^3
2) FILTER CLOTH			
A = 3.0 x 1.5 x 30	=	135.0	135.000 m^2

TYPE OF WORK : NATIONAL ROAD BRIDGE - B
LOCATION : B

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
A_1 = (5.0 + 5.1) x 0.6 : 2	=	3.03	
V_1 = 2.625 x 21.0 m x 2	=	72.72	
A_2 = (0.5 + 1.1) x 0.5 : 2	=	0.33	
V_2 = 0.4 x 12.0 x 2	=	11.880	
V = V_1 + V_2	=	84.6	84.600 m^3
BACKFILL WITH SELECTED SOIL			
A_1 = (5.0 + 1.1) x 0.6 : 2	=	0.48	
V_1 = 0.480 x 12.0 m x 2	=	14.4	
V_2 = 0.480 x 9.0 x 4	=	17.28	
V = V_1 + V_2	=	31.68	31.68 m^3
GABION MATTRESS, FILTER CLOTH			
1) GABION MATTRESS			
n = 47			
V = 3.0 x 1.5 x 0.5 x 47	=	105.75	105.75 m^3
2) FILTER CLOTH			
A = 3.0 x 1.5 x 47	=	211.5	211.500 m^2

TYPE OF WORK : NATIONAL ROAD BRIDGE - C
LOCATION : C

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
A_1 = (9.5 + 10.0) x 0.5 : 2	=	4.875	
V_1 = 4.875 x 12.0	=	58.5	58.500 m^3
A_2 = (0.5 + 1.1) x 0.6 : 2	=	0.48	
V_2 = 0.48 x 6.0 x 2	=	5.76	5.760 m^3
BACKFILL WITH SELECTED SOIL			
A = (5.0 + 1.1) x 0.6 : 2	=	0.48	
V = 0.48 x (12.0 + 6.0) x 2	=	18.24	18.240 m^3

TYPE OF WORK : NATIONAL ROAD BRIDGE - C
LOCATION : C

CALCULATION			RESULT
GABION MATTRESS, FILTER CLOTH			
1) GABION MATTRESS			
n = 15			
V = 3.0 x 1.5 x 0.5 x 15	=	33.75	33.750 m^3
2) FILTER CLOTH			
A = 3.0 x 1.5 x 15	=	67.5	67.500 m^2
RIPRAP MOUND			
A_1 = (4.5 + 6.5) x 1.0 : 2	=	5.5	
V_1 = 5.5 x 12.0 m x 2	=	66.000	
A_2 = 1.0 x 4.5 : 2	=	1.0	
V_2 = 1.0 x 4.5 x 1.0 x 12.0	=	16.5	
V = V_1 + V_2	=	82.6	82.500 m^3

TYPE OF WORK :
LOCATION : NEW SIMONGAN BRIDGE

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
A_1 = 6.0 x 0.8	=	4.800	
A_2 = (6.5 + 7.2) x 0.7 : 2	=	4.795	
A_3 = (0.5 + 0.7) x 0.7 : 2	=	0.420	
V_1 = 4.800 x 21.0	=	100.800	
V_2 = 4.795 x 21.0	=	100.695	
V_3 = 0.420 x 12.0 x 2	=	10.080	
V = $V_1 + V_2 + V_3$	=	211.575	211.575 m^3
BACKFILL WITH SELECTED SOIL			
A = (0.5 + 1.2) x 0.7 : 2	=	0.595	
V = 0.595 x (21.0 + 12.0 x 2)	=	26.775	26.775 m^3
CONCRETE BLOCK			
CONCRETE BLOCK			
n = 8 x 14 - 2	=	110	110
GRAVEL BEDDING			
V = 1.5 x 1.5 x 0.10 x 110	=	24.750	24.750 m^3
GEOTEXTILE SHEET			
A = 1.5 x 1.5 x 110	=	247.500	247.500 m^2
RUBBLE STONE FILLING			
V = (12.00 x 21.00 x 0.70) – 110 x 0.87	=	80.700	80.700 m^3

TYPE OF WORK :
LOCATION : TOLL ROAD BRIDGE

CALCULATION			RESULT
STRUCTURAL EXCAVATION			
A_1 = (5.0 + 5.5) x 0.5 : 2	=	2.625	
V_1 = 2.625 x 21.0 m x 2	=	110.25	
A_2 = (0.5 + 1.1) x 0.5 : 2	=	0.4	
V_2 = 0.4 x 12.0 x 2	=	9.600	
V = V_1 + V_2	=	119.85	119.85 m^3
BACKFILL WITH SELECTED SOIL			
A_1 = (5.0 + 1.1) x 0.5 : 2	=	0.4	
V_1 = 0.4 x 21.0 m x 2	=	16.8	
V_2 = 0.4 x 12.0 x 2	=	9.6	
V = V_1 + V_2	=	26.4	26.4 m^3

TYPE OF WORK :
LOCATION : TOLL ROAD BRIDGE

CALCULATION			RESULT
RUBBLE STONE FILLING			
A_1 = 1.0 x 4.5 : 2	=	2.25	
A_2 = 0.8 x 4.5 : 2	=	1.800	
A = A_1 + A_2	=	4.05	
V = 4.05 x 0.5	=	2.025	2.025 m^3
GABION MATTRESS, FILTER CLOTH			
1) GABION MATTRESS			
n = 45			
V = 3.0 x 1.5 x 0.5 x 45	=	101.25	101.25 m^3
2) FILTER CLOTH			
A = 3.0 x 1.5 x 45	=	202.5	202.500 m^2

CHAPTER 3 SIMONGAN WEIR

3.1 Channel Excavation

TYPE OF WORK : CHANNEL EXCAVATION

LOCATION : WF. 96 ~ WF 104

CALCULATION	RESULT

• Excavation below water level EL +5.20

Station	Distance (m)	Area (m^2)	Average (m^2)	Volume (m^3)
WF. 96		30.69		
97	50.59	37.26	33.98	1719.0
98	51.92	14.50	25.88	1343.7
99	50.40	0.00	7.25	365.4
100	51.02	167.10	83.55	4262.7
101	49.82	111.57	139.34	6941.9
102	54.05	94.96	103.27	5581.7
103	51.07	113.22	104.09	5315.9
104	58.36	112.28	112.75	6580.1
			TOTAL	32110.4

RESULT: 32110.4 m^3

※ Including Soft Rock Excavation (V = 500 m^3)

• Excavation above water level EL +5.20

Station	Distance (m)	Area (m^2)	Average (m^2)	Volume (m^3)
WF. 96		46.08		
97	50.59	18.14	32.11	1624.4
98	51.92	0.00	9.07	470.9
99	50.40	0.00	0.00	0.0
100	51.02	2.06	1.03	52.0
101	49.82	33.85	17.96	894.8
102	54.05	18.22	26.04	1407.5
103	51.07	28.04	23.13	1181.2
104	58.36	20.86	24.45	1426.9
			TOTAL	7057.7

RESULT: 7057.7 m^3

TYPE OF WORK :	SOLID SODDING
LOCATION :	

A_1 : Downstream of Weir at Left Bank

A_2 : Upstream of Weir at Left Bank

A_3 : Upstream of Weir at Left Intake Sluice

S

A_5

CALCULATION	RESULT
- STRUCTURES	
$A_1 = 15.00 \times 2 \times 1.118 = 33.54$	
$A_2 = 26.00 \times 1 \times 1.118 = 29.07$	
$A_3 = 42.00 \times 3 \times 1.118 = 140.87$	
$A_4 = (11.00 + 5.00) \times 1/2 \times 4.00 = 32.00$	
$A_5 = 1/2 \times 9.00 \times 5.00 = 22.50$	
- REVETMENT	

STATION	Distance (m)	Left Bank L (m)	Left Bank A (m^2)	Right Bank L (m)	Right Bank A (m^2)
100		0.0	0.0	10.0	
101	49.82	0.0	0.0	1.18	29.39
102	54.05	0.0	0.0	0.59	47.83
103	51.07	0.0	0.0	1.03	41.37
104	58.36	3.32	96.88	2.77	110.884
	TOTAL		96.88		229.47

$\sum A = 584.33$ — RESULT: $584.33 m^2$

TYPE OF WORK :	BACKFILL WITH SELECTED SOIL
LOCATION :	Weir and Intake Structures

V_1 = Downstream of Weir at left Bank

V_2 : Downstream of Weir at Right Bank

V_3 : Downstream of Weir at Approach wall section

V_4 : Main Body of Weir

V_5 : Upstream of Weir at Approach wall Section

CALCULATION		RESULT
$V_1 = 15.21 \times 42.00$	$= 638.82$	
$V_2 = 15.94 \times 42.00$	$= 669.48$	
$V_3 = (67.21 + 81.49) \times 25.00$	$= 3717.50$	
$V_4 = (54.85 + 60.83) \times 18.50$	$= 1180.205$	
$V_5 = (73.08 + 67.82) \times (7.50 + 21.00)$	$= 4015.65$	
TOTAL = 10221.66		$10221.7 m^3$

TYPE OF WORK :	EARTH FILL ON RIVERBED
LOCATION :	

CALCULATION	RESULT
$V_1 = (13.65 + 20.29) \times 42.00 = 1425.48$	
$V_2 = 53.28 \times (7.50 + 18.00) = 1358.64$	
TOTAL = 2784.12	$2784.1\ m^3$

TYPE OF WORK :	EMBANKMENT	CALCULATION	RESULT
LOCATION :	APPROACH ROAD		
		(Right Bank)	
		$V_1 = 18.67 \times 7.00 = 130.69$	
		(Left Bank)	
		$V_2 = 25.14 \times 7.00 = 175.98$	
		TOTAL = 306.67	$306.7 m^3$

TYPE OF WORK :	STRUCTURAL EXCAVATION	CALCULATION	RESULT
LOCATION :	Weir and Intake Structures		
V_1 : Downstream of Weir at left Bank		$V_1 = 13.67 \times 42.00 = 574.14$	
V_2 : Downstream of Weir at Right Bank		$V_2 = 16.19 \times 42.00 = 679.98$	
V_3 : Downstream of Weir at G.M and C.B. Section		$V_3 = 6.86 \times 42.00 = 288.12$	
V_4 : Downstream of Weir at Approach wall Section		$V_4 = (16.62 + 53.69) \times 25.00 = 1757.75$	
V_5 : Downstream of Weir at Concrete Apron Section		$V_5 = 21.04 \times 5 \times 25.00 = 2630.00$	
V_6 : Main Body of Weir		$V_6 = (82.29 + 26.00 \times 3 + 17.60 \times 2 + 104.67) \times 18.50$	
		$= 5182.96$	
V_7 : Upstream of weir at Concrete Apron and A. W. Section		$V_7 = (42.28 + 17.60 \times 2 + 5.13 + 9.41 + 75.62) \times 7.50$	
S		$= 1219.80$	
V_8		$V_8 = (42.28 + 75.62) \times 21.00 = 2475.90$	
V_9 : Concrete Blocks at Upstream of Weir		$V_9 = 837.0 \times (0.70 + 0.10) = 669.60$	
V_{10} : Gabion Mattress at Upstream of Weir		$V_{10} = 775.4 \times 0.50 = 387.70$	
		TOTAL = 15865.95	$15866.0 m^3$

TYPE OF WORK :	Restoration of Flood wall
LOCATION :	B 8

CALCULATION	RESULT
$V = (7.00 + 5.00) \times 4.00 \times 0.30 \quad = 14.400$	$14.40 m^3$

TYPE OF WORK :	DEMOLITION OF EXISTING STRUCTURES
LOCATION :	B 7

V_1 : Downstream of Weir at Left Bank

V_2 : Downstream of Weir at Right Bank

V_3 : Upstream of weir at Right Existing Sluice

V_4 : Upstream of weir at Left Bank

V_5 : Near Right Existing Sluice

V_6 : Right Existing Sluice

V_7 : Simongan Weir

CALCULATION	RESULT
- REVETMENT	
$V_1 = 8.10 \times 0.30 \times 88.00 = 213.84$	
$V_2 = 9.45 \times 0.30 \times 85.00 = 240.98$	
$V_3 = 3.70 \times 0.80 \times 26.00 = 76.960$	
$V_4 = 6.00 \times 0.50 \times 13.00 = 39.000$	
- RETAINING WALL	
$V_5 = 4.50 \times 0.60 \times 25.00 = 67.50$	
- STRUCTURES	
$V_6 = (9.00 \times 19.00 \times 7.00) = 1197.00$	
$V_7 = (30.00 \times 1.65 \times 3.50) + (6.00 \times 2.00 \times 3.50) + (83.00 \times 0.60 \times 60.00)$	
$= 3203.25$	
TOTAL = 5038.53	5038.53