Working Division: No-2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/11	Reinfacement bar	ton	68.827	
	Concrete volume = 2,294.232			
	w = 2,294.232 × 0.03 = 68.827			

Volume calculation Sheet

Work Division : Right Abutment

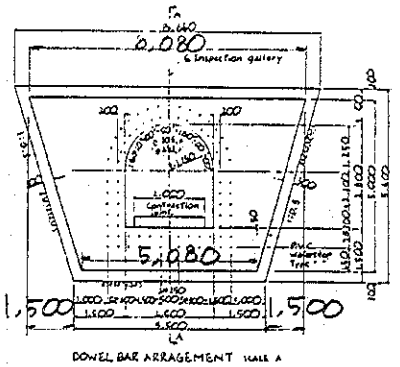
C3/12 (9)

Squarmeter of sod Facing					Squarmeter of Shotcrete				
Section No.	Distance m	Sectional length m	Means length m	Area sq.m	Section No.	Distance m	Sectional length m	Means length m	Area sq.m
Section 1-1	.000	6.170	.000	.000	Section 1-1	.000	.000	.000	.000
Section 2-2	10.000	19.420	12.795	127.950	Section 2-2	10.000	.000	.000	.000
Section 3-3	20.000	18.500	18.960	379.200	Section 3-3	20.000	33.540	16.770	335.400
Section 4-4	20.000	17.130	17.815	356.300	Section 4-4	20.000	33.540	33.540	670.800
Section 5-5	20.000	16.450	16.790	335.800	Section 5-5	20.000	33.540	33.540	670.800
Section 6-6	20.000	16.100	16.275	325.500	Section 6-6	20.000	32.420	32.980	659.600
Section 7-7	20.000	16.330	16.215	324.300	Section 7-7	20.000	51.420	41.920	838.400
Section 8-8	20.000	15.990	16.160	323.200	Section 8-8	20.000	49.190	50.305	1,006.100
Section 9-9	13.000	.000	7.995	103.935	Section 9-9	13.000	35.500	42.345	550.485
Section 10-10	5.000	.000	.000	.000	Section 10-10	5.000	32.370	33.935	169.675
			.000	.000			.000	16.185	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
		Total Voulme (cu.m)	=	2,276.185			Total Voulme (cu.m)	=	4,901.260

VI-2-82

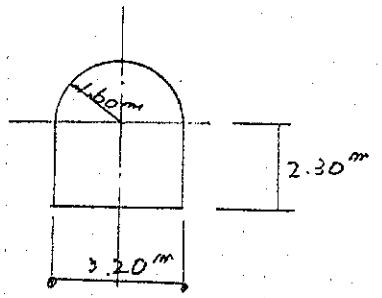
Working Division: Inspection gallery

Description	Calculation Details	Unit	Quantity	Remarks
C3/13 (a)	Waterstop type "A"	m	684.4	
	$\ell = 5.220 \times 2 + 8.08 + 5.08 = 23.60$ m			
	nos = 29			
	$L = 23.60 \times 29 = 684.4$ m			



DOWEL BAR ARRAGEMENT SCALE A

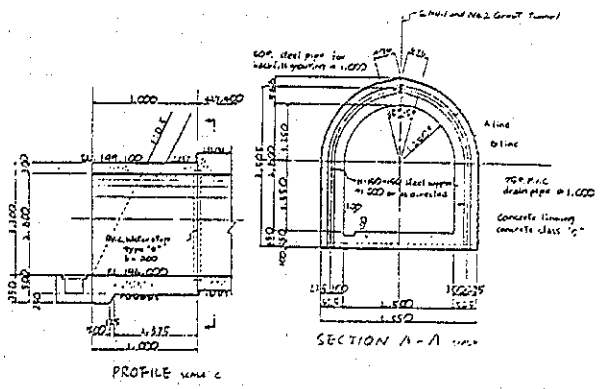
Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
(3/1316)	P.V.C water stop type "B" (b=200)	m	102.612	
	$\ell = \{(2 \times \pi \times 1.60 \times 180/360) + 3.20 + 2.30 \times 2\} \times 8 = 102.612$ m			

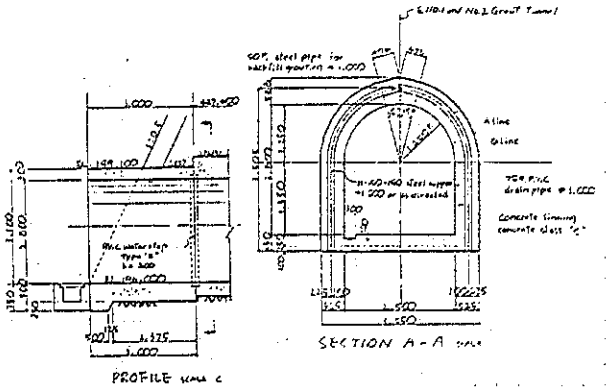
VI-2-84

Working Division: No. 1 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/13(b)	P.V.C waterstop type B	m	65.928	
	$l = 2 \times \pi \times 1.35 \times 180/360 + 1.75 + 1.65$			
	$+ 0.10 + 0.50 = 8.241$ m			
	$n = 8$			
	$l = 8.241 \times 8 = 65.928$ m			



Working Division: No.2 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/13(b)	P.V.C. waterstop Type B	M	296.676	
	$\ell = 8.241$ M $\quad n = 36$			
	$L = 8.241 \times 36 = 296.676$ M			

PROFILE

SECTION A-A

98-Z-111

Working Division: C4 Measuring Apparatus (1/8)

Description	Calculation Details	Unit	Quantity	Remarks
101	- Strain gage Type pore pressure meter	no.	29	
	(Under inspection gallery)			
	Sta. No. 4 ---------- 3 no.			
	" 6 ---------- 3 "			
	" 8 ---------- 3 "			
	" 10 ---------- 3 "			
	" 12 ---------- 3 "			
	Subtotal 15 no.			
	Sta. No. 14 ---------- 3 no.			
	" 16 ---------- 3 "			
	" 18 ---------- 3 "			
	" 20 ---------- 3 "			
	" 22 ---------- 3 "			
	Subtotal 15 no.			
	(Embankment)			
	Sta. No. 16 ---------- 13 no.			
	" 20 ---------- 20 "			
	Subtotal 33 no.			
	(Dam axis under grout tunnel)			
	Right bank ---------- 6 no.			
	Left bank ---------- 10 "			
	Subtotal 16 no.			

VII-2-87

Working Division: C4 Measuring Apparatus

Description	Calculation Details	Unit	Quantity	Remarks
102	- Strain gage type earth pressure meter	no.	4	
	Sta. No. 16 ---------- 4 no.			
103	- Multi-layer settlement meter (crossarm type)			
	Sta. No. 16 ---------- 1 set	set	1	
	Sta. No. 10 ---------- 1 set	set	1	
104	- Surface displacement survey points			
	Reference Point (R.P.) / Survey Point (S.P.)			
	Crest 2 / 6	pcs.	8	
	Slope			
	U/s El. 190.0 2 / 5			
	D/s El. 185.0 2 / 5			
	D/s El. 190.0 2 / 3			
	D/s El. 155.0 2 / 3			
	Subtotal 8 / 16	pcs	24	
105	- Leakage measuring apparatus	L.S.	-	

88-2-11

Working Division: C4 Measuring Apparatus

Description	Calculation Details	Unit	Quantity	Remarks
106	Water level detector and indicator with gauging staff	set	1	
107	Relay terminal box and cables			
	-Relay terminal box	no	5	
	-Cable (Chloroprene cabtyre)	m	6,150	
	right bank : PN-11 18.9+260 = 278.9 m			
	grout tunnel PN-12 32.8+260 = 292.8 "			
	PN-21 18.9+275 = 293.9 "			
	PN-22 32.8+275 = 307.8 "			
	PN-31 18.9+290 = 308.9 "			
	PN-32 32.8+290 = 322.8 "			
	to RTB No.3 = 1,805.1 m -①			
	left bank : PN-111 18.9+2 = 20.9 m			
	grout tunnel PN-112 32.8+2 = 34.8 "			
	PN-121 18.9+17 = 35.9 "			
	PN-122 32.8+17 = 49.8 "			
	PN-131 18.9+32 = 50.9 "			
	PN-132 32.8+32 = 64.8 "			
	PN-141 18.9+47 = 65.9 "			
	PN-142 32.8+47 = 79.8 "			
	PN-151 18.9+62 = 80.9 "			

68-2-11

Working Division: C4 Measuring Apparatus

Description	Calculation Details	Unit	Quantity	Remarks
	PN-152 32.8+62 =94.8m			
	to RTB No.5 =578.5m ···②			
	inspection : to RTB No.2 =1010.2m ···③			
	gallery			
	inspection : to RTB No.1 =978.7m ···④			
	gallery			

to RTB No.2 in inspection gallery :

PF-111 = 21.1+3.0
-112 = 21.1+1.5
-121 = 11.7+1.5
} = 59.9

22.8×12 = 273.6

PF-211 = 24.6+3.0
-212 = 24.6+1.5
-222 = 16.0+1.5
} = 71.2

22.8×9 = 205.2

PF-311 = 23.8+3.0
-312 = 23.8+1.5
-321 = 15.0+1.5
} = 68.6

21.6×6 = 129.6

PF-411 = 20.2+3.0
-412 = 20.2+1.5
-421 = 10.5+1.5
} = 56.9

22.2×3 = 66.6

PF-511 = 26.9+3.0
-512 = 26.9+1.5
-521 = 13.8+1.5
} = 98.6

to RTB No.1 in inspection gallery :

PF-611 = 21.8+3.0
-612 = 21.8+1.5
-621 = 12.6+1.5
} = 62.2

17.9×12 = 208.8

PF-711 = 21.8+3.0
-712 = 21.8+1.5
-721 = 12.6+1.5
} = 62.2

25.3×9 = 227.7

06-2-VI

Working Division: C4 Measuring Apparatus

Description	Calculation Details	Unit	Quantity	Remarks
				PF-811 = 22.4 + 3.0 -812 = 22.4 + 1.5 -821 = 13.3 + 1.5 } = 64.1
				22.7 × 6 = 136.2
				PF-911 = 23.1 + 3.0 -912 = 23.1 + 1.5 -921 = 14.1 + 1.5 } = 66.3
				28.3 × 3 = 84.9
				PF-1011 = 23.1 + 3.0 -1012 = 23.1 + 1.5 -1021 = 14.1 + 1.5 } = 66.3
Leakage measuring facility - dam control house	23 m			
	43 "			
	$14^{m}\times\sqrt{1^2+2^2}$ = 31.3			
	49 "			
	$122^{m}\times\sqrt{1^2+1.7^2}$ = 240.6 "			
	(spillway bridge) = 31 "			
	33 "			
	3.5 "			
	33			
	3			
	5			
	= 495.4 m --- ⑤			

16-2-11

Working Division: C4 Measuring Apparatus

Description	Calculation Details		Unit	Quantity	Remarks
	water level	18			
	- dam control	145			
	house	11			
		33			
		3.5			
		33			
		3			
		5			
		251.5m --⑥			
	Total ① to ⑥	5,119.4 m			
	5,119.4m × 1.2	≒ 6,150			
	- Cable (chloroprene cabtyre - heavy duty)		m	7,390	
	Sta No. 10				
	- RTB No. 3	1,613 m --①			

PP-11 = 9
-12 = 0
-13 = 7
-14 = 14.5
} = 30.5 + (8+11.0+39.0+55.0+7.0) × 4 = 510.5m

PP-21 = 8
-22 = 0
-23 = 12
} = 20.0 + (10+48+6+55+20) × 3 = 398.0"

PP-31 = 6.5
-32 = 0
-33 = 11.0
} = 19.5 + (48.0+6.0+55.0+7.0) × 3 = 365.5"

PP-41 = 4
-42 = 0
-43 = 8
} = 12.0 + (77+25+7) × 3 = 339.0"

1,613.0m

11-2-92

Working Division: C4 Measuring Apparatus

(7/8)

Description	Calculation Details		Unit	Quantity	Remarks
	Sta No. 16				PP-111 = 16 -112 = 11 -113 = 0 -114 = 8.5 -115 = 17 -116 = 21 EP-11 = 11 -12 = 0 -13 = 17 } = 101.5 + (21+18+36+39+55+17) × 9 = 1,139.5 m
	- RTB No. 4	4,540.5 m ··· ②			
	Total ① + ②	6,153.5 m			PP-211 = 10 -212 = 0 -213 = 15.5 } = 25.5 + (10+68+11+39+55+17) × 3 = 595.5 m
	6,153.5 m × 1.2	≒ 7,390			PP-311 = 13 -312 = 9 -313 = 0 -314 = 14 -315 = 18 } = 54 + (68+11+39+55+17) × 5 = 954.0 m
					PP-411 = 6.5 -412 = 0 -413 = 11 EP-21 = 11 } = 28.5 + (108+6+55+17) × 4 = 732.5 m
					PP-511 = 4 -512 = 0 -513 = 8 } = 12 + (137+25+17) × 3 = 519.0 m
					4,540.5 m

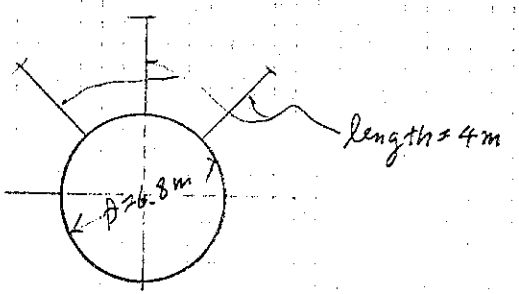
E5-2-1/1

Working Division: C4 Measuring Apparatus

Description	Calculation Details	Unit	Quantity	Remarks
	- Cable (multi core)	m	950	
	Total ① to ⑥ = 789.7 m			
	789.7 m × 1.2 ≒ 950			
08/	Recording and data processing system			
	- Scanner	no.	1	
	- Digitizer	no.	1	
	- Personal computer	no.	1	
	- Printer	no.	1	
	- Plotter	no.	1	
	- A.C. stabilizer	no.	1	

RTB No.1
ℓ = 22.8 m + 22.2 m + 21.6 m + 22.8 m + 22.8 m = 112.2 m --- ①
RTB No.2
ℓ = 43 m + 5 m + 12.5 m = 60.5 m, 60.5 m × 2 = 121.0 m --- ②
Dam Crest
RTB No.3
RTB No.4
bridge 31 m × 4 = 124 m --- ③
16 m × 2 = 32 m --- ④
RTB No.5
11 × 1 = 11.0 m ----- ⑤
ℓ = 33 m + 3.5 m + 33 m + 3 m + 5 m = 77.5 m,
77.5 m × 5 = 387.5 m --- ⑥
Dam Control House

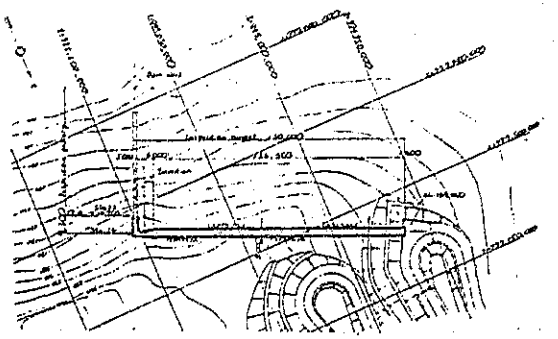
Working Division: F5 RIVER OUTLET WORKS (Miscellaneous Work)

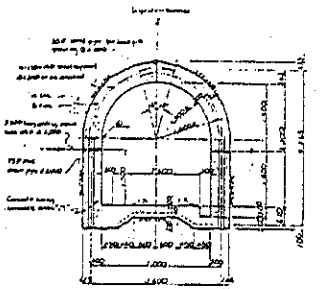
Description	Calculation Details	Unit	Quantity	Remarks
103	Drilling holes with perforated P.V.C. pipes downstream of plug portion in the diversion tunnel			
	- Drilling (D = 50 mm)			
	Length of diversion tunnel to be drilled			
	= 248 m			
	Interval of drilled section = 6 m			
	Number of drilled section			
	$N = \frac{248}{6}$			
	= 41.3			
	= 42			
	Drilled length per section			
	4m × 3 = 12m / sec.			
	Total length of drilling			
	42 sec. × 12m/sec = 504 ≒	m	510	
	- Perforated P.V.C. pipe			
	length same as drilling one	m	510	

56-2-11

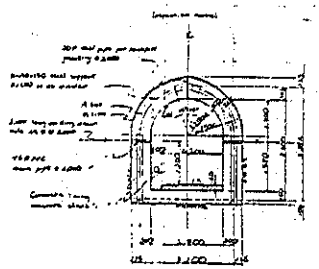
Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C5/03	Inspection tunnel			
	P.V.C drain hole, 75 ϕ	m	53.55	
	< Section A-A			
	n = 14.3/3.00 = 5			
	$\ell = 5 \times 0.525 \times 2 = 5.25$ m			
	< Section B-B >			
	n = 136.50/3.00 = 46			
	$\ell = 46 \times 0.525 \times 2 = 48.3$ m			
	$L = 48.3 + 5.25 = 53.55$ m			
C5/02	600 ϕ dia, concrete drain pipe	m	20.00	
	$\ell = 20$ m			





SECTION B-B SCALE C



SECTION A-A SCALE C

VI-2-96

Working Division: No.1 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Drainge works			
C5/03	25φ, PVC drain pipe	m	8.4	
	$L_1 = 0.525 \times 2 = 1.05$			
	$N = 90/12 \doteq 8$ nos			
	$L = 1.05 \times 8 = 8.4$ m			

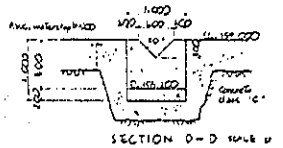
VI-2-97

Working Division: No. 2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C5/03	Drainage works	m	87.80	
	25φ, R.U.C. drain pipe			
	$\ell_1 = 0.525 \times 2 = 1.05$ m			
	$N = 430.4/12 = 36$			
	$L = 1.05 \times 36 = 37.8$			

Working Division: Inspection tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/01	Inspection tunnel			
	stainless steel plate, 10mm (Triangular weir)	Sq.m	0.83	
	A = 0.81 × 1.02 = 0.83			

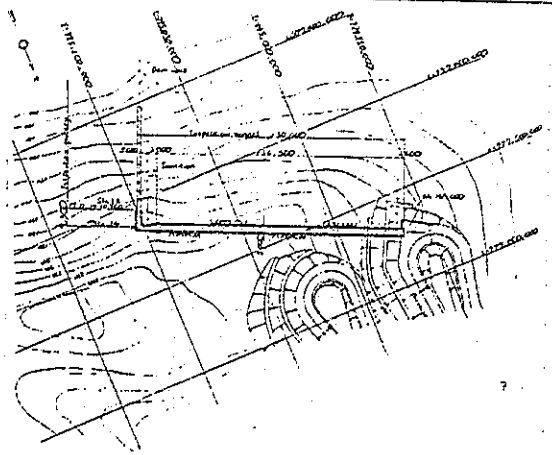


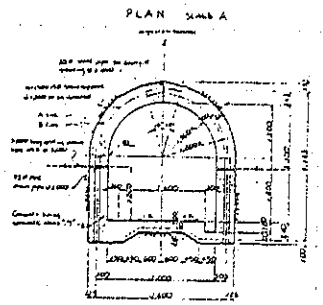
Working Division: Inspection galler

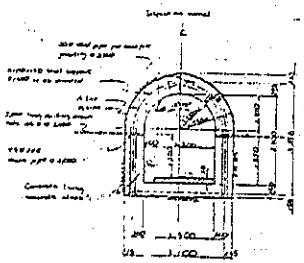
Description	Calculation Details	Unit	Quantity	Remarks
c6	Miscellaneous works			
	Non-embedd metal work			
c6/02	Handrail	m	272.715	
	Steel pipe, 35 ϕ			
	L = 272.715 m			

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/03	Inspection tunnel			
	Steel Support H=150×150 w=31.5 kg/m	kg	35,184.272	
	<Section B – B>			
	$l_1 = (2 \times \pi \times 1.80 \times 75°/360) \times 2 = 4.712$ m			
	$l_2 = \tan 15° \times 1.80 \times 2 = 0.965$ m			
	$l_3 = 2.40 \times 2 = 4.80$ m			
	$l = l_1 + l_2 + l_3 = 10.477$ m			
	$N = 91$ $L = 10.477 \times 91 = 953.407$ m			
	$w_1 = 31.50^{kg} \times 953.407 = 30,032.321^{kg}$			
	<section A – A>			
	$l_1 = (2 \times \pi \times 1.55 \times 75°/360) \times 2 = 4.058$ m			
	$l_2 = \tan 15° \times 1.55 \times 2 = 0.831$ m			
	$l_2 = 1.90 \times 2 = 3.8$ m			
	$l = l_1 + l_2 + l_3 = 8.689$ m			
	$N = 10$ $L = 8.689 \times 10 = 86.89$ m			
	$w_2 = 31.50^{kg} \times 86.89 = 2,737.035^{kg}$			
	<Transition>			
	$\frac{1}{2} \times (10.477 + 8.689) = 9.583$ m			
	$n = 8$ $L = 8 \times 9.583 = 76.664$			
	$w_3 = 76.664 \times 31.50^{kg} = 2,414.916$			
	$w = w_1 + w_2 = 35,184.272^{kg}$			



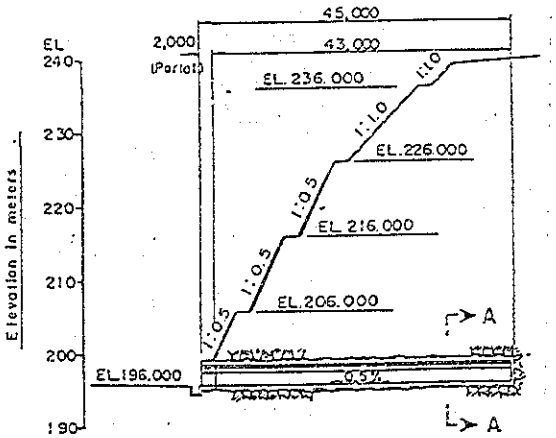




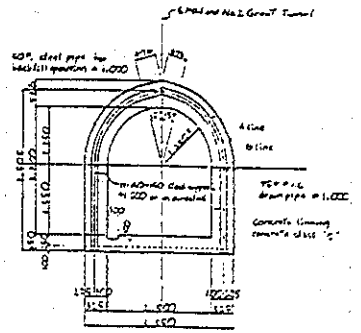
VI-2-101

Working Division: No.1 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/03	Steel support H=150x150	kg	8 466	
	$l = 2\times\pi\times1.55\times180/360 + 1.90\times2$			
	$= 8.670$ m			
	$n = 45.00/1.50 = 31$ nos			
	$w = 31.5$ kg/m			
	$W = 31.50^{kg} \times 31 \times 8.670 = 8,466^{kg}$			



PROFILE



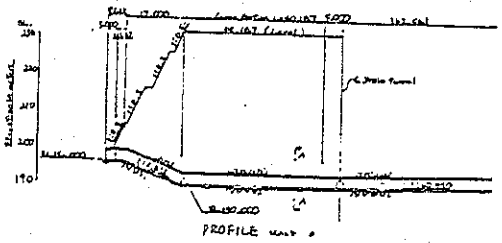
SECTION A-A

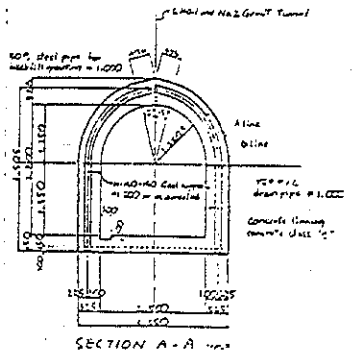
GROUT TUNNEL
STRUCTURAL DETAILS

VI-2-102

Working Division: No.2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/03	Steel support H=150×150	Kg	78,108.00	
	$l = 8.670$ m $n = 428.428/1.50$			
	$= 286$			
	$w = 31.5$ Kg/m			
	$W = 8.670 \times 286 \times 31.5$			
	$= 78,108$ Kg			





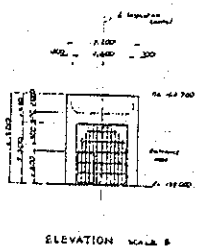
VI-2-103

Working Division: Miscellaneous Metal Work

Description	Calculation Details	Unit	Quantity	Remarks
C6/04	Grating for sump pit in Inspection gallery	kg	216	
	B = 2.0 - (0.3x2) + 0.1 = 1.5 m			
	L = 8.0 m			
	A = 8.0 x 1.5 = 12.0 m^2			
	W = 12.0 x 18 kg/m^2 = 216 kg			

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection Tunnel			
C6/05				
	Non-embedded metal works			
	Grating (500x1,000) N=10	nos	4	
	w=9 kg/1nos w = 90 kg			
	<Portal>	ton	0.135	
C6/06	16 ϕ, reinbar w=1.56 kg/m			
	n=3.00/0.1=31nos			
	l=2.80x31=86.8 m			
	w=1.56x86.8=135.408 kg			

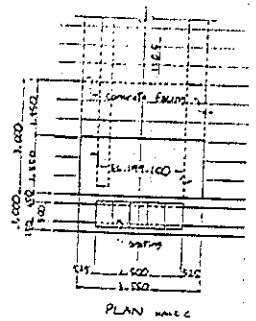


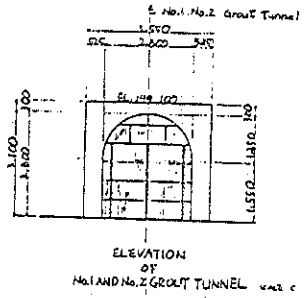
ELEVATION

VI-2-105

Working Division: No.1 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/05	Non-embedded metal work			
	Grating (500×1,000) N=5	nos	5	
	w = 9 kg/nos			
	w = 9.00 × 5 = 45 kg			
C6/06	Portal (φ16, rein.bar)	ton	0.12	
	w = 1.56 kg/m			
	n = 2.80 / 0.10 = 29			
	l = 29 × 2.55 = 73.95 m			
	w = 73.95 × 1.56 = 115.362 kg			

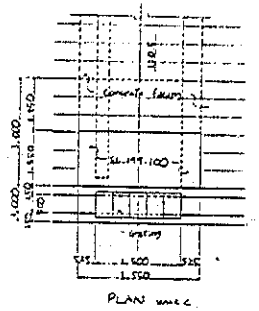


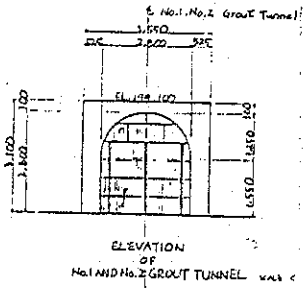


901-2-11

Working Division: No.2 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C6/05	Non-embedded metal work			
	<Grating (500×1,000) N=5 >	nos	5	
	w = 9 kg/ nos			
	w = 9.00×5 = 45 kg			
C6/06	<Portal>			
		ton	0.12	
	w = 1.65 kg/m			
	n = 2.90/0.10 = 29			
	ℓ = 29×2.55 = 73.95 m			
	w = 73.95×1.56 = 115.362 kg			

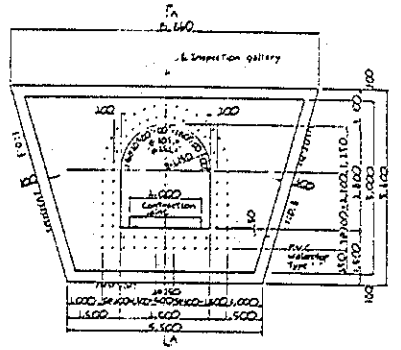




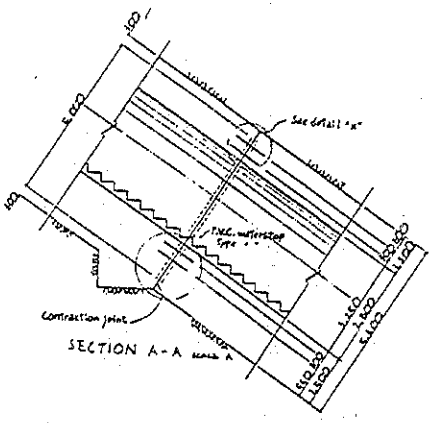
VI-2-107

Working Division: Inspection gallery

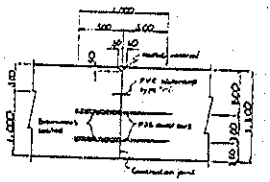
Description	Calculation Details	Unit	Quantity	Remarks
C6/07	Dowel bars	kg	9,695.28	
	84 nos per contraction joint			
	Length per each = 1.00 m			
	Nos. of contraction joint portion = 29			
	L = 84 × 1.00 × 29 = 2436 m			
	D25, reinforcement bar = 3.98 kg/m			
	w = 2.436 × 3.98 = 9,695.28 kg			

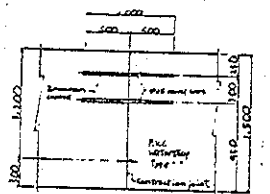


DOWEL BAR ARRAGEMENT SCALE A



SECTION A-A SCALE A


DETAIL "X" SCALE B



DETAIL "Y" SCALE B

801 - 2 - 111

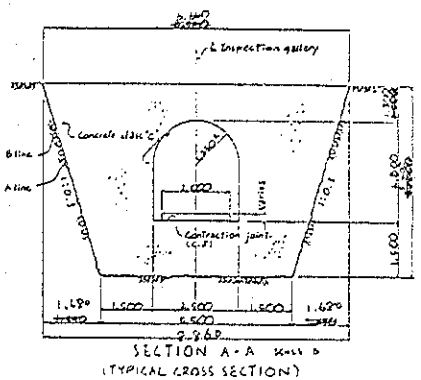
Working Division: Concrete guard blocks

Description	Calculation Details	Unit	Quantity	Remarks
C7/01	concrete guard blocks	nos	167	
	L=249.50 (crest length)			
	nos = 249.50/3.0 x2 ≈ 167 nos			
	Lighting pole base	nos	17	
C7/07	N = 249.50/15.00 = 17			

601-2-11

Working Division: Inspection gallery

Description	Calculation Details	Unit	Quantity	Remarks
	Miscellaneous works			
	Bituminas coating	m^2	1,893.847	
C7/02	A = 33.879 m^2			
	Nos. of contraction joint portion = 29			
	A = 33.879 x 29 = 982.491 m^2			
C6/05	for Dowel bar			
	a = 2 x π x 0.015 x 1.00 = 0.094 m^2/nos			
	A = 0.094 x 9,695.28 = 911.356			
	Total = 1,893.847			



SECTION A-A
(TYPICAL CROSS SECTION)

VII-2-110

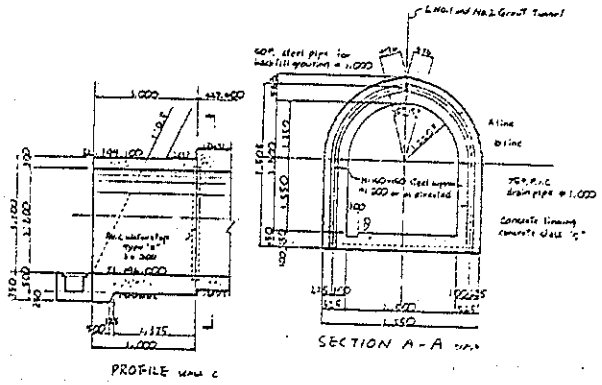
Working Division: INSPECTION TUNNEL

Description	Calculation Details	Unit	Quantity	Remarks
C7/02	Bituminus coating	m^2	78.8	Refer to Form work class F1
	A = 5.099 n = 14			
	A = 5.099 × 14 = 71.386			
	A = 3.90 × 4.20 − π × 1.50²/2 − 1.80			
	× 3.00 = 7.445			
	total A = 78.831			

VI-2-111

Working Division: No.1 Grout Tunnel

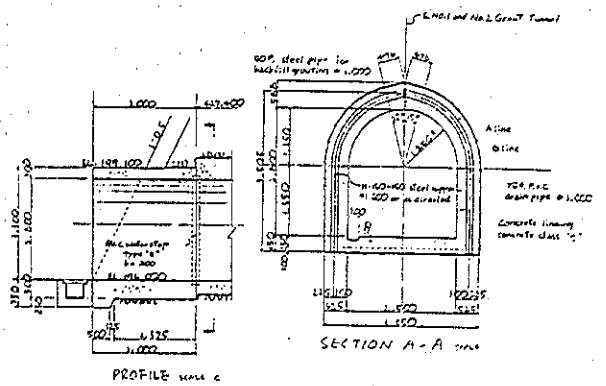
Description	Calculation Details	Unit	Quantity	Remarks
C7/02	Miscellaneous works			
	Bituminas coarting	M^2	42.84	
	Please refer to Formwork F1			
	A = 42.84 M^2			



VI-2-112

Working Division: No.2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C7/02	Miscellaneous works			
	Bituminas coarting	m^2	192.78	
	$A = 5.355\ m^2 \quad n = 36$			
	$A = 192.78\ m^2$			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Miscellaneous works			
C7/04	Gravel metaling	m^3	4	
	$60^{m^2} \times 0.20^{m} = 4\ m^3$			
C7/05	Base course			
	$V = 60^{m^2} \times 0.15^{m} =$	m^3	9	
C7/06	Sub-base course	m^3	18	
	$V = 60 \times 0.30 = 18\ m^3$			
C7/03	Gravel bedding			
	$V = 1.01 \times 0.10 \times 50 = 5.05$	m^3	5.05	

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D	SPILLWAY								
D1	Earthwork								
/01	Clearing and stripping	m2	44,410						T2.2.3
/02	Excavation, common, in open-cut	m3	153,800						T2.4.6
/03	Excavation, weathered rock, in open-cut	m3	592,500						T2.4.6
/04	Excavation, rock in open-cut	m3	77,900						T2.4.6
/05	Trench excavation, all classes, for underdrain beneath slab	m3	290						T2.4.6
/06	Free drain backfill with selected gravel, for underdrain beneath slab	m3	230						T2.7.6
/07	Free drain backfilling behind wall	m3	14,120						T2.7.6
/08	25mm dia. anchor bar	m	4,810						T2.10.4
/09	29mm dia. anchor bar	m	21,600						T2.10.4
/10	32mm dia. anchor bar	m	11,900						T2.10.4

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
/11	Stone pitching	m2	670						T2.10.5
/12	Sod facing	m2	4,600						T2.10.5
/13	Riprap at slope of spoil bank	m3	710						T2.6.5
/14	Gravel metalling	m3	250						T2.7.6
	Subtotal of item D1								

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D2	Concrete Work								
/01	Concrete, class B, in drain ditch type B	m3	150						T4.1.18
/02	Concrete, class B, in concrete facing	m3	590						T4.1.18
/03	Concrete, class C, in weir	m3	4,140						T4.1.18
/04	Concrete, class C, in chuteway	m3	5,030						T4.1.18
/05	Concrete, class C, in dam abutment and guide wall	m3	7,220						T4.1.18
/06	Concrete, class C, in stilling basin	m3	15,840						T4.1.18
/07	Concrete, class C, in side-channel	m3	13,190						T4.1.18

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
/08	Waterstop, type "A"	m	3,320						T4.1.18
/09	Form F1 for item/01 to /07	m2	9,340						T4.1.18
/10	Form F2 for item/01 to /07	m2	6,030						T4.1.18
/11	Form F4 for item/02 to /06	m2	17,050						T4.1.18
/12	Reinforcing bar	ton	930						T4.1.18
/13	Bituminous joint filler in contraction joints	m2	5,800						T4.1.18
/14	Shotcrete on cutting slope on abutment mountain	m2	15,700						T4.2.7
/15	P.V.C. pipe for weep hole, 75 mm dia.	m	90						T2.9.3

Subtotal of item D2

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D3	Drainage and Aeration								
/01	P.V.C. perforated drain pipe, 250 mm dia.	m	1,100						T2.9.3
/02	Steel drain pipe, 150 mm dia.	m	50						T2.9.3
/03	Steel drain pipe, 250 mm dia.	m	60						T2.9.3
/04	Geo-textile-made drain	m	2,710						T2.9.3
	Subtotal of item D3								

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D4	Road Work								
/01	Asphalt pavement	m2	2,210						T5.2.5
/02	Base course	m3	330						T5.2.5
/03	Subbase course	m3	660						T5.2.5

Subtotal of item D4

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D5	Miscellaneous Metalwork								
/01	Embedded metalwork	kg	5						T9.6.2
/02	Steel trap	kg	5						T9.6.2

Subtotal of item D5

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
D6	Steel Bridge								
/01	Fabrication, transportation and painting								
	- Steel grider	kg	24,100						T11.11.4
	- Painting (shop)	m2	510						T11.11.4
	- Painting (splice)	m2	20						T11.11.4
	- Painting (field)	m2	520						T11.11.4
	Subtotal of item D6 /01								
/02	Incidental facilities for bridge								
	- Bearing shoe, 50 ton (Fix)	ea	3						T11.11.4
	- Bearing shoe, 50 ton (Mov.)	ea	3						T11.11.4
	- Expansion joint	kg	3,100						T11.11.4
	- Drainage hole including pipe and catch basin	ea	6						T11.11.4
	- Joint filler	m2	31						T4.1.18
	Subtotal of item D6 /02								

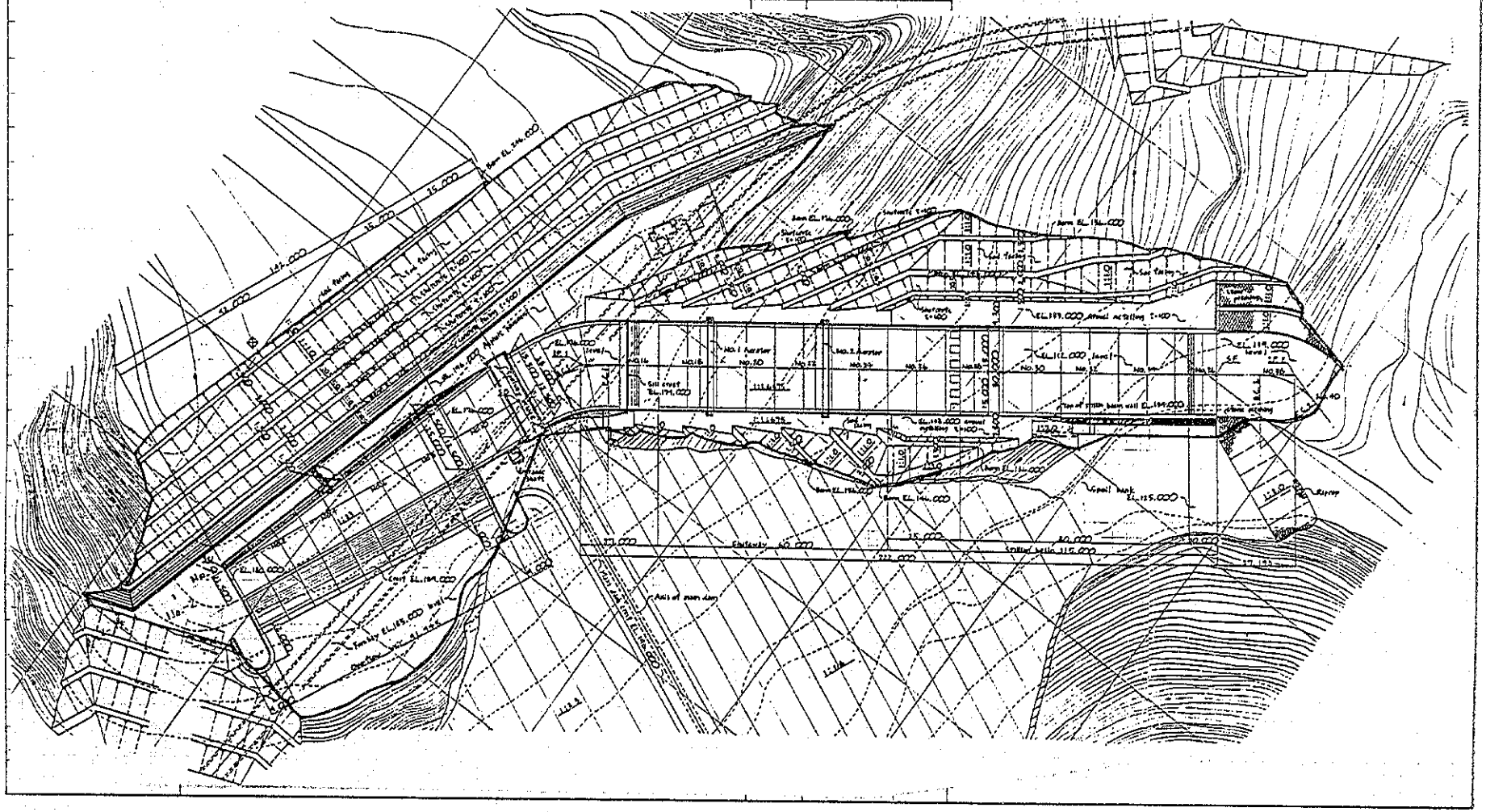
Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Item No.	Work	Unit	Quantity	Foregin Currency ( ) Unit Price	Foregin Currency ( ) Amount	Local Currency (Rs) Unit Price	Local Currency (Rs) Amount	Total Equivalent (Rs)	Ref. Clause or Sub-clause
/03	Concrete work for superstructure								
	- Concrete class-C for parapet wall and its base for guardrail	m3	21						T4.1.18
	- Concrete class-G for slab	m3	45						T4.1.18
	- Reinforcemen bar	ton	11						T4.1.18
	- Form F1	m2	210						T4.1.18
	- Form F3	m2	130						T4.1.18
	Subtotal of item D6 /03								
/04	Surface treatment								
	- Surface treatment	m2	180						T5.2.5
	Subtotal of item D6 /04								
	Subtotal of item D6								
	TOTAL OF ITEM D								

Note: The Tenderer shall fill in J¥ or US$ in brackets adjacent to "Foreign Currency" described above, which the Tenderer proposes to apply as the foreign currency in the Contract.

Working Division: Clearing and Stripping

Description	Calculation Details	Unit	Quantity	Remarks
D1/01	clearing and stripping for Spillway	m^2	44,405	
	Distance was measured by curvimeter on the cross sections			



D1/01 Clering and Stripping for Spillway

No.	Section No.	Distance (m)	Sectional Length (m)	Mean (m)	Areaa (m2)
1	-2 -14 m	0.000	14.00		
2	-2	14.000	41.00	27.50	385.00
3	0	20.000	140.00	90.50	1,810.00
4	2	20.000	145.00	142.50	2,850.00
5	4	20.000	148.00	146.50	2,930.00
6	6	20.000	140.00	144.00	2,880.00
7	8	20.000	135.00	137.50	2,750.00
8	9+2.0 m	12.000	130.00	132.50	1,590.00
9	10	8.000	125.00	127.50	1,020.00
10	11+7.0 m	17.000	102.00	113.50	1,929.50
11	BC(13+2.263 m)	15.263	110.00	106.00	1,617.88
12	14	7.737	115.00	112.50	870.41
13	EC(15+1.290 m)	11.290	132.00	123.50	1,394.32
14	16	8.710	135.00	133.50	1,162.79
15	16+5.553 m	5.553	130.00	132.50	735.77
16	18	14.447	140.00	135.00	1,950.35
17	20	20.000	130.00	135.00	2,700.00
18	22	20.000	97.00	113.50	2,270.00
19	24	20.000	90.00	93.50	1,870.00
20	26	20.000	95.00	92.50	1,850.00
21	27+3.553 m	13.553	95.00	95.00	1,287.54
22	28	6.447	95.00	95.00	612.47
23	30	20.000	80.00	87.50	1,750.00
24	32	20.000	80.00	80.00	1,600.00
25	34	20.000	74.00	77.00	1,540.00
26	35+3.553 m	13.553	70.00	72.00	975.82
27	36+3.553 m	10.000	65.00	67.50	675.00
28	37+8.553 m	15.000	50.00	57.50	862.50
29	40	21.447	0.00	25.00	536.18
	Total	434.000			44,405.50

Working Division: Excavation, Free drain backfilling behind wall, Sod facing

Description	Calculation Details	Unit	Quantity	Remarks
D1/02	Excavation, common, in open-cut	m^3	153,800	
D1/03	Excavation, weathered rock, in open-cut	m^3	592,500	
D1/04	Excavation, rock, in open-cut	m^3	77,900	
D1/07	Free drain backfilling behind wall (Sec.0~40)	m^3	(11,200)	
	〃 (Retaining wall)	m^3	(2,920)	
	total	m^3	14,120	
D1/12	Sod facing	m^2	4,600	

Working Division: Excavation (1)

Section No.	Distance	Excavation, common			Excavation, w. Rock			Remarks
		Sectional Area	Mean	Volume	Sectional Area	Mean	Volume	
	m	m²	m²	m³	m²	m²	m³	
0-340m	0	0			0			
0-20.0	14.0	0	0	0	375	187.5	2,625	
0	20.0	453	226.5	4530	2,176	1,275.5	25,510	
2	20.0	660	556.5	11,130	2,388	2,282	45,640	
4	20.0	668	664	13,280	2,563	2,475.5	49,510	
6	20.0	403	535.5	10,710	2,690	2,626.5	52,530	
8	20.0	353	378	7,560	2,646	2,668	53,360	
9+2.0	12.0	330	341.5	4,098	2,618	2,632	31,584	
10	8.0	318	324	2,592	2,603	2,610.5	20,884	
11+7.0	17.0	188	253	4301	2,326	2,464.5	41,897	
BC (13+2.263)	15.263	178	183	2,793	2,326	2,326	35,502	
14	7.737	173	175.5	1,358	2,460	2,393	18,515	
EC (15+1.290)	11.290	184	178.5	2,015	2,644	2,552	28,812	
16	8.71	75	129.5	1,128	2,209	2,526.5	22,006	
16+5.553	5.553	141	108	600	2,083	2,246	12,472	
18	14.447	201	171	2,470	1,540	1,811.5	26,171	
20	20.0	158	179.5	3,590	1,123	1,331.5	26,630	
22	20.0	268	213	4,260	1,114	1,118.5	22,370	
24	20.0	685	476.5	9530	1,098	1,106	22,120	
26	20.0	775	730	14,600	1,070	1,084	21,680	
27+3.553	13.553	700	737.5	9,995	758	914	12,387	
28	6.447	708	704	4539	573	665.5	4290	
30	20.0	495	601.5	12,030	289	431	8,620	
32	20.0	376	435.5	8,710	166	227.5	4,550	
34	20.0	191	283.5	5,670	65	115.5	2,310	
35+3.553	13.553	349	270	3,659	0	32.5	440	
				(145,129)			(592,915)	

61.8.

N. K. Form No. 2312

Working Division: Excavation(2)

Section No.	Distance	Excavation, common			Excavation, W. Rock			Remarks
		Sectional Area	Mean	Volume	Sectional Area	Mean	Volume	
	m	m^2	m^2	m^3	m^2	m^2	m^3	
35+3.553		349			0			
36+3.553	10.0	276	312.5	3,125	0		0	
37+8.553	15.0	188	232	3,480	0		0	
40	21.997	0	94	2,016	0		0	
				(8,621)			(0)	
		Total		153,220			592,915	
			≒	153,800		≒	592,500	

61.8.

N.K. Form No. 2312

Working Division: Excavation (3), Backfill (1)

Section No.	Distance	Excavation, Rock			Backfill			Remarks
		Sectional Area	Mean	Volume	Sectional Area	Mean	Volume	
	m	m²	m²	m³	m²	m²	m³	
0		–			29			
2	20.0	–			29	29	580	
4	20.0	–			29	29	580	
6	20.0	–			29	29	580	
8	20.0	–			29	29	580	
9+2.000	12.0	–			29	29	348	
10	8.0	–			29	29	232	
11+7.000	17.0	–			40	34.5	587	
BC(13+2.263)	15.263	–			44	42	641	
14	7.737	–			41	42.5	329	
EC(15+1.290)	11.290	–			11	26	294	
16	8.71	–			–	5.5	48	
16+5.553	5.553	–			–			
18	14.447	–			–			
20	20.0	–			–			
22	20.0	–			–			
24	20.0	–			–			
26	20.0	405	202.5	4.050	52	26	520	
27+3.553	13.553	778	591.5	8.017	73	62.5	847	
28	6.447	963	870.5	5.612	73	73	471	
30	20.0	909	936	18.720	73	73	1460	
32	20.0	802	855.5	17.110	38	55.5	1.110	
34	20.0	575	688.5	13.770	40	39	780	
35+3.553	13.553	363 (115)	469	6.356	51	45.5	617	
36+3.553	10.0	155	135	1.350	(66)	58.5	585	
37+8.553	15.0	95	125	1.875	–		0	
40	21.447	0	47.5	1.019				

61.8.

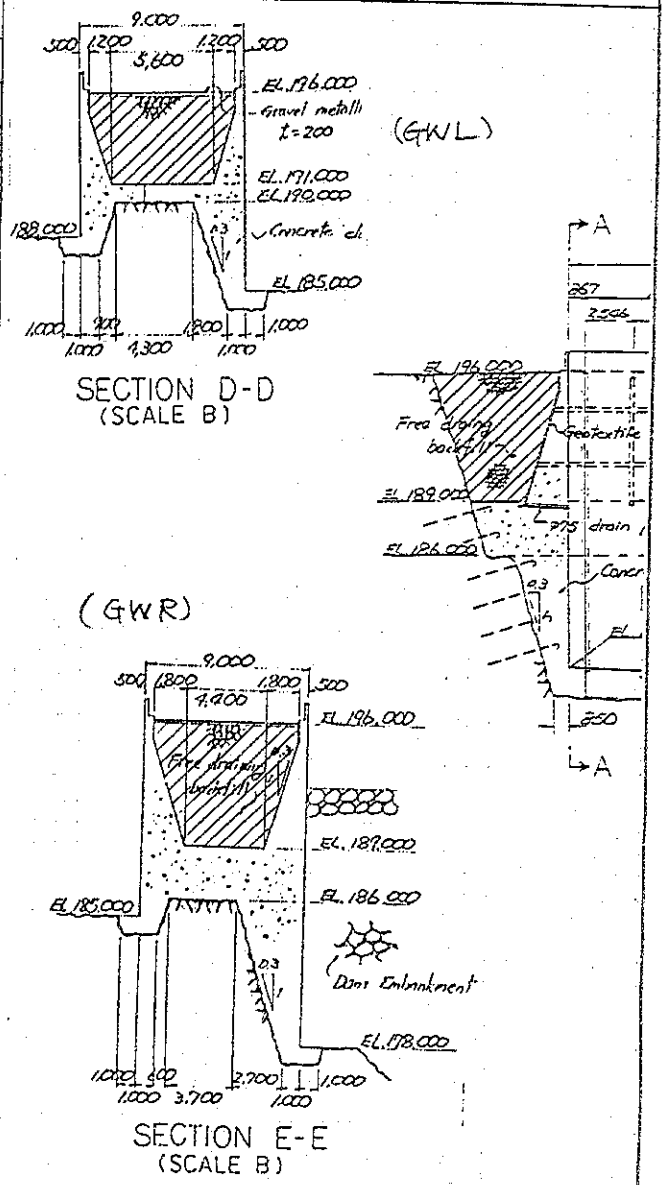
77,879 ≒ 77,900

11,189 ≒ 11,200

N.K. Form No. 2312

Working Division: Backfill (2)

Description	Calculation Details	Unit	Quantity	Remarks
Retaining Wall	(Free draining material)			
Left side (GWL)	$(5.60 + 8.00) \times \frac{1}{2} \times 4.0 + 8.0 \times 1.0$			
	$= 35.2\ m^2$			
	$35.2 \times (6.0 + 4.5 \times \frac{1}{2}) = 290.4\ m^3$			
	$(3.2 + 6.8) \times \frac{1}{2} \times 6.0 + 6.8 \times 1.0$			
	$= 36.8\ m^2$			
	$36.8 \times (14.207 + 13.698) = 1,026.90\ m^3$			
	$290.4 + 1026.9 = 1,3173\ m^3$	m^3	$1,317^3$	
Right side (GWR)	$(4.4 + 8.0) \times \frac{1}{2} \times 6.0 + 8.0 \times 1.0$			
	$= 45.2\ m^2$			
	$45.2 \times (9.0 + 4.5/2) = 508.5\ m^3$			
	$\{(8.0 \times 11.0) + (9.5 \times 12.2)\} \times \frac{1}{2} \times 6.0$			
	$= 611.7\ m^3$			
	$11.0/2.3 = 4.783\ m$			
	$11.0 \times 4.783 \times \frac{1}{2} \times (12.0 + 12.5/2)$			
	$= 480.09\ m^3$			
	$508.5 + 611.7 + 480.09 = 1,600.29\ m^3$	m^3	$1,600^3$	



(2,917.6)

Working Division: Shotcrete (1) Sod facing (1)

Section No.	Distance	Shotcrete			Sod facing			Remarks
		~~Sectional Area~~	Mean	~~Volume~~	~~Sectional Area~~	Mean	Volume	
	m	Length (m)	m^2	Area (m^2)	Length (m)	m^2	Area (m^2)	
0-34.0	0	3.0			—			
0-20.0	14.0	22.0	12.5	175	—			
0	20.0	51.5	36.8	735	11.0	5.5	110	
2	20.0	51.5	51.5	1,030	10.5	10.75	215	
4	20.0	47.5	49.5	990	15.0	12.75	255	
6	20.0	46.5	47	940	14.0	14.5	290	
8	20.0	46.0	46.25	925	12.0	13	260	
9+2.000	12.0	46.5	46.25	555	11.0	11.5	138	
10	8.0	46.5	46.5	372	12.0	11.5	92	
11+7.000	17.0	46.5	46.5	791	12.0	12	204	
BC (13+2.263)	15.263	46.0	46.25	706	11.0	11.5	176	
14	7.737	46.0	46	356	8.5	9.75	75	
EC (15+1.290)	11.290	46.0	46	519	7.0	7.75	87	
16	8.71	46.0	46	401	6.0	6.5	57	
16+5.553	5.553	46.0	46	255	4.0	5	28	
18	14.447	46.0	46	665	2.0	3	43	
20	20.0	66.0	56	1,120	7.0	4.5	90	
22	20.0	43.0	54.5	1,090	9.0	8	160	
24	20.0	56.0	49.5	990	9.0	9	180	
26	20.0	54.0	55	1,100	12.0	10.5	210	
27+3.553	13.553	49.0	51.5	698	10.0	11.0	149	
28	6.447	36.0	42.5	274	19.0	14.5	93	
30	20.0	14.0	25	500	22.0	20.5	410	
				(15,187)			(3,322)	

61.8.

N.K. Form No. 2312

Working Division: Shotcrete (2), Sod facing (2)

Section No.	Distance	Shotcrete			Sod facing			Remarks
		~~Sectional Area~~	Mean	~~Volume~~	~~Sectional Area~~	Mean	~~Volume~~	
	m	Length (m)	m^2 (m)	Area (m^2)	Length (m)	m^2 (m)	Area (m^2)	
30		14.0			22.0			
32	20.0	15.0	14.5	290	17.0	19.5	390	
34	20.0	4.0	9.5	190	22.0	19.5	390	
35 + 3.553	13.553	–	2	27	16.0	19	258	
36 + 3.553	10.0	–			6.0	11	110	
37 + 8.553	15.0	–			–	3	45	
				(507)			(1,193)	
		Total		15,699			4,515	
				≒15,700			≒4,600	

61.8.

N.K. Form No. 2312

Working Division: Anchor bar (1)

Description	Calculation Details	Unit	Quantity	Remarks
Φ1/08 25 mm	dia anchor bar	m	4,809.0	
Φ1/09 29 mm	dia anchor bar	m	21,586.0	
Φ1/10 32 mm	dia anchor bar	m	11,873.0	
(1) Side channel	1) Slab			
	Φ29, ℓ = 4,000			
	Block SCS-1~15 (15 blocks)			
	$L_1 = 9 \times (10+22) \times \frac{1}{2} \times 10 \times 4.00$ = 5,760.00m			
	Block SCS-16~19 (4 blocks)			
	$L_2 = 9 \times 22 \times 2 \times 4.00$ = 1,584.00m			
	Block SCS-20~21 (2 blocks)			
	$L_3 = 14 \times 22 \times 4.00$ = 1,232.00m			
	Block SCS-22~25 (4 blocks)			
	$L_4 = (17+26) \times \frac{1}{2} \times 22 \times 4.00$ = 10,406.00m			
	Total L = 18,982.00 m			
	2) Training wall (Right)			
	a) Φ29, ℓ = 2,500			
	SCR-1~3 $L_1 = (5+7+4) \times 2 \times 2.50$ = 80.00m			
	b) Φ29, ℓ = 3,500			
	SCR-1~7 $L_2 = (4+7+4+6\times4) \times 2 \times 3.50$ = 273.00m			
	3) Training wall (Left)			
	a) Φ29, ℓ = 2,500			
	GWL-3 $L_1 = 8 \times 2 \times 2.50$ = 40.00m			
	SCL-1~9 $L_2 = 7 \times (2+3) \times \frac{1}{2} \times 9 \times 2.50$ = 552.00m			
	SCL-10~12 $L_3 = 7 \times 5 \times 3 \times 2.50$ = 263.00m			
	SCL-13~15 $L_4 = 10 \times 5 \times 3 \times 2.50$ = 375.00m			

Working Division: Anchor bar (2)

Description	Calculation Details	Unit	Quantity	Remarks
	SCL-16 $L_5 = 6 \times 2 \times 2.50$ = 30.00m			
	Sub-total = 1,260.00 m			
	b) D29, $\ell = 3,500$			
	SCL-1~12 $L_6 = 7 \times 2 \times 12 \times 3.50$ = 172.00 m			
	SCL-13~15 $L_7 = 10 \times 2 \times 3 \times 3.50$ = 210.00 m			
	SCL-16 $L_8 = 4 \times 2 \times 3.50$ = 92.00 m			
	Sub-total = 424.00 m			
	4) Weir			
	D29, $\ell = 5,500$			
	SW-1~9 $L = 7 \times (10+8) \times \frac{1}{2} \times 9$ = 567.00m			
(2) Chuteway	1) Slab			
	D25, $\ell = 2,500$			
	Block CWS-1, 2, 5~10, 13~16 (12 blocks)			
	$L_1 = 9 \times 7 \times 12 \times 2.50$ = 1,890.00m			
	Block CWS-3, 4, 11, 12 (4 blocks)			
	$L_2 = 9 \times 7 \times 4 \times 2.50$ = 630.00m			
	Total $L = 1,890.00 + 630.00$ = 2,520.00m			
	2) Training wall (Left and Right)			
	a) D25, $\ell = 2,500$			
	$L = 7 \times 3 \times 8 \times 2 \times 2.50$ = 840.00m			
	b) D25, $\ell = 4,500$			
	$L = 7 \times 2 \times 8 \times 2 \times 4.50$ = 1,008.00m			

Working Division: Anchor bar (3)

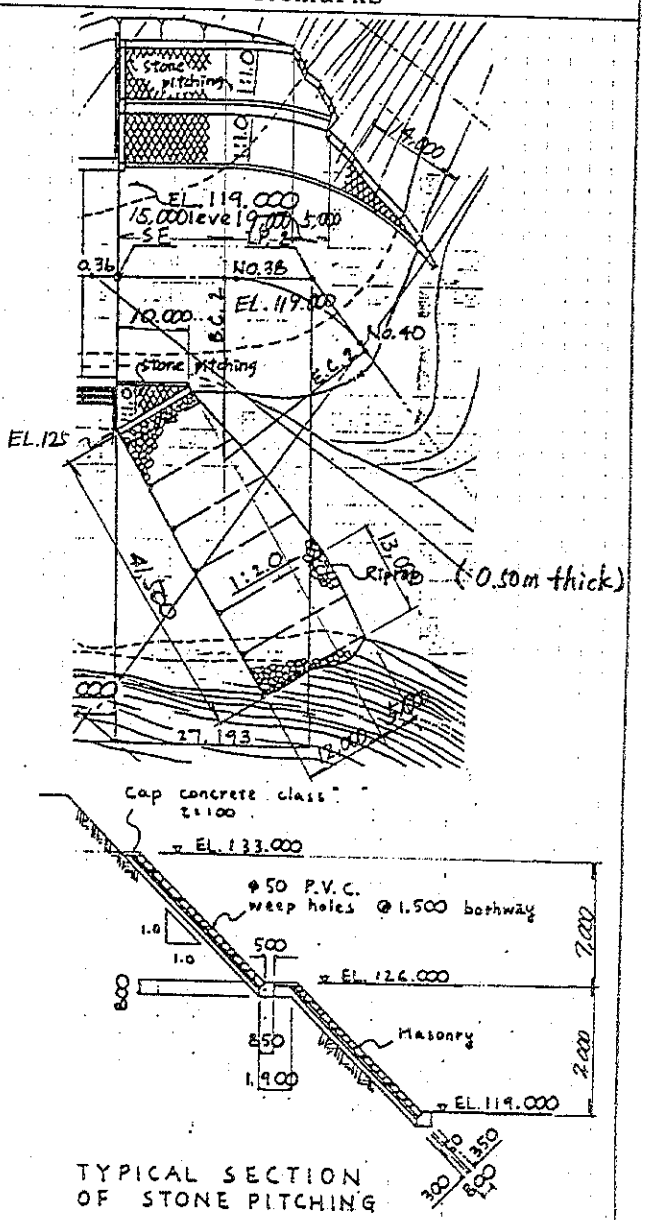
Description	Calculation Details	Unit	Quantity	Remarks
(3) Stilling basin	1) Slab			
	a) D25, ℓ = 2,500			
	Block SBS-1 ~ 2 L_1 = 7×9×2×2.50 = 315.00m			
	b) D32, ℓ = 5,000			
	Block SBS-3 ~ 20 L_2 = 7×9×18×5.00 = 5,670.00m			
	Block SBS-21 ~ 22 L_3 = 10×9×2×5.00 = 900.00m			
	Block SBS-23 ~ 24 L_4 = 2×9×2×5.00 = 180.00m			
	Sub-total = 6,750.00 m			
	2) Training wall (Right)			
	a) D25, ℓ = 4,500			
	SBR-1 L_1 = 7×2×4.50 = 63.00m			
	b) D32, ℓ = 5,000			
	SBR-2 L_2 = 5×7×5.00 = 175.00m			
	SBR-3 L_3 = (4×9+3×5)×5.00 = 255.00m			
	SBR-4 ~ 6 L_4 = 7×9×3×5.00 = 945.00m			
	SBR-7 L_5 = 7×7×5.00 = 245.00m			
	SBR-8 L_6 = 7×(7+9)×½×5.00 = 196.00m			
	SBR-9 ~ 10 L_7 = 7×4×2×5.00 = 280.00m			
	SBR-11 L_8 = 4×4×5.00 = 80.00m			
	Sub-total = 2,123.00 m			
	3) Training wall (Left)			
	a) D25, ℓ = 4.500			
	SBL-1 L_1 = 7×2×4.50 = 63.00m			
	b) D32, ℓ = 5,000			
	SBL-2 L_2 = 5×7×5.00 = 175.00m			
	SBL-3 L_3 = (4×9+3×5)×5.00 = 255.00m			

Working Division: Anchor bar (4)

Description	Calculation Details	Unit	Quantity	Remarks
	SBL-1 ~ 11 $L_4 = 7 \times 9 \times 8 \times 5.00 = 2,520.00$ m			
	Sub-total = 2,950.00 m			
(4) Total	1) D25			
	$L = 2,520.00 + 840.00 + 1,008.00 + 315.00$			
	$+ 63.00 + 63.00$			
	$= 4,809.00$ m			
	2) D29			
	$L = 18,982.00 + 80.00 + 273.00 + 1,260.00$			
	$+ 924.00 + 567.00$			
	$= 21,586.00$ m			
	3) D32			
	$L = 6,750.00 + 2,173.00 + 2,950.00$			
	$= 11,873.00$ m			

Working Division: Stone pitching , Riprap

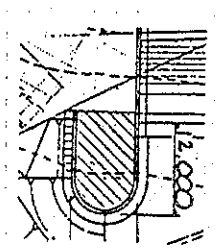
Description	Calculation Details	Unit	Quantity	Remarks
D1/11 Stone pitching	1) Left bank	m^2	661.2	
	$A_1 = \{24.0 \times (7.0+7.0) + 5.0 \times (14.0+7.0)/2 + 14.0 \times 7.0/2\} \times \sqrt{2} = 618.72\ m^2$			
	2) Right bank			
	$A_2 = 10.0 \times 6.0/2 \times \sqrt{2} = 42.43\ m^2$			
	3) Total			
	$A = 618.72 + 42.43 = 661.15\ m^2$			
D1/13 Riprap	$V = \{41.50 \times 12.00 + (41.50+13.00)/2 \times 5.00\} \times \sqrt{5} \times 0.50 = 709.11\ m^3$	m^3	709.1	

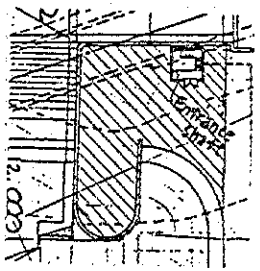


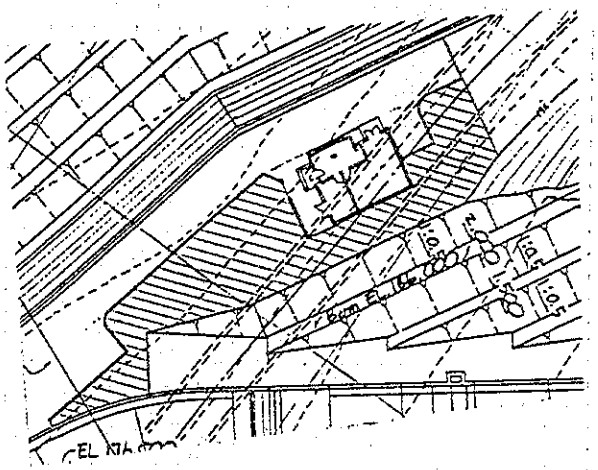
TYPICAL SECTION OF STONE PITCHING

Working Division: Gravel metalling (1)

Description	Calculation Details	Unit	Quantity	Remarks
D1/14 Gravel	metalling			
	GWL-1			
	$(8.0 \times 9.0 + 8.0^2 \times \frac{\pi}{4} \times \frac{1}{2}) \times 0.10$			
	$= 9.71\ m^3$			
	GWR-1			
	$(9.13 + 19.0 \times 12.0) \times 0.10 = 32.51\ m^3$			
	Dam control house			
	by planimeter $82.63\ m^3$			
	Sub-total			
	$V = 9.71 + 32.51 + 82.63 = 124.85 m^3$			



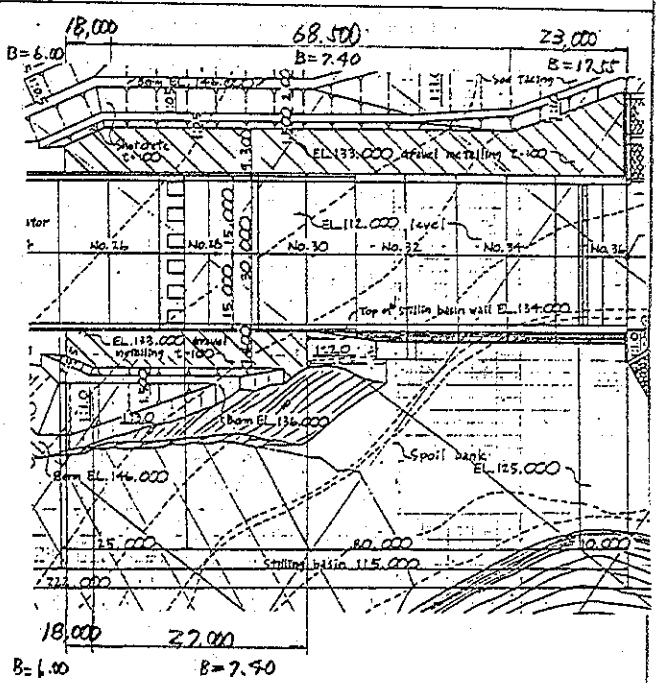




V1-3-24

Working Division: Gravel metalling (2)

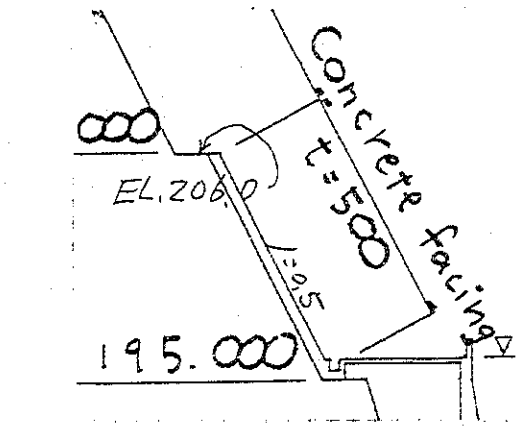
Description	Calculation Details	Unit	Quantity	Remarks
D1/14 Gravel	metalling	m^3	123.5	
	Left bank $V_1 = \{(16.0+7.4)/2 \times 18.0 + 7.4 \times 68.5 + (7.4+17.55)/2 \times 23.0\} \times 0.10$			
	$= 91.44\ m^3$			
	Right bank $V_2 = \{(6.0+7.4)/2 \times 18.0 + 7.4 \times 27.0\} \times 0.10$			
	$= 32.04\ m^3$			
	Sub-total			
	$V = 91.44 + 32.04 = 123.48\ m^3$			
	total volume of gravel metalling			
	$V = 124.85 + 123.48 = 248.33$	m^3	248.3	

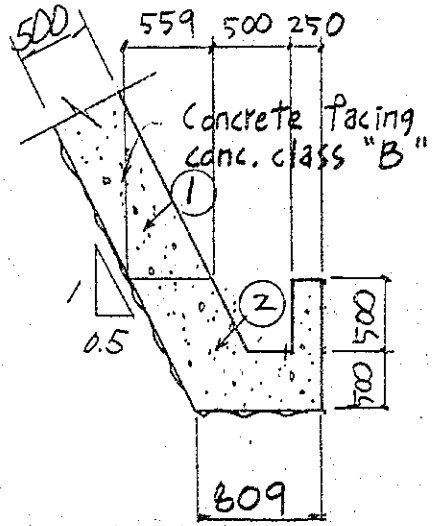


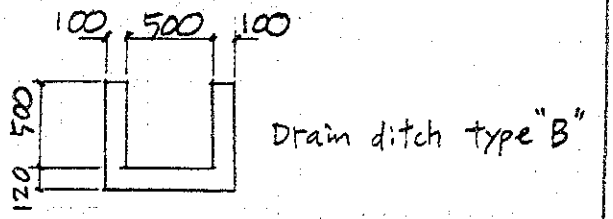
Gravel Metalling

Working Division: D2 Concrete Work

Description	Calculation Details	Unit	Quantity	Remarks
D2/02 concrete (class "B")	facing EL. 206.0 ~ EL. 196.0 ($\sqrt{1^2+0.5^2}$)	m³	586.1	
①	$\ell = (206.0-196.0) \times 1.118 = 11.18^{m}$			
	$L = 11.0 + 219 + 75 = 305^{m}$			
	$\nabla_1 = 11.18 \times 0.5 \times 305 = 310.59\ m^3$			
②	$A = (0.809 + 1.309) \times 1/2 \times 1.000$			
	$- (0.250 + 0.500) \times 1/2 \times 0.500 = 0.872^{m^2}$			
	$L = 17 + 220 + 79 = 316^{m}$			
	$\nabla_2 = 0.872 \times 316 = 275.55^{m^3}$			
	$\Sigma\nabla = \nabla_1 + \nabla_2 = 586.1^{m^3}$			
D2/01	concrete class "B" in drain ditch type B	m³	142.4	
	$A = 0.700 \times 0.620 - 0.500 \times 0.500 = 0.184^{m^2}$			
	Berm EL.236 $\ell = 244^{m}$ EL.166 $\ell = 80^{m}$			
	EL.216 $\ell = 276^{m}$ EL.146 $\ell = 122^{m}$			
	EL.186 $\ell = 52^{m}$			
	Total $\ell = 774^{m}$			
	$\nabla = 0.184 \times 774 = 142.4^{m^3}$			







Working Division: D2 Concrete Work

Description	Calculation Details	Unit	Quantity	Remarks
D2/02 weir	(SW-1 ~ SW-9)			
(class "c")	SW-1			
	{(0.72+1.921)x½x1.5 + 1.921x3.5			
	+(2.8+8.398)x½x5.5 + (1.5+1.95)			
	x½x1.5}			
	= 42.09 m^2			
	SW-9			
	42.09 + 1.921x(180.0-176.0)			
	= 49.77 m^2			
	(42.09+49.77)x½x9.994x9			
	= 4131.22	m^3	4131 m^2	

Working Division: D2 Concrete work, Concrete, chuteway and stilling basin

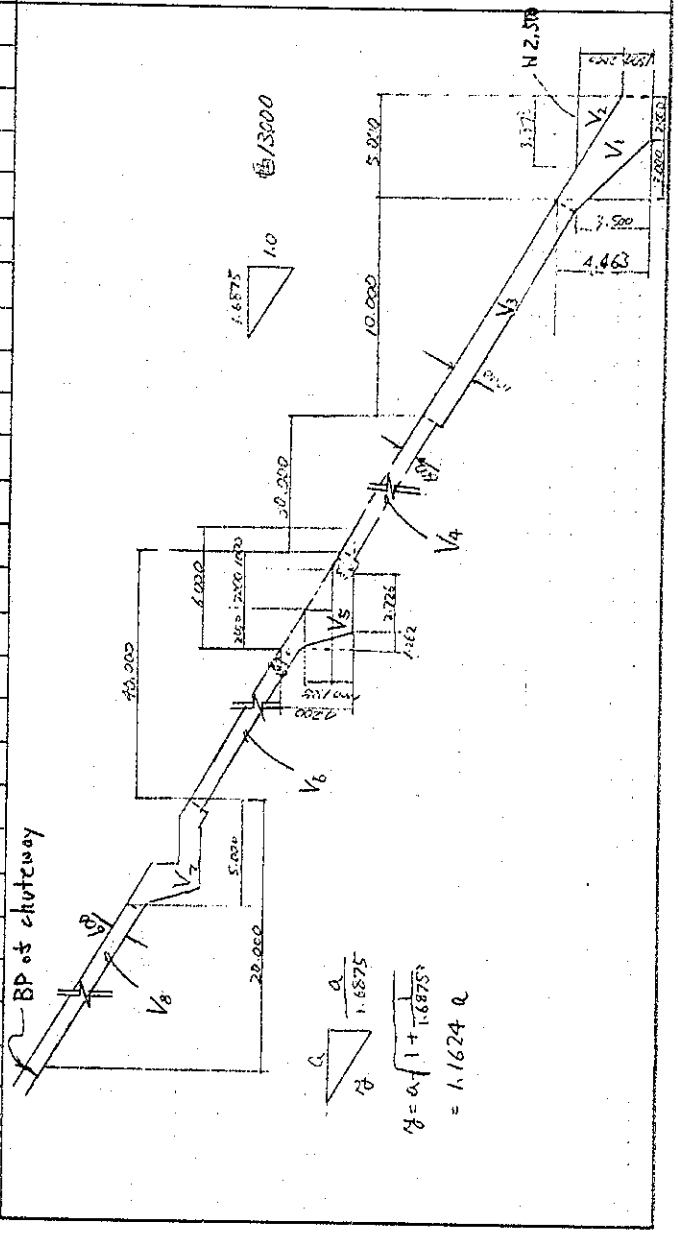
Description	Calculation Details		Unit	Quantity	Remarks
D2/03	Concrete, class C, in chuteway				
	slab	1,915.3			
	Training wall (Right)	1,554.3			
	" " (Left)	1,554.3			
	total	5,023.9	m^3	5,023.9	
D2/05	Concrete, class C, in stilling basin				
	slab	4,899.0			
	Training wall (Right)	5,550.9			
	" " (Left)	5,386.0			
	total	15,835.9	m^3	15,835.9	

Working Division: D2 Concrete work, Concrete

Description	Calculation Details	Unit	Quantity	Remarks
	80,000 (Chuteway)			115,000 (Stilling basin)
	70,000 + 2,500 @ 2 = 75,000			11@10,000 = 110,000
				5,000

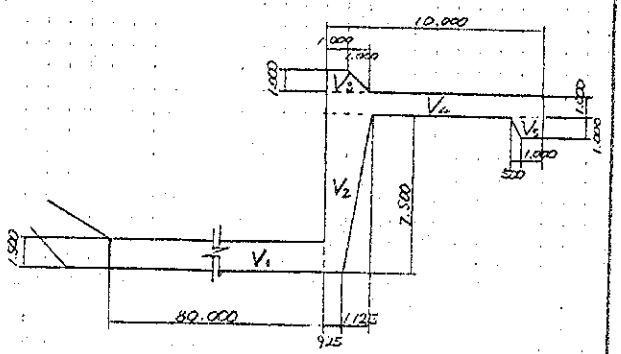
Working Division: Spillway, Chuteway, Slab

Description	Calculation Details	Unit	Quantity	Remarks
D2/03 (and D2/05)	Concrete for Slab of Chuteway (and a Part of Stilling Basin)			
Block CWS-1 to CWS-16 (and SBS-1 to SBS-6)	$V_1 = \{\frac{1}{2} \times (1.5 + 4.463) \times 5.0 - \frac{1}{2} \times 3.5 \times 3.0\} \times 28.0$			
	$= 270.41\ m^3$			
	$V_2 = (\frac{1}{2} \cdot 3.375 \times 2.0 \times 2.5) \times 6.0 = 50.63\ m^3$			
	$V_3 = 10.0 \times 1.1624 \times 1.0 \times 28.0 = 325.47\ m^3$			
	$V_4 = 30.0 \times 1.1624 \times 0.6 \times 28.0 = 585.85\ m^3$			
	$V_5 = \{\frac{1}{2} \times 6.0 \times 4.2 - (\frac{1}{2} \times 1.262 \times 2.335 +$			
	$\frac{1}{2} \times 2.0 \times 1.335)\} \times 28.0 = 274.17\ m^3$			
	$V_6 = 35.0 \times 1.1624 \times 0.6 \times 28.0 = 683.49$			
	$V_7 = \{\frac{1}{2} \times 6.0 \times 4.2 - (\frac{1}{2} \times 1.262 \times 2.335 +$			
	$\frac{1}{2} \times 2.0 \times 1.335)\} \times 28.0 = 274.17\ m^3$			
	$V_8 = 15.0 \times 1.1624 \times 0.6 \times 28.0 = 292.93$			
	Sub Total $= 2,757.12\ m^3$			
	Chuteway Block CWS-1 to CWS-16	m^3	1,915.33	
	$V = V_4/30 \times 20 + V_5 + V_6 + V_7 + V_8$			
	$= 585.85/30 \times 20 + 274.17 + 683.49 +$			
	$274.17 + 292.93$			
	$= 1,915.33\ m^3$			
	Stilling Basin Block SBS-1 to SBS-6			
	$V = V_1 + V_2 + V_3 + V_4/30 \times 10$			
	$= 270.41 + 50.63 + 325.47 + 585.85/30 \times 10$			
	$= 841.79\ m^3$			



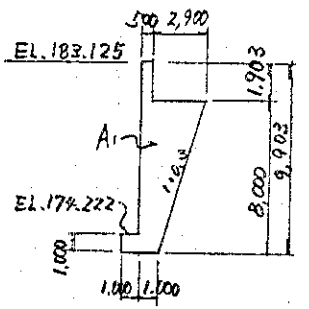
Working Division: Spillway, Stilling Basin, Slab

Description	Calculation Details	Unit	Quantity	Remarks
D2/05	Concrete for slab of Stilling Basin			
	Block SBS-1 to 24			
	$V_1 = 1.5 \times 80.0 \times 28.0 = 3,360.0\ m^3$			
	$V_2 = (2.05+0.925)/2 \times 7.5 \times 30.0 = 334.69\ m^3$			
	$V_3 = (1.0+2.0)/2 \times 1.0 \times 30.0 = 45.00\ m^3$			
	$V_4 = 1.0 \times 10.0 \times 28.0 = 280.00\ m^3$			
	$V_5 = (1.5+1.0)/2 \times 1.0 \times 30.0 = 37.50\ m^3$			
	Total $V = 4,057.19\ m^3$			
	Total of concrete volume of Block SBS-1 to SBS-24	m^3	4,899.0	
	$V = 841.79 + 4,057.19$			
	$= 4,898.98\ m^3$			

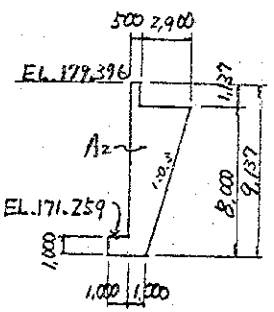


Working Division: Spillway, Chuteway, Right Wall

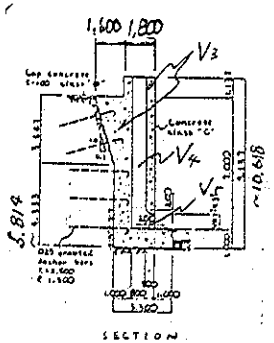
Description	Calculation Details	Unit	Quantity	Remarks
D2/03	Concrete for Right Training Wall in Chuteway			
Block CWR-1	$A_1 = 0.5 \times 1.903 + (3.40+1.00)/2 \times 8.0 + 1.0 \times 1.0 = 19.55\ m^2$			
(U/S part)	$A_2 = 0.5 \times 1.137 + (3.40+1.00)/2 \times 8.0 + 1.0 \times 1.0 = 19.17\ m$			
L = 5.00 m	$V_1 = (19.55+19.17)/2 \times 5.00 = 96.80\ m^3$			
Block CWR-1~8	(excluding aerators)			
L = 70.00 m	$A_2 = 19.17\ m^2$			
	$V_2 = 19.17 \times 70.00 = 1,341.90\ m^3$			
Aerators in Block CWR-2 and 6				
L = 2.50 m x 2nos.	$A_3 = 1.8 \times 1.137 + (3.40+2.30)/2 \times 3.667 + 2.30 \times 4.333$			
= 5.00 m	$+ 1.0 \times 1.0 = 23.46\ m^2$			
	$A_4 = 1.8 \times 1.137 + (3.40+2.30)/2 \times 3.667 + 2.30 \times 5.814$			
	$+ 1.0 \times 1.0 = 26.87\ m^2$			
	$A_5 = (9.317 + 0.50/1.6875 - 1.0) \times 0.80 = 6.89\ m^2$			
	$A_6 = (10.618 - 0.50/1.6875 - 1.0) \times 0.80 = 7.46\ m^2$			
	$A_7 = (0.296+1.185)/2 \times 1.50 = 1.11\ m^2$			
	$V_3 = (23.46+26.87)/2 \times 2.50 = 62.91\ m^3$			
	$V_4 = (6.89+7.46)/2 \times 1.50 = 10.76\ m^3$			
	$V_5 = 1.11 \times 0.50 = 0.56\ m^3$			
	$V_6 = \{(0.50+1.10)/2 \times 1.80 + 1.10 \times 0.80/2\} \times 3.30 = 6.20\ m^3$			
	$V_7 = 62.91 - (10.76+0.56) + 6.20 = 57.79\ m^3$			
	Total of Aerators $V = 57.79 \times 2 = 115.58\ m^3$			
Total of concrete class C for Block CWR-1 to CWR-8		m^3	1,554.3	
$V = 96.80 + 1,341.90 + 115.58 = 1,554.28\ m^3$				

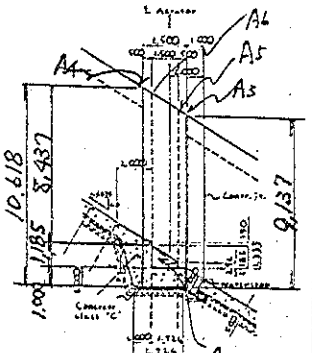


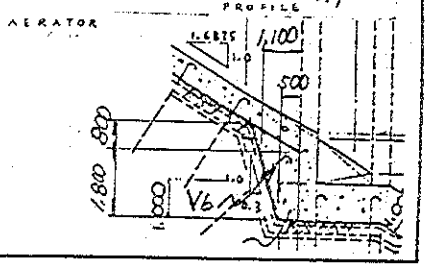
Sec. A1-A1
Block CWR-1
(U/S part)



Sec. A2-A2
Block CWR-1 (D/S)
and CWR-2~8







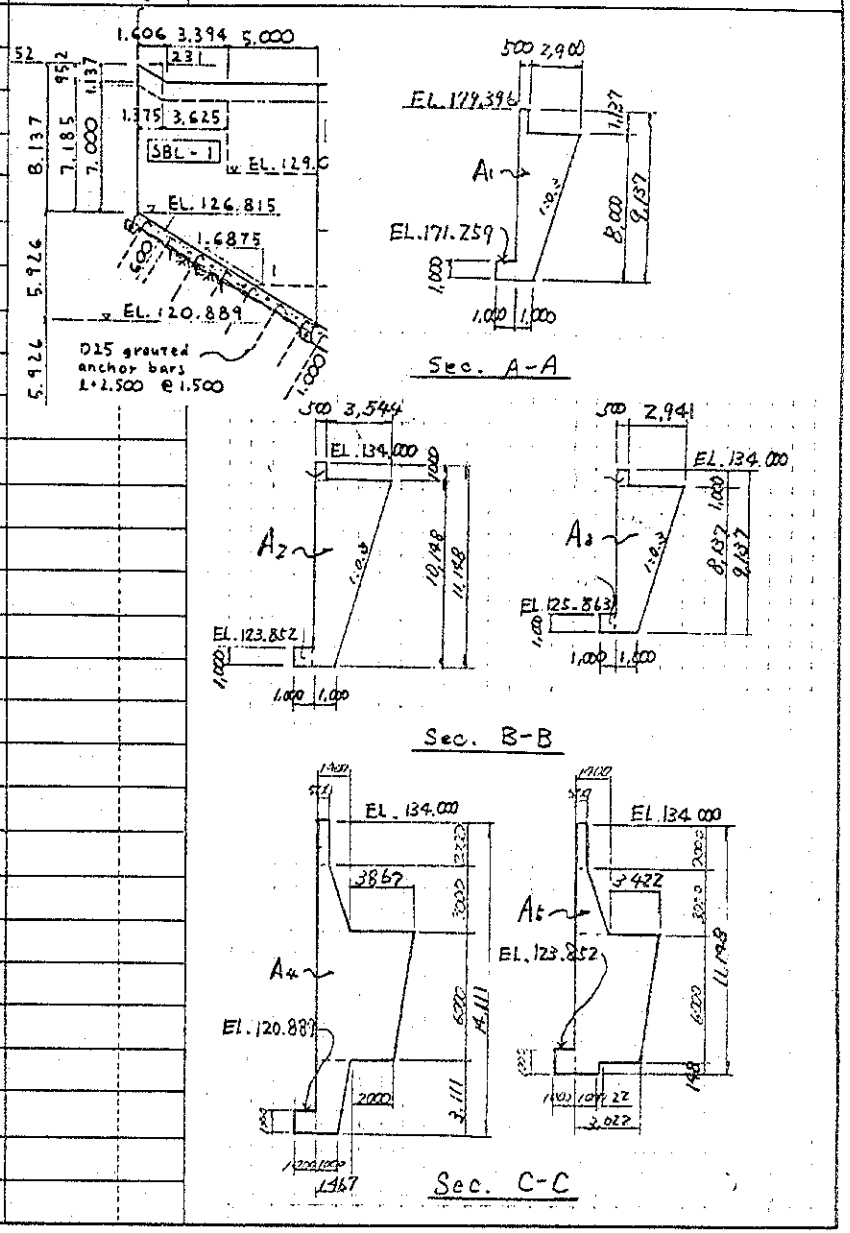
VI-3-32

Working Division: Spillway, Chuteway, Left Wall

Description	Calculation Details	Unit	Quantity	Remarks
D2/53	Concrete for Left Retaing Wall in Chuteway			
Block CWL-1	(U/S part) L= 5.00 m Same as CWR-1			
	V_1= 96.80 m^3			
Block CWL-1~8	(excluding aerators) Same as CWR-1~8			
	V_2= 1,341.90 m^3			
Aerators in Block CWL-2 and 6	Same as CWR-2 and 6			
	V_a= 115.58 m^3			
Total of concrete class C for Block CWL-1 to CWL-8				
	V= 96.80 + 1,341.90 + 115.58 = 1,554.28 m^3	m^3	1,554 m^3	

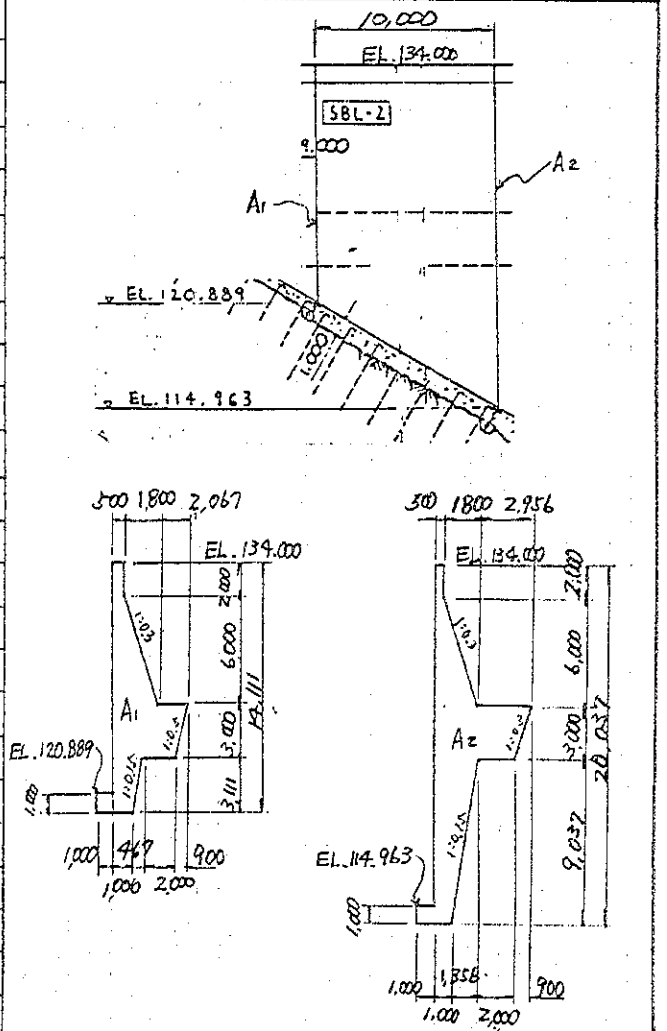
Working Division: Spillway, Stilling Basin, Right Traing Wall (1)

Description	Calculation Details	Unit	Quantity	Remarks
D2/05	Concrete for Right Training Wall in Stilling Basin			
Block SBR-1				
u/s part	$L = 1.606$ m (Sec. A-A)			
	$A_1 = 0.5 \times 1.137 + (3.40 + 1.00)/2 \times 8.0 + 1.0 \times 1.0 = 19.17$ m^2			
	$V_1 = 19.17 \times 1.606 = 30.79$ m^3			
Middle part	$L = 3.394$ m (Sec. B-B)			
	$A_2 = 0.50 \times 1.00 + (4.044 + 1.0)/2 \times 10.148 + 1.0 \times 1.0 = 27.09$ m^2			
	$A_3 = 0.50 \times 1.00 + (3.441 + 1.0)/2 \times 8.137 + 1.0 \times 1.0 = 19.57$			
	$V_2 = (27.09 + 19.57)/2 \times 3.394 = 79.18$ m^3			
D/s part	$L = 5.00$ m (Sec. C-C)			
	$A_4 = 0.50 \times 2.00 + (0.50 + 1.40)/2 \times 3.00 + (5.267 + 3.467)/2 \times 6.00 + (1.467 + 1.00)/2 \times 3.111 + 1.0 \times 1.0$			
	$= 34.89$ m^2			
	$A_5 = 0.50 \times 2.00 + (0.50 + 1.40)/2 \times 3.00 + (4.822 + 3.022)/2 \times 6.00 + (1.022 + 1.00)/2 \times 0.148 + 1.0 \times 1.0$			
	$= 28.53$ m^2			
	$V_3 = (34.89 + 28.53)/2 \times 5.00 = 158.55$ m^3			
	Total $V = 30.79 + 79.18 + 158.55 = 268.52$ m^3			



Working Division: Spillway, Stilling Basin, Right Training Wall (2)

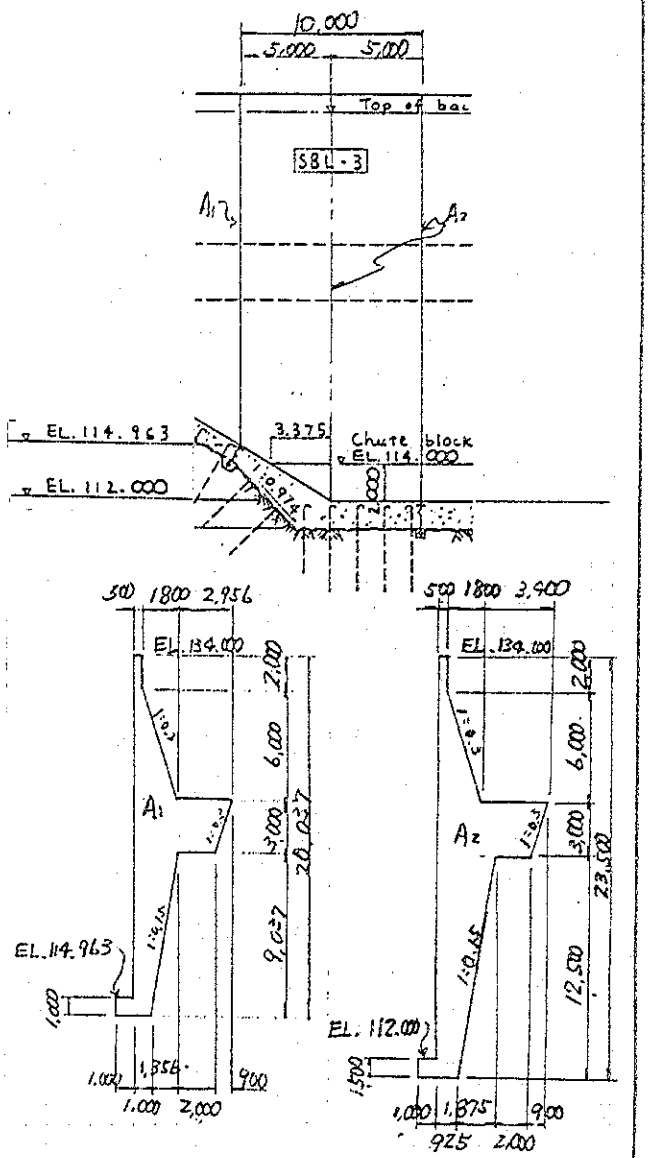
Description	Calculation Details	Unit	Quantity	Remarks
Block SBR-2	L = 10.000 m (Sec. D-D)			
	A_1 = 0.50 × 2.00 + (0.50 + 2.30)/2 × 6.0 + (2.30 + 2.067 + 1.467 + 2.00)/2 × 3.00 + (1.467 + 1.00)/2 × 3.111 + 1.0 × 1.0 = 25.99 m²			
	A_2 = 0.50 × 2.00 + (0.50 + 2.30)/2 × 6.0 + (2.30 + 2.956 + 2.356 + 2.00)/2 × 3.00 + (2.356 + 1.00)/2 × 9.037 + 1.0 × 1.0 = 39.98 m²			
	V = (25.99 + 39.98)/2 × 10.00 = 329.85 m³			



Sec. D-D

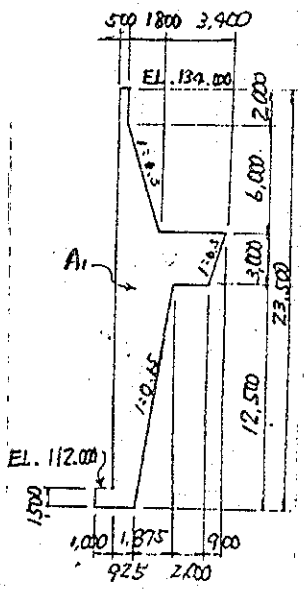
Working Division: Spillway, Stilling Basin, Right Training Wall (3)

Description	Calculation Details	Unit	Quantity	Remarks
Block SBR-3	L=10.000 m			
	A_1= 39.98 m² (Same as A_2 of Block SBR-2)			
	A_2= 0.5×2.00+(0.50+2.30)/2×6.00+(2.30+3.40			
	+0.925+3.875)/2×3.00+(0.925×2+1.875)			
	/2×12.50+1.50×1.00= 49.93 m²			
	V= (39.98+49.93)/2×5.00+ 49.93×5.00			
	= 474.43 m³			

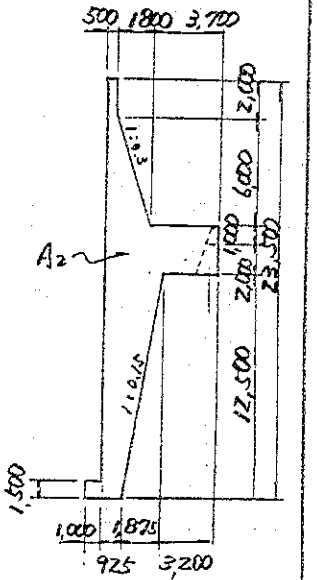


Working Division: Spillway, Stilling Basin, Right Training Wall (4)

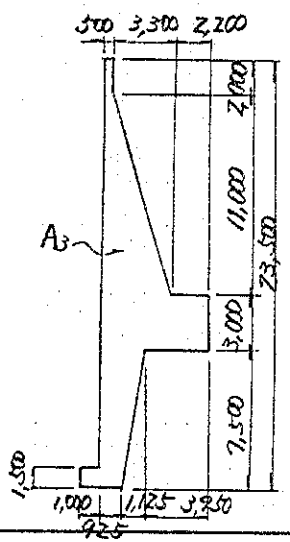
Description	Calculation Details	Unit	Quantity	Remarks
Block SBR-4 ~ SBR-6	L = 3 @ 10.000 = 30.000 m (Sec. E-E)			
	A_1 = 49.93 m² (Same as A_2 of Block SBR-3)			
	V = 49.93 × 30.00 = 1,497.90 m³			
Block SBR-7	L = 4.000 + 6.000 = 10.000 m (Sec. E-E & F-F)			
	A_1 = 49.93 m² (Same as A_2 of Block SBR-3)			
	A_2 = A_1 + (1.20+0.30)/2×3.00 = 52.18 m²			
	V = 49.93 × 4.00 + (49.93+52.18)/2×6.00 = 506.05 m³			
Block SBR-8	L = 10.000 m (Sec. F-F & G-G)			
	A_2 = 52.18 m² (Same as A_2 of Block SBR-7)			
	A_3 = 0.50×2.00 + (0.50+3.80)/2×11.00 + 6.00×2.00			
	+ (0.925×2+1.125)/2×2.50 + 1.50×1.00			
	= 55.31 m²			
	V = (52.18 + 55.31)/2 × 10.00 = 537.45 m³			



Sec. E-E



Sec. F-F

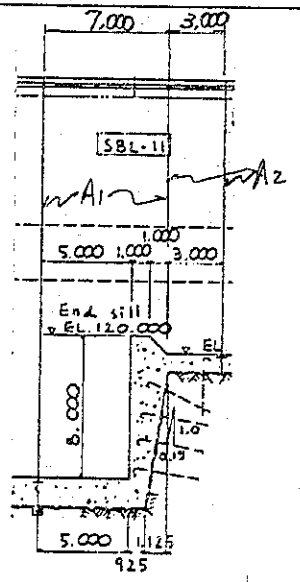


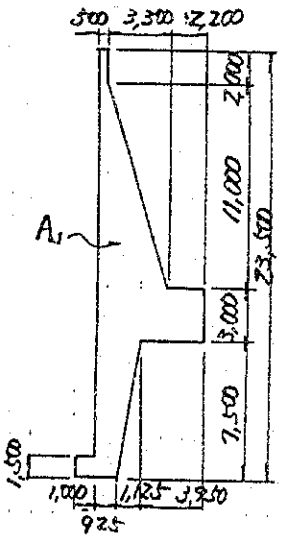
Sec. G-G

VI-3-37

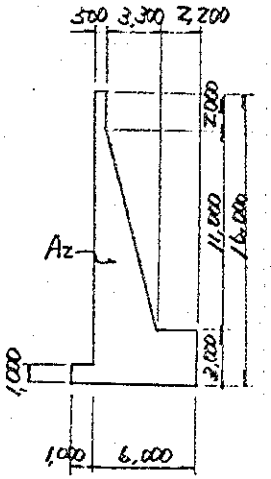
Working Division: Spillway, Stilling Basin, Right Training Wall (5)

Description	Calculation Details	Unit	Quantity	Remarks
Block SBR-9~10	L = 2 @ 10.000 = 20.000 m (Sec. G-G)			
	A_1 = 55.31 m² (Same as A_2 of Block SBR-8)			
	V = 55.31 × 20.00 = 1,106.20 m³			
Block SBR-11	L = 7.000 + 3.000 = 10.000 m (Sec. G-G & I-I)			
	A_1 = 55.31 m² (Same as A_2 of Block SBR-8)			
	A_2 = 0.50×2.00 + (0.50+3.80)/2×11.00 + 6.00×3.00			
	+1.00×1.00 = 43.65 m²			
	V = 55.31×7.00 + 43.65×3.00 = 518.12 m³			





Sec. G-G

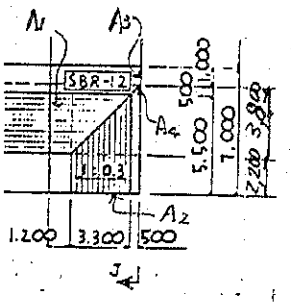


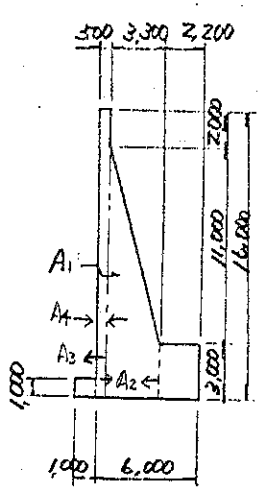
Sec. I-I

Working Division: Spillway, Stilling Basin, Right Training Wall (6)

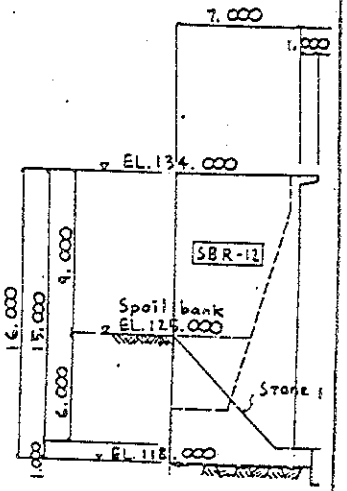
Description	Calculation Details	Unit	Quantity
Block SBR-12	$A_1 = 43.65\ m^2$ (Same as A_2 of Block SBR-11)		
	$A_2 = 0.50 \times 2.00 + (0.50 + 3.80)/2 \times 11.00 + 3.8 \times 3.0 = 36.05\ m^2$		
	$A_3 = 0.50 \times 16.00 + 1.00 \times 1.00 = 9.00\ m^2$		
	$A_4 = 0.50 \times 16.00 = 8.00\ m^2$		
	$V = 43.65 \times 1.20 + (43.65 + 9.00)/2 \times 3.80$		
	$+ (8.00 + 36.05)/2 \times 3.80 + 24.65 \times 2.20$		
	$= 290.34\ m^3$		
Wave corbel	of Block SBR-7 to SBR-12		
	$A = 1.0 \times 0.3 + 1.0 \times 0.2/2 = 0.40\ m^2$		
	$L = 55.00\ m$		
	$V = 0.40 \times 55.00 = 22.00\ m^3$		
Total Volume of Right Training Wall SBR-1 to SBR-12		m^3	5,550.9
	$V = 268.52 + 329.85 + 474.43 + 1,497.20 + 506.05$		
	$+ 537.45 + 1,106.20 + 518.12 + 290.34 + 22.00$		
	$= 5,550.86\ m^2$		

Remarks

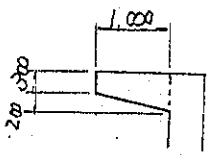




Sec. I-I



Sec. J-J



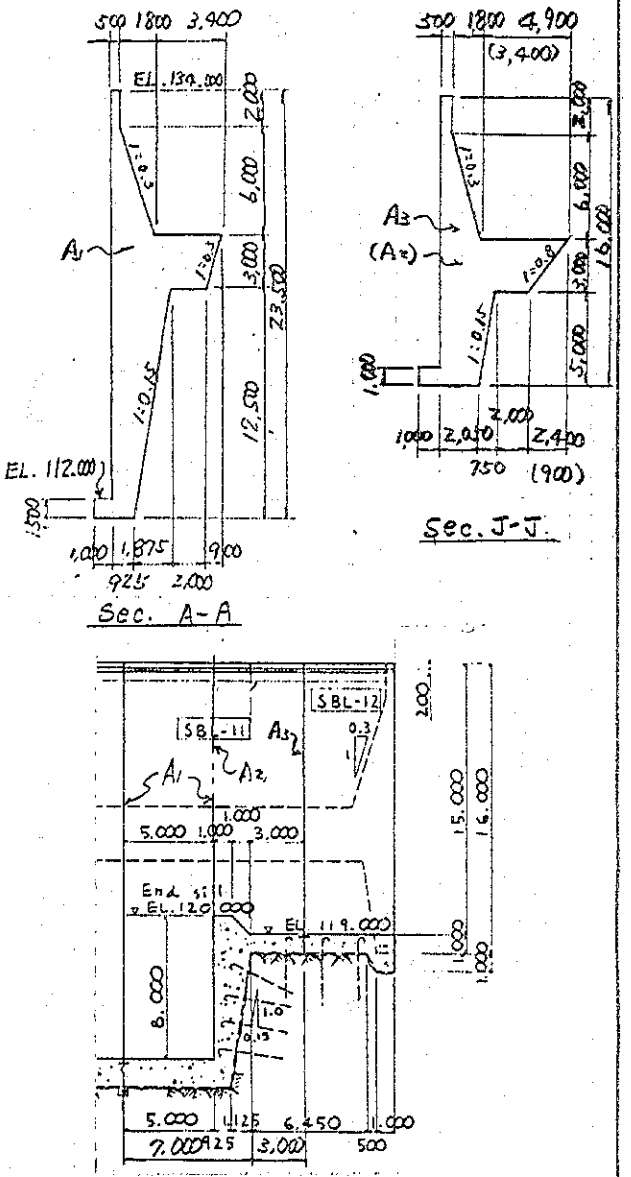
Wave Corbel

Working Division: Spillway, Stilling Basin, Left Training Wall (1)

Description	Calculation Details	Unit	Quantity	Remarks
D2106 Concrete, Class C, for Left Taaing Wall				
Block SBL-1	Same as Block SBR-1			
	$V = 268.52\ m^3$			
Block SBL-2	same as Block SBR-2			
	$V = 329.85\ m^3$			
Block SBL-3	Same as Block SBR-3			
	$V = 474.43\ m^3$			
Block SBL-4~10	$L = 7 @ 10.000 = 70.000\ m$ (Sec. E-E)			
	$A = 49.93\ m^2$ (Same as Block SBR-4)			
	$V = 49.93 \times 70.00 = 3,495.10\ m^3$			

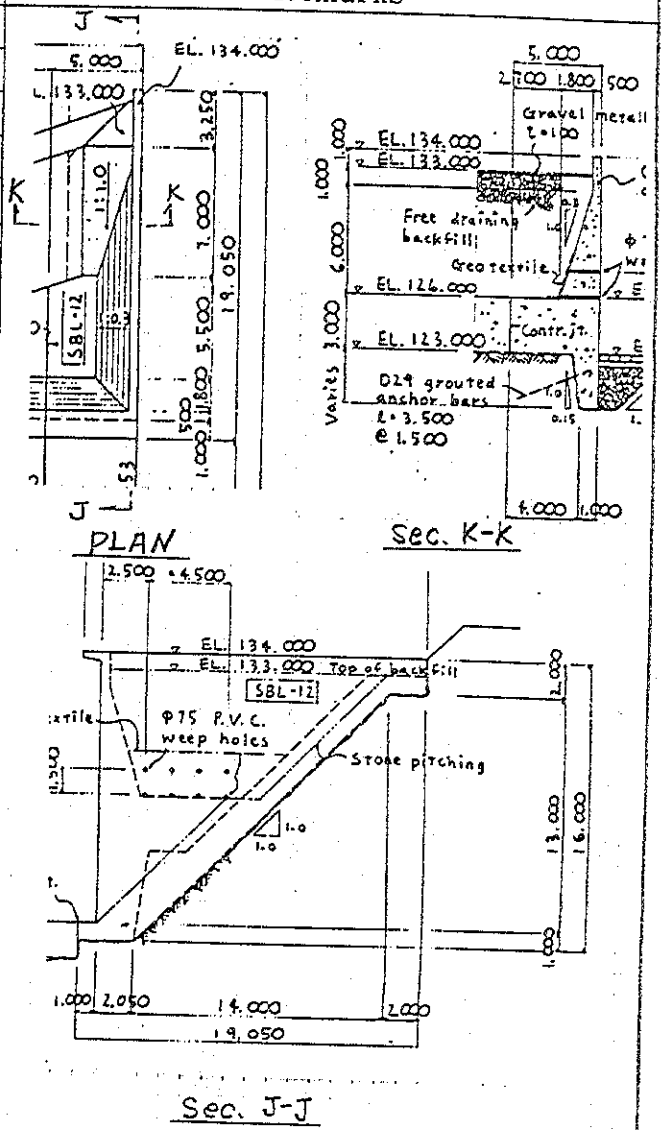
Working Division: Spillway, Stilling Basin, Left Training Wall (2)

Description	Calculation Details	Unit	Quantity	Remarks
Block SBL-11	L = 5.000 + 5.000 = 10.000 m (Sec. A-A & J-J)			
	A_1 = 49.93 m^2 (Same as Block SBL-10)			
	A_2 = 0.50 × 2.00 + (0.50 + 2.30)/2 × 6.00 + (2.30 + 3.40 + 2.05 + 2.75)/2 × 3.00 + (2.05 × 2 + 0.75)/2 × 5.00 + 1.0 × 1.0 = 38.28 m^2			
	A_3 = 0.50 × 2.00 + (0.50 + 2.30)/2 × 6.00 + (2.30 + 4.90 + 2.05 + 2.75)/2 × 3.00 + (2.05 × 2 + 0.75)/2 × 5.00 + 1.0 × 1.0 = 40.53 m^2			
	V = 49.93 × 5.00 + (38.28 + 40.53)/2 × 5.00			
	= 446.68 m^3			

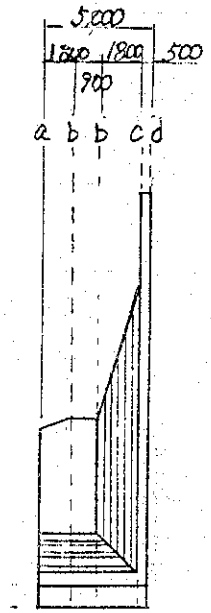


Working Division: Spillway, Stilling Basin, Left Training Wall (3)

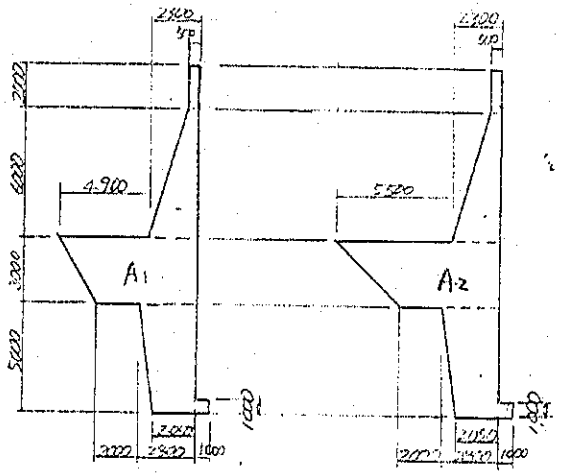
Description	Calculation Details	Unit	Quantity	Remarks
Block SBL-12	A_1 = 40.53 m² (Same as A_2 of Block SBL-11)			
	A_2 = 0.5×2.0 + (0.5+2.3)/2×6.0 + (5.5+2.3+2.0+2.8)/2×3.0 + (2.8+2.05)/2×5.0 + 1.0×1.0 = 41.43 m²			
	A_3 = (3.25+4.25)/2×1.0 + 0.5×2.0 + (16.05+2.05)/2×14.0 + 1.0×1.0 = 132.45 m²			
	A_4 = (18.05+2.05)/2×16.0 + 2.0×2.0/2 + 1.0×1.0 = 163.80 m²			
	V = (40.53+41.43)/2×1.80 + 41.43×0.90 + (41.43+132.45)/2×1.80 + 163.80×0.50 = 349.44 m³			
Wave corbel	of Block SBL-7 to SBL-12			
	V = 22.00 m³ (Same as Block SBR-7 to SBR-12)			
Total Volume	of Left Training Wall SBL-1 to SBL-12	m³	5,386.0	
	V = 268.52 + 329.85 + 474.43 + 3,495.10 + 446.68 + 349.44 + 22.00 = 5,386.02			



Working Division: Spillway, Stilling Basin, Left Training Wall (4)

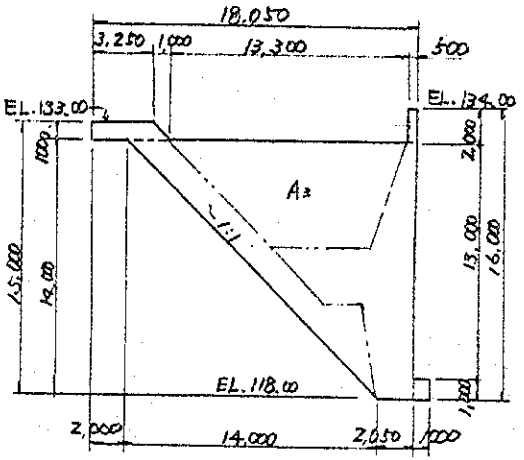


Plan

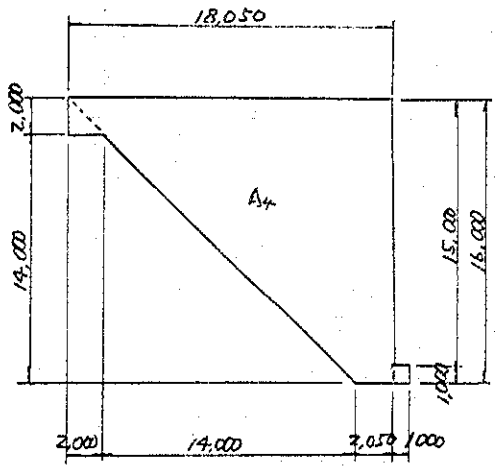


Sec. a-a

Sec. b-b



Sec. c-c



Sec. d-d

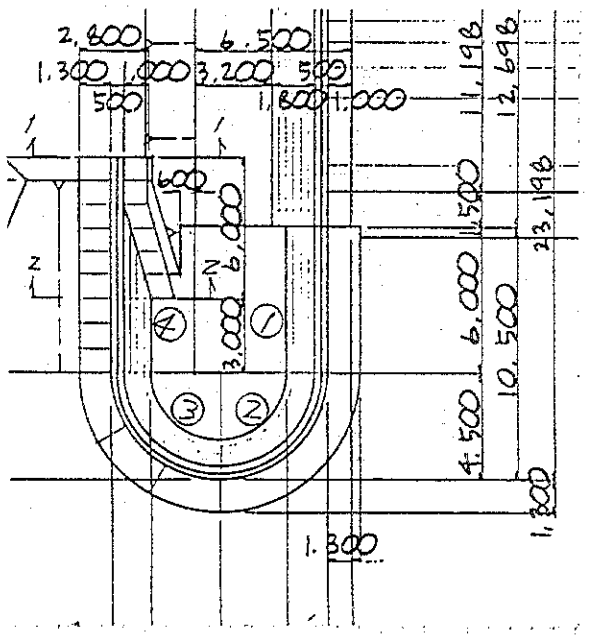
BLOCK SBL-12

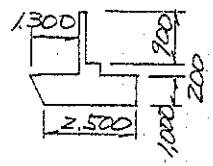
Working Division: Concrete, Dam Abutment and Guide Wall (1)

Description	Calculation Details	Unit	Quantity	Remarks
₱2/04	Concrete, class "C", in dam abutment and guide wall			
	GWL-1 ~ GWL-3	m^3	1,620	
	GWR-1	m^3	1,010	
	SCR-1 ~ SCR-7	m^3	4,590	
	total	m^3	7,220	

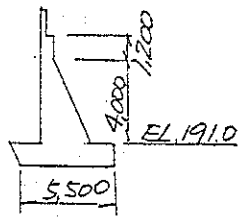
Working Division: Concrete, Dam Abutment and Guide Wall (2)

Description	Calculation Details	Unit	Quantity	Remarks
	(See DWG.NO. C-062)			
GWL-1 (Sec. D-D)	① {0.2 × 0.9 + 0.5 × 1.2 + (0.5+1.7) × ½ × 4.0 + 6.5 × 1.0 + (2.8+1.0) × ½ × 6.0 + (1.30+1.0) × ½ × 1.0} × 6.0 = 24.23 × 6.0 = 145.38 m³			
	② (24.23 − 1.0 × 1.0) × 45 × 2 × π × 1/360 = 23.23 × 7.069 = 164.21 m³			
	③ {0.2 × 0.9 + 0.5 × 1.2 + (0.5+1.7) × ½ × 4.0 + 4.5 × 1.0 + (1.9+1.0) × ½ × 3.0 + (1.30+1.0) × ½ × 1.0} = 15.18 m²			
	(15.18 + 23.23) × ½ × 7.069 = 135.76 m³			
	④ {0.2 × 0.9 + 0.5 × 1.2 + (0.5+1.7) × ½ × 4.0 + (5.8 + 5.5) × ½ × 1.0} = 10.83 m²			
	(10.83 + 15.18) × ½ × 3.0 = 39.02 m³			
	{0.2 × 0.9 + 0.5 × 0.2 + (2.8+2.5) × ½ × 1.0} = 2.93 m²			





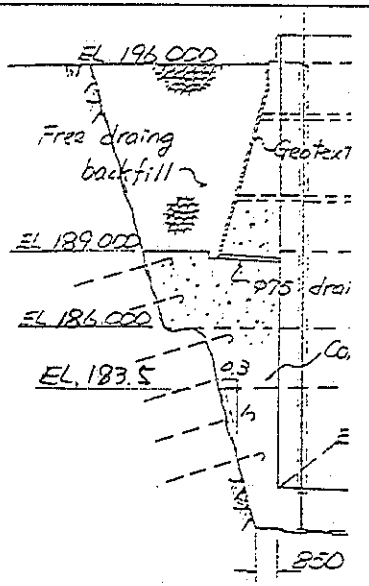
Sec. 1

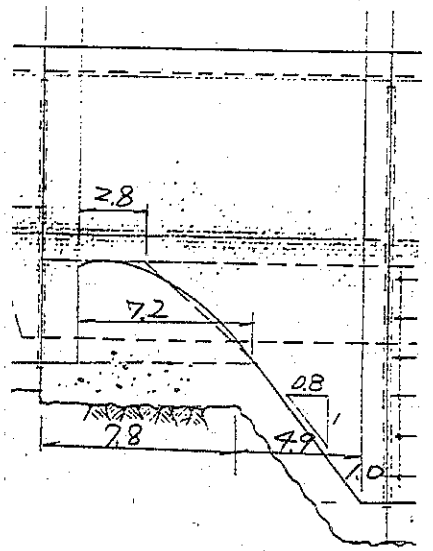


Sec. 2

Working Division: Concrete, Dam Abutment and Guide Wall (3)

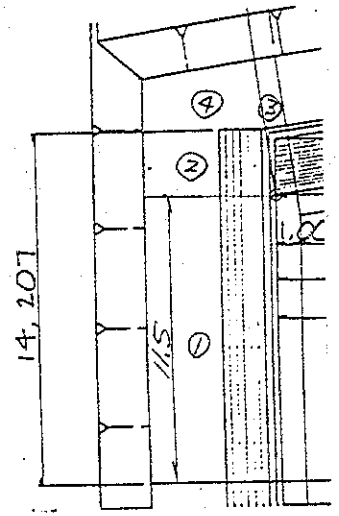
Description	Calculation Details	Unit	Quantity	Remarks
GWL-1	$(2.93+10.83)\times\frac{1}{2}\times 6.0$			
	$= 41.28\ m^3$			
	$41.28 + 39.02 = 80.3\ m^3$			
	① + ② + ③ + ④ $= 525.65\ m^3$			
GWL-2	$\{0.2\times0.9 + 0.5\times1.2 + (0.5+2.3)\times\frac{1}{2}\times 6.0$			
	$+ (4.6+5.5)\times\frac{1}{2}\times 3.0 + (3.1+2.35)\times\frac{1}{2}\times 2.5$			
	$+ (1.45+1.0)\times\frac{1}{2}\times 1.5\}$			
	$= 32.98\ m^2$			
	$\{0.2\times0.9 + 0.5\times1.2 + (0.5+2.3)\times\frac{1}{2}\times 6.0$			
	$+ (4.6+5.5)\times\frac{1}{2}\times 3.0 + (3.1+0.85)\times\frac{1}{2}$			
	$\times 7.5 + 1.5\times 1.0\}$			
	$= 40.64\ m^2$			
	$32.98\times 7.8 + (32.98+40.64)\times\frac{1}{2}\times 4.9$			
	$+ 40.64\times 1.0$			
	$= 478.25\ m^3$			
	weir portion			
	$\{(7.2+2.8)\times\frac{1}{2}\times 4.0\}\times 1.0$			
	$= 20.0\ m^3$			
	$478.25 + 20.0 = 498.25\ m^3$			





Working Division: Concrete, Dam Abutment and Guide Wall (4)

Description	Calculation Details	Unit	Quantity	Remarks
GWL-3	① 40.64 m^2 x 11.5 = 467.36 m^3			
	(See, GWL-2)			
	② {0.2x0.9 + 0.5x1.2 + (0.5+2.3)x$\frac{1}{2}$x 6.0			
	+ (4.6+5.5) x$\frac{1}{2}$ x 3.0}			
	= 24.33 m^2			
	(40.64 + 24.33) x$\frac{1}{2}$ x 2.707			
	= 87.94 m^3			
	③ {0.2x0.9 + 0.5x1.2 + (0.5+1.4)x$\frac{1}{2}$x6.0			
	+ (3.7 + 4.15) x$\frac{1}{2}$x 3.0 + (0.85 + 2.2)			
	x$\frac{1}{2}$x 1.75}			
	= 29.69 m^2			
	29.69 x 0.867 = 25.74 m^3			
	④ {(4.15-1.4) + (3.7-1.4)}x$\frac{1}{2}$x 5.0			
	= 12.63 m^3			
	① + ② + ③ + ④ = 593.67 m^3			
Total volume of dam abutment and guide wall GWL-1 to GWL-3		m^3	1,617.7	
	V = 525.7 + 698.3 + 593.7			
	= 1,617.7			



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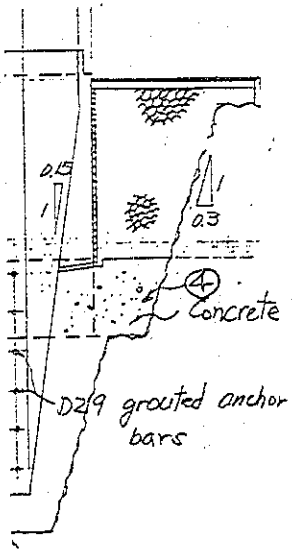
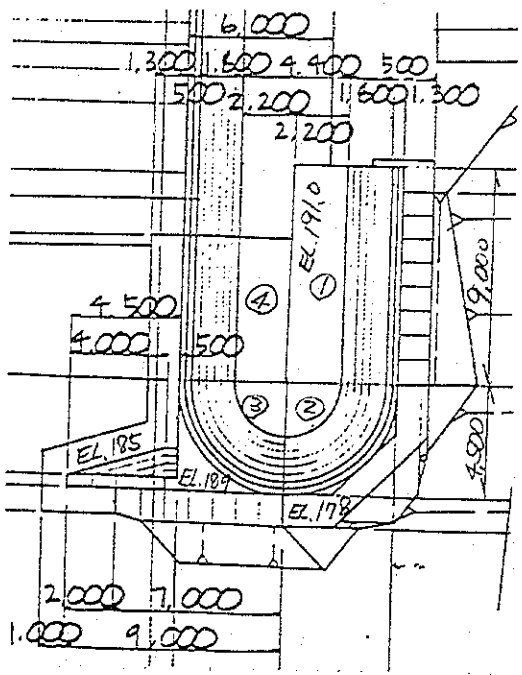
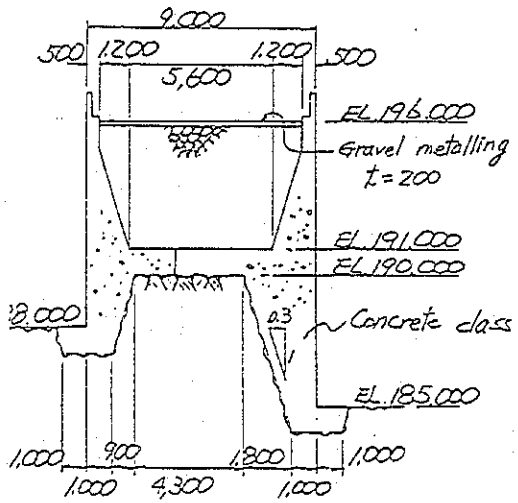


Working Division: Concrete, Dam Abutment and Guide Wall (5)

Description	Calculation Details	Unit	Quantity	Remarks
GWR-1	①			
	$\{0.2\times0.9+0.5\times1.2+(0.5+2.3)\times\frac{1}{2}\times6.0$			
	$+3.0\times4.5+(2.0+2.6)\times\frac{1}{2}\times1.0\}$			
	$=24.98\ m^2$			
	$24.98+(3.7+1.3)\times\frac{1}{2}\times(186-178)$			
	$=44.98\ m^2$			
	$(24.98+44.98)\times\frac{1}{2}\times9.0=314.82\ m^3$			
	② $44.98\times7.069=317.96\ m^3$			
	③ above EL. 189.0			
	$0.2\times0.9+0.5\times1.2+(0.5+2.3)\times1/2\times6.0$			
	$=9.18\ m^2$			
	$9.18\times7.069=64.89\ m^3$			
	EL.189 ~ EL.186.0			
	$4.5\times4.5\times3.0=60.75\ m^3$			
	toe			
	$1.0\times1.0\times(1.8+5.8+1.8+2.2)$			
	$=11.6\ m^3$			
	$\{(3.7+1.0)\times\frac{1}{2}\times9.0+(2.0+2.3)\times\frac{1}{2}\times1.0)$			
	$\times\frac{1}{2}\times7.096$			
	$=82.67\ m^3$			

Working Division: Concrete, Dam Abutment and Guide Wall (6)

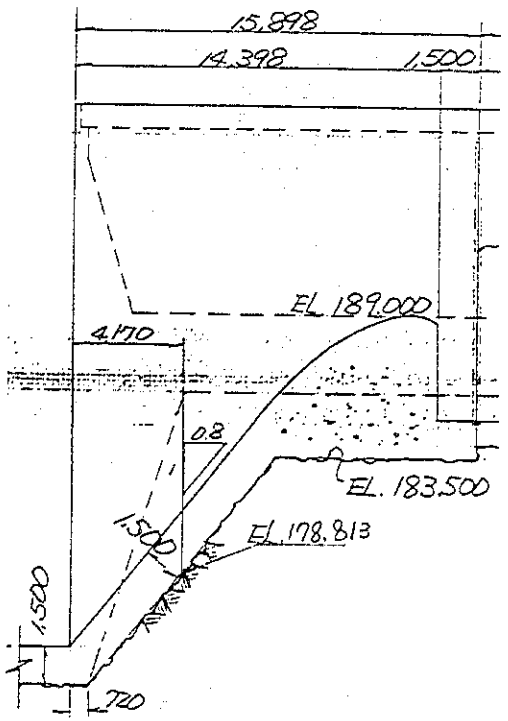
Description	Calculation Details	Unit	Quantity	Remarks
	64.89 + 60.75 + 11.6 + 82.67			
	= 219.91 m^3			
	④ $\left\{0.2\times0.9 + 0.5\times1.2 + (0.5+2.3)\times\frac{1}{2}\times6.0\right.$			
	$+ 4.5\times3.0 + (1.0+1.6)\times\frac{1}{2}\times2.0$			
	$\left.+1.0\times1.0\right\}$			
	= 26.28 m^2			
	$26.28\times6.0 = 157.68$ m^3			
	① + ② + ③ + ④			
	= 314.82 + 317.96 + 219.91 + 157.68			
	= 1,010.37 m^3			



SECTION D-D
(SCALE B)

Working Division: Concrete, Dam Abutment and Guide Wall (7)

Description	Calculation Details	Unit	Quantity	Remarks
SCR-1	above EL. 189.0			
	$0.2 \times 0.9 + 0.5 \times 1.2 + (0.3 + 2.3) \times \frac{1}{2} \times 6.0$			
	$= 9.18\ m^2$			
	$\ell_1 = 11.0 - 1.0 - 2.3 = 7.7\ m$			
	$\ell_2 = 2.3\ m$			
	$\ell_3 = 15.898 - 2.3 = 13.598\ m$			
	$9.18 \times (7.7 + 2.3 + 13.598) = 216.63\ m^3$			
	EL. 189.0 ~ EL. 186.0			
	$\{5.8 \times 10.0 + 6.0 \times (15.898 - 5.8)$			
	$- 2.2 \times 3.0\} \times 3.0$			
	$= 335.96\ m^3$			

Working Division: Concrete, Dam Abutment and Guide Wall (8)

Description	Calculation Details	Unit	Quantity	Remarks
SCR-1	below EL. 186.0			
	$q_1 = \{(3.45+0.72) + 0.72\} \times \frac{1}{2} \times 11.5$			
	$= 28.118\ m^2$			
	(2.156)			
	$l_1 = 10.0 - (186 - 178.813) \times 0.3 = 7.844\ m$			
	$q_2 = (3.156 + 1.0) \times \frac{1}{2} \times (186 - 178.813)$			
	$= 14.935\ m^2$			
	$l_2 = (2.156 + 3.45) \times \frac{1}{2} = 2.80\ m$			
	$q_3 = (1.75 + 1.0) \times \frac{1}{2} \times 2.5$			
	$= 3.44\ m^2$			
	$l_3 = 15.898 - 0.72 - (183.5 - 174.5) \times 0.8$			
	$= 7.978\ m$			
	$28.118 \times 7.844 + 14.935 \times 2.80 + 3.44$			
	$\times 7.978$			
	$= 289.82\ m^3$			
	Toe $1.5 \times 1.0 \times 11.0 = 16.5\ m^3$			
	$(0.72 + 1.92) \times \frac{1}{2} \times 1.5 \times 1.0 = 1.98\ m^3$			
	$1.92 \times (183.5 - 176.0) \times 1.0 = 14.4$			
	$1.5 \times 9.0 \times 1.0 = 13.5$			
	weir $(2.8 + 7.2) \times \frac{1}{2} \times 4.0 \times 1.0 = 20.0$			
	$66.38\ m^3$