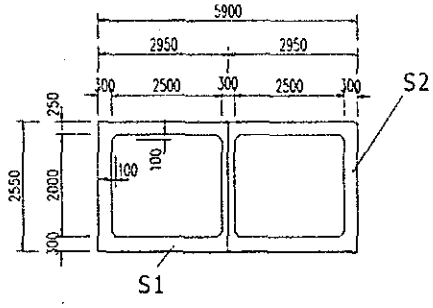
2.4. Box culvert at station 9+326

BOX CULVERT 9+326

I	BOX CULVERT STATION 9+326			QUANTITIES
	L	= 21.878 + 15.950 + 0.02 = 37.848		
1	CULVERT			
+	CONCRETE (M3)			
	S1=S2	= 2.950 x 2.550 - 2.500 x 2.000 + 2 x 0.100 x 0.100	=	2.543
	S	= S1 + S2	=	5.085
	VOLUME	= S x (21.878 + 15.950) + 5.900 x 0.200 x 0.300 x 2	=	193.06
		DOUBLE BOX CULVERT 		
+	FORM (M2)			706.09
*	INSIDE FORM (M2)			492.951
	BOX BULWARK	= (2.000 + 2 x 0.100 x (1:SIN45^0 - 1)) x 37.828 x 4	=	315.159
	BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 37.828 x 2	=	177.792
*	OUTSIDE FORM (M2)			213.138
	BOX BULWARK	= 2.550 x 2 x 37.828 + 4 x 0.300 x 0.200	=	193.163
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4	=	14.890
	CENTER	= S	=	5.085
+	SCAFFOLDING (M2)	= 2.550 x 2.000 x 37.828 + 4.000 x 0.300 x 0.200	=	193.16
+	SUPPORT			
	AREA (M2)	= 5.900 x 2.000 - S	=	6.715
	VOLUME (M3)	= AREA x L	=	254.15

BOXCULVERT STATION 9+326
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	350	1.208	1456	1759.449
2	2850	250	12	176	0.888	501.6	445.327
3	6270	250	14	176	1.208	1103.52	1333.507
4	1500	250	14	348	1.208	522	630.791
5	1550	125	18	350	1.998	542.5	1083.687
6	1970	250	12	352	0.888	693.44	615.645
7	2850	125	12	350	0.888	997.5	885.594
8	1049	250	12	352	0.888	369.248	327.823
9	1120	250	12	352	0.888	394.24	350.012
10	22383	250	12	52	0.888	1163.916	1033.340
11	22483	250	12	100	0.888	2248.3	1996.071
12	5780	250	12	2	0.888	11.56	10.263
13	1440	250	12	26	0.888	37.44	33.240
14	1180	250	12	525.072	0.888	619.58496	550.076
15	1280	250	12	525.072	0.888	672.09216	596.692

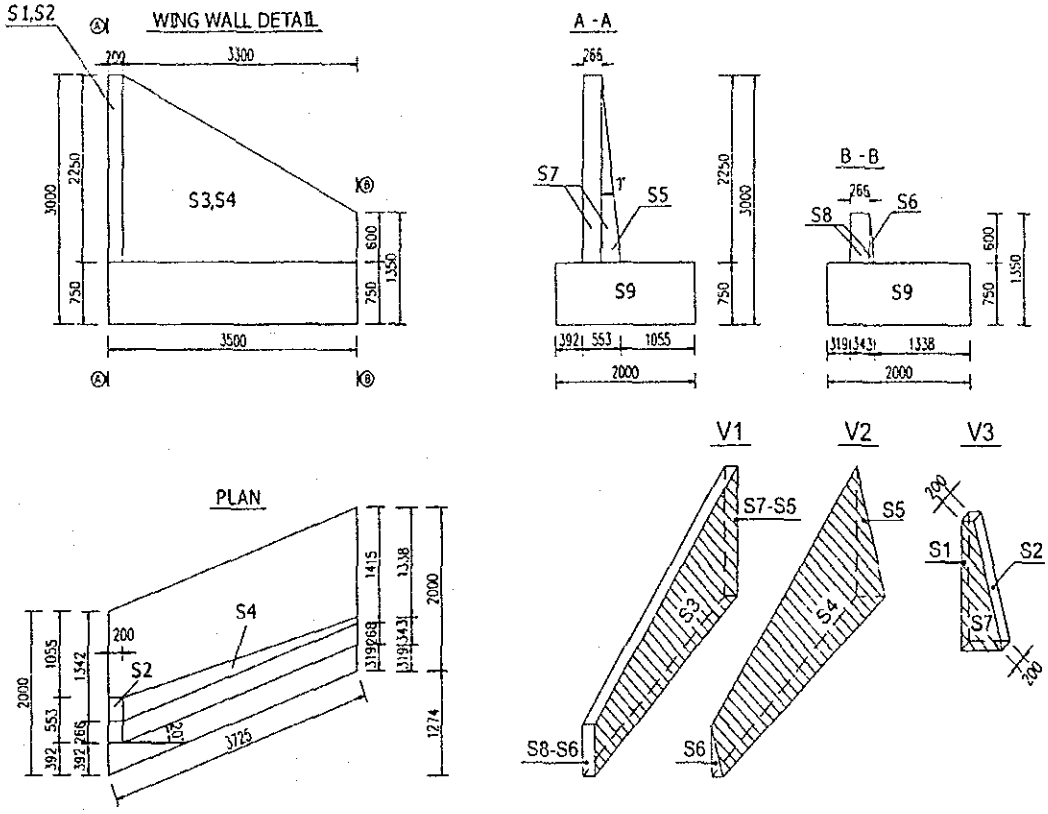
REINFORCEMENT :	D<=14	10567.8	TOTAL FOR SEGMENT 1 :
REINFORCEMENT :	16=D<=25	1083.7	REINFORCEMENT (KG): 11651.5
REINFORCEMENT :	25<D=32		CONCRETE (M^3): 111.60

SEGMENT 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	254	1.208	1056.64	1276.86
2	2850	250	12	128	0.888	364.8	323.87
3	6270	250	14	128	1.208	802.56	969.82
4	1500	250	14	252	1.208	378	456.78
5	1550	125	18	254	1.998	393.7	786.45
6	1970	250	12	256	0.888	504.32	447.74
7	2850	125	12	254	0.888	723.9	642.69
8	1049	250	12	256	0.888	268.544	238.42
9	1120	250	12	256	0.888	286.72	254.55
10	16455	250	12	52	0.888	855.66	759.67
11	16555	250	12	100	0.888	1655.5	1469.77
12	5780	250	12	2	0.888	11.56	10.26
13	1440	250	12	26	0.888	37.44	33.24
14	1180	250	12	382.8	0.888	451.704	401.03
15	1280	250	12	382.8	0.888	489.984	435.01

REINFORCEMENT :	D<=14	7719.7	TOTAL FOR SEGMENT 2 :
REINFORCEMENT :	16=D<=25	786.4	REINFORCEMENT (KG): 8506.2
REINFORCEMENT :	25<D=32		CONCRETE (M^3): 81.46
	TOTAL FOR SEGMENT 1 & 2		
REINFORCEMENT :	D<=14	18287.6	REINFORCEMENT (KG) : 20157.7
REINFORCEMENT :	16=D<=25	1870.1	
REINFORCEMENT :	25<D=32		CONCRETE (M^3) : 193.06

2 WINGWALL

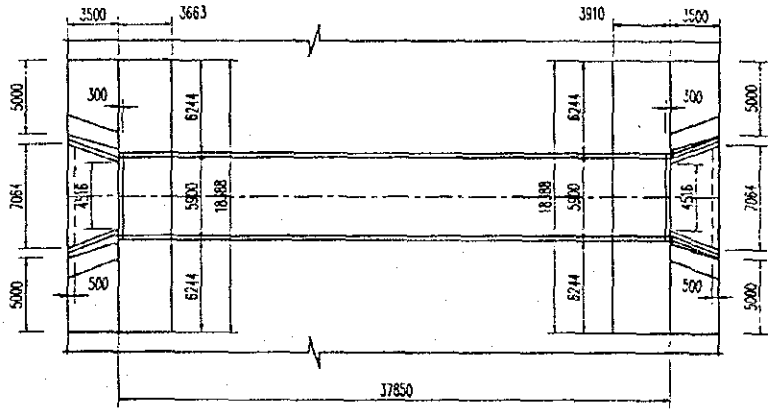


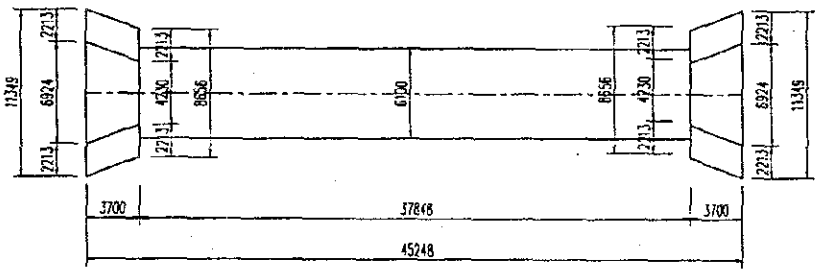
+	CALCULATING VALUES														
	S1	=	0.200	x	2.250								=		0.450
	S2	=	S1	:	$\cos 7^0$	=	0.450	:	0.993				=		0.453
	S3	=	(2.250	+	0.600)	x	(3.500	-	0.200)	:	2	x $\cos 20^0$	=		5.004
	S4	=	S3	:	$\cos 7^0$	=	5.004	:	0.993				=		5.042
	S5	=	(0.553	-	0.266)	x	2.250	:	2				=		0.323
	S6	=	(0.343	-	0.266)	x	0.600	:	2				=		0.023
	S7	=	S5	+	(2.250	x	0.266)	=	0.323	+	0.599		=		0.922
	S8	=	S6	+	(0.600	x	0.266)	=	0.023	+	0.160		=		0.183
	S9	=	2.000	x	0.750								=		1.500
+	CONCRETE (m^3)												=		7.25
	- Footing	=	S9	x	3.500	=	1.500	x	3.500				=		5.250
	- Wing wall	=	V1	+	V2	+	V3	=	1.331	+	0.480	+ 0.184	=		1.995
	V1	=	S3	x	0.266	=	5.004	x	0.266				=		1.331
	V2	=	(3.500	-	0.200)	:	3	x	(S5	+	S6	+ $(S5 \times S6)^{0.5}$)			
		=	1.100	x	(0.323	+	0.023	+	0.086)				=		0.480
	V3	=	S7	x	0.200	=	0.922	x	0.200				=		0.184
+	FORM (m^2)												=		22.50
	- Footing	=	(3.500	:	$\cos 20^0$	+	S9)	x	2	=	(3.725	+ 1.500) x 2	=		10.449
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+ S8			
		=	0.450	+	0.453	+	5.004	+	5.042	+	0.922	+ 0.183	=		12.053
+	SCAFFOLDING (m^2)												=		22.44
	- Footing	=	(3.500	:	$\cos 20^0$	+	1.000	+	2.000	+	1.000)	x 2 x 0.750	=		11.587
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)				
		=	5.004	+	5.042	+	0.806						=		10.852

BOX CULVERT STATION 9+326
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2258	12	20	0.888	45.2	40.1
1b	2310	14	20	1.208	46.2	55.8
2a	3723	12	6	0.888	22.3	19.8
2b	2100	12	16	0.888	33.6	29.8
2c	582	12	20	0.888	11.6	10.3
3	4254	12	2	0.888	8.5	7.6
4	4429	12	20	0.888	88.6	78.6
5a	3043	12	15	0.888	45.6	40.5
5b	2150	12	6	0.888	12.9	11.5
5c	2467	20	15	2.466	37.0	91.3
5d	1574	20	6	2.466	9.4	23.3
6	2444	14	16	1.208	39.1	47.3
7	2301	12	4	0.888	9.2	8.2
8	2301	12	4	0.888	9.2	8.2
9	3605	12	4	0.888	14.4	12.8
10	1304	14	8	1.208	10.4	12.6
11	744	12	11	0.888	8.2	7.3
12	2143	12	1	0.888	2.1	1.9
REINFORCEMENT :				D<=14		**392.2** KG
REINFORCEMENT :				14< D<=25		**114.6** KG
TOTAL REINFORCEMENT :						**506.8** KG

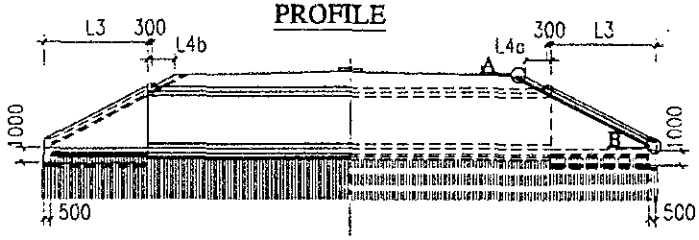
BOX CULVERT FOR DRAINAGE
(STATION 9+326)



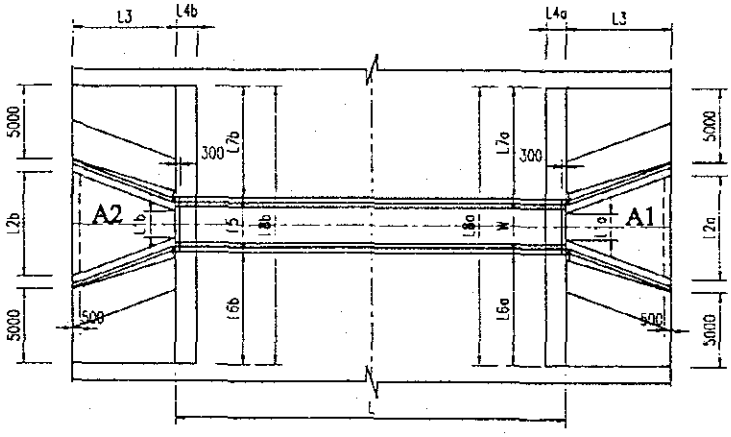


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

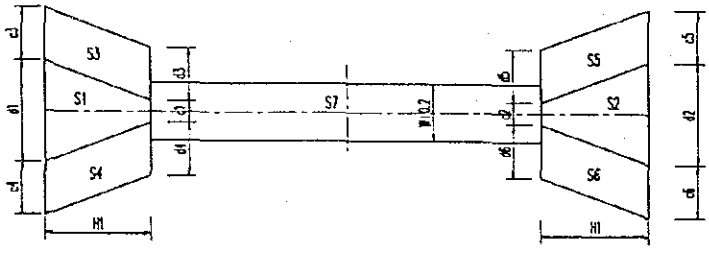
PROFILE



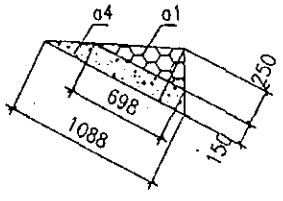
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

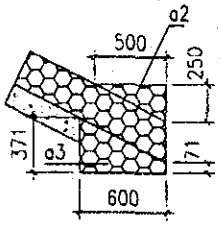


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM9+326

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)

S7=	L	x	(W + 0.2)	=			
=	37.850	x	6.100	=	230.885	(m2)	

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	20.265	+	20.265	)	x 0.3	+	(	7.064	+	7.064	) x 0.45 x 0.5	≈	<u>15.34</u>	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	37.850	x	6.100	x	0.2	=	<u>46.18</u>	(m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=			
=	(	20.635	+	20.6349	+	8.188	+	8.188	+	8.188	+	8.188	)	x	0.1	=	7.40	(m3)	

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=						
=	(	8.188	+	8.188	+	8.188	+	8.188	+	230.885	)	x 25 x 5 :100	=	329.55	(100m)				

** L=3M*

W3=	(	S1	+	S2	+	(0.8 x 4.5 x 4)	)	x 25 x 3 : 100	=										
=	(	20.635	+	20.6349	+	14.400	)	x 25 x 3 : 100	=	41.75	(100m)								

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	+	(0.8 x 4.5 x 4)	) x 0.15 =		
=	(	20.635	+	20.635	+	8.188	+	8.188	+	8.188	+	8.188	+	230.885	+	(0.8 x 4.5 x 4)	) x 0.15 =	47.90	(m3)

6. STONE MASONRY

a1=		0.695	x	0.25	x		0.5	=		0.087	(m2)								
a2=		0.5	x	0.25	x		0.5	=		0.063	(m2)								
a3=	(	0.071	+	0.371	)	x	0.5	x	0.6	=	0.133	(m2)							
a4=	(	0.698	+	1.088	)	x	0.5	x	0.15	=	0.134	(m2)							

b1=	0.300	x	L5	=	0.300	x	5.900	=	1.770	(m2)	(b1 IS AREA OF HEAD WALL)

b2a= (L6a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b2b= (L6b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3a= (L7a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3b= (L7b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b4a= L8a x L4a = 18.388 x 3.910 = 71.897 (m2)

b4b= L8b x L4b = 18.388 x 3.663 = 67.355 (m2)

b5= 0.6 x 5 x 2 = 6.000 (m2)

V1a= a1 x L8a = 0.087 x 18.388 = 1.597 (m3)

V1b= a1 x L8b = 0.087 x 18.388 = 1.597 (m3)

V2= (a2 + a3) x 5 x 4 = (0.063 + 0.133) x 5 x 4 = 3.902 (m3)

V3a= (b4a - b1 + b2a + b3a) x 0.25 : COS(26.56) =
= (71.897 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 30.616 (m3)

V3b= (b4b - b1 + b2b + b3b) x 0.25 : COS(26.56) =
= (67.355 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 29.345 (m3)

TOTAL = (V1a + V1b + V2 + V3a + V3b) =
(1.597 + 1.597 + 3.902 + 30.616 + 29.345) = *67.058* (m3)

7. BASE BEDDING:

V4a=	a4	x	L8a			=	0.134	x	18.388			=	2.463	(m3)				
V4b=	a4	x	L8b			=	0.134	x	18.388			=	2.463	(m3)				
V5a=	(	b4a	-	b1	+	b2a	+	b3a	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	71.897	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	17.363	(m3)
V5b=	(	b4b	-	b1	+	b2b	+	b3b	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	67.355	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	16.601	(m3)
TOTAL =		(	V4a	+	V4b	+	V5a	+	V5b	)=								
		(	2.463	+	2.463	+	17.363	+	16.601	)=	38.89		(m3)					

8. FORM :

=	(L2a	+	L2b)	X 0.75	x	2	=	
	(7.064	+	7.064	X 0.75	x	2	=	**21.192** (m2)

9. SCAFFOLDING :

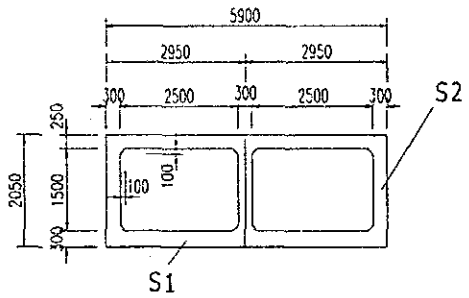
=	(L2a	+	L2b)	X 0.75	x	2	=	
	(7.064	+	7.064	X 0.75	x	2	=	**21.192** (m2)

2.5. Box culvert at station 9+760

BOX CULVERT 9+760

I	BOX CULVERT STATION 09+760													QUANTITIES
	L	=	14.154	+	21.940	+	0.02	=	36.114					
1	CULVERT													
+	CONCRETE (M3)													
	S1=S2	=	2.950	x	2.050	-	2.500	x	1.500	+	2	x	0.100	x 0.100 = 2.318
	S	=	S1	+	S2									= 4.635
	VOLUME	=	S	x	(14.154	+	21.940)	+	5.900	x	0.200	x	0.300	x 2 = 168.00
+	FORM (M2)													561.41
*	INSIDE FORM (M2)													394.557
	BOX BULWARK	=	(1.500	+	2	x	0.100	x	(1/SIN45°	-	1))	x	36.094	x 4 = 228.524
	BOTTOM OF THE BOX	=	(2.500	-	0.100	x	2)	x	36.094	x	2			= 166.032
*	OUTSIDE FORM (M2)													166.850
	BOX BULWARK	=	2.050	x	2	x	36.094	+	4	x	0.300	x	0.200	= 148.225
	THE END OF CULVERT	=	S	x	2	+	5.900	x	0.200	x	4			= 13.990
	CENTER	=	S											= 4.635
+	SCAFFOLDING (M2)	=	2.050	x	2.000	x	36.094	+	4.000	x	0.300	x	0.200	= 148.23
+	SUPPORT													
	AREA (M2)	=	5.900	x	1.500	-	S							= 4.215
	VOLUME (M3)	=	AREA	x	L									= 152.22

DOUBLE BOX CULVERT



BOXCULVERT STATION 9+760
QUANTITIES TABLE OF REINFORCEMENT
SEGMENT 1

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	226	1.208	827.2	999.6
2	2350	250	12	114	0.888	267.9	237.8
3	6270	250	14	114	1.208	714.8	863.7
4	1500	250	14	224	1.208	336.0	406.0
5	1550	125	18	226	1.998	350.3	699.8
6	1970	250	12	228	0.888	449.2	398.8
7	2350	125	12	226	0.888	531.1	471.5
8	1049	250	12	228	0.888	239.2	212.3
9	1120	250	12	228	0.888	255.4	226.7
10	14659	250	12	52	0.888	762.3	676.8
11	14759	250	12	88	0.888	1298.8	1153.1
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	339.696	0.888	400.8	355.9

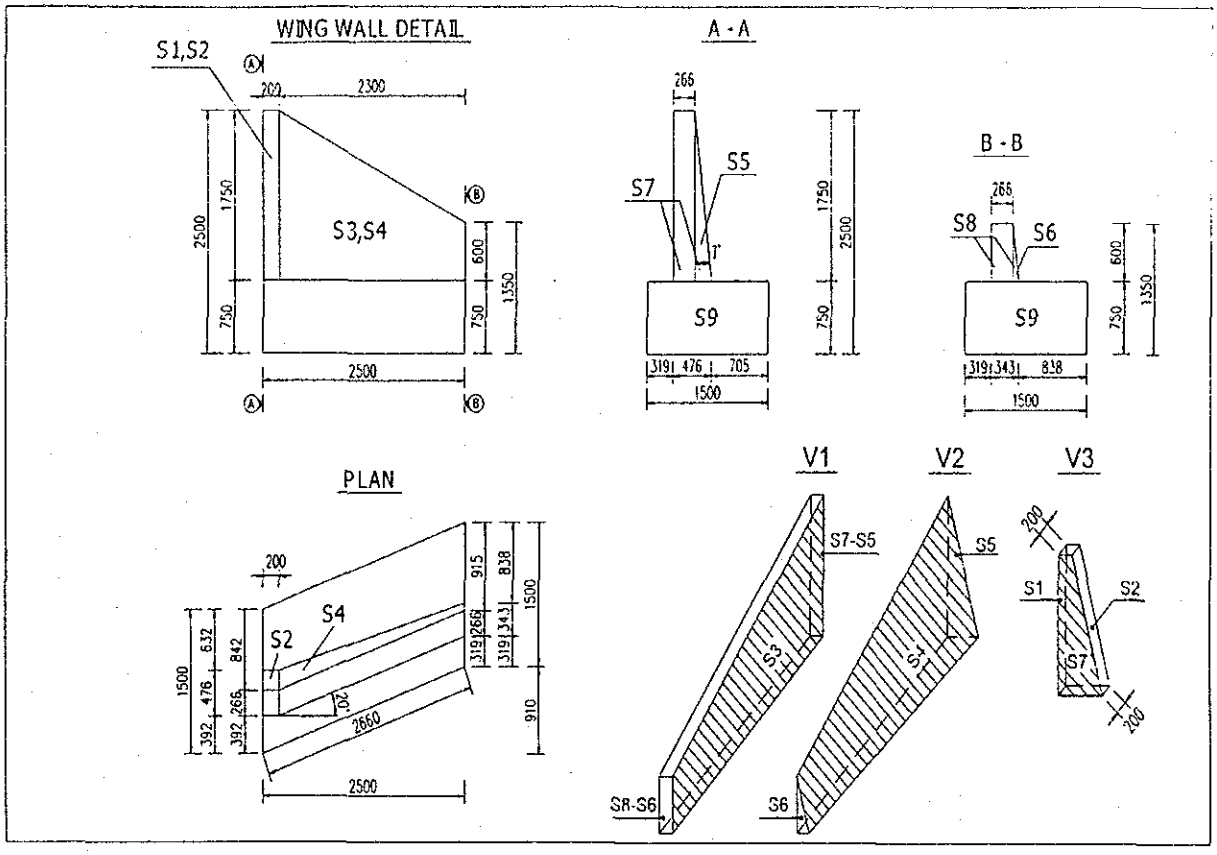
REINFORCEMENT : D<=14	6045.7	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	699.8	REINFORCEMENT (KG):	6745.5
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	65.96

SEGMENT 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	350	1.208	1281.0	1548.0
2	2350	250	12	176	0.888	413.6	367.2
3	6270	250	14	176	1.208	1103.5	1333.5
4	1500	250	14	348	1.208	522.0	630.8
5	1550	125	18	350	1.998	542.5	1083.7
6	1970	250	12	352	0.888	693.4	615.6
7	2350	125	12	350	0.888	822.5	730.2
8	1049	250	12	352	0.888	369.2	327.8
9	1120	250	12	352	0.888	394.2	350.0
10	22445	250	12	52	0.888	1167.1	1036.2
11	22545	250	12	88	0.888	1984.0	1761.4
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	526.56	0.888	621.3	551.6

REINFORCEMENT : D<=14	9295.9	TOTAL FOR SEGMENT 2 :	
REINFORCEMENT : 16=D<=25	1083.7	REINFORCEMENT (KG):	10379.6
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	102.05
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	15341.6	REINFORCEMENT (KG) :	17125.1
REINFORCEMENT : 16=D<=25	1783.4		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	168.00

2 WINGWALL

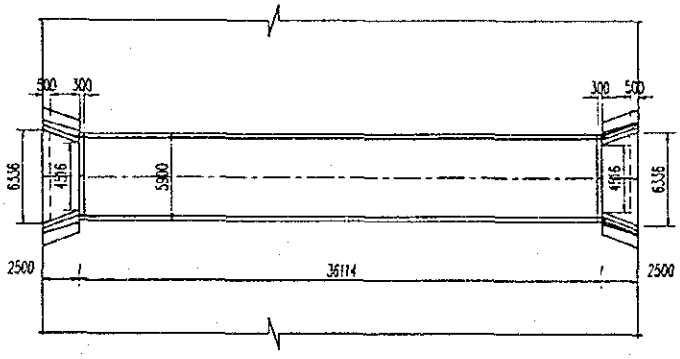


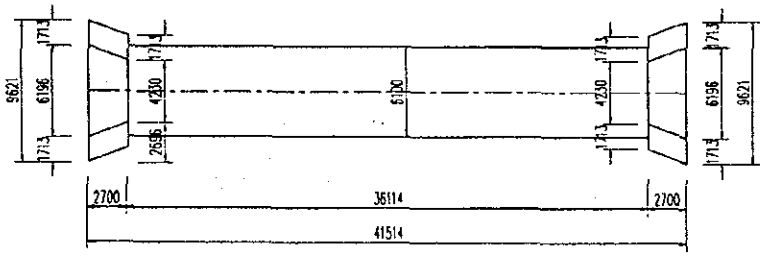
+	CALCULATING VALUES												
	S1	=	0.200	x	1.750							=	0.350
	S2	=	S1	:	$\cos 7^0$	=	0.350	:	0.993			=	0.353
	S3	=	(1.750	+	0.600)	x	(2.500	-	0.200)	:	2	x $\cos 20^0$	=	2.876
	S4	=	S3	:	$\cos 7^0$	=	2.876	:	0.993			=	2.898
	S5	=	(0.476	-	0.266)	x	1.750	:	2			=	0.184
	S6	=	(0.343	-	0.266)	x	0.600	:	2			=	0.023
	S7	=	S5	+	(1.750	x	0.266)	=	0.184	+	0.466	=	0.650
	S8	=	S6	+	(0.600	x	0.266)	=	0.023	+	0.160	=	0.183
	S9	=	1.500	x	0.750							=	1.125
+	CONCRETE (m^3)											=	3.92
	- Footing	=	S9	x	2.500	=	1.125	x	2.500			=	2.813
	- Wing wall	=	V1	+	V2	+	V3	=	0.765	+	0.210 + 0.130	=	1.105
	V1	=	S3	x	0.266	=	2.876	x	0.266			=	0.765
	V2	=	(2.500	-	0.200)	:	3	x	(S5	+	S6 + $(S5 \times S6)^{0.5}$)		
		=	0.767	x	(0.184	+	0.023	+	0.065)			=	0.210
	V3	=	S7	x	0.200	=	0.650	x	0.200			=	0.13
+	FORM (m^2)											=	14.88
	- Footing	=	(2.500	:	$\cos 20^0$	+	S9)	x	2	=	(2.660 + 1.125) x 2	=	7.571
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7 + S8		
		=	0.350	+	0.353	+	2.876	+	2.898	+	0.650 + 0.183	=	7.309
+	SCAFFOLDING (m^2)											=	15.82
	- Footing	=	(2.500	:	$\cos 20^0$	+	1.000	+	1.500	+	1.000) x 2 x 0.750	=	9.241
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)		
		=	2.876	+	2.898	+	0.806					=	6.580

BOX CULVERT STATION 9+760
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2011	12	15	0.888	30.2	26.8
1b	2060	14	15	1.208	30.9	37.3
2a	2651	12	6	0.888	15.9	14.1
2b	1552	12	12	0.888	18.6	16.5
2c	582	12	15	0.888	8.7	7.8
3	3005	12	2	0.888	6.0	5.3
4	3378	12	16	0.888	54.0	48.0
5a	2574	12	11	0.888	28.3	25.1
5b	1868	12	4	0.888	7.5	6.6
5c	1998	20	11	2.466	22.0	54.2
5d	1292	20	4	2.466	5.2	12.7
6	2444	14	8	1.208	19.6	23.6
7	1814	12	4	0.888	7.3	6.4
8	1814	12	4	0.888	7.3	6.4
9	2554	12	4	0.888	10.2	9.1
10	1304	14	5	1.208	6.5	7.9
11	724	12	9	0.888	6.5	5.8
12	1791	12	1	0.888	1.8	1.6
		REINFORCEMENT :		D=<14		**248.5** KG
		REINFORCEMENT :		14< D<=25		**66.9** KG
		TOTAL REINFORCEMENT :				**315.4** KG

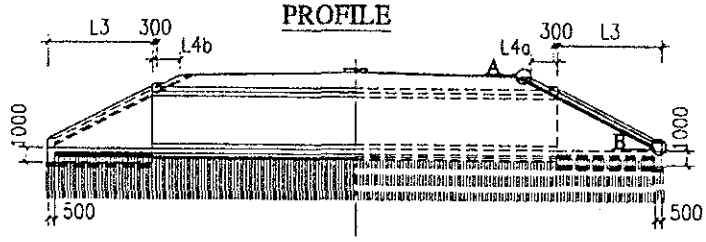
BOX CULVERT FOR DRAINAGE
(STATION 9+760)



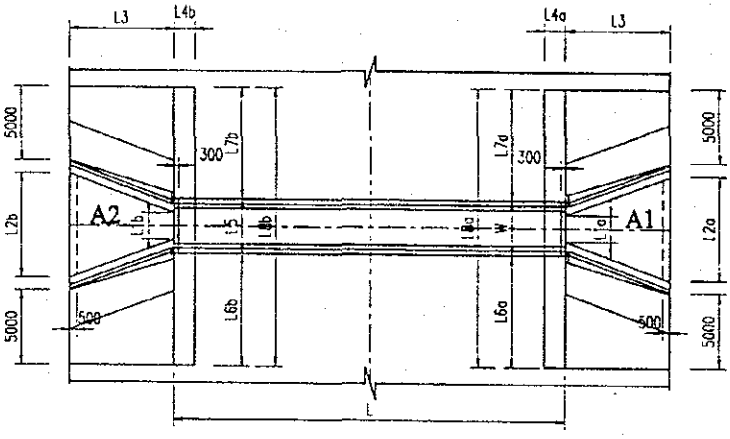


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

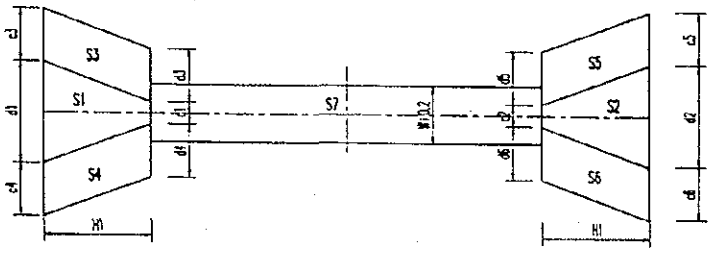
PROFILE



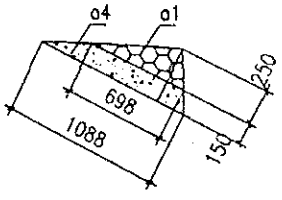
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

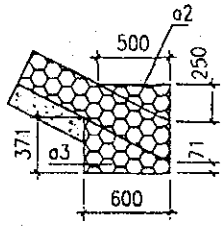


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM9+760

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S7=		L	x	(W + 0.2)	=							
=		36.114	x	6.100	=		220.295		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=				
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)		
A2=	(	L1b	+	L2b	)	x	L3	:	2	=				
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)		
	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=	
=	(	13.565	+	13.565	)	x 0.3	+	(	6.336	+	6.336	) x 0.45 x 0.5	=	***10.99*** (m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	36.114	x	6.100	x	0.2	=	***44.06*** (m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=			
=	(	14.075	+	14.0751	+	4.625	+	4.625	+	4.625	+	4.625	)	x	0.1	=	4.67	(m3)	

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=						
=	(	4.625	+	4.625	+	4.625	+	4.625	+	220.295	)	x 25 x 5 :100	=				298.49	(100m)	

** L=3M*

W3=	(	S1	+	S2	+	0	)	x 25 x 3 : 100	=										
=	(	14.075	+	14.0751	+	0.000	)	x 25 x 3 : 100	=								21.11	(100m)	

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	) x 0.15 =						
=	(	14.075	+	14.075	+	4.625	+	4.625	+	4.625	+	4.625	+	220.295	) x 0.15 =		40.04				
																	(m3)				

6.FORM

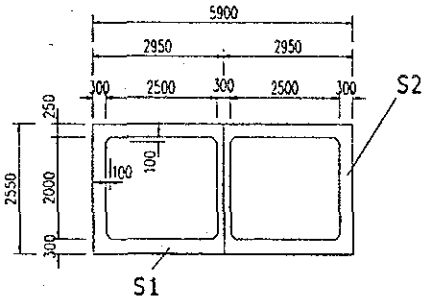
=	(L2a	+	L2b)	)	X 0.75	x	2	=											
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008	(m2)									

7.SCAFFOLDING

=	(L2a	+	L2b)	)	X 0.75	x	2	=											
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008	(m2)									

2.6. Box culvert at station 10+310

BOX CULVERT 10+310

			QUANTITIES
1	BOX CULVERT STATION 10+310		
	L	= 16.472 + 14.750 + 0.02 = 31.242	
1	CULVERT		
+	CONCRETE (M3)		
	S1	= 2.950 x 2.550 - 2.500 x 2.000 + 2 x 0.100 x 0.100 =	2.543
	S	= S1 + S2 =	5.085
	VOLUME	= S x (16.472 + 14.750) + 5.900 x 0.200 x 0.300 x 2 =	159.47
	DOUBLE BOX CULVERT		
+	FORM		586.31
*	INSIDE FORM (M2)		406.865
	BOX BULWARK	= (2.000 + 2 x 0.100 x (1:SIN45^0 - 1)) x 31.222 x 4 =	260.122
	BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 31.222 x 2 =	146.743
*	OUTSIDE FORM (M2)		179.447
	BOX BULWARK	= 2.550 x 2 x 31.222 + 4 x 0.300 x 0.200 =	159.472
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	14.890
	CENTER	= S =	5.085
+	SCAFFOLDING (M2)	= 2.550 x 2.000 x 31.222 + 4.000 x 0.300 x 0.200 =	159.47
+	SUPPORT		
	AREA (M2)	= 5.900 x 2.000 - S =	6.715
	VOLUME (M3)	= AREA x L =	209.79

BOXCULVERT STATION 10+310
QUANTITIES TABLE OF REINFORCEMENT
SEGMENT 1

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	262	1.208	1089.92	1317.073
2	2850	250	12	132	0.888	376.2	333.995
3	6270	250	14	132	1.208	827.64	1000.131
4	1500	250	14	260	1.208	390	471.281
5	1550	125	18	262	1.998	406.1	811.217
6	1970	250	12	264	0.888	520.08	461.734
7	2850	125	12	262	0.888	746.7	662.930
8	1049	250	12	264	0.888	276.936	245.867
9	1120	250	12	264	0.888	295.68	262.509
10	16977	250	12	52	0.888	882.804	783.765
11	17077	250	12	100	0.888	1707.7	1516.119
12	5780	250	12	2	0.888	11.56	10.263
13	1440	250	12	26	0.888	37.44	33.240
14	1180	250	12	395.328	0.888	466.48704	414.153
15	1280	250	12	395.328	0.888	506.01984	449.251

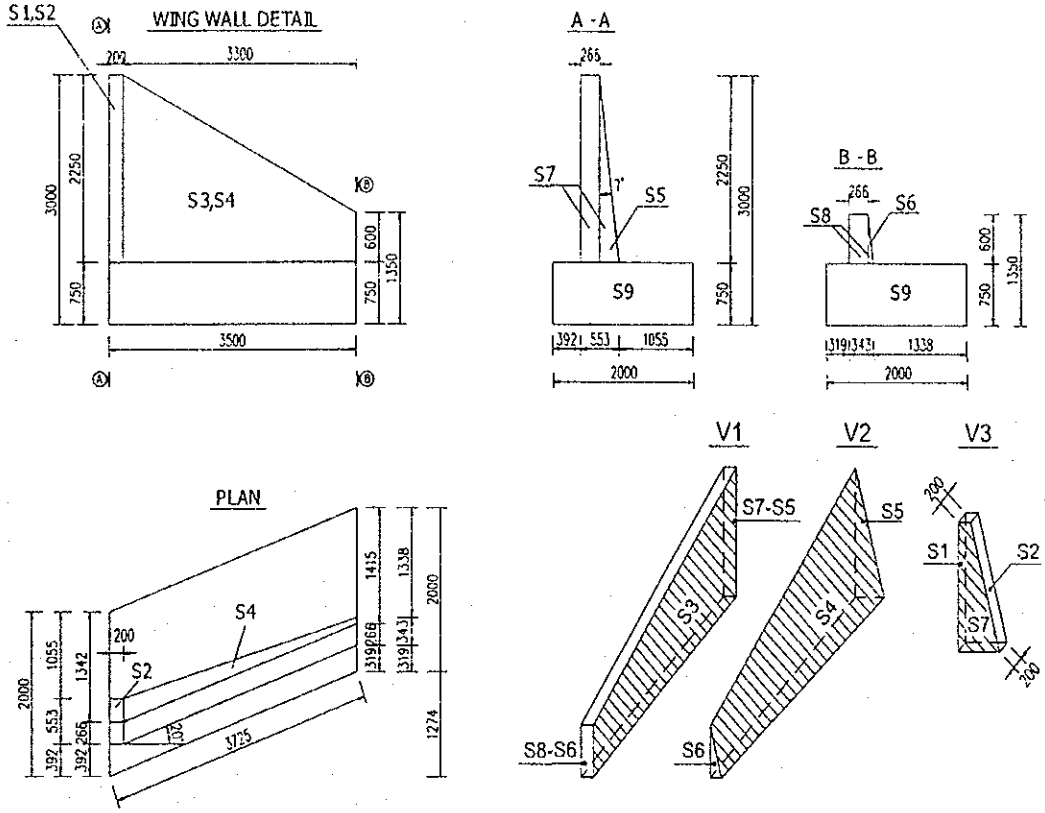
REINFORCEMENT : D<=14	7962.3	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	811.2	REINFORCEMENT (KG):	8773.5
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	84.11

SEGMENT 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	238	1.208	990.08	1196.43
2	2850	250	12	120	0.888	342	303.63
3	6270	250	14	120	1.208	752.4	909.21
4	1500	250	14	236	1.208	354	427.78
5	1550	125	18	238	1.998	368.9	736.91
6	1970	250	12	240	0.888	472.8	419.76
7	2850	125	12	238	0.888	678.3	602.20
8	1049	250	12	240	0.888	251.76	223.52
9	1120	250	12	240	0.888	268.8	238.64
10	15255	250	12	52	0.888	793.26	704.27
11	15355	250	12	100	0.888	1535.5	1363.24
12	5780	250	12	2	0.888	11.56	10.26
13	1440	250	12	26	0.888	37.44	33.24
14	1180	250	12	354	0.888	417.72	370.86
15	1280	250	12	354	0.888	453.12	402.29

REINFORCEMENT : D<=14	7205.3	TOTAL FOR SEGMENT 2 :	
REINFORCEMENT : 16=D<=25	736.9	REINFORCEMENT (KG):	7942.2
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	75.36
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	15167.6	REINFORCEMENT (KG) :	16715.8
REINFORCEMENT : 16=D<=25	1548.1		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	159.47

2 WINGWALL

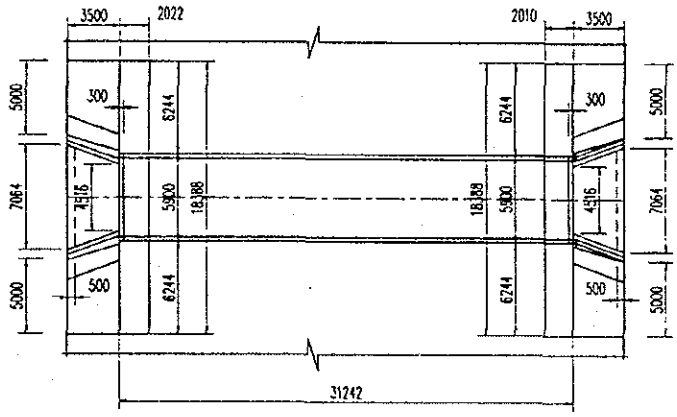


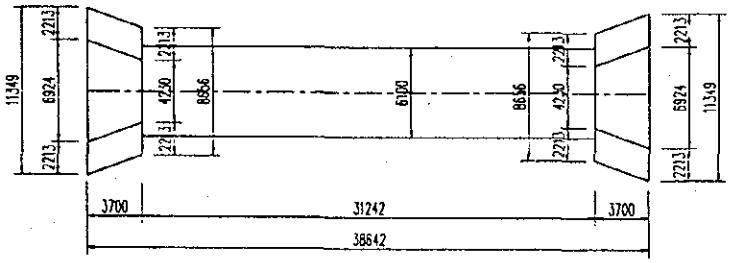
+	CALCULATING VALUES																		
	S1	=	0.200	x	2.250												=	0.450
	S2	=	S1	:	$\cos 7^0$	=	0.450	:	0.993								=	0.453
	S3	=	(2.250	+	0.600)	x	(3.500	-	0.200)	:	2	x	$\cos 20^0$				=	5.004
	S4	=	S3	:	$\cos 7^0$	=	5.004	:	0.993								=	5.042
	S5	=	(0.553	-	0.266)	x	2.250	:	2								=	0.323
	S6	=	(0.343	-	0.266)	x	0.600	:	2								=	0.023
	S7	=	S5	+	(2.250	x	0.266)		=		0.323	+	0.599				=	0.922
	S8	=	S6	+	(0.600	x	0.266)		=		0.023	+	0.160				=	0.183
	S9	=	2.000	x	0.750												=	1.500
+	CONCRETE (m^3)																=	7.25
	- Footing	=	S9	x	3.500	=	1.500	x	3.500								=	5.250
	- Wing wall	=	V1	+	V2	+	V3	=	1.331	+	0.480	+	0.184				=	1.995
	V1	=	S3	x	0.266	=	5.004	x	0.266								=	1.331
	V2	=	(3.500	-	0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)					
		=	1.100	x	(0.323	+	0.023	+	0.086)								=	0.480
	V3	=	S7	x	0.200	=	0.922	x	0.200								=	0.184
+	FORM (m^2)																=	22.50
	- Footing	=	(3.500	:	$\cos 20^0$	+	S9)	x	2	=	(3.725	+	1.500)	x	2		=	10.449
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+	S8					
		=	0.450	+	0.453	+	5.004	+	5.042	+	0.922	+	0.183				=	12.053
+	SCAFFOLDING (m^2)																=	22.44
	- Footing	=	(3.500	:	$\cos 20^0$	+	1.000	+	2.000	+	1.000)	x	2	x	0.750		=	11.587
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)							
		=	5.004	+	5.042	+	0.806										=	10.852

BOX CULVERT STATION 10+310
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2258	12	20	0.888	45.2	40.1
1b	2310	14	20	1.208	46.2	55.8
2a	3723	12	6	0.888	22.3	19.8
2b	2100	12	16	0.888	33.6	29.8
2c	582	12	20	0.888	11.6	10.3
3	4254	12	2	0.888	8.5	7.6
4	4429	12	20	0.888	88.6	78.6
5a	3043	12	15	0.888	45.6	40.5
5b	2150	12	6	0.888	12.9	11.5
5c	2467	20	15	2.466	37.0	91.3
5d	1574	20	6	2.466	9.4	23.3
6	2444	14	16	1.208	39.1	47.3
7	2301	12	4	0.888	9.2	8.2
8	2301	12	4	0.888	9.2	8.2
9	3605	12	4	0.888	14.4	12.8
10	1304	14	8	1.208	10.4	12.6
11	744	12	11	0.888	8.2	7.3
12	2143	12	1	0.888	2.1	1.9
REINFORCEMENT :				D<=14		**392.2** KG
REINFORCEMENT :				14< D<=25		**114.6** KG
TOTAL REINFORCEMENT :						**506.8** KG

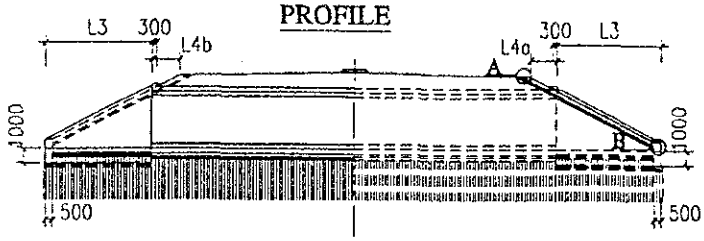
BOX CULVERT FOR DRAINAGE
(STATION 10+310)



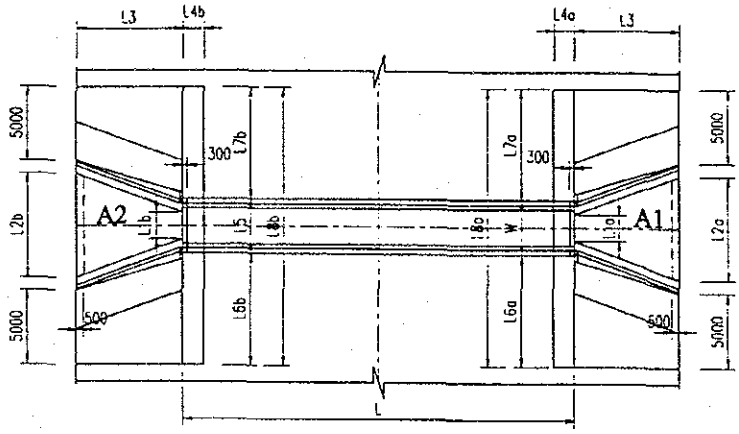


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

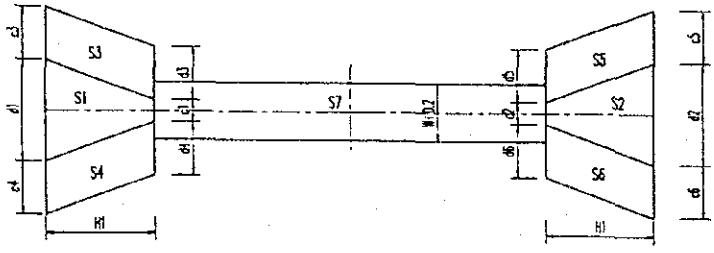
PROFILE



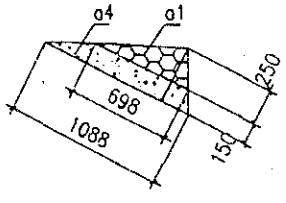
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

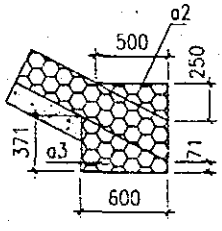


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM10+310

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S7=		L	x	(W + 0.2)	=							
=		31.242	x	6.100	=		190.576		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	20.265	+	20.265	)	x 0.3	+	(	7.064	+	7.064	) x 0.45 x 0.5	=	15.34	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	31.242	x	6.100	x	0.2	=	38.12	(m3)

3. LEAN CONCRETE:

= (S1 + S2 + S3 + S4 + S5 + S6) x 0.1 =
= (20.635 + 20.6349 + 8.188 + 8.188 + 8.188 + 8.188) x 0.1 = *7.40* (m3)

4. WOOD PILE:

** L=5M*
W5= (S3 + S4 + S5 + S6 + S7) x 25 x 5 :100 =
= (8.188 + 8.188 + 8.188 + 8.188 + 190.576) x 25 x 5 :100 = *279.16* (100m)

** L=3M*
W3= (S1 + S2 + (0.8 x 4.5 x 4)) x 25 x 3 : 100 =
= (20.635 + 20.6349 + 14.400) x 25 x 3 : 100 = *41.75* (100m)

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

= (S1 + S2 + S3 + S4 + S5 + S6 + S7 + (0.8 x 4.5 x 4)) x 0.15 =
= (20.635 + 20.635 + 8.188 + 8.188 + 8.188 + 8.188 + 190.576 + (0.8 x 4.5 x 4)) x 0.15 = *41.85* (m3)

6. STONE MASONRY

a1= 0.695 x 0.25 x 0.5 = 0.087 (m2)
a2= 0.5 x 0.25 x 0.5 = 0.063 (m2)
a3= (0.071 + 0.371) x 0.5 x 0.6 = 0.133 (m2)
a4= (0.698 + 1.088) x 0.5 x 0.15 = 0.134 (m2)

b1= 0.300 x L5 = 0.300 x 5.900 = 1.770 (m2) (b1 IS AREA OF HEAD WALL)

b2a= (L6a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b2b= (L6b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3a= (L7a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3b= (L7b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b4a= L8a x L4a = 18.388 x 2.010 = 36.960 (m2)

b4b= L8b x L4b = 18.388 x 2.022 = 37.181 (m2)

b5= 0.6 x 5 x 2 = 6.000 (m2)

V1a= a1 x L8a = 0.087 x 18.388 = 1.597 (m3)

V1b= a1 x L8b = 0.087 x 18.388 = 1.597 (m3)

V2= (a2 + a3) x 5 x 4 = (0.063 + 0.133) x 5 x 4 = 3.902 (m3)

V3a= (b4a - b1 + b2a + b3a) x 0.25 : COS(26.56) =
= (36.960 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 20.846 (m3)

V3b= (b4b - b1 + b2b + b3b) x 0.25 : COS(26.56) =
= (37.181 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 20.907 (m3)

TOTAL = (V1a + V1b + V2 + V3a + V3b) =
(1.597 + 1.597 + 3.902 + 20.846 + 20.907) = ***48.850*** (m3)

7. BASE BEDDING:

V4a=		a4	x	L8a			=	0.134	x	18.388			=	2.463	(m3)			
V4b=		a4	x	L8b			=	0.134	x	18.388			=	2.463	(m3)			
V5a=	(	b4a	-	b1	+	b2a	+	b3a	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	36.960	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	11.501	(m3)
V5b=	(	b4b	-	b1	+	b2b	+	b3b	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	37.181	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	11.538	(m3)
TOTAL =			(	V4a	+	V4b	+	V5a	+	V5b	)=							
			(	2.463	+	2.463	+	11.501	+	11.538	)=	27.96		(m3)				

8. FORM :

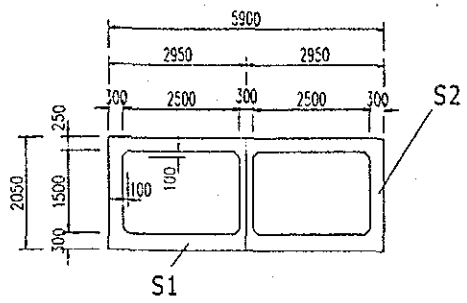
=	(L2a	+	L2b)	X 0.75	x	2	=		
	(7.064	+	7.064	X 0.75	x	2	=	21.192	(m2)

9. SCAFFOLDING :

=	(L2a	+	L2b)	X 0.75	x	2	=		
	(7.064	+	7.064	X 0.75	x	2	=	21.192	(m2)

2.7. Box culvert at station 10+690

BOX CULVERT 10+690

I	BOX CULVERT STATION 10+690 L = 13.860 + 17.650 + 0.02 = 31.530	QUANTITIES
1	CULVERT	
+	CONCRETE (M3)	
	S1=S2 = 2.950 x 2.050 - 2.500 x 1.500 + 2 x 0.100 x 0.100 =	2.318
	S = S1 + S2 =	4.635
	VOLUME = S x (13.860 + 17.650) + 5.900 x 0.200 x 0.300 x 2 =	146.76
	DOUBLE BOX CULVERT 	
+	FORM (M2)	492.50
*	INSIDE FORM (M2)	344.447
	BOX BULWARK = (1.500 + 2 x 0.100 x (1/SIN45^0 - 1)) x 31.510 x 4 =	199.501
	BOTTOM OF THE BOX = (2.500 - 0.100 x 2) x 31.510 x 2 =	144.946
*	OUTSIDE FORM (M2)	148.056
	BOX BULWARK = 2.050 x 2 x 31.510 + 4 x 0.300 x 0.200 =	129.431
	THE END OF CULVERT = S x 2 + 5.900 x 0.200 x 4 =	13.990
	CENTER = S =	4.635
+	SCAFFOLDING (M2) = 2.050 x 2.000 x 31.510 + 4.000 x 0.300 x 0.200 =	129.43
+	SUPPORT	
	AREA (M2) = 5.900 x 1.500 - S =	4.215
	VOLUME (M3) = AREA x L =	132.90

BOXCULVERT STATION 10+690
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	222	1.208	812.5	981.9
2	2350	250	12	112	0.888	263.2	233.7
3	6270	250	14	112	1.208	702.2	848.6
4	1500	250	14	220	1.208	330.0	398.8
5	1550	125	18	222	1.998	344.1	687.4
6	1970	250	12	224	0.888	441.3	391.8
7	2350	125	12	222	0.888	521.7	463.2
8	1049	250	12	224	0.888	235.0	208.6
9	1120	250	12	224	0.888	250.9	222.7
10	14365	250	12	52	0.888	747.0	663.2
11	14465	250	12	88	0.888	1272.9	1130.1
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	332.64	0.888	392.5	348.5

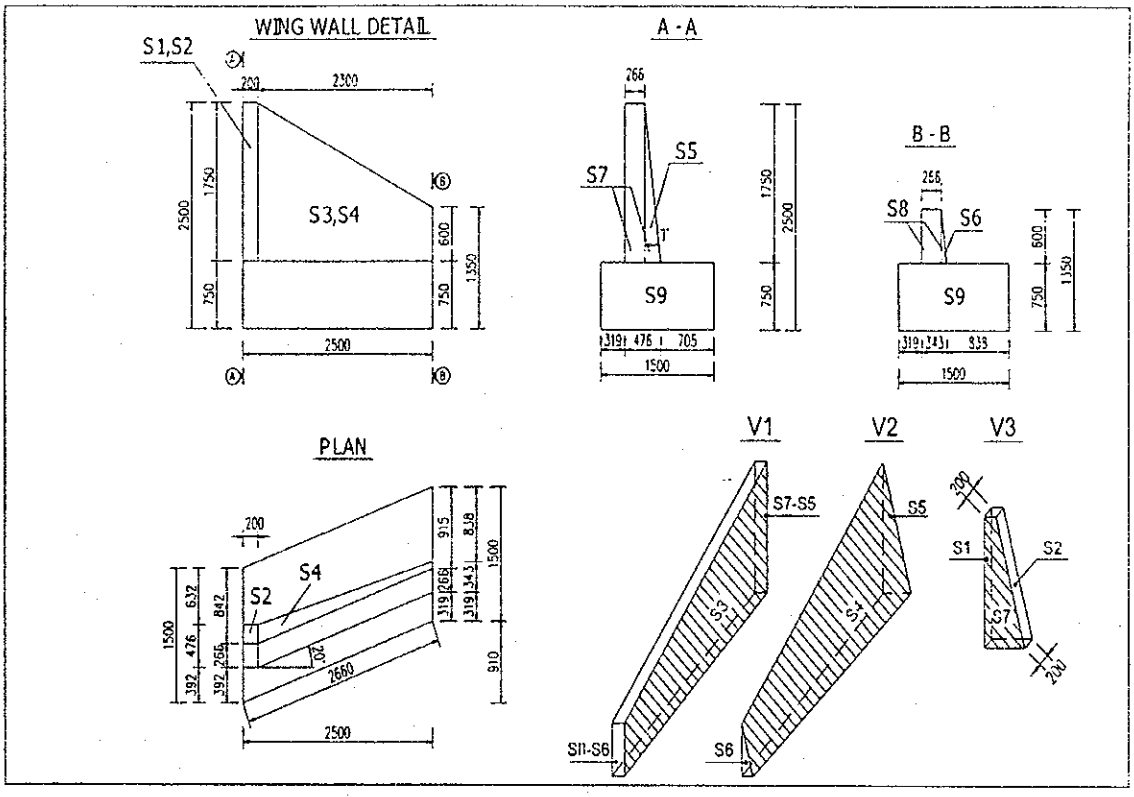
REINFORCEMENT : D<=14	5934.5	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	687.4	REINFORCEMENT (KG):	6621.8
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	64.60

SEGMENT 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	282	1.208	1032.1	1247.2
2	2350	250	12	142	0.888	333.7	296.3
3	6270	250	14	142	1.208	890.3	1075.9
4	1500	250	14	280	1.208	420.0	507.5
5	1550	125	18	282	1.998	437.1	873.1
6	1970	250	12	284	0.888	559.5	496.7
7	2350	125	12	282	0.888	662.7	588.4
8	1049	250	12	284	0.888	297.9	264.5
9	1120	250	12	284	0.888	318.1	282.4
10	18155	250	12	52	0.888	944.1	838.1
11	18255	250	12	88	0.888	1606.4	1426.2
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	423.6	0.888	499.8	443.8

REINFORCEMENT : D<=14	7510.5	TOTAL FOR SEGMENT 2 :	
REINFORCEMENT : 16=D<=25	873.1	REINFORCEMENT (KG):	8383.7
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	82.16
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	13445.0	REINFORCEMENT (KG) :	15005.5
REINFORCEMENT : 16=D<=25	1560.5		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	146.76

2 WINGWALL

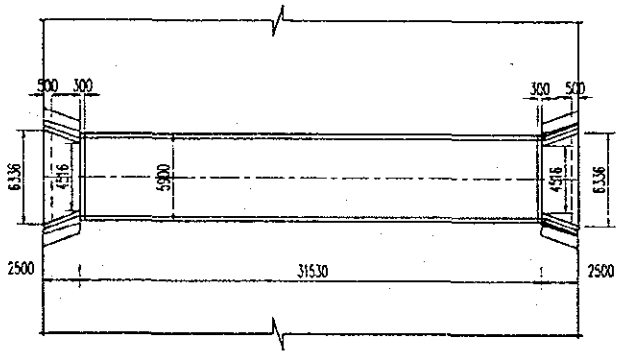


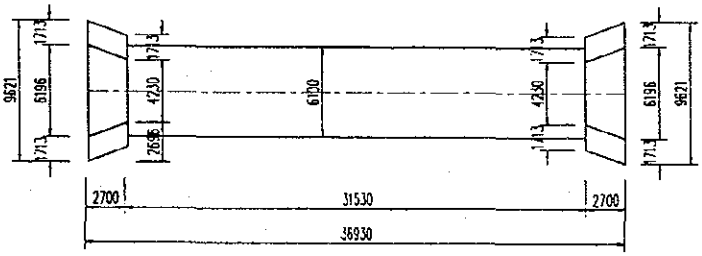
+	CALCULATING VALUES												
	S1	=	0.200	x	1.750							=	0.350
	S2	=	S1	:	$\cos 7^0$	=	0.350	:	0.993			=	0.353
	S3	=	(1.750 + 0.600)	x	(2.500 - 0.200)	:	2	x	$\cos 20^0$			=	2.876
	S4	=	S3	:	$\cos 7^0$	=	2.876	:	0.993			=	2.898
	S5	=	(0.476 - 0.266)	x	1.750	:	2					=	0.184
	S6	=	(0.343 - 0.266)	x	0.600	:	2					=	0.023
	S7	=	S5	+	(1.750 x 0.266)	=	0.184	+	0.466			=	0.650
	S8	=	S6	+	(0.600 x 0.266)	=	0.023	+	0.160			=	0.183
	S9	=	1.500	x	0.750							=	1.125
+	CONCRETE (m^3)											=	3.92
	- Footing	=	S9	x	2.500	=	1.125	x	2.500			=	2.813
	- Wing wall	=	V1	+	V2	+	V3	=	0.765	+	0.210 + 0.130	=	1.105
	V1	=	S3	x	0.266	=	2.876	x	0.266			=	0.765
	V2	=	(2.500 - 0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)		
		=	0.767	x	(0.184	+	0.023	+	0.065)			=	0.210
	V3	=	S7	x	0.200	=	0.650	x	0.200			=	0.13
+	FORM (m^2)											=	14.88
	- Footing	=	(2.500 : $\cos 20^0$	+	S9)	x	2	=	(2.660	+	1.125) x 2	=	7.571
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7 + S8		
		=	0.350	+	0.353	+	2.876	+	2.898	+	0.650 + 0.183	=	7.309
+	SCAFFOLDING (m^2)											=	15.82
	- Footing	=	(2.500 : $\cos 20^0$	+	1.000	+	1.500	+	1.000)	x	2 x 0.750	=	9.241
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)		
		=	2.876	+	2.898	+	0.806					=	6.580

BOX CULVERT STATION 10+690
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2011	12	15	0.888	30.2	26.8
1b	2060	14	15	1.208	30.9	37.3
2a	2651	12	6	0.888	15.9	14.1
2b	1552	12	12	0.888	18.6	16.5
2c	582	12	15	0.888	8.7	7.8
3	3005	12	2	0.888	6.0	5.3
4	3378	12	16	0.888	54.0	48.0
5a	2574	12	11	0.888	28.3	25.1
5b	1868	12	4	0.888	7.5	6.6
5c	1998	20	11	2.466	22.0	54.2
5d	1292	20	4	2.466	5.2	12.7
6	2444	14	8	1.208	19.6	23.6
7	1814	12	4	0.888	7.3	6.4
8	1814	12	4	0.888	7.3	6.4
9	2554	12	4	0.888	10.2	9.1
10	1304	14	5	1.208	6.5	7.9
11	724	12	9	0.888	6.5	5.8
12	1791	12	1	0.888	1.8	1.6
REINFORCEMENT :				D=<14		**248.5** KG
REINFORCEMENT :				14< D<=25		**66.9** KG
TOTAL REINFORCEMENT :						**315.4** KG

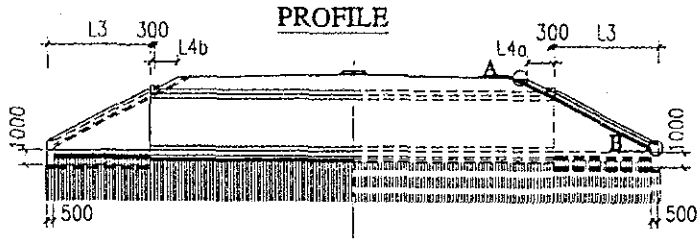
BOX CULVERT FOR DRAINAGE
(STATION 10+690)



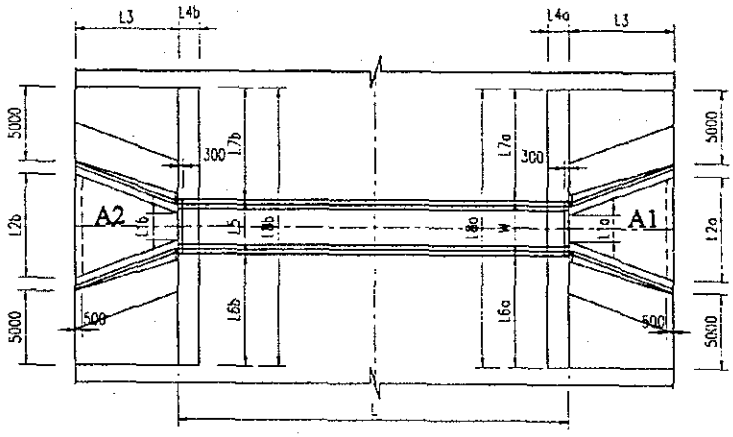


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

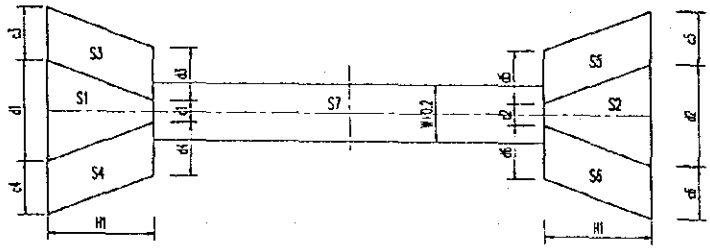
PROFILE



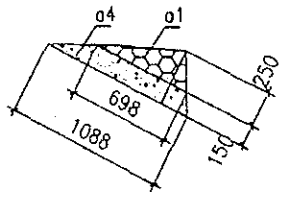
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

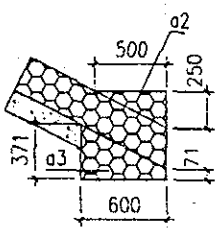


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM10+690

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S7=		L	x	(W + 0.2)	=							
=		31.530	x	6.100	=		192.333		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	13.565	+	13.565	)	x 0.3	+	(	6.336	+	6.336	) x 0.45 x 0.5	=	*10.99*	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	31.530	x	6.100	x	0.2	=	*38.47*	(m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=			
=	(	14.075	+	14.0751	+	4.625	+	4.625	+	4.625	+	4.625	)	x	0.1	=	4.67	(m3)	

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=						
=	(	4.625	+	4.625	+	4.625	+	4.625	+	192.333	)	x 25 x 5 :100	=				263.54	(100m)	

** L=3M*

W3=	(	S1	+	S2	+	0	)	x 25 x 3 : 100	=										
=	(	14.075	+	14.0751	+	0.000	)	x 25 x 3 : 100	=								21.11	(100m)	

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	) x 0.15 =						
=	(	14.075	+	14.075	+	4.625	+	4.625	+	4.625	+	4.625	+	192.333	) x 0.15 =				35.85		
																			(m3)		

6.FORM

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008 (m2)

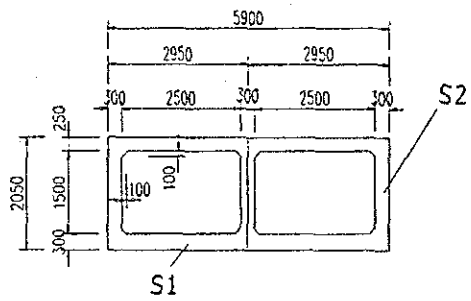
7.SCAFFOLDING

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008 (m2)

2.8. Box culvert at station 10+950

BOX CULVERT 10+950

I	BOX CULVERT STATION 10+950		QUANTITIES
	L	= 13.340 + 13.340 + 0.02 = 26.700	
1	CULVERT		
+	CONCRETE (M3)		
	S1=S2	= 2.950 x 2.050 - 2.500 x 1.500 + 2 x 0.100 x 0.100 =	2.318
	S	= S1 + S2 =	4.635
	VOLUME	= S x (13.340 + 13.340) + 5.900 x 0.200 x 0.300 x 2 =	124.36
		DOUBLE BOX CULVERT	
+	FORM (M2)		419.90
*	INSIDE FORM (M2)		291.649
	BOX BULWARK	= (1.500 + 2 x 0.100 x (1/SIN45^0 - 1)) x 26.680 x 4 =	168.921
	BOTTOM OF THE BOX	= (2.500 - 0.100 x 2) x 26.680 x 2 =	122.728
*	OUTSIDE FORM (M2)		128.253
	BOX BULWARK	= 2.050 x 2 x 26.680 + 4 x 0.300 x 0.200 =	109.628
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	13.990
	CENTER	= S =	4.635
+	SCAFFOLDING (M2)	= 2.050 x 2.000 x 26.680 + 4.000 x 0.300 x 0.200 =	109.63
+	SUPPORT		
	AREA (M2)	= 5.900 x 1.500 - S =	4.215
	VOLUME (M3)	= AREA x L =	112.54



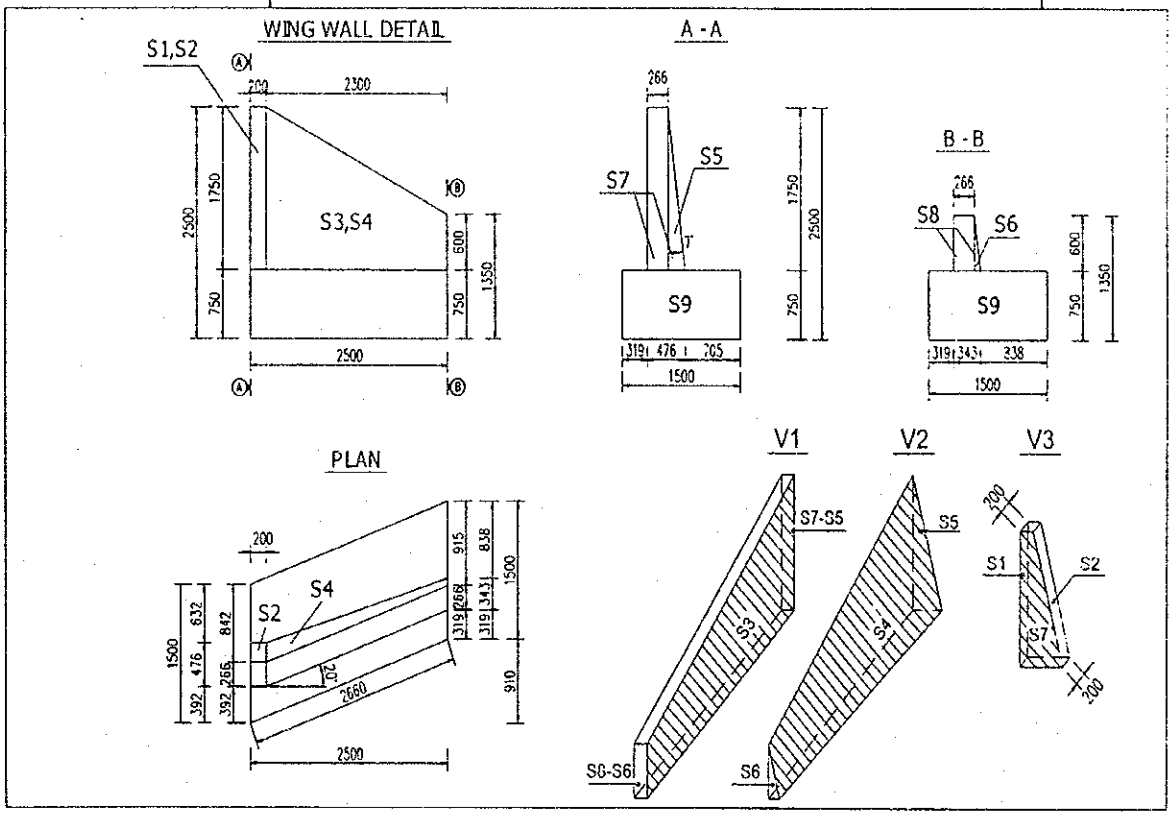
BOXCULVERT STATION 10+950
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	214	1.208	783.24	946.5
2	2350	250	12	108	0.888	253.8	225.3
3	6270	250	14	108	1.208	677.16	818.3
4	1500	250	14	212	1.208	318	384.3
5	1550	125	18	214	1.998	331.7	662.6
6	1970	250	12	216	0.888	425.52	377.8
7	2350	125	12	214	0.888	502.9	446.5
8	1049	250	12	216	0.888	226.584	201.2
9	1120	250	12	216	0.888	241.92	214.8
10	13845	250	12	52	0.888	719.94	639.2
11	13945	250	12	88	0.888	1227.16	1089.5
12	5780	250	12	2	0.888	11.56	10.3
13	1440	250	12	26	0.888	37.44	33.2
14	1180	250	12	320.16	0.888	377.7888	335.4

REINFORCEMENT : D<=14	5722.1	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	662.6	REINFORCEMENT (KG):	6384.7
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	62.18
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	11444.29	REINFORCEMENT (KG) :	12769.5
REINFORCEMENT : 16=D<=25	1325.195		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	124.36

2 WINGWALL

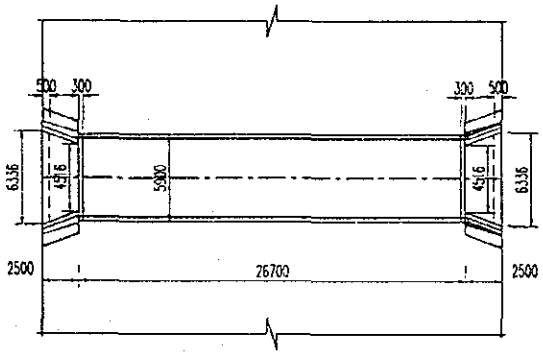


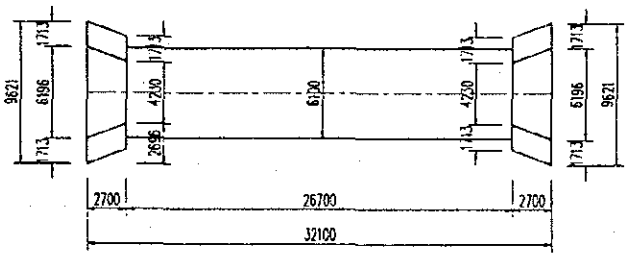
+	CALCULATING VALUES													
	S1	=	0.200	x	1.750								=	0.350
	S2	=	S1	:	$\cos 7^0$	=	0.350	:	0.993				=	0.353
	S3	=	(1.750	+	0.600)	x	(2.500	-	0.200)	:	2	x $\cos 20^0$	=	2.876
	S4	=	S3	:	$\cos 7^0$	=	2.876	:	0.993				=	2.898
	S5	=	(0.476	-	0.266)	x	1.750	:	2				=	0.184
	S6	=	(0.343	-	0.266)	x	0.600	:	2				=	0.023
	S7	=	S5	+	(1.750	x	0.266)		=		0.184	+ 0.466	=	0.650
	S8	=	S6	+	(0.600	x	0.266)		=		0.023	+ 0.160	=	0.183
	S9	=	1.500	x	0.750								=	1.125
+	CONCRETE (m^3)												=	3.92
	- Footing	=	S9	x	2.500	=	1.125	x	2.500				=	2.813
	- Wing wall	=	V1	+	V2	+	V3	=	0.765	+	0.210	+ 0.130	=	1.105
	V1	=	S3	x	0.266	=	2.876	x	0.266				=	0.765
	V2	=	(2.500	-	0.200)	:	3	x	(S5	+	S6	+ $(S5 \times S6)^{0.5}$)		
		=	0.767	x	(0.184	+	0.023	+	0.065)				=	0.210
	V3	=	S7	x	0.200	=	0.650	x	0.200				=	0.13
+	FORM (m^2)												=	14.88
	- Footing	=	(2.500	:	$\cos 20^0$	+	S9)	x	2	=	(2.660	+ 1.125) x 2	=	7.571
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+ S8		
		=	0.350	+	0.353	+	2.876	+	2.898	+	0.650	+ 0.183	=	7.309
+	SCAFFOLDING (m^2)												=	15.82
	- Footing	=	(2.500	:	$\cos 20^0$	+	1.000	+	1.500	+	1.000)	x 2 x 0.750	=	9.241
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)			
		=	2.876	+	2.898	+	0.806						=	6.580

BOX CULVERT STATION 10+950
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2011	12	15	0.888	30.2	26.8
1b	2060	14	15	1.208	30.9	37.3
2a	2651	12	6	0.888	15.9	14.1
2b	1552	12	12	0.888	18.6	16.5
2c	582	12	15	0.888	8.7	7.8
3	3005	12	2	0.888	6.0	5.3
4	3378	12	16	0.888	54.0	48.0
5a	2574	12	11	0.888	28.3	25.1
5b	1868	12	4	0.888	7.5	6.6
5c	1998	20	11	2.466	22.0	54.2
5d	1292	20	4	2.466	5.2	12.7
6	2444	14	8	1.208	19.6	23.6
7	1814	12	4	0.888	7.3	6.4
8	1814	12	4	0.888	7.3	6.4
9	2554	12	4	0.888	10.2	9.1
10	1304	14	5	1.208	6.5	7.9
11	724	12	9	0.888	6.5	5.8
12	1791	12	1	0.888	1.8	1.6
		REINFORCEMENT :		D=<14		**248.5** KG
		REINFORCEMENT :		14< D<=25		**66.9** KG
		TOTAL REINFORCEMENT :				**315.4** KG

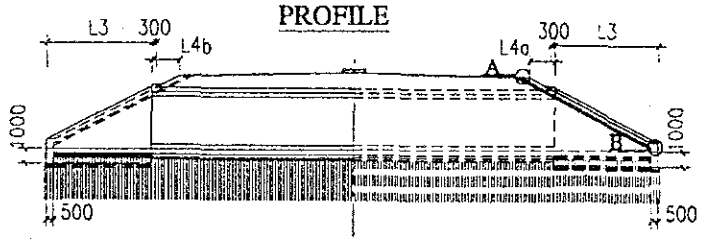
BOX CULVERT FOR DRAINAGE
(STATION 10+950)



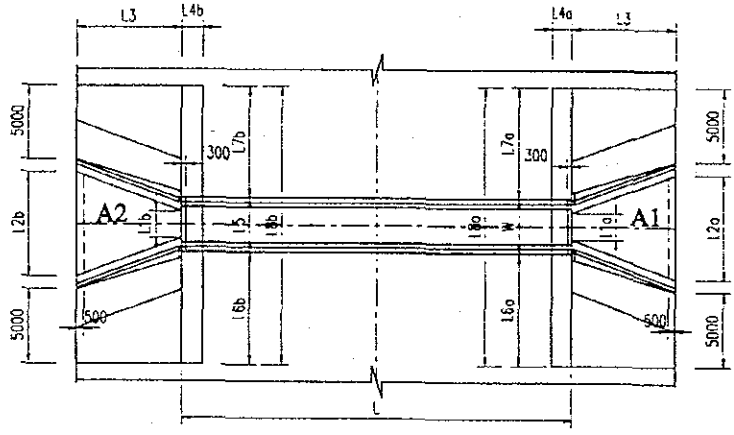


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

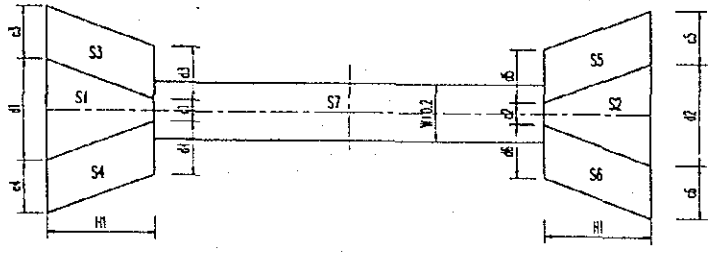
PROFILE



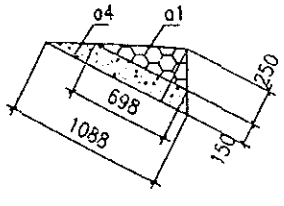
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

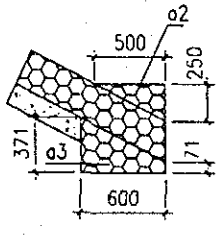


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM10+950

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S7=		L	x	(W + 0.2)	=							
=		26.700	x	6.100	=		162.870		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=					
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)			
A2=	(	L1b	+	L2b	)	x	L3	:	2	=					
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)			
	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	13.565	+	13.565	)	x 0.3	+	(	6.336	+	6.336	) x 0.45 x 0.5	=	*10.99*	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	26.700	x	6.100	x	0.2	=	32.57 (m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=			
=	(	14.075	+	14.0751	+	4.625	+	4.625	+	4.625	+	4.625	)	x	0.1	=	4.67	(m3)	

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=						
=	(	4.625	+	4.625	+	4.625	+	4.625	+	162.870	)	x 25 x 5 :100	=				226.71	(100m)	

** L=3M*

W3=	(	S1	+	S2	+	0	)	x 25 x 3 : 100	=										
=	(	14.075	+	14.0751	+	0.000	)	x 25 x 3 : 100	=								21.11	(100m)	

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	) x 0.15 =								
=	(	14.075	+	14.075	+	4.625	+	4.625	+	4.625	+	4.625	+	162.870	) x 0.15 =							31.43	(m3)

6.FORM

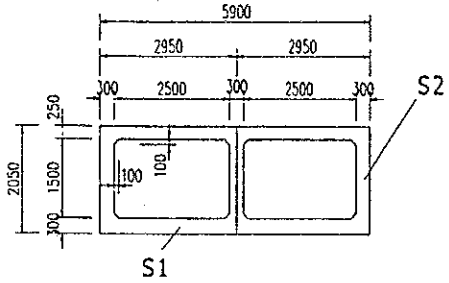
=	(L2a	+	L2b)	)	X 0.75	x	2	=		
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008	(m2)

7.SCAFFOLDING

=	(L2a	+	L2b)	)	X 0.75	x	2	=		
	(6.336	+	6.336	)	X .0.75	x	2	=	19.008	(m2)

2.9. Box culvert at station 11+451

BOX CULVERT 11+451

I	BOX CULVERT STATION 11+451		QUANTITIES
	L	= 13.340 + 13.340 + 0.02 = 26.700	
1	CULVERT		
+	CONCRETE (M3)		
	S1=S2	= 2.950 x 2.050 - 2.500 x 1.500 + 2 x 0.100 x 0.100 =	2.318
	S	= S1 + S2 =	4.635
	VOLUME	= S x (13.340 + 13.340) + 5.900 x 0.200 x 0.300 x 2 =	124.36
	DOUBLE BOX CULVERT		
+	FORM (M2)		419.90
*	INSIDE FORM (M2)		291.649
	BOX BULWARK	= (1.500 + 2 x 0.100 x (1/SIN45^0 - 1)) x 26.680 x 4 =	168.921
	BOTTOM OF THE BOX	= (2.500 - 0.100 x 2) x 26.680 x 2 =	122.728
*	OUTSIDE FORM (M2)		128.253
	BOX BULWARK	= 2.050 x 2 x 26.680 + 4 x 0.300 x 0.200 =	109.628
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	13.990
	CENTER	= S =	4.635
+	SCAFFOLDING (M2)	= 2.050 x 2.000 x 26.680 + 4.000 x 0.300 x 0.200 =	109.63
+	SUPPORT		
	AREA (M2)	= 5.900 x 1.500 - S =	4.215
	VOLUME (M3)	= AREA x L =	112.54

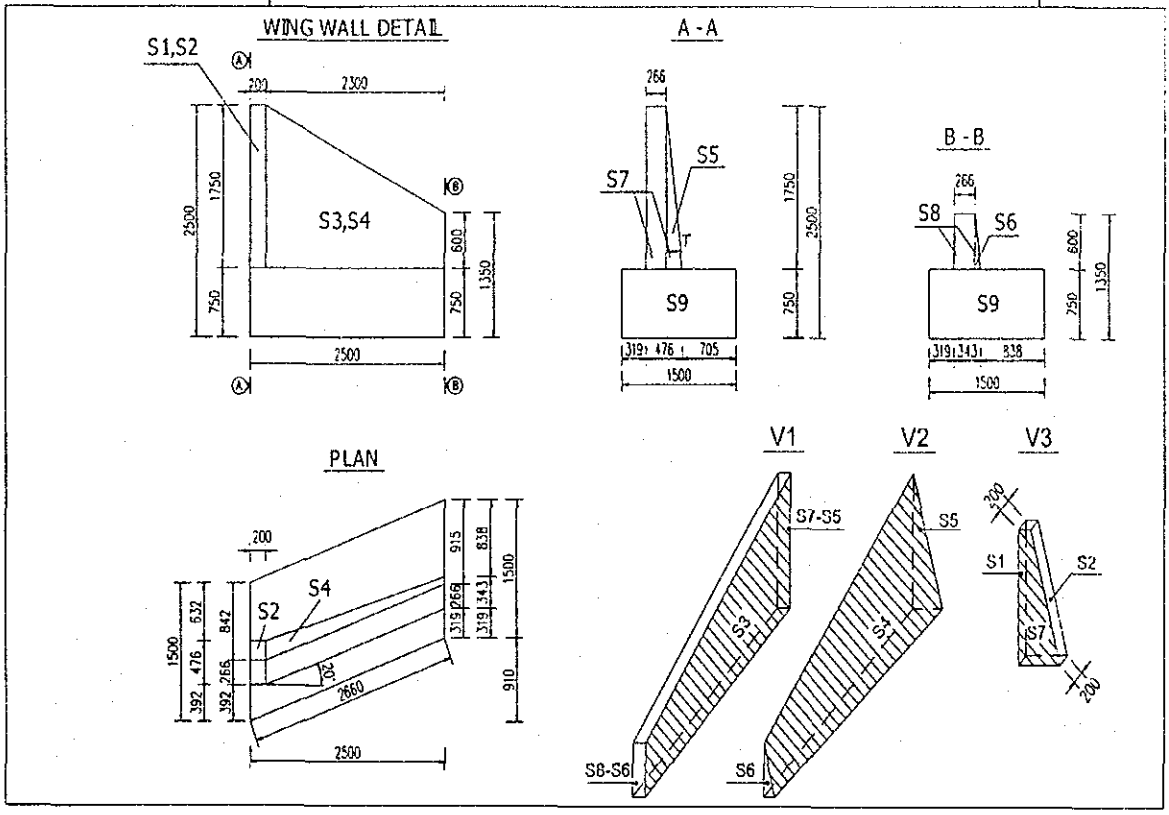
BOXCULVERT STATION 11+451
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	214	1.208	783.24	946.5
2	2350	250	12	108	0.888	253.8	225.3
3	6270	250	14	108	1.208	677.16	818.3
4	1500	250	14	212	1.208	318	384.3
5	1550	125	18	214	1.998	331.7	662.6
6	1970	250	12	216	0.888	425.52	377.8
7	2350	125	12	214	0.888	502.9	446.5
8	1049	250	12	216	0.888	226.584	201.2
9	1120	250	12	216	0.888	241.92	214.8
10	13845	250	12	52	0.888	719.94	639.2
11	13945	250	12	88	0.888	1227.16	1089.5
12	5780	250	12	2	0.888	11.56	10.3
13	1440	250	12	26	0.888	37.44	33.2
14	1180	250	12	320.16	0.888	377.7888	335.4

REINFORCEMENT : D<=14	5722.1	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	662.6	REINFORCEMENT (KG):	6384.7
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	62.18
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	11444.29	REINFORCEMENT (KG) :	12769.5
REINFORCEMENT : 16=D<=25	1325.195		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	124.36

2 WINGWALL

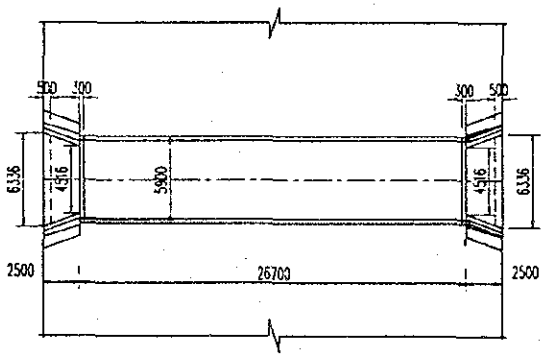


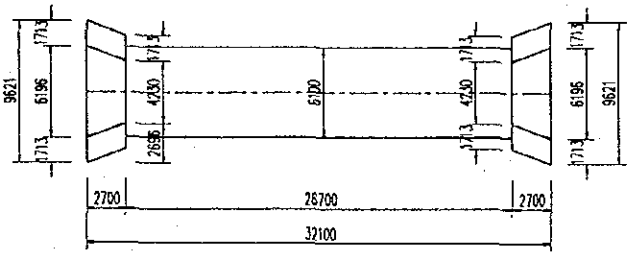
+	CALCULATING VALUES												
	S1	=	0.200	x	1.750							=	0.350
	S2	=	S1	:	$\cos 7^0$	=	0.350	:	0.993			=	0.353
	S3	=	(1.750	+	0.600)	x	(2.500	-	0.200)	:	2	x $\cos 20^3$	=	2.876
	S4	=	S3	:	$\cos 7^0$	=	2.876	:	0.993			=	2.898
	S5	=	(0.476	-	0.266)	x	1.750	:	2			=	0.184
	S6	=	(0.343	-	0.266)	x	0.600	:	2			=	0.023
	S7	=	S5	+	(1.750	x	0.266)	=	0.184	+	0.466	=	0.650
	S8	=	S6	+	(0.600	x	0.266)	=	0.023	+	0.160	=	0.183
	S9	=	1.500	x	0.750							=	1.125
+	CONCRETE (m^3)											=	3.92
	- Footing	=	S9	x	2.500	=	1.125	x	2.500			=	2.813
	- Wing wall	=	V1	+	V2	+	V3	=	0.765	+	0.210 + 0.130	=	1.105
	V1	=	S3	x	0.266	=	2.876	x	0.266			=	0.765
	V2	=	(2.500	-	0.200)	:	3	x	(S5	+	S6 + $(S5 \times S6)^{0.5}$)		
		=	0.767	x	(0.184	+	0.023	+	0.065)			=	0.210
	V3	=	S7	x	0.200	=	0.650	x	0.200			=	0.13
+	FORM (m^2)											=	14.88
	- Footing	=	(2.500	:	$\cos 20^0$	+	S9)	x	2	=	(2.660 + 1.125) x 2	=	7.571
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7 + S8		
		=	0.350	+	0.353	+	2.876	+	2.898	+	0.650 + 0.183	=	7.309
+	SCAFFOLDING (m^2)											=	15.82
	- Footing	=	(2.500	:	$\cos 20^0$	+	1.000	+	1.500	+	1.000) x 2 x 0.750	=	9.241
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)		
		=	2.876	+	2.898	+	0.806					=	6.580

BOX CULVERT STATION 11+451
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2011	12	15	0.888	30.2	26.8
1b	2060	14	15	1.208	30.9	37.3
2a	2651	12	6	0.888	15.9	14.1
2b	1552	12	12	0.888	18.6	16.5
2c	582	12	15	0.888	8.7	7.8
3	3005	12	2	0.888	6.0	5.3
4	3378	12	16	0.888	54.0	48.0
5a	2574	12	11	0.888	28.3	25.1
5b	1868	12	4	0.888	7.5	6.6
5c	1998	20	11	2.466	22.0	54.2
5d	1292	20	4	2.466	5.2	12.7
6	2444	14	8	1.208	19.6	23.6
7	1814	12	4	0.888	7.3	6.4
8	1814	12	4	0.888	7.3	6.4
9	2554	12	4	0.888	10.2	9.1
10	1304	14	5	1.208	6.5	7.9
11	724	12	9	0.888	6.5	5.8
12	1791	12	1	0.888	1.8	1.6
REINFORCEMENT :				D=<14		**248.5** KG
REINFORCEMENT :				14< D<=25		**66.9** KG
TOTAL REINFORCEMENT :						**315.4** KG

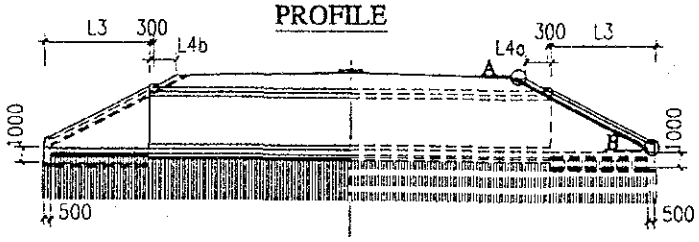
BOX CULVERT FOR DRAINAGE
(STATION 11+451)



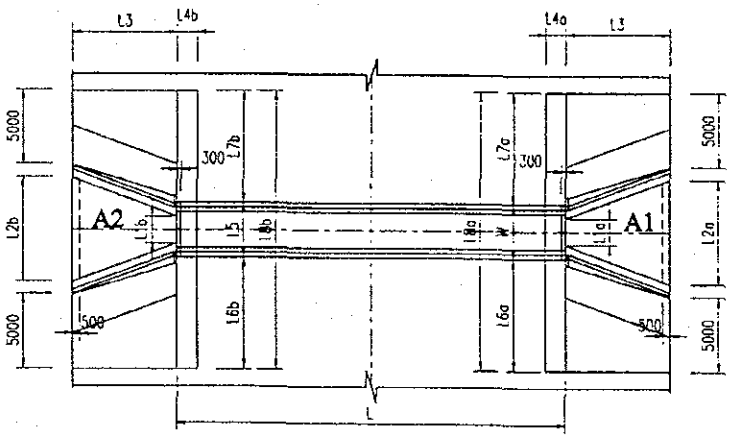


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

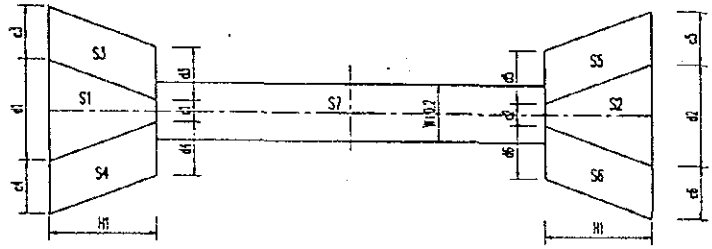
PROFILE



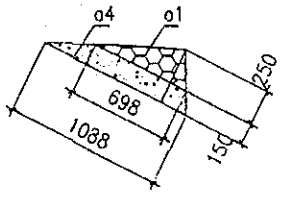
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

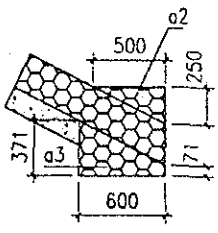


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM11+451

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625	(m2)
S7=		L	x	(W + 0.2)	=							
=		26.700	x	6.100	=		162.870		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	6.336	)	x	2.500	:	2	=	13.565	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	13.565	+	13.565	)	x 0.3	+	(	6.336	+	6.336	) x 0.45 x 0.5	=	*10.99*	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	26.700	x	6.100	x	0.2	=	32.57 (m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=			
=	(	14.075	+	14.0751	+	4.625	+	4.625	+	4.625	+	4.625	)	x	0.1	=	4.67	(m3)	

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=						
=	(	4.625	+	4.625	+	4.625	+	4.625	+	162.870	)	x 25 x 5 :100	=				226.71	(100m)	

** L=3M*

W3=	(	S1	+	S2	+	0	)	x 25 x 3 : 100	=										
=	(	14.075	+	14.0751	+	0.000	)	x 25 x 3 : 100	=								21.11	(100m)	

NOTE: S=0.8 x 4.5 x 4 IS AREA *WOOD PILE TOE OF SLOPE*

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	) x 0.15 =						
=	(	14.075	+	14.075	+	4.625	+	4.625	+	4.625	+	4.625	+	162.870	) x 0.15 =				31.43		
																			(m3)		

6.FORM

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008 (m2)

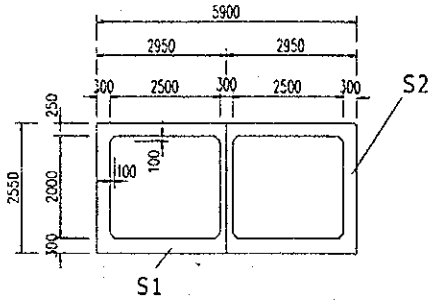
7.SCAFFOLDING

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(6.336	+	6.336	)	X 0.75	x	2	=	19.008 (m2)

2.10. Box culvert at station 11+690

BOX CULVERT 11+690

I	BOX CULVERT STATION 11+690		QUANTITIES
	L	= 15.590 + 15.590 + 0.02 = 31.200	
1	CULVERT		
+	CONCRETE (M3)		
	S1=S2	= 2.950 x 2.550 - 2.500 x 2.000 + 2 x 0.100 x 0.100 =	2.543
	S	= S1 + S2 =	5.085
	VOLUME	= S x (15.590 + 15.590) + 5.900 x 0.200 x 0.300 x 2 =	159.26
		DOUBLE BOX CULVERT	
+	FORM (M2)		606.22
*	INSIDE FORM (M2)		426.982
	BOX BULWARK	= (2.000 + 2 x 0.300 x (1:SIN45^0 - 1)) x 31.180 x 4 =	280.436
	BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 31.180 x 2 =	146.546
*	OUTSIDE FORM (M2)		179.233
	BOX BULWARK	= 2.550 x 2 x 31.180 + 4 x 0.300 x 0.200 =	159.258
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	14.890
	CENTER	= S =	5.085
+	SCAFFOLDING (M2)	= 2.550 x 2.000 x 31.180 + 4.000 x 0.300 x 0.200 =	159.26
+	SUPPORT		
	AREA (M2)	= 5.900 x 2.000 - S =	6.715
	VOLUME (M3)	= AREA x L =	209.51



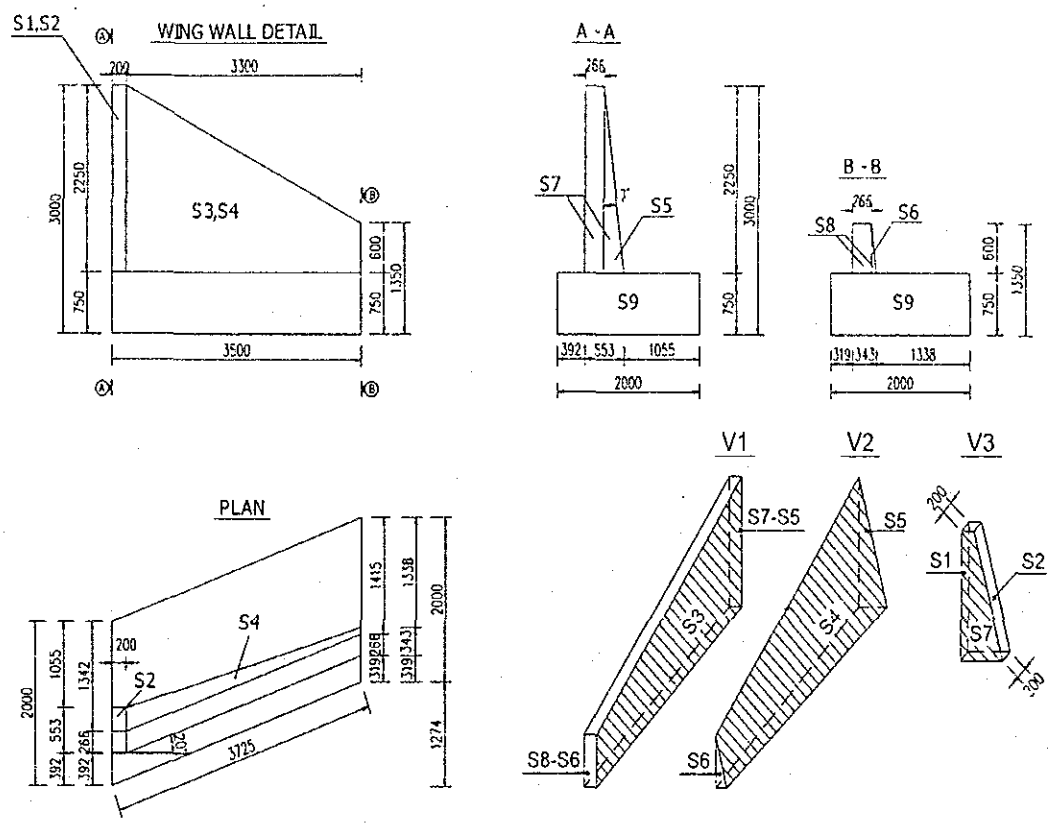
BOXCULVERT STATION 11+690
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	250	1.208	1040.0	1256.7
2	2850	250	12	126	0.888	359.1	318.8
3	6270	250	14	126	1.208	790.0	954.7
4	1500	250	14	248	1.208	372.0	449.5
5	1550	125	18	250	1.998	387.5	774.1
6	1970	250	12	252	0.888	496.4	440.7
7	2850	125	12	250	0.888	712.5	632.6
8	1049	250	12	252	0.888	264.3	234.7
9	1120	250	12	252	0.888	282.2	250.6
10	16095	250	12	52	0.888	836.9	743.0
11	16195	250	12	100	0.888	1619.5	1437.8
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	374.16	0.888	441.5	392.0
15	1280	250	12	374.16	0.888	478.9	425.2

REINFORCEMENT : D<=14	7579.9	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	774.1	REINFORCEMENT (KG):	8353.9
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	79.63
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	15159.76	REINFORCEMENT (KG) :	16707.9
REINFORCEMENT : 16=D<=25	1548.125		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	159.26

2 WINGWALL

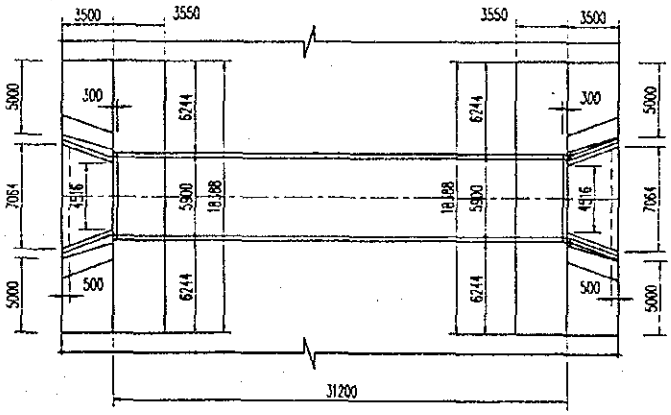


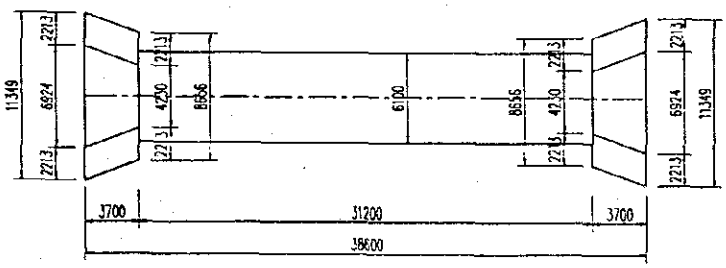
+	CALCULATING VALUES													
	S1	=	0.200	x	2.250								=	0.450
	S2	=	S1	:	$\cos 7^0$	=	0.450	:	0.993				=	0.453
	S3	=	(2.250	+	0.600)	x	(3.500	-	0.200)	:	2	x $\cos 20^0$	=	5.004
	S4	=	S3	:	$\cos 7^0$	=	5.004	:	0.993				=	5.042
	S5	=	(0.553	-	0.266)	x	2.250	:	2				=	0.323
	S6	=	(0.343	-	0.266)	x	0.600	:	2				=	0.023
	S7	=	S5	+	(2.250	x	0.266)	=	0.323	+	0.599		=	0.922
	S8	=	S6	+	(0.600	x	0.266)	=	0.023	+	0.160		=	0.183
	S9	=	2.000	x	0.750								=	1.500
+	CONCRETE (m^3)												=	7.25
	- Footing	=	S9	x	3.500	=	1.500	x	3.500				=	5.250
	- Wing wall	=	V1	+	V2	+	V3	=	1.331	+	0.480	+ 0.184	=	1.995
	V1	=	S3	x	0.266	=	5.004	x	0.266				=	1.331
	V2	=	(3.500	-	0.200)	:	3	x	(S5	+	S6	+ $(S5 \times S6)^{0.5}$)		
		=	1.100	x	(0.323	+	0.023	+	0.086)				=	0.480
	V3	=	S7	x	0.200	=	0.922	x	0.200				=	0.184
+	FORM (m^2)												=	22.50
	- Footing	=	(3.500	:	$\cos 20^0$	+	S9)	x	2	=	(3.725	+ 1.500) x 2	=	10.449
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+ S8		
		=	0.450	+	0.453	+	5.004	+	5.042	+	0.922	+ 0.183	=	12.053
+	SCAFFOLDING (m^2)												=	22.44
	- Footing	=	(3.500	:	$\cos 20^0$	+	1.000	+	2.000	+	1.000)	x 2 x 0.750	=	11.587
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)			
		=	5.004	+	5.042	+	0.806						=	10.852

BOX CULVERT STATION 11+690
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2258	12	20	0.888	45.2	40.1
1b	2310	14	20	1.208	46.2	55.8
2a	3723	12	6	0.888	22.3	19.8
2b	2100	12	16	0.888	33.6	29.8
2c	582	12	20	0.888	11.6	10.3
3	4254	12	2	0.888	8.5	7.6
4	4429	12	20	0.888	88.6	78.6
5a	3043	12	15	0.888	45.6	40.5
5b	2150	12	6	0.888	12.9	11.5
5c	2467	20	15	2.466	37.0	91.3
5d	1574	20	6	2.466	9.4	23.3
6	2444	14	16	1.208	39.1	47.3
7	2301	12	4	0.888	9.2	8.2
8	2301	12	4	0.888	9.2	8.2
9	3605	12	4	0.888	14.4	12.8
10	1304	14	8	1.208	10.4	12.6
11	744	12	11	0.888	8.2	7.3
12	2143	12	1	0.888	2.1	1.9
REINFORCEMENT :				D<=14		**392.2** KG
REINFORCEMENT :				14< D<=25		**114.6** KG
TOTAL REINFORCEMENT :						**506.8** KG

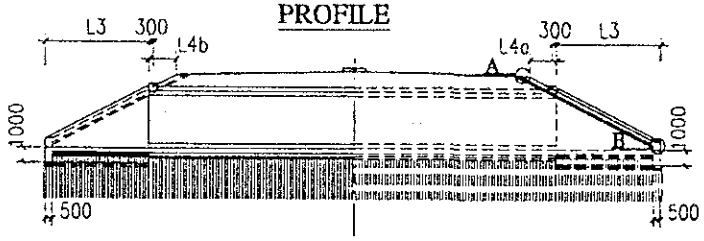
BOX CULVERT FOR DRAINAGE
(STATION 11+690)



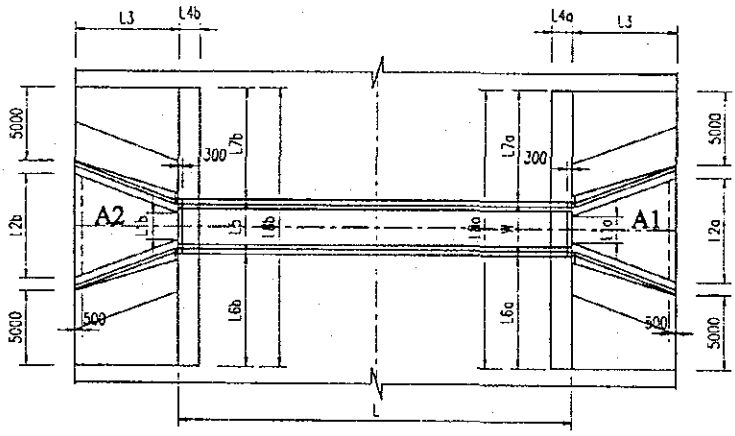


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

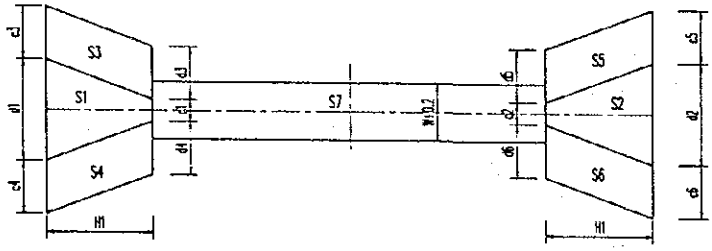
PROFILE



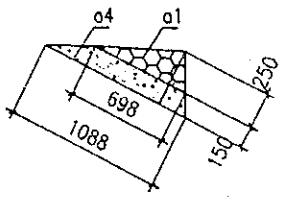
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

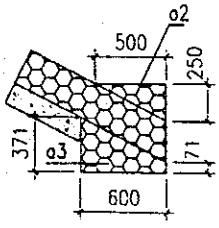


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM11+690

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S7=		L	x	(W + 0.2)	=							
=		31.200	x	6.100	=		190.320		(m2)			

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	20.265	+	20.265	)	x 0.3	+	(	7.064	+	7.064	) x 0.45 x 0.5	=	15.34	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	31.200	x	6.100	x	0.2	=	***38.06*** (m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=		
=	(	20.635	+	20.6349	+	8.188	+	8.188	+	8.188	+	8.188	)	x	0.1	=	7.40	(m3)

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=					
=	(	8.188	+	8.188	+	8.188	+	8.188	+	190.320	)	x 25 x 5 :100	=		278.84	(100m)		

** L=3M*

W3=	(	S1	+	S2	+	(0.8 x 4.5 x 4)	)	x 25 x 3 : 100	=									
=	(	20.635	+	20.6349	+	14.400	)	x 25 x 3 : 100	=		41.75	(100m)						

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	+	(0.8 x 4.5 x 4)	)	x 0.15 =							
=	(	20.635	+	20.635	+	8.188	+	8.188	+	8.188	+	8.188	+	190.320	+	(0.8 x 4.5 x 4)	)	x 0.15 =	41.81	(m3)					

6. STONE MASONRY

a1=		0.695	x	0.25	x		0.5	=		0.087	(m2)							
a2=		0.5	x	0.25	x		0.5	=		0.063	(m2)							
a3=	(	0.071	+	0.371	)	x	0.5	x	0.6	=	0.133	(m2)						
a4=	(	0.698	+	1.088	)	x	0.5	x	0.15	=	0.134	(m2)						

b1=		0.300	x	L5	=	0.300	x		5.900	=		1.770	(m2)					

(b1 IS AREA OF HEAD WALL)

b2a=	(	L6a	+	5.000	)	x	L3	x 0.5	=									
=	(	6.244	+	5.000	)	x	3.500	x 0.5	=	19.677	(m2)							

b2b= (L6b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3a= (L7a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3b= (L7b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b4a= L8a x L4a = 18.388 x 3.550 = 65.277 (m2)

b4b= L8b x L4b = 18.388 x 3.550 = 65.277 (m2)

b5= 0.6 x 5 x 2 = 6.000 (m2)

V1a= a1 x L8a = 0.087 x 18.388 = 1.597 (m3)

V1b= a1 x L8b = 0.087 x 18.388 = 1.597 (m3)

V2= (a2 + a3) x 5 x 4 = (0.063 + 0.133) x 5 x 4 = 3.902 (m3)

V3a= (b4a - b1 + b2a + b3a) x 0.25 : COS(26.56) =
= (65.277 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 28.764 (m3)

V3b= (b4b - b1 + b2b + b3b) x 0.25 : COS(26.56) =
= (65.277 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 28.764 (m3)

TOTAL = (V1a + V1b + V2 + V3a + V3b) =
(1.597 + 1.597 + 3.902 + 28.764 + 28.764) = ***64.626*** (m3)

6. BASE BEDDING:

V4a=		a4	x	L8a			=	0.134	x	18.388			=	2.463	(m3)			
V4b=		a4	x	L8b			=	0.134	x	18.388			=	2.463	(m3)			
V5a=	(	b4a	-	b1	+	b2a	+	b3a	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	65.277	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	16.252	(m3)
V5b=	(	b4b	-	b1	+	b2b	+	b3b	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	65.277	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	16.252	(m3)
TOTAL =			(	V4a	+	V4b	+	V5a	+	V5b	)=							
			(	2.463	+	2.463	+	16.252	+	16.252	)=	37.43		(m3)				

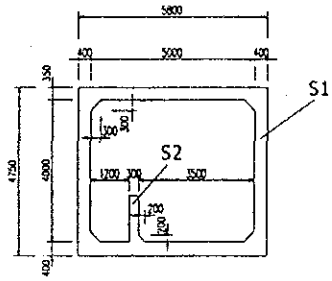
8. FORM :

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(7.064	+	7.064	)	X 0.75	x	2	=	**21.192** (m2)

9. SCAFFOLDING :

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(7.064	+	7.064	)	X 0.75	x	2	=	**21.192** (m2)

2.11. Box culvert at station 11+976.5

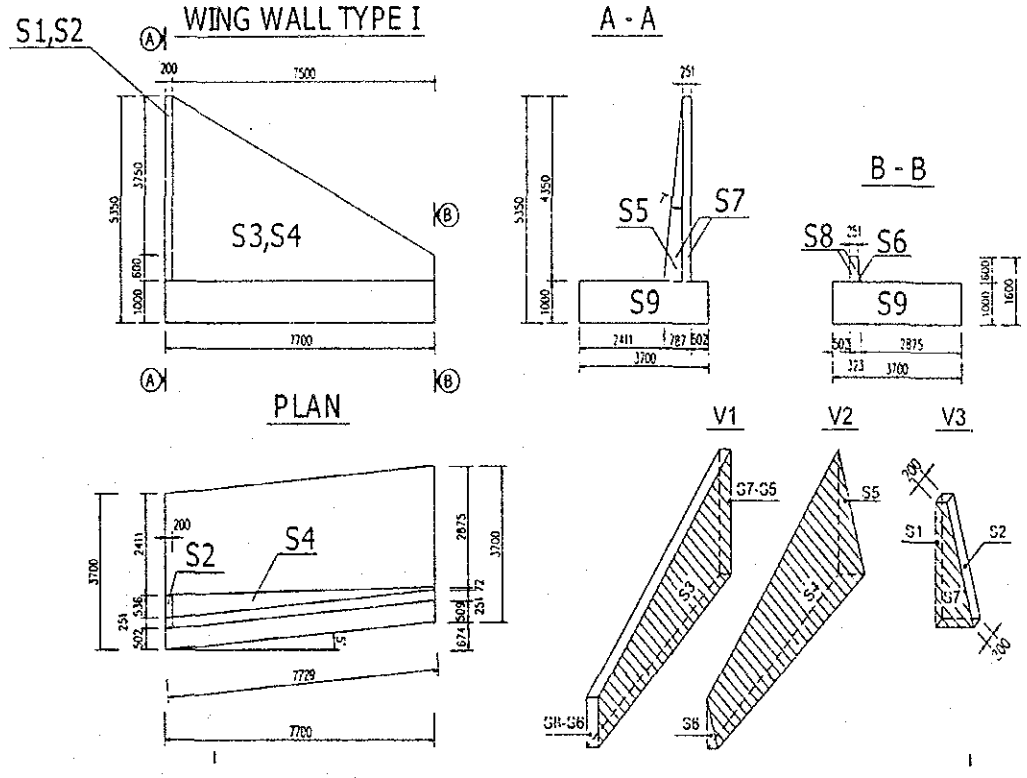
I	BOX CULVERT STATION 11+976.5		QUANTITIES
	L	= 13.562 + 13.562 + 0.02 = 27.143	
1	CULVERT		
+	CONCRETE (M3)		
	S1	= 5.800 x 4.750 - 5.000 x 4.000 + 2 x 0.300 x 0.300 =	7.730
	S2	= 1.300 x 0.300 + 0.200 x 0.200 : 2 =	0.410
	S	= S1 + S2 =	8.140
	VOLUME	= S x (13.562 + 13.562) + 5.800 x 0.200 x 0.300 x 2 =	221.48
		SINGLE BOX CULVERT 	
+	FORM (M2)		674.345
*	INSIDE FORM (M2)		387.314
	BOX BULWARK	= (4.000 + 2 x 0.300 x (1:SIN45^0 - 1)) x 27.123 x 2 =	230.466
	BOTTOM OF THE BOX	= (5.000 - 0.300 x 2) x 27.123 x 1 =	119.341
	RETAINING WALL	= (1.300 + (1:SIN45^0 - 1) x 0.200) x 27.12 =	37.507
*	OUTSIDE FORM (M2)		287.032
	BOX BULWARK	= 4.750 x 2 x 27.123 + 4 x 0.300 x 0.200 =	257.909
	THE END OF CULVERT	= S x 2 : SIN85^0 + 5.800 x 0.200 x 4 =	20.983
	CENTER	= S =	8.140
+	SCAFFOLDING (M2)	= BOX BULWARK =	257.909
+	SUPPORT		
	AREA (M2)	= 4.750 x 2.000 x 27.123 + 4.000 x 0.300 x 0.200 =	1.360
	VOLUME (M3)	= AREA x L =	36.914

BOXCULVERT STATION 11+976.5
QUANTITIES TABLE OF REINFORCEMENT
SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1a	7770	250	20	108	2.466	839.2	2069.5
1b	7782	250	20	3	2.466	23.3	57.6
2	4610	250	20	106	2.466	488.7	1205.1
3a	6604	250	22	53	2.984	350.0	1044.4
3b	6627	250	22	2	2.984	13.3	39.5
4a	6360	250	20	108	2.466	686.9	1693.9
4b	6382	250	20	3	2.466	19.1	47.2
5a	3220	250	12	108	0.888	347.8	308.7
5b	3232	250	12	6	0.888	19.4	17.2
6a	6575	250	20	53	2.466	348.5	859.4
6b	6598	250	20	2	2.466	13.2	32.5
7	5170	250	16	111	1.578	573.9	905.8
8a	1567	250	12	108	0.888	169.2	150.2
8b	1571	250	12	3	0.888	4.7	4.2
9a	1638	250	12	108	0.888	176.9	157.0
9b	1642	250	12	3	0.888	4.9	4.4
10	1560	250	12	24	0.888	37.4	33.2
11	5682	250	12	2	0.888	11.4	10.1
12	3700	250	12	54	0.888	199.8	177.4
13	1355	250	12	54	0.888	73.2	65.0
14	14207	250	12	48	0.888	681.9	605.4
15	14068	250	12	32	0.888	450.2	399.7
16	14546	250	12	32	0.888	465.5	413.2
17	14006	250	12	10	0.888	140.1	124.3
18	14307	250	12	48	0.888	686.7	609.7
19	1410	250	14	228	1.208	321.5	388.5
20	1440	250	12	228	0.888	328.3	291.5

REINFORCEMENT : D<=14	3759.7	TOTAL FOR SEGMENT 1 :	
REINFORCEMENT : 16=D<=25	7955.1	REINFORCEMENT (KG):	11714.8
REINFORCEMENT : 25<D=32		CONCRETE (M^3):	110.74
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT : D<=14	7519.493	REINFORCEMENT (KG) :	23429.7
REINFORCEMENT : 16=D<=25	15910.16		
REINFORCEMENT : 25<D=32		CONCRETE (M^3) :	221.48

2 WINGWALL TYPE I

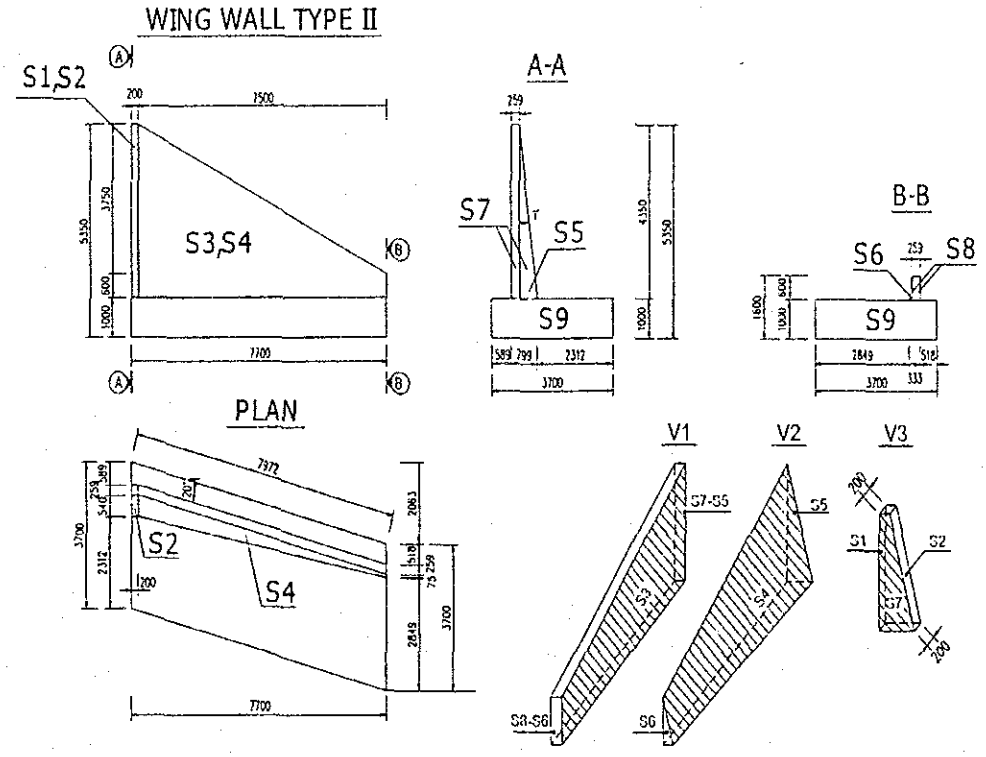


+	CALCULATING VALUES															
	S1	=	0.200	x	4.350									=		0.870
	S2	=	S1	:	$\cos 7^0$	=		0.870	:	0.993				=		0.877
	S3	=	(4.350	+	0.600)	x	(7.700	-	0.200)	:	2	x	$\cos 5^0$	=		18.633
	S4	=	S3	:	$\cos 7^0$	=		18.633	:	0.993				=		18.773
	S5	=	(0.784	-	0.251)	x	4.350	:	2					=		1.159
	S6	=	(0.323	-	0.251)	x	0.600	:	2					=		0.022
	S7	=	S5	+	(4.350	x	0.251)		=		1.159	+	1.092	=		2.251
	S8	=	S6	+	(0.600	x	0.251)		=		0.022	+	0.151	=		0.173
	S9	=	3.700	x	1.000									=		3.700
+	CONCRETE (m^3)													=		36.97
	- Footing	=	S9	x	7.700		=		3.700	x	7.700			=		28.490
	- Wing wall	=	V1	+	V2	+	V3		=		4.677	+	3.350	+	0.450	= 8.477
	V1	=	S3	x	0.251		=		18.633	x	0.251			=		4.677
	V2	=	(7.700	-	0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)			
		=	2.500	x	(1.159	+	0.022	+	0.160)					=		3.350
	V3	=	S7	x	0.200		=		2.251	x	0.200			=		0.45
+	FORM (m^2)													=		64.44
	- Footing	=	(7.700	:	$\cos 5^0$	+	S9)	x	2	=	(7.729	+	3.700)	x	2	= 22.859
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+	S8			
		=	0.870	+	0.877	+	18.633	+	18.773	+	2.251	+	0.173	=		41.576
+	SCAFFOLDING (m^2)													=		65.06
	- Footing	=	(7.700	:	$\cos 5^0$	+	1.000	+	3.700	+	1.000)	x	2	x	1.000	= 26.859
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.323	+	1.000)					
		=	18.633	+	18.773	+	0.794							=		38.200

BOX CULVERT STATION 11+976.5
REINFORCEMENT OF WINGWALL TYPE I

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3571	12	39	0.888	139.2	123.6
1b	3701	18	39	1.998	144.3	288.3
2a	7870	12	6	0.888	47.2	41.9
2b	4396	12	36	0.888	158.3	140.5
2c	552	12	39	0.888	21.5	19.1
3	8696	12	2	0.888	17.4	15.4
4	8691	12	38	0.888	330.3	293.2
5a	5350	12	37	0.888	198.0	175.7
5b	3660	12	2	0.888	7.3	6.5
5c	4344	22	37	2.984	160.7	479.6
5d	2654	22	2	2.984	5.3	15.8
6	2944	14	81	1.208	238.5	288.2
7	4008	12	4	0.888	16.0	14.2
8	4008	12	6	0.888	24.0	21.4
9	7617	12	6	0.888	45.7	40.6
10	1304	14	14	1.208	18.3	22.1
11	847	12	21	0.888	17.8	15.8
12	3241	12	2	0.888	6.5	5.8
REINFORCEMENT :				D=<14	**1224.0** KG	
REINFORCEMENT :				14< D<=25	**783.8** KG	
TOTAL REINFORCEMENT :					**2007.8** KG	

3 WINGWALL TYPE II

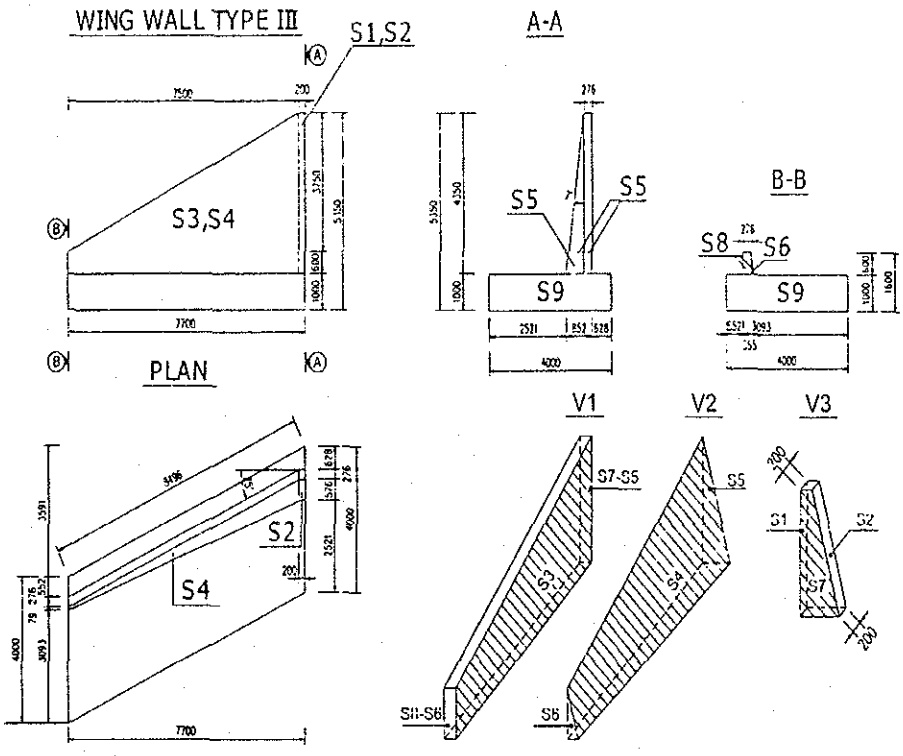


+	CALCULATING VALUES													
	S1	=	0.200	x	4.350								=	0.870
	S2	=	S1	:	$\cos 7^0$	=	0.870	:	0.993				=	0.877
	S3	=	(4.350 + 0.600)	x	(7.700 - 0.200)	:	2	x	$\cos 20^0$				=	19.754
	S4	=	S3	:	$\cos 7^0$	=	19.754	:	0.993				=	19.902
	S5	=	(0.799 - 0.259)	x	4.350	:	2						=	1.175
	S6	=	(0.333 - 0.259)	x	0.600	:	2						=	0.022
	S7	=	S5	+	(4.350 x 0.259)	=	1.175	+	1.127				=	2.302
	S8	=	S6	+	(0.600 x 0.259)	=	0.022	+	0.155				=	0.177
	S9	=	3.700	x	1.000								=	3.700
+	CONCRETE (m^3)												=	37.47
	- Footing	=	S9	x	7.700	=	3.700	x	7.700				=	28.490
	- Wing wall	=	V1	+	V2	+	V3	=	5.116	+	3.400	+ 0.460	=	8.976
	V1	=	S3	x	0.259	=	19.754	x	0.259				=	5.116
	V2	=	(7.700 - 0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)			
		=	2.500	x	(1.175	+	0.022	+	0.161)				=	3.400
	V3	=	S7	x	0.200	=	2.302	x	0.200				=	0.46
+	FORM (m^2)												=	67.67
	- Footing	=	(7.700 : $\cos 20^0$	+	S9)	x	2	=	(8.194	+	3.700)	x 2	=	23.788
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+ S8		
		=	0.870	+	0.877	+	19.754	+	19.902	+	2.302	+ 0.177	=	43.882
+	SCAFFOLDING (m^2)												=	68.24
	- Footing	=	(7.700 : $\cos 20^0$	+	1.000	+	3.700	+	1.000)	x	2	x 1.000	=	27.788
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.333	+	1.000)			
		=	19.754	+	19.902	+	0.800						=	40.456

BOX CULVERT STATION 11+976.5
REINFORCEMENT OF WINGWALL TYPE II

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3573	12	41	0.888	146.5	130.1
1b	3704	18	41	1.998	151.8	303.3
2a	8065	12	6	0.888	48.4	43.0
2b	4525	12	36	0.888	162.9	144.6
2c	552	12	41	0.888	22.6	20.1
3	8907	12	2	0.888	17.8	15.8
4	8930	12	36	0.888	321.5	285.4
5a	5238	12	35	0.888	183.3	162.8
5b	3611	12	8	0.888	28.9	25.6
5c	4232	22	35	2.984	148.1	442.0
5d	2605	22	8	2.984	20.8	62.2
6	2944	14	72	1.208	212.0	256.1
7	4004	12	4	0.888	16.0	14.2
8	4004	12	6	0.888	24.0	21.3
9	7856	12	6	0.888	47.1	41.8
10	1304	14	14	1.208	18.3	22.1
11	858	12	21	0.888	18.0	16.0
12	3291	12	2	0.888	6.6	5.8
REINFORCEMENT :			D=<14		**1204.8** KG	
REINFORCEMENT :			14< D<=25		**807.5** KG	
TOTAL REINFORCEMENT :					**2012.3** KG	

4 WINGWALL TYPE III



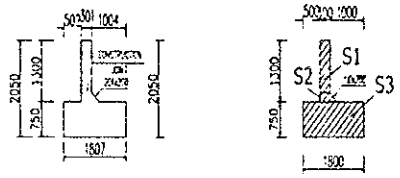
+	CALCULATING VALUES			
	S1	= 0.200 x 4.350	=	0.870
	S2	= S1 : $\cos 25^0$ = 0.870 : 0.993	=	0.877
	S3	= (4.350 + 0.600) x (7.700 - 0.200) : 2 x $\cos 25^0$	=	20.481
	S4	= S3 : $\cos 25^0$ = 20.481 : 0.993	=	20.635
	S5	= (0.852 - 0.276) x 4.350 : 2	=	1.253
	S6	= (0.355 - 0.276) x 0.600 : 2	=	0.024
	S7	= S5 + (4.350 x 0.276) = 1.253 + 1.201	=	2.454
	S8	= S6 + (0.600 x 0.276) = 0.024 + 0.166	=	0.190
	S9	= 4.000 x 1.000	=	4.000
+	CONCRETE (m^3)		=	40.57
	- Footing	= S9 x 7.700 = 4.000 x 7.700	=	30.800
	- Wing wall	= V1 + V2 + V3 = 5.653 + 3.630 + 0.491	=	9.774
	V1	= S3 x 0.276 = 20.481 x 0.276	=	5.653
	V2	= (7.700 - 0.200) : 3 x (S5 + S6 + $(S5 \times S6)^{0.5}$)		
		= 2.500 x (1.253 + 0.024 + 0.173)	=	3.630
	V3	= S7 x 0.200 = 2.454 x 0.200	=	0.491
+	FORM (m^2)		=	70.50
	- Footing	= (7.700 : $\cos 25^0$ + S9) x 2 = (8.496 + 4.000) x 2	=	24.992
	- Wing wall	= S1 + S2 + S3 + S4 + S7 + S8		
		= 0.870 + 0.877 + 20.481 + 20.635 + 2.454 + 0.190	=	45.506
+	SCAFFOLDING (m^2)		=	70.92
	- Footing	= (7.700 : $\cos 25^0$ + 1.000 + 4.000 + 1.000) x 2 x 1.000	=	28.992
	- Wing wall	= S3 + S4 + 0.600 x (0.355 + 1.000)		
		= 20.481 + 20.635 + 0.813	=	41.929

BOX CULVERT STATION 11+976.5
REINFORCEMENT OF WINGWALL TYPE III

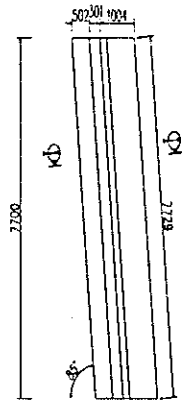
BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3575	12	43	0.888	153.7	136.5
1b	3709	18	43	1.998	159.5	318.6
2a	8609	12	6	0.888	51.7	45.9
2b	4806	12	36	0.888	173.0	153.6
2c	552	12	43	0.888	23.7	21.1
3	9505	12	2	0.888	19.0	16.9
4	9446	12	38	0.888	358.9	318.7
5a	5289	12	34	0.888	179.8	159.7
5b	3636	12	15	0.888	54.5	48.4
5c	4283	22	34	2.984	145.6	434.5
5d	2630	22	15	2.984	39.5	117.7
6	2944	14	88	1.208	259.1	313.1
7	4296	12	4	0.888	17.2	15.3
8	4296	12	6	0.888	25.8	22.9
9	8372	12	6	0.888	50.2	44.6
10	1304	14	14	1.208	18.3	22.1
11	891	12	21	0.888	18.7	16.6
12	2742	12	3	0.888	8.2	7.3
REINFORCEMENT :			D=<14		**1342.4** KG	
REINFORCEMENT :			14< D<=25		**870.9** KG	
TOTAL REINFORCEMENT :					**2213.2** KG	

5 RETAINING WALL

RETAINING WALL I-1



PLAN



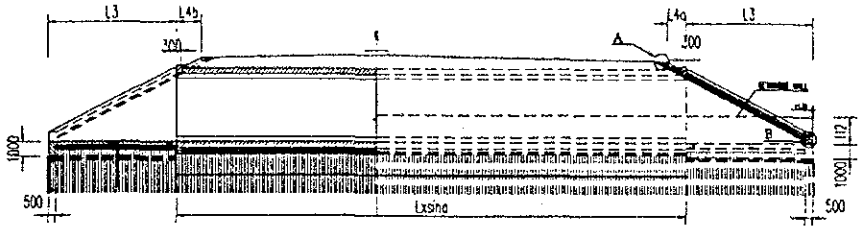
+	CONCRETE (M3)																
	S	=	S1	+	S2	+	S3										1.760
	S1	=	0.300	x	(1.300	-	0.200)									=	0.330
	S2	=	(0.300	+	0.300	+	0.200)	x	0.200	:	2.000					=	0.080
	S3	=	0.750	x	1.800											=	1.350
	VOLUME	=	S	x	7.729											=	13.60
+	FORM (M2)																38.39
	BASE OF RETAINING WALL	=	1.807	x	0.750	+	2	x	0.750	x	7.729					=	12.949
	RETAINING WALL	=	(1.300	-	0.200)	x	7.729	x	2	+	(S1	:	COS85^0)			=	20.790
	FOOT-RETAINING WALL	=	7.729	x	0.2	:	SIN45^0	+	(S2	:	COS85^0)	+	7.729	x	0.2	=	4.650
+	SCAFFOLDING (M2)																46.12
*	BASE OF RETAININGWALL																37.221
	PERIMETER	=	1.807	+	1.000	+	7.729	+	1.000	+	7.729	+	1.000	+	1.004	=	21.269
	AREA	=	PERIMETER	x	0.750											=	15.952
*	RETAININGWALL	=	2	x	7.729	x	1.800	+	1.800	x	(0.301	+	1.000)			=	30.166

BOX CULVERT STATION 11+976.5
REINFORCEMENT OF RETAINING WALL

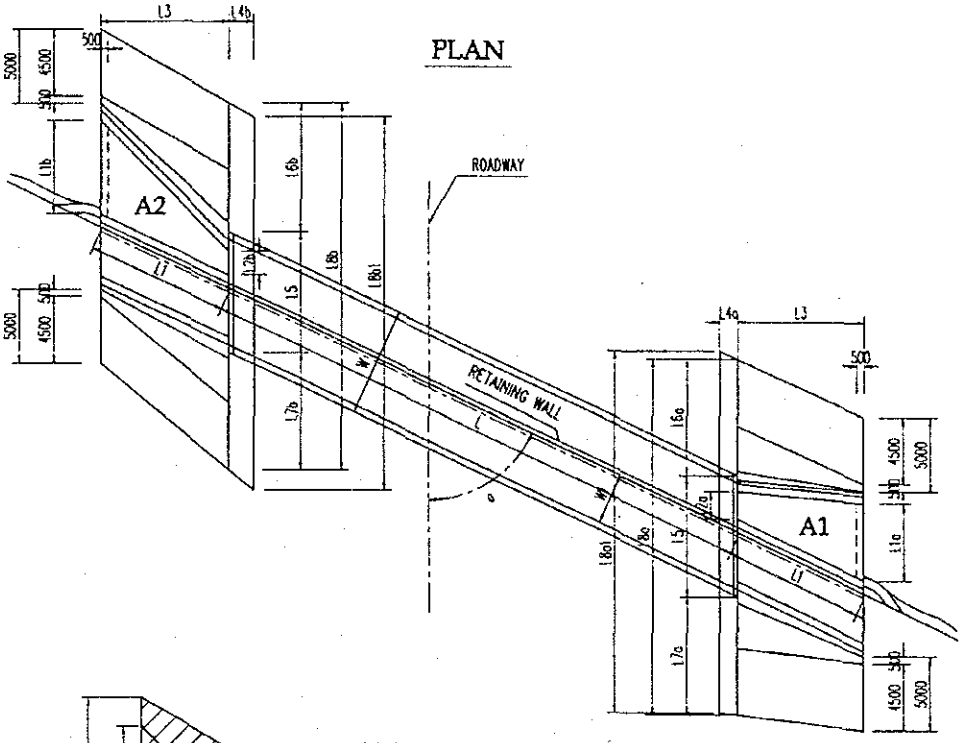
BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1	4496	12	40	0.888	179.8	159.7
2	7830	12	10	0.888	78.3	69.5
3	1410	12	40	0.888	56.4	50.1
4	2572	12	74	0.888	190.3	169.0
5	8501	12	16	0.888	136.0	120.8
6	2444	14	27	1.208	66.0	79.7
7	2150	12	8	0.888	17.2	15.3
8	8073	12	4	0.888	32.3	28.7
		REIFORCEMENT		D<=14		**692.7** KG
		REIFORCEMENT		14< D<=25		**0.0** KG
		TOTAL REINFORCEMENT :				**692.7** KG

NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR PATH & DRAINAGE

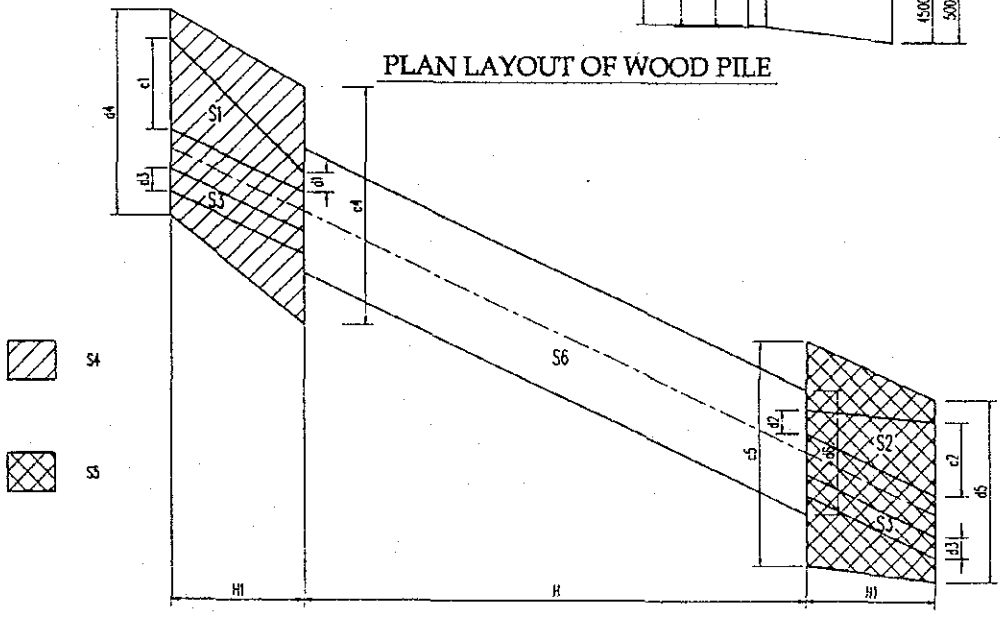
PROFILE



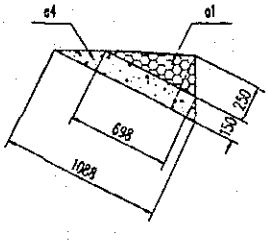
PLAN



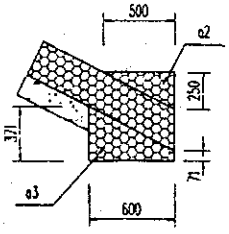
PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B



BOX CULVERT FOR PATH & DRAINAGE
(STATION 11+976.50)

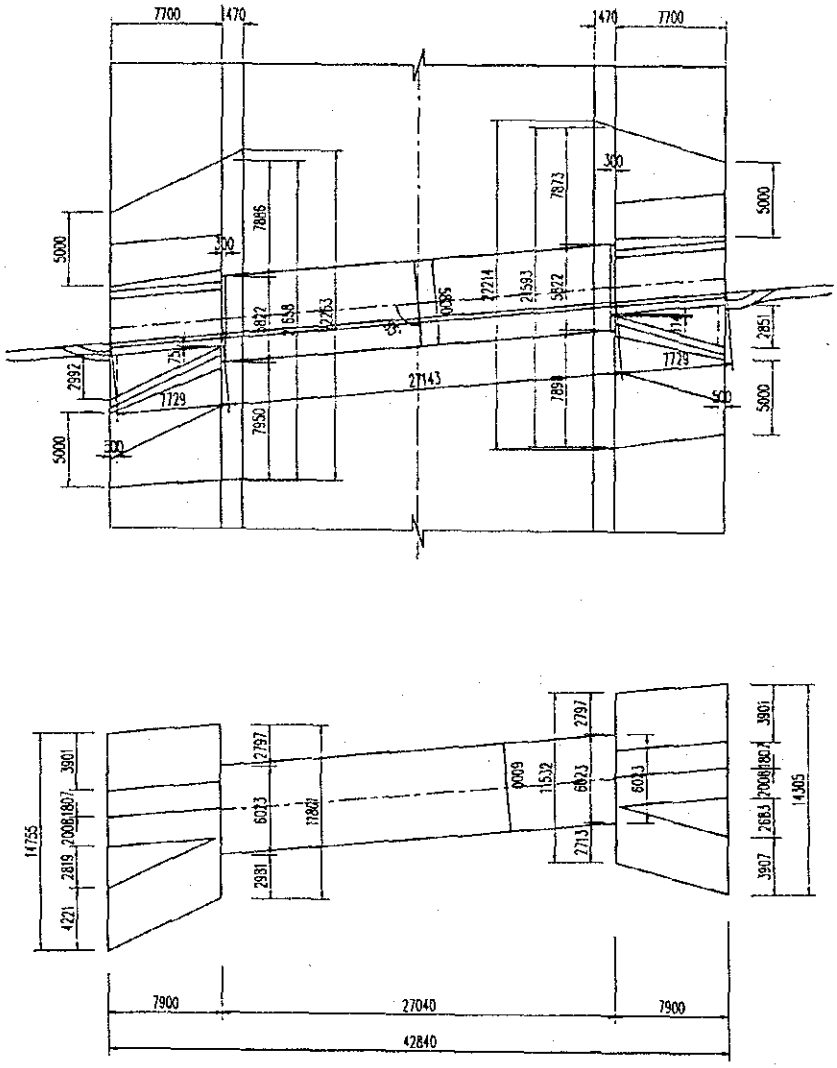


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM 11+976.5

S1=	(	c1	+	d1	)	x	H1	:	2	=		(m2)								
S1=	(	2.819	+	0.000	)	x	7.900	:	2	=	11.135	(m2)								
S2=	(	c2	+	d2	)	x	H1	:	2	=		(m2)								
S2=	(	2.683	+	0.000	)	x	7.900	:	2	=	10.598	(m2)								
S4=	(	c4	+	d4	)	x	H1	:	2	=		(m2)								
S4=	(	11.801	+	14.755	)	x	7.900	:	2	=	104.896	(m2)								
S5=	(	c5	+	d5	)	x	H1	:	2	=		(m2)								
S5=	(	11.532	+	14.305	)	x	7.900	:	2	=	102.056	(m2)								
S3=		d3	x	H1		=			(m2)											
S3=		1.807	x	7.900		=	14.275		(m2)											
S6=		H	x	d6		=			(m2)											
S6=		27.040	x	6.023		=	162.862		(m2)											

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2.00	=		(m2)												
A1=	(	2.851	+	0.114	)	x	7.700	:	2.00	=	11.415	(m2)												
A2=	(	L1b	+	L2b	)	x	L3	:	2.00	=		(m2)												
A2=	(	2.992	+	0.075	)	x	7.700	:	2.00	=	11.808	(m2)												
A =	(	A1	+	A2	)	x	t	+	(	0.700	x	0.500	) x	(	L1a	+	L1b	) =						
A =	(	11.415	+	11.808	)	x	0.300	+	(	0.700	x	0.500	) x	(	2.851	+	2.992	) =	9.012	(m3)				

2. CONCRETE FOUNDATION OF CULVERT:

F =	L	x	(	w +0.2)	x	0.2 =	27.143	x	6.000	x	0.2	=	32.572	(m3)										

3. LEAN CONRETE:

G =	(	S4	-	S3	+	S5	-	S3	)	x	0.100	=												
G =	(	104.896	-	14.275	+	102.056	-	14.275	)	x	0.100	=	17.840	(m3)										

4. WOOD PILE:

L=5M

W5=	(	S4	+	S5	+	S6	-	S1	-	S2	-	(2 x S3)	) x	(25 x 5 : 100)	=									
W5=	(	104.896	+	102.056	+	162.862	-	11.135	-	10.598	-	28.551	) x	1.250	=	399.413	(100m)							

L=3M

W3=	(	S1	+	S2	+	(2 x S3)	+	(0.8 x 4.5 x 4)	) x (25 x 3 : 100)	=					
W3=	(	11.135	+	10.598	+	28.551	+	14.400	) x 0.75	=	48.513	(100m)			

PROTECTION

W31=	(	S7	x	25.000	x	3.000	x	2.0	) :	100.000	=		(100m)		
	(	1.920	x	25.000	x	3.000	x	2.0	) :	100.000	=	2.880	(100m)		
TOTAL =		(	W3	+	W31	)	=	51.393	(100m)						

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

K =	(	S4	+	S5	+	S6	+	(0.8 x 4.5 x 4)	) x	0.150	=				
=	(	104.896	+	102.056	+	162.862	+	14.400	) x	0.150	=	57.632	(m3)		

PROTECTION

K1=	(	S7	x	0.150	x	2.000	)	=	(m3)						
	(	1.920	x	0.150	x	2.000	)	=	0.576	(m3)					
TOTAL =		(	K	+	K1	)	=	58.208	(m3)						

6. STONE MASONRY

a1=		0.698	x	0.250		x	0.500			=	0.087	(m2)			
a2=		0.500	x	0.250		x	0.500			=	0.063	(m2)			
a3=	(	0.071	+	0.371	)	x	0.500	x	0.600	=	0.133	(m2)			
a4=	(	0.698	+	1.088	)	x	0.500	x	0.150	=	0.134	(m2)			
b1=		0.300	x	L5	=		(m2)								
b1=		0.300	x	5.822	=	1.747	(m2)								

b2a=	(	L6a	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.873	+	5.000	)	x	7.700	x	0.500	=	49.561	(m2)			
b2b=	(	L6b	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.886	+	5.000	)	x	7.700	x	0.500	=	49.611	(m2)			
b3a=	(	L7a	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.898	+	5.000	)	x	7.700	x	0.500	=	49.657	(m2)			
b3b=	(	L7b	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.950	+	5.000	)	x	7.700	x	0.500	=	49.858	(m2)			

b4a= (L8a + L8a1) x L4a x 0.500 = (m2)

(21.593 + 22.214) x 1.470 x 0.500 = 32.198 (m2)

b4b= (L8b + L8b1) x L4b x 0.500 = (m2)

(21.658 + 22.253) x 1.470 x 0.500 = 32.275 (m2)

b5= (0.600 x 5.000) 2.000 = 6.000 (m2)

V1a= a1 x L8a1 = 0.087 x 22.214 = 1.938 (m3)

V1b= a1 x L8b1 = 0.087 x 22.253 = 1.942 (m3)

V2= (a2 + a3) x 5.000 x 4.000 = (m3)

= (0.063 + 0.133) x 5.000 x 4.000 = 3.902 (m3)

V3a= (b2a + b3a + b4a - b1) x 0.250 : COS(26.565) = (m3)

= (49.561 + 49.657 + 32.198 - 1.747) x 0.250 : 0.894 = 36.245 (m3)

V3b= (b2b + b3b + b4b - b1) x 0.250 : COS(26.565) = (m3)

= (49.611 + 49.858 + 32.275 - 1.747) x 0.250 : 0.894 = 36.336 (m3)

PROTECTION

V3c= (L9 x 0.600 x 0.600 x 2.0) + (S8 x 2.00 x 0.25) =

(3.240 x 0.600 x 0.600 x 2.0) + (1.99 x 0.50) = 3.326 (m3)

TOTAL = (V1a + V1b + V2 + V3a + V3b + V3c) = (m3)

(1.938 + 1.942 + 3.902 + 36.245 + 36.336 + 3.326) = 83.689 (m3)

7. BASE BEDDING:

V4a= a4 x L8a1 = 0.134 x 22.214 = 2.976 (m3)

V4a= a4 x L8b1 = 0.134 x 22.253 = 2.981 (m3)

V5a= (b2a + b3a + b4a - b1 - b5) x 0.150 : COS(26.565) =

= (49.561 + 49.657 + 32.198 - 1.747 - 6.000) x 0.150 : 0.894 = 20.741 (m3)

V5b= (b2b + b3b + b4b - b1 - b5) x 0.150 : COS(26.565) =

= (49.611 + 49.858 + 32.275 - 1.747 - 6.000) x 0.150 : 0.894 = 20.795 (m3)

PROTECTION

V5c= (S8 x 0.150 x 2.000) = (m3)

(1.99 x 0.150 x 2.000) = 0.596 (m3)

TOTAL = (V4a + V4b + V5a + V5b + V5c) = (m3)

(2.976 + 2.981 + 20.741 + 20.795 + 0.596) = 48.089 (m3)

8. PATH

a. LATERITE

M =	(	L	+	2 x L1	)	x	W1	x	0.400	=					
	(	27.143	+	15.458	)	x	3.500	x	0.400	=	59.641	(m3)			

b. SAND FILL

N =	(	L	+	2 x L1	)	x	W1	x	(	H2	-	0.400	)	=			(m3)
	(	27.143	+	15.458	)	x	3.500	x	(	1.300	-	0.400	)	=	134.193		(m3)

9.FORM :

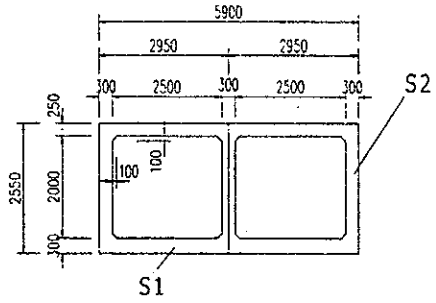
=	(	L1a	+	L1b	)	x	1	x	2	=		
	(	2.851	+	2.992	)	x	1	x	2	=	11.686	(m2)

10.SCAFFOLDING :

=	(	L1a	+	L1b	)	x	1	x	2	=		
	(	2.851	+	2.992	)	x	1	x	2	=	11.686	(m2)

2.12. Box culvert at station 12+180

BOX CULVERT 12+180

I	BOX CULVERT STATION 12+180		QUANTITIES
	L	= 19.210 + 19.210 + 0.02 = 38.440	
1	CULVERT		
+	CONCRETE (M3)		
	S1 = S2	= 2.950 x 2.550 - 2.500 x 2.000 + 2 x 0.100 x 0.100 =	2.543
	S	= S1 + S2 =	5.085
	VOLUME	= S x (19.210 + 19.210) + 5.900 x 0.200 x 0.300 x 2 =	196.08
		DOUBLE BOX CULVERT	
			
+	FORM (M2)		716.82
*	INSIDE FORM (M2)		500.665
	BOX BULWARK	= (2.000 + 2 x 0.100 x (1:SIN45^0 - 1)) x 38.420 x 4 =	320.091
	BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 38.420 x 2 =	180.574
*	OUTSIDE FORM (M2)		216.157
	BOX BULWARK	= 2.550 x 2 x 38.420 + 4 x 0.300 x 0.200 =	196.182
	THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	14.890
	CENTER	= S =	5.085
+	SCAFFOLDING (M2)	= 2.550 x 2.000 x 38.420 + 4.000 x 0.300 x 0.200 =	196.18
+	SUPPORT		
	AREA (M2)	= 5.900 x 2.000 - S =	6.715
	VOLUME (M3)	= AREA x L =	258.12

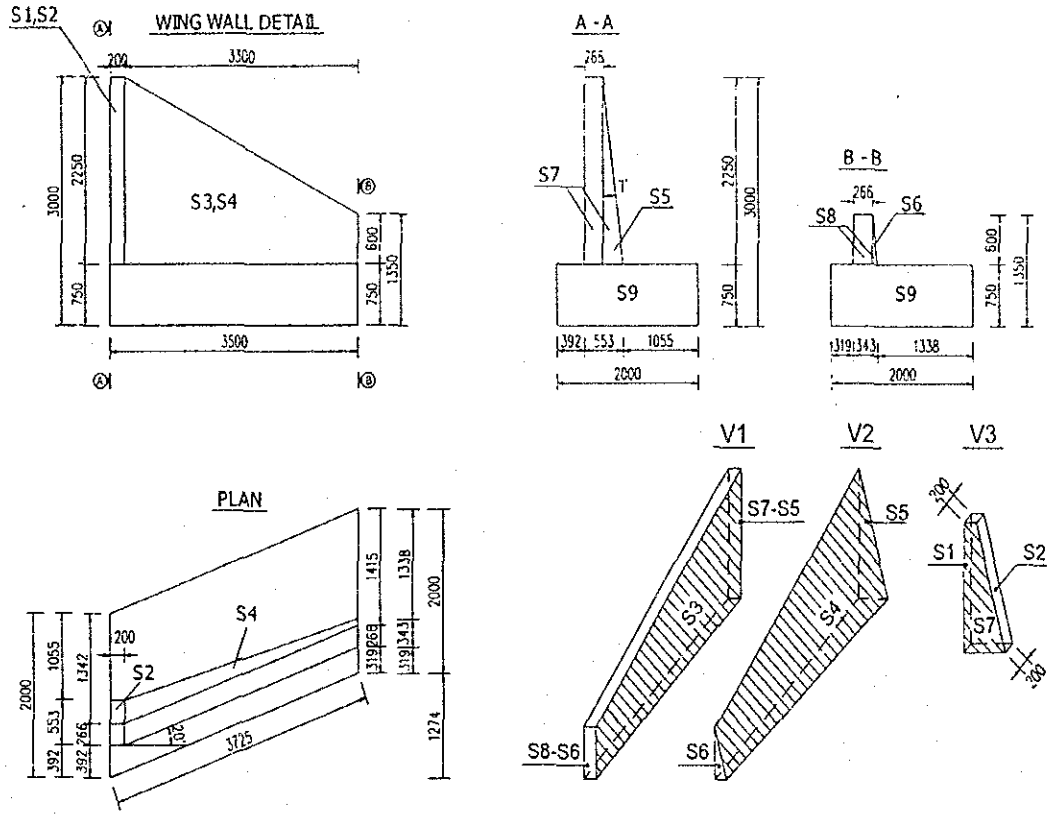
QUANTITIES TABLE OF BOXCULVERT STATION 12+180

SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	4160	125	14	306	1.208	1273.0	1538.3
2	2850	250	12	154	0.888	438.9	389.7
3	6270	250	14	154	1.208	965.6	1166.8
4	1500	250	14	304	1.208	456.0	551.0
5	1550	125	18	306	1.998	474.3	947.5
6	1970	250	12	308	0.888	606.8	538.7
7	2850	125	12	306	0.888	872.1	774.3
8	1049	250	12	308	0.888	323.1	286.8
9	1120	250	12	308	0.888	345.0	306.3
10	19715	250	12	52	0.888	1025.2	910.2
11	19815	250	12	100	0.888	1981.5	1759.2
12	5780	250	12	2	0.888	11.6	10.3
13	1440	250	12	26	0.888	37.4	33.2
14	1180	250	12	461.04	0.888	544.0	483.0
15	1280	250	12	461.04	0.888	590.1	523.9

REINFORCEMENT :	D<=14	9271.6	TOTAL FOR 1 SEGMENT :
REINFORCEMENT :	16=D<=25	947.5	REINFORCEMENT (KG): 10219.1
REINFORCEMENT :	25<D=32		CONCRETE (M^3): 98.04
TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT :	D<=14	18543.26	REINFORCEMENT (KG) : 20438.2
REINFORCEMENT :	16=D<=25	1894.904	
REINFORCEMENT :	25<D=32		CONCRETE (M^3) : 196.08

2 WINGWALL

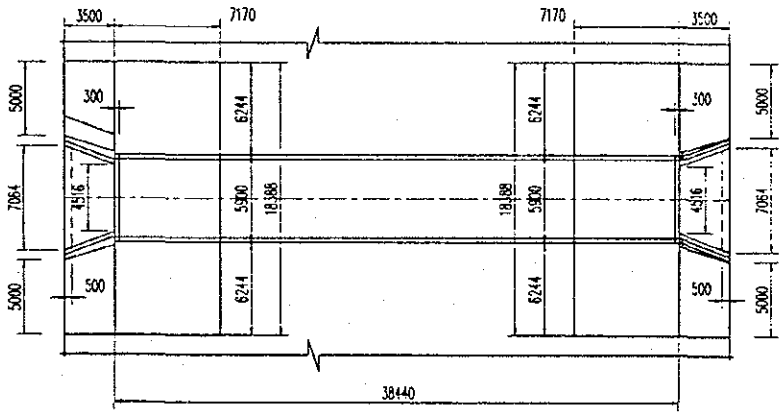


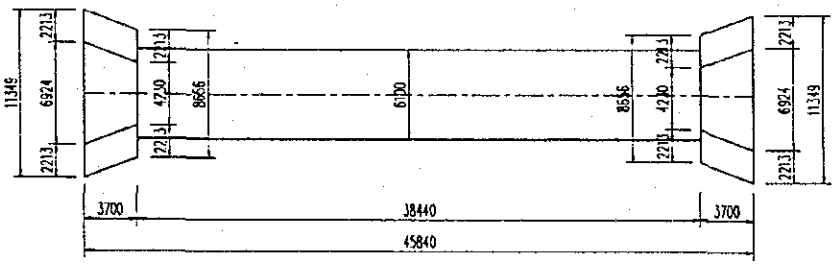
+	CALCULATING VALUES												
	S1	=	0.200	x	2.250							=	0.450
	S2	=	S1	:	$\cos 7^{0}$	=	0.450	:	0.993			=	0.453
	S3	=	(2.250	+	0.600)	x	(3.500	-	0.200)	:	2	x $\cos 20^{0}$	=	5.004
	S4	=	S3	:	$\cos 7^{0}$	=	5.004	:	0.993			=	5.042
	S5	=	(0.553	-	0.266)	x	2.250	:	2			=	0.323
	S6	=	(0.343	-	0.266)	x	0.600	:	2			=	0.023
	S7	=	S5	+	(2.250	x	0.266)	=	0.323	+	0.599	=	0.922
	S8	=	S6	+	(0.600	x	0.266)	=	0.023	+	0.160	=	0.183
	S9	=	2.000	x	0.750							=	1.500
+	CONCRETE (m^3)											=	7.25
	- Footing	=	S9	x	3.500	=	1.500	x	3.500			=	5.250
	- Wing wall	=	V1	+	V2	+	V3	=	1.331	+	0.480 + 0.184	=	1.995
	V1	=	S3	x	0.266	=	5.004	x	0.266			=	1.331
	V2	=	(3.500	-	0.200)	:	3	x	(S5	+	S6 + $(S5 \times S6)^{0.5}$)		
		=	1.100	x	(0.323	+	0.023	+	0.086)			=	0.480
	V3	=	S7	x	0.200	=	0.922	x	0.200			=	0.184
+	FORM (m^2)											=	22.50
	- Footing	=	(3.500	:	$\cos 20^{0}$	+	S9)	x	2	=	(3.725 + 1.500) x 2	=	10.449
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7 + S8			
		=	0.450	+	0.453	+	5.004	+	5.042	+	0.922 + 0.183	=	12.053
+	SCAFFOLDING (m^2)											=	22.44
	- Footing	=	(3.500	:	$\cos 20^{0}$	+	1.000	+	2.000	+	1.000) x 2 x 0.750	=	11.587
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.343	+	1.000)			
		=	5.004	+	5.042	+	0.806					=	10.852

BOX CULVERT STATION 12+180
REINFORCEMENT OF WINGWALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	2258	12	20	0.888	45.2	40.1
1b	2310	14	20	1.208	46.2	55.8
2a	3723	12	6	0.888	22.3	19.8
2b	2100	12	16	0.888	33.6	29.8
2c	582	12	20	0.888	11.6	10.3
3	4254	12	2	0.888	8.5	7.6
4	4429	12	20	0.888	88.6	78.6
5a	3043	12	15	0.888	45.6	40.5
5b	2150	12	6	0.888	12.9	11.5
5c	2467	20	15	2.466	37.0	91.3
5d	1574	20	6	2.466	9.4	23.3
6	2444	14	16	1.208	39.1	47.3
7	2301	12	4	0.888	9.2	8.2
8	2301	12	4	0.888	9.2	8.2
9	3605	12	4	0.888	14.4	12.8
10	1304	14	8	1.208	10.4	12.6
11	744	12	11	0.888	8.2	7.3
12	2143	12	1	0.888	2.1	1.9
REINFORCEMENT :				D<=14	**392.2** KG	
REINFORCEMENT :				14< D<=25	**114.6** KG	
TOTAL REINFORCEMENT :					**506.8** KG	

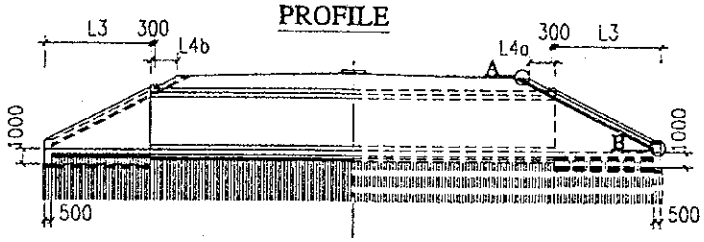
BOX CULVERT FOR DRAINAGE
(STATION 12+180)



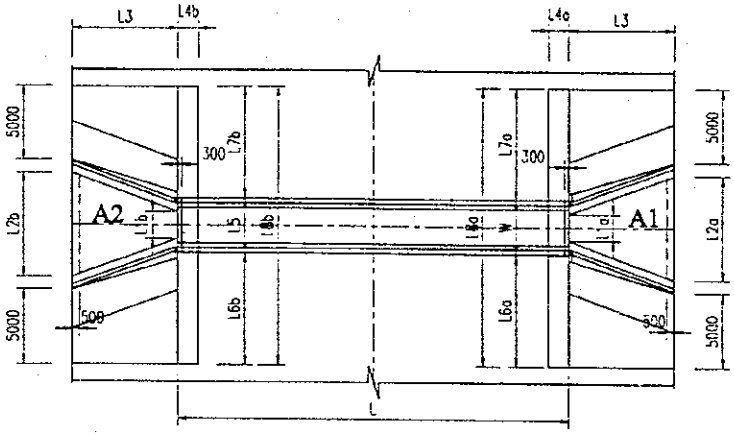


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE

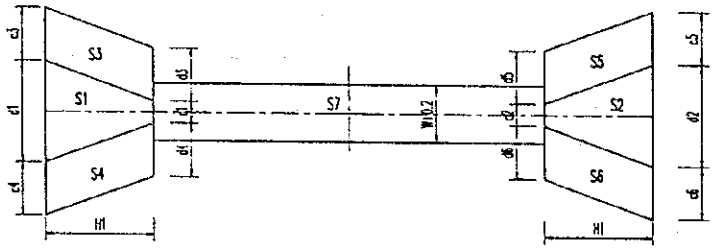
PROFILE



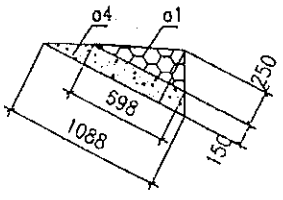
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

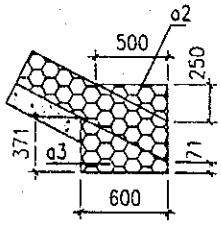


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM12+180

S1=	(	c1	+	d1	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=		
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635	(m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=		
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188	(m2)
S7=		L	x	(W + 0.2)	=							
=		38.440	x	6.100	=		234.484	(m2)				

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=		
=	(	4.516	+	7.064	)	x	3.500	:	2	=	20.265	(m2)

	(	A1	+	A2	)	x 0.3	+	(	L2a	+	L2b	) x 0.45 x 0.5	=		
=	(	20.265	+	20.265	)	x 0.3	+	(	7.064	+	7.064	) x 0.45 x 0.5	=	15.34	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W + 0.2)	x	0.2	=	38.440	x	6.100	x	0.2	=	46.90 (m3)

3. LEAN CONCRETE:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	)	x	0.1	=		
=	(	20.635	+	20.6349	+	8.188	+	8.188	+	8.188	+	8.188	)	x	0.1	=	7.40	(m3)

4. WOOD PILE:

** L=5M*

W5=	(	S3	+	S4	+	S5	+	S6	+	S7	)	x 25 x 5 :100	=					
=	(	8.188	+	8.188	+	8.188	+	8.188	+	234.484	)	x 25 x 5 :100	=		334.05	(100m)		

** L=3M*

W3=	(	S1	+	S2	+	(0.8 x 4.5 x 4)	)	x 25 x 3 : 100	=									
=	(	20.635	+	20.6349	+	14.400	)	x 25 x 3 : 100	=		41.75	(100m)						

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

=	(	S1	+	S2	+	S3	+	S4	+	S5	+	S6	+	S7	+ (0.8 x 4.5 x 4)	) x 0.15 =								
=	(	20.635	+	20.635	+	8.188	+	8.188	+	8.188	+	8.188	+	234.484	+ (0.8 x 4.5 x 4)	) x 0.15 =	48.44	(m3)						

6. STONE MASONRY

a1=		0.695	x	0.25	x		0.5	=		0.087	(m2)													
a2=		0.5	x	0.25	x		0.5	=		0.063	(m2)													
a3=	(	0.071	+	0.371	)	x	0.5	x	0.6	=	0.133	(m2)												
a4=	(	0.698	+	1.088	)	x	0.5	x	0.15	=	0.134	(m2)												

b1=		0.300	x	L5	=	0.300	x	5.900	=	1.770	(m2)	(b1 IS AREA OF HEAD WALL)												

b2a=	(	L6a	+	5.000	)	x	L3	x 0.5	=															
=	(	6.244	+	5.000	)	x	3.500	x 0.5	=	19.677	(m2)													

b2b= (L6b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3a= (L7a + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b3b= (L7b + 5.000) x L3 x 0.5 =
= (6.244 + 5.000) x 3.500 x 0.5 = 19.677 (m2)

b4a= L8a x L4a = 18.388 x 7.170 = 131.842 (m2)

b4b= L8b x L4b = 18.388 x 7.170 = 131.842 (m2)

b5= 0.6 x 5 x 2 = 6.000 (m2)

V1a= a1 x L8a = 0.087 x 18.388 = 1.597 (m3)

V1b= a1 x L8b = 0.087 x 18.388 = 1.597 (m3)

V2= (a2 + a3) x 5 x 4 = (0.063 + 0.133) x 5 x 4 = 3.902 (m3)

V3a= (b4a - b1 + b2a + b3a) x 0.25 : COS(26.56) =
= (131.842 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 47.379 (m3)

V3b= (b4b - b1 + b2b + b3b) x 0.25 : COS(26.56) =
= (131.842 - 1.770 + 19.677 + 19.677) x 0.25 : 0.894 = 47.379 (m3)

TOTAL = (V1a + V1b + V2 + V3a + V3b) =
(1.597 + 1.597 + 3.902 + 47.379 + 47.379) = ***101.854*** (m3)

6. BASE BEDDING:

V4a=		a4	x	L8a			=	0.134	x	18.388			=	2.463	(m3)			
V4b=		a4	x	L8b			=	0.134	x	18.388			=	2.463	(m3)			
V5a=	(	b4a	-	b1	+	b2a	+	b3a	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	131.842	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	27.420	(m3)
V5b=	(	b4b	-	b1	+	b2b	+	b3b	-	b5	)	x	0.15	:	COS(26.56)	=		
=	(	131.842	-	1.770	+	19.677	+	19.677	-	6.000	)	x	0.15	:	0.894	=	27.420	(m3)
TOTAL =			(	V4a	+	V4b	+	V5a	+	V5b	)=							
			(	2.463	+	2.463	+	27.420	+	27.420	)=	59.77		(m3)				

8. FORM :

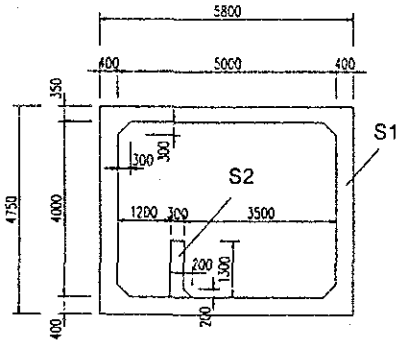
=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(7.064	+	7.064	)	X 0.75	x	2	=	**21.192** (m2)

9. SCAFFOLDING :

=	(L2a	+	L2b)	)	X 0.75	x	2	=	
	(7.064	+	7.064	)	X 0.75	x	2	=	**21.192** (m2)

2.13. Box culvert at station 12+592.5

BOX CULVERT 12+592.5

I	BOX CULVERT STATION 12+592.5			QUANTITIES
	L	= 14.329 + 14.329 + 0.02 = 28.678		
1	CULVERT			
+	CONCRETE (M3)			
	S1	= 5.800 x 4.750 - 5.000 x 4.000 + 2 x 0.300 x 0.300	=	7.730
	S2	= 1.300 x 0.300 + 0.200 x 0.200 : 2	=	0.410
	S	= S1 + S2	=	8.140
	VOLUME	= S x (14.329 + 14.329) + 5.800 x 0.200 x 0.300 x 2	=	233.97
		SINGLE BOX CULVERT 		
+	FORM (M2)			711.38
*	INSIDE FORM (M2)			409.253
	BOX BULWARK	= (4.000 + 2 x 0.300 x (1:SIN45^0 - 1)) x 28.658 x 2	=	243.528
	BOTTOM OF THE BOX	= (5.000 - 0.300 x 2) x 28.658 x 1	=	126.095
	RETAINING WALL	= (1.300 + (1:SIN45^0 - 1) x 0.200) x 28.66	=	39.630
*	OUTSIDE FORM (M2)			302.128
	BOX BULWARK	= 4.750 x 2 x 28.658 + 4 x 0.300 x 0.200	=	272.491
	THE END OF CULVERT	= S x 2 : SIN75^0 + 5.800 x 0.200 x 4	=	21.497
	CENTER	= S	=	8.140
+	SCAFFOLDING (M2)	= 4.750 x 2.000 x 28.658 + 4.000 x 0.300 x 0.200	=	272.49
+	SUPPORT			
	AREA (M2)	= 5.800 x 4.750 - S	=	19.410
	VOLUME (M3)	= AREA x L	=	556.64

BOXCULVERT STATION 12+592.5
QUANTITIES TABLE OF REINFORCEMENT

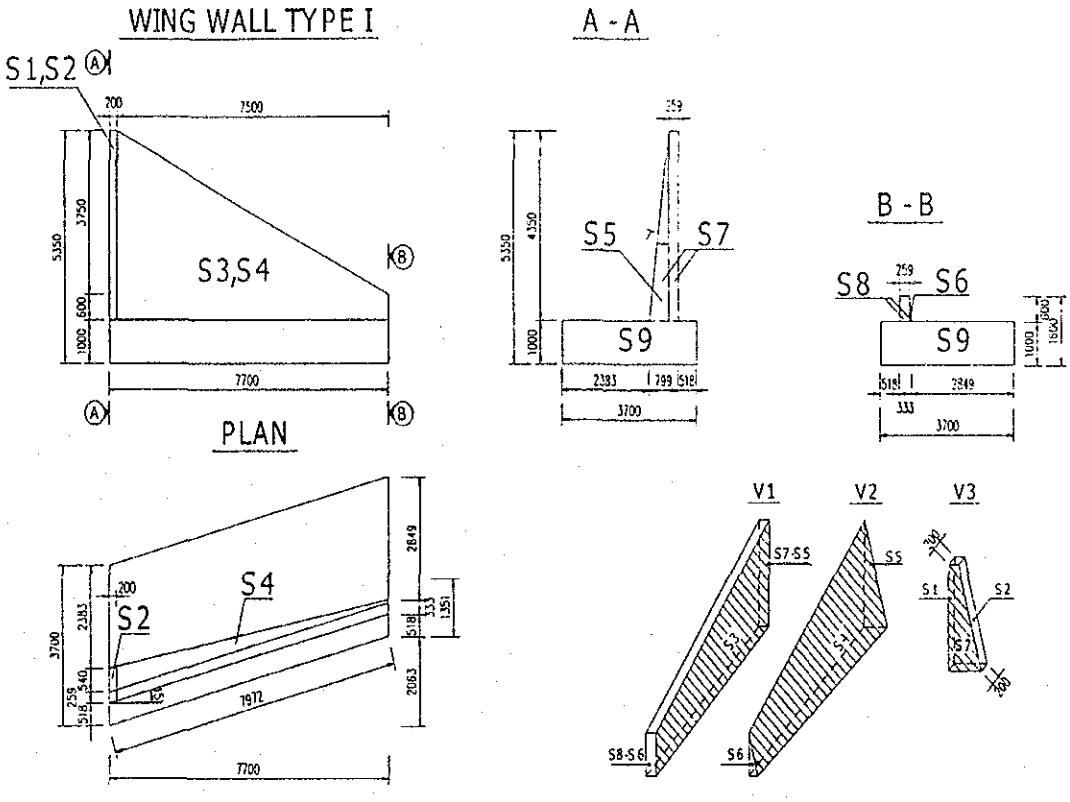
SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1a	7770	250	20	110	2.466	854.7	2107.8
1b	7881	250	20	7	2.466	55.2	136.1
2	4610	250	20	108	2.466	497.9	1227.8
3a	6604	250	22	54	2.984	356.6	1064.2
3b	6808	250	22	6	2.984	40.8	121.9
4a	6360	250	20	110	2.466	699.6	1725.3
4b	6560	250	20	7	2.466	45.9	113.2
5a	3220	250	12	110	0.888	354.2	314.5
5b	3334	250	12	14	0.888	46.7	41.4
6a	6575	250	20	54	2.466	355.1	875.7
6b	6783	250	20	6	2.466	40.7	100.4
7	5170	250	16	117	1.578	604.9	954.7
8a	1567	250	12	110	0.888	172.4	153.0
8b	1608	250	12	7	0.888	11.3	10.0
9a	1638	250	12	110	0.888	180.1	159.9
9b	1680	250	12	7	0.888	11.8	10.4
10	1560	250	12	24	0.888	37.4	33.2
11	5860	250	12	2	0.888	11.7	10.4
12	3700	250	12	57	0.888	210.9	187.2
13	1355	250	12	57	0.888	77.2	68.6
14	14613	250	12	48	0.888	701.4	622.7
15	13980	250	12	32	0.888	447.3	397.2
16	15446	250	12	32	0.888	494.3	438.8
17	14204	250	12	10	0.888	142.0	126.1
18	14713	250	12	48	0.888	706.2	627.0
19	1410	250	14	248	1.208	349.7	422.6
20	1440	250	12	248	0.888	357.1	317.1

REINFORCEMENT :	D<=14	3940.1	TOTAL FOR SEGMENT 1 :
REINFORCEMENT :	16=D<=25	8427.1	REINFORCEMENT (KG): 12367.2
REINFORCEMENT :	25<D=32		CONCRETE (M^3): 116.99

TOTAL FOR SEGMENT 1 & 2			
REINFORCEMENT :	D<=14	7880.264	REINFORCEMENT (KG) : 24734.4
REINFORCEMENT :	16=D<=25	16854.13	
REINFORCEMENT :	25<D=32		CONCRETE (M^3) : 233.97

2 WINGWALL TYPE I

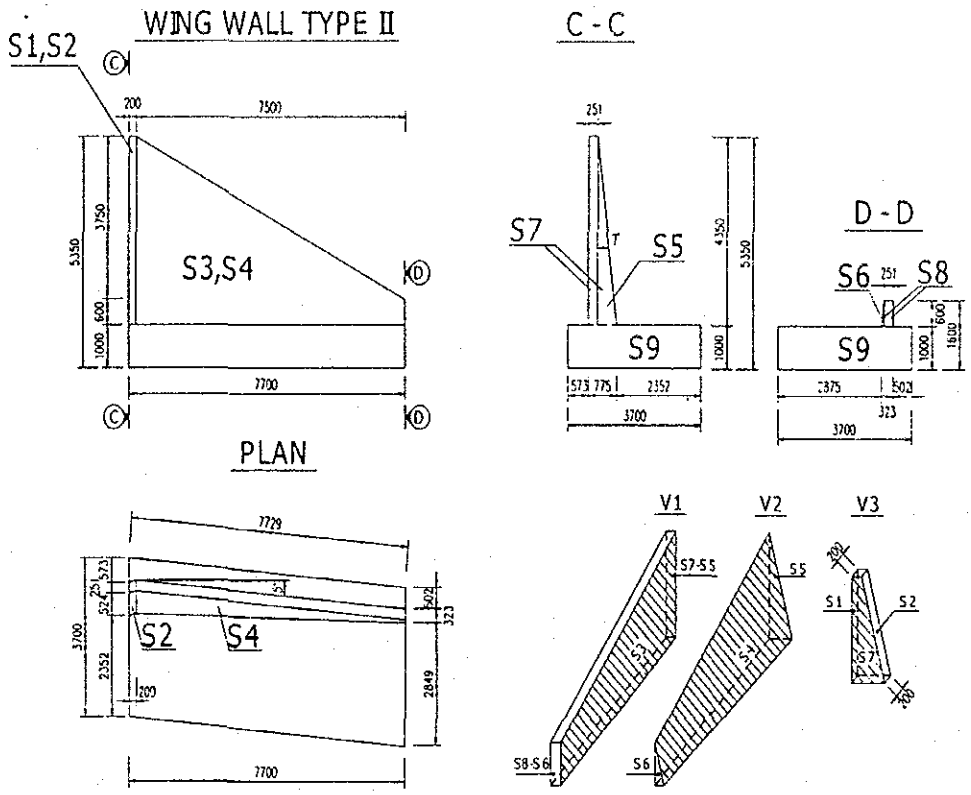


+	CALCULATING VALUES														
	S1	=	0.200	x	4.350									=	0.870
	S2	=	S1	:	$\cos 7^{0}$	=		0.870	:	0.993				=	0.877
	S3	=	(4.350	+	0.600)	x	(7.700	-	0.200)	:	2	x	$\cos 15^{0}$	=	19.217
	S4	=	S3	:	$\cos 7^{0}$	=		19.217	:	0.993				=	19.361
	S5	=	(0.799	-	0.259)	x	4.350	:	2					=	1.175
	S6	=	(0.333	-	0.259)	x	0.600	:	2					=	0.022
	S7	=	S5	+	(4.350	x	0.259)		=		1.175	+	1.127	=	2.302
	S8	=	S6	+	(0.600	x	0.259)		=		0.022	+	0.155	=	0.177
	S9	=	3.700	x	1.000									=	3.700
+	CONCRETE (m^3)													=	37.33
	- Footing	=	S9	x	7.700		=		3.700	x	7.700			=	28.490
	- Wing wall	=	V1	+	V2	+	V3		=		4.977	+	3.400 + 0.460	=	8.837
	V1	=	S3	x	0.259		=		19.217	x	0.259			=	4.977
	V2	=	(7.700	-	0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)		
		=	2.500	x	(1.175	+	0.022	+	0.161)					=	3.400
	V3	=	S7	x	0.200		=		2.302	x	0.200			=	0.46
+	FORM (m^2)													=	66.15
	- Footing	=	(7.700	:	$\cos 15^{0}$	+	S9)	x	2	=	(7.972	+	3.700) x 2	=	23.343
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+	S8		
		=	0.870	+	0.877	+	19.217	+	19.361	+	2.302	+	0.177	=	42.804
+	SCAFFOLDING (m^2)													=	66.72
	- Footing	=	(7.700	:	$\cos 15^{0}$	+	1.000	+	3.700	+	1.000)	x	2 x 1.000	=	27.343
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.333	+	1.000)				
		=	19.217	+	19.361	+	0.800							=	39.378

BOX CULVERT STATION 12+592.5
REINFORCEMENT OF WINGWALL TYPE I

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3555	12	41	0.888	145.8	129.4
1b	3686	18	41	1.998	151.1	301.8
2a	7977	12	6	0.888	47.9	42.5
2b	4192	12	38	0.888	159.3	141.4
2c	584	12	41	0.888	23.9	21.3
3	9022	12	2	0.888	18.0	16.0
4	8930	12	36	0.888	321.5	285.4
5a	5238	12	35	0.888	183.3	162.8
5b	3611	12	8	0.888	28.9	25.6
5c	4232	22	35	2.984	148.1	442.0
5d	2605	22	8	2.984	20.8	62.2
6	2944	14	72	1.208	212.0	256.1
7	4004	12	4	0.888	16.0	14.2
8	4004	12	6	0.888	24.0	21.3
9	7856	12	6	0.888	47.1	41.8
10	1304	14	14	1.208	18.3	22.1
11	857	12	22	0.888	18.8	16.7
12	3317	12	2	0.888	6.6	5.9
		REINFORCEMENT :		D<=14	**1202.6** KG	
		REINFORCEMENT :		14< D<=25	**806.0** KG	
		TOTAL REINFORCEMENT :			**2008.7** KG	

3 WINGWALL TYPE II

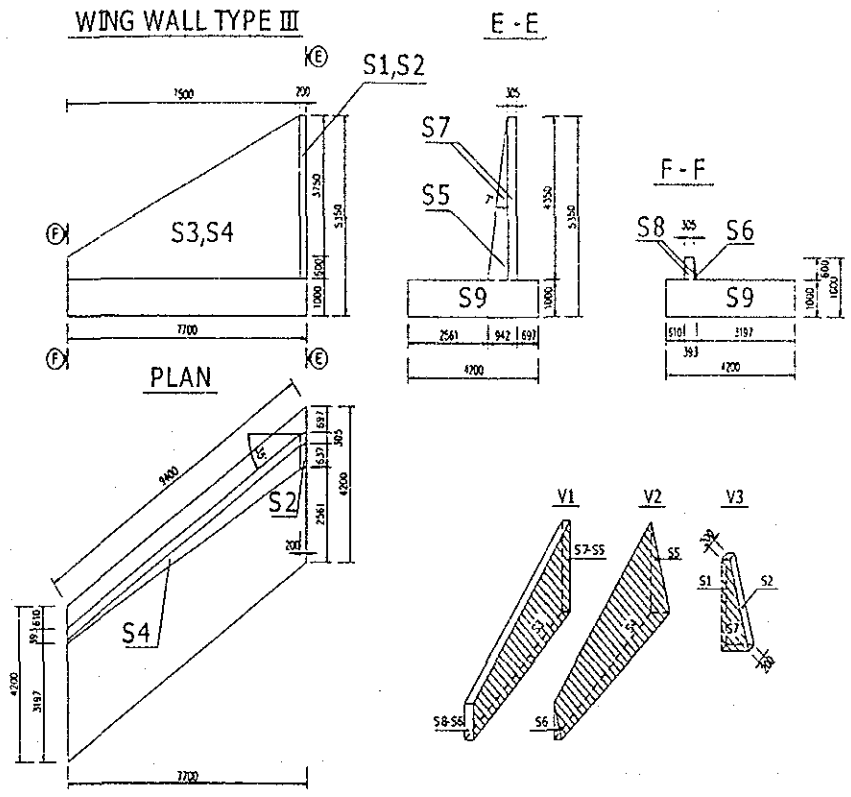


+	CALCULATING VALUES															
	S1	=	0.200	x	4.350									=	0.870
	S2	=	S1	:	$\cos 7^0$	=	0.870	:	0.993					=	0.877
	S3	=	(4.350	+	0.600)	x	(7.700	-	0.200)	:	2	x	$\cos 5^0$	=	18.633
	S4	=	S3	:	$\cos 7^0$	=	18.633	:	0.993					=	18.773
	S5	=	(0.775	-	0.251)	x	4.350	:	2					=	1.14
	S6	=	(0.323	-	0.251)	x	0.600	:	2					=	0.022
	S7	=	S5	+	(4.350	x	0.251)	=	1.140	+	1.092			=	2.232
	S8	=	S6	+	(0.600	x	0.251)	=	0.022	+	0.151			=	0.173
	S9	=	3.700	x	1.000									=	3.700
+	CONCRETE (m^3)													=	36.91
	- Footing	=	S9	x	7.700	=	3.700	x	7.700					=	28.490
	- Wing wall	=	V1	+	V2	+	V3	=	4.677	+	3.300	+	0.446	=	8.423
	V1	=	S3	x	0.251	=	18.633	x	0.251					=	4.677
	V2	=	(7.700	-	0.200)	:	3	x	(S5	+	S6	+	$(S5 \times S6)^{0.5}$)		
		=	2.500	x	(1.140	+	0.022	+	0.158)					=	3.300
	V3	=	S7	x	0.200	=	2.232	x	0.200					=	0.446
+	FORM (m^2)													=	64.42
	- Footing	=	(7.700	:	$\cos 5^0$	+	S9)	x	2	=	(7.729	+	3.700)	x	2	=	22.859
	- Wing wall	=	S1	+	S2	+	S3	+	S4	+	S7	+	S8			
		=	0.870	+	0.877	+	18.633	+	18.773	+	2.232	+	0.173			=	41.557
+	SCAFFOLDING (m^2)															=	65.06
	- Footing	=	(7.700	:	$\cos 5^0$	+	1.000	+	3.700	+	1.000)	x	2	x	1.000	=	26.859
	- Wing wall	=	S3	+	S4	+	0.600	x	(0.323	+	1.000)						
		=	18.633	+	18.773	+	0.794									=	38.200

BOX CULVERT STATION 12+592.5
REINFORCEMENT OF WINGWALL TYPE II

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3555	12	40	0.888	142.2	126.2
1b	3685	18	40	1.998	147.4	294.4
2a	7749	12	6	0.888	46.5	41.3
2b	4354	12	38	0.888	165.5	146.9
2c	584	12	40	0.888	23.4	20.7
3	8749	12	2	0.888	17.5	15.5
4	8691	12	38	0.888	330.3	293.2
5a	5350	12	37	0.888	198.0	175.7
5b	3953	12	2	0.888	7.9	7.0
5c	4344	22	37	2.984	160.7	479.6
5d	2947	22	2	2.984	5.9	17.6
6	2944	14	72	1.208	212.0	256.1
7	4008	12	4	0.888	16.0	14.2
8	4008	12	6	0.888	24.0	21.4
9	7617	12	6	0.888	45.7	40.6
10	1304	14	14	1.208	18.3	22.1
11	840	12	22	0.888	18.5	16.4
12	3270	12	2	0.888	6.5	5.8
		REINFORCEMENT :		D<=14	**1203.2** KG	
		REINFORCEMENT :		14< D<=25	**791.6** KG	
		TOTAL REINFORCEMENT :			**1994.8** KG	

4 WINGWALL TYPE III

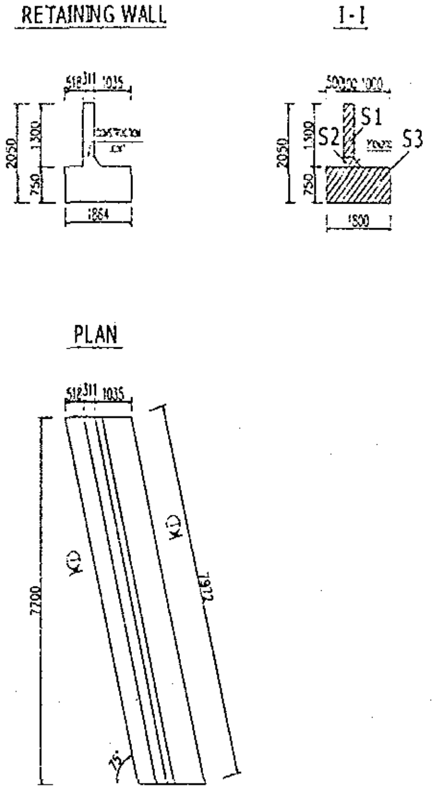


+	CALCULATING VALUES				
	S1	= 0.200 x 4.350		=	0.870
	S2	= S1 : $\cos 7^0$	= 0.870 : 0.993	=	0.877
	S3	= (4.350 + 0.600) x (7.700 - 0.200) : 2 x $\cos 35^0$		=	22.661
	S4	= S3 : $\cos 7^0$	= 22.661 : 0.993	=	22.831
	S5	= (0.942 - 0.305) x 4.350 : 2		=	1.385
	S6	= (0.393 - 0.305) x 0.600 : 2		=	0.026
	S7	= S5 + (4.350 x 0.305)	= 1.385 + 1.327	=	2.712
	S8	= S6 + (0.600 x 0.305)	= 0.026 + 0.183	=	0.209
	S9	= 4.200 x 1.000		=	4.200
+	CONCRETE (m^3)			=	43.79
	- Footing	= S9 x 7.700	= 4.200 x 7.700	=	32.340
	- Wing wall	= V1 + V2 + V3	= 6.912 + 4.000 + 0.542	=	11.454
	V1	= S3 x 0.305	= 22.661 x 0.305	=	6.912
	V2	= (7.700 - 0.200) : 3 x (S5 + S6 + $(S5 \times S6)^{0.5}$)			
		= 2.500 x (1.385 + 0.026 + 0.190)		=	4.000
	V3	= S7 x 0.200	= 2.712 x 0.200	=	0.542
+	FORM (m^2)			=	77.36
	- Footing	= (7.700 : $\cos 35^0$ + S9) x 2	= (9.400 + 4.200) x 2	=	27.200
	- Wing wall	= S1 + S2 + S3 + S4 + S7 + S8			
		= 0.870 + 0.877 + 22.661 + 22.831 + 2.712 + 0.209		=	50.160
+	SCAFFOLDING (m^2)			=	77.53
	- Footing	= (7.700 : $\cos 35^0$ + 1.000 + 4.200 + 1.000) x 2 x 1.000		=	31.200
	- Wing wall	= S3 + S4 + 0.600 x (0.393 + 1.000)			
		= 22.661 + 22.831 + 0.836		=	46.328

BOX CULVERT STATION 12+592.5
REINFORCEMENT OF WINGWALL TYPE III

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1a	3561	12	48	0.888	170.9	151.8
1b	3704	18	48	1.998	177.8	355.1
2a	9466	12	6	0.888	56.8	50.4
2b	5295	12	38	0.888	201.2	178.6
2c	597	12	48	0.888	28.7	25.4
3	10544	12	2	0.888	21.1	18.7
4	10337	12	34	0.888	351.5	312.0
5a	5104	12	35	0.888	178.6	158.6
5b	3533	12	20	0.888	70.7	62.7
5c	4098	22	35	2.984	143.4	428.0
5d	2527	22	20	2.984	50.5	150.8
6	2944	14	80	1.208	235.5	284.6
7	4483	12	4	0.888	17.9	15.9
8	4483	12	6	0.888	26.9	23.9
9	9263	12	6	0.888	55.6	49.3
10	1304	14	14	1.208	18.3	22.1
11	975	12	22	0.888	21.5	19.0
12	3233	12	3	0.888	9.7	8.6
		REIFORCEMENT		D<=14		**1381.8** KG
		REIFORCEMENT		14< D<=25		**933.9** KG
		TOTAL REINFORCEMENT :				**2315.7** KG

6 RETAINING WALL

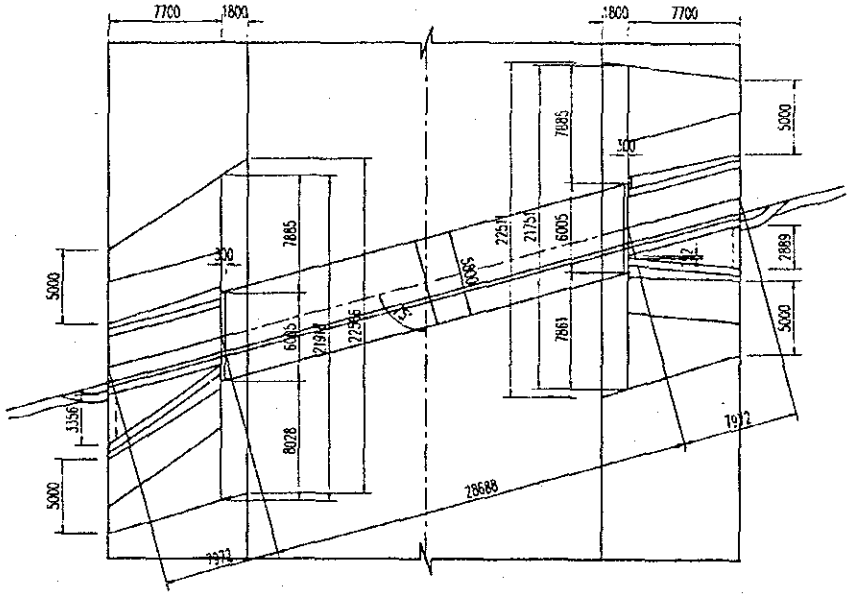


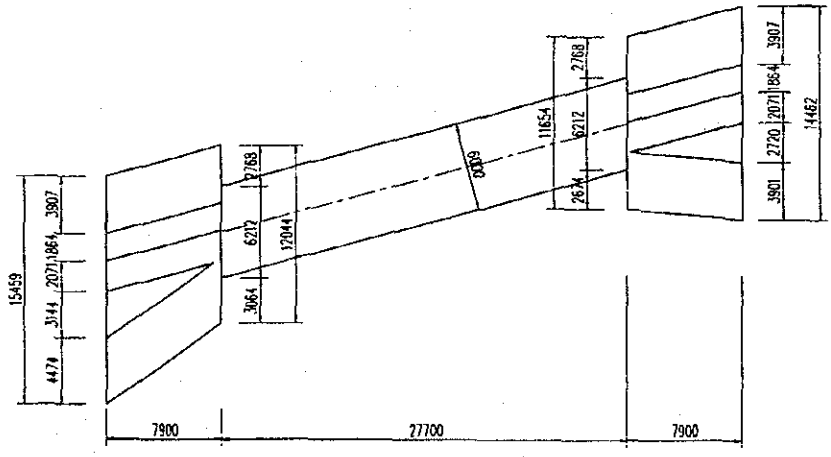
+	CONCRETE (M3)		
	S	= S1 + S2 + S3	1.760
	S1	= 0.300 x (1.300 - 0.200) =	0.330
	S2	= (0.300 + 0.300 + 0.200) x 0.200 : 2.000 =	0.080
	S3	= 0.750 x 1.800 =	1.350
	VOLUME	= S x 7.972 =	<u>14.03</u>
+	FORM (M2)		<u>39.45</u>
	BASE OF RETAINING WALL	= 1.864 x 0.750 + 2 x 0.750 x 7.972 =	13.356
	RETAINING WALL	= (1.300 - 0.200) x 7.972 x 2 + (S1 : COS85^0) =	21.325
	FOOT-RETAINING WALL	= 7.972 x 0.2 : SIN45^0 + (S2 : COS85^0) + 7.972 x 0.2 =	4.767
+	SCAFFOLDING (M2)		78.500
*	BASE OF RETAININGWALL		<u>47.44</u>
	PERIMETER	= 1.864 + 1.000 + 7.972 + 1.000 + 7.972 + 1.000 + 1.035 =	21.843
	AREA	= PERIMETER x 0.750 =	16.382
*	RETAININGWALL	= 2 x 7.972 x 1.800 + 1.800 x (0.311 + 1.000) =	31.059

BOX CULVERT STATION 12+592.5
REINFORCEMENT OF RETAINING WALL

BAR MARK	UNIT LENGTH (MM)	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
1	4496	12	40	0.888	179.8	159.7
2	8075	12	10	0.888	80.8	71.7
3	1410	12	40	0.888	56.4	50.1
4a	2572	12	74	0.888	190.3	169.0
4b	1884	12	8	0.888	15.1	13.4
5	8741	12	16	0.888	139.9	124.2
6	2444	14	27	1.208	66.0	79.7
7	2205	12	8	0.888	17.6	15.7
8	8313	12	4	0.888	33.3	29.5
		REIFORCEMENT		D<=14		**712.9** KG
		REIFORCEMENT		14< D<=25		**0.0** KG
		TOTAL REINFORCEMENT :				**712.9** KG

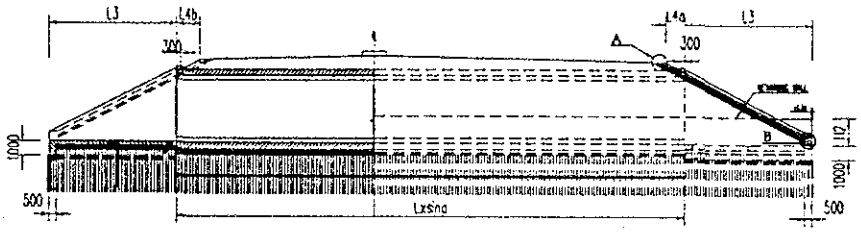
BOX CULVERT FOR PATH & DRAINAGE
(STATION 12+592.50)



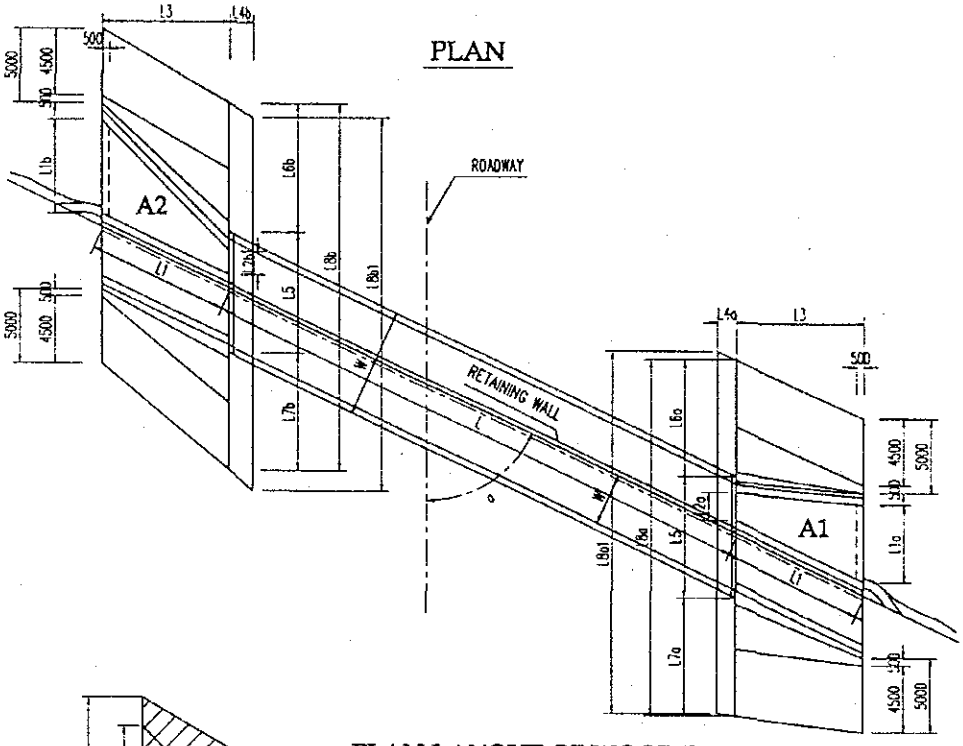


NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR PATH & DRAINAGE

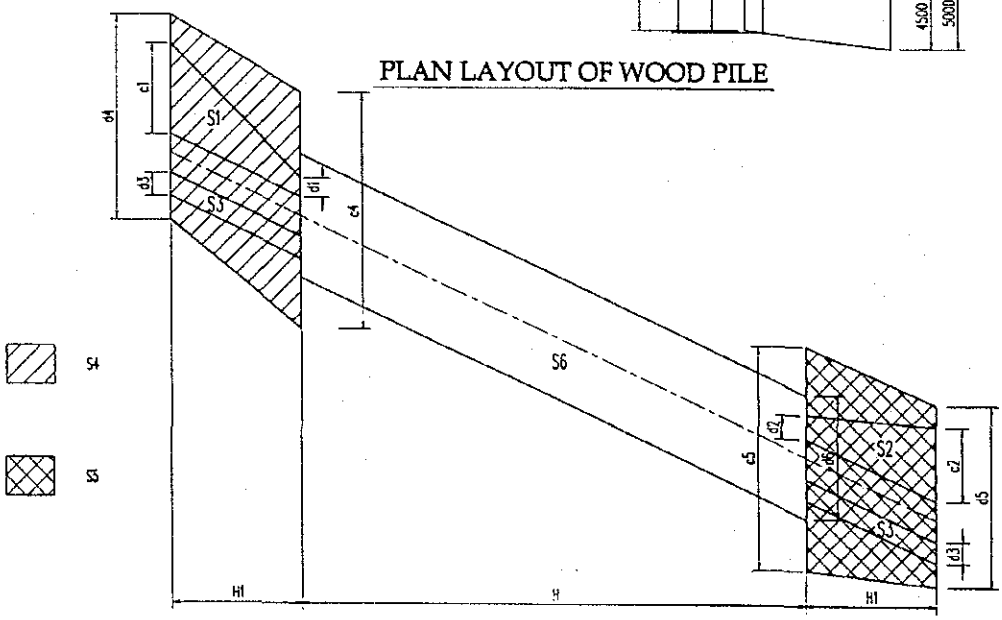
PROFILE



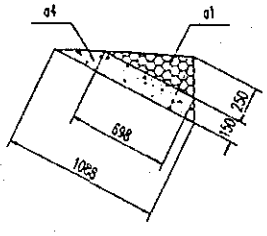
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

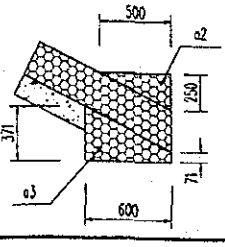


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM 12+592.5

S1=	(	c1	+	d1	)	x	H1	:	2	=		(m2)								
S1=	(	3.144	+	0.000	)	x	7.900	:	2	=	12.419	(m2)								
S2=	(	c2	+	d2	)	x	H1	:	2	=		(m2)								
S2=	(	2.720	+	0.000	)	x	7.900	:	2	=	10.744	(m2)								
S4=	(	c4	+	d4	)	x	H1	:	2	=		(m2)								
S4=	(	12.044	+	15.459	)	x	7.900	:	2	=	108.637	(m2)								
S5=	(	c5	+	d5	)	x	H1	:	2	=		(m2)								
S5=	(	11.654	+	14.462	)	x	7.900	:	2	=	103.158	(m2)								
S3=		d3	x	H1		=			(m2)											
S3=		1.864	x	7.900		=	14.726		(m2)											
S6=		H	x	d6		=			(m2)											
S6=		27.700	x	6.212		=	172.072		(m2)											

1. APRON CONCRETE:

A1=	(	L1a	+	L2a	)	x	L3	:	2.00	=		(m2)								
A1=	(	2.889	+	0.152	)	x	7.700	:	2.00	=	11.708	(m2)								
A2=	(	L1b	+	L2b	)	x	L3	:	2.00	=		(m2)								
A2=	(	3.356	+	0.000	)	x	7.700	:	2.00	=	12.921	(m2)								
A =	(	A1	+	A2	)	x	t	+	(	0.700	x	0.500	) x	(	L1a	+	L1b	) =		
A =	(	11.708	+	12.921	)	x	0.300	+	(	0.700	x	0.500	) x	(	2.889	+	3.356	) =	9.57	(m3)

2. CONCRETE FOUNDATION OF CULVERT:

F =	L	x	(	w +0.2)	x	0.2 =	28.688	x	6.000	x	0.2	=	34.426	(m3)		

3. LEAN CONRETE:

G =	(	S4	-	S3	+	S5	-	S3	)	x	0.100	=						
G =	(	108.637	-	14.726	+	103.158	-	14.726	)	x	0.100	=	18.234	(m3)				

4. WOOD PILE:

L=5M

W5=	(	S4	+	S5	+	S6	-	S1	-	S2	-	(2 x S3)	) x	(25 x 5 : 100)	=									
W5=	(	108.637	+	103.158	+	172.072	-	12.419	-	10.744	-	29.451	) x	1.250	=	414.067	(100m)							

L=3M

W3=	(	S1	+	S2	+	(2 x S3)	+	(0.8 x 4.5 x 4)	) x (25 x 3 : 100)	=					
W3=	(	12.419	+	10.744	+	29.451	+	14.400	) x 0.75	=	50.261	(100m)			

PROTECTION

W31=	(	S7	x	25.000	x	3.000	x	2.0	) :	100.000	=		(100m)		
	(	1.920	x	25.000	x	3.000	x	2.0	) :	100.000	=	2.880	(100m)		
TOTAL =		(	W3	+	W31	)	=	53.141	(100m)						

NOTE: S=0.8 x 4.5 x 4 IS AREA WOOD PILE TOE OF SLOPE

5. SAND BEDDING:

K =	(	S4	+	S5	+	S6	+	(0.8 x 4.5 x 4)	) x	0.150	=				
=	(	108.637	+	103.158	+	172.072	+	14.400	) x	0.150	=	59.740	(m3)		

PROTECTION

K1=	(	S7	x	0.150	x	2.000	)	=	(m3)						
	(	1.920	x	0.150	x	2.000	)	=	0.576	(m3)					
TOTAL =		(	K	+	K1	)	=	60.316	(m3)						

6. STONE MASONRY

a1=		0.698	x	0.250		x	0.500			=	0.087	(m2)			
a2=		0.500	x	0.250		x	0.500			=	0.063	(m2)			
a3=	(	0.071	+	0.371	)	x	0.500	x	0.600	=	0.133	(m2)			
a4=	(	0.698	+	1.088	)	x	0.500	x	0.150	=	0.134	(m2)			
b1=		0.300	x	L5	=		(m2)								
b1=		0.300	x	6.005	=	1.802	(m2)								

b2a=	(	L6a	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.885	+	5.000	)	x	7.700	x	0.500	=	49.607	(m2)			
b2b=	(	L6b	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.885	+	5.000	)	x	7.700	x	0.500	=	49.607	(m2)			
b3a=	(	L7a	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	7.861	+	5.000	)	x	7.700	x	0.500	=	49.515	(m2)			
b3b=	(	L7b	+	5.000	)	x	L3	x	0.500	=		(m2)			
=	(	8.028	+	5.000	)	x	7.700	x	0.500	=	50.158	(m2)			

b4a= (L8a + L8a1) x L4a x 0.500 = (m2)
(21.751 + 22.511) x 1.800 x 0.500 = 39.836 (m2)
b4b= (L8b + L8b1) x L4b x 0.500 = (m2)
(21.918 + 22.566) x 1.800 x 0.500 = 40.036 (m2)
b5= (0.600 x 5.000) x 2.000 = 6.000 (m2)

V1a= a1 x L8a1 = 0.087 x 22.511 = 1.964 (m3)
V1b= a1 x L8b1 = 0.087 x 22.566 = 1.969 (m3)
V2= (a2 + a3) x 5.000 x 4.000 = (m3)
= (0.063 + 0.133) x 5.000 x 4.000 = 3.902 (m3)
V3a= (b2a + b3a + b4a - b1) x 0.250 : COS(26.565) = (m3)
= (49.607 + 49.515 + 39.836 - 1.802) x 0.250 : 0.894 = 38.338 (m3)
V3b= (b2b + b3b + b4b - b1) x 0.250 : COS(26.565) = (m3)
= (49.607 + 50.158 + 40.036 - 1.802) x 0.250 : 0.894 = 38.573 (m3)

PROTECTION

V3c= (L9 x 0.600 x 0.600 x 2.0) + (S8 x 2.00 x 0.25) =
(3.240 x 0.600 x 0.600 x 2.0) + (1.99 x 0.50) = 3.326 (m3)
TOTAL = (V1a + V1b + V2 + V3a + V3b + V3c) = (m3)
(1.964 + 1.969 + 3.902 + 38.338 + 38.573 + 3.326) = **88.072** (m3)

7. BASE BEDDING:

V4a= a4 x L8a1 = 0.134 x 22.511 = 3.015 (m3)
V4a= a4 x L8b1 = 0.134 x 22.566 = 3.023 (m3)
V5a= (b2a + b3a + b4a - b1 - b5) x 0.150 : COS(26.565) =
= (49.607 + 49.515 + 39.836 - 1.802 - 6.000) x 0.150 : 0.894 = 21.996 (m3)
V5b= (b2b + b3b + b4b - b1 - b5) x 0.150 : COS(26.565) =
= (49.607 + 50.158 + 40.036 - 1.802 - 6.000) x 0.150 : 0.894 = 22.138 (m3)

PROTECTION

V5c= (S8 x 0.150 x 2.000) = (m3)
(1.99 x 0.150 x 2.000) = 0.596 (m3)

TOTAL = (V4a + V4b + V5a + V5b + V5c) = (m3)
(3.015 + 3.023 + 21.996 + 22.138 + 0.596) = **50.768** (m3)

8. PATH

a. LATERITE

M =	(	L	+	2 x L1	)	x	W1	x	0.400	=				
	(	28.688	+	15.944	)	x	3.500	x	0.400	=	62.485	(m3)		

b. SAND FILL

N =	(	L	+	2 x L1	)	x	W1	x	(	H2	-	0.400	)	=		(m3)
	(	28.688	+	15.944	)	x	3.500	x	(	1.300	-	0.400	)	=	140.591	(m3)

9.FORM :

=	(	L1a	+	L1b	)	x	1	x	2	=		
	(	2.889	+	3.356	)	x	1	x	2	=	12.490	(m2)

10.SCAFFOLDING :

=	(	L1a	+	L1b	)	x	1	x	2	=		
	(	2.889	+	3.356	)	x	1	x	2	=	12.490	(m2)