Volume calculation Sheet

Work Division : Clearing and Stripping

C.1 /01 a) Clearing and Stripping of Dam					C.1 /01) Clearing and Stripping of Right Abutment				
Section No.	Distance m	Sectional Length m	Means area m	Volume sq.m	Section No.	Distance m	Sectional Length m	Means area m	Volume sq.m
Sta.0+9.000	.000	45.000	.000	.000	Section 1-1	.000	16.000	.000	.000
Sta.2	11.000	56.000	50.500	555.500	Section 2-2	10.000	33.000	24.500	245.000
Sta.4	20.000	115.000	85.500	1,710.000	Section 3-3	20.000	79.000	56.000	1,120.000
Sta.4+7.300	7.300	129.000	122.000	890.600	Section 4-4	20.000	89.000	84.000	1,680.000
Sta.6	12.700	155.000	142.000	1,803.400	Section 5-5	20.000	82.000	85.500	1,710.000
Sta.8	20.000	211.000	183.000	3,660.000	Section 6-6	20.000	83.000	82.500	1,650.000
Sta.10	20.000	288.000	249.500	4,990.000	Section 7-7	20.000	74.000	78.500	1,570.000
Sta.11+4.500	14.500	320.000	304.000	4,408.000	Section 8-8	20.000	67.000	70.500	1,410.000
Sta.12	5.500	368.000	344.000	1,892.000	Section 9-9	13.000	83.000	75.000	975.000
Sta.14	20.000	363.000	365.500	7,310.000	Section 10-10	5.000	87.000	85.000	425.000
Sta.15+7.366	17.366	337.000	350.000	6,078.100				43.500	.000
Sta.16	2.634	326.000	331.500	873.171				.000	.000
Sta.16+5.800	5.800	336.000	331.000	1,919.800				.000	.000
Sta.18	14.200	305.000	320.500	4,551.100				.000	.000
Sta.19+7.700	17.700	270.000	287.500	5,088.750				.000	.000
Sta.20	2.300	270.000	270.000	621.000				.000	.000
Sta.22	20.000	240.000	255.000	5,100.000				.000	.000
Sta.22+7.700	7.700	238.000	239.000	1,840.300				.000	.000
Sta.24	12.300	80.000	159.000	1,955.700				.000	.000
Sta.24+8.400	8.400	62.000	71.000	596.400				.000	.000
	.000		31.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (Sq.m) =				55,843.821	Total Voulme (Sq.m) =				10,785.000

Volume calculation Sheet

C1

Work Division : Excavation for Main Dam

102 Volume of Excavation Common					104 a) Volume of Excavation Weathered Rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta.0+9.000	.000	280.000	.000	.000	Sta.0+9.000	.000	48.000	.000	.000
Sta.2	11.000	460.000	370.000	4,070.000	Sta.2	11.000	72.000	60.000	660.000
Sta.4	20.000	700.000	580.000	11,600.000	Sta.4	20.000	96.000	84.000	1,680.000
Sta.4+7.300	7.300	750.000	725.000	5,292.500	Sta.4+7.300	7.300	32.000	64.000	467.200
Sta.6	12.700	700.000	725.000	9,207.500	Sta.6	12.700	96.000	64.000	812.800
Sta.8	20.000	1,000.000	850.000	17,000.000	Sta.8	20.000	120.000	108.000	2,160.000
Sta.10	20.000	1,200.000	1,100.000	22,000.000	Sta.10	20.000	112.000	116.000	2,320.000
Sta.11+4.500	14.500	970.000	1,085.000	15,732.500	Sta.11+4.500	14.500	264.000	188.000	2,726.000
Sta.12	5.500	760.000	865.000	4,757.500	Sta.12	5.500	304.000	284.000	1,562.000
Sta.14	20.000	820.000	790.000	15,800.000	Sta.14	20.000	320.000	312.000	6,240.000
Sta.15+7.366	17.366	500.000	660.000	11,461.560	Sta.15+7.366	17.366	104.000	212.000	3,681.592
Sta.16	2.634	465.000	482.500	1,270.905	Sta.16	2.634	144.000	124.000	326.616
Sta.16+5.800	5.800	555.000	510.000	2,958.000	Sta.16+5.800	5.800	32.000	88.000	510.400
Sta.18	14.200	506.000	530.500	7,533.100	Sta.18	14.200	88.000	60.000	852.000
Sta.19+7.700	17.700	800.000	653.000	11,558.100	Sta.19+7.700	17.700	176.000	132.000	2,336.400
Sta.20	2.300	840.000	820.000	1,886.000	Sta.20	2.300	120.000	148.000	340.400
Sta.22	20.000	1,180.000	1,010.000	20,200.000	Sta.22	20.000	376.000	248.000	4,960.000
Sta.22+7.700	7.700	1,570.000	1,375.000	10,587.500	Sta.22+7.700	7.700	480.000	428.000	3,295.600
Sta.24	12.300	300.000	935.000	11,500.500	Sta.24	12.300	584.000	532.000	6,543.600
Sta.24+8.400	8.400	180.000	240.000	2,016.000	Sta.24+8.400	8.400	480.000	532.000	4,468.800
	.000		90.000	.000		.000		240.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				186,431.665	Total Voulme (cu.m) =				45,943.408

11-2-14

Volume calculation Sheet

C 1

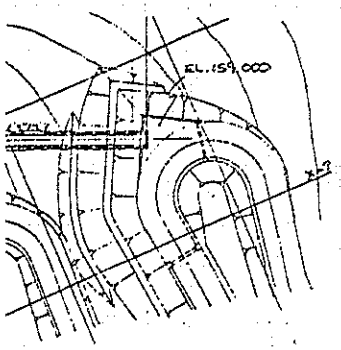
Work Division : Excavation for Main Dam

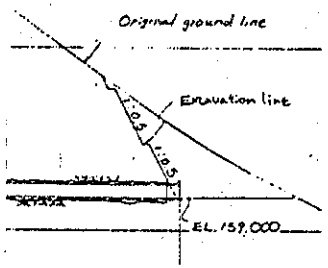
105 a) Volume of Excavation Hard Rock					03 Volume of Excavation Sand and Gravel				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta.0+9.000	.000	12.000	.000	.000	Sta.0+9.000	.000	.000	.000	.000
Sta.2	11.000	18.000	15.000	165.000	Sta.2	11.000	.000	.000	.000
Sta.4	20.000	24.000	21.000	420.000	Sta.4	20.000	.000	.000	.000
Sta.4+7.300	7.300	8.000	16.000	116.800	Sta.4+7.300	7.300	.000	.000	.000
Sta.6	12.700	24.000	16.000	203.200	Sta.6	12.700	.000	.000	.000
Sta.8	20.000	30.000	27.000	540.000	Sta.8	20.000	.000	.000	.000
Sta.10	20.000	28.000	29.000	580.000	Sta.10	20.000	.000	.000	.000
Sta.11+4.500	14.500	66.000	47.000	681.500	Sta.11+4.500	14.500	130.000	65.000	942.500
Sta.12	5.500	76.000	71.000	390.500	Sta.12	5.500	240.000	185.000	1,017.500
Sta.14	20.000	80.000	78.000	1,560.000	Sta.14	20.000	60.000	150.000	3,000.000
Sta.15+7.366	17.366	26.000	53.000	920.398	Sta.15+7.366	17.366	110.000	85.000	1,476.110
Sta.16	2.634	36.000	31.000	81.654	Sta.16	2.634	135.000	122.500	322.665
Sta.16+5.800	5.800	8.000	22.000	127.600	Sta.16+5.800	5.800	45.000	90.000	522.000
Sta.18	14.200	22.000	15.000	213.000	Sta.18	14.200	84.000	64.500	915.900
Sta.19+7.700	17.700	44.000	33.000	584.100	Sta.19+7.700	17.700	.000	42.000	743.400
Sta.20	2.300	30.000	37.000	85.100	Sta.20	2.300	.000	.000	.000
Sta.22	20.000	34.000	32.000	640.000	Sta.22	20.000	.000	.000	.000
Sta.22+7.700	7.700	120.000	77.000	592.900	Sta.22+7.700	7.700	.000	.000	.000
Sta.24	12.300	146.000	133.000	1,635.900	Sta.24	12.300	.000	.000	.000
Sta.24+8.400	8.400	120.000	133.000	1,117.200	Sta.24+8.400	8.400	.000	.000	.000
	.000		60.000	.000		.000		.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				10,654.852	Total Voulme (cu.m) =				8,940.075

III - 2 - 15

Working Division: Inspection tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C1	Open cut excavation	m^3		
	$V = \frac{1}{2} \times 32 \times 9 \times 50^{m} = 7,200\ m^3$			
C1/02	Open cut excavation common			
	$V = 7,200 \times 0.5 = 3600\ m^3$	m^3	3,600	
C1/04(c)	Open cut excavation weathered rock			
	$V = 7,200 \times 0.3 = 2,160\ m^3$	m^3	2,200	
C1/05(d)	Open cut excavation hard rock			
	$V = 7,200 \times 0.2 = 1,440\ m^3$		1,500	





11-2-16

Volume calculation Sheet

Work Division : Right Abutment

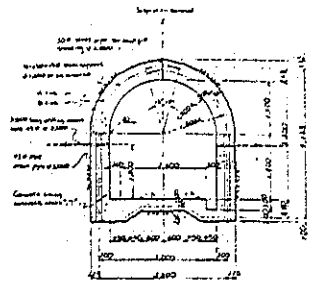
Volume of Excavation weathered Rock					Volume of Excavation Rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Section 1-1	.000	56.000	.000	.000	Section 1-1	.000	16.000	.000	.000
Section 2-2	10.000	100.000	78.000	780.000	Section 2-2	10.000	110.000	63.000	630.000
Section 3-3	20.000	200.000	150.000	3,000.000	Section 3-3	20.000	482.000	296.000	5,920.000
Section 4-4	20.000	268.000	234.000	4,680.000	Section 4-4	20.000	840.000	661.000	13,220.000
Section 5-5	20.000	416.000	342.000	6,840.000	Section 5-5	20.000	618.000	729.000	14,580.000
Section 6-6	20.000	360.000	388.000	7,760.000	Section 6-6	20.000	808.000	713.000	14,260.000
Section 7-7	20.000	350.000	355.000	7,100.000	Section 7-7	20.000	936.000	872.000	17,440.000
Section 8-8	20.000	360.000	355.000	7,100.000	Section 8-8	20.000	720.000	828.000	16,560.000
Section 9-9	13.000	738.000	549.000	7,137.000	Section 9-9	13.000	728.000	724.000	9,412.000
Section 10-10	5.000	748.000	743.000	3,715.000	Section 10-10	5.000	760.000	744.000	3,720.000
		.000	374.000	.000			.000	380.000	.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) =				48,112.000	Total Voulme (cu.m) =				95,742.000

104 b)

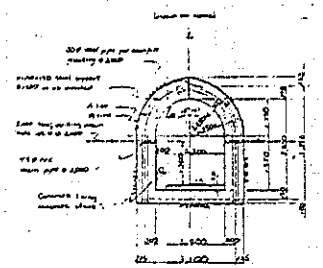
105 b)

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection tunnel	m^3	2,401.534	
C1/06	tunnel excavation			
a)	(Section B-B)			
	$A_1 = \pi \times 2.025^2 \times 75/360 \times 2 = 5.368\ m^2$			
	$A_2 = \frac{1}{2} \times 0.591 \times 2.205 \times 2 = 1.303\ m^2$			
	$A_3 = 2.40 \times 4.05 = 9.72\ m^2$			
	$A_4 = \frac{1}{2} \times (1.20 + 2.10) \times 0.30 = 0.495\ m^2$			
	$A = A_1 + A_2 + A_3 - A_4 = 15.896\ m^2$			
	$V_1 = 15.896 \times 136.50 = 2,169.804\ m^3$			
	(Section A-A)			
	$A_1 = \pi \times 1.775^2 \times 75/360 \times 2 = 4.124\ m^2$			
	$A_2 = \frac{1}{2} \times 0.315 \times 1.775 \times 2 = 0.559\ m^2$			
	$A_3 = 1.90 \times 3.55 = 6.745\ m^2$			
	$A = A_1 + A_2 + A_3 = 11.428\ m^2$			
	$V_2 = 11.428 \times 14.30\ m = 163.420\ m^3$			
	(Transition)			
	$V_3 = \frac{1}{2} \times (15.896 + 11.428) \times 5.00 = 68.31\ m^3$			
	Total $V_1 + V_2 + V_3 = 2,401.534$			



SECTION B - B SCALE C

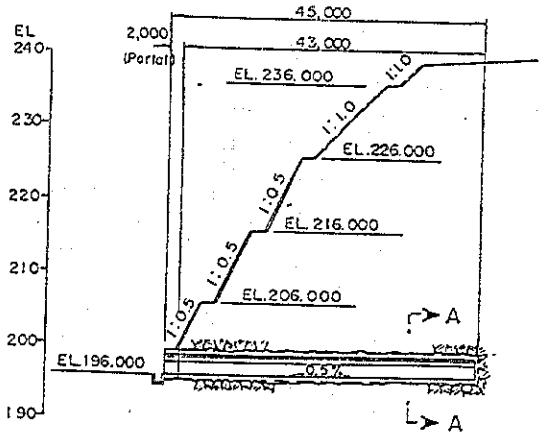


SECTION A - A SCALE C

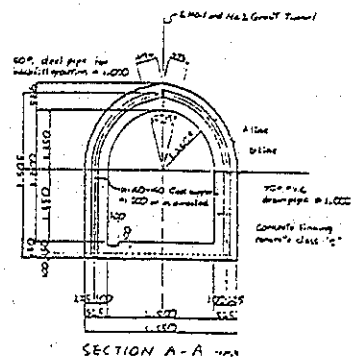
Working Division: No.1 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C1/06	Tunnel excavation	m^3	503.7	
b)				
	$A_1 = \frac{1}{2} \times 0.476 \times 1.775 \times 2 = 0.845\ m^2$			
	$A_2 = (\pi \times 1.775^2 \times 75°/360) \times 2 = 4.124\ m^2$			
	$A_3 = 3.55 \times 1.90 = 6.745\ m^2$			
	$A = 11.714\ m^2$			
	$V = 11.714\ m^2 \times 43.00 = 503.702\ m^3$			

PLAN (NO.1 GROUT TUNNEL)

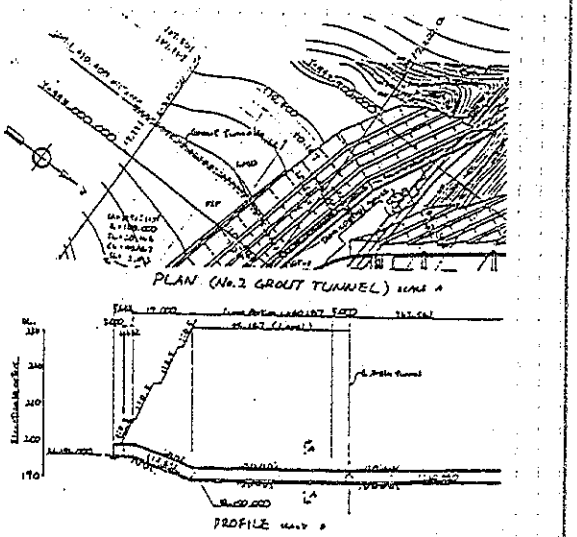


PROFILE SCALE B



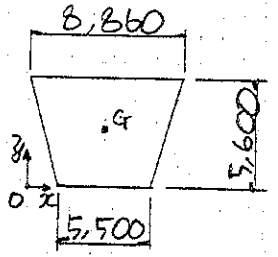
61-2-11

Working Division: No.2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C1/06 c)	Tunnel excavation	m^3	5,018.606	
	Please refer to tunnel excavation for No.1 grout tunnel			
	$A = 11.714\ m^2$			
	$l = 2.632 + 18.028 + 40.187 + 5.00 + 362.581 = 428.428$			
	$V = 11.714 \times 428.428 = 5,018.606\ m^3$			

Working Division: Inspection gallery

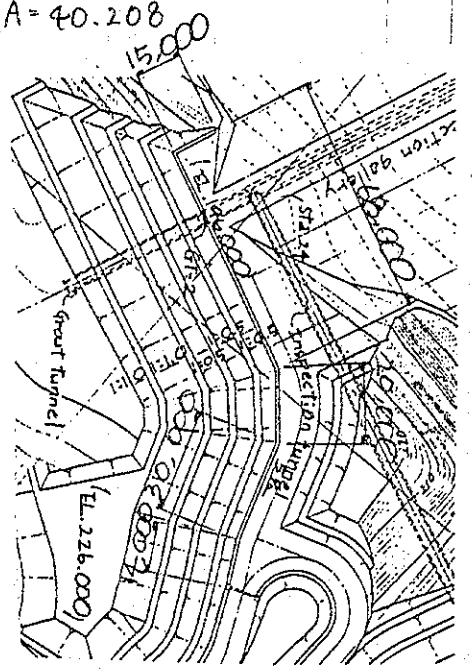
Description	Calculation Details	Unit	Quantity	Remarks
C1/07 a)	Trench cut	m^3	11,146.811	
	- For inspection gallery			
	$\ell = 272.715$			
	$V_1 = 40.208 \times 272.715 = 10{,}965.325\ m^3$			
(Sump pit)	$V_2 = 9.80\ m^2 \times 11\ m = 107.8\ m^3$			
	$V_1 + V_2 = 11{,}073.125\ m^3$			
	- For Drain ditch			
	$V = \frac{1}{2} \times (0.8 + 0.96) \times 0.6 \times 137\ m$			
	$= 72.366\ m^3$			
	- For Drain pit			
	$V = \frac{1}{2} \times (0.8 + 0.96) \times 0.75 \times 2 = 1.32\ m^3$			



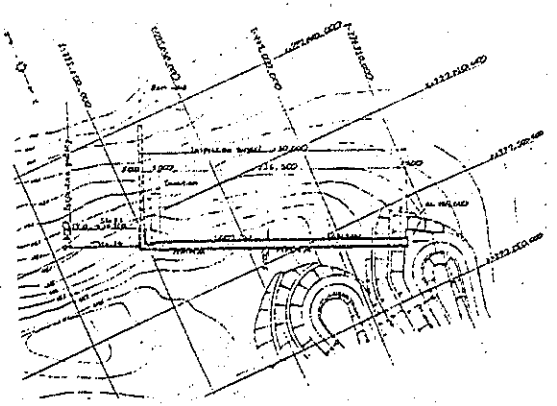
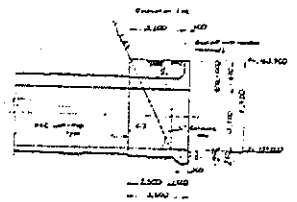
x = 4.430

y = 3.018

A = 40.208



Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection Tunnel	m^3	50.531	
C1/07	Trench cut excavation			
	$V = \frac{1}{2} \times (1.45 + 1.00) \times 0.75 \times 55^{m}$			
	$= 50.531$			 PROFILE SCALE 1

1/1-2-22

Volume calculation Sheet

Work Division EM/R EL 196.0 - 190.0

C1 /08 Volume of Impervious earth core					C1 /10 Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	41.700	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	41.700	41.700	458.700	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	41.700	41.700	834.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	41.700	41.700	304.410	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	41.700	41.700	529.590	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	41.700	41.700	834.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	41.700	41.700	834.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	41.700	41.700	604.650	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	41.700	41.700	229.350	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	41.700	41.700	834.000	Sta. 14	20.000	.000	.000	.000
Sta. 15+7,366	17.366	41.700	41.700	724.162	Sta. 15+7,366	17.366	.000	.000	.000
Sta. 16	2.634	41.700	41.700	109.838	Sta. 16	2.634	.000	.000	.000
Sta. 16+5,800	5.800	41.700	41.700	241.860	Sta. 16+5,800	5.800	.000	.000	.000
Sta. 18	14.200	41.700	41.700	592.140	Sta. 18	14.200	.000	.000	.000
Sta. 19+7,700	17.700	41.700	41.700	738.090	Sta. 19+7,700	17.700	.000	.000	.000
Sta. 20	2.300	41.700	41.700	95.910	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	41.700	41.700	834.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	41.700	41.700	321.090	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	41.700	41.700	512.910	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	16.300	29.000	243.600	Sta. 24+8,400	8.400	.000	.000	.000
			8.150	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				9,876.300	Total Voulme (cu.m) =				.000

VI-2-23

Volume calculation Sheet

Work Divisior EM/R EL 190.0 - 180.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	65.700	.000	.000	Sta. 0+9,000	9.000	9.000	.000	.000
Sta. 2	11.000	128.500	97.100	1,068.100	Sta. 2	11.000	39.000	24.000	264.000
Sta. 4	20.000	128.500	128.500	2,570.000	Sta. 4	20.000	39.000	39.000	780.000
Sta. 4+7,300	7.300	128.500	128.500	938.050	Sta. 4+7,300	7.300	39.000	39.000	284.700
Sta. 6	12.700	128.500	128.500	1,631.950	Sta. 6	12.700	39.000	39.000	495.300
Sta. 8	20.000	128.500	128.500	2,570.000	Sta. 8	20.000	39.000	39.000	780.000
Sta. 10	20.000	128.500	128.500	2,570.000	Sta. 10	20.000	39.000	39.000	780.000
Sta. 11+4,500	14.500	128.500	128.500	1,863.250	Sta. 11+4,500	14.500	39.000	39.000	565.500
Sta. 12	5.500	128.500	128.500	706.750	Sta. 12	5.500	39.000	39.000	214.500
Sta. 14	20.000	128.500	128.500	2,570.000	Sta. 14	20.000	39.000	39.000	780.000
Sta. 15+7,366	17.366	128.500	128.500	2,231.531	Sta. 15+7,366	17.366	39.000	39.000	677.274
Sta. 16	2.634	128.500	128.500	338.469	Sta. 16	2.634	39.000	39.000	102.726
Sta. 16+5,800	5.800	128.500	128.500	745.300	Sta. 16+5,800	5.800	39.000	39.000	226.200
Sta. 18	14.200	128.500	128.500	1,824.700	Sta. 18	14.200	39.000	39.000	553.800
Sta. 19+7,700	17.700	128.500	128.500	2,274.450	Sta. 19+7,700	17.700	39.000	39.000	690.300
Sta. 20	2.300	128.500	128.500	295.550	Sta. 20	2.300	39.000	39.000	89.700
Sta. 22	20.000	128.500	128.500	2,570.000	Sta. 22	20.000	39.000	39.000	780.000
Sta. 22+7,700	7.700	128.500	128.500	989.450	Sta. 22+7,700	7.700	39.000	39.000	300.300
Sta. 24	12.300	64.700	96.600	1,188.180	Sta. 24	12.300	13.900	26.450	325.335
Sta. 24+8,400	8.400	.000	32.350	271.740	Sta. 24+8,400	8.400	.000	6.950	58.380
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				29,217.470	Total Voulme (cu.m) =				8,748.015

11 - 2 - 24

Volume calculation Sheet

Work Divisior EM/R EL 180.0 - 170.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	31.100	15.550	171.050	Sta. 2	11.000	12.200	6.100	67.100
Sta. 4	20.000	165.000	98.050	1,961.000	Sta. 4	20.000	60.000	36.100	722.000
Sta. 4+7,300	7.300	165.000	165.000	1,204.500	Sta. 4+7,300	7.300	60.000	60.000	438.000
Sta. 6	12.700	165.000	165.000	2,095.500	Sta. 6	12.700	60.000	60.000	762.000
Sta. 8	20.000	165.000	165.000	3,300.000	Sta. 8	20.000	60.000	60.000	1,200.000
Sta. 10	20.000	165.000	165.000	3,300.000	Sta. 10	20.000	60.000	60.000	1,200.000
Sta. 11+4,500	14.500	165.000	165.000	2,392.500	Sta. 11+4,500	14.500	60.000	60.000	870.000
Sta. 12	5.500	165.000	165.000	907.500	Sta. 12	5.500	60.000	60.000	330.000
Sta. 14	20.000	165.000	165.000	3,300.000	Sta. 14	20.000	60.000	60.000	1,200.000
Sta. 15+7,366	17.366	165.000	165.000	2,865.390	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	165.000	165.000	434.610	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	165.000	165.000	957.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	165.000	165.000	2,343.000	Sta. 18	14.200	60.000	60.000	852.000
Sta. 19+7,700	17.700	165.000	165.000	2,920.500	Sta. 19+7,700	17.700	60.000	60.000	1,062.000
Sta. 20	2.300	165.000	165.000	379.500	Sta. 20	2.300	60.000	60.000	138.000
Sta. 22	20.000	165.000	165.000	3,300.000	Sta. 22	20.000	60.000	60.000	1,200.000
Sta. 22+7,700	7.700	165.000	165.000	1,270.500	Sta. 22+7,700	7.700	60.000	60.000	462.000
Sta. 24	12.300	.000	82.500	1,014.750	Sta. 24	12.300	.000	30.000	369.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				34,117.300	Total Voulme (cu.m) =				12,420.100

VI - 2 - 25

Volume calculation Sheet

Work Division EM/R EL 170.0 - 160.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	126.600	63.300	1,266.000	Sta. 4	20.000	40.000	20.000	400.000
Sta. 4+7,300	7.300	195.000	160.800	1,173.840	Sta. 4+7,300	7.300	60.000	50.000	365.000
Sta. 6	12.700	195.000	195.000	2,476.500	Sta. 6	12.700	60.000	60.000	762.000
Sta. 8	20.000	195.000	195.000	3,900.000	Sta. 8	20.000	60.000	60.000	1,200.000
Sta. 10	20.000	195.000	195.000	3,900.000	Sta. 10	20.000	60.000	60.000	1,200.000
Sta. 11+4,500	14.500	195.000	195.000	2,827.500	Sta. 11+4,500	14.500	60.000	60.000	870.000
Sta. 12	5.500	195.000	195.000	1,072.500	Sta. 12	5.500	60.000	60.000	330.000
Sta. 14	20.000	195.000	195.000	3,900.000	Sta. 14	20.000	60.000	60.000	1,200.000
Sta. 15+7,366	17.366	195.000	195.000	3,386.370	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	195.000	195.000	513.630	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	195.000	195.000	1,131.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	195.000	195.000	2,769.000	Sta. 18	14.200	60.000	60.000	852.000
Sta. 19+7,700	17.700	195.000	195.000	3,451.500	Sta. 19+7,700	17.700	60.000	60.000	1,062.000
Sta. 20	2.300	195.000	195.000	448.500	Sta. 20	2.300	60.000	60.000	138.000
Sta. 22	20.000	195.000	195.000	3,900.000	Sta. 22	20.000	60.000	60.000	1,200.000
Sta. 22+7,700	7.700	123.500	159.250	1,226.225	Sta. 22+7,700	7.700	39.000	49.500	381.150
Sta. 24	12.300	.000	61.750	759.525	Sta. 24	12.300	.000	19.500	239.850
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				38,102.090	Total Voulme (cu.m) =				11,748.000

II - 2 - 26

Volume calculation Sheet

Work Divisior EM/R EL 160.0 - 150.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	42.500	21.250	155.125	Sta. 4+7,300	7.300	12.000	6.000	43.800
Sta. 6	12.700	191.000	116.750	1,482.725	Sta. 6	12.700	54.000	33.000	419.100
Sta. 8	20.000	225.000	208.000	4,160.000	Sta. 8	20.000	60.000	57.000	1,140.000
Sta. 10	20.000	225.000	225.000	4,500.000	Sta. 10	20.000	60.000	60.000	1,200.000
Sta. 11+4,500	14.500	225.000	225.000	3,262.500	Sta. 11+4,500	14.500	60.000	60.000	870.000
Sta. 12	5.500	225.000	225.000	1,237.500	Sta. 12	5.500	60.000	60.000	330.000
Sta. 14	20.000	225.000	225.000	4,500.000	Sta. 14	20.000	60.000	60.000	1,200.000
Sta. 15+7,366	17.366	225.000	225.000	3,907.350	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	225.000	225.000	592.650	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	225.000	225.000	1,305.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	225.000	225.000	3,195.000	Sta. 18	14.200	60.000	60.000	852.000
Sta. 19+7,700	17.700	225.000	225.000	3,982.500	Sta. 19+7,700	17.700	60.000	60.000	1,062.000
Sta. 20	2.300	225.000	225.000	517.500	Sta. 20	2.300	60.000	60.000	138.000
Sta. 22	20.000	90.300	157.650	3,153.000	Sta. 22	20.000	25.200	42.600	852.000
Sta. 22+7,700	7.700	.000	45.150	347.655	Sta. 22+7,700	7.700	.000	12.600	97.020
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				36,298.505	Total Voulme (cu.m) =				9,751.920

VI-2 - 27

Volume calculation Sheet

Work Divisior EM/R EL 150.0 - 140.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	255.000	127.500	2,550.000	Sta. 8	20.000	60.000	30.000	600.000
Sta. 10	20.000	255.000	255.000	5,100.000	Sta. 10	20.000	60.000	60.000	1,200.000
Sta. 11+4,500	14.500	255.000	255.000	3,697.500	Sta. 11+4,500	14.500	60.000	60.000	870.000
Sta. 12	5.500	255.000	255.000	1,402.500	Sta. 12	5.500	60.000	60.000	330.000
Sta. 14	20.000	255.000	255.000	5,100.000	Sta. 14	20.000	60.000	60.000	1,200.000
Sta. 15+7,366	17.366	255.000	255.000	4,428.330	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	255.000	255.000	671.670	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	255.000	255.000	1,479.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	255.000	255.000	3,621.000	Sta. 18	14.200	60.000	60.000	852.000
Sta. 19+7,700	17.700	255.000	255.000	4,513.500	Sta. 19+7,700	17.700	60.000	60.000	1,062.000
Sta. 20	2.300	255.000	255.000	586.500	Sta. 20	2.300	60.000	60.000	138.000
Sta. 22	20.000	.000	127.500	2,550.000	Sta. 22	20.000	.000	30.000	600.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				35,700.000	Total Voulme (cu.m) =				8,400.000

VI - 2 - 28

Volume calculation Sheet

Work Division EM/R EL 140.0 - 130.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	229.300	114.650	2,293.000	Sta. 10	20.000	48.600	24.300	486.000
Sta. 11+4,500	14.500	285.000	257.150	3,728.675	Sta. 11+4,500	14.500	60.000	54.300	787.350
Sta. 12	5.500	285.000	285.000	1,567.500	Sta. 12	5.500	60.000	60.000	330.000
Sta. 14	20.000	285.000	285.000	5,700.000	Sta. 14	20.000	60.000	60.000	1,200.000
Sta. 15+7,366	17.366	285.000	285.000	4,949.310	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	285.000	285.000	750.690	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	285.000	285.000	1,653.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	285.000	285.000	4,047.000	Sta. 18	14.200	60.000	60.000	852.000
Sta. 19+7,700	17.700	182.000	233.500	4,132.950	Sta. 19+7,700	17.700	39.000	49.500	876.150
Sta. 20	2.300	115.500	148.750	342.125	Sta. 20	2.300	25.200	32.100	73.830
Sta. 22	20.000	.000	57.750	1,155.000	Sta. 22	20.000	.000	12.600	252.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				30,319.250	Total Voulme (cu.m) =				6,405.330

VI-2-29

Volume calculation Sheet

Work Division EM/R EL 130.0 - 120.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	.000	.000	.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	123.000	61.500	891.750	Sta. 11+4,500	14.500	24.000	12.000	174.000
Sta. 12	5.500	220.000	171.500	943.250	Sta. 12	5.500	45.100	34.550	190.025
Sta. 14	20.000	315.000	267.500	5,350.000	Sta. 14	20.000	60.000	52.550	1,051.000
Sta. 15+7,366	17.366	315.000	315.000	5,470.290	Sta. 15+7,366	17.366	60.000	60.000	1,041.960
Sta. 16	2.634	315.000	315.000	829.710	Sta. 16	2.634	60.000	60.000	158.040
Sta. 16+5,800	5.800	315.000	315.000	1,827.000	Sta. 16+5,800	5.800	60.000	60.000	348.000
Sta. 18	14.200	109.200	212.100	3,011.820	Sta. 18	14.200	47.400	53.700	762.540
Sta. 19+7,700	17.700	.000	54.600	966.420	Sta. 19+7,700	17.700	.000	23.700	419.490
Sta. 20	2.300	.000	.000	.000	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	.000	.000	.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				19,290.240	Total Voulme (cu.m) =				4,145.055

Volume calculation Sheet

Work Divisior EM/R EL 120.0 - 110.0

Volume of Impervious earth core					Volume of Coarse filter				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	.000	.000	.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	.000	.000	.000	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	.000	.000	.000	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	274.000	137.000	2,740.000	Sta. 14	20.000	48.000	24.000	480.000
Sta. 15+7,366	17.366	274.000	274.000	4,758.284	Sta. 15+7,366	17.366	48.000	48.000	833.568
Sta. 16	2.634	224.300	249.150	656.261	Sta. 16	2.634	39.600	43.800	115.369
Sta. 16+5,800	5.800	118.100	171.200	992.960	Sta. 16+5,800	5.800	10.500	25.050	145.290
Sta. 18	14.200	.000	59.050	838.510	Sta. 18	14.200	.400	5.450	77.390
Sta. 19+7,700	17.700	.000	.000	.000	Sta. 19+7,700	17.700	.000	.200	3.540
Sta. 20	2.300	.000	.000	.000	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	.000	.000	.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				9,986.015	Total Voulme (cu.m) =				1,655.157

W-2-31

242,907.2 m³

63,273.6 m³

Volume calculation Sheet

Work Division EM/R EL 196.0 - 190.0

C1/09 Volume of Fine filte					C1/11 Volume of Inner shell of random rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	36.900	.000	.000	Sta. 0+9,000	9.000	30.900	.000	.000
Sta. 2	11.000	36.900	36.900	405.900	Sta. 2	11.000	32.800	31.850	350.350
Sta. 4	20.000	36.900	36.900	738.000	Sta. 4	20.000	32.800	32.800	656.000
Sta. 4+7,300	7.300	36.900	36.900	269.370	Sta. 4+7,300	7.300	32.800	32.800	239.440
Sta. 6	12.700	36.900	36.900	468.630	Sta. 6	12.700	32.800	32.800	416.560
Sta. 8	20.000	36.900	36.900	738.000	Sta. 8	20.000	32.800	32.800	656.000
Sta. 10	20.000	36.900	36.900	738.000	Sta. 10	20.000	32.800	32.800	656.000
Sta. 11+4,500	14.500	36.900	36.900	535.050	Sta. 11+4,500	14.500	32.800	32.800	475.600
Sta. 12	5.500	36.900	36.900	202.950	Sta. 12	5.500	32.800	32.800	180.400
Sta. 14	20.000	36.900	36.900	738.000	Sta. 14	20.000	32.800	32.800	656.000
Sta. 15+7,366	17.366	36.900	36.900	640.805	Sta. 15+7,366	17.366	32.800	32.800	569.605
Sta. 16	2.634	36.900	36.900	97.195	Sta. 16	2.634	32.800	32.800	86.395
Sta. 16+5,800	5.800	36.900	36.900	214.020	Sta. 16+5,800	5.800	32.800	32.800	190.240
Sta. 18	14.200	36.900	36.900	523.980	Sta. 18	14.200	32.800	32.800	465.760
Sta. 19+7,700	17.700	36.900	36.900	653.130	Sta. 19+7,700	17.700	32.800	32.800	580.560
Sta. 20	2.300	36.900	36.900	84.870	Sta. 20	2.300	32.800	32.800	75.440
Sta. 22	20.000	36.900	36.900	738.000	Sta. 22	20.000	32.800	32.800	656.000
Sta. 22+7,700	7.700	36.900	36.900	284.130	Sta. 22+7,700	7.700	32.800	32.800	252.560
Sta. 24	12.300	36.900	36.900	453.870	Sta. 24	12.300	32.800	32.800	403.440
Sta. 24+8,400	8.400	12.900	24.900	209.160	Sta. 24+8,400	8.400	.300	16.550	139.020
			6.450	.000				.150	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				4,840.110	Total Voulme (cu.m) =				7,705.370

II-2-32

Volume calculation Sheet

Work Divisior EM/R EL 190.0 - 180.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	33.300	.000	.000	Sta. 0+9,000	9.000	22.500	.000	.000
Sta. 2	11.000	74.700	54.000	594.000	Sta. 2	11.000	125.000	73.750	811.250
Sta. 4	20.000	74.700	74.700	1,494.000	Sta. 4	20.000	290.500	207.750	4,155.000
Sta. 4+7,300	7.300	74.700	74.700	545.310	Sta. 4+7,300	7.300	290.500	290.500	2,120.650
Sta. 6	12.700	74.700	74.700	948.690	Sta. 6	12.700	290.500	290.500	3,689.350
Sta. 8	20.000	74.700	74.700	1,494.000	Sta. 8	20.000	290.500	290.500	5,810.000
Sta. 10	20.000	74.700	74.700	1,494.000	Sta. 10	20.000	290.500	290.500	5,810.000
Sta. 11+4,500	14.500	74.700	74.700	1,083.150	Sta. 11+4,500	14.500	290.500	290.500	4,212.250
Sta. 12	5.500	74.700	74.700	410.850	Sta. 12	5.500	290.500	290.500	1,597.750
Sta. 14	20.000	74.700	74.700	1,494.000	Sta. 14	20.000	290.500	290.500	5,810.000
Sta. 15+7,366	17.366	74.700	74.700	1,297.240	Sta. 15+7,366	17.366	290.500	290.500	5,044.823
Sta. 16	2.634	74.700	74.700	196.760	Sta. 16	2.634	290.500	290.500	765.177
Sta. 16+5,800	5.800	74.700	74.700	433.260	Sta. 16+5,800	5.800	290.500	290.500	1,684.900
Sta. 18	14.200	74.700	74.700	1,060.740	Sta. 18	14.200	290.500	290.500	4,125.100
Sta. 19+7,700	17.700	74.700	74.700	1,322.190	Sta. 19+7,700	17.700	290.500	290.500	5,141.850
Sta. 20	2.300	74.700	74.700	171.810	Sta. 20	2.300	290.500	290.500	668.150
Sta. 22	20.000	74.700	74.700	1,494.000	Sta. 22	20.000	301.800	296.150	5,923.000
Sta. 22+7,700	7.700	74.700	74.700	575.190	Sta. 22+7,700	7.700	290.500	296.150	2,280.355
Sta. 24	12.300	47.200	60.950	749.685	Sta. 24	12.300	50.300	170.400	2,095.920
Sta. 24+8,400	8.400	.000	23.600	198.240	Sta. 24+8,400	8.400	.000	25.150	211.260
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				9,403.965	Total Voulme (cu.m) =				61,956.785

VI-2-33

Volume calculation Sheet

Work Divisior EM/R EL 180.0 - 170.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	12.200	6.100	67.100	Sta. 2	11.000	4.600	2.300	25.300
Sta. 4	20.000	60.000	36.100	722.000	Sta. 4	20.000	430.000	217.300	4,346.000
Sta. 4+7,300	7.300	60.000	60.000	438.000	Sta. 4+7,300	7.300	550.000	490.000	3,577.000
Sta. 6	12.700	60.000	60.000	762.000	Sta. 6	12.700	650.000	600.000	7,620.000
Sta. 8	20.000	60.000	60.000	1,200.000	Sta. 8	20.000	655.000	652.500	13,050.000
Sta. 10	20.000	60.000	60.000	1,200.000	Sta. 10	20.000	655.000	655.000	13,100.000
Sta. 11+4,500	14.500	60.000	60.000	870.000	Sta. 11+4,500	14.500	655.000	655.000	9,497.500
Sta. 12	5.500	60.000	60.000	330.000	Sta. 12	5.500	655.000	655.000	3,602.500
Sta. 14	20.000	60.000	60.000	1,200.000	Sta. 14	20.000	655.000	655.000	13,100.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	655.000	655.000	11,374.730
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	655.000	655.000	1,725.270
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	655.000	655.000	3,799.000
Sta. 18	14.200	60.000	60.000	852.000	Sta. 18	14.200	655.000	655.000	9,301.000
Sta. 19+7,700	17.700	60.000	60.000	1,062.000	Sta. 19+7,700	17.700	655.000	655.000	11,593.500
Sta. 20	2.300	60.000	60.000	138.000	Sta. 20	2.300	655.000	655.000	1,506.500
Sta. 22	20.000	60.000	60.000	1,200.000	Sta. 22	20.000	617.500	636.250	12,725.000
Sta. 22+7,700	7.700	60.000	60.000	462.000	Sta. 22+7,700	7.700	460.500	539.000	4,150.300
Sta. 24	12.300	.000	30.000	369.000	Sta. 24	12.300	.000	230.250	2,832.075
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				12,420.100	Total Voulme (cu.m) =				126,925.675

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Volume calculation Sheet

Work Division EM/R EL 170.0 - 160.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	40.000	20.000	400.000	Sta. 4	20.000	102.500	51.250	1,025.000
Sta. 4+7,300	7.300	60.000	50.000	365.000	Sta. 4+7,300	7.300	370.300	236.400	1,725.720
Sta. 6	12.700	60.000	60.000	762.000	Sta. 6	12.700	671.400	520.850	6,614.795
Sta. 8	20.000	60.000	60.000	1,200.000	Sta. 8	20.000	1,040.000	855.700	17,114.000
Sta. 10	20.000	60.000	60.000	1,200.000	Sta. 10	20.000	1,040.000	1,040.000	20,800.000
Sta. 11+4,500	14.500	60.000	60.000	870.000	Sta. 11+4,500	14.500	1,040.000	1,040.000	15,080.000
Sta. 12	5.500	60.000	60.000	330.000	Sta. 12	5.500	1,040.000	1,040.000	5,720.000
Sta. 14	20.000	60.000	60.000	1,200.000	Sta. 14	20.000	1,040.000	1,040.000	20,800.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	1,040.000	1,040.000	18,060.640
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	1,040.000	1,040.000	2,739.360
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	1,040.000	1,040.000	6,032.000
Sta. 18	14.200	60.000	60.000	852.000	Sta. 18	14.200	1,040.000	1,040.000	14,768.000
Sta. 19+7,700	17.700	60.000	60.000	1,062.000	Sta. 19+7,700	17.700	1,014.900	1,027.450	18,185.865
Sta. 20	2.300	60.000	60.000	138.000	Sta. 20	2.300	1,022.000	1,018.450	2,342.435
Sta. 22	20.000	60.000	60.000	1,200.000	Sta. 22	20.000	703.500	862.750	17,255.000
Sta. 22+7,700	7.700	39.000	49.500	381.150	Sta. 22+7,700	7.700	347.100	525.300	4,044.810
Sta. 24	12.300	.000	19.500	239.850	Sta. 24	12.300	.000	173.550	2,134.665
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				11,748.000	Total Voulme (cu.m) =				174,442.290

Volume calculation Sheet

Work Division EM/R EL 160.0 - 150.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	12.000	6.000	43.800	Sta. 4+7,300	7.300	4.500	2.250	16.425
Sta. 6	12.700	54.000	33.000	419.100	Sta. 6	12.700	337.200	170.850	2,169.795
Sta. 8	20.000	60.000	57.000	1,140.000	Sta. 8	20.000	1,035.000	686.100	13,722.000
Sta. 10	20.000	60.000	60.000	1,200.000	Sta. 10	20.000	1,446.100	1,240.550	24,811.000
Sta. 11+4,500	14.500	60.000	60.000	870.000	Sta. 11+4,500	14.500	1,457.100	1,451.600	21,048.200
Sta. 12	5.500	60.000	60.000	330.000	Sta. 12	5.500	1,465.400	1,461.250	8,036.875
Sta. 14	20.000	60.000	60.000	1,200.000	Sta. 14	20.000	1,514.900	1,490.150	29,803.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	1,543.800	1,529.350	26,558.692
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	1,558.900	1,551.350	4,086.256
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	1,567.100	1,563.000	9,065.400
Sta. 18	14.200	60.000	60.000	852.000	Sta. 18	14.200	1,601.500	1,584.300	22,497.060
Sta. 19+7,700	17.700	60.000	60.000	1,062.000	Sta. 19+7,700	17.700	1,290.400	1,445.950	25,593.315
Sta. 20	2.300	60.000	60.000	138.000	Sta. 20	2.300	1,274.100	1,282.250	2,949.175
Sta. 22	20.000	25.200	42.600	852.000	Sta. 22	20.000	811.400	1,042.750	20,855.000
Sta. 22+7,700	7.700	.000	12.600	97.020	Sta. 22+7,700	7.700	280.000	545.700	4,201.890
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	140.000	1,722.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m)			=	9,751.920	Total Voulme (cu.m)			=	217,136.083

Volume calculation Sheet

Work Divisior EM/R EL 150.0 - 140.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	60.000	30.000	600.000	Sta. 8	20.000	467.500	233.750	4,675.000
Sta. 10	20.000	60.000	60.000	1,200.000	Sta. 10	20.000	1,132.500	800.000	16,000.000
Sta. 11+4,500	14.500	60.000	60.000	870.000	Sta. 11+4,500	14.500	1,381.000	1,256.750	18,222.875
Sta. 12	5.500	60.000	60.000	330.000	Sta. 12	5.500	1,407.300	1,394.150	7,667.825
Sta. 14	20.000	60.000	60.000	1,200.000	Sta. 14	20.000	1,623.800	1,515.550	30,311.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	1,695.000	1,659.400	28,817.140
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	1,722.500	1,708.750	4,500.848
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	1,737.500	1,730.000	10,034.000
Sta. 18	14.200	60.000	60.000	852.000	Sta. 18	14.200	1,520.600	1,629.050	23,132.510
Sta. 19+7,700	17.700	60.000	60.000	1,062.000	Sta. 19+7,700	17.700	1,242.500	1,381.550	24,453.435
Sta. 20	2.300	60.000	60.000	138.000	Sta. 20	2.300	1,218.000	1,230.250	2,829.575
Sta. 22	20.000	.000	30.000	600.000	Sta. 22	20.000	300.000	759.000	15,180.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	150.000	1,155.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m)		=		8,400.000	Total Voulme (cu.m)		=		186,979.208

W-2-37

Volume calculation Sheet

Work Division EM/R EL 140.0 - 130.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9.000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	2.500	1.250	25.000
Sta. 10	20.000	48.600	24.300	486.000	Sta. 10	20.000	576.500	289.500	5,790.000
Sta. 11+4,500	14.500	60.000	54.300	787.350	Sta. 11+4,500	14.500	1,032.500	804.500	11,665.250
Sta. 12	5.500	60.000	60.000	330.000	Sta. 12	5.500	1,067.500	1,050.000	5,775.000
Sta. 14	20.000	60.000	60.000	1,200.000	Sta. 14	20.000	1,260.500	1,164.000	23,280.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	1,425.800	1,343.150	23,325.143
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	1,460.600	1,443.200	3,801.389
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	1,275.300	1,367.950	7,934.110
Sta. 18	14.200	60.000	60.000	852.000	Sta. 18	14.200	960.600	1,117.950	15,874.890
Sta. 19+7,700	17.700	39.000	49.500	876.150	Sta. 19+7,700	17.700	684.400	822.500	14,558.250
Sta. 20	2.300	25.200	32.100	73.830	Sta. 20	2.300	542.300	613.350	1,410.705
Sta. 22	20.000	.000	12.600	252.000	Sta. 22	20.000	.000	271.150	5,423.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				6,405.330	Total Voulme (cu.m) =				118,862.737

VI-2-38

Volume calculation Sheet

Work Divisior EM/R EL 130.0 - 120.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	.000	.000	.000	Sta. 10	20.000	320.000	160.000	3,200.000
Sta. 11+4,500	14.500	24.000	12.000	174.000	Sta. 11+4,500	14.500	970.300	645.150	9,354.675
Sta. 12	5.500	43.600	33.800	185.900	Sta. 12	5.500	1,097.600	1,033.950	5,686.725
Sta. 14	20.000	60.000	51.800	1,036.000	Sta. 14	20.000	1,125.500	1,111.550	22,231.000
Sta. 15+7,366	17.366	60.000	60.000	1,041.960	Sta. 15+7,366	17.366	712.300	918.900	15,957.617
Sta. 16	2.634	60.000	60.000	158.040	Sta. 16	2.634	738.700	725.500	1,910.967
Sta. 16+5,800	5.800	60.000	60.000	348.000	Sta. 16+5,800	5.800	663.500	701.100	4,066.380
Sta. 18	14.200	44.800	52.400	744.080	Sta. 18	14.200	635.800	649.650	9,225.030
Sta. 19+7,700	17.700	.000	22.400	396.480	Sta. 19+7,700	17.700	66.000	350.900	6,210.930
Sta. 20	2.300	.000	.000	.000	Sta. 20	2.300	21.300	43.650	100.395
Sta. 22	20.000	.000	.000	.000	Sta. 22	20.000	.000	10.650	213.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				4,084.460	Total Voulme (cu.m) =				78,156.719

VI-2-39

Volume calculation Sheet

Work Divisior EM/R EL 120.0 - 110.0

Volume of Fine filte					Volume of Inner shell of random rock				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	.000	.000	.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	.000	.000	.000	Sta. 10	20.000	10.000	5.000	100.000
Sta. 11+4,500	14.500	.000	.000	.000	Sta. 11+4,500	14.500	460.000	235.000	3,407.500
Sta. 12	5.500	.000	.000	.000	Sta. 12	5.500	460.000	460.000	2,530.000
Sta. 14	20.000	48.000	24.000	480.000	Sta. 14	20.000	252.000	356.000	7,120.000
Sta. 15+7,366	17.366	60.000	54.000	937.764	Sta. 15+7,366	17.366	101.000	176.500	3,065.099
Sta. 16	2.634	36.900	48.450	127.617	Sta. 16	2.634	78.300	89.650	236.138
Sta. 16+5,800	5.800	10.500	23.700	137.460	Sta. 16+5,800	5.800	27.200	52.750	305.950
Sta. 18	14.200	.000	5.250	74.550	Sta. 18	14.200	50.000	38.600	548.120
Sta. 19+7,700	17.700	.000	.000	.000	Sta. 19+7,700	17.700	.000	25.000	442.500
Sta. 20	2.300	.000	.000	.000	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	.000	.000	.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	.000	.000	.000	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	.000	.000	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m)		=		1,757.391	Total Voulme (cu.m)		=		17,755.307

68,811.3 m^3

989,920.2 m^3

VI - 2 - 40

Volume calculation Sheet

Work Division EM/R EL 196.0 - 190.0

C1/12 Volume of Riprap					Volume of Top				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	5.800	.000	.000	Sta. 0+9,000	9.000	11.900	.000	.000
Sta. 2	11.000	9.200	7.500	82.500	Sta. 2	11.000	11.900	11.900	130.900
Sta. 4	20.000	9.200	9.200	184.000	Sta. 4	20.000	11.900	11.900	238.000
Sta. 4+7,300	7.300	9.200	9.200	67.160	Sta. 4+7,300	7.300	11.900	11.900	86.870
Sta. 6	12.700	9.200	9.200	116.840	Sta. 6	12.700	11.900	11.900	151.130
Sta. 8	20.000	9.200	9.200	184.000	Sta. 8	20.000	11.900	11.900	238.000
Sta. 10	20.000	9.200	9.200	184.000	Sta. 10	20.000	11.900	11.900	238.000
Sta. 11+4,500	14.500	9.200	9.200	133.400	Sta. 11+4,500	14.500	11.900	11.900	172.550
Sta. 12	5.500	9.200	9.200	50.600	Sta. 12	5.500	11.900	11.900	65.450
Sta. 14	20.000	9.200	9.200	184.000	Sta. 14	20.000	11.900	11.900	238.000
Sta. 15+7,366	17.366	9.200	9.200	159.767	Sta. 15+7,366	17.366	11.900	11.900	206.655
Sta. 16	2.634	9.200	9.200	24.233	Sta. 16	2.634	11.900	11.900	31.345
Sta. 16+5,800	5.800	9.200	9.200	53.360	Sta. 16+5,800	5.800	11.900	11.900	69.020
Sta. 18	14.200	9.200	9.200	130.640	Sta. 18	14.200	11.900	11.900	168.980
Sta. 19+7,700	17.700	9.200	9.200	162.840	Sta. 19+7,700	17.700	11.900	11.900	210.630
Sta. 20	2.300	9.200	9.200	21.160	Sta. 20	2.300	11.900	11.900	27.370
Sta. 22	20.000	9.200	9.200	184.000	Sta. 22	20.000	11.900	11.900	238.000
Sta. 22+7,700	7.700	9.200	9.200	70.840	Sta. 22+7,700	7.700	11.900	11.900	91.630
Sta. 24	12.300	9.200	9.200	113.160	Sta. 24	12.300	11.900	11.900	146.370
Sta. 24+8,400	8.400	1.000	5.100	42.840	Sta. 24+8,400	8.400	11.300	11.600	97.440
			.500	.000				5.650	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				2,149.340	Total Voulme (cu.m) =				2,846.340

VI-2-41

Volume calculation Sheet

Work Divisior EM/R EL 190.0 - 180.0

Volume of Riprap					Volume of Top				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	4.000	2.000	22.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	23.000	13.500	270.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	23.000	23.000	167.900	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	23.000	23.000	292.100	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	23.000	23.000	460.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	23.000	23.000	460.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	23.000	23.000	333.500	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	23.000	23.000	126.500	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	23.000	23.000	460.000	Sta. 14	20.000	.000	.000	.000
Sta. 15+7,366	17.366	23.000	23.000	399.418	Sta. 15+7,366	17.366	.000	.000	.000
Sta. 16	2.634	23.000	23.000	60.582	Sta. 16	2.634	.000	.000	.000
Sta. 16+5,800	5.800	23.000	23.000	133.400	Sta. 16+5,800	5.800	.000	.000	.000
Sta. 18	14.200	23.000	23.000	326.600	Sta. 18	14.200	.000	.000	.000
Sta. 19+7,700	17.700	23.000	23.000	407.100	Sta. 19+7,700	17.700	.000	.000	.000
Sta. 20	2.300	23.000	23.000	52.900	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	23.000	23.000	460.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	23.000	23.000	177.100	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	1.200	12.100	148.830	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.600	5.040	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				4,762.970	Total Voulme (cu.m) =				.000

24-2-11

Volume calculation Sheet

Work Division EM/R EL 180.0 - 170.0

Volume of Riprap					Volume of Top				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9.000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	3.500	1.750	35.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	9.200	6.350	46.355	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	21.900	15.550	197.485	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	23.000	22.450	449.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	23.000	23.000	460.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	23.000	23.000	333.500	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	23.000	23.000	126.500	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	23.000	23.000	460.000	Sta. 14	20.000	.000	.000	.000
Sta. 15+7,366	17.366	23.000	23.000	399.418	Sta. 15+7,366	17.366	.000	.000	.000
Sta. 16	2.634	23.000	23.000	60.582	Sta. 16	2.634	.000	.000	.000
Sta. 16+5,800	5.800	23.000	23.000	133.400	Sta. 16+5,800	5.800	.000	.000	.000
Sta. 18	14.200	23.000	23.000	326.600	Sta. 18	14.200	.000	.000	.000
Sta. 19+7,700	17.700	23.000	23.000	407.100	Sta. 19+7,700	17.700	.000	.000	.000
Sta. 20	2.300	23.000	23.000	52.900	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	23.000	23.000	460.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	23.000	23.000	177.100	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	11.500	141.450	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				4,266.390	Total Voulme (cu.m) =				.000

V/-2-43

Volume calculation Sheet

Work Divisior EM/R EL 170.0 - 160.0

Volume of Riprap					Volume of Top				
Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m	Section No.	Distance m	Sectional area sq.m	Means area sq.m	Volume cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	23.000	11.500	230.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	23.000	23.000	460.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	23.000	23.000	333.500	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	23.000	23.000	126.500	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	23.000	23.000	460.000	Sta. 14	20.000	.000	.000	.000
Sta. 15+7,366	17.366	23.000	23.000	399.418	Sta. 15+7,366	17.366	.000	.000	.000
Sta. 16	2.634	23.000	23.000	60.582	Sta. 16	2.634	.000	.000	.000
Sta. 16+5,800	5.800	23.000	23.000	133.400	Sta. 16+5,800	5.800	.000	.000	.000
Sta. 18	14.200	23.000	23.000	326.600	Sta. 18	14.200	.000	.000	.000
Sta. 19+7,700	17.700	23.000	23.000	407.100	Sta. 19+7,700	17.700	.000	.000	.000
Sta. 20	2.300	23.000	23.000	52.900	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	23.000	23.000	460.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	23.000	23.000	177.100	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	11.500	141.450	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				3,768.550	Total Voulme (cu.m) =				.000

Volume calculation Sheet

Work Division EM/R EL 160.0 - 150.0

Volume of Riprap					Volume of Top				
Section No.	Distance	Sectional area	Means area	Volume	Section No.	Distance	Sectional area	Means area	Volume
	m	sq.m	sq.m	cu.m		m	sq.m	sq.m	cu.m
Sta. 0+9,000	9.000	.000	.000	.000	Sta. 0+9,000	9.000	.000	.000	.000
Sta. 2	11.000	.000	.000	.000	Sta. 2	11.000	.000	.000	.000
Sta. 4	20.000	.000	.000	.000	Sta. 4	20.000	.000	.000	.000
Sta. 4+7,300	7.300	.000	.000	.000	Sta. 4+7,300	7.300	.000	.000	.000
Sta. 6	12.700	.000	.000	.000	Sta. 6	12.700	.000	.000	.000
Sta. 8	20.000	6.900	3.450	69.000	Sta. 8	20.000	.000	.000	.000
Sta. 10	20.000	10.400	8.650	173.000	Sta. 10	20.000	.000	.000	.000
Sta. 11+4,500	14.500	10.400	10.400	150.800	Sta. 11+4,500	14.500	.000	.000	.000
Sta. 12	5.500	10.400	10.400	57.200	Sta. 12	5.500	.000	.000	.000
Sta. 14	20.000	10.400	10.400	208.000	Sta. 14	20.000	.000	.000	.000
Sta. 15+7,366	17.366	10.400	10.400	180.606	Sta. 15+7,366	17.366	.000	.000	.000
Sta. 16	2.634	10.400	10.400	27.394	Sta. 16	2.634	.000	.000	.000
Sta. 16+5,800	5.800	10.400	10.400	60.320	Sta. 16+5,800	5.800	.000	.000	.000
Sta. 18	14.200	10.400	10.400	147.680	Sta. 18	14.200	.000	.000	.000
Sta. 19+7,700	17.700	10.400	10.400	184.080	Sta. 19+7,700	17.700	.000	.000	.000
Sta. 20	2.300	10.400	10.400	23.920	Sta. 20	2.300	.000	.000	.000
Sta. 22	20.000	10.400	10.400	208.000	Sta. 22	20.000	.000	.000	.000
Sta. 22+7,700	7.700	10.400	10.400	80.080	Sta. 22+7,700	7.700	.000	.000	.000
Sta. 24	12.300	.000	5.200	63.960	Sta. 24	12.300	.000	.000	.000
Sta. 24+8,400	8.400	.000	.000	.000	Sta. 24+8,400	8.400	.000	.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
			.000	.000				.000	.000
Total Voulme (cu.m) =				1,634.040	Total Voulme (cu.m) =				.000

16,581.3 m³

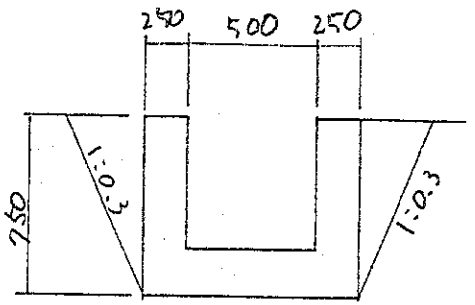
W-2-45

Working Division:

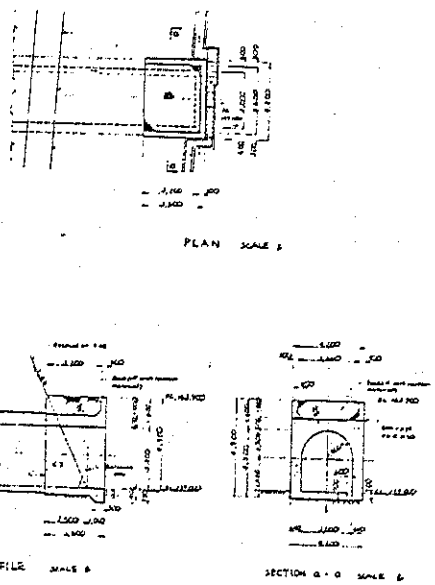
Description	Calculation Details	Unit	Quantity	Remarks
C1/13	Surface coarse for main dam crest	m^2	1,746.15	
	L=249.45 m			
	A = 7.00 × 249.45 = 1,746.15			
C1/14	Compacted sand and gravel fill as base course for main dam crest	m^3	296.845	
	V= 7.00 × 0.17 × 249.45 = 296.845			
C1/15	Compacted gravel and cobble fill as subbase course for main dam crest	m^3	523.845	
	V= 7.00 × 0.30 × 249.45 = 523.845			
C1/16	Shoulder protection	m^3	2,222.60	
	V= 8.91 m × 249.45 = 2,222.60			
C1/17	Sod facing for right abutment	m^2	2,276.185	

98-Z-111

Working Division: INSPECTION TUNNEL

Description	Calculation Details	Unit	Quantity	Remarks
C1/19	Backfill in random materials	m^3	8.45	
	$A = \frac{1}{2} \times 0.225 \times 0.75 \times 2 = 0.169\ m^2$			
	$V = 0.169 \times 50^{m} = 8.45\ m^3$			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection Tunnel	m^3	14.553	
C1/18	Backfill in free-drainage materials			
	$V_1 = 3.20 \times 3.60 \times 1.00 = 11.52\ m^2$			
	$A_1 = 11.52\ m^2$			
	$A_2 = 3.00 \times 2.90 = 8.70\ m^2$			
	$V_2 = \frac{1}{2} \times (11.52 + 8.70) \times 0.30 = 3.033\ m^3$			
	$V = V_1 + V_2 = 14.553\ m^3$			

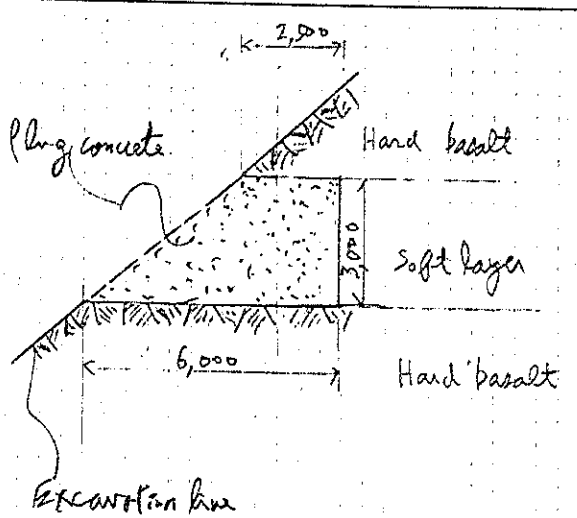
84-2-11

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	free draining			
C1/18	Backfill in ~~selected~~ material	m^3	12.656	
	$V = 0.15 \times 0.3 \times 0.75 \times 150 = 12.656$			
C1/20	Gravel bedding for drainage ditch	m^3	15.15	
	$V = 0.10 \times 1.01 \times 150 = 15.15$			

VI-2-49

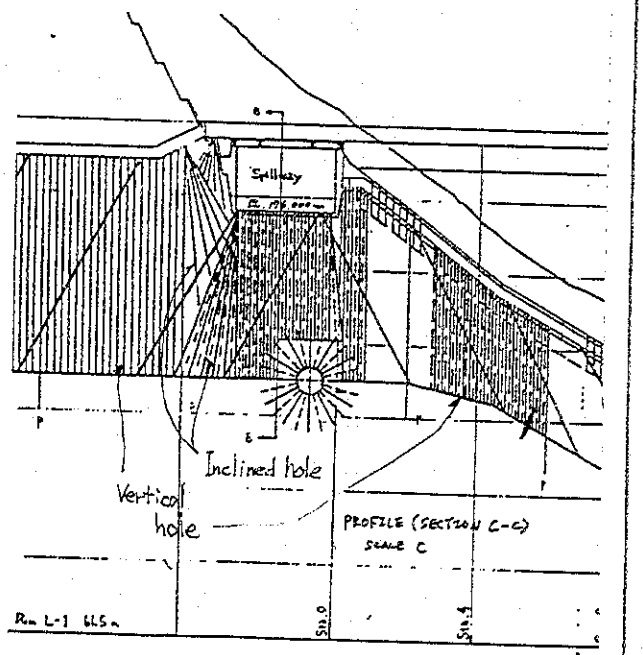
Working Division: C MAZN DAM C1/21 Excavation for plug concrete for core foundation

Description	Calculation Details	Unit	Quantity	Remarks
C1/21	Area = (2,000 + 6,000) × 3.000 × 1/2			
	= 12,000 m²			
	Concrete class E			
	Soft layer length:			
	left abutment / right abutment			
	L1 46.0 m / R1 46.0 m			
	2 43.0 " / 2 45.0 "			
	3 40.0 " / 3 41.0 "			
	4 38.0 " / 4 38.0 "			
	5 36.0 " / 5 35.0 "			
	6 35.0 " / 6 33.0 "			
	7 25.0 "			
	Subtotal 238.0 m / 263.0 m			
	Total 501.0 m			
	Volume = 12.0 m² × 501.0 m			
	= 6,012 m³			
	Miscellaneous 20 %			
	V ≒ 6,012 m³ × 1.2 ≒ 7,220 m³	m³	7,220	
C3/07	Volume of concrete, class E, plug concrete for core foundation, same as C1/24	m³	7,220	
	Heat of plug concrete for core foundation			

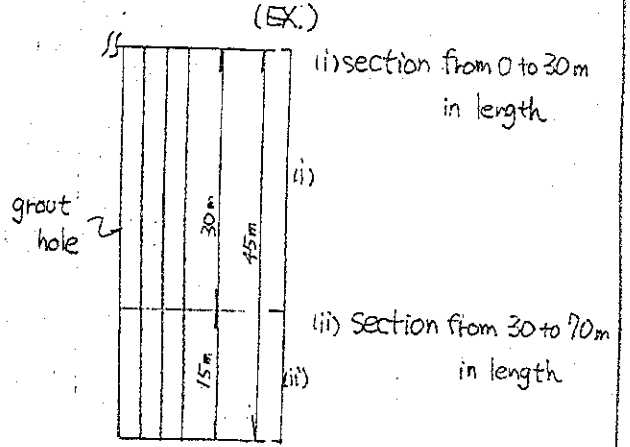
05-2-50

Working Division: MAIN DAM, Drilling and Grouting for Foundation Treatment of Main Dam, Spillway and Dam Rims

Description	Calculation Details	Unit	Quantity	Remarks
C2	01/ Drilling curtain grout-holes without core sampling			
	(a) Vertical hole			
	(i) Section from 0 to 30 m in length	m	13,770	
	30 m × 459 holes = 13,770 m			
	(ii) Section from 30 to 70 m in length.	m	7,280	
	5 m × 14 holes = 70 m			
	10 m × 16 holes = 160 m			
	15 m × 13 holes = 195 m			
	20 m × 31 holes = 620 m			
	25 m × 51 holes = 1,275 m			
	30 m × 133 holes = 3,990 m			
	23 m × 5 holes = 115 m			
	13~23 m × 15 holes = 270 m			
	0~13 m × 24 holes = 156 m			
	0~20 m × 42 holes = 420 m			
	subtotal (ii) = 7,271 m			
	rounding up above, 7,280 m			

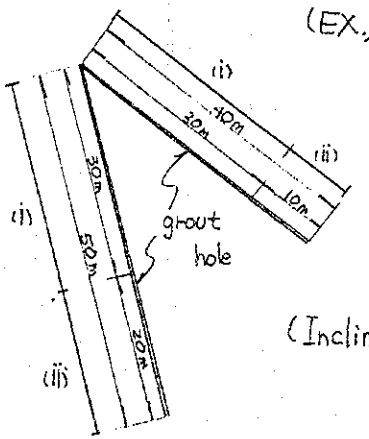


(EX.)



(Vertical hole)

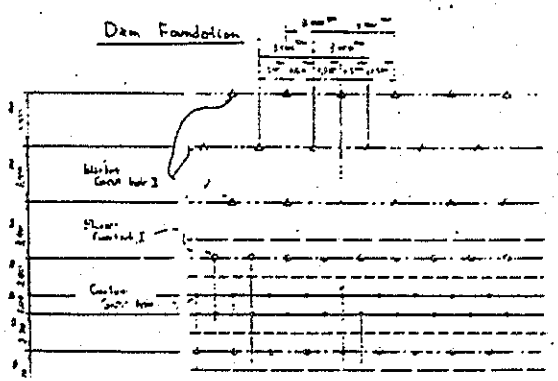
Working Division:

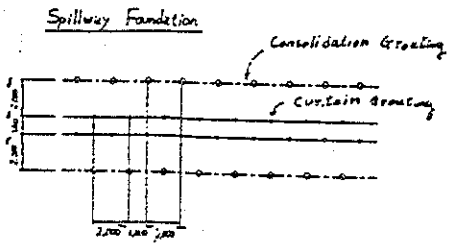
Description	Calculation Details	Unit	Quantity	Remarks
C2.101	(b) Inclined hole			(EX.)  (Inclined hole)
	(i) Section from 0 to 30 m in length	m	1,570	(i) section from 0 to 30 m in length 30m x 2 holes = 60m
	10 m x 3 holes = 30 m 15 m x 4 holes = 60 m 20 m x 2 holes = 40 m 25 m x 1 holes = 25 m 30 m x 47 holes = 1,410 m sub total : 1,565 m rounding up above, 1,570 m			(ii) section from 30 to 70m in length 10m + 20m = 30m
	(ii) Section from 30 to 70 m in length	m	930	
	5m x 4 holes = 20 m 10m x 2 holes = 20 m 20m x 1 holes = 20 m 25m x 27 holes = 675 m 30m x 1 holes = 30 m 15m~16m x 10 holes = 165 m total 930 m			

III-2-52

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
C2	/02 Drilling consolidation and blanket grout holes without sampling	m	5,050	
	—Dam foundation—			
	· Blanket grouting I 122 holes × 10 m × 2 lanes = 2,440 m			
	· Blanket grouting II 82 holes × 5 m × 6 lanes = 2,460 m			
	—Spillway foundation—			
	· Consolidation grouting 15 holes × 5 m × 2 lanes = 150 m			
	total 5,050 m			
	/03 Core drilling			
	(a) Vertical hole			
	(i) section from 0 to 30 m in length	m	450	
	15 holes × 30 m = 450 m			
	(ii) section more than 30m in length	m	420	





VI-2-53

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
C2 /03	(b) Inclined hole			
	(i) Section from 0 to 30 m in length	m	1,290	
	· Check hole			
	23 holes x 30m = 690 m			
	· Others			
	20 holes x 30 m = 600 m			
	sub total 1,290 m			
	(ii) Section more than 30 m in length	m	1,840	
	· Check hole			
	550 m			
	· Others			
	1,290 m			
	sub total 1,840 m			

11-2-54

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
C2	04/ Water pressure test in borehall (1,900 hrs.)			
	The breakdown is as follows			
	(a) Under a single pressure — 5,515 times	time	5,520	
	rounding up above, 5,520 times			
	(b) Under varied (seven) pressures — 800 times	time	800	
	05/ Packer setting			
	(a) Depth not more than 9 m — 1,826 times	time	1,830	
	rounding up above, 1,830 times			
	(b) Depth 10 m to 30 m — 2,377 times	time	2,380	
	rounding up above, 2,380 times			
*)	Quantities in this page are estimated based on judgement of the senior geologist.			

VI-2-55

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
C2 /05	(c) Depth more than 30 m	time	2,120	
	— 2,112 times			
	rounding up above,			
	2,120 times			
	06/ Grouting	ton	1,300	
	07/ material			
	(a) Cement	ton	1,300	
	(b) Sand	ton	10	
	(c) Bentnite	ton	10	
	*) Quantities in this page are estimated based on judgement of the senior geologist.			
	*) Quantities of backfill grouting are referred to C3/09 for inspection tunnel, No.1 grout tunnel and No.2 grout tunnel.			

Working Division: Inspection tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C2/08 (a)	Grouting works			
	Backfill grouting	m^3	18.9	
	$A = \frac{1}{2} \times 1.085 \times 0.233 = 0.126\ m^2$			
	$V = 0.126 \times 150^{m} = 18.9\ m^3$			

Working Division: No.1 Grout Tunnel

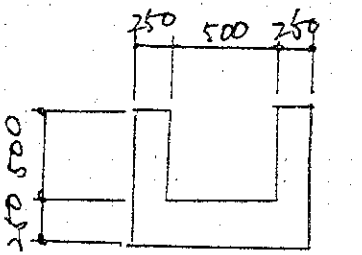
Description	Calculation Details	Unit	Quantity	Remarks
C2/08(b)	Backfill grouting	m^3	6.2	
	$A = \frac{1}{2} \times 0.920 \times 0.30 = 0.138\ m^2$			
	$V = 0.138\ m^2 \times 45\ m = 6.210\ m^3$			

Working Division: No.2 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C2/08 (C)	Backfill grouting	m^3	118.8	
	$A = \frac{1}{2} \times 0.920 \times 0.60 = 0.276\ m^2$			
	$V = 0.276 m^2 \times 430.40\ m = 118.79$			

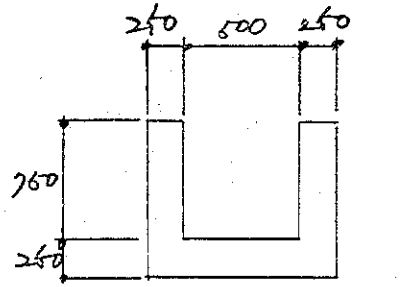
Working Division: Concrete class B

Description	Calculation Details	Unit	Quantity	Remarks
C3/02	concrete class B for drain ditch	m^3	25.00	
	$V = 0.50 m^2 \times 150 = 75\ m^3$			



$l = 150$ m

Working Division: Inspection tunnel

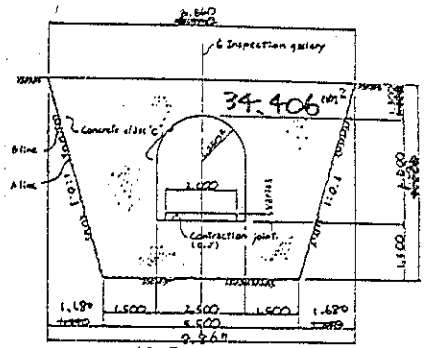
Description	Calculation Details	Unit	Quantity	Remarks
C3/02	Concrete class B in drain ditch	m^3	25.00	
	$V = (1.00 \times 0.75 - 0.5 \times 0.5) \times 50$			
	$= 25\ m^3$			

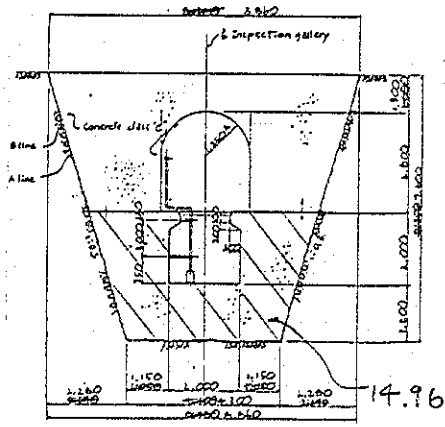
$\ell = 50\ m$

VI-2-61

Working Division: Inspection gallery

Description	Calculation Details	Unit	Quantity	Remarks
C3/03	Concrete class C			
	- Inspection gallery	m^3	8,904.042	
	Sectional area = 40.208 - 2 × π × 1.25 × 180/360 - 1.55 × 2.50 = 32.406 m^2			
	L = 272.715 m			
	V_1 = 32.406 × 272.715 = 8,837.602 m^3			
	Vacant volume = $\frac{1}{2}$ × (5.50 × 6.40) × 1.50 × 11 m = 98.175 m^3			
	V_1 = 8,837.602 - 98.175 = 8,739.427 m^3			
	Sump pit portion			
	A = $\frac{1}{2}$ × (4.30 + 6.40) × 3.5 - 2.00 × 1.50 - $\frac{1}{2}$ × (2.00 + 1.40) × 0.20 - 1.40 × 0.30 = 14.965 m^2			
	V_2 = 14.965 × 11.00 = 164.615 m^3			
	Total = V_1 + V_2 = 8,904.042			

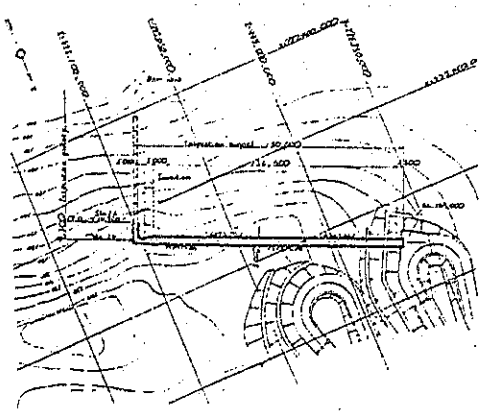


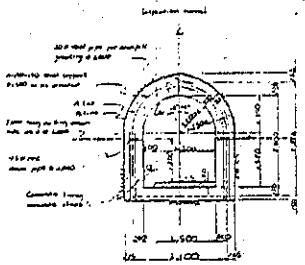


V/-2-62

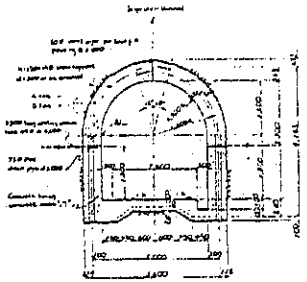
Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection tunnel	m^3	1,083.79	
C3/04	Concrete class C			
	Section B-B			
	$A = 15.896 - \pi \times 1.50^2 \times 180/360 - 3.00 \times 1.80 - 0.30 \times 0.30 = 6.872\ m^2$			
	$V_1 = 6.872 \times 136.50 = 938.028\ m^3$			
	Section A-A			
	$A = 11.428 - \pi \times 1.25^2 \times 180/360 - 1.55 \times 2.50 = 5.099\ m^2$			
	$V_2 = 5.099 \times 14.30^m = 72.916\ m^3$			
	Transition			
	$V_3 = \frac{1}{2} \times (6.872 + 5.099) \times 5.00 = 29.928\ m^3$			
Sub Total	$V = V_1 + V_2 + V_3 = 1040.872$			





SECTION A-A



SECTION B-B

VI-2-83

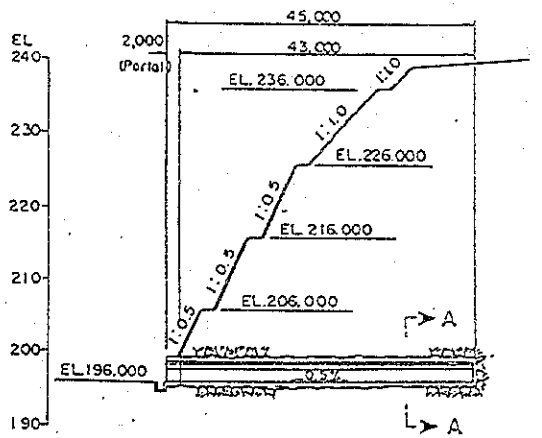
Working Division: Inspection tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Concrete class "C"			
	Portal			
	$A_1 = 4.30 \times 4.20 - \pi \times 1.50^2/2 - 1.80 \times 3.00 - 0.30 \times 0.30 = 9.036\ m^2$			
	$A_2 = 4.65 \times 4.20 - \pi \times 1.50^2/2 - 1.80 \times 3.00 - 0.30 \times 0.30 = 10.506\ m^2$			
	$A_3 = 0.30 \times 0.70 + \frac{1}{2} \times (0.30 + 0.60) \times 0.30 = 0.345\ m^2$			
	$V_1 = 9.036 \times 3.20 = 28.915\ m^3$			
	$V_2 = \frac{1}{2} \times (9.036 + 10.506) \times 0.50 = 4.886\ m^3$			
	$V_3 = 10.506 \times 0.50 = 5.253\ m^3$			
	$V_4 = 0.345 \times 11.20 = 3.864\ m^3$			
	Sub Total = 42.918			
	Total = 1,040.872 + 42.918 = 1,083.79 m^3			

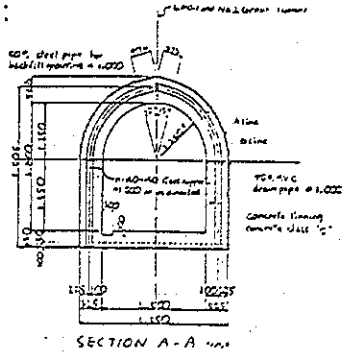
VI-2-64

Working Division: No. 1 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
				PLAN (NO.1 GROUT TUNNEL)
	Tunnel Linning			
C3/04	(Concrete class C)	m^3	230.3	
	$A = 11.714 - \pi \times 1.25^2 \times 180/360 - 1.55$			
	$\times 2.50 - 0.10 \times 0.30 = 5.355\ m^2$			
	$V = 5.355 \times 43\ m = 230.27\ m^3$			



PROFILE SCALE B

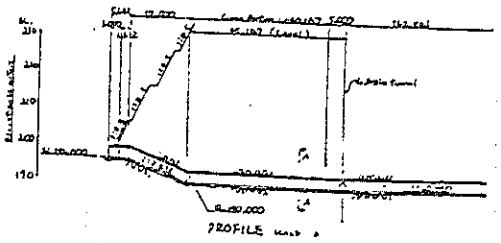


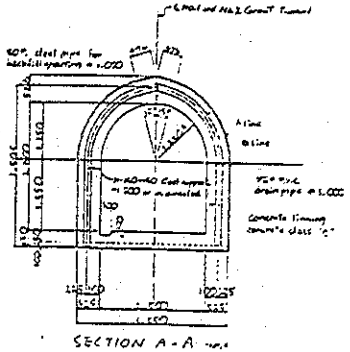
SECTION A-A

59-2-11

Working Division: No.2 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/04	Tunnel Linning (Concrete class C)	M^3	2,294.232	
	Please refer to concrete class C for No.1 grout tunnel			
	A=5.355 ℓ=428.428			
	$V = 5.355 \times 428.428 = 2,294.232\ M^3$			





99-2-66

Working Division: Concrete class F

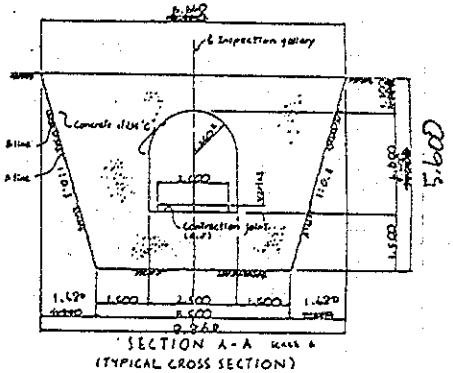
Description	Calculation Details	Unit	Quantity	Remarks
C3/08	Concrete class F in leveling	m^3	15.00	
	concrete for drain ditch			
	V= 0.1 × 1.00 × 150 = 15 m			

VI-2-67

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	F			
C3/08	Concrete class in levelling concrete for drain ditch	m^3	5.00	
	$V = 1.01 \times 0.10 \times 50 = 5$			

Working Division: Inspection gallery

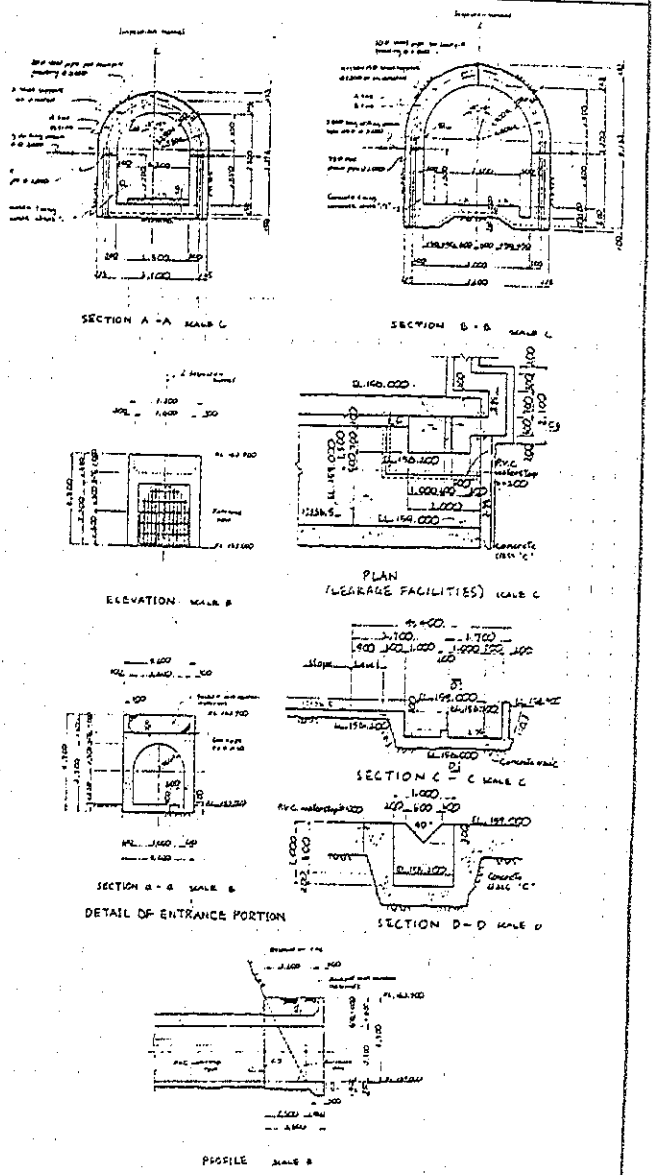
Description	Calculation Details	Unit	Quantity	Remarks
C3/09	Form work class F1	m^2	982.491	
	$A = \frac{1}{2} \times (8.860 + 5.50) \times 5.600$			
	$\pi \times 1.250^2 / 2 - 1.55 \times 2.50$			
	$= 33.879$			
	Nos. of contraction joint = 29			
	$A = 33.879 \times 29 = 982.491$			

SECTION A-A
(TYPICAL CROSS SECTION)

VI-2-69

Working Division: Inspection Tunnel

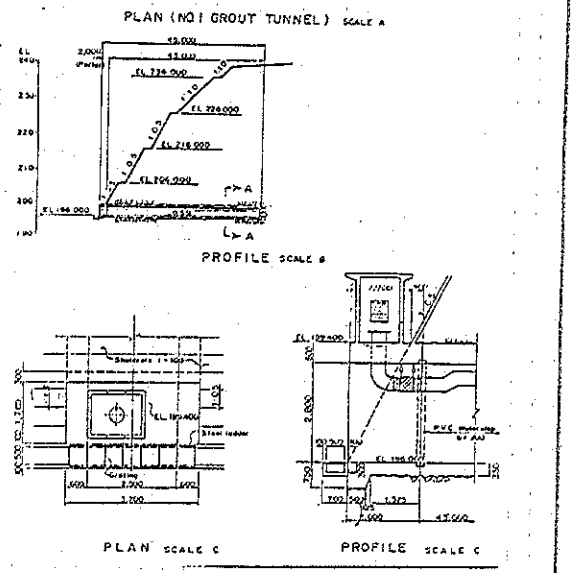
Description	Calculation Details	Unit	Quantity	Remarks
C3/09	Inspection tunnel			
	Form work class F1	m^3	187.754	
	Section A-A			
	$A = 5.099\ m^2$ $\quad \ell = 14.30\ m$			
	$n = 14.30 / 12.00 = 1.19 = 2$			
	$A_1 = 5.099 \times 2 = 10.198$			
	Section B-B			
	$A = 6.872\ m^2$ $\quad \ell = 136.50\ m$			
	$n = 136.50 / 12.00 = 11.38 = 12$			
	$A_2 = 6.872 \times 12 = 82.464$			
	Portal			
	$A_3 = (0.70 + \sqrt{0.3^2+0.3^2}) \times 11.20 = 12.592$			
	Drain ditch			
	$A_4 = 0.75 \times 2 \times 55\ m = 82.5\ m^2$			
	total $= 187.754\ m^3$			

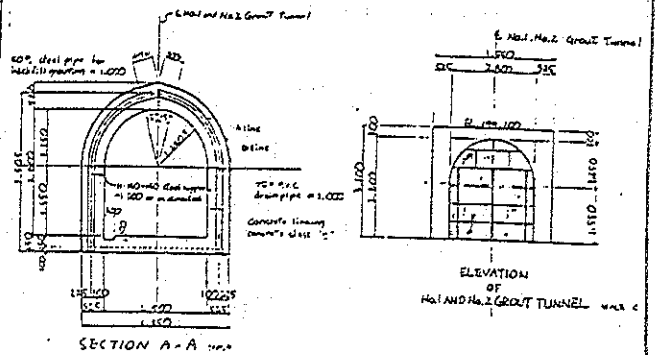


11-2-90

Working Division: No.1 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/09	Formwork class F1	m^2	30.47	
	Sectional area = 5.355 m^2			
	l = 43 m			
	Nos of contraction joint = 43.0/12 = 4			
	$A_1 = 5.355 \times 4 = 21.42\ m^2$			
	<Portal>			
	$A_2 = \frac{1}{2} \times (0.35 + 2.00) \times 3.85 \times 2$			
	$= 9.048$			

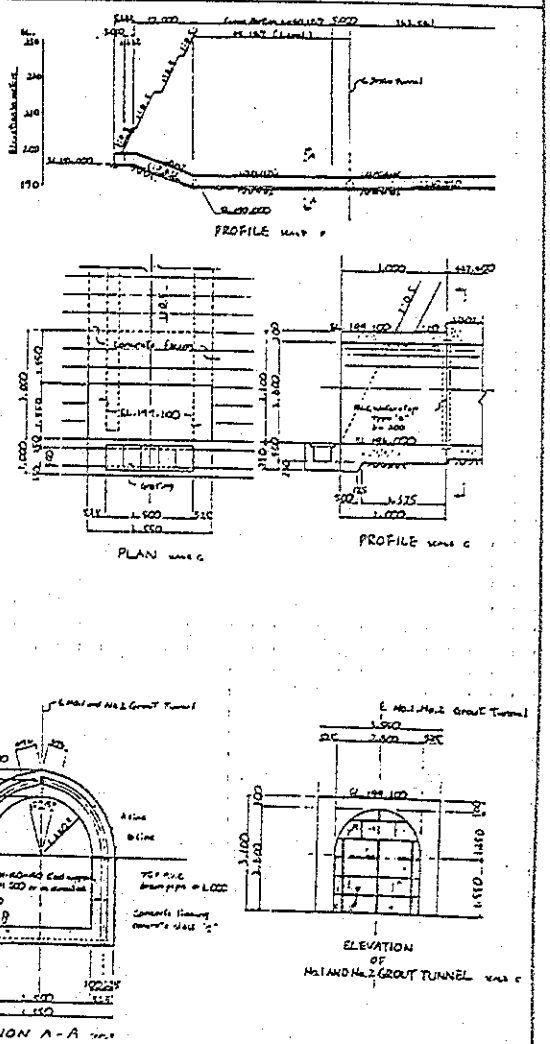




VI-2-71

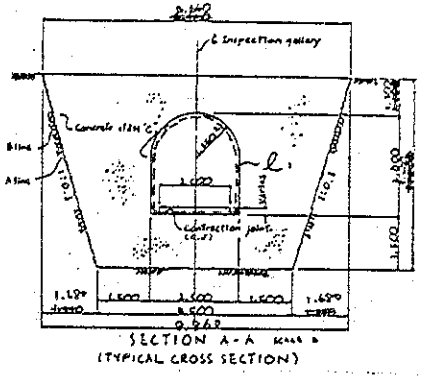
Working Division: No.2 Grout Tunnel

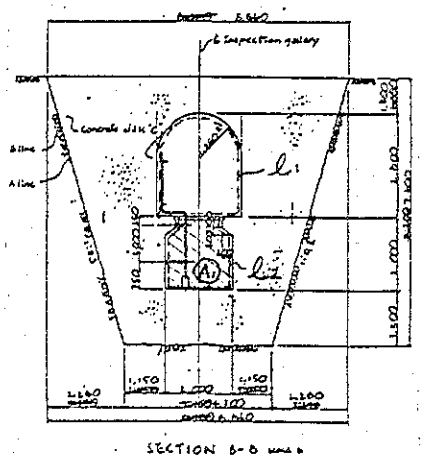
Description	Calculation Details	Unit	Quantity	Remarks
C3/09	Formwork class F1	m^2	209.913	
	Please refer to Formwork class F1 for No.1 Grout Tunnel			
	$l = 5.355\ m^2$			
	$n = 428.428 / 12.00 = 36$			
	$A_1 = 5.355 \times 36 = 192.78\ m^2$			
	$A_2 = \frac{1}{2} \times (1.45 + 3.00) \times 3.85 \times 2$			
	$= 17.133\ m^2$			
	Total $A = A_1 + A_2 = 209.913\ m^2$			



Working Division: Inspection gallery

Description	Calculation Details	Unit	Quantity	Remarks
C3/10	Form work, class F2.	m^2	2,665.126	
	$l_1 = 2 \times \pi \times 1.25 \times 180/360 + 1.55 \times 2 + 2.50 = 9.527$ m			
	$l_2 = 0.30 \times 2 + \sqrt{0.3^2 + 0.2^2} \times 2 + 1.50 \times 2 + 2.00 = 6.321$ m			
	Length of l_1 portion = 272.715 m			
	Length of l_2 Portion = 10.00 m			
	$L_1 = 9.527 \times 272.715 = 2,598.156$ m^2			
	$L_2 = 6.321 \times 10.00 = 63.21$ m^2			
	(A1) $A = 0.30 \times 1.40 + \frac{1}{3} \times (1.40 + 2.00) \times 0.20 + 1.50 \times 2.00 = 3.76$ m^2			
	Total area = 2,665.126 m^2			

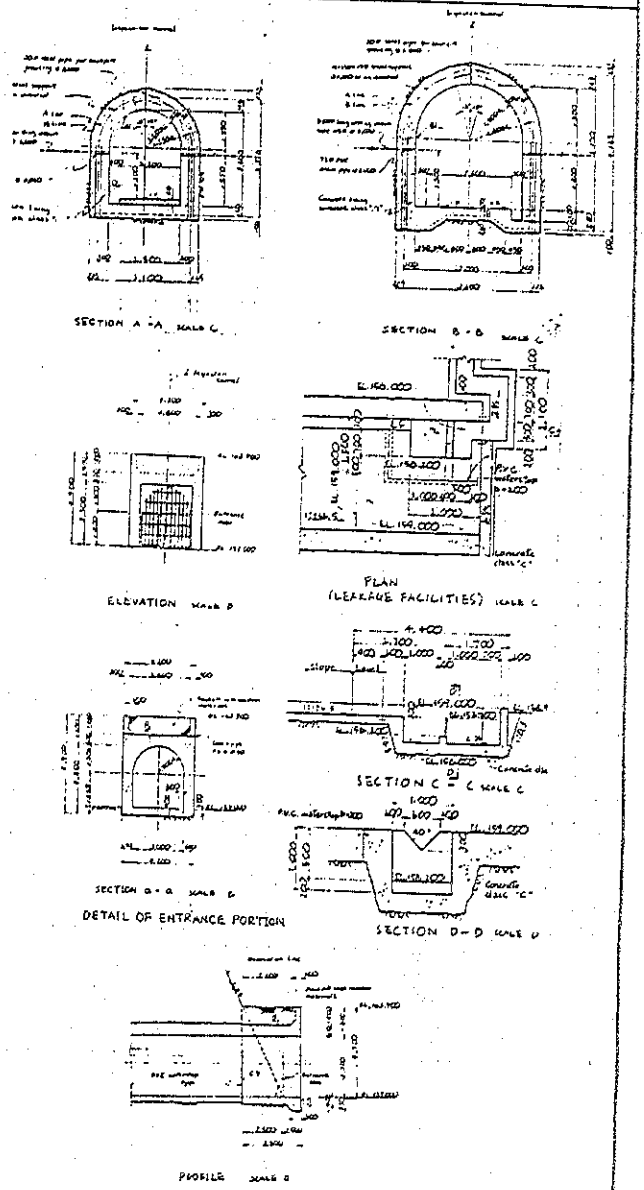




VI-2-73

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Inspection Tunnel			
C3/10	Formwork class F2	m^2	1,411.911	
	Section A-A			
	$l_1 = 2 \times \pi \times 1.25 \times 180/360 = 3.927$ m			
	$l_2 = 1.550 \times 2 = 3.10$ m			
	$l = 3.927 + 3.10 = 7.027$			
	$A_1 = 7.027 \times 14.30$ m $= 100.486$ m^2			
	Section B-B			
	$l_1 = 2 \times \pi \times 1.50 \times 180/360 = 4.712$ m			
	$l_2 = 1.80 \times 2 = 3.60$ m			
	$l = 4.712 + 3.60 = 8.312$ m			
	$A_2 = 8.312 \times 136.5 = 1,134.588$ m^2			
	Transition			
	$A_3 = \frac{1}{2} \times (7.027 + 8.312) \times 5.00 = 38.348$ m^2			
	Portal			
	$A_4 = (4.90 \times 4.20 - 8.934) + \frac{1}{2} \times (3.20 + 2.50) \times 4.90 = 43.479$			



VI-2-74

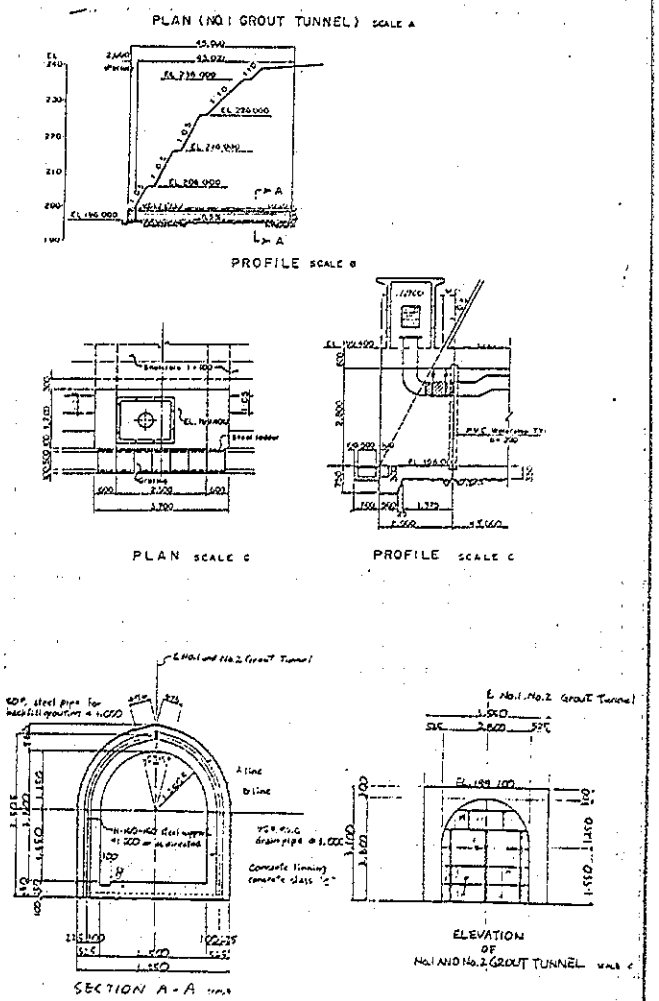
Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
	Formwork class F2			
	$A_5 = 0.60 \times 150.00 = 90.00\ m^2$			
	$A_6 = (0.70 \times 2.20 - 0.20 \times 0.20) \times 2 + 0.70 \times 1.00 + 0.2 \times 2 \times 1.00 + 0.50 \times 0.70 + 0.50 \times 0.70 + 0.30 \times 0.70 = 5.01\ m^2$			
	total $A = A_1$ to $A_6 = 1,411.91$			

VI-2-75

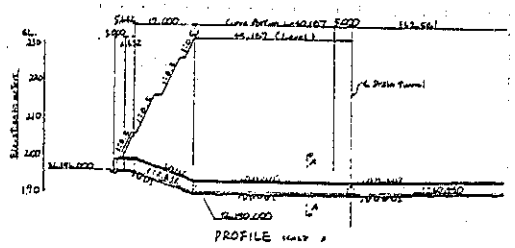
Working Division: No.1 Grout Tunnel

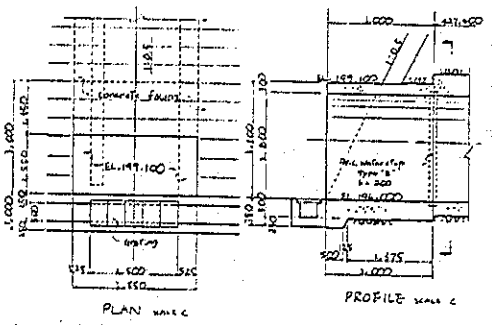
Description	Calculation Details	Unit	Quantity	Remarks
C3/10	Foram work class F_2	m^2	341.34	
	< Tunnel portion >			
	$l_1 = 2 \times \pi \times 1.25 \times 180/360 + 1.65 \times 2$			
	$= 7.227$ m			
	$A_1 = 7.227 \times 45^{m} = 325.22\ m^2$			
	<Portal>			
	$A_2 = 3.10 \times 3.55 = 11.005\ m^2$			
	$A_3 = \frac{1}{2} \times 1.650 \times 3.10 \times 2 = 5.115\ m^2$			

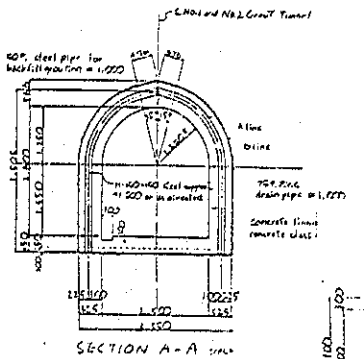


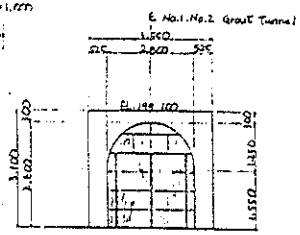
Working Division: No.2 Grout Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/10	Form work class F_2	m^2	3,112.369	
	Please refer to Form work class F_2 for No.1 grout tunnel			
	$l_1 = 7.227$ m $\quad l_2 = 428.428$			
	$A_1 = 7.227 \times 428.428 = 3,096.249$ m^2			
	<Portal>			
	$A_2 = 3.10 \times 3.55 = 11.005$ m^2			
	$A_3 = \frac{1}{2} \times 1.650 \times 3.10 \times 2 = 5.115$ m^2			
	Total $A = A_1 + A_2 + A_3 = 3,112.369$			









VI-2-11

Working Division: Inspection gallery

Description	Calculation Details	Unit	Quantity	Remarks
C 3/11	Reinforcement bar	Ton	178	
	Concrete volume = 8,904.042 m^3			
	Rein.bar = 20 kg x 8,904.042			
	= 178,080.84 kg = 178 ton			

11-2-78

Working Division: Inspection Tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/11	Reinforcement bar	ton	32.514	
	Concrete volume = 1,083.79 m^3			
	1,083.79 m^3 × 0.03 = 32.514			

VI-2-79

Working Division: No.1 Grout tunnel

Description	Calculation Details	Unit	Quantity	Remarks
C3/11	Reinfacement bar	ton	14.137	
	Concrete volume = 471.24 m^3			
	$w = 471.24 \times 0.03 = 14.137$			

08-2-11