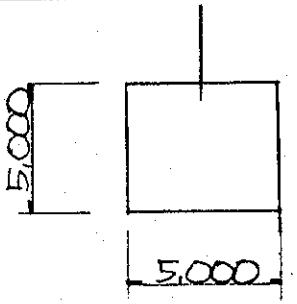
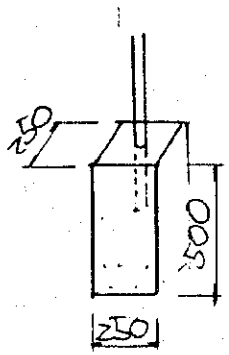
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for catch basin			
	Type 1 5nos			
	$0.03 \times 1.4^2 \times 5$ = $0.29 m^3$			
	Type 2 10 nos			
	$0.03 \times 1.0^2 \times 10$ = $0.30 m^3$			
	Type 3 6 nos			
	$0.03 \times 1.0^2 \times 6$ = $0.18 m^3$			
	Sub total 0.77	m^3		
	Total 46.05 + 25.39 + 0.77			
	= 72.21	m^3		

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/16	Concrete, class G, for anchor block of trash boom and foundation of wire net fence			
	- for anchor block of trash boom			
	$5.0 \times 5.0 \times 4.0 \times 2 = 200\ m^3$			
	- for foundation of wire net fence			
	wire net fence length 14 m			
	$14/2 + 1 = 8$ nos			
	$0.5 \times 0.25^2 \times 8 = 0.25\ m^3$			
	Total 200.25	m^3		

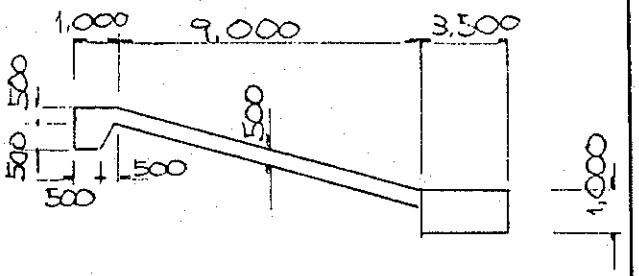




2.0m interval

Working Division:

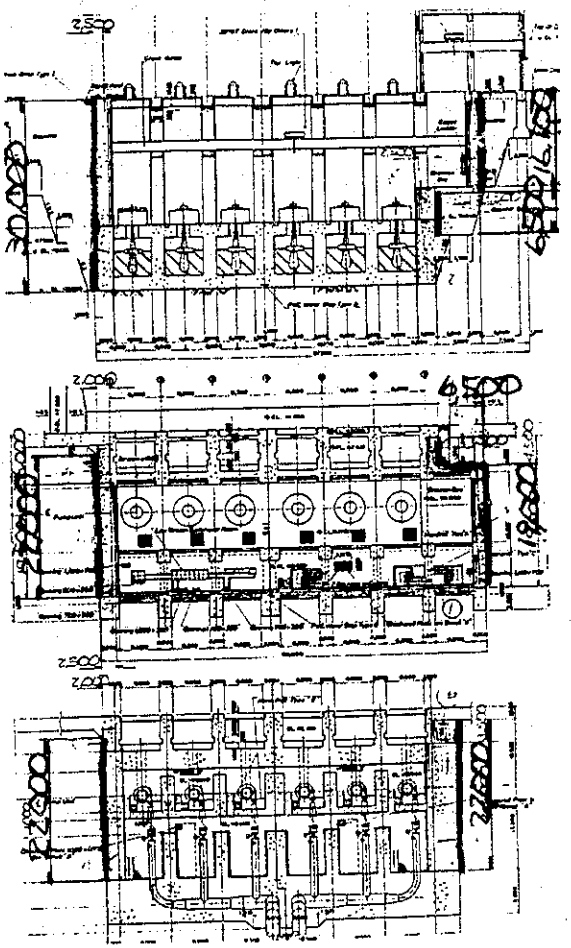
Description	Calculation Details	Unit	Quantity	Remarks
/17	Formwork, F1 finish, for concrete items /01, /02, /03, /04, /07, /12 and /13			
	- for /01			
	$\{0.5 \times 1.0 + \frac{1.0+0.5}{2} \times 0.5 + 0.5 \times 9.0$			
	$+ 3.5 \times 1.0\} \times 3$			
	$= 26.63\ m^2$			



3 joints

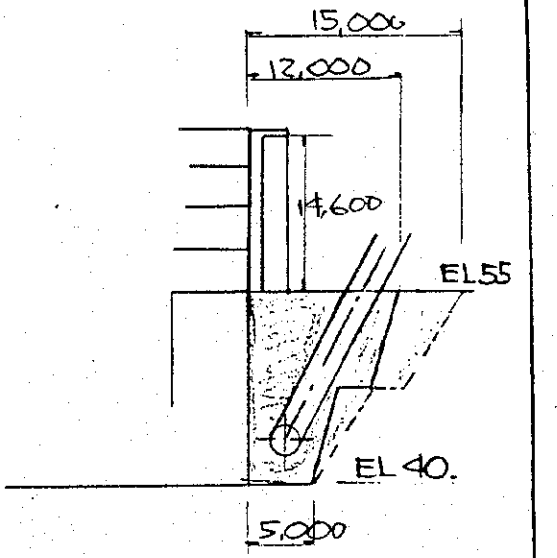
Working Division:

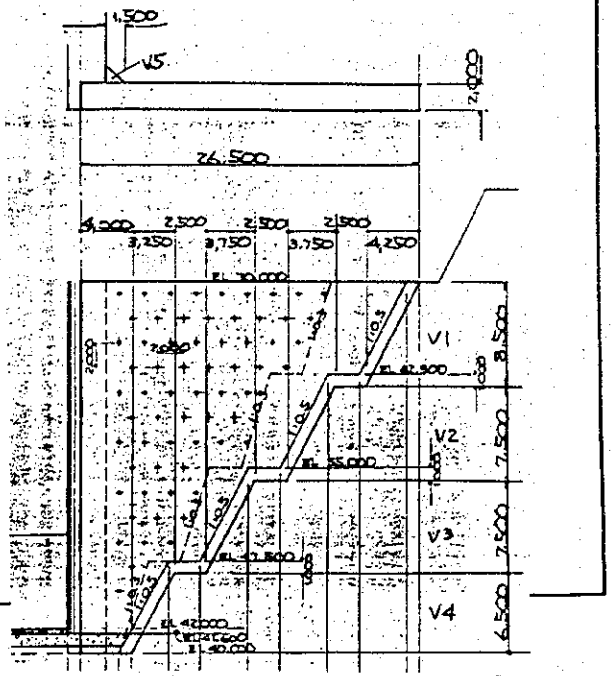
Description	Calculation Details	Unit	Quantity	Remarks
-	for 102			
	Side wall			
	A1 = 30.0 × 22.0 = 600.00m²			
	A2 = 6.5 × 22.0 = 143.00m²			
	A3 = (19.0 + 6.50 + √2 × 1.50 + 1.50) × 16.10 = 468.85m²			
	sub total 1,211.85m²			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	backwall 1			
	$A_1 = \left(\frac{5.0+7.25}{2} \times 7.5 + \frac{9.75+12.0}{2} \times 7.5\right) \times 2$			
	$= 255\ m^2$			
	$A_2 = \frac{5.0+8.75}{2} \times 7.5 + \frac{11.25+15.0}{2} \times 7.5$			
	$= 150\ m^2$			
	sub total $405\ m^2$			
	backwall 2			
	$14.6 \times 6.0 \times 7 = 613.2\ m^2$			
	-Wing wall			
	$A_1 = \frac{1}{2} \times (26.5+22.5) \times 8.5 = 208.25\ m^2$			
	$A_2 = \frac{1}{2} \times (19.75+16) \times 7.5 = 134.06\ m^2$			
	$A_3 = \frac{1}{2} \times (13.5+9.75) \times 7.5 = 87.19$			
	$A_4 = \frac{1}{2} \times (7.25+4.0) \times 6.5 = 36.56$			
	$A_5 = \sqrt{2 \times 1.5^2} \times 30 = 63.64$			
	$529.70\ m^2$			
	$\Sigma A = 2 \times 529.70 = 1,059.4\ m^2$			
	for 102 total			
	$1,271.85 + 405 + 613.2 + 1059.4$			
	$= 3,349.45\ m^2$			





24-1-1

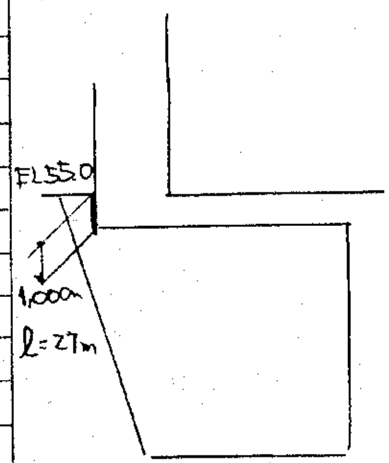
85

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for 103			
	2.5 × 15.1 × 2 + 8 + (3.0 × 2 + 2.0 × 6) × 15.1			
	= 875.8 m²			
	for 104			
	- slab EL 70.0			
	4.5 × 0.5 = 2.25 m²			
	- bottom slab			
	2.0 × 53 + 5.0 × 53 = 371.0 m²			
	Total 104 373.25 m²			
	for 107			
	beam at El 70.1 (c.c)			
	A1 = 1.50 × 15.0 + 1.2 × 12.0 − 0.8 × 0.7 × 3			
	= 35.22 m²			
	A2 = 1.50 × 7.50 × 2 + 1.20 × 6.00 × 2			
	= 36.90 m²			
	A3 = 0.70 × 6.00 × 2 × 3 = 25.20 m²			
	107 total 97.32 m²			

4-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for /12			
	① $\left\{ \frac{8.312+5.529}{2} \times 7.5 + \frac{5.529+5.245}{2} \times 7.5 \right\}$			
	$\times 3$			
	= 276.92 m²			
	② 19.893 × 8.0			
	= 159.14 m²			
	for /12 total 436.06 m²			
	for /13			
	1.0 × 27 = 27.0 m²			
	Total			
	26.63 + 3,349.45 + 875.8 + 373.25			
	+97.32 + 436.06 + 27.00			
	> 5,185.51 m²			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/18	Formwork, F1 finish, for concrete of item 14			
	for drain ditch			
	① around pump house type I ℓ = 135.5m			
	$0.7 \times 2 \times 135.5 = 189.7\ m^2$			
	② along foot of cutting slope at El.70. type II ℓ = 273.928			
	$1.05 \times 2 \times 273.928 = 575.25\ m^2$			
	③ on cutting slope type III ℓ = 36.52m			
	$0.8 \times 2 \times 36.52 = 58.43\ m^2$			
	④ on berm El.92.5 type III ℓ = 239m			
	$0.8 \times 2 \times 239 = 382.40\ m^2$			
	for drain ditch total 1,205.78 m^2			

67-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for catch basin			
	① Type 1 5 nos			
	(1.4×1.6×4 − 0.9×0.8×2 − 0.6×0.6)×5			
	= = 35.80 m²			
	② Type 2 10 nos			
	(1.0×1.4×4 − 0.6×0.6×2)×10			
	= 48.80 m²			
	③ Type 3 6 nos.			
	(1.0×1.4×4 − 0.6×0.6×3)×6			
	= 27.12 m²			
	for catch basin total 111.72 m²			
	Total 1,317.5 m²			

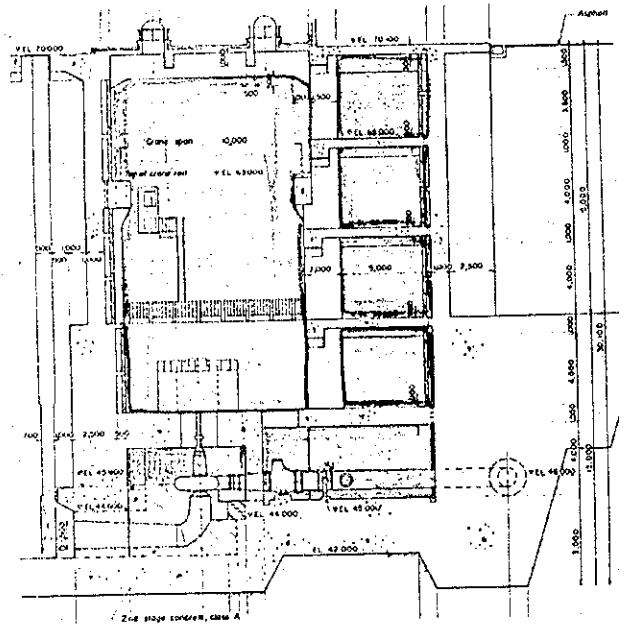
09-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/19	Formwork F1 finish, for concrete of item /16			
	for anchor block of trash boom 2nos			
	$4.0 \times 5.0 \times 4 \times 2 = 160 m^2$			
	for foundation of wire net fence 8 nos			
	$0.25 \times 0.5 \times 4 \times 8 = 4 m^2$			
	Total $164 m^2$			

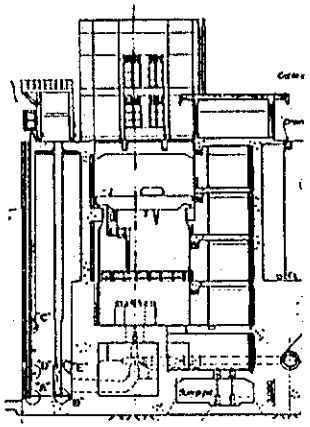
19-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
120	Formwork, F2 finish, for concrete of items 102, 105, 106, 107, 108, 109, 110 and 111			
for 102	Side wall			
	$A1 = (5.608 \times 11.0 - 0.5 \times 1.0) \times 2 = 122.38 m^2$			
	$A2 = 9.0 \times 1.5 \times 2 = 27.00 m^2$			
	$A3 = (11.392 \times 10.0 - \frac{1}{2} \times 0.5 \times 1.0) \times 2 = 227.34 m^2$			
	$A4 = 5.0 \times (4.6 + 4.5 + 4.5 + 4.5) \times 2 - 5.0 \times (1.0 + 0.5 \times 3) = 168.50 m^2$			
	$A5 = 6.5 \times 2.0 \times 2 = 26.00 m^2$			
	$A6 = 4.0 \times (2.5 + 7.0) \times 2 = 76.00 m^2$			
	sub total 647.22	m^2		

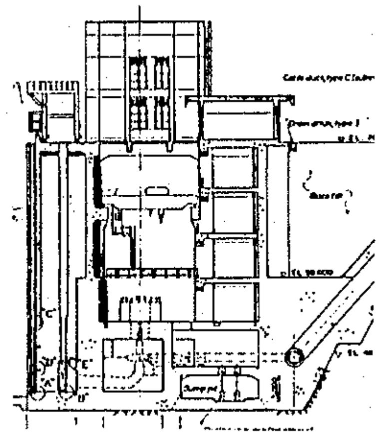
29-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Backwall			
	A1 = 55.5×4.6 + 4.55×0.5 − 1.0×1.5×4			
	−1.0×2.4 − 1.0×1.55 − 1.0×0.5			
	= 247.13 m²			
	A2 = 55.5×4.5 − 0.5 − (1.0×4 + 2.0 + 1.3 + 0.5)			
	= 245.85 m²			
	A3 = A2 = 245.85 m²			
	A4 = 47.0×4.5 − 0.5×(1.0×3 + 2.0 + 1.3			
	+ 0.5×2)			
	= 207.85 m²			
	A5 = 6.0×4.0×6 = 144.00 m²			
	sub total 1,090.68 m²			
	for 102 Total 1,737.90 m²			

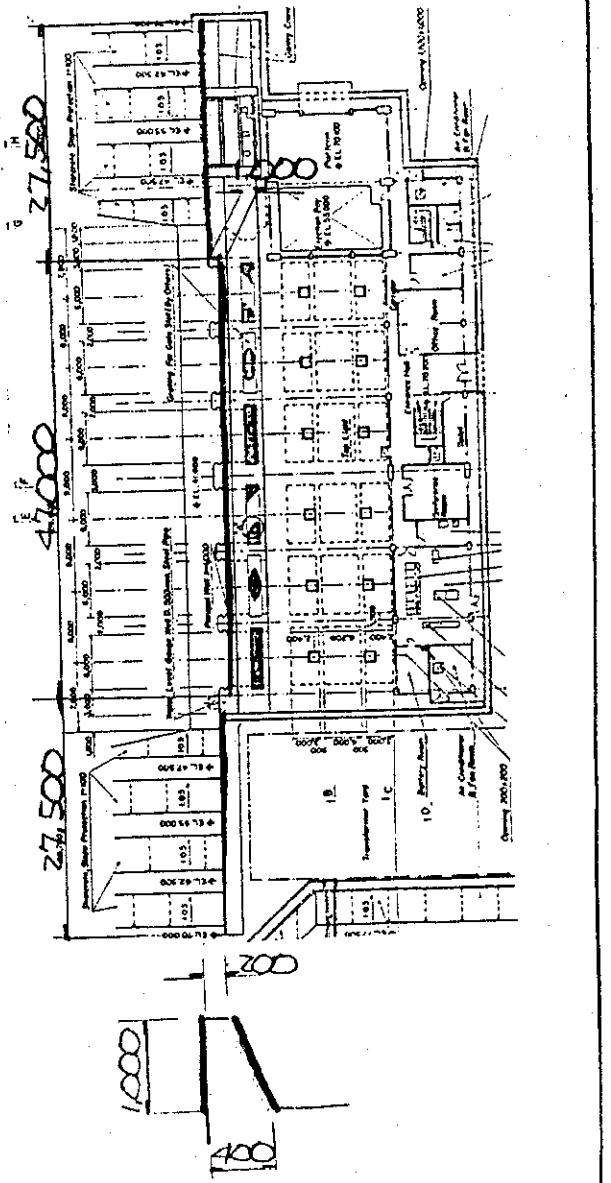
S9-1-63

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	105			
	Front wall (A)			
	A1 = 5.708 × 6.0 × 6 = 205.49 m²			
	A2 = 7.308 × 6.0 = 43.85 m²			
	A3 = 6.392 × 6.0 × 7 = 268.46 m²			
	A4 = 5.0 × 6.0 × 6 = 180.00 m²			
	subtotal 697.80 m²			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Front wall (B)			
	$A1 = (1.0 + 1.02) \times (102.0 + 1.0 \times 2)$			
	$= 210.08 m^2$			
	$A2 = \frac{1}{2} \times (0.2 + 0.4) \times 1.0 \times 2 = 0.60 m^2$			
	Sub-total $210.68 m^2$			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Concrete block (A)			see figure of concrete work
	① (0.50×5.708 +0.90×6.392+0.5×4.7)			
	×2×6 −(0.50×0.4×2×6+0.90×0.4×6)			
	= 126.92	m^2		
	② (0.50×2+0.90+0.5)×6.00×6			
	+0.5×10.5×3−(0.5×0.4×12			
	+0.90×0.40×6+0.5×0.4×6×2 = 95.19	m^2		
	③ 0.3×2×6.0×6×3+0.3×10.5×2×3			
	−0.3×0.4×8×3 = 80.82	m^2		
	④ 18.6×0.5×2−(0.5×0.3×2×3			
	+0.3×0.2×2×3) = 17.34	m^2		
	⑤ (4.6+4.5×3)×0.5×2×6			
	−(0.5×0.3×2×6+0.3×0.2×6)×4			
	= 99.96	m^2		
	⑥ (4.6+4.5×3−1.0−0.5×3)×0.5×2×8			
	−(0.5×0.3×2×8+0.2×0.3×2×8)×4			
	= 111.36	m^2		

99-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	⑦ (5.0×2 +47.0)×0.5×4			
	−0.5×0.4×14×4 = 102.80	m^2		
	⑧ (5.0×2 +47.0)×0.3×2×4			
	−0.4×0.3×14×4 = 130.08	m^2		
	⑨ 4.5×0.5×2×2 − (0.5×0.3×2×2			
	+0.3×0.2×2×2) = 8.16	m^2		
	⑩ 10.5×0.5 − (0.5×0.4×2) = 4.85	m^2		
	⑪ 0.3×10.5×2 − 0.4×0.3×4 = 5.82	m^2		
	subtotal 783.30	m^2		

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Concrete (B)			see figure of concrete work
	① (0.5+0.9)×6.0 −(0.5+0.9)×0.4 = 7.84	m^2		
	② 0.3×2×2×6.0 −0.3×0.4×2×2 = 6.72	m^2		
	③(5.708×0.5 + 6.392×0.9)×2 −(0.5+0.9+0.2)×0.3×2 = 16.25	m^2		
	④ 0.5×10.5×2 − 0.4×0.5×4 = 9.70	m^2		
	⑤ 0.3×10.5×2×3 −0.4×0.3×6 = 18.18	m^2		
	⑥ 0.5×13.6×2×2 −0.3×0.5×2×4 = 26.00	m^2		
	⑦ 0.5×4.5×3 − 0.5×0.4×3 = 6.15	m^2		
	⑧(0.3×2+0.4×4)×4.5 −(0.3×2+0.4×4)×0.4 = 9.02	m^2		

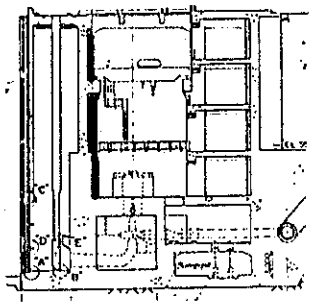
89-1-1

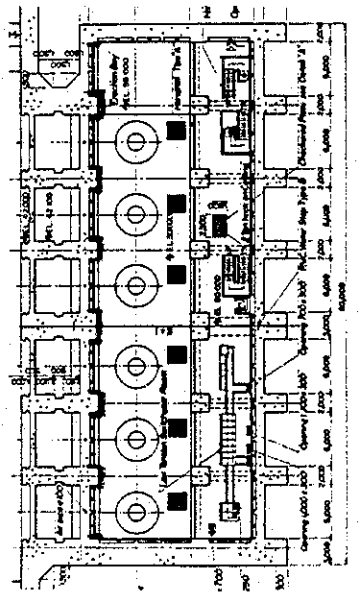
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	(9) $0.5\times(4.6+4.5\times2-1.0-0.5\times2)\times2$			
	$-(0.5\times0.3\times6+0.3\times0.2\times2+$			
	$0.4\times0.2\times4)$ $= 10.26$	m^2		
	(10) $0.5\times8.5\times3-0.4\times0.5\times3$			
	$= 12.15$	m^2		
	(11) $0.5\times(4.6+4.5\times2-1.0-0.5\times2)\times2$			
	$-(0.5\times0.3\times6+0.3\times0.2\times2$			
	$+0.4\times0.2\times4)$ $= 10.26$	m^2		
	(12) $0.3\times(8.5-0.5)\times2\times3$			
	$-0.4\times0.3\times2\times3$ $= 13.68$	m^2		
	sub total 146.21	m^2		
	for 105 total			
	$697.80+210.68+783.36+146.21$			
	$= 1,837.99$	m^2		

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for 106			
	① (1.00×2+0.5+1.5)×6.392 = 25.57	m^2		
	② (1.00×12+0.5+2.0×4+3.0+0.5) ×11.392 = 273.41	m^2		
	③ (0.5×14+0.5×2+2.0×5+3.0) ×5.708 = 119.87	m^2		
	subtotal 418.85	m^2		

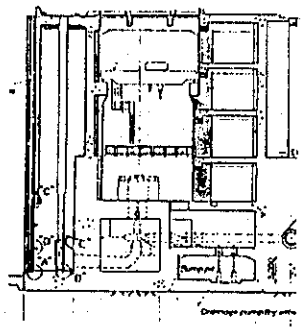


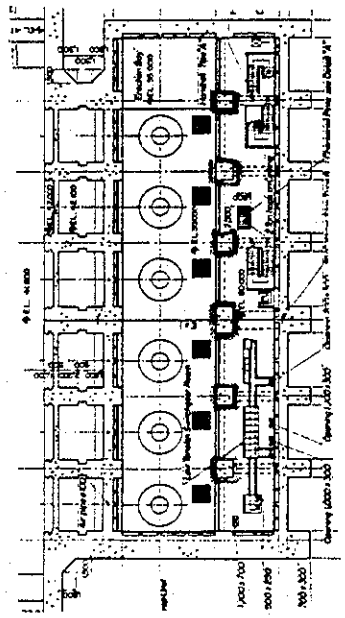


04-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	① {(5.339+1.0−0.3)×2.0			
	−1.0×0.5 + ½×1.0×0.5}×2 = 21.86	m^2		
	{(6.208+1.5−0.5)×1.5			
	+0.5×0.3−1.0×0.5}×2 = 21.12	m^2		
	(4.5×2+4.6)×(1.5+0.5) = 27.20	m^2		
	(5.339+1.118+6.208)×(1.5+0.5) = 25.33	m^2		
	② {(10.392+1.0−0.5×2)×2.0			
	−1.0×0.5×2 + ½×1.0×0.5}×12 = 240.41	m^2		
	{(6.208+1.5−0.5)×1.5 + 0.5×0.5			
	−1.0×0.5}×12 = 126.74	m^2		
	(4.5×3+4.6)×(0.5×2+3.0+2.0×4)			
	= 217.20	m^2		
	(10.392+1.118+6.208)×(0.5×2+3.0+			
	2.0×4) = 212.62	m^2		
	sub total 892.48	m^2		
	total of for /06 1,311.33	m^2		





14-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	for /07			
	beam of El. 70.1 (A)			see figure of concrete work
	① $(6.5\times6+6.55\times4+6.25\times2)$			
	$\times(0.80\times2+0.50)$ = 163.17	m^2		
	② $(6.5\times3+6.55\times2+6.25)\times(0.5+1.3)$			
	= 69.93	m^2		
	③ $(1.3\times11.0+\frac{1}{2}\times1.0\times0.5\times2$			
	$-0.5\times0.8\times2)\times13$ = 182.00	m^2		
	④ $(11.0-1.0\times2+\sqrt{1.0^2+0.5^2}\times2)$			
	$\times(1.5\times5+1.2\times2+0.5)$			
	= 116.86	m^2		
	sub total 531.96	m^2		

1-1-72

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	beam of El. 70.1 (B)			see figure of concrete work
	① (1.0×13 + 1.5×4 + 1.2×2 + 1.55 + 0.5) × 5.0 = 117.25	m^2		
	② (0.8 × 6.0 + $\frac{1}{2}$ × 1.0 × 0.5 × 2) × 7 × 2 − 6.0 × 0.3 × 7 + (4.0 + $\sqrt{1.0^2+0.5^2}$ × 2) × 1.0 × 7 = 105.25	m^2		
	sub total 222.50	m^2		

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	beam of EL 65.0			see figure of concrete work
	① $(0.5\times13+1.0\times6+1.3+0.5)\times5.0$			
	$=71.50$	m^2		
	② $(1.0\times6.0+\frac{1}{2}\times1.0\times0.5\times2)\times7\times2$			
	$-6.0\times0.5\times7+(4.0+\sqrt{1.0^2+0.5^2}\times2)$			
	$\times1.0\times7$ $=113.65$	m^2		
	Sub total 185.15	m^2		
	beam of EL 60.0			
	same as beam of 65.0			
	sub total 185.15	m^2		

84-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	beam of EL 55.0			see figure of concrete work
	① $(0.5\times1.1+1.0\times5+1.3+0.5)\times5.0$			
	$=61.50\ m^2$			
	② $(1.0\times6.0+\frac{1}{2}\times1.0\times0.5\times2)\times6\times2$			
	$-6.0\times0.5\times6+(4.0+\sqrt{1.0^2+0.5^2}\times2)\times1.0\times6$			
	$=97.42\ m^2$			
	sub total 158.92	m^2		

74-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	floor supporting of El 70.0			see figure of concrete work
	$A_1 = 1.0 \times 6.0 \times 2 \times 6 = 72.00\ m^2$			
	$A_2 = 1/2 \times 0.5 \times 1.0 \times 2 \times 6 \times 2 = 6.00$			
	$A_3 = \sqrt{0.5^2+1.0^2} \times (4.5-1.5) \times 12 = 40.25$			
	$A_4 = 1/2 \times \sqrt{0.5^2+1.0^2} \times 1.0 \times 12 = 6.71$			
	$A_5 = \sqrt{0.5^2+1.0^2} \times (6.0-1.0 \times 2) \times 6 = 26.83$			
	$A_6 = 1/2 \times \sqrt{0.5^2+1.0^2} \times 1.0 \times 12 = 6.71$			
	$A_7 = (4.5-1.5) \times (6.0-1.0 \times 2) \times 6 = 72.00$			
	Sub total = 230.50	m^2		

94-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab of EL 70.1 (A)			figure of concrete work
	$A_1 = (11.0 - 0.5 \times 2) \times (6.5 \times 3 + 6.55 \times 2 + 6.25) = 388.5$			
	$-A_2 = 1.2 \times 1.2 \times 2 \times 6 = -17.28$			
	sub total $371.22\ m^2$			

L4-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab of EL 70.1 (B)			see figure of concrete work
	$A1 = 0.5 \times 6.0 \times 7 = 21.00\ m^2$			
	$A2 = 5.0 \times (6.75 + 6.5 + 6.55 + 6.25) = 227.75\ m^2$			
	$A3 = 0.2 \times 0.2 + 0.2 \times 0.6 + 5.3 \times 0.2 + 0.6 \times 0.25 + 0.2 \times 0.45 + 1.5 \times 1.8 + 2.9 \times 5.0 + 2.9 \times 4.0 = -30.26\ m^2$			
	$A4 = \{(0.2+0.2) + (0.2+0.6) + (5.3+0.2) + (0.6+0.25) + (0.2+0.45) + (1.5+1.8) + (2.9+5.0) + (2.9+4.0)\} \times 2 \times 0.5 = 26.30\ m^2$			
	Sub total $244.79\ m^2$			

84-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab of El. 65.0			
	$A1 = 0.5 \times 6.0 \times 7 = 21.00\ m^2$			
	$A2 = 5.0 \times (7.0 \times 6 + 6.7) = 243.50\ m^2$			
	$-A3 = (0.75 + 1.10 + 1.00 + 0.75) \times 0.3 + 1.5 \times 1.8 + 5.0 \times 2.9 \times 2 = -32.78\ m^2$			
	$A4 = \{(0.75 + 0.3) \times 2 + (1.10 + 0.3) + (1.0 + 0.3) + (1.5 + 1.8) + (5.0 + 2.9) \times 2\} \times 0.5 \times 2 = 23.90\ m^2$			
	sub total $255.62\ m^2$			

64-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Slab of EL 60.0			see figure of concrete work
	$A_1 = 1.0 \times 6.0 \times 7 = 42.00\ m^2$			
	$A_2 = 5.0 \times (7.0 \times 5 + 6.7 + 6.5) = 241.00\ m^2$			
	$A_3 = 2.9 \times 5.0 \times 2 + 1.6 \times 2.5 + 1.5 \times 1.8$			
	$+ 0.25 \times (0.5 + 0.5)$			
	$+ 0.3 \times (0.7 + 1.0 + 1.1 + 0.7)$			
	$= -\ 37.00\ m^2$			
	$A_4 = (2.9 + 5.0) \times 2 + (1.6 + 2.5)$			
	$+ (1.5 + 1.8) + (0.25 + 0.5) \times 2$			
	$+ (0.3 + 0.7) \times 2 + (0.3 + 1.0) + (0.3 + 1.1)$			
	$+ 18.7 \times 0.25 \times 2 + 0.6 \times 2$			
	$+ (1.5 \times 0.25 + 0.6) \times 2$			
	$= 41.90\ m^2$			
	sub total $287.90\ m^2$			

08-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab of El 55.0			see figure of concrete work
	$A_1 = 1.0 \times 6.0 \times 6 = 36.00\ m^2$			
	$A_2 = 5.0 \times (7.0 \times 4 + 6.7 + 6.5) = 206.00\ m^2$			
-	$A_3 = 2.9 \times 4.5 + 2.9 \times 5.0 + 1.8 \times 1.5$ $+ 0.25 \times 0.5 \times 2 + 0.25 \times 0.75 \times 2$ $+ 0.3 \times (2.0 + 1.25 + 1.25 + 2.0)$ $+ 0.25 \times 0.5 \times 2$ $= - 33.08\ m^2$			
	$A_4 = (2.9 + 4.5) + (2.9 + 5.0) + (1.8 + 1.5)$ $+ (0.25 + 0.5) \times 2 + (0.25 + 0.75) \times 2$ $+ (0.3 + 2.0) \times 2 + (0.3 + 1.25) \times 2$ $+ (0.25 + 0.5) \times 2$ $= 31.30\ m^2$			
	sub total $240.22\ m^2$			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab El 50 (A)			see figure of concrete work
	A1 = 47.0 × 1.0 = 47.00 m^2			
	A2 = (6.0 × 7.0 − π/4 × 2.0²) × 6 = 233.15 m^2			
	A3 = 1.0 × 1.0 × 4 = 4.00 m^2			
	A4 = π × 2.0 × 2.0 × 6 = 75.40 m^2			
	A5 = (0.5 × 4.5 × 2 + 0.7 × 0.5) × 6 = 29.10 m^2			
	sub total 388.65	m^2		

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	slab El 50.(B)			see figure of concrete work
	A1 = 9.5 × 6.0 × 6 + 3.3 × 0.5 × 2			
	= 345.50 m²			
	-A2 = 2.0 × 2.0 × 6 + 1.0 × 1.0 × 5			
	+ 1.5 × 1.8 + 2.9 × 4.5 + 1.5 × 4.5			
	= - 51.50 m²			
	A3 = {(2.0+2.0) × 6 + (1.0+1.0) × 5			
	+ (1.5+1.8) + (2.9+4.5) + (1.5+4.5)} × 2 × 1.0			
	= 101.40 m²			
	A4 = 5.0 × 0.5 × 2 × 6 + 41.6 × 0.5 × 2			
	- 0.5 × 0.7 × 8 + 3.3 × 0.5 × 2 × 2			
	= 75.40 m²			
	Sub total 470.80 m²			
	for 107 total			
	531.96 + 222.50 + 185.15 + 185.15			
	+ 158.92 + 230.50 + 371.22 + 244.79			
	+ 255.62 + 287.90 + 240.22			
	+ 388.65 + 470.80 = 3,773.38 m²			

8-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	108 for crane girder			see figure of concrete work
	A1 = (1.50 + 0.20 × 3) × 56.0 = 117.60 m²			
	A2 = 1.50 × 6.0 × 7 = 63.00			
	A3 = (1.50 + 0.20 × 2) × 56.0 = 106.40			
	A4 = (1.50 + 1.0) × 6.0 × 7 = 105.00			
	392.00 m²			
	Both side 392.00 × 2 = 784.00 m²			

70

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
~~b2~~	109			
	Valve room A			
A_1	$= (9.5 \times 4.0 - 2.5 \times 3.0) \times 10 = 305.00$	m^2		see figure of concrete work
A_2	$= (2.5+3.0) \times (2.0 \times 4 + 3.0) = 60.50$			
A_3	$= 5.5 \times 4.0 \times 10 = 220.00$			
A_4	$= 2.0 \times (2.0 \times 4 + 3.0) = 22.00$			
A_5	$= 3.0 \times (15.0 \times 2 + 8.0 + 5.0) - 2.0^2 \times 6 = 105.00$			
A_6	$= 3.0 \times 1.0 \times 4 = 12.00$			
A_7	$= 1.0 \times (2.0+7.0) \times 2 \times 6 = 48.00$			
A_8	$= 1.9 \times 5.0 \times 10 = 95.00$			
A_9	$= 4.0 \times (15 \times 2 + 8.0 + 5.0 - 2.0 \times 4 - 3.0) - 2.0^2 \times 6 = 104.00$			
A_{10}	$= 1.9 \times 6.0 \times 6 = 68.40$			
	sub total 1,039.90	m^2		

48-1-1

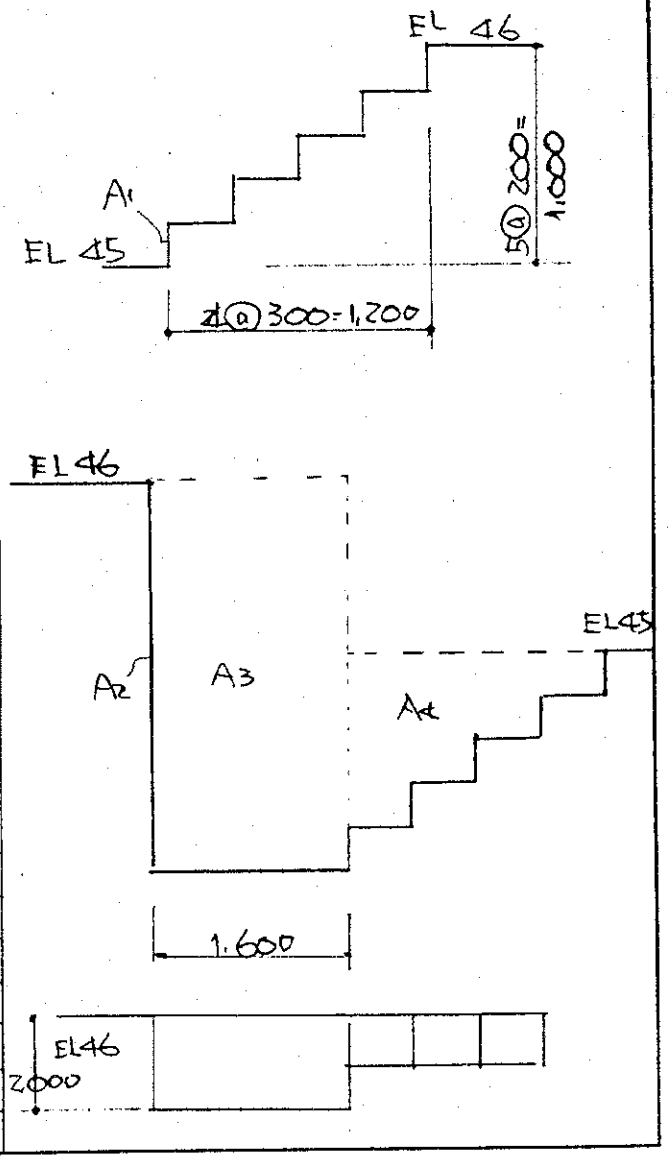
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	Valve room B			
	$A_1 = 2.0 \times 47.00$ = 94.00 m²			see figure of concrete work
	$A_2 = 3.9 \times 6.0 \times 6.0 - 3.0 \times 2.5 \times 6 = 95.40 m^2$			
	$A_3 = 4.0 \times 3.0 \times 6$ = 72.00 m²			
	$A_4 = 4.0 \times 2.5 \times 6 \times 2$ = 120.00 m²			
	Sub total 381.40 m²			
	for 109 total 1,421.30 m²			

98-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	/10			
	$A_1 = 0.2 \times 1.0 \times 5 \times 2 \times 6 = 12.00\ m^2$			
	$A_2 = 2.0 \times 2.0 \times 6 = 24.00\ m^2$			
	$A_3 = 2.0 \times 1.6 \times 6 = 19.20\ m^2$			
	$A_4 = (0.2+0.4+0.6+0.8) \times 0.3 \times 2 \times 6 = 7.20\ m^3$			
	for discharge pipe			
	$(2.0 \times 2.0 - \frac{\pi}{4} \times 1.0^2) \times 6 = 19.29\ m^2$			
	for /10 total $81.69\ m^2$			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	/11			see figure of concrete work
	gate and trashrack			
	$A_1 = (0.25+0.3+0.25)\times 27.9\times 12 = 267.84$	m^2		
	$A_1' = (0.45+0.65+0.45)\times 27.9\times 12 = 518.94$	m^2		
	$A_2 = (0.45\times 2+0.7)\times 8.5\times 12 = 163.20$	m^2		
	$A_2' = (0.6\times 2+1.550)\times 8.5\times 12 = 280.50$	m^2		
	$A_3 = 0.9\times 19.4\times 2\times 12 = 419.04$	m^2		
	$A_4 = (\sqrt{0.25^2\times 2}+0.25)\times 6.0\times 6$			
	$+0.5\times 0.4\times 12 = 24.13$	m^2		
	$A_5 = 0.4\times 2\times 6.0\times 6$			
	$+0.25\times 0.25\times 12 = 29.55$	m^2		
	$A_6 = \frac{0.6+0.5}{2}\times 0.9\times 12 = 5.94$			
	$A_7 = (0.25+\sqrt{0.25^2+0.1^2})\times 6.0\times 6$			
	$+\frac{0.35+0.25}{2}\times 12 = 22.29$			
	$A_8 = (0.4+\sqrt{2\times 0.15^2})\times 6.0\times 6$			
	$+0.45\times 0.15\times 12 = 22.85$			
	sub total			
	1,759.28	m^2		

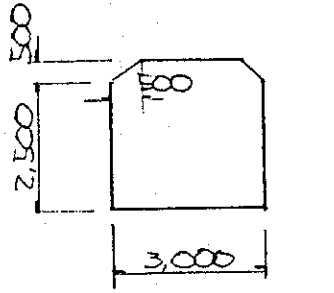
88-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
	girder			
	$(0.2+0.4)\times 56.0\times 2 = 67.20\ m^2$			
	gantry crane			
	$0.18\times 2\times 77.50\times 2 = 55.80\ m^2$			
	for /11 Total 1,877.28 m^2			
	Grand Total of /20			
	for			
	/02 1,737.90			
	/05 1,837.99			
	/06 1,311.33			
	/07 3,773.38			
	/08 784.00			
	/09 1,421.30			
	/10 81.69			
	/11 1,877.28			
	Total 12,824.87 m^2			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/21	Formwork, F3 finish, for concrete of items /04, /05, /06, /10 and /11			
for /04				
	sump pit			
	$(\sqrt{0.5^2\times2}\times2+2.0+2.5\times2)\times8.5\times2$			
	$=143.04\,m^2$			
	$(3.0\times2.5+\frac{3.0+2.0}{2}\times0.5+\sqrt{0.5^2\times2}\times3.0)\times2\times2$			
	$=43.49\,m^2$			
	sub total $186.53\,m^2$			
	Bottom slab			
	$0.4\times6.0\times6 = 14.40\,m^2$			
	$0.1\times6.0\times6 = 3.60\,m^2$			
	sub total $18.00\,m^2$			
	for /04 total $204.53\,m^2$			



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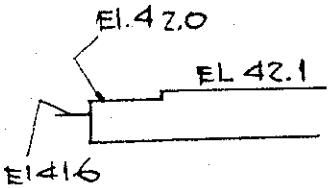


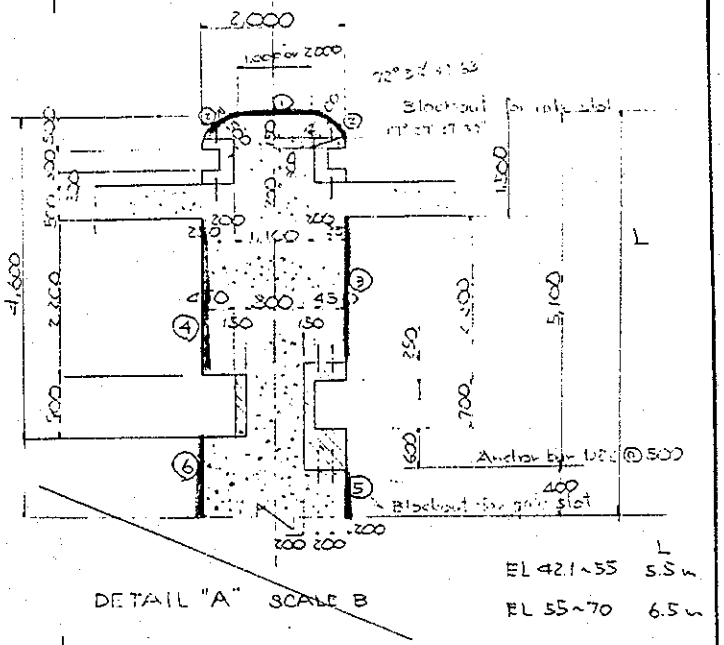
06-1-1

Working Division:

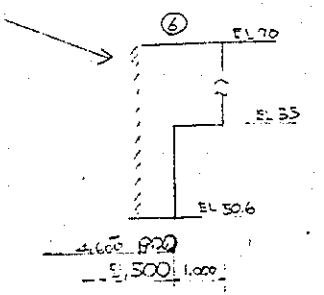
Description	Calculation Details	Unit	Quantity	Remarks
for 105				see figure of concrete work
	front wall (A)			
	A1 = 19.4 × 6.0 × 6 = 698.40	m^2		
	A2 = 14.0 × 6.0 × 6 = 504.00	m^2		
	A3 = 5.0 × 6.0 × 6 = 180.00	m^2		
	sub total			
	1,382.40	m^2		
	for 105 total 1,382.40m^2			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	106			
	Column C1			
	① $2.0 \times 27.9 + 1.0 \times 27.9 \times 4 =$ 167.40	m^2		
	② $2 \times \pi \times 0.5 \times \frac{72°32'32.63''}{360°} \times 12 =$ 7.60	m^2		
	③ $2.05 \times 8.5 \times 12 =$ 209.10	m^2		
	④ $2.2 \times 19.4 \times 12 =$ 512.16	m^2		
	⑤ $0.4 \times 8.5 \times 12 =$ 40.80	m^2		
	⑥ $\{(EL\,70-55) \times 1.9 + (EL\,55-50.6) \times 0.9\} \times 12$			
	$= 389.52$	m^2		
	Total of for 106 = 1,326.58	m^2		



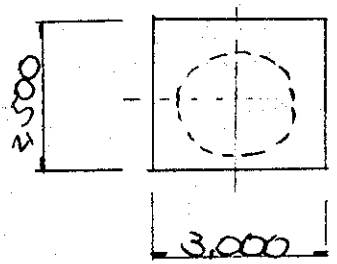
DETAIL "A" SCALE B



1-1-92

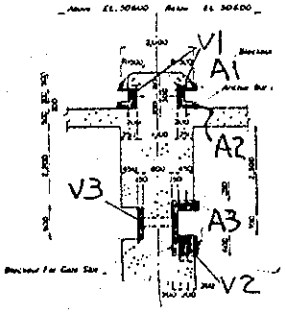
Working Division:

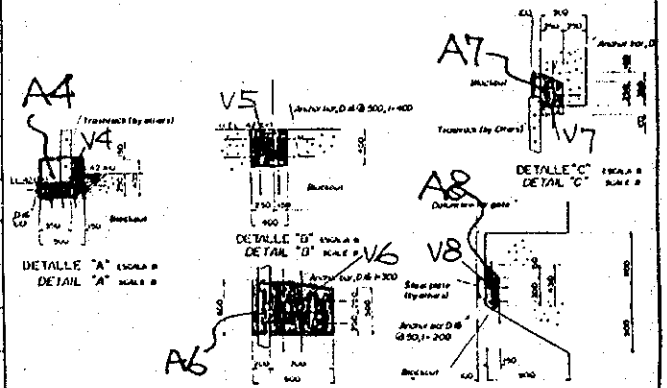
Description	Calculation Details	Unit	Quantity	Remarks
for	/10			
	2.5 × 3.0 × 6 = 45.00 m³			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
for	/11			
	gate and trashrack			
	$A_1 = 2 \times \pi \times 0.5 \times \frac{17°\,27'\,27.37''}{360°} \times 27.9 \times 12$			
	$= 51.01\ m^2$			
	$A_2 = 0.2 \times 27.9 \times 12 = 66.96\ m^2$			
	$A_3 = (0.25 + 0.6) \times 8.5 = 7.23\ m^2$			
	$A_4 = 0.5 \times 0.4 \times 2 \times 6 = 2.40\ m^2$			
	$A_6 = \frac{0.6+0.5}{2} \times 0.7 \times 2 \times 2 \times 6 = 9.24\ m^2$			
	$A_7 = (0.35 + 0.25) \times 6.0 \times 6 = 21.60\ m^2$			
	$A_8 = (0.45 + 0.172) \times 6.0 \times 6 = 22.39\ m^2$			
	for /11 Total $130.83\ m^2$			
	/21 Grand total			
	for			
	/04 $204.53\ m^2$			
	/05 1,382.40			
	/06 1,326.58			
	/10 45.00			
	/11 130.83			
	$3,089.34\ m^2$			





Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
122	Formwork, F3 finish, for concrete			
	of item 114			see figure of concrete work
	drain ditch			
	- for type I			
	0.5 × 2 × 135.5 m = 135.50 m²			
	- for type II			
	0.8 × 2 × 273.928 m = 438.28 m²			
	- for type III			
	0.6 × 2 × (36.52 + 239) = 330.62 m²			
	catch basin			
	Type 1			
	(1.0 × 1.4 × 4 − 0.6 × 0.6 − 0.8 × 0.9 × 2) × 5			
	= 19.00 m²			
	Type 2			
	(0.7 × 1.2 × 4 − 0.6 × 0.6 × 2) × 10			
	= 26.40 m²			
	Type 3			
	(0.7 × 1.2 × 4 − 0.6 × 0.6 × 3) × 6			
	= 13.68 m²			
	Total 963.48 m²			

1-1-24

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/23	Reinforcing bars for concrete			
-	for item /01 Re bar 70 kg/m³			
	513 × 70 = 35,910 kg			
-	for item /02			
	Side & back wall concrete 10,992 m³			
	re bar 35 kg/m³			
	Wing wall concrete 1,928 m³			
	re bar 100 kg/m³			
	10,992 × 35 + 1,928 × 100			
	= 577,520 kg			
-	for item /03 rebar 115 kg/m³			
	Concrete 713 m³			
	713 × 115			
	= 81,995 kg			
-	for item /04			
	slab EL 70.0 Concrete 54 m³			
	Rebar 65 kg/m³			
	Platform C 17 m³			
	R 120 kg/m³			
	Bottom slab C 3,789 m³			
	R 35 kg/m³			
	54 × 65 + 17 × 120 + 3,789 × 35			
	= 138,165 kg			

96-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for item 105			
	Front wall Concrete 1,334 m^3			
	Rebar 100 kg/m^3			
	1,334 × 100 = 133,400	kg		
-	for item 106			
	Concrete 2,922 m^3			
	Rebar 115 kg/m^3			
	2,922 × 115 = 336,030	kg		
-	for item 107			
	Platform Concrete 75 m^3			
	Rebar 120 kg/m^3			
	El 70.1 C = 377 + 260 = 637 m^3			
	R = 115 kg/m^3			
	El 65 C = 85 + 115 = 200 m^3			
	R = 130 kg/m^3			
	60 C = 85 + 120 = 205 m^3			
	R = 75 kg/m^3			
	55 C = 73 + 241 = 314 m^3			
	R = 75 kg/m^3			
	supporting C = 162 m^3			
	R = 65 kg/m^3			
	below El 50 C = 1,060 m^3			
	R = 35 kg/m^3			
	75×120 + 637×115 + 200×130 + 205×75			
	+ 314×75 + 162×65 + 1,060×35 = 194,810	kg		

46-1-1

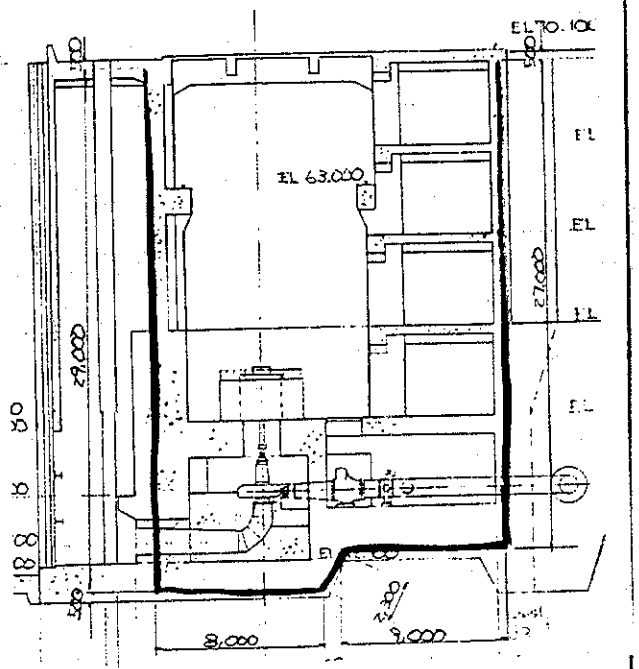
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for item /08			
	Concrete 198 m^3			
	Re bar 115 kg/m^3			
	198 x 115 = 22,770	kg		
-	for item /09			
	Concrete 1,966 kg/m^3			
	Rebar 35 kg/m^3			
	1,966 x 35 = 68,810	kg		
-	for item /12			
	Concrete 613 m^3			
	Re bar 90 kg/m^3			
	613 x 90 = 55,170	kg		
-	for item /14			
	drain ditch Concrete 328 m^3			
	Re-bar 30 kg/m^3			
	Catch basin Concrete 20 m^3			
	Re-bar 50 kg/m^3			
	328 x 30 + 20 x 50 = 10,840	kg		
	Total			
	35,910 + 577,520 + 81,995 + 138,165			
	+ 133,400 + 336,030 + 194,810 + 22,770			
	+ 68,810 + 55,170 + 10,840			
	= 1,655,420	kg		

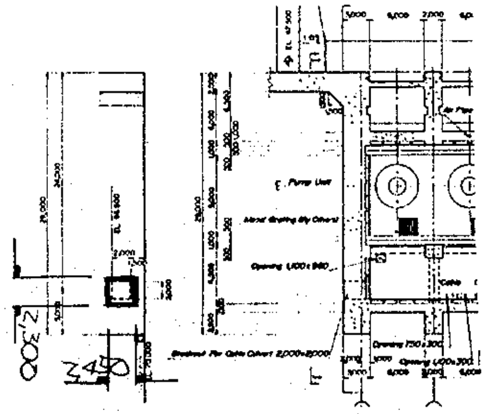
1-1-98

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
124	P.V.C water stop, type A (B=300mm)			
	L = 29.0 + 8.0 + 2.3 + 9.0 + 27 = 75.3	m		

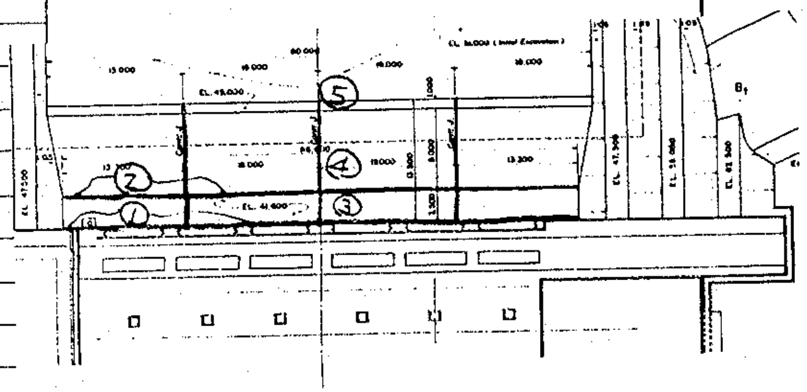


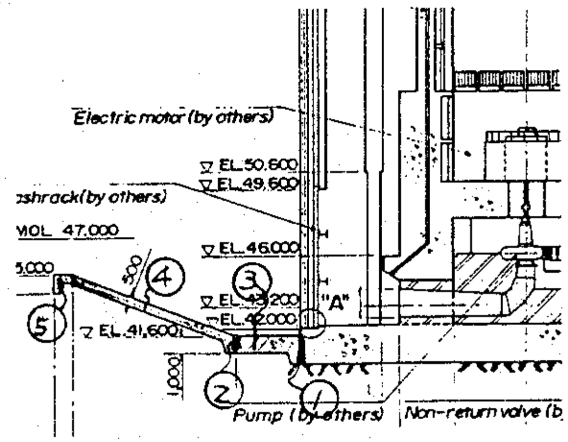
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/25	P.V.C. water stop, Type B (B=200mm)			
	(2.3+2.45) x 2 = 9.5	m		

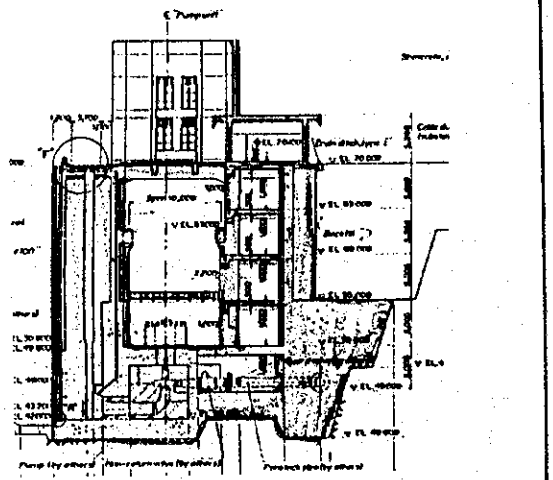
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
126	Bitumious coating for contraction joint of bottom slab of inlet channel & Penstock			
	- bottom slab			
	① $1.6 \times 56.6 = 90.56\,m^2$			
	② $1.0 \times 56.6 = 56.60\,m^2$			
	③ $(1.0 \times 3.5 + \frac{0.5+0.8}{2} \times 0.6) \times 3 = 11.67\,m^2$			
	④ $0.5 \times 9.0 \times 3 = 13.50\,m^2$			
	⑤ $(1.0 \times 0.5 + \frac{0.5+0.75}{2} \times 0.5) \times 3 = 2.44\,m^2$			
	sub Total $174.77\,m^2$			
	- Penstock			
	$\frac{8.312 + 5.529}{2} \times 7.5 + \frac{5.529 + 5.245}{2} \times 7.5$			
	$= 92.31\,m^2$			
	Total $267.08\,m^2$			





Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
/27	Joint filler, for expansion joint of substructure of pump house			
	$A_1 = 30.0 \times 29.0 = 870\ m^2$			
	$A_2 = \frac{1}{2} \times (0.2+0.4) \times 1.0 = 0.30$			
	$A_3 = \frac{1.0+4.75}{2} \times 7.5 + \frac{7.25+11.0}{2} \times 7.5 = 90.0$			
	$-A_4 = 5.5 \times 10 = -55.0$			
	$-A_5 = 1.5 \times 9.0 = -13.5$			
	$-A_6 = \frac{9.0+10.0}{2} \times 1.0 = -9.5$			
	$-A_7 = 10 \times 10.5 = -105.0$			
	$-A_8 = 5.0 \times 4.0 \times 4 = -80.0$			
	$-A_9 = \frac{9.5+7.5}{2} \times 2.0 = -17.0$			
	Total 680.3 m^2			

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Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
128	Dowel bar, 22 mm diameter (round bar), for bottom slab of inlet channel			
				ℓ = 1,000
				500 pitch
	26 × 1.0 × 3 = 78 m			
				26 nos see dwg
				3 lines
	w = 2.98 kg/m			
	W = 2.98 × 78 = 232.44 kg			
129	Anchor bar, 25 mm dia. for encasing concrete			
				ℓ = 4,500
				see dwg
	12 × 6 × 4.5 = 324 m			

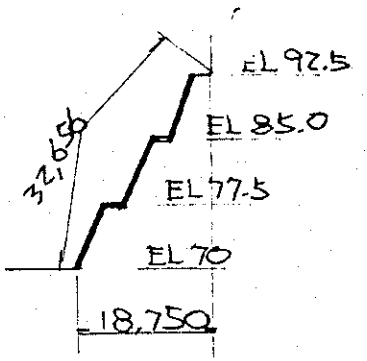
Working Division:

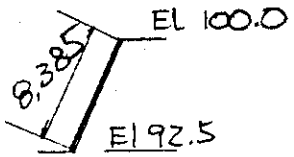
Description	Calculation Details	Unit	Quantity	Remarks
130	Shotcrete with wire mesh for cut slope protection, t=100mm			Location is shown on dwg. of drainage facility. Line
	for inlet channel			
	right bank			right bank
	Sec. Line (m) Mean (m) Dis. (m) Area (m²)			Sec O & a
	O 69.6 - - -			6.596+2.5+8.385+2.5+
	a 69.6 69.6 3.5 243.6			8.385+2.5+8.385+6.0+
	b 20.7 45.2 10.0 452.0			8.385+2.5+8.385+2.5
	c 9.2 15.0 10.0 150.0			+2.546 = 69.567 m ≒ 69.6m
	O' 0 4.6 10.0 46.0			sec. b
				$\sqrt{\{(59-45)\times 0.5\}^2+(59-45)^2}+2.5\times 2$
	sub Total 891.6			= 20.652 = 20.7 m
				sec. C
	left bank			$\sqrt{\{(51-45)\times 0.5\}^2+(51-45)^2}+2.5$
	Sec Line (m) Mean Dis. Area (m²)			= 9.2 m
	O 41.8 - - -			left bank sec O & a
	a 41.8 41.8 3.5 146.3			$\sqrt{\{(70-41.6)\times 0.5\}^2+(70-41.6)^2}$
	b 22.9 32.4 10.0 324.0			+2.5×4 = 41.75
	c 12.6 17.8 10.0 178.0			sec. b
	O' 0 6.3 10.0 63.0			$\sqrt{(61-45)\times 0.5\}^2+(61-45)^2}+2.5\times 2$
	sub total 711.3			= 22.9 m
				sec. C
	for inlet channel total			$\sqrt{\{(54-45)\times 0.5\}^2+(54-45)^2}+2.5$
	1,602.9			= 12.6
	= 1,603 m²			

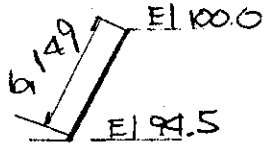
A01-1-1

Working Division:

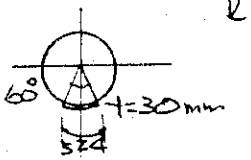
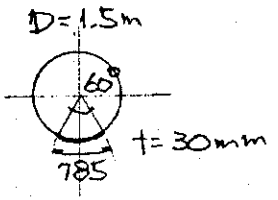
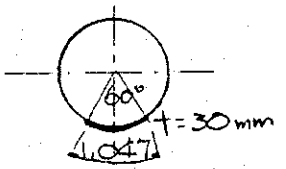
Description	Calculation Details	Unit	Quantity	Remarks
	for around P/s			
	EL 70 ~ 92.5			
	$l = 49.5 \times 2 + 127 + 2 \times 18.75 - 10$			
	$= 253.5$ m			
	$A = 253.5 \times 32.656 = 8,278$ m^2			
	EL 92.5 ~ 94.5			
	$l = \sqrt{6.0^2 + 6.0^2} \times 2 + 9.5 + 5.5$			
	$= 31.971$ m			
	$A = 31.971 \times 2.236 = 71$ m^2			
	El. 92.5 ~ 100.0			
	$l = 8.0 + 5.5 = 13.5$ m			
	$A = 13.5 \times 8.385 = 113$ m^2			
	El 94.5 ~ 100.0			
	$l = 8.5$ m			
	$6.149 \times 8.5 = 52$ m^2			
	Sub total 8,514 m^2			
	Total 10,117 m^2			





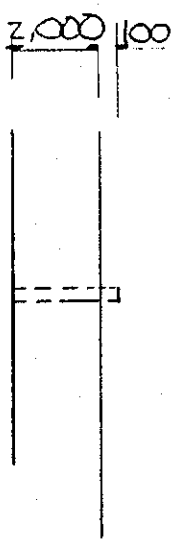


Working Division:

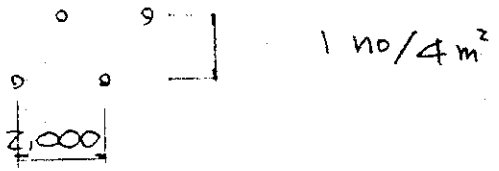
Description	Calculation Details	Unit	Quantity	Remarks
131	Contact grouting, for penstock pipe			for one lane
	the place where the pipes are installed horizontally at EL 46.0			D=1.0m ℓ=10.571m
	$V = 0.03 \times (0.524 \times 10.571 + \frac{0.524+0.785}{2} \times 2.0$			
	$+ 0.785 \times 6.0 + \frac{0.785+1.047}{2} \times 2.0$			D=1.0m ~ 1.5m ℓ= 2.0m
	$+ 1.047 \times 5.5) \times 2$			
	$= 1.15\ m^3$			D=1.5m ℓ= 6.0m
				D=1.5~2.0m ℓ= 2.0m
				
				D=2.0m ℓ= 5.5m

901-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
132	P.V.C pipes, 75mm dia., for weep holes in wing wall, including sand and gravel			
	right wing wall 64 nos (number is refered to dwg.)			
	left wing wall 52 nos			
	2.1 x (64 + 52) = 243.6m			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
133	P.V.C pipes 50mm dia for weep holes in shotcrete protection, including sand and gravel			 1 no/4 m²
	- Projected Area of shotcrete on slope			
	Inlet channel			
	Sec. Line (m) Mean (m) Dis (m) Area (m²)			
	0 74.8			
	a 46.4+28.4=74.8 74.8 3.5 262			
	b 14+16=30 52.4 10.0 524			
	c 6+9=15 22.5 10.0 225			
	o' 0 7.5 10.0 75			
	sub total 1,086m²			
	around P/S			
	El 70~92.5			
	A= 22.5 × 253.5 = 5,704 m²			
	El 92.5~94.5			
	A= 2.0 × 31.97 = 64			
	El 92.5~100			
	A= 7.5 × 13.5 = 101			
	El 94.5~100			
	A= 5.5 × 8.5 = 47			
	sub total 5,916 m²			
	Projected Area 7,002 m²			

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Working Division:

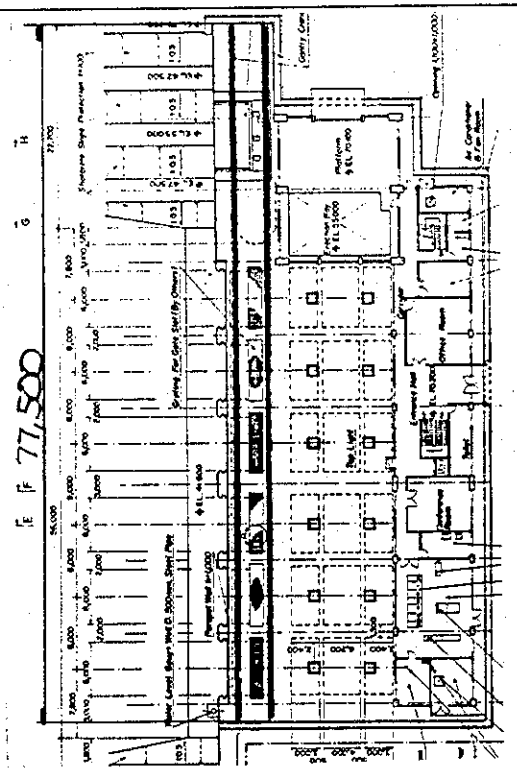
Description	Calculation Details	Unit	Quantity	Remarks
	length = 7,002/4 × 0.2 = 350 m			
134	P.V.C pipe, 100 mm dia., for drain			
	El 65 19 nos l = 0.5 m			
	60 " l = 0.5 m			
	55 " l = 0.5 m			
	50 " l = 1.0 m			
	crane rail 14 nos l = 1.5 m			
	19 × (0.5 × 3 + 1.0) + 14 × 1.5			
	= 68.5 m			

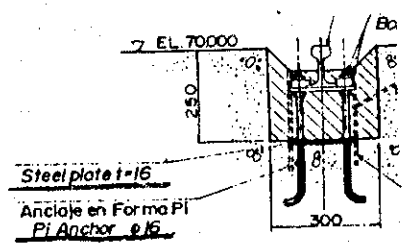
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
2.4	Road Work			
101	Asphaltic concrete surface course around pumping station at EL 700 m			
	Area to be covered is shown on dwg.			
	$A = 108 \times 49.5 + \frac{1}{2} \times 17 \times 10 - 29 \times 59$			
	$- 8 \times 21.5 - 5.5 \times 9 - 135.5 \times 0.8$			
	$- 197.428 \times 1.3 = 3,140\ m^2$			
	$t = 50$			
	$V = 3,140 \times 0.05 =$ 157	m^3		
102	Asphalt stabilized subbase course			
	$V = 3,140 \times 0.05 =$ 157	m^3		
103	Prime coat			
	$V = 1$ lit/m^2 $V = 3,140$	lit		
104	Tack coat			
	$V = 1.5$ lit/m^2			
	$V = 1.5 \times 3,140 = 4,710$	lit		

Working Division:

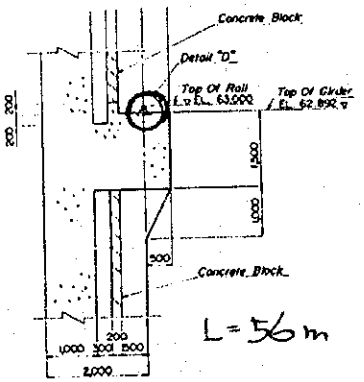
Description	Calculation Details	Unit	Quantity	Remarks
2.5	Miscellaneous Metal Works			
101	Embedded metal			
-	Anchor bar (Pi anchor)			
	L=77.5 m			
	no. of set = 77.5/0.75 = 103 sets			
	D.16 l=0.4×2=0.8m w=1.578kg/m			
	W=0.8×1.578 = 1.262kg/set			
	W=1.262 × 103 × 2 × 2 = 520kg			
-	Anchor plate for gantry crane rail			
	t=16 250×150			
	w=0.016×0.25×0.15×7,850kg/m³			
	=4.71kg/set			
	W=4.71×103×2 = 970.	kg		

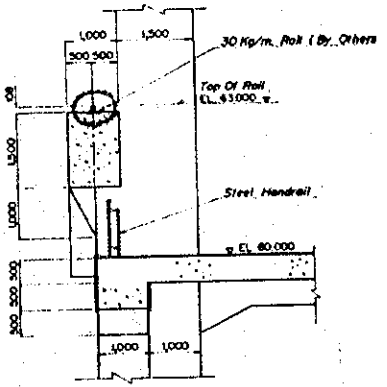


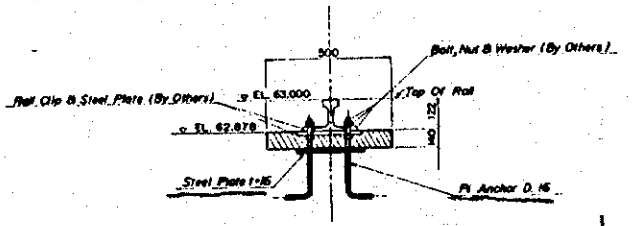


Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	Anchor bar for overhead crane			
	no. of set = 56/0.75 = 75 sets			
	π-anchor D.16 w = 1.578 kg/m			
	W = 1.578 kg/m × 0.40 × 6 = 3.787 kg/set			
	W = 3.787 kg/set × 75 × 2 = 568 kg			
–	Anchor plate for overhead crane rail			
	t = 16 250×200			
	W = 0.016 × 0.25 × 0.20 × 7,850 kg/m³ = 6.28 kg/set			
	W = 6.28 × 75 × 2 = 942 kg			

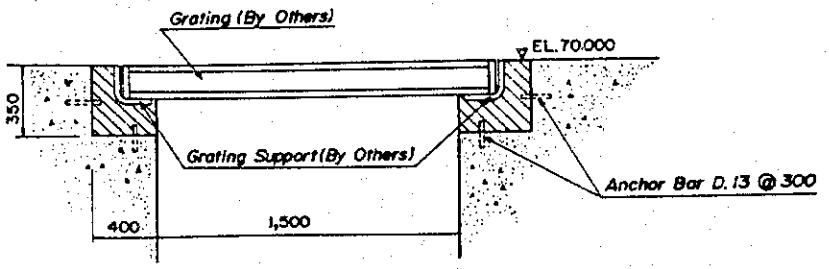


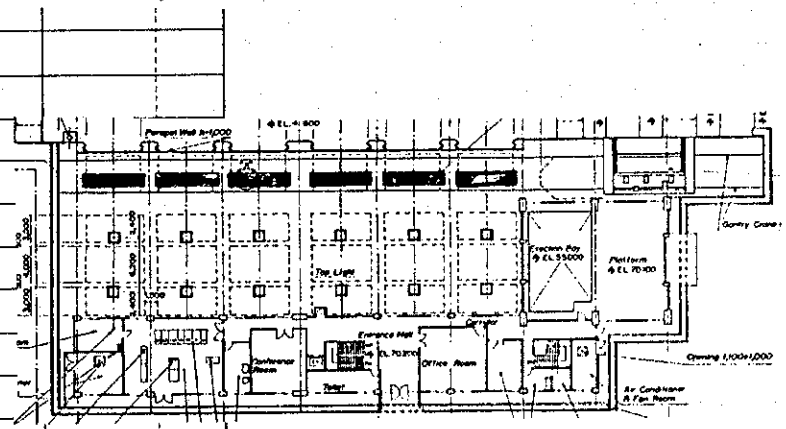




Working Division:

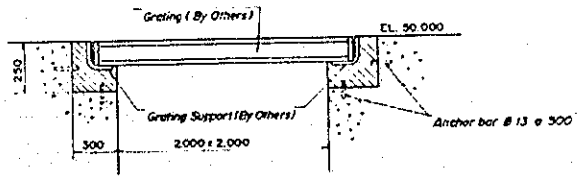
Description	Calculation Details	Unit	Quantity	Remarks
–	Anchor bar for gate slot hole			
	No. = (1.62 + 6.92) × 2 × $\frac{1}{0.5}$ = 34			
	W = 0.995 kg/m × 0.13 × 34 × 6 = 26 kg			

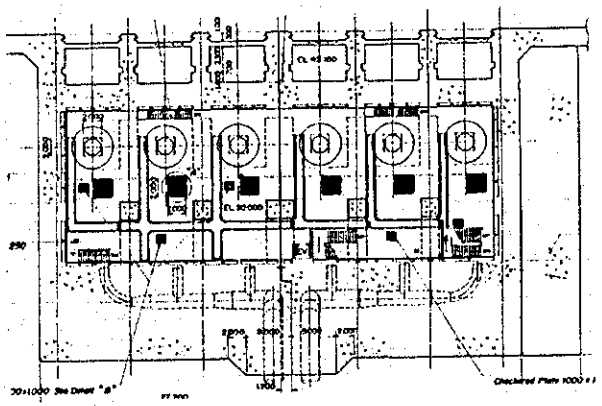




Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	Anchor bar for valve room			
	No. = (2.0+2.0)×2 × 1/0.5 = 16 nos.			
	W = 0.995 kg/m × 0.13 m × 16 × 6			
	= 12kg			



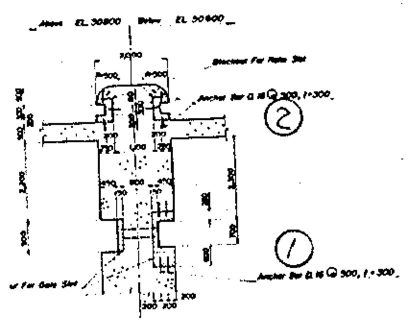


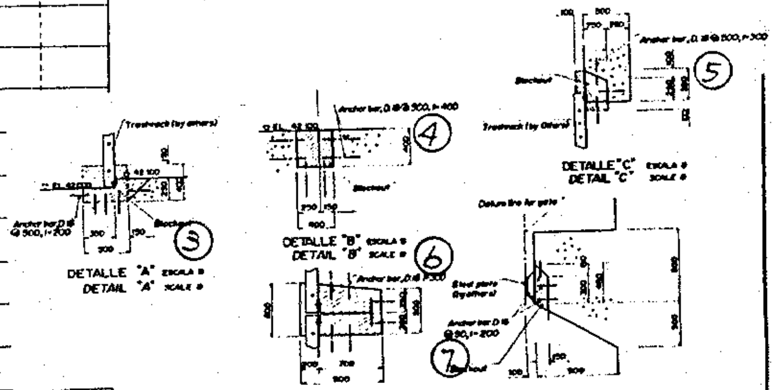
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	Drain ditch grating support			
	W = 5.37 kg/m Type I l = 135.5 m			
	W = 135.5 × 5.37 = 728 kg			

Working Division:

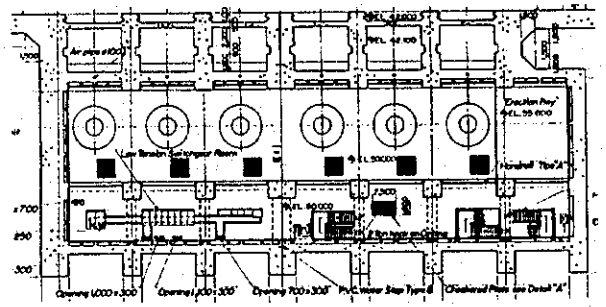
Description	Calculation Details	Unit	Quantity	Remarks
-	Anchor bar for gate			
①	Nos. (70-50.6)/0.5 = 39 nos			
	(50.6-42.1)/0.5 = 17 nos			
	W = 1.56 kg/m × 0.5 × (39×2+17×6)			
	× 12 = 1,685 kg			
②	Nos. (70-42.1)/0.50 = 56 nos			
	W = 1.56 kg/m × 0.3 × 56 × 3×12			
	= 943 kg			
③	Nos. 6.0/0.5 × 6 = 72			
	W = 1.56×0.2×5×72 = 112 kg			
④	72 nos.			
	W = 1.56×0.4×6×72 = 270 kg			
⑤	W = 1.56×0.3×3×72 = 101 kg			
⑥	W = 1.56×0.3×4×2×6 = 22 kg			
⑦	W = 1.56×0.2× 3×72 = 67 kg			
	sub total 3,200 kg			

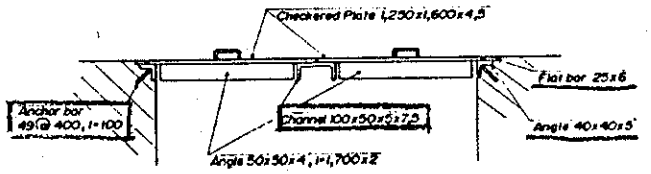




Working Division:

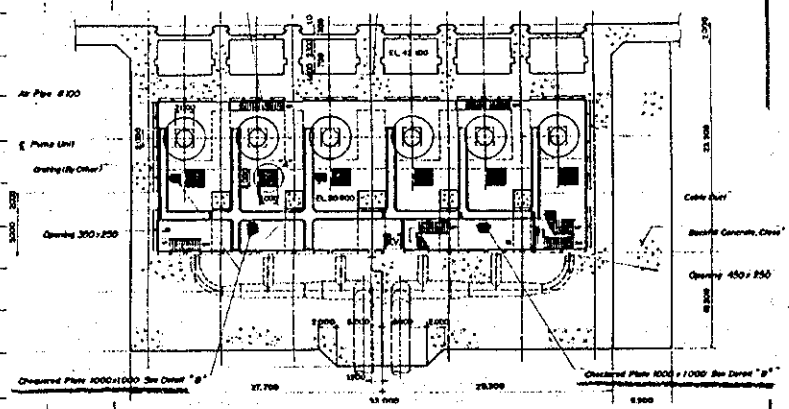
Description	Calculation Details	Unit	Quantity	Remarks
-	Anchor bar for checkered plate El. 60.			
	$\phi 9$ $w = 0.499$ kg/m			
	No. = (2.5+1.6)/0.4×2 = 21.			
	W = 21×0.1×0.499 = 1.0kg			
-	Channel for checkered plate El. 60			
	[100×50×5×7.5 $w = 9.36$ kg/m			
	W = 1.6×9.36 = 15.0kg			
-	Flat bar for checkered plate El. 60			
	25×6			
	W = 0.025×0.006×(2.5+1.6)×2×7.850			
	= 9.7kg			
-	Angle for checkered plate El. 60			
	⌜ 40×40×5			
	W = (0.04+0.04)×0.005×(2.5+1.6)×2			
	×7.850 = 25.7kg			
	Sub total			
	51	kg		

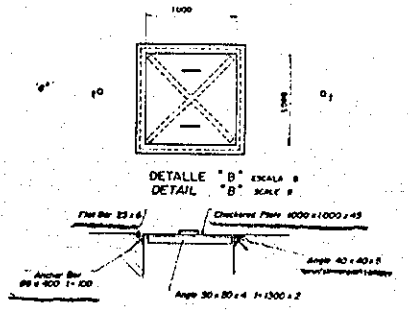




Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for checkered plate Fl.50			
	5 nos			
①	Anchor bar φ9			
	no. = (1.0+1.0)/0.4×2 = 10 nos			
	W = 10×0.1×0.499 = 0.5kg			
②	Flat bar			
	W = 0.025×0.006×(1.0+1.0)×2×7,850			
	= 4.7kg			
③	Angle			
	W = (0.04+0.04)×0.005×(1.0+1.0)×2			
	×7,850 = 12.6kg			
	17.8kg			
	17.8×5 =			
	sub total 89	kg		





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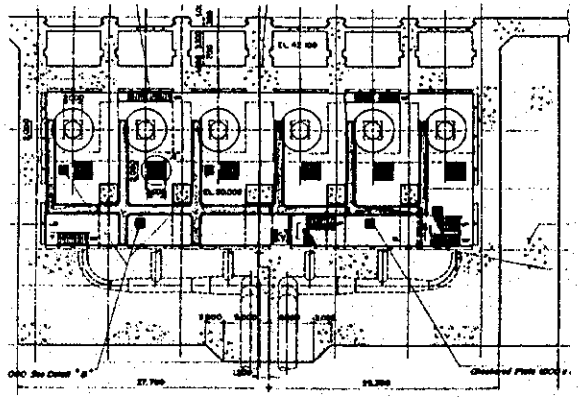
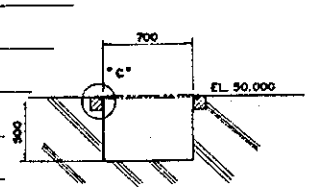
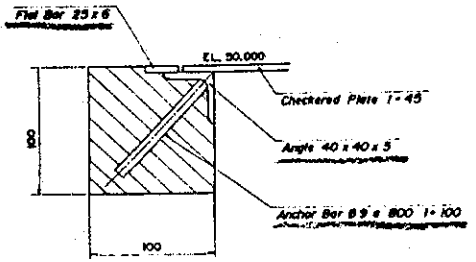
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for checkered plate of cable duct			
①	Anchor bar			
	nos. 102.2×2/0.8 = 256 nos.			
	W = 256×0.1×0.499 = 12.8 kg			
②	Flat bar			
	W = 0.025×0.006×102.2×2×7,850			
	= 240.7 kg			
③	Angle			
	W = (0.04+0.04)×0.005×102.2×2			
	×7,850 = 641.8 kg			
	sub total 895	kg		

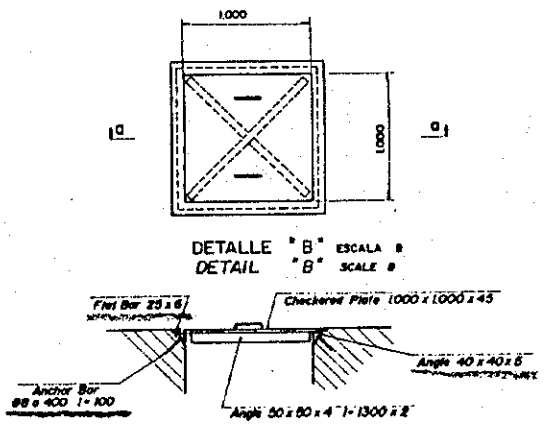


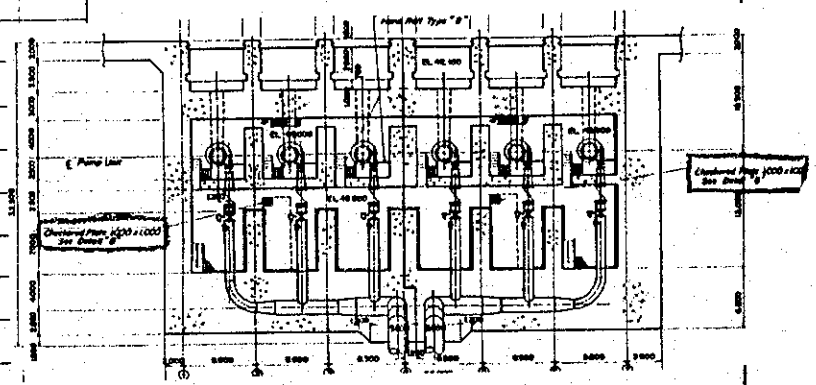




Working Division:

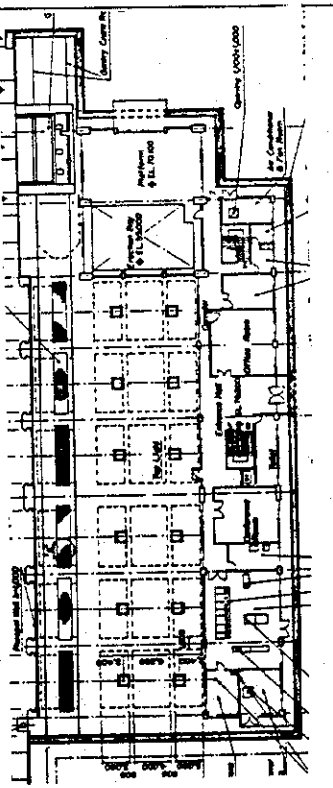
Description	Calculation Details	Unit	Quantity	Remarks
-	for checkered plate of sump pit 2 nos.			
①	Anchor bar 10 nos W = 10×0.1×0.499 = 0.5kg			
②	Flat bar W = 0.025×0.006×(1.0+1.0)×2×7.850 = 4.7kg			
③	Angle W = (0.04+0.04)×0.005×(1.0+1.0)×2 ×7.850 = 12.6kg			
	17.8kg			
	17.8×2= 36 kg			
	Embedded metal total 7.965kg			

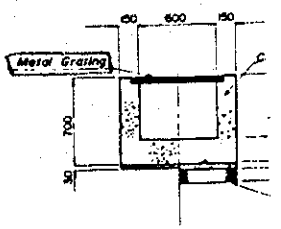




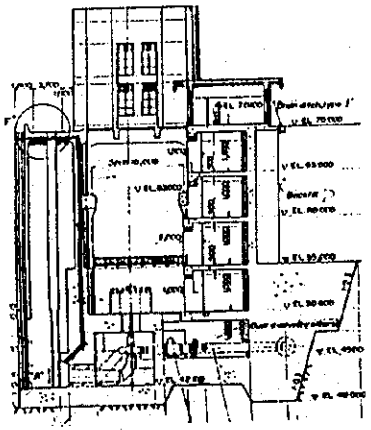
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
102	Steel grating, for drain ditch			
	around P/s 700×50			
	W = 70 kg/m² × 0.7 × 135.5 = 6,640 kg			





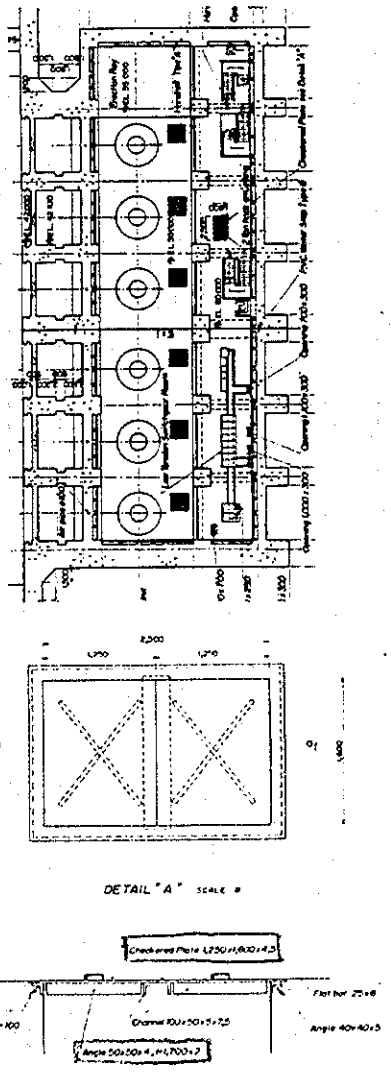
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
103	Steel pipe, 100mm dia., for air pipe			
	6 nos. l=23m/no.			
	L = 6×23 = 138m			
	w = 12.2 kg/m			
	W = 12.2 ×138 = 1,683.6 kg			

1-1-122

Working Division:

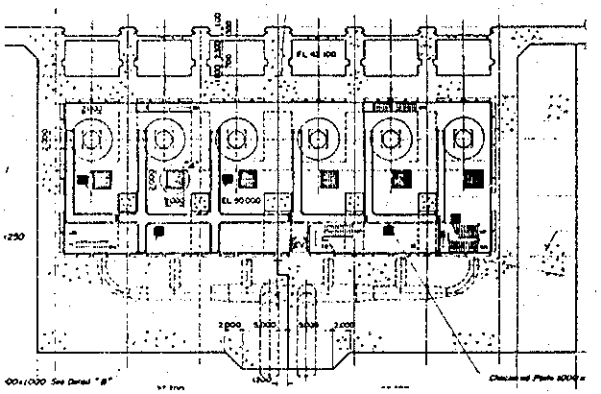
Description	Calculation Details	Unit	Quantity	Remarks
104	checkered plate			
-	at El. 60. 1.25×1.6 2 nos.			
	t = 4.5 mm			
	checkered plate			
	1.25×1.6×0.0045×7,850 kg/m³×2			
	= 141.3 kg			
	Angle			
	(0.05+0.05)×0.004×1.7×2×7.850×2			
	= 21.4 kg			
	sub total			
	163	kg		

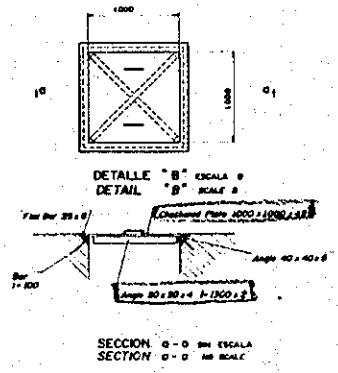


1-1-23

Working Division:

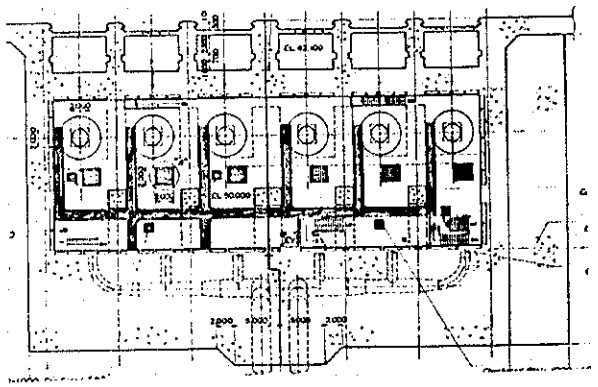
Description	Calculation Details	Unit	Quantity	Remarks
-	El. 50 1.0×1.0 5 nos. t = 4.5 mm			
	checkered plate 1.0×1.0×0.0045×7,850 kg/m³×5 = 176.6 kg			
	Angle (0.05+0.05)×0.004×1.3×2×7,850×5 = 40.8 kg			
	subtotal 217 kg			

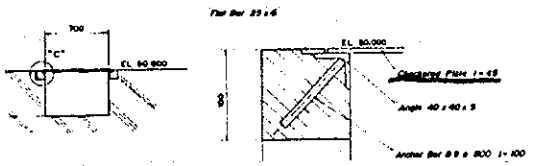




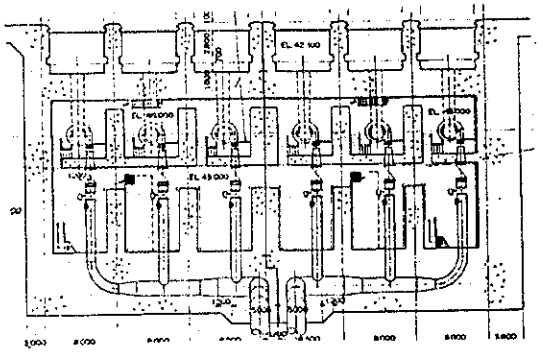
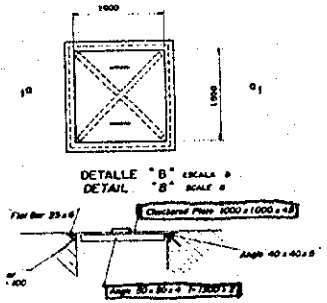
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	cable Duct			
	length 9.0×6+41.6+3.3×2			
	= 102.2 m			
	width 700			
	thickness 4.5			
	W = 0.7×102.2×0.0045×7,850 kg/m³			
	= 2,527	kg		



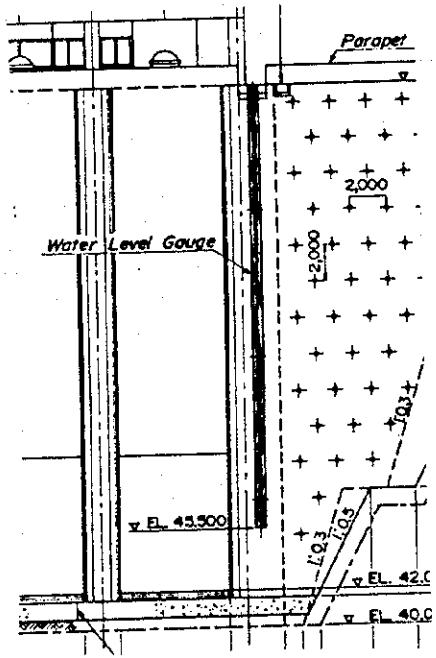


Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for sump pit			
	1.0×1.0 2 nos			
	t=4.5 mm			
	checkered plate			
	1.0×1.0×0.0045×7,850×2			
	= 70.7 kg			
	Angle			
	(0.05+0.05)×0.004×1.3×2×7,850×2			
	= 16.3 kg			
	Sub total 87	kg		
	checkered plate Total			
	163 + 217 + 2,527 + 87			
	= 2,994 kg			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
105	Steel pipes for water level gauge			
	ϕ 500 mm ℓ = 24.5m			
	w = 74.3 kg/m			
	W = 74.3 × 24.5 × 1.005 = 1,830 kg			



Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
106	Wire net fence with gate			see drawing
	l = 14m + 10m = 24m			
	w = 13 kg/m			
	W = 13 x 24 = 312 = 320kg			

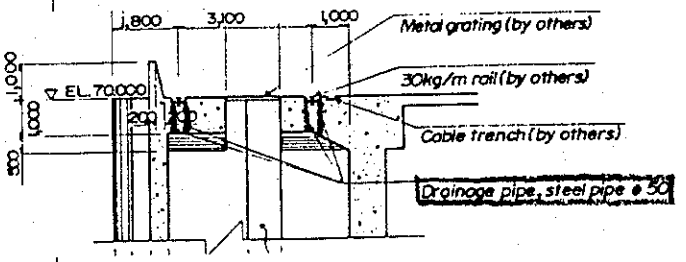
1-1-28

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
107	Round bar, for step ladder			see drawing
	in sump pit 8nos./pit			
	ϕ22 round bar			
	$l = (0.18+0.15)\times 2 + 0.4 + 0.05\times 2\times 2$			
	$= 1.26$ m			
	$L = 1.26\times 8\times 2 = 20.16$ m			
	ϕ22mm $w = 2.98$ kg/m			
	$W = 20.16\times 2.98 =$ 60 kg			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
108	Steel pipes, 50 mm diameter, for drainage of gantry crane rail			
	$l = 0.9 \times 4 \times 6 = 21.6$ m			
	$W = 5.31$ kg/m			
	$W = 5.31 \times 21.6 = 114.70 = 115$ kg			



1-1-30

Working Division: 5. SEVERINO SUBSTATION

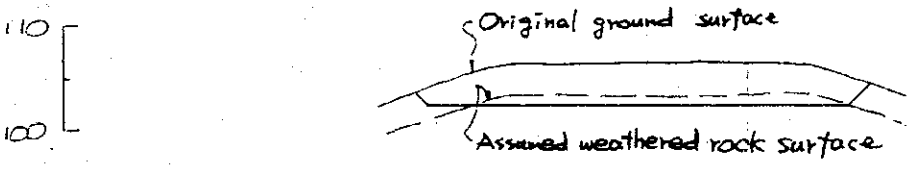
Description	Calculation Details	Unit	Quantity	Remarks
5.1	EARTHWORK			
101	Clearing the switchyard site			
	2,603	m^2		
102	Open-cut excavation, in common, for switchyard			
	6,751	m^3		
103	Open-cut excavation, in weathered rock, for switchyard			
	2,043	m^3		
110	Sod facing, for cut slope protection			
	214 + 176 + 112 = 502 m^2 502	m^2		

Substation (Switchyard) Earth Work

		Site Clearance		Excavation, common		Excavation, w. rock		Sod Facing	
Sec. No.	Distance (m)	L (m)	A (m2)	A (m2)	V (m3)	A (m2)	V (m3)	L (m)	A (m2)
0		0.0		0.0		0.0		0.0	
1	5.00	55.0	137.5	115.0	287.5	35.0	87.5	4.9	
2	11.00	44.5	547.3	110.0	1,237.5	45.0	440.0	4.7	52.8
3	25.50	33.0	988.1	95.0	2,613.8	30.0	956.3	2.3	89.3
4	25.50	34.5	860.6	95.0	2,422.5	12.0	535.5	3.3	71.4
5	4.00	0.0	69.0	0.0	190.0	0.0	24.0	0.0	
Total of 2			2,603		6,751		2,043		214

2-1-1-1

Sec. 1

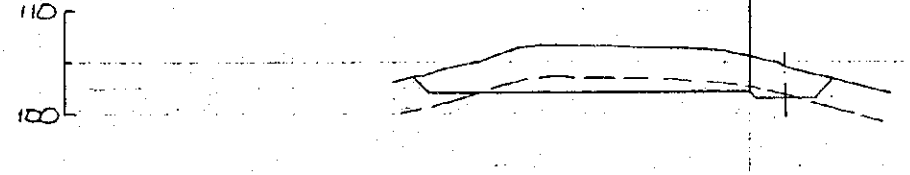


CR	55 m
EX	115 m²
EWR	35 m²
SF	4.9 m

Sec. 2

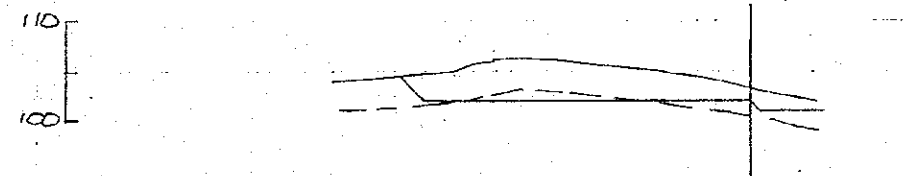
CR	44.5 m
Ex C	110 m²
Ex WR	45 m²
SF	4.7 m

Sec. 3



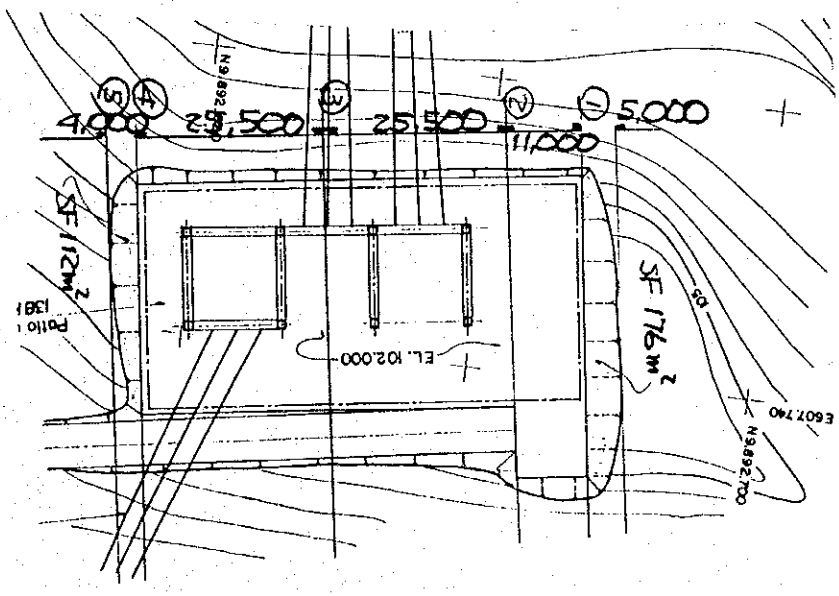
CR	33 m
EXC	95 m²
EX WR	30 m²
SF	2.3 m

Sec. 4

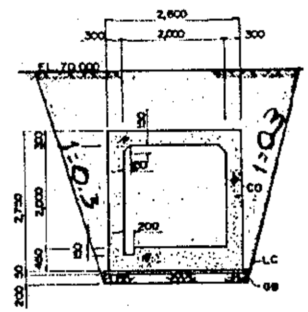


CR	34.5
EXC	95 m²
EX WR	12 m²
SF	3.3 m

CR: Clearing
EXC: Excavation, common
EXWR: Excavation, weathered rock
SF : Sod facing



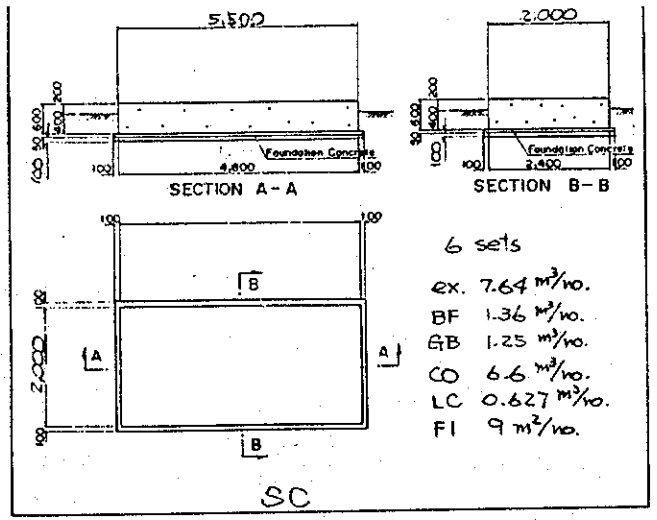
Working Division:

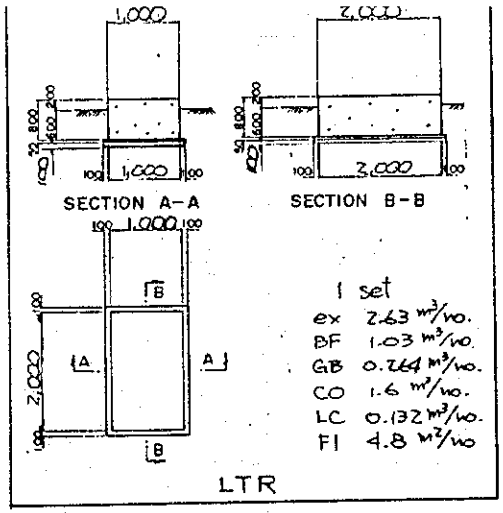
Description	Calculation Details	Unit	Quantity	Remarks
104	open-cut excavation, in common,			
	for cable culvert			
	Length = 22.8 m $\quad A = 16.5\ m^3/m$			
	$V = 22.8 \times 16.5 = 376\ m^3$			

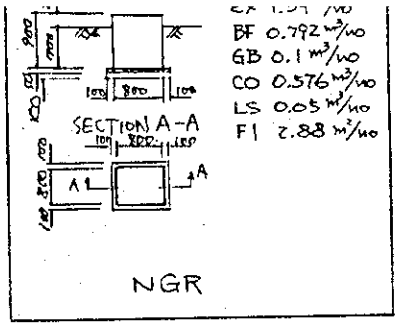
Working Division:

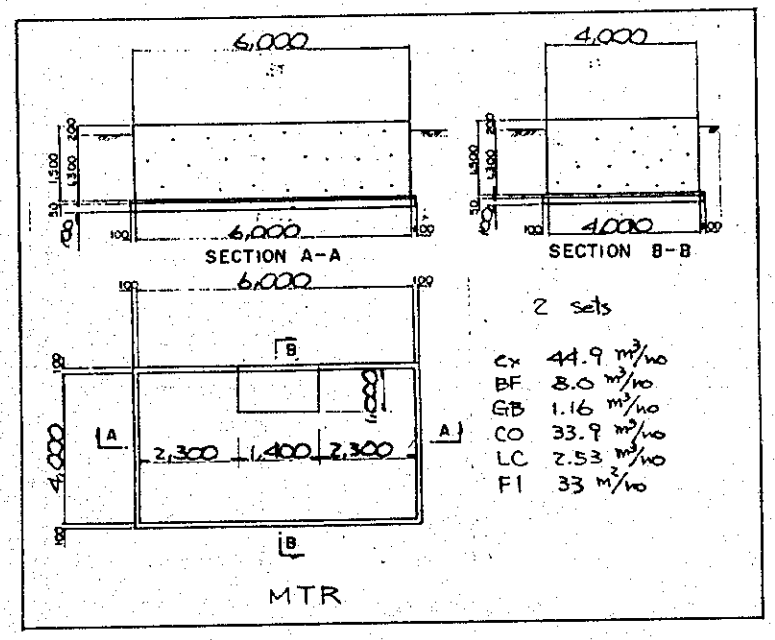
Description	Calculation Details	Unit	Quantity	Remarks
105	Trench excavation, all classes, for foundation of equipment			see figures in the following pages
	SC 6 sets × 7.64 m³/set = 45.84	m³		
	LTR 1 set × 2.63 m³/set = 2.63			
	NGR 1 set × 1.39 m³/set = 1.39			
	MTR 2 sets × 44.9 m³/set = 89.8			
	LA 12 sets × 2.38 m³/set = 28.56			
	CT 6 sets × 2.38 m³/set = 14.28			
	SI 3 sets × 2.38 m³/set = 7.14			
	CCPD 2 sets × 1.85 m³/set = 3.70			
	CPD 4 sets × 1.85 m³/set = 7.40			
	CH 4 sets × 1.15 m³/set = 4.60			
	TB 1 set × 1.11 m³/set = 1.11			
	DS 21 nos. × 4.92 m³/no. = 103.32			
	CB 4 sets × 6.89 m³/no. = 27.56			
	P1 7 sets × 85.8 m³/no. = 600.6			
	P2 5 sets × 62.3 m³/set = 311.5			
	13.8kV CUB 1 set × 7.72 m³/set = 7.72			
	Total 1,257.15			
	= 1,257 m³			

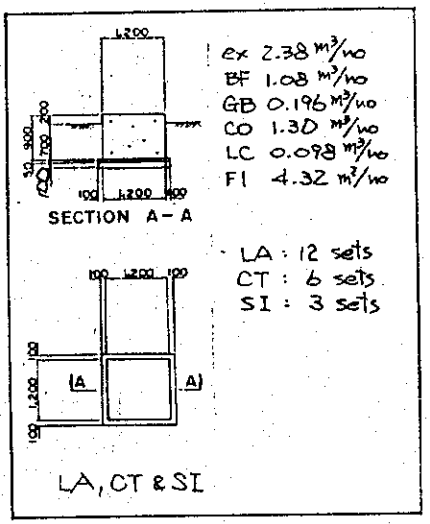
1-1-124

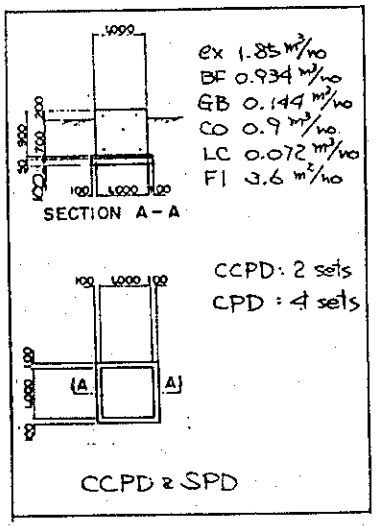


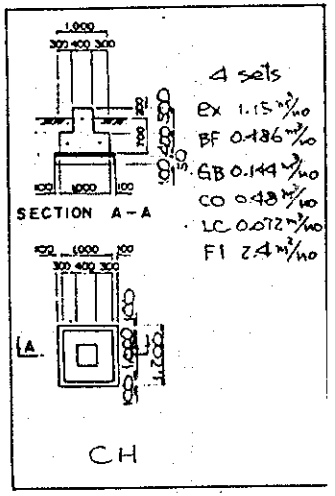




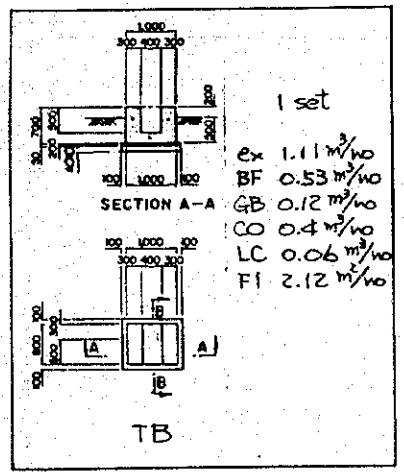






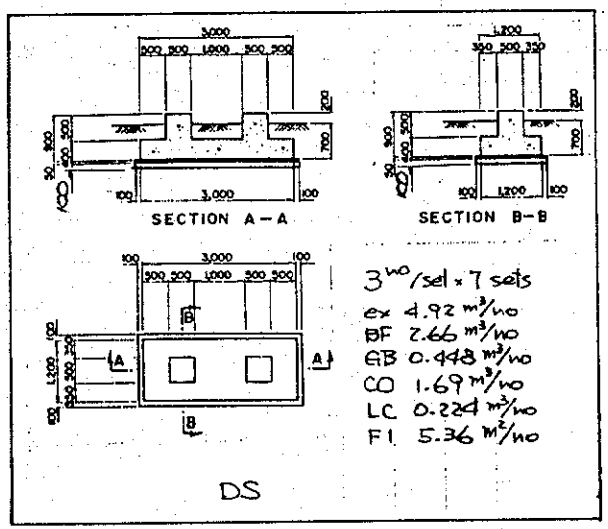


ex: trench excavation
BF: Backfill
GB: Gravel bedding
CO: Concrete, class E
LC: Leveling concrete, class H
FI: Form, FI finish



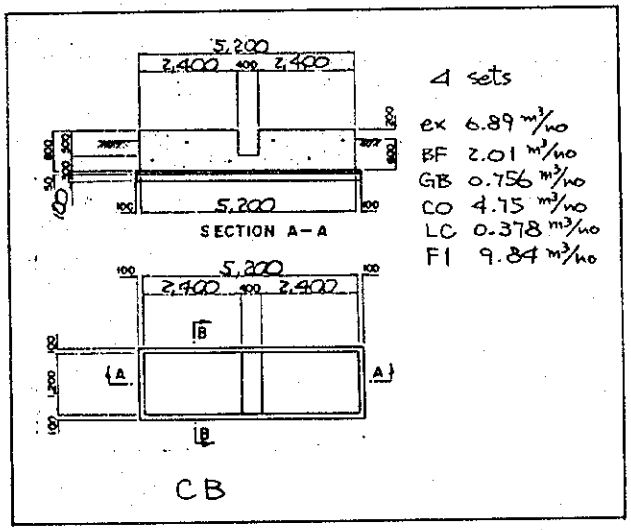
1 set

ex 1.11 m³/no
BF 0.53 m³/no
GB 0.12 m³/no
CO 0.4 m³/no
LC 0.06 m³/no
F1 2.12 m²/no



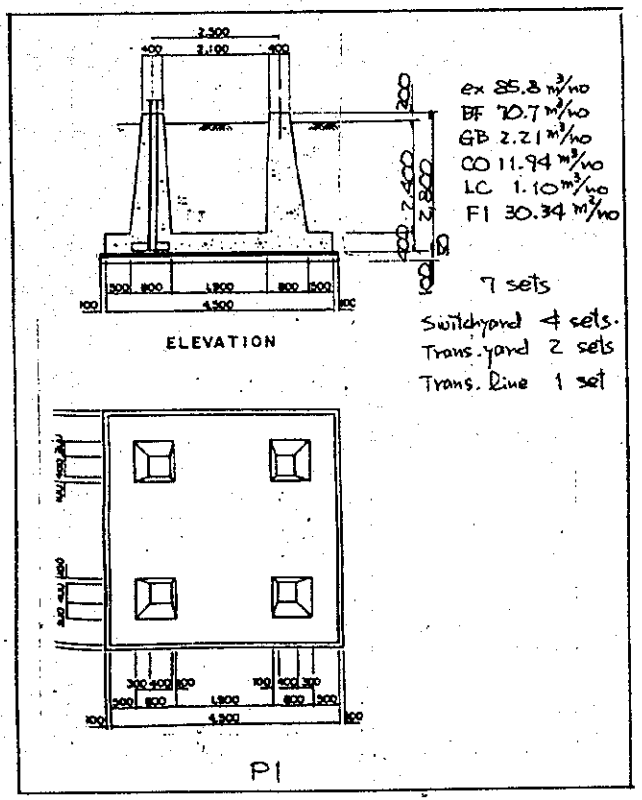
3 no/set × 7 sets

ex 4.92 m³/no
BF 2.66 m³/no
GB 0.448 m³/no
CO 1.69 m³/no
LC 0.224 m³/no
F1 5.36 m²/no



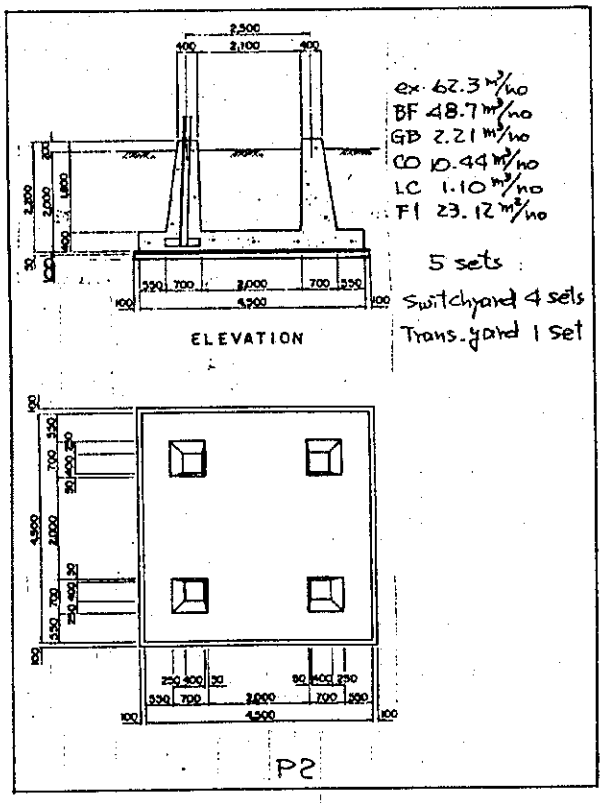
4 sets

ex 6.89 m³/no
BF 2.01 m³/no
GB 0.756 m³/no
CO 4.75 m³/no
LC 0.378 m³/no
F1 9.84 m³/no



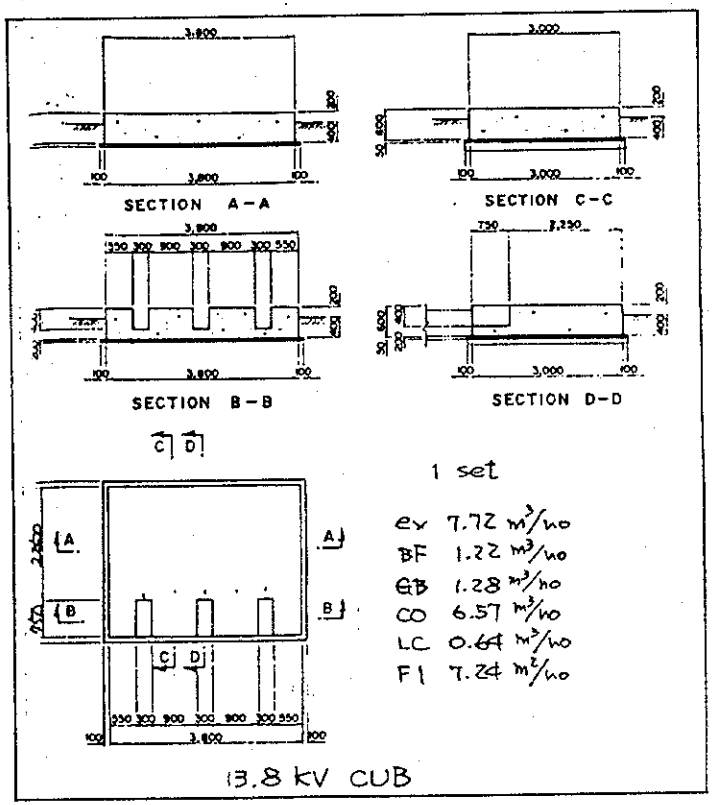
ex 85.8 m³/no
BF 70.7 m³/no
GB 2.21 m³/no
CO 11.94 m³/no
LC 1.10 m³/no
F1 30.34 m²/no

7 sets
Switchyard 4 sets
Trans. yard 2 sets
Trans. line 1 set



ex 62.3 m³/no
BF 48.7 m³/no
GB 2.21 m³/no
CO 10.44 m³/no
LC 1.10 m³/no
F1 23.12 m²/no

5 sets
Switchyard 4 sets
Trans. yard 1 set



1 set

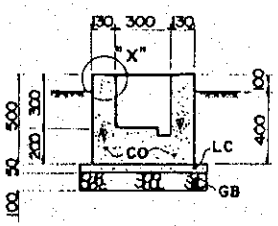
ex 7.72 m³/no
BF 1.22 m³/no
GB 1.28 m³/no
CO 6.57 m³/no
LC 0.64 m³/no
F1 7.24 m²/no

Working Division:

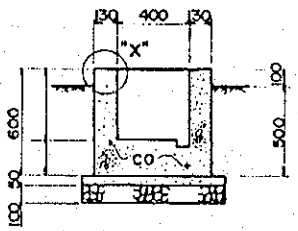
Description	Calculation Details	Unit	Quantity	Remarks
106	Trench excavation, all classes,			
	for cable duct, drain ditch,			
	catch basin and foundation of wire			
	net fence			
-	for cable duct			
①	Switchyard			see next page
	Type A $l = 43$ m 0.508 m^3/m			
	43 × 0.508 = 21.84 m^3			
	Type B $l = 61$ m 0.528 m^3/m			
	61 × 0.528 = 32.21 m^3			
	54.05	m^3		
②	Transformer Yard			
	Type A $l = 16$ m 0.508 m^3/m			
	16 × 0.508 = 8.13 m^3			
	Type B $l = 40$ m 0.528 m^3/m			
	40 × 0.528 = 21.12 m^3			
	Type C $l = 114$ m 1.165 m^3/m			
	114 × 1.165 = 132.81 m^3			
	Type D $l = 16.5$ m 2.01 m^3/m			
	16.5 × 2.01 = 33.17 m^3			
	195.23	m^3		
	sub total 249	m^3		

ex 0.508 m³/m
BF 0.17 m³/m
GB 0.076 m³/m
CO 0.19 m³/m
LC 0.038 m³/m
F1 1.0 m²/m
F2 0.6 m²/m

Length
Switchyard 43m
Trans. yard 16m



TYPE A



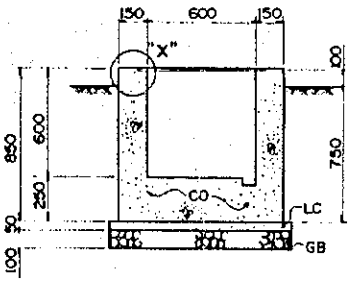
TYPE B

ex 0.528 m³/m
BF 0.069 m³/m
GB 0.086 m³/m
CO 0.236 m³/m
LC 0.043 m³/m
F1 1.2 m²/m
F2 0.8 m²/m

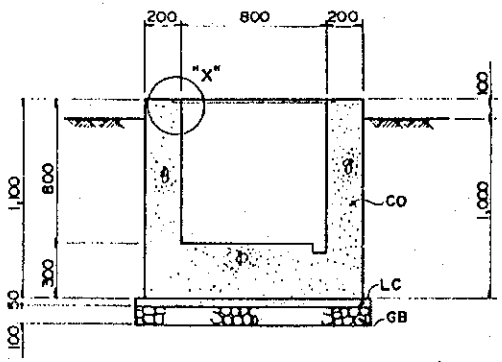
Length
Switchyard 61m
Trans. yard 40m

ex 1.165 m³/m
BF 0.325 m³/m
GB 0.11 m³/m
CO 0.405 m³/m
LC 0.055 m³/m
F1 1.7 m²/m
F2 1.2 m²/m

Length
Trans. yard 114m



TYPE C



TYPE D

ex 2.01 m³/m
BF 0.6 m³/m
GB 0.14 m³/m
CO 0.68 m³/m
LC 0.07 m³/m
F1 2.2 m²/m
F2 1.6 m²/m

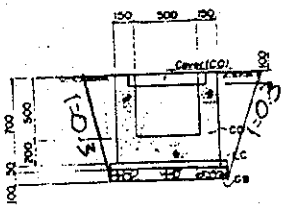
Length
Trans. yard 16.5m

CABLE DUCT SCALE A

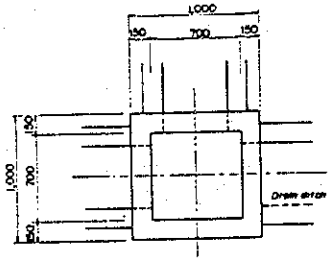
ex: trench excavation
BF: Backfill
GB: Gravel bedding
CO: Concrete, class F
LC: leveling concrete, class H
F1: Form, F1 finish
F2: Form, F2 finish

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for drain ditch			
	Switchyard			
	l = 218 m 0.897 m^3/m			
	V = 218 × 0.897 = 196 m^3			
-	for catch basin			
	Switchyard			
	3 nos. 2.9 m^3/no.			
	V = 3 × 2.9 = 8.7 = 9 m^3			
-	for foundation of wire net fence			
①	Switchyard l = 180 m			
	no. of foundation = $1 + {}^{180}/_{2}$ = 91 nos			
	$V = \frac{0.25^2+0.55^2}{2} \times 0.5 \times 91$ = 8.30 m^3			
②	Transformer Yard l = 122 + 44 = 166 m			
	no. of foundation = $1 + {}^{166}/_{2}$ = 84 nos.			
	$V = \frac{0.25^2+0.55^2}{2} \times 0.5 \times 84$ = 7.67 m^3			
	sub total 16 m^3			
	Total 249 + 196 + 9 + 16 = 470 m^3			



DRAIN DITCH



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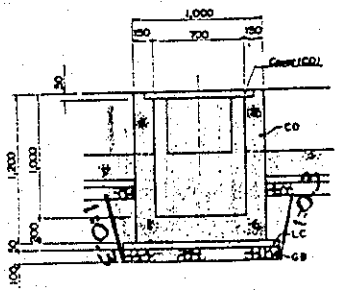
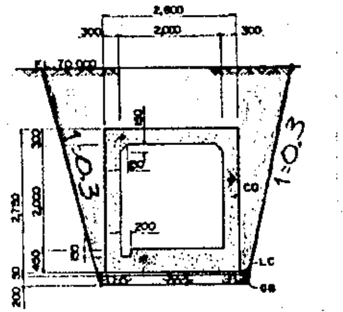


SECTION

CATCH BASIN

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
107	Backfiel			
-	for cable culvert			
	8.65 m^3/m $l = 22.8$ m			
	$V = 8.65 \times 22.8$ = 197 m^3			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	for foundation of equipment			
				see figure of Item 105
--	SC 6 sets × 1.36 m³/set = 8.16 m³			
	LTR 1 set × 1.03 m³/set = 1.03 m³			
	NGR 1 set × 0.792 m³/set = 0.79 m³			
	MTR 2 sets × 8.0 m³/set = 16.0 m³			
	LA 12 sets × 1.08 m³/set = 12.96 m³			
	CT 6 sets × 1.08 m³/set = 6.48 m³			
	SI 3 sets × 1.08 m³/set = 3.24 m³			
	CCPD 2 sets × 0.934 m³/set = 1.87 m³			
	CPD 4 sets × 0.934 m³/set = 3.74 m³			
	CH 4 sets × 0.486 m³/set = 1.94 m³			
	TB 1 set × 0.53 m³/set = 0.53 m³			
	DS 21 nos. × 2.66 m³/no. = 55.9 m³			
	CB 4 sets × 2.01 m³/set = 8.04 m³			
	P1 7 sets × 70.7 m³/set = 494.9 m³			
	P2 5 sets × 48.7 m³/set = 243.5 "			
	13.8kV CUB 1 set × 1.22 m³/set = 1.22			
	Sub Total 860 m³			

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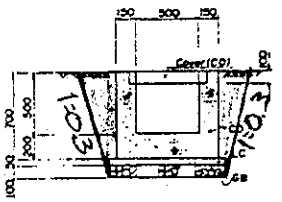
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for cable duct			see figure of Item 106
①	Switchyard			
	Type A $\ell = 43$ m			
	$43 \times 0.17\ m^3/m = 7.31\ m^3$			
	Type B $\ell = 61$ m			
	$61 \times 0.069\ m^3/m = 4.21\ m^3$			
	11.52	m^3		
②	Transformer Yard			
	Type A $\ell = 16$ m			
	$16 \times 0.17\ m^3/m = 2.72\ m^3$			
	Type B $\ell = 40$ m			
	$40 \times 0.069\ m^3/m = 2.76\ m^3$			
	Type C $\ell = 114$ m			
	$114 \times 0.325\ m^3/m = 37.05\ m^3$			
	Type D $\ell = 16.5$ m			
	$16.5 \times 0.6\ m^3/m = 9.9\ m^3$			
	52.43	m^3		
	sub total 64	m^3		

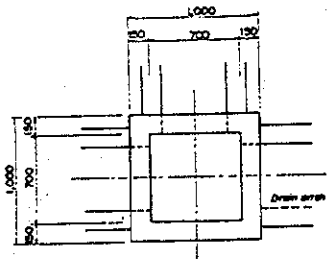
1-1-143

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	for drain ditch			
	l = 218 m , 0.21 m³/m			
	V = 218 × 0.21 = 46 m³			
-	for catch basin			
	3 nos 0.7 m³/no			
	V = 3 × 0.7 = 2.1 m³			
	Total 197 + 860 + 64 + 46 + 2			
	= 1,169 m³			



DRAIN DITCH SCALE A



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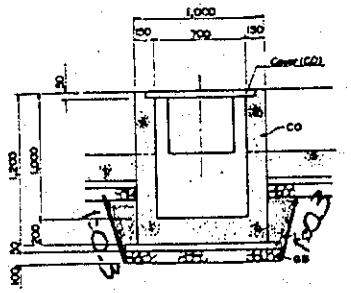
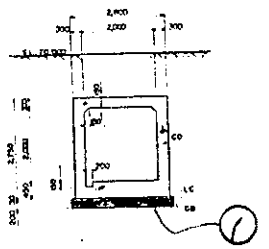


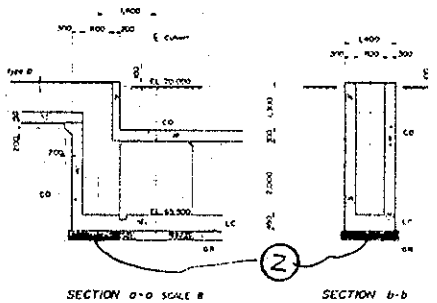
SECTION

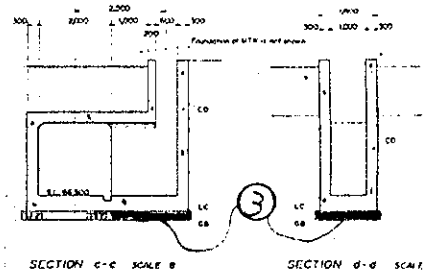
CATCH BASIN SCALE A

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
108	Gravel bedding, for cable culvert, foundation of equipment, cable duct, drain ditch and catch basin			
–	for cable culvert $\ell = 22.8$ m 0.56 m^3/m			
①	22.8×0.56 = 12.77 m^3			
②	connection to cable duct type D $1.1 \times 1.2 \times 0.2$ = 0.26 m^3			
③	connection to MTR $1.8 \times 1.8 \times 0.2 \times 2$ = 1.3 m^3			
	sub total 14 m^3			







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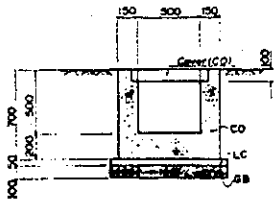
Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
–	for foundation of equipment			
..	SC 6 sets ×1.25 m³/set = 7.50 m³			see figure of Item 105
	LTR 1 set ×0.264 m³/set = 0.26 "			
	NGR 1 set ×0.1 m³/set = 0.10 "			
	MTR 2 sets ×1.16 m³/set = 2.32 "			
	LA 12 sets ×0.196 m³/set = 2.35 "			
	CT 6 sets ×0.196 m³/set = 1.18 "			
	SI 3 sets ×0.196 m³/set = 0.59 "			
	CCPD 2 sets ×0.144 m³/set = 0.29 "			
	CPD 4 sets ×0.144 m³/set = 0.58 "			
	CH 4 sets ×0.144 m³/set = 0.58 "			
	TB 1 set ×0.12 m³/set = 0.12 "			
	DS 21 nos. ×0.448 m³/no = 9.41 "			
	CB 4 sets ×0.756 m³/set = 3.02 "			
	PI 7 sets ×2.21 m³/set = 15.47 "			
	P2 5 sets ×2.21 m³/set = 11.05 "			
	13.8kv CUB 1 set ×1.28 m³/set = 1.28 "			
	sub total 56 m³			

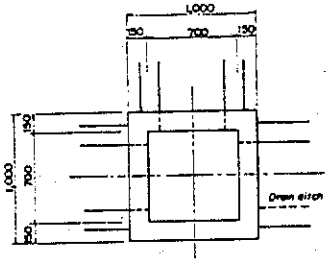
9-1-1-1

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
-	drain ditch			
	l = 218 m 0.083 m³/m			
	V = 218 × 0.083 = 18 m³			
-	for catch basin			
	3 nos. 0.05 m³/no			
	V = 3 × 0.05 = 0.2 m³			
	Total			
	14 + 56 + 28 + 18 + 0.2 = 116 m³			



DRAIN DITCH



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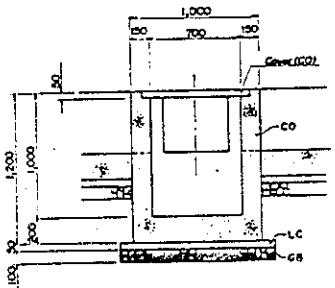

SECTION

CATCH BASIN

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
109	Gravel surfacing			
	Switchyard Area = 60×30 = 1,800 m^2			see drawing
	Transformer yard Area = 16×45 = 720 m^2			
	SC 6nos × 5.5 × 2.0 = − 66 m^2			
	LTR 1 × 1.0 × 2.0 = − 2 "			
	NGR 1 × 0.8 × 0.8 = − 0.64 "			
	MTR 2 × 4.0 × 6.0 = − 48 "			
	SI, LA, CT 21 × 1.2 × 1.2 = − 30.24 "			
	CCPD, CPD 6 × 1.0 × 1.0 = − 6 "			
	CH 4 × 0.4 × 0.4 = − 0.64 "			
	TB 1 × 1.0 × 0.8 = − 0.8 "			
	DS 21 × 0.5 × 0.5 × 2 = − 10.5 "			
	P1 6 × 0.4^2 × 4 = − 3.84 "			
	P2 5 × 0.4^2 × 4 = − 3.2 "			
	Cable duct			
	A 59 × 0.56 = − 33.04 "			
	B 101 × 0.66 = − 66.66 "			
	D 16.5 × 1.2 = − 19.8 "			
	13.8 kV 1 × 3.8 × 3.0 = − 11.4 "			
	2,217 m^2			
	t = 100 mm			
	V = 2,217 × 0.1 = 222 m^3			

Working Division:

Description	Calculation Details	Unit	Quantity	Remarks
5.2	CONCRETE WORK			
101	Concrete, class E, for foundation of equipment			see figure of earth work
"	SC 6 sets × 6.6 m³/set = 39.6m³			
	LTR 1 set × 1.6 m³/set = 1.6 "			
	NGR 1 set × 0.576 m³/set = 0.6 "			
	MTR 2 sets × 33.9 m³/set = 67.8 "			
	LA 12 sets × 1.3 m³/set = 15.6 "			
	CT 6 sets × 1.3 m³/set = 7.8 "			
	SI 3 sets × 1.3 m³/set = 3.9 "			
	CCPD 2 sets × 0.9 m³/set = 1.8 "			
	CPD 4 sets × 0.9 m³/set = 3.6 "			
	CH 4 sets × 0.48 m³/set = 1.9 "			
	TB 1 set × 0.4 m³/set = 0.4 "			
	DS 21 nos. × 1.69 m³/no = 35.5 "			
	CB 4 sets × 4.75 m³/set = 19.0 "			
	P1 7 sets × 11.94 m³/set = 83.6 "			
	P2 5 sets × 10.44 m³/set = 52.2 "			
	13.8kV CUB 1set × 6.57 m³/set = 6.6 "			
	341.5			
	= 342m³			

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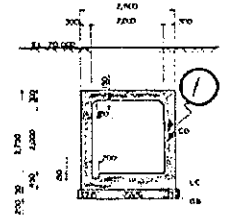
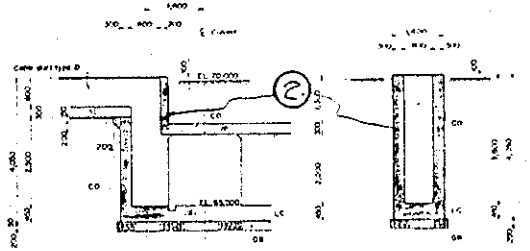
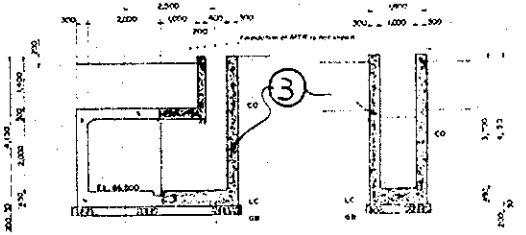
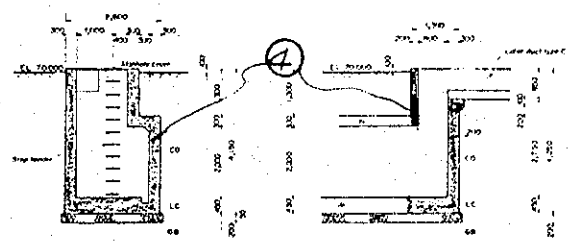
Working Division:

Description	Calculation Details			Unit	Quantity	Remarks
102	Concrete, class E, for cable culvert					
	ℓ = 22.8m					
①	22.8 × 3.2	=	72.96 m³			
②	Connection to cable duct Type D					
	− 2.0 × 0.3 × 0.8	=	−0.48 m³			
	0.3 × 3.6 × 0.8	=	0.86 "			
	0.3 × 0.8 × 2.5	=	0.60 "			
	0.45 × 1.4 × 1.1	=	0.69 "			
			1.67 m³			
③	Connection to MTR					
	−2.0 × 0.3 × 1.0	= −	0.60 m³			
	0.3 × 2.0 × 0.7 × 2	=	0.84 "			
	0.3 × 1.6 × 0.7	=	0.34 "			
	0.45 × 1.6 × 1.8	=	1.30 "			
	0.3 × 3.7 × 1.6	=	1.78 "			
	0.3 × 0.6 × 3.7 × 2	=	1.33 "			
	0.2 × 1.0 × 1.4	=	0.28			
			5.27			
		5.27 × 2	= 10.54 m³			
④	Connection to cable duct Type C					
	− 0.3 × 0.8 × 1.4	= −	0.34			
	0.3 × (1.3 × 1.4 − 0.6 × 0.6)	=	0.44			
	0.3 × 1.3 × 0.8	=	0.31			
	0.2 × 2.0 × 1.3	=	0.52			
			0.93 m³			









Working Division: _____

Description	Calculation Details	Unit	Quantity	Remarks
	Total 72.96 + 1.67 + 10.54 + 0.93			
	= 86 m^3			

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