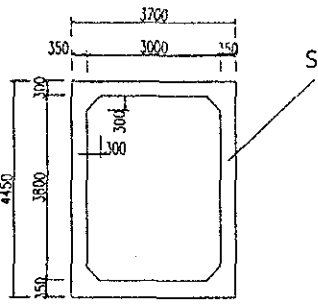


2.14. Box culvert at station 12+756

BOX CULVERT

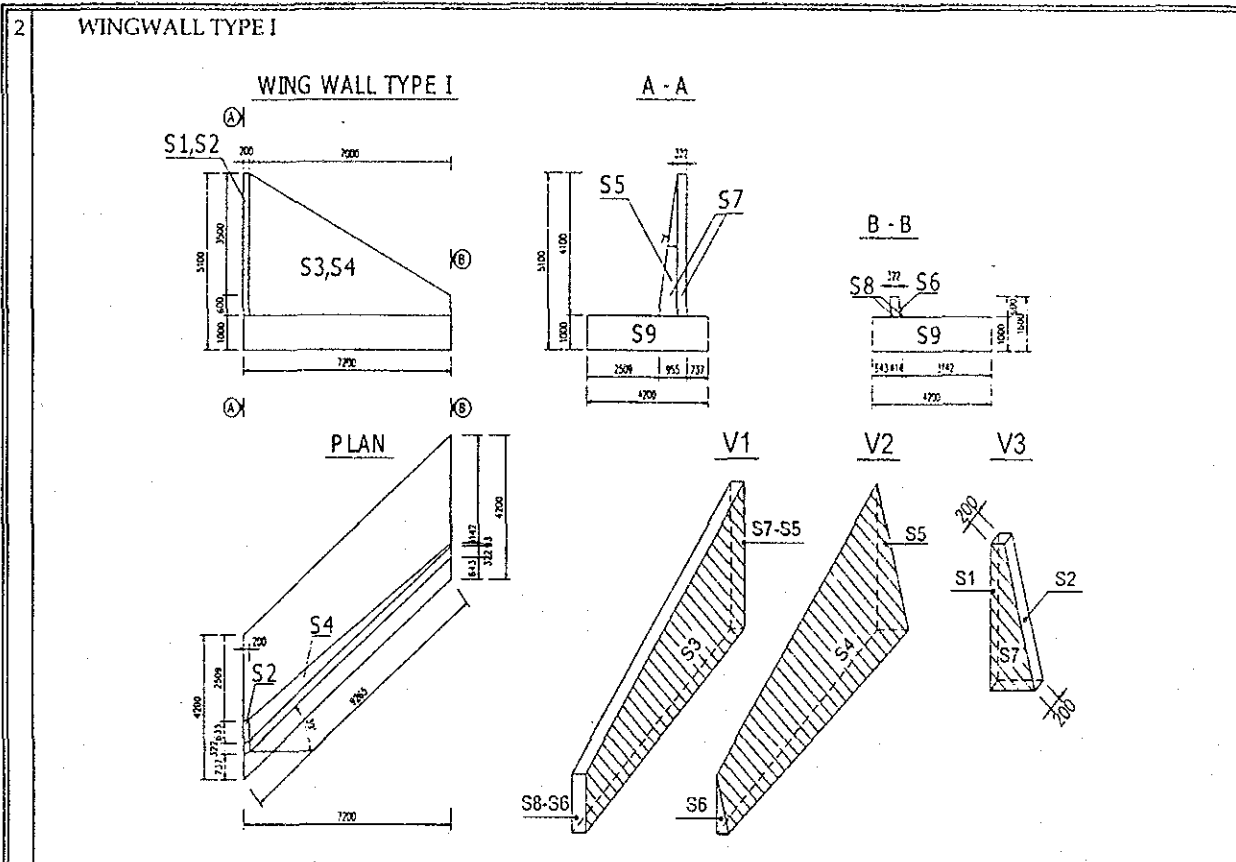
12+756

I	BOX CULVERT STATION 12+756 L = 14.733 + 14.733 + 0.02 = 29.486	QUANTITIES
1 + S VOLUME	CULVERT + CONCRETE (M3) $= 3.700 \times 4.450 - 3.800 \times 3.000 + 2 \times 0.300 \times 0.300 =$ $= S \times (14.733 + 14.733) + 3.700 \times 0.200 \times 0.300 \times 2 =$	5.245 <u>155.00</u>
<p>SINGLE BOX CULVERT</p>		
		
+ FORM (M2)		<u>591.09</u>
* INSIDE FORM (M2)		309.306
BOX BULWARK	$= (3.800 + 2 \times 0.300 \times (1:\text{SIN}45^\circ - 1)) \times 29.466 \times 2 =$	238.588
BOTTOM OF THE BOX	$= (3.000 - 0.300 \times 2) \times 29.466 \times 1 =$	70.718
* OUTSIDE FORM (M2)		281.787
BOX BULWARK	$= 4.450 \times 2 \times 29.466 + 4 \times 0.300 \times 0.200 =$	262.487
THE END OF CULVERT CENTER	$= S \times 2 : \text{SIN}71^\circ + 3.700 \times 0.200 \times 4 =$ $= S$	14.054 5.245
+ SCAFFOLDING (M2)	$= 4.450 \times 2.000 \times 29.466 + 4.000 \times 0.300 \times 0.200 =$	<u>262.49</u>
+ SUPPORT		
AREA (M2)	$= 3.700 \times 4.450 - S =$	11.220
VOLUME (M3)	$= \text{AREA} \times L =$	<u>330.83</u>

BOXCULVERT STATION 12+756
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

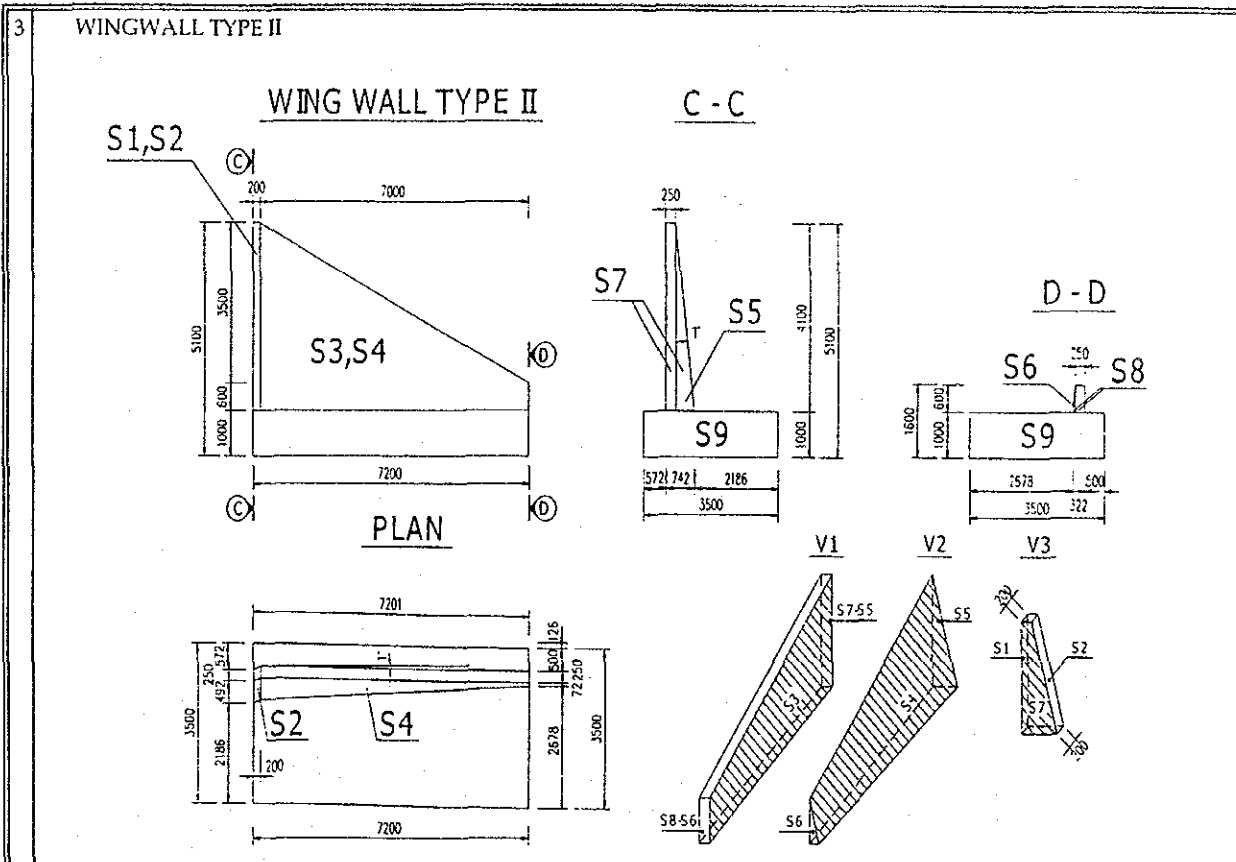
SYMBOL OF BAR	UNIT LENGTH	SPACE	DIAMETER	NUMBER	UNIT WEIGHT	TOTAL LENGTH	TOTAL WEIGHT
	(mm)	(mm)	(mm)	OF BAR	(kg/m)	(m)	(kg)
1a	6410	250	14	114	1.208	730.7	883.0
1b	6530	250	14	6	1.208	39.2	47.3
2	4330	250	12	112	0.888	485.0	430.6
3a	4289	250	16	56	1.578	240.2	379.1
3b	4503	250	16	5	1.578	22.5	35.5
4a	4070	250	14	114	1.208	464.0	560.7
4b	4276	250	14	6	1.208	25.7	31.0
5a	2520	250	12	114	0.888	287.3	255.1
5b	2665	250	12	12	0.888	32.0	28.4
6a	4331	250	16	56	1.578	242.5	382.8
6b	4547	250	16	5	1.578	22.7	35.9
7	4820	250	14	120	1.208	578.4	698.9
8a	1474	250	12	114	0.888	168.0	149.2
8b	1534	250	12	6	0.888	9.2	8.2
9a	1545	250	12	114	0.888	176.1	156.3
9b	1609	250	12	6	0.888	9.7	8.6
10	1540	250	12	16	0.888	24.6	21.9
11	3786	250	12	2	0.888	7.6	6.7
12	15338	250	12	32	0.888	490.8	435.8
13	14849	250	12	30	0.888	445.5	395.5
14	15997	250	12	30	0.888	479.9	426.1
15	15438	250	12	32	0.888	494.0	438.6
16	1280	250	12	236	0.888	302.1	268.2
17	1380	250	12	236	0.888	325.7	289.1
REINFORCEMENT : D<=14				5539.1	TOTAL FOR SEGMENT 1 :		
REINFORCEMENT : 16=D<=25				833.3	REINFORCEMENT (KG):		6372.4
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		77.50
TOTAL FOR SEGMENT 1 & 2							
REINFORCEMENT : D<=14				11078.16	REINFORCEMENT (KG) :		12744.7
REINFORCEMENT : 16=D<=25				1666.577			
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		155.00



+ CALCULATING VALUES			
S1	=	0.200 x 4.100	= 0.820
S2	=	S1 : cos7°	= 0.820 : 0.993 = 0.826
S3	=	(4.100 + 0.600) x (7.200 - 0.200) : 2 x cos39°	= 21.167
S4	=	S3 : cos7°	= 21.167 : 0.993 = 21.326
S5	=	(0.955 - 0.322) x 4.100 : 2	= 1.298
S6	=	(0.414 - 0.322) x 0.600 : 2	= 0.028
S7	=	S5 + (4.100 x 0.322)	= 1.298 + 1.320 = 2.618
S8	=	S6 + (0.600 x 0.322)	= 0.028 + 0.193 = 0.221
S9	=	4.200 x 1.000	= 4.200
+ CONCRETE (m³)			
- Footing	=	S9 x 7.200	= 4.200 x 7.200 = 30.240
- Wing wall	=	V1 + V2 + V3	= 6.816 + 3.540 + 0.524 = 10.880
V1	=	S3 x 0.322	= 21.167 x 0.322 = 6.816
V2	=	(7.200 - 0.200) : 3 x (S5 + S6 + (S5 x S6) ^{0.5})	= 2.333 x (1.298 + 0.028 + 0.191) = 3.540
V3	=	S7 x 0.200	= 2.618 x 0.200 = 0.524
+ FORM (m²)			
- Footing	=	(7.200 : cos39° + S9) x 2	= (9.265 + 4.200) x 2 = 26.929
- Wing wall	=	S1 + S2 + S3 + S4 + S7 + S8	= 0.820 + 0.826 + 21.167 + 21.326 + 2.618 + 0.221 = 46.978
+ SCAFFOLDING (m²)			
- Footing	=	(7.200 : cos39° + 1.000 + 4.200 + 1.000) x 2 x 1.000	= 30.929
- Wing wall	=	S3 + S4 + 0.600 x (0.414 + 1.000)	= 21.167 + 21.326 + 0.818 = 43.341

**BOX CULVERT STATION 12+756
REINFORCEMENT OF WINGWALL TYPE I**

BAR MARK	UNIT LENGTH	DIAMETER	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)	(MM)				
1a	3436	12	47	0.888	161.5	143.4
1b	3545	16	47	1.578	166.6	262.9
2a	7486	12	6	0.888	44.9	39.9
2b	5378	12	34	0.888	182.8	162.3
2c	618	12	47	0.888	29.0	25.8
3	10336	12	2	0.888	20.7	18.4
4	10195	12	34	0.888	346.6	307.7
5a	4928	12	34	0.888	167.6	148.8
5b	3323	12	24	0.888	79.7	70.8
5c	3922	22	34	2.984	133.3	397.9
5d	2317	22	24	2.984	55.6	165.9
6	2944	14	70	1.208	206.1	249.0
7	4476	12	4	0.888	17.9	15.9
8	4476	12	6	0.888	26.9	23.8
9	9121	12	6	0.888	54.7	48.6
10	1304	14	14	1.208	18.3	22.1
11	1007	12	20	0.888	20.1	17.9
12	3098	12	3	0.888	9.3	8.3
REINFORCEMENT				D<=14	1302.6 KG	
REINFORCEMENT				14<D<=25	826.8 KG	
TOTAL REINFORCEMENT :					2129.3 KG	

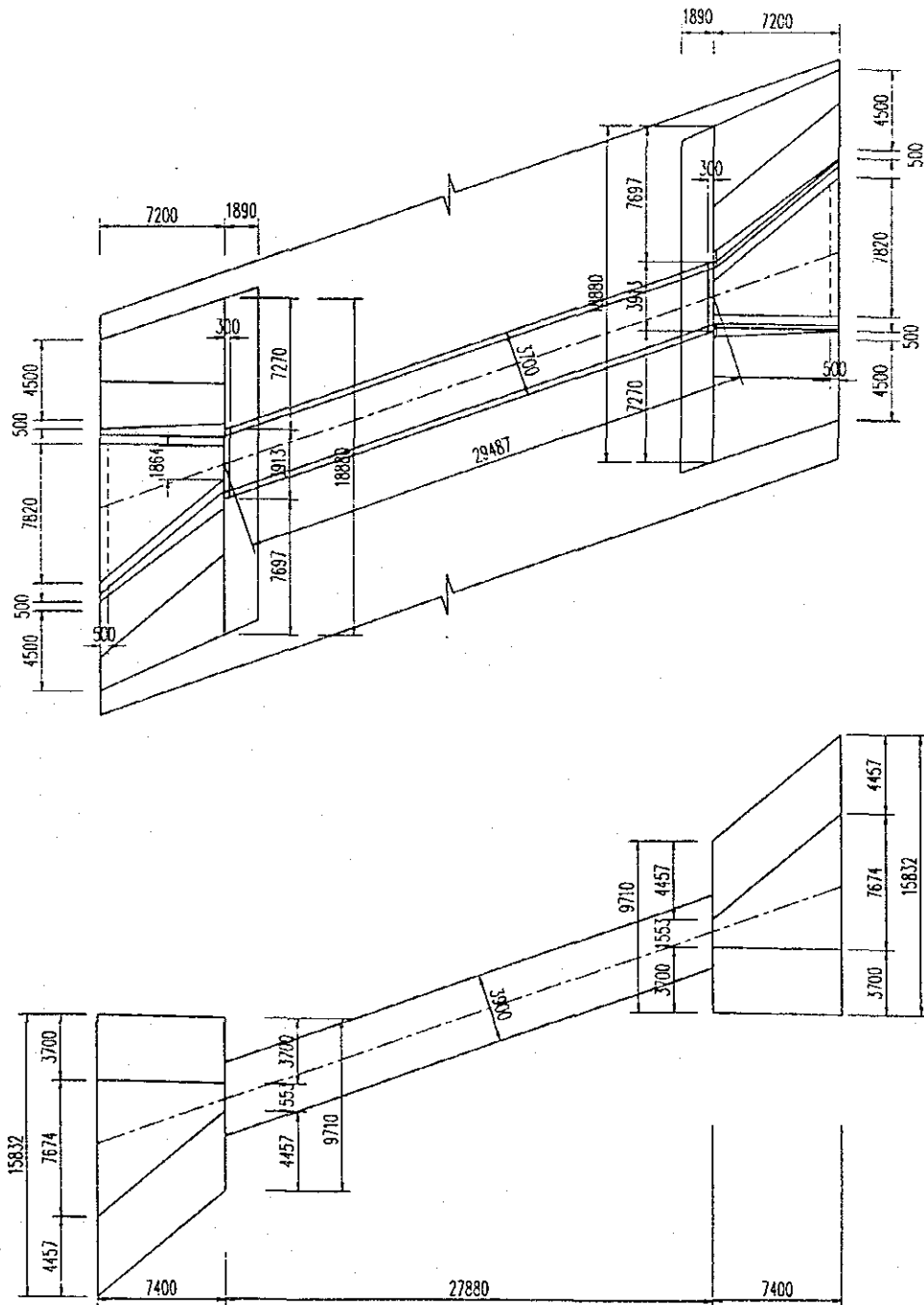


+ CALCULATING VALUES			
S1	=	0.200 x 4.100	= 0.820
S2	=	S1 : cos 7° ¹	= 0.820 : 0.993 = 0.826
S3	=	(4.100 + 0.600) x (7.200 - 0.200) : 2 x cos 1° ¹	= 16.453
S4	=	S3 : cos 7° ²	= 16.453 : 0.993 = 16.577
S5	=	(0.742 - 0.250) x 4.100 : 2	= 1.009
S6	=	(0.322 - 0.250) x 0.600 : 2	= 0.022
S7	=	S5 + (4.100 x 0.250)	= 1.009 + 1.025 = 2.034
S8	=	S6 + (0.600 x 0.250)	= 0.022 + 0.150 = 0.172
S9	=	3.500 x 1.000	= 3.500
+ CONCRETE (m ³)			
- Footing	=	S9 x 7.200	= 3.500 x 7.200 = 25.200
- Wing wall	=	V1 + V2 + V3	= 4.113 + 2.750 + 0.407 = 7.270
V1	=	S3 x 0.250	= 16.453 x 0.250 = 4.113
V2	=	(7.200 - 0.200) : 3 x (S5 + S6 + (S5 x S6) ^{0.5})	= 2.333 x (1.009 + 0.022 + 0.149) = 2.750
V3	=	S7 x 0.200	= 2.034 x 0.200 = 0.407
+ FORM (m ²)			
- Footing	=	(7.200 : cos 1° ¹ + S9) x 2	= (7.201 + 3.500) x 2 = 21.402
- Wing wall	=	S1 + S2 + S3 + S4 + S7 + S8	= 0.820 + 0.826 + 16.453 + 16.577 + 2.034 + 0.172 = 36.882
+ SCAFFOLDING (m ²)			
- Footing	=	(7.200 : cos 1° ¹ + 1.000 + 3.500 + 1.000) x 2 x 1.000	= 25.402
- Wing wall	=	S3 + S4 + 0.600 x (0.322 + 1.000)	= 16.453 + 16.577 + 0.793 = 33.823

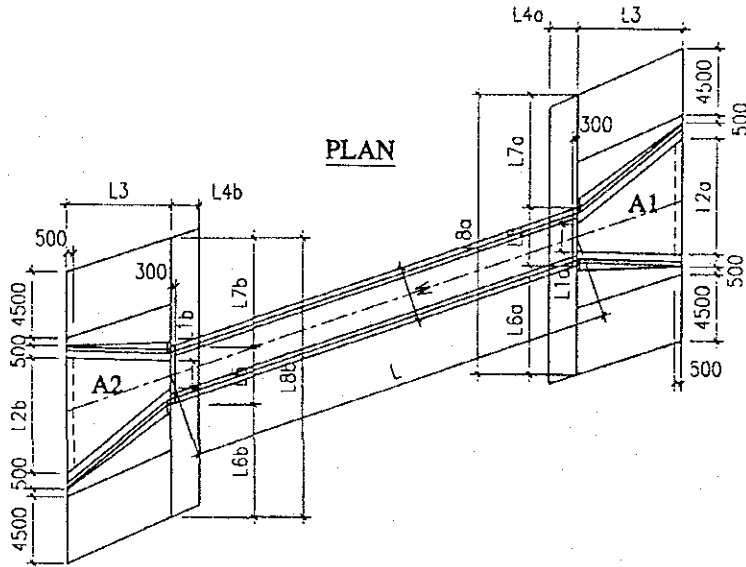
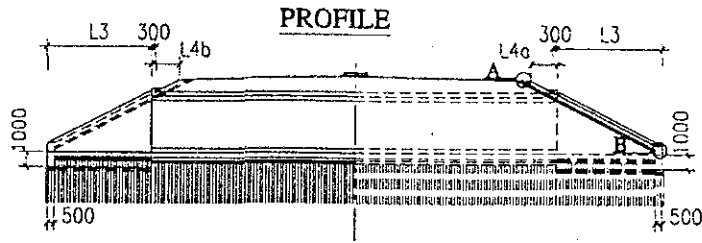
**BOX CULVERT STATION 12+756
REINFORCEMENT OF WINGWALL TYPE II**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
1a	3436	12	37	0.888	127.1	112.9
1b	3530	16	37	1.578	130.6	206.1
2a	7468	12	6	0.888	44.8	39.8
2b	4170	12	34	0.888	141.8	125.9
2c	550	12	37	0.888	20.4	18.1
3	7295	12	2	0.888	14.6	13.0
4	8163	12	36	0.888	293.9	260.9
5a	5164	12	36	0.888	185.9	165.0
5b	4158	22	36	2.984	149.7	446.7
6	2944	14	64	1.208	188.4	227.7
7	3808	12	4	0.888	15.2	13.5
8	3808	12	6	0.888	22.8	20.3
9	7089	12	6	0.888	42.5	37.8
10	1304	14	14	1.208	18.3	22.1
11	858	12	20	0.888	17.2	15.2
12	3058	12	2	0.888	6.1	5.4
REINFORCEMENT						1077.5 KG
REINFORCEMENT						652.8 KG
REINFORCEMENT						1730.3 KG

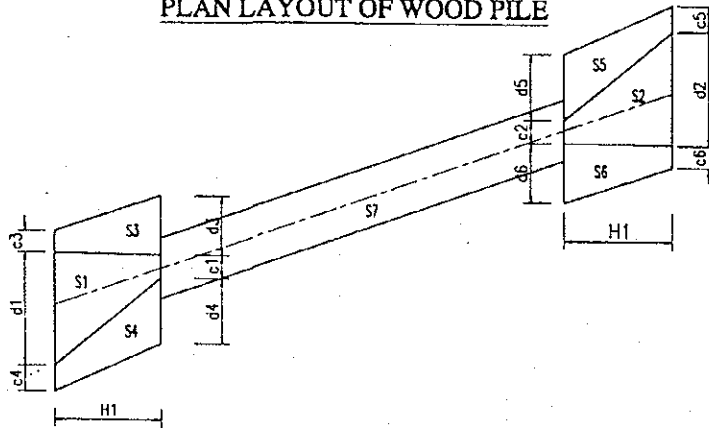
BOX CULVERT FOR DRAINAGE (STATION 12+756)



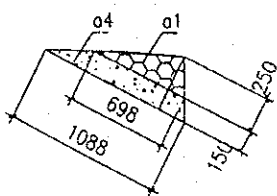
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

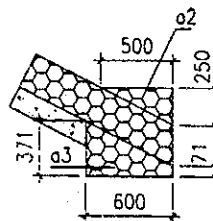


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM12+756

S1=	(	c1	+	d1	)	x	H1	:	2	=	
=	(	1.553	+	7.674	)	x	7.400	:	2	=	34.140 (m2)
S2=	(	c2	+	d2	)	x	H1	:	2	=	
=	(	1.553	+	7.674	)	x	7.400	:	2	=	34.140 (m2)
S3=	(	c3	+	d3	)	x	H1	:	2	=	
=	(	3.700	+	3.700	)	x	7.400	:	2	=	27.380 (m2)
S4=	(	c4	+	d4	)	x	H1	:	2	=	
=	(	4.457	+	4.457	)	x	7.400	:	2	=	32.982 (m2)
S5=	(	c5	+	d5	)	x	H1	:	2	=	
=	(	4.457	+	4.457	)	x	7.400	:	2	=	32.982 (m2)
S6=	(	c6	+	d6	)	x	H1	:	2	=	
=	(	3.700	+	3.700	)	x	7.400	:	2	=	27.380 (m2)
S7=	L	x	(W + 0.2)	=							
=	29.487	x	3.900	=	114.999						(m2)
<u>1. APRON CONCRETE:</u>											
A1=	(	L1a	+	L2a	)	x	L3	:	2	=	
=	(	1.864	+	7.820	)	x	7.200	:	2	=	34.862 (m2)
A2=	(	L1b	+	L2b	)	x	L3	:	2	=	
=	(	1.864	+	7.820	)	x	7.200	:	2	=	34.862 (m2)
	(	A1	+	A2	)	x	0.3	+	(	L2a	+
=	(	34.862	+	34.862	)	x	0.3	+	(	7.82	+
										L2b	) x 0.7 x 0.5
										7.82	) x 0.7 x 0.5
										=	26.39 (m3)
										=	

2. CONCRETE FOUNDATION OF CULVERT:

$$L \times (W + 0.2) \times 0.2 = 29.487 \times 3.900 \times 0.2 = 23.00 \text{ (m3)}$$

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (34.140 + 34.1399 + 27.380 + 32.982 + 32.982 + 27.380) \times 0.1 = \underline{18.90} \quad (\text{m}^3)$$

4. WOOD PILE:

* L=5M

$$W5 = (S3 + S4 + S5 + S6) \times 25 \times 5 : 100 =$$

$$= (27.380 + 32.982 + 32.982 + 27.380) \times 25 \times 5 : 100 = \underline{294.65} \quad (100\text{m})$$

* L=3M

$$W3 = (S1 + S2 + (0.8 \times 4.5 \times 4) + 14.400) \times 25 \times 3 : 100 =$$

$$= (34.140 + 34.1399 + 14.400) \times 25 \times 3 : 100 = \underline{62.01} \quad (100\text{m})$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7 + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$= (34.140 + 34.140 + 27.380 + 32.982 + 32.982 + 27.380 + 114.999 + (0.8 \times 4.5 \times 4) \times 0.15 = \underline{47.76} \quad (\text{m}^3)$$

6. STONE MASONRY

$$a1 = 0.695 \times 0.25 \times 0.5 = 0.087 \quad (\text{m}^2)$$

$$a2 = 0.5 \times 0.25 \times 0.5 = 0.063 \quad (\text{m}^2)$$

$$a3 = (0.071 + 0.371) \times 0.5 \times 0.6 = 0.133 \quad (\text{m}^2)$$

$$a4 = (0.698 + 1.088) \times 0.5 \times 0.15 = 0.134 \quad (\text{m}^2)$$

$$b1 = 0.300 \times L5 = 0.300 \times 3.913 = 1.174 \quad (\text{m}^2) \quad (\text{b1 IS AREA OF HEAD WALL})$$

$$b2a = (L6a + 5.000) \times L3 \times 0.5 =$$

$$= (7.270 + 5.000) \times 7.200 \times 0.5 = 44.172 \quad (\text{m}^2)$$

$$\begin{aligned}
& b2b = (L6b + 5.000) \times L3 \times 0.5 = \\
& = (7.697 + 5.000) \times 7.200 \times 0.5 = 45.7092 \text{ (m2)} \\
& b3a = (L7a + 5.000) \times L3 \times 0.5 = \\
& = (7.697 + 5.000) \times 7.200 \times 0.5 = 45.7092 \text{ (m2)} \\
& b3b = (L7b + 5.000) \times L3 \times 0.5 = \\
& = (7.27 + 5.000) \times 7.200 \times 0.5 = 44.172 \text{ (m2)} \\
& b4a = L8a \times L4a = 18.880 \times 1.890 = 35.683 \text{ (m2)} \\
& b4b = L8b \times L4b = 18.880 \times 1.890 = 35.683 \text{ (m2)} \\
& b5 = 0.6 \times 5 \times 2 = 6.000 \text{ (m2)} \\
& V1a = a1 \times L8a = 0.087 \times 18.880 = 1.640 \text{ (m3)} \\
& V1b = a1 \times L8b = 0.087 \times 18.880 = 1.640 \text{ (m3)} \\
& V2 = (a2 + a3) \times 5 \times 4 = (0.063 + 0.133) \times 5 \times 4 = 3.902 \text{ (m3)} \\
& V3a = (b4a - b1 + b2a + b3a) \times 0.25 = \\
& = (35.683 - 1.174 + 44.172 + 45.7092) \times 0.25 = 34.785 \text{ (m3)} \\
& V3b = (b4b - b1 + b2b + b3b) \times 0.25 = \\
& = (35.683 - 1.174 + 45.7092 + 44.172) \times 0.25 = 34.785 \text{ (m3)} \\
& \text{TOTAL} = (V1a + V1b + V2 + V3a + V3b) = \\
& (1.640 + 1.640 + 3.902 + 34.785 + 34.785) = \underline{76.752} \text{ (m3)}
\end{aligned}$$

7. BASE BEDDING:

$$\begin{aligned}
 V4a &= a4 \times L8a \times 0.134 = 18.880 \times 0.134 = 2.529 \text{ (m3)} \\
 V4b &= a4 \times L8b \times 0.134 = 18.880 \times 0.134 = 2.529 \text{ (m3)} \\
 V5a &= (b4a + b2a + b3a - b5) \times 0.15 = (35.683 + 44.172 + 45.7092 - 6.000) \times 0.15 = 19.864 \text{ (m3)} \\
 V5b &= (b4b + b2b + b3b - b5) \times 0.15 = (35.683 + 45.7092 + 44.172 - 6.000) \times 0.15 = 19.864 \text{ (m3)} \\
 \text{TOTAL} &= (V4a + V4b + V5a + V5b) = (2.529 + 2.529 + 19.864 + 19.864) = 44.79 \text{ (m3)}
 \end{aligned}$$

8. FORM:

$$\begin{aligned}
 &= (L2a + L2b) \times 1 \times 2 = 31.28 \text{ (m2)} \\
 &= (7.820 + 7.820) \times 1 \times 2 = 31.28 \text{ (m2)}
 \end{aligned}$$

9. SCAFFOLDING:

$$\begin{aligned}
 &= (L2a + L2b) \times 1 \times 2 = 31.28 \text{ (m2)} \\
 &= (7.820 + 7.820) \times 1 \times 2 = 31.28 \text{ (m2)}
 \end{aligned}$$

2.15. Box culvert at station 13+600

BOX CULVERT

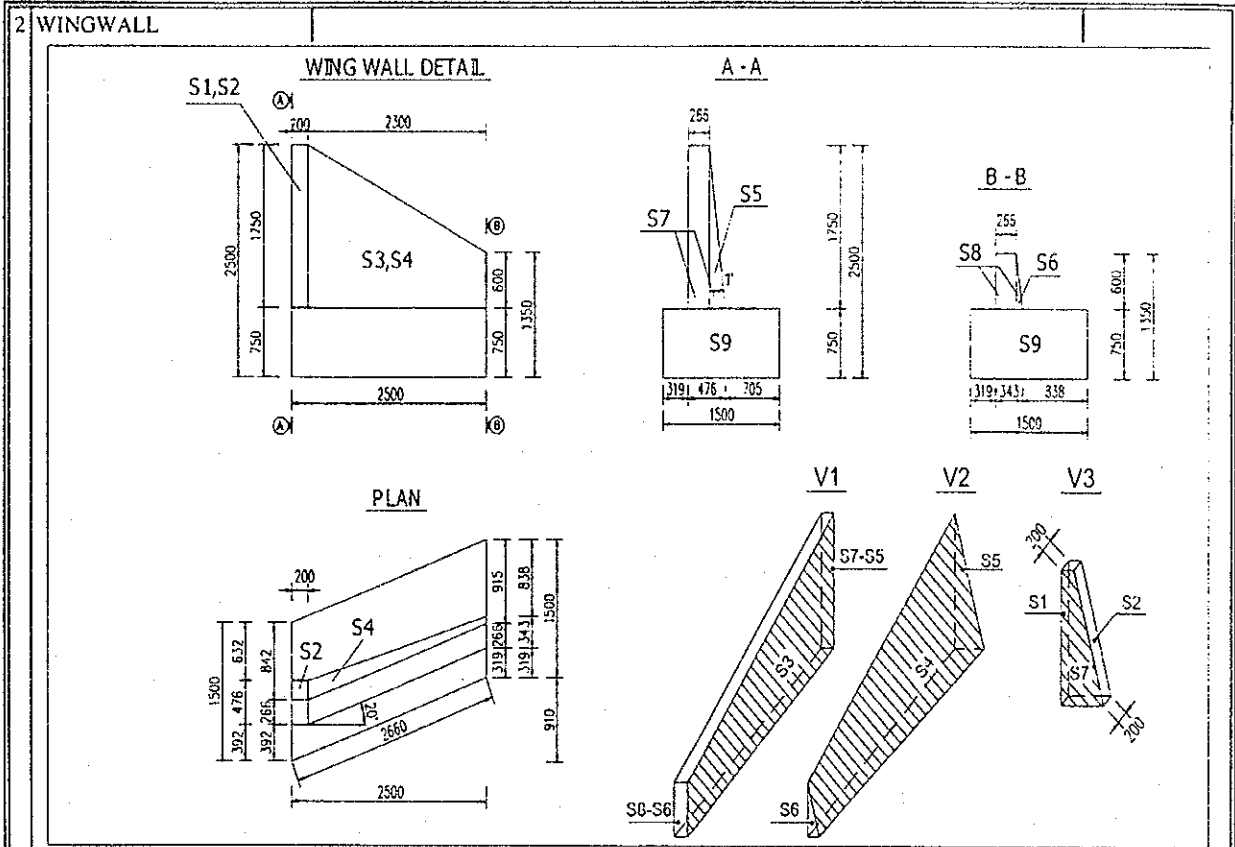
13+600

I	BOX CULVERT STATION 13+600	QUANTITIES
	$L = 13.340 + 13.340 + 0.02 = 26.700$	
1	CULVERT	
+	CONCRETE (M3)	
	$S1=S2 = 2.950 \times 2.050 - 2.500 \times 1.500 + 2 \times 0.100 \times 0.100 = 2.318$	
	$S = S1 + S2 = 4.635$	
	$VOLUME = S \times (13.340 + 13.340) + 5.900 \times 0.200 \times 0.300 \times 2 = 124.36$	
	<p>DOUBLE BOX CULVERT</p>	
+	FORM (M2)	<u>419.90</u>
*	INSIDE FORM (M2)	291.649
	$BOX\ BULWARK = (1.500 + 2 \times 0.100 \times (1/\sin 45^\circ - 1)) \times 26.680 \times 4 = 168.921$	
	$BOTTOM\ OF\ THE\ BOX = (2.500 - 0.100 \times 2) \times 26.680 \times 2 = 122.728$	
*	OUTSIDE FORM (M2)	128.253
	$BOX\ BULWARK = 2.050 \times 2 \times 26.680 + 4 \times 0.300 \times 0.200 = 109.628$	
	$THE\ END\ OF\ CULVERT = S \times 2 + 5.900 \times 0.200 \times 4 = 13.990$	
	$CENTER = S = 4.635$	
+	SCAFFOLDING (M2)	<u>109.63</u>
+	SUPPORT	
	$AREA\ (M2) = 5.900 \times 1.500 - S = 4.215$	
	$VOLUME\ (M3) = AREA \times L = 112.54$	

BOXCULVERT STATION 13+600
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	302.9	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



+ CALCULATING VALUES

S1	=	0.200 × 1.750	=	0.350
S2	=	S1 : cos7°	=	0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) × (2.500 - 0.200) : 2 × cos20°	=	2.876
S4	=	S3 : cos7°	=	2.876 : 0.993 = 2.898
S5	=	(0.476 - 0.266) × 1.750 : 2	=	0.184
S6	=	(0.343 - 0.266) × 0.600 : 2	=	0.023
S7	=	S5 + (1.750 × 0.266)	=	0.184 + 0.466 = 0.650
S8	=	S6 + (0.600 × 0.266)	=	0.023 + 0.160 = 0.183
S9	=	1.500 × 0.750	=	1.125

+ CONCRETE (m³)

- Footing	=	S9 × 2.500	=	1.125 × 2.500 = 2.813
- Wing wall	=	V1 + V2 + V3	=	0.765 + 0.210 + 0.130 = 1.105
V1	=	S3 × 0.266	=	2.876 × 0.266 = 0.765
V2	=	(2.500 - 0.200) : 3 × (S5 + S6 + (S5 × S6) ^{0.5})	=	0.767 × (0.184 + 0.023 + 0.065) = 0.210
V3	=	S7 × 0.200	=	0.650 × 0.200 = 0.13

+ FORM (m²)

- Footing	=	(2.500 : cos20° + S9) × 2	=	(2.660 + 1.125) × 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

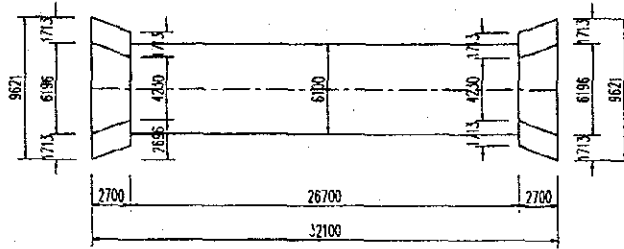
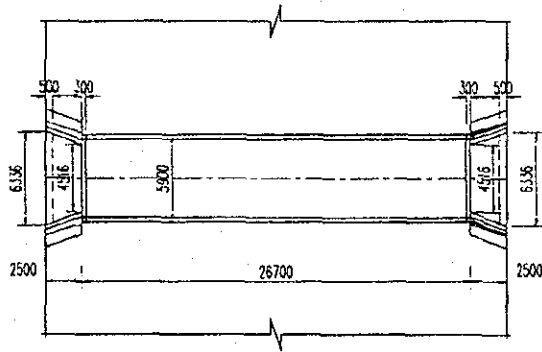
+ SCAFFOLDING (m²)

- Footing	=	(2.500 : cos20° + 1.000 + 1.500 + 1.000) × 2 × 0.750	=	9.241
- Wing wall	=	S3 + S4 + 0.600 × (0.343 + 1.000)	=	2.876 + 2.898 + 0.806 = 6.580

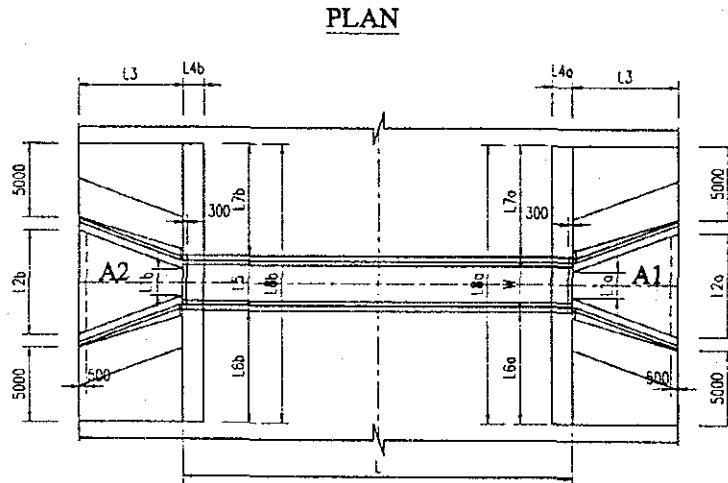
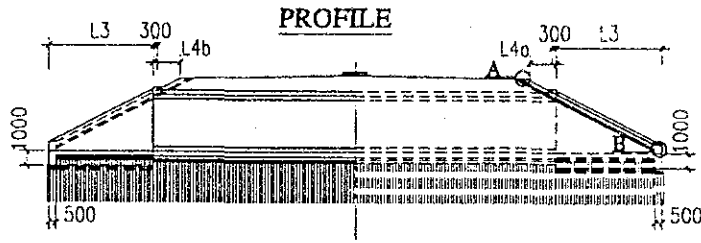
**BOX CULVERT STATION 13+600
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)	
	(MM)						
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

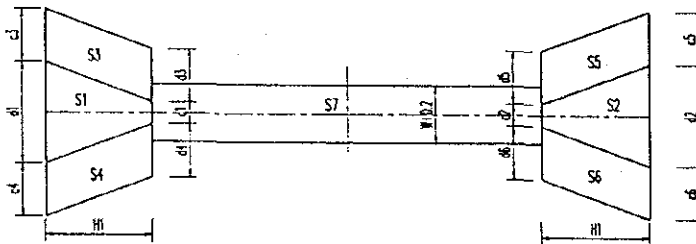
BOX CULVERT FOR DRAINAGE (STATION 13+600)



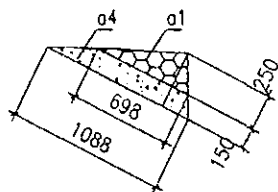
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

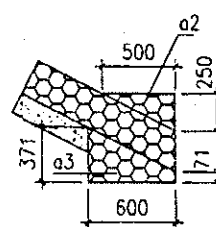


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM13+600

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	+	2.315	)	x	2.700	:	2	=	5.438 (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						

L 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	+
=	(	13.565	+	13.565	)	x	0.3	+	(	6.336	+
										L2b	) x 0.45 x 0.5
										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:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625 + 5.438 + 4.625) \times 0.1 = 4.75 \text{ (m3)}$$

$$= (S3 + S4 + S5 + S6) \times 25 \times 5 : 100 =$$

$$= (4.625 + 4.625 + 5.438 + 4.625) \times 25 \times 5 : 100 = 227.73 \text{ (100m)}$$

4. WOOD PILE:

*L=5M

$$W5 = (S3 + S4 + S5 + S6) \times 25 \times 3 : 100 =$$

$$= (4.625 + 4.625 + 5.438 + 4.625) \times 25 \times 3 : 100 = 21.11 \text{ (100m)}$$

*L=3M

$$W3 = (S1 + S2 + S3 + S4) \times 25 \times 3 : 100 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625) \times 25 \times 3 : 100 =$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= (14.075 + 14.075 + 4.625 + 4.625 + 5.438 + 4.625 + 162.870) \times 0.15 = 31.55 \text{ (m3)}$$

6. FORM

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$= (6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}$$

7. SCAFFOLDING

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$= (6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}$$

2.16. Box culvert at station 14+247

BOX CULVERT

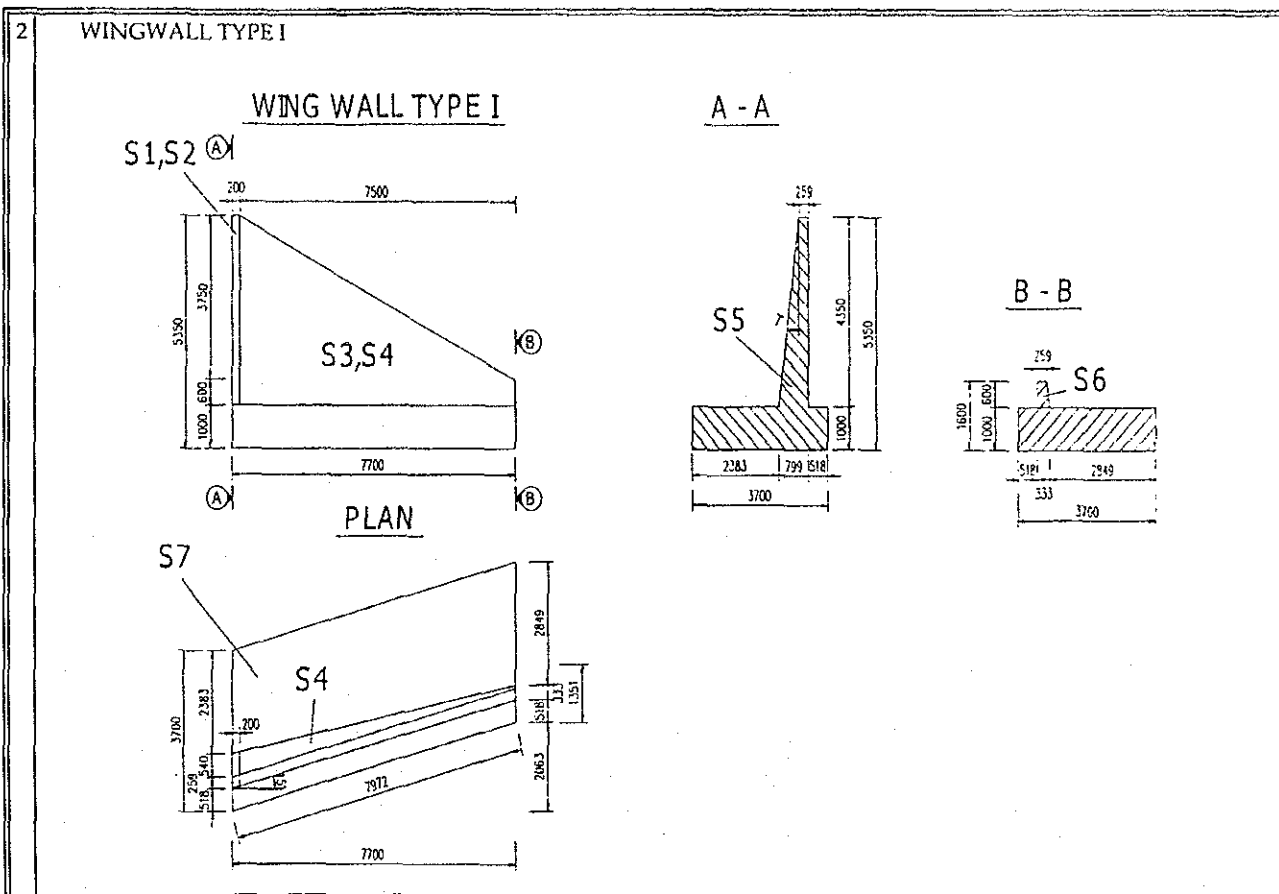
14+247

I	BOX CULVERT STATION 14+247 L = 14.329 + 14.329 + 0.02 = 28.678	QUANTITIES
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 =	<u>233.97</u>
SINGLE BOX CULVERT		
+	FORM (M2)	<u>711.38</u>
*	INSIDE FORM (M2)	409.253
	BOX BULWARK = (4.000 + 2 x 0.300 x (1:SIN45° - 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° - 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° + 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 =	<u>272.49</u>
+	SUPPORT	
	AREA (M2) = 5.800 x 4.750 - S =	19.410
	VOLUME (M3) = AREA x L =	<u>556.64</u>

BOXCULVERT STATION 14+247
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

SYMBOL OF BAR	UNIT LENGTH	SPACE	DIAMETER	NUMBER	UNIT WEIGHT	TOTAL LENGTH	TOTAL WEIGHT
	(mm)	(mm)	(mm)	OF BAR	(kg/m)	(m)	(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



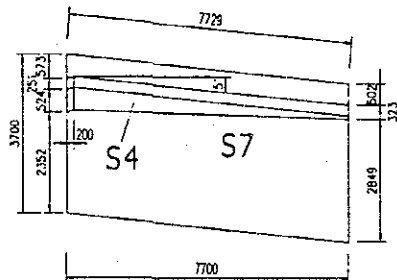
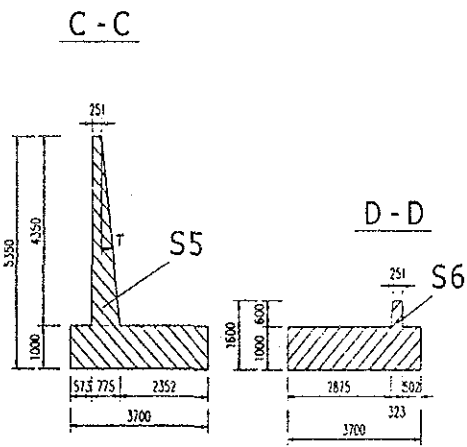
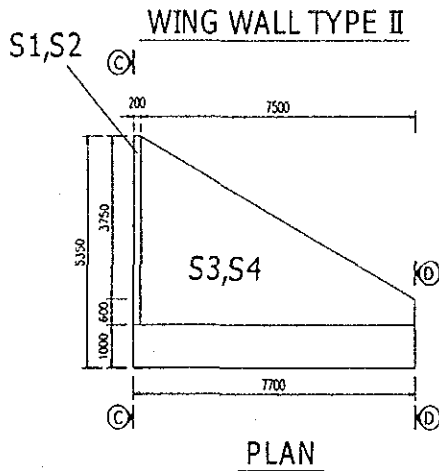
+ CONCRETE (M3)			
S7	= (3.700 + 3.700) : 2 x 7.700	=	28.490
* BASE OF THE WINGWALL	= S7 x 1.000	=	28.490
S5	= (0.799 + 0.259) : 2 x 4.350	=	2.301
S6	= (0.333 + 0.259) : 2 x 0.600	=	0.178
* WINGWALL	= 7.700 : 3 x (S5 + S6 + (S5xS6) ^{0.5})	=	8.003
SUM		=	<u>36.49</u>
+ FORM (M2)			
* BASE OF THE WINGWALL		=	23.344
BASE OF THE WINGWALL	= (7.972 + 3.700 + 3.7 + 7.972) x 1.000	=	23.344
* WINGWALL		=	42.798
S1+S2	= 0.200 x 4.350 x 2	=	1.740
S3	= (4.350 + 0.600) x 7.500 : (2 x COS15°)	=	19.217
S4	= 19.217 : COS7°	=	19.362
S5	= 2.301	=	2.301
S6	= 0.178	=	0.178
+ SCAFFOLDING (M2)			
* BASE OF THE WINGWALL		=	26.344
PERIMETER	= 7.972 + 1.000 + 7.972 + 1.000 + 3.7 + 1.000 + 3.700	=	26.344
AREA	= PERIMETER x 1.000	=	26.344
* WINGWALL	= S3 x 2 + 0.600 x (0.333 + 1)	=	39.234

**BOX CULVERT STATION 14+247
REINFORCEMENT OF WINGWALL TYPE I**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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

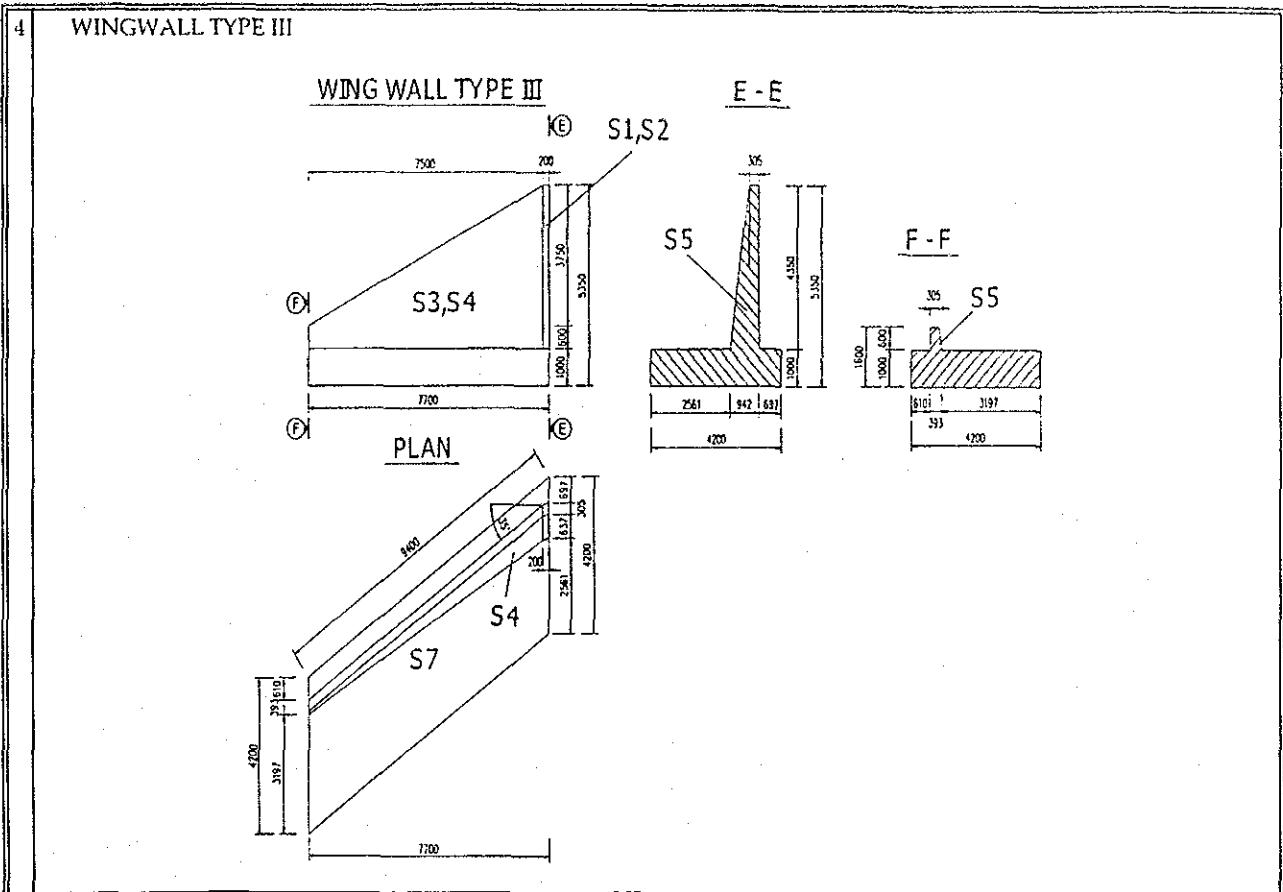
WINGWALL TYPE II



+ CONCRETE (M3)			
S7	= (3.700 + 3.700) : 2 x 7.700	=	28.490
* BASE OF THE WINGWALL	= S7 x 1.000	=	28.490
S5	= (0.775 + 0.251) : 2 x 4.350	=	2.232
S6	= (0.323 + 0.251) : 2 x 0.600	=	0.172
* WINGWALL	= 7.700 : 3 x (S5 + S6 + (S5xS6) ^{0.5})	=	7.761
SUM		=	<u>36.25</u>
+ FORM (M2)			<u>64.41</u>
* BASE OF THE WINGWALL		=	22.858
BASE OF THE WINGWALL	= (7.729 + 3.700 + 3.7 + 7.729) x 1.000	=	22.858
* WINGWALL			41.550
S1+S2	= 0.200 x 4.350 x 2	=	1.740
S3	= (4.350 + 0.600) x 7.500 : (2 x COS5°)	=	18.633
S4	= 18.633 : COS7°	=	18.773
S5	= 2.232	=	2.232
S6	= 0.172	=	0.172
+ SCAFFOLDING (M2)			<u>63.92</u>
* BASE OF THE WINGWALL			25.858
PERIMETER	= 7.729 + 1.000 + 7.729 + 1.000 + 3.7 + 1.000 + 3.700	=	25.858
AREA	= PERIMETER x 1.000	=	25.858
* WINGWALL	= S3 x 2 + 0.600 x (0.323 + 1)	=	38.060

**BOX CULVERT STATION 14+247
REINFORCEMENT OF WINGWALL TYPE II**

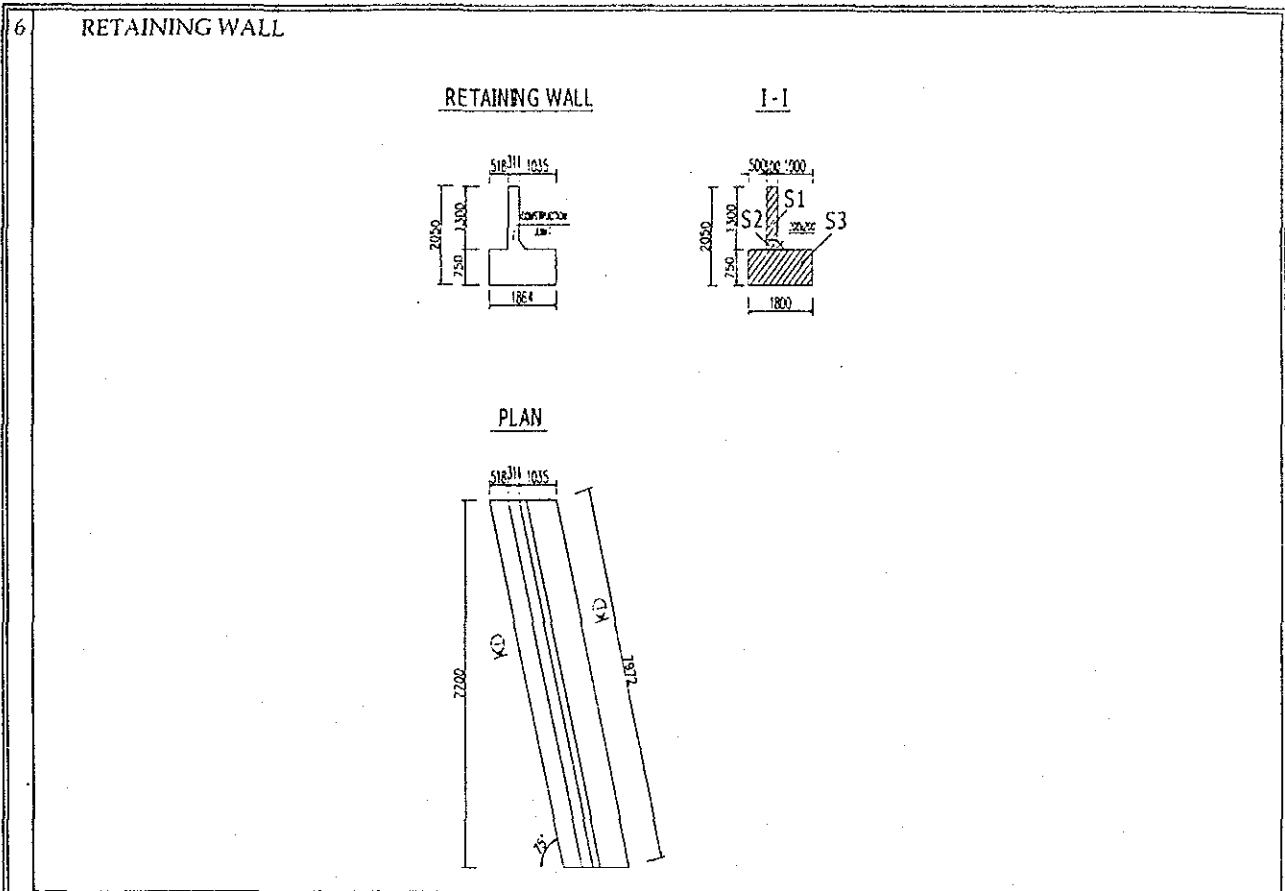
BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
1a	3555	12	40	0.888	142.2	126.2
1b	3685	18	40	1.998	147.4	294.4
2a	7749	12	6	0.888	46.5	41.3
2b	4354	12	38	0.888	165.5	146.9
2c	584	12	40	0.888	23.4	20.7
3	8749	12	2	0.888	17.5	15.5
4	8691	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 :						1203.2 KG
REINFORCEMENT :						791.6 KG
REINFORCEMENT :						14 < D <= 25
TOTAL REINFORCEMENT :						1994.8 KG



+ CONCRETE (M3)			
S7	= (4.200 + 4.200) : 2 x 7.700	=	32.340
* BASE OF THE WINGWALL	= S7 x 1.000	=	32.340
S5	= (0.942 + 0.305) : 2 x 4.350	=	2.712
S6	= (0.393 + 0.305) : 2 x 0.600	=	0.209
* WINGWALL	= 7.700 : 3 x (S5 + S6 + (S5xS6) ^{0.5})	=	9.433
SUM		=	<u>41.77</u>
+ FORM (M2)			<u>77.35</u>
* BASE OF THE WINGWALL		=	27.200
BASE OF THE WINGWALL	= (9.400 + 4.200 + 4.200 + 9.400) x 1.000	=	27.200
* WINGWALL			50.153
S1+S2	= 0.200 x 4.350 x 2	=	1.740
S3	= (4.350 + 0.600) x 7.500 : (2 x COS35 ⁰)	=	22.661
S4	= 22.661 : COS7 ⁰	=	22.831
S5	= 2.712	=	2.712
S6	= 0.209	=	0.209
+ SCAFFOLDING (M2)			<u>76.36</u>
* BASE OF THE WINGWALL			30.200
PERIMETER	= 9.400 + 1.000 + 9.400 + 1.000 + 4.2 + 1.000 + 4.200	=	30.200
AREA	= PERIMETER x 1.000	=	30.200
* WINGWALL	= S3 x 2 + 0.600 x (0.393 + 1)	=	46.157

**BOX CULVERT STATION 14+247
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
REINFORCEMENT					D<=14	1381.8 KG
REINFORCEMENT					14< D<=25	933.9 KG
TOTAL REINFORCEMENT :						2315.7 KG



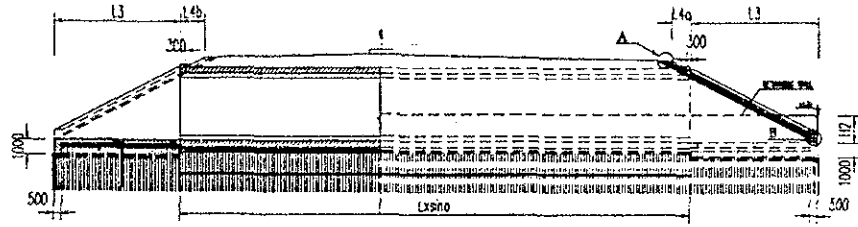
+ CONCRETE (M3)		
S	= S1 + S2 + S3	1.760
S1	= 0.300 x (1.300 - 0.200)	0.330
S2	= (0.300 + 0.300 + 0.200) x 0.200 : 2.000	0.080
S3	= 0.750 x 1.800	1.350
VOLUME	= S x 7.972	<u>14.03</u>
+ FORM (M2)		<u>39.45</u>
BASE OF RETAINING WALL	= 1.864 x 0.750 + 2 x 0.750 x 7.972	13.356
RETAINING WALL	= (1.300 - 0.200) x 7.972 x 2 + (S1 : COS85°)	21.325
FOOT-RETAINING WALL	= 7.972 x 0.2 : SIN45° + (S2 : COS85°) + 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 14+247
REINFORCEMENT OF RETAINING WALL**

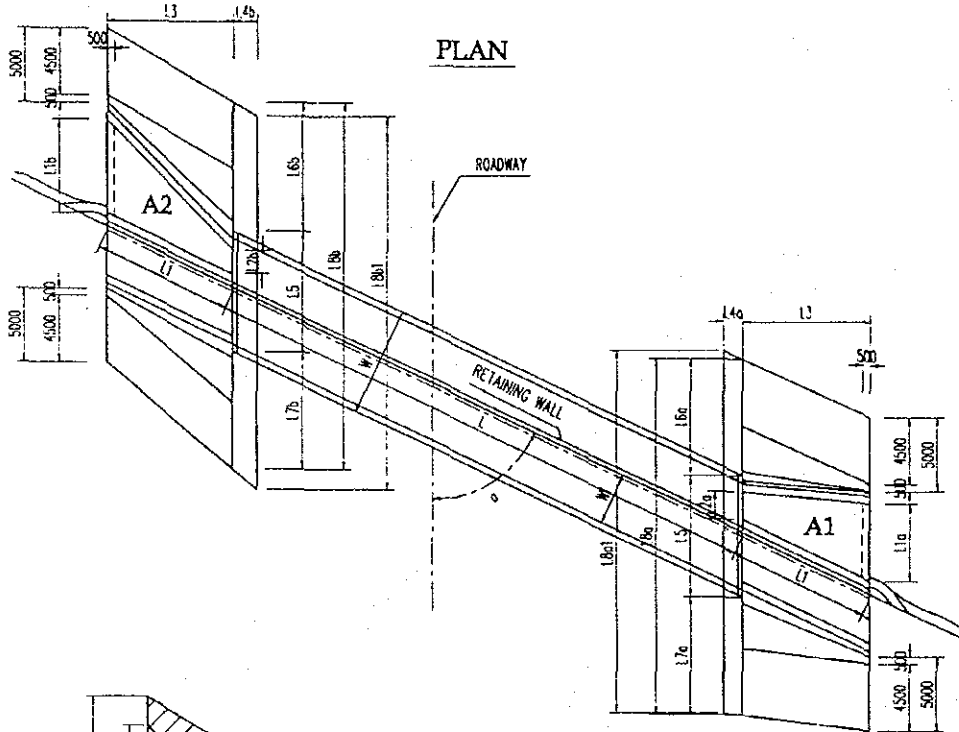
BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
1	4496	12	40	0.888	179.8	159.7
2	8075	12	10	0.888	80.8	71.7
3	1410	12	40	0.888	56.4	50.1
4a	2572	12	74	0.888	190.3	169.0
4b	1884	12	8	0.888	15.1	13.4
5	8741	12	16	0.888	139.9	124.2
6	2444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

NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR PATH & DRAINAGE

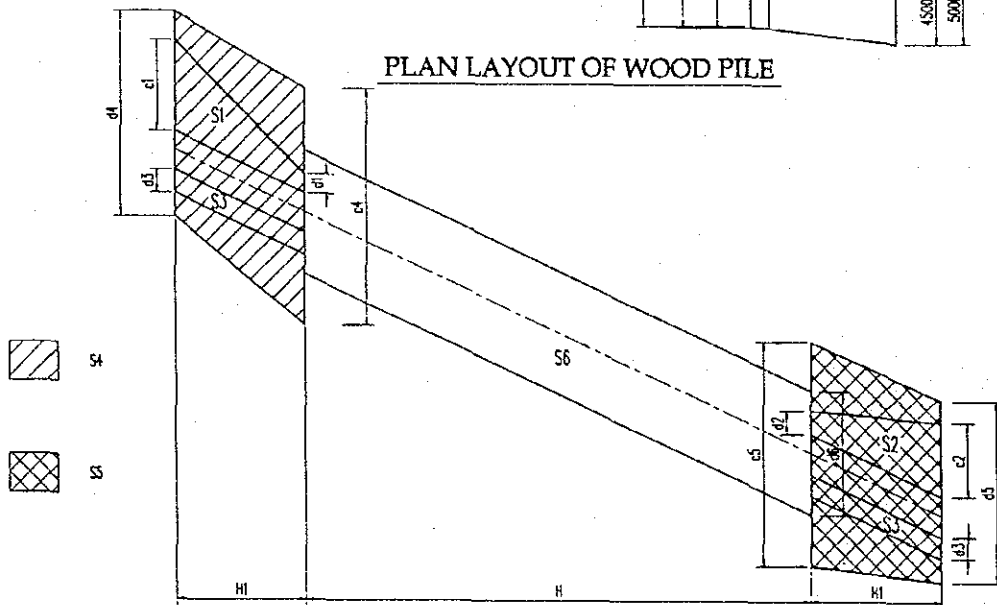
PROFILE



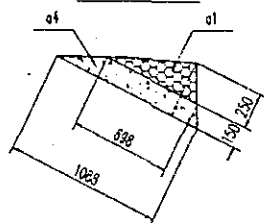
PLAN



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

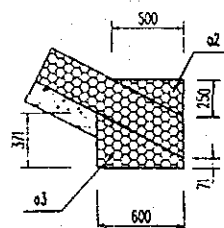


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM 14+247

S1=	(	c1	+	d1	)	x	HI	:	2	=	(m2)
S1=	(	3.144	+	0.000	)	x	7.900	:	2	=	12.419 (m2)
S2=	(	c2	+	d2	)	x	HI	:	2	=	(m2)
S2=	(	2.720	+	0.000	)	x	7.900	:	2	=	10.744 (m2)
S4=	(	c4	+	d4	)	x	HI	:	2	=	(m2)
S4=	(	12.044	+	15.459	)	x	7.900	:	2	=	108.637 (m2)
S5=	(	c5	+	d5	)	x	HI	:	2	=	(m2)
S5=	(	11.654	+	14.462	)	x	7.900	:	2	=	103.158 (m2)
S3=		d3	x	HI	=						(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) =	
A =	(11.708	+	12.921)	x	0.300	+	(0.700	x	0.500) =	
													9.574	(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 CONCRETE:

G =	(	S4	-	S3	+	S5	-	S3	)	x	0.100	=
G =	(	108.637	-	14.726	+	103.158	-	14.726	)	x	0.100	=
													<u>18.234</u>	(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
														<u>414.067</u>
														(100m)

L=3M
W3= (S1 + S2 + (2 x S3) + (0.8 x 4.5 x 4)) x (25 x 3 : 100) = 50.261 (100m)
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 = 2.880 (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:

$$K = (S4 + S5 + S6 + (0.8 \times 4.5 \times 4)) \times 0.150 = 59.740 \text{ (m}^3\text{)}$$

$$= (108.637 + 103.158 + 172.072 + 14.400) \times 0.150 = 59.740 \text{ (m}^3\text{)}$$

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

6. STONE MASONRY

$$a1= 0.698 \times 0.250 \times 0.500 = 0.087 \text{ (m}^2\text{)}$$

$$a2= 0.500 \times 0.250 \times 0.500 = 0.063 \text{ (m}^2\text{)}$$

$$a3= (0.071 + 0.371) \times 0.500 \times 0.600 = 0.133 \text{ (m}^2\text{)}$$

$$a4= (0.698 + 1.088) \times 0.500 \times 0.150 = 0.134 \text{ (m}^2\text{)}$$

$$b1= 0.300 \times L5 = \text{(m}^2\text{)}$$

$$b1= 0.300 \times 6.005 = 1.802 \text{ (m}^2\text{)}$$

$$b2a= (L6a + 5.000) \times L3 \times 0.500 = \text{(m}^2\text{)}$$

$$= (7.885 + 5.000) \times 7.700 \times 0.500 = 49.607 \text{ (m}^2\text{)}$$

$$b2b= (L6b + 5.000) \times L3 \times 0.500 = \text{(m}^2\text{)}$$

$$= (7.885 + 5.000) \times 7.700 \times 0.500 = 49.607 \text{ (m}^2\text{)}$$

$$b3a= (L7a + 5.000) \times L3 \times 0.500 = \text{(m}^2\text{)}$$

$$= (7.861 + 5.000) \times 7.700 \times 0.500 = 49.515 \text{ (m}^2\text{)}$$

$$b3b= (L7b + 5.000) \times L3 \times 0.500 = \text{(m}^2\text{)}$$

$$= (8.028 + 5.000) \times 7.700 \times 0.500 = 50.158 \text{ (m}^2\text{)}$$

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) x 0.250 = (m3)
 = (49.607 + 49.515 + 39.836) x 0.250 = 38.338 (m3)
 V3b= (b2b + b3b + b4b) x 0.250 = (m3)
 = (49.607 + 50.158 + 40.036) x 0.250 = 38.573 (m3)

PROTECTION

V3c= (L9 x 0.600 x 0.600 x 2.0) + (S8 x 2.00 x 0.25) = (m3)
 (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) = 88.072 (m3)

6. 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) x 0.150 = (m3)
 = (49.607 + 49.515 + 39.836) x 0.150 = 21.996 (m3)
 V5b= (b2b + b3b + b4b) x 0.150 = (m3)
 = (49.607 + 50.158 + 40.036) x 0.150 = 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) = 50.768 (m3)

7. PATH

a. LATERITE

$$\begin{aligned} M &= (L + 2 \times L1) \times W1 \times 0.400 = \\ &= (28.688 + 15.944) \times 3.500 \times 0.400 = \underline{62.485} \text{ (m3)} \\ \text{b. SAND FILL} \\ N &= (L + 2 \times L1) \times W1 \times (H2 - 0.400) = \\ &= (28.688 + 15.944) \times 3.500 \times (1.300 - 0.400) = \underline{140.591} \text{ (m3)} \end{aligned}$$

8. FORM:

$$\begin{aligned} &= (L1a + L1b) \times 1 \times 2 = \\ &= (2.889 + 3.356) \times 1 \times 2 = \underline{12.490} \text{ (m2)} \end{aligned}$$

9. SCAFFOLDING:

$$\begin{aligned} &= (L1a + L1b) \times 1 \times 2 = \\ &= (2.889 + 3.356) \times 1 \times 2 = \underline{12.490} \text{ (m2)} \end{aligned}$$

2.17. Box culvert at station 14+450

BOX CULVERT

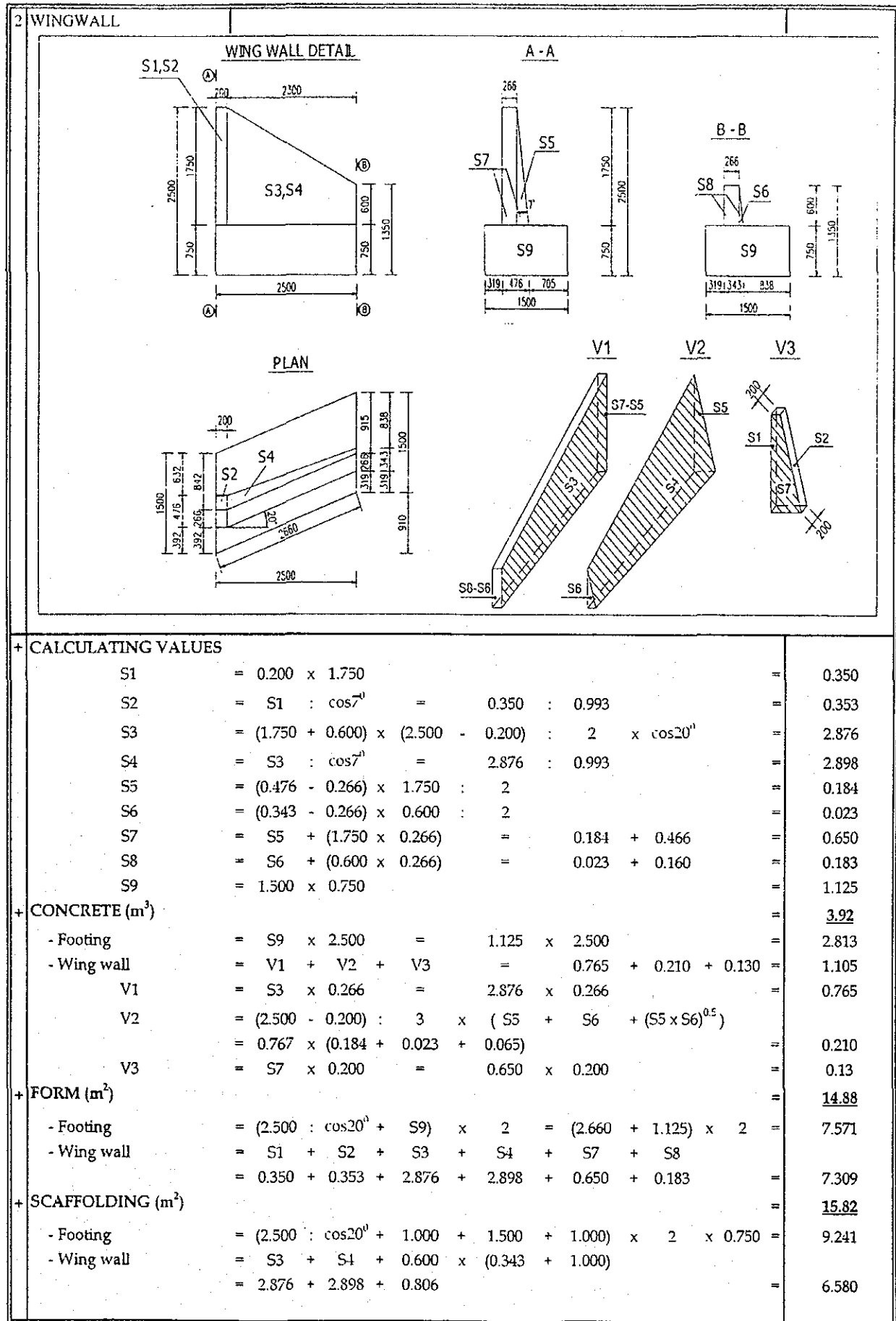
14+450

BOX CULVERT STATION 14+450		QUANTITIES
L = 13.340 + 13.340 + 0.02 = 26.700		
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 =	<u>124.36</u>
<p>DOUBLE BOX CULVERT</p>		
+ FORM (M2)		<u>419.90</u>
* INSIDE FORM (M2)		291.649
BOX BULWARK	= (1.500 + 2 x 0.100 x (1/SIN45° - 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 =	<u>109.63</u>
+ SUPPORT		
AREA (M2)	= 5.900 x 1.500 - S =	4.215
VOLUME (M3)	= AREA x L =	<u>112.54</u>

BOXCULVERT STATION 14+450
QUANTITIES TABLE OF REINFORCEMENT

SEGMENT 1 & 2

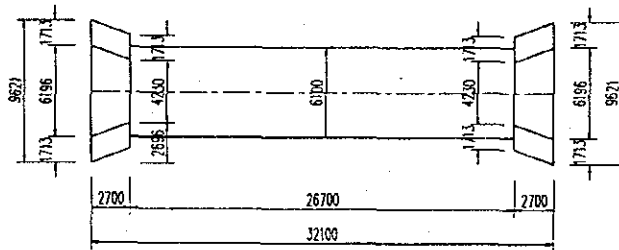
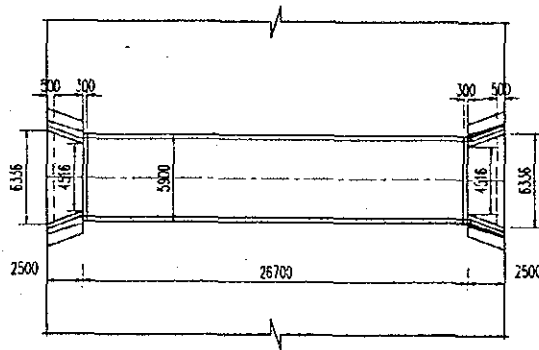
SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	3660	125	14	214	1.208	783.24	946.5
2	2350	250	12	108	0.888	253.8	225.3
3	6270	250	14	108	1.208	677.16	818.3
4	1500	250	14	212	1.208	318	384.3
5	1550	125	18	214	1.998	331.7	662.6
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



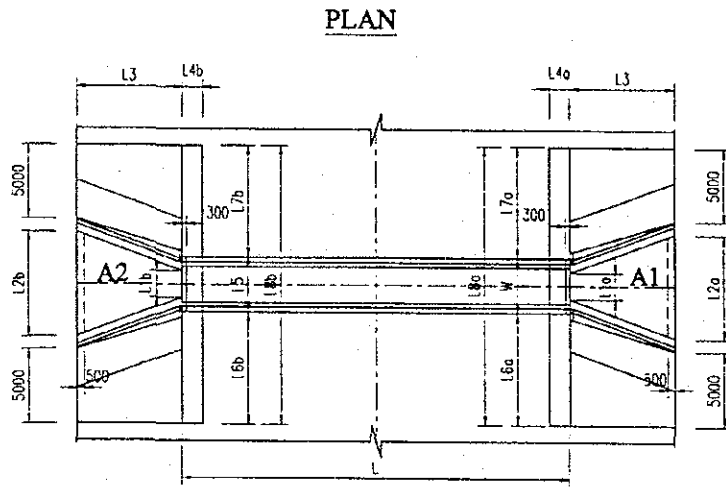
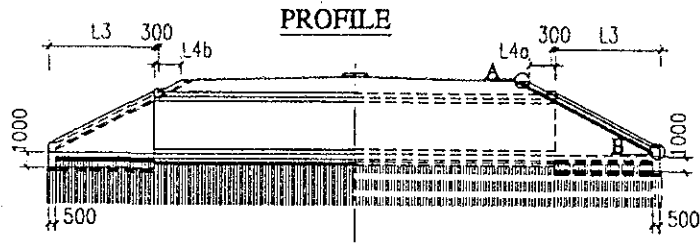
**BOX CULVERT STATION 14+450
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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	

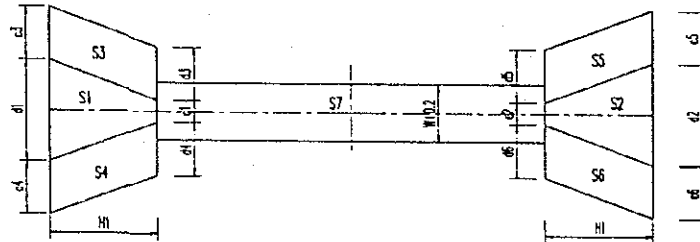
BOX CULVERT FOR DRAINAGE (STATION 14+450)



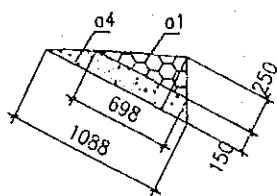
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

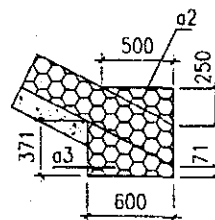


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM14+450

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						
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	+
=	(	13.565	+	13.565	)	x	0.3	+	(	6.336	+
										L2b)
)
											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:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = \underline{4.67} \text{ (m3)}$$

4. WOOD PILE:

* L=5M

$$W5 = (S3 + S4 + S5 + S6) \times 25 \times 5 : 100 =$$

$$= (4.625 + 4.625 + 4.625 + 4.625) \times 25 \times 5 : 100 = \underline{226.71} \text{ (100m)}$$

* L=3M

$$W3 = (S1 + S2 + 0 + 0.000) \times 25 \times 3 : 100 =$$

$$= (14.075 + 14.0751 + 0 + 0.000) \times 25 \times 3 : 100 = \underline{21.11} \text{ (100m)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= (14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 162.870) \times 0.15 = \underline{31.43} \text{ (m3)}$$

6. FORM

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

7. SCAFFOLDING

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

2.18. Box culvert at station 14+625

BOX CULVERT

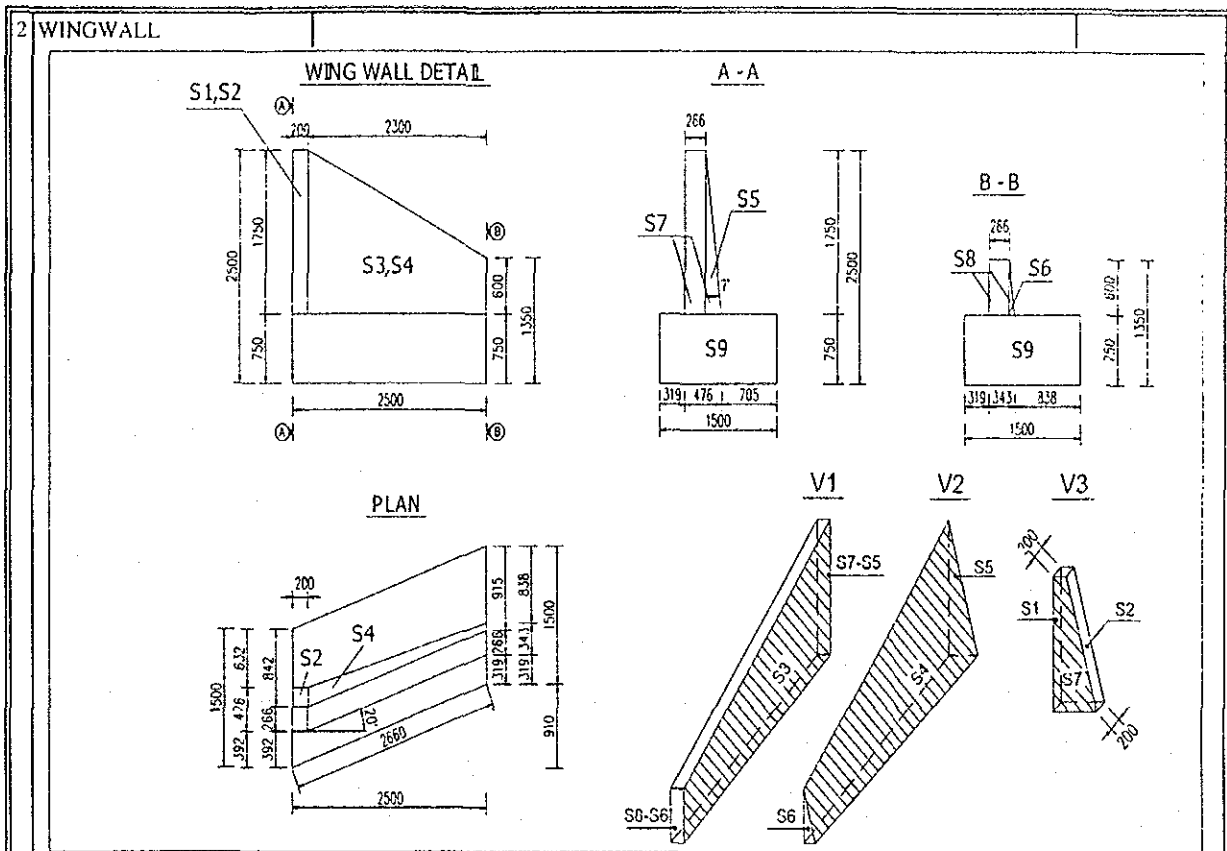
14+625

BOX CULVERT STATION	14+625	QUANTITIES
L	= 13.340 + 13.340 + 0.02 = 26.700	
1 CULVERT + CONCRETE (M3) S1=S2 S VOLUME	$= 2.950 \times 2.050 - 2.500 \times 1.500 + 2 \times 0.100 \times 0.100 =$ $= S1 + S2 =$ $= S \times (13.340 + 13.340) + 5.900 \times 0.200 \times 0.300 \times 2 =$	2.318 4.635 <u>124.36</u>
<p>DOUBLE BOX CULVERT</p>		
+ FORM (M2) * INSIDE FORM (M2) BOX BULWARK BOTTOM OF THE BOX * OUTSIDE FORM (M2) BOX BULWARK THE END OF CULVERT CENTER + SCAFFOLDING (M2) + SUPPORT AREA (M2) VOLUME (M3)	$= (1.500 + 2 \times 0.100 \times (1/\sin 45^\circ - 1)) \times 26.680 \times 4 =$ $= (2.500 - 0.100 \times 2) \times 26.680 \times 2 =$ $= 2.050 \times 2 \times 26.680 + 4 \times 0.300 \times 0.200 =$ $= S \times 2 + 5.900 \times 0.200 \times 4 =$ $= S$ $= 2.050 \times 2.000 \times 26.680 + 4.000 \times 0.300 \times 0.200 =$ $= 5.900 \times 1.500 - S =$ $= \text{AREA} \times L =$	<u>419.90</u> 291.649 168.921 122.728 128.253 109.628 13.990 4.635 <u>109.63</u> 4.215 <u>112.54</u>

BOXCULVERT STATION 14+625
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		



+ CALCULATING VALUES

S1	=	0.200 x 1.750	=	0.350
S2	=	S1 : cos7°	=	0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) x (2.500 - 0.200) : 2 x cos20°	=	2.876
S4	=	S3 : cos7°	=	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 (m³)

- 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 x 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 (m²)

- Footing	=	(2.500 : cos20° + 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

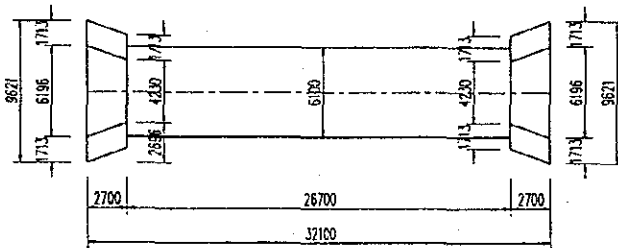
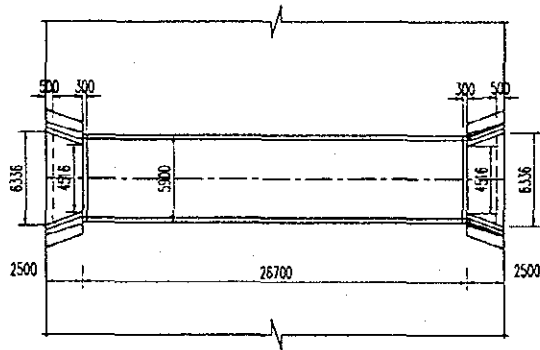
+ SCAFFOLDING (m²)

- Footing	=	(2.500 : cos20° + 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

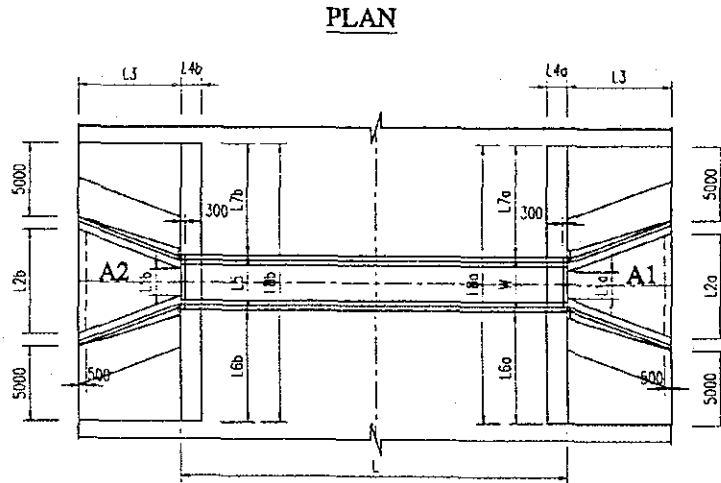
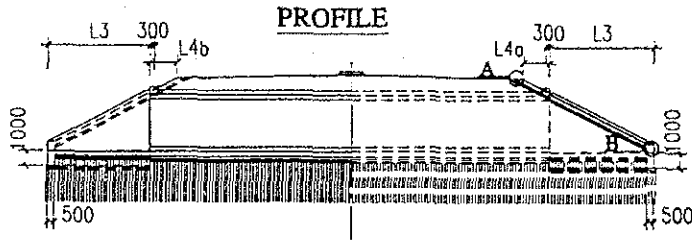
**BOX CULVERT STATION 14+625
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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

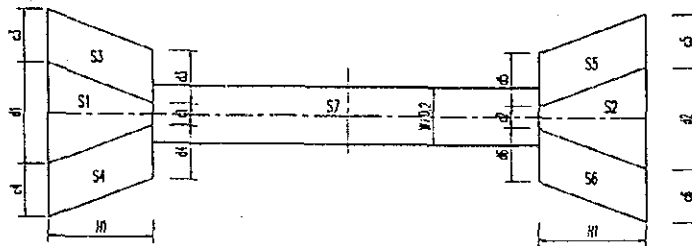
BOX CULVERT FOR DRAINAGE (STATION 14+625)



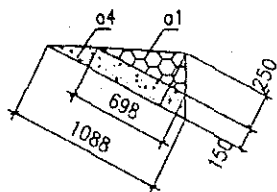
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

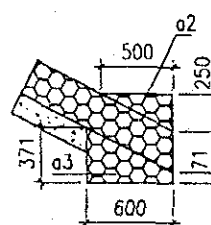


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM14+625

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)
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	+
=	(	13.565	+	13.565	)	x	0.3	+	(	6.336	+
										L2b	) x 0.45 x 0.5
										6.336	) x 0.45 x 0.5
											= 10.99 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

$$L \times (W + 0.2) \times 0.2 = 26.700 \times 6.100 \times 0.2 = 32.57 \text{ (m3)}$$

3. LEAN CONCRETE:

$$= ((S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= ((14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = 4.67 \text{ (m3)}$$

4. WOOD PILE:

* L=5M

$$W5 = ((S3 + S4 + S5 + S6 + S7) \times 25 \times 5 : 100 =$$

$$= ((4.625 + 4.625 + 4.625 + 4.625 + 162.870) \times 25 \times 5 : 100 = 226.71 \text{ (100m)}$$

* L=3M

$$W3 = ((S1 + S2 + 0 + 0.000) \times 25 \times 3 : 100 =$$

$$= ((14.075 + 14.0751 + 0.000) \times 25 \times 3 : 100 = 21.11 \text{ (100m)}$$

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

5. SAND BEDDING:

$$= ((S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= ((14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 162.870) \times 0.15 = 31.43 \text{ (m3)}$$

6. FORM

$$= ((L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}$$

7. SCAFFOLDING

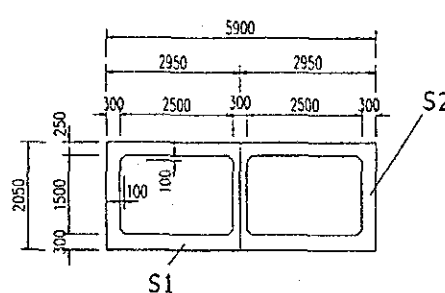
$$= ((L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}$$

2.19. Box culvert at station 14+890

BOX CULVERT

14+890

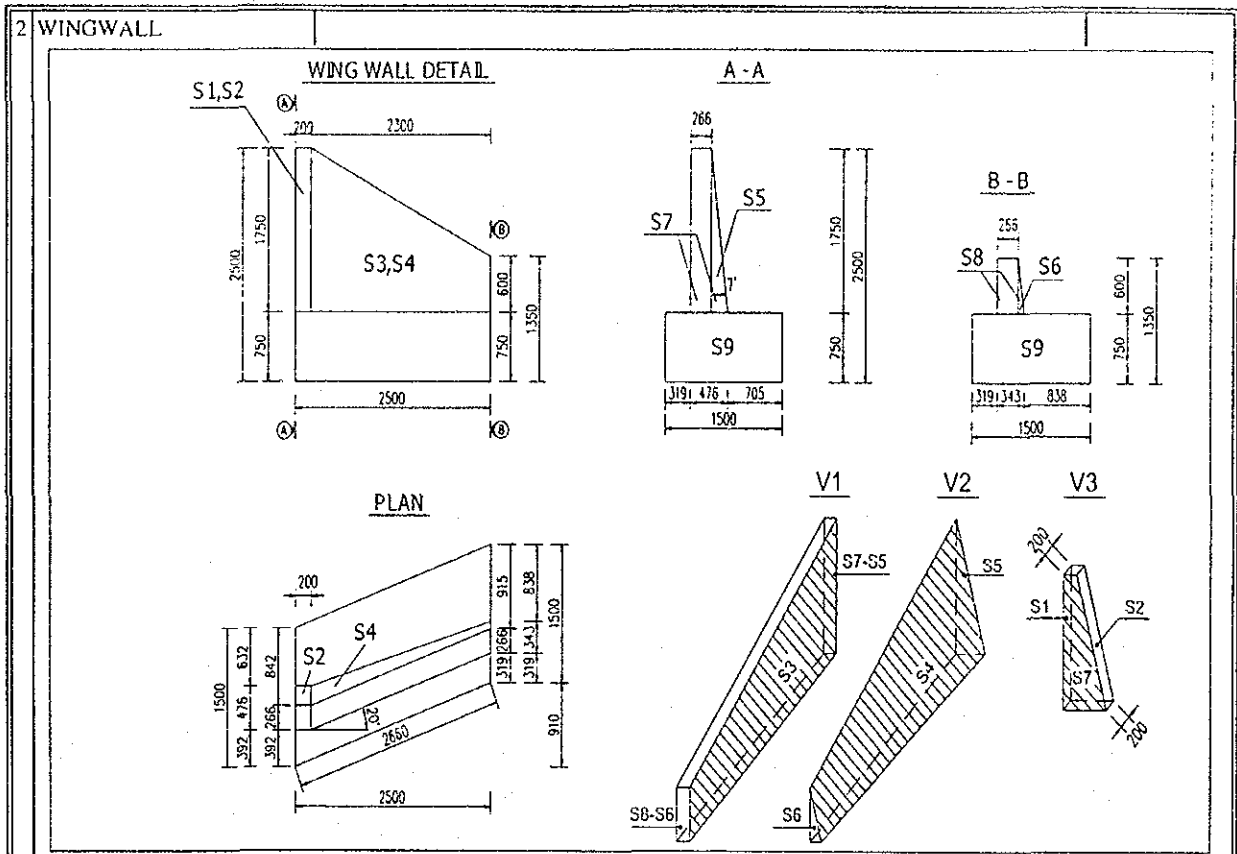
I	BOX CULVERT STATION 14+890 L = 13.340 + 15.200 + 0.02 = 28.560	QUANTITIES
1	CULVERT	
+	CONCRETE (M3)	
	S1=S2 = 2.950 x 2.050 - 2.500 x 1.500 + 2 x 0.100 x 0.100 =	2.318
	S = S1 + S2 =	4.635
	VOLUME = S x (13.340 + 15.200) + 5.900 x 0.200 x 0.300 x 2 =	<u>132.99</u>
<p>DOUBLE BOX CULVERT</p> 		
+	FORM (M2)	<u>447.86</u>
*	INSIDE FORM (M2)	311.981
	BOX BULWARK = (1.500 + 2 x 0.100 x (1/SIN45° - 1)) x 28.540 x 4 =	180.697
	BOTTOM OF THE BOX = (2.500 - 0.100 x 2) x 28.540 x 2 =	131.284
*	OUTSIDE FORM (M2)	135.879
	BOX BULWARK = 2.050 x 2 x 28.540 + 4 x 0.300 x 0.200 =	117.254
	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 28.540 + 4.000 x 0.300 x 0.200 =	<u>117.25</u>
+	SUPPORT	
	AREA (M2) = 5.900 x 1.500 - S =	4.215
	VOLUME (M3) = AREA x L =	<u>120.38</u>

BOXCULVERT STATION 14+890
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	214	1.208	783.2	946.5
2	2350	250	12	108	0.888	253.8	225.3
3	6270	250	14	108	1.208	677.2	818.3
4	1500	250	14	212	1.208	318.0	384.3
5	1550	125	18	214	1.998	331.7	662.6
6	1970	250	12	216	0.888	425.5	377.8
7	2350	125	12	214	0.888	502.9	446.5
8	1049	250	12	216	0.888	226.6	201.2
9	1120	250	12	216	0.888	241.9	214.8
10	13845	250	12	52	0.888	719.9	639.2
11	13945	250	12	88	0.888	1227.2	1089.5
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	320.16	0.888	377.8	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

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	242	1.208	885.7	1070.3
2	2350	250	12	122	0.888	286.7	254.5
3	6270	250	14	122	1.208	764.9	924.4
4	1500	250	14	240	1.208	360.0	435.0
5	1550	125	18	242	1.998	375.1	749.3
6	1970	250	12	244	0.888	480.7	426.8
7	2350	125	12	242	0.888	568.7	504.9
8	1049	250	12	244	0.888	256.0	227.2
9	1120	250	12	244	0.888	273.3	242.6
10	15705	250	12	52	0.888	816.7	725.0
11	15805	250	12	88	0.888	1390.8	1234.8
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	364.8	0.888	430.5	382.2
REINFORCEMENT : D<=14				6471.3	TOTAL FOR SEGMENT 2:		
REINFORCEMENT : 16=D<=25				749.3	REINFORCEMENT (KG):		7220.6
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		70.81
TOTAL FOR SEGMENT 1 & 2							
REINFORCEMENT : D<=14				12193.4	REINFORCEMENT (KG):		13605.3
REINFORCEMENT : 16=D<=25				1411.9			
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		132.99

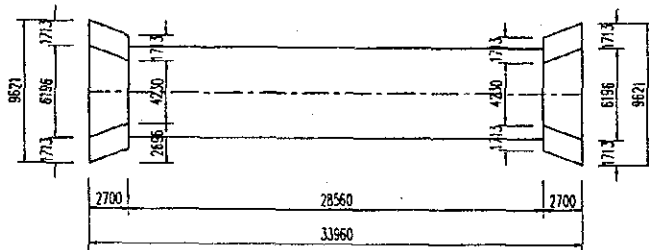
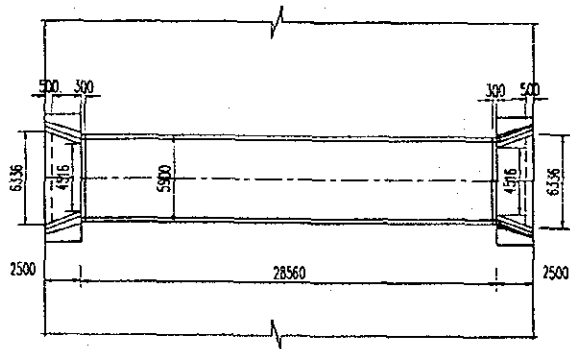


+ CALCULATING VALUES			
S1	=	0.200 x 1.750	= 0.350
S2	=	S1 : cos7°	= 0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) x (2.500 - 0.200) : 2 x cos20°	= 2.876
S4	=	S3 : cos7°	= 2.876 : 0.993 = 2.898
S5	=	(0.476 - 0.266) x 1.750 : 2	= 0.184
S6	=	(0.343 - 0.266) x 0.600 : 2	= 0.023
S7	=	S5 + (1.750 x 0.266)	= 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 (m³)			
- 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 x 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 (m²)			
- Footing	=	(2.500 : cos20° + 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 (m²)			
- Footing	=	(2.500 : cos20° + 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

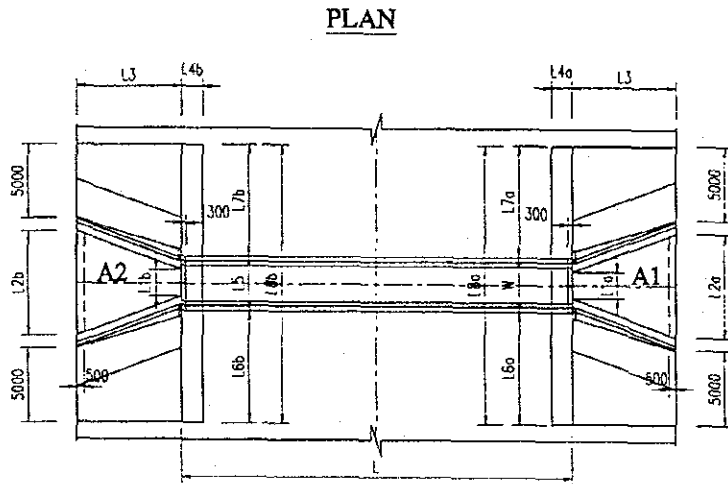
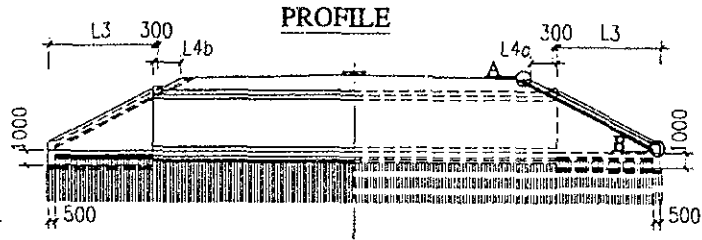
**BOX CULVERT STATION 14+890
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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 :						248.5 KG
REINFORCEMENT :						14 < D <= 25
TOTAL REINFORCEMENT :						66.9 KG
TOTAL REINFORCEMENT :						315.4 KG

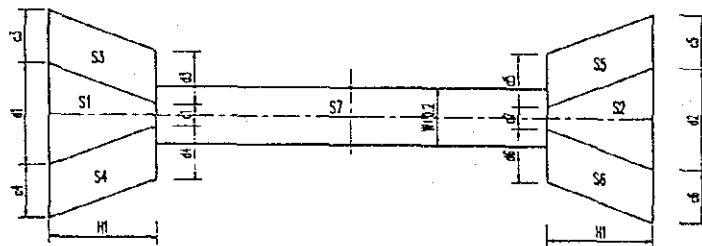
BOX CULVERT FOR DRAINAGE
(STATION 14+890)



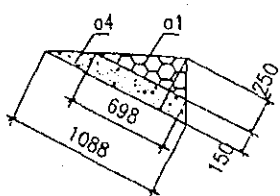
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

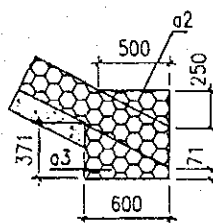


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM14+890

S1=	(	c1	+	d1	)	x	HI	:	2	=	
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075 (m2)
S2=	(	c2	+	d2	)	x	HI	:	2	=	
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075 (m2)
S3=	(	c3	+	d3	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S4=	(	c4	+	d4	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S5=	(	c5	+	d5	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S6=	(	c6	+	d6	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S7=	(	L	x	(W+0.2))	=					
=	(	28.560	x	6.100	)	=	174.216				(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	+
=	(	13.565	+	13.565	)	x	0.3	+	(	6.336	+
										L2b)
											) x 0.45 x 0.5
											) x 0.45 x 0.5
											= 10.99 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

L	x	(W+0.2)	x	0.2	=	28.560	x	6.100	x	0.2	=	34.84 (m3)
---	---	---------	---	-----	---	--------	---	-------	---	-----	---	------------

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = \underline{4.67} \text{ (m3)}$$

4. WOOD PILE:

$$\frac{*L=5M}{W5= (S3 + S4 + S5 + S6 + S7) \times 25 \times 5 : 100 =}$$

$$= (4.625 + 4.625 + 4.625 + 4.625 + 174.216) \times 25 \times 5 : 100 = \underline{240.90} \text{ (100md)}$$

$$\frac{*L=3M}{W3= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 25 \times 3 : 100 =}$$

$$= (14.075 + 14.0751 + 0.000 + 4.625 + 4.625 + 4.625 + 174.216) \times 25 \times 3 : 100 = \underline{21.11} \text{ (100md)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= (14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 174.216) \times 0.15 = \underline{33.13} \text{ (m3)}$$

6. FORM

$$= (L2a + L2b) \times 2 =$$

$$(6.336 + 6.336) \times 2 = 19.008 \text{ (m2)}$$

7. SCAFFOLDING

$$= (L2a + L2b) \times 2 =$$

$$(6.336 + 6.336) \times 2 = 19.008 \text{ (m2)}$$

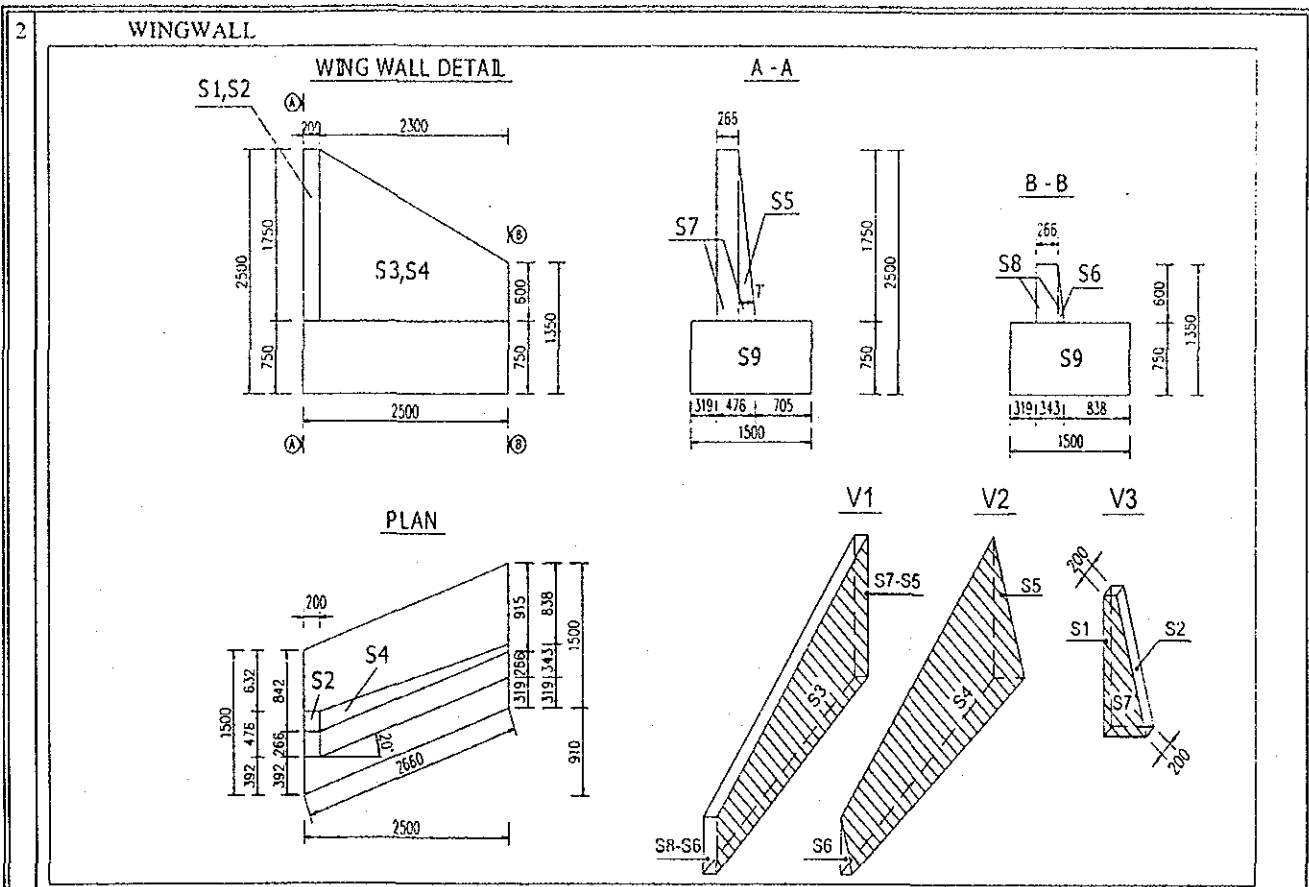
2.20. Box culvert at interchange 3 – ramp
“A” – station 0+154

BOX CULVERT AT INTERCHANGE 3 RAMP "A" - 0+154

BOX CULVERT AT INTERCHANGE 3 RAMP "A" 0+154		QUANTITIES
L	= 13.100	
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 L + 5.900 x 0.200 x 0.300 x 2 =	<u>61.43</u>
<p>DOUBLE BOX CULVERT</p>		
+ FORM (M2)		<u>212.45</u>
* INSIDE FORM (M2)		144.511
BOX BULWARK	= (1.500 + 2 x 0.100 x (1: SIN45° - 1)) x 13.100 x 4 =	82.941
BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 13.100 x 2 =	61.570
* OUTSIDE FORM (M2)		67.940
BOX BULWARK	= 2.050 x 2 x 13.100 + 4 x 0.300 x 0.200 =	53.950
THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	13.990
+ SCAFFOLDING (M2)	= 2.050 x 2 x 13.100 + 4 x 0.300 x 0.200 =	<u>53.95</u>
+ SUPPORT		
AREA (M2)	= 5.900 x 1.500 - S	= 4.215
VOLUME (M3)	= AREA x L	= <u>55.22</u>

**BOXCULVERT AT INTERCHANGE 3-RAMP" A" 0+154
QUANTITIES TABLE OF REINFORCEMENT**

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	210	1.208	768.6	928.8
2	2350	250	12	106	0.888	249.1	221.2
3	6270	250	14	106	1.208	664.62	803.1
4	1500	250	14	208	1.208	312	377.0
5	1550	125	18	210	1.998	325.5	650.2
6	1970	250	12	212	0.888	417.64	370.8
7	2350	125	12	210	0.888	493.5	438.1
8	1049	250	12	212	0.888	222.388	197.4
9	1120	250	12	212	0.888	237.44	210.8
10	13605	250	12	52	0.888	707.46	628.1
11	13705	250	12	88	0.888	1206.04	1070.7
12	5780	250	12	4	0.888	23.12	20.5
13	1440	250	12	52	0.888	74.88	66.5
14	1180	250	12	314.4	0.888	370.992	329.4
REINFORCEMENT : D<=14				5662.5	TOTAL :		
REINFORCEMENT : 16=D<=25				650.2	REINFORCEMENT (KG):		6312.7
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		61.43

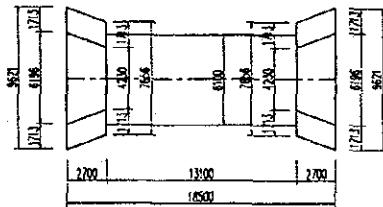
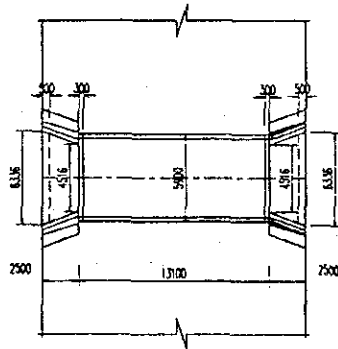


+ CALCULATING VALUES			
S1	=	0.200 x 1.750	= 0.350
S2	=	S1 : cos ^{71°}	= 0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) x (2.500 - 0.200) : 2 x cos ^{20°}	= 2.876
S4	=	S3 : cos ^{70°}	= 2.876 : 0.993 = 2.898
S5	=	(0.476 - 0.266) x 1.750 : 2	= 0.184
S6	=	(0.343 - 0.266) x 0.600 : 2	= 0.023
S7	=	S5 + (1.750 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)			
- 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 x 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)			
- Footing	=	(2.500 : cos ^{20°} + 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)			
- Footing	=	(2.500 : cos ^{20°} + 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

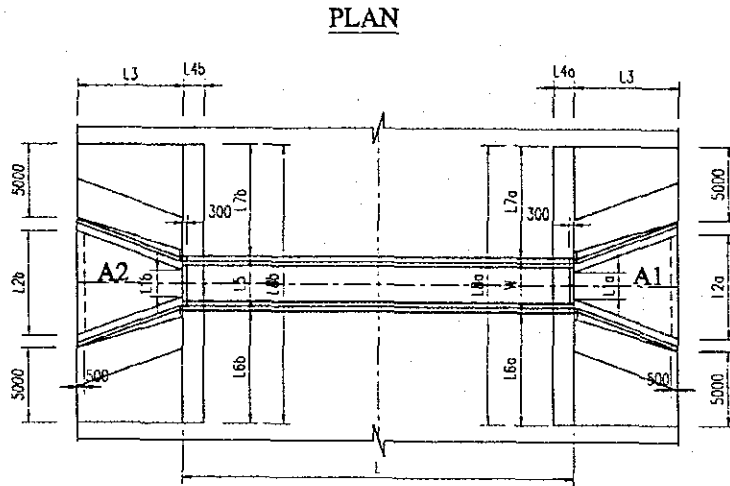
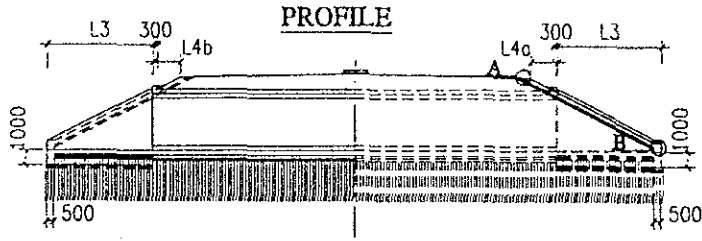
**BOX CULVERT AT INTERCHANGE 3 RAMP "A" 0+154
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)			(KG/M)		
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	

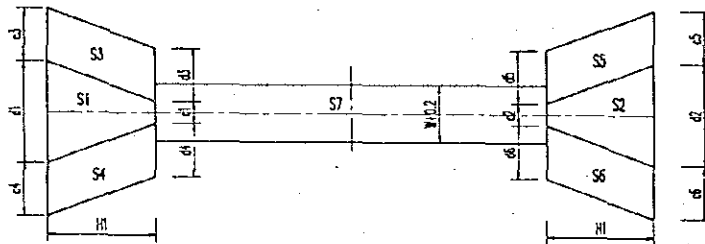
BOX CULVERT FOR DRAINAGE
 (INTERCHANGE 3 - RAMP "A" - STATION 0+154)



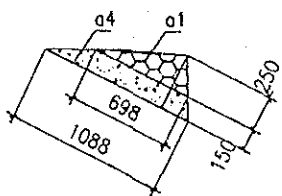
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

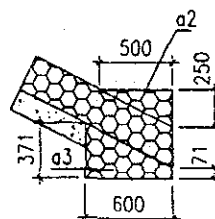


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM0+154 RAMP "A" INTERCHANGE 3

S1=	(	c1	)	x	H1	:	2	=	
=	(	4.230	)	x	2.700	:	2	=	(m2)
S2=	(	c2	)	x	H1	:	2	=	14.075 (m2)
=	(	4.230	)	x	2.700	:	2	=	14.075 (m2)
S3=	(	c3	)	x	H1	:	2	=	(m2)
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S4=	(	c4	)	x	H1	:	2	=	(m2)
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S5=	(	c5	)	x	H1	:	2	=	(m2)
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S6=	(	c6	)	x	H1	:	2	=	(m2)
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S7=	L	x	(W + 0.2)	=					
=	13.100	x	6.100	=	79.910				(m2)
1. APRON CONCRETE:									
A1=	(	L1a	)	x	L3	:	2	=	
=	(	4.516	)	x	2.500	:	2	=	13.565 (m2)
A2=	(	L1b	)	x	L3	:	2	=	
=	(	4.516	)	x	2.500	:	2	=	13.565 (m2)
	(	A1	)	x	0.3	+	(	L2a	+
=	(	13.565	)	x	0.3	+	(	6.336	+
								L2b	) x 0.45 x 0.5
								6.336	) x 0.45 x 0.5
									= 10.99 (m3)
2. CONCRETE FOUNDATION OF CULVERT:									
L	x	(W + 0.2)	x	0.2	=	13.100	x	6.100	x
								0.2	=
									15.98 (m3)

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = \underline{4.67} \text{ (m3)}$$

4. WOOD PILE:

* I=5M

$$W5 = (S3 + S4 + S5 + S6) \times 25 \times 5 : 100 =$$

$$= (4.625 + 4.625 + 4.625 + 4.625) \times 25 \times 5 : 100 = \underline{123.01} \text{ (100m)}$$

* I=3M

$$W3 = (S1 + S2 + S7) \times 25 \times 3 : 100 =$$

$$= (14.075 + 14.0751 + 0.000) \times 25 \times 3 : 100 = \underline{21.11} \text{ (100m)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= (14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 79.910) \times 0.15 = \underline{18.98} \text{ (m3)}$$

6. FORM

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$= (6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

7. SCAFFOLDING

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$= (6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

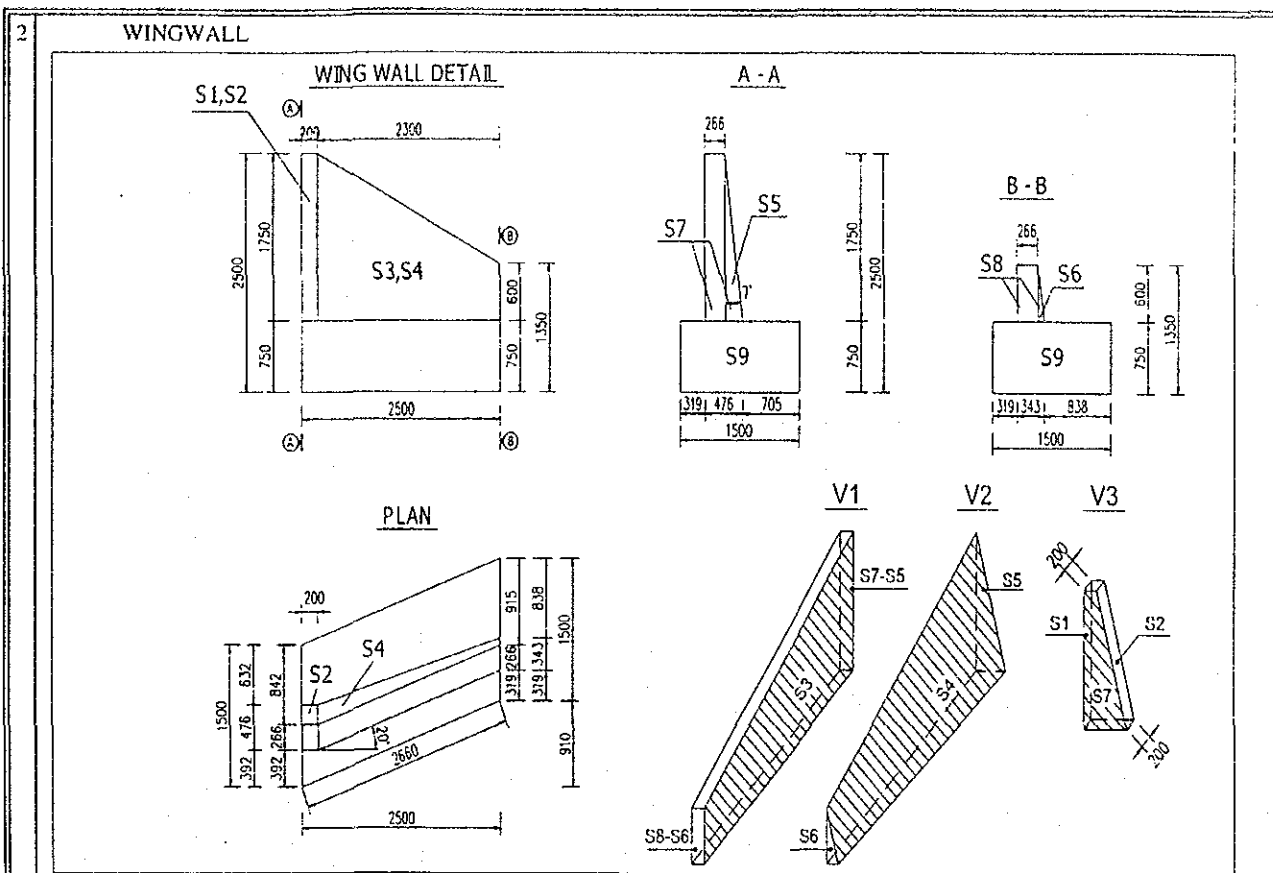
2.21. Box culvert at interchange 3 – ramp
“B” – station 0+286.5

BOX CULVERT AT INTERCHANGE 3 RAMP "B" - 0+286.5

I	BOX CULVERT AT INTERCHANGE 3 RAMP "B" 0+286.5 L = 10.120	QUANTITIES
1	CULVERT + CONCRETE (M3) $S1 = S2 = 2.950 \times 2.050 - 2.500 \times 1.500 + 2 \times 0.100 \times 0.100 = 2.318$ $S = S1 + S2 = 4.635$ VOLUME = $S \times L + 5.900 \times 0.200 \times 0.300 \times 2 = 47.61$	
<p>DOUBLE BOX CULVERT</p>		
+	FORM	<u>174.07</u>
*	INSIDE FORM (M2)	118.344
	BOX BULWARK	= $(1.500 + 2 \times 0.300 \times (1:\text{SIN}45^\circ - 1)) \times 10.120 \times 4 = 70.780$
	BOTTOM OF THE BOX	= $(2.950 - 0.300 \times 2) \times 10.120 \times 2 = 47.564$
*	OUTSIDE FORM (M2)	55.722
	BOX BULWARK	= $2.050 \times 2 \times 10.120 + 4 \times 0.300 \times 0.200 = 41.732$
	THE END OF CULVERT	= $S \times 2 + 5.900 \times 0.200 \times 4 = 13.990$
+	SCAFFOLDING (M2)	= $2.050 \times 2 \times 10.120 + 4 \times 0.300 \times 0.200 = 41.73$
+	SUPPORT	
	AREA (M2)	= $5.900 \times 1.500 - S = 4.215$
	VOLUME (M3)	= $\text{AREA} \times L = 42.66$

BOXCULVERT AT INTERCHANGE 3-RAMP" B" 0+286.5
QUANTITIES TABLE OF REINFORCEMENT

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	162	1.208	592.92	716.5
2	2350	250	12	82	0.888	192.7	171.1
3	6270	250	14	82	1.208	514.14	621.3
4	1500	250	14	160	1.208	240	290.0
5	1550	125	18	162	1.998	251.1	501.6
6	1970	250	12	164	0.888	323.08	286.8
7	2350	125	12	162	0.888	380.7	338.0
8	1049	250	12	164	0.888	172.036	152.7
9	1120	250	12	164	0.888	183.68	163.1
10	10260	250	12	52	0.888	533.52	473.7
11	10360	250	12	88	0.888	911.68	809.4
12	5780	250	12	4	0.888	23.12	20.5
13	1440	250	12	52	0.888	74.88	66.5
14	1180	250	12	242.88	0.888	286.5984	254.4
REINFORCEMENT : D<=14				4364.0	TOTAL :		
REINFORCEMENT : 16=D<=25				501.6	REINFORCEMENT (KG):		
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		
					4865.6		
					47.61		

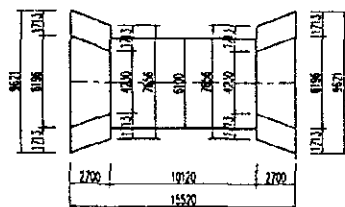
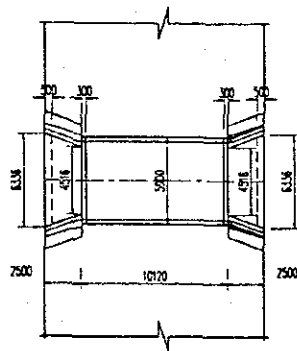


+ CALCULATING VALUES				
S1	=	0.200 x 1.750	=	0.350
S2	=	S1 : cos7°	=	0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) x (2.500 - 0.200) : 2 x cos20°	=	2.876
S4	=	S3 : cos7°	=	2.876 : 0.993 = 2.898
S5	=	(0.476 - 0.266) x 1.750 : 2	=	0.184
S6	=	(0.343 - 0.266) x 0.600 : 2	=	0.023
S7	=	S5 + (1.750 x 0.266)	=	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 (m³)				
- 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 x 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 (m²)				
- Footing	=	(2.500 : cos20° + 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 (m²)				
- Footing	=	(2.500 : cos20° + 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

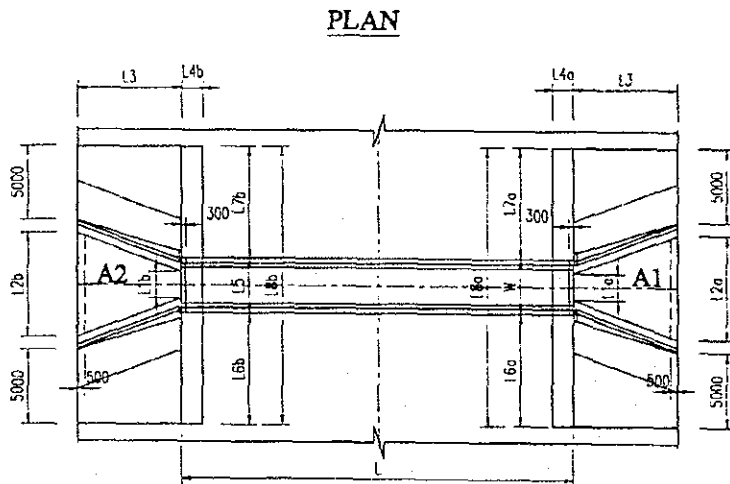
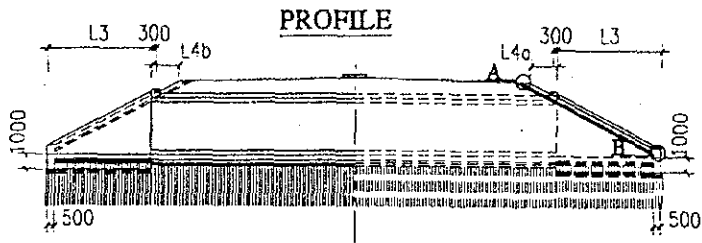
**BOX CULVERT AT INTERCHANGE 3 RAMP "B" 0+286.5
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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	248.5 KG
REINFORCEMENT:				14< D<=25	66.9	66.9 KG
TOTAL REINFORCEMENT:						315.4 KG

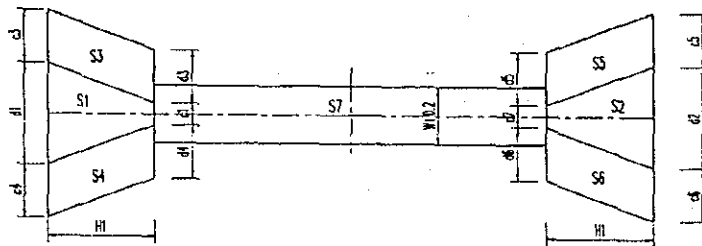
BOX CULVERT FOR DRAINAGE
 (INTERCHANGE 3 - RAMP "B" - STATION 0+286.5)



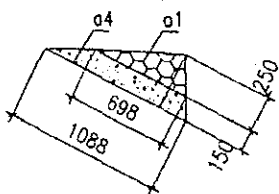
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

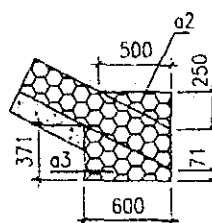


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM0+286.5 - RAMP "B" INTERCHANGE 3

S1=	(	c1	)	x	H1	:	2	=	
=	(	4.230	)	x	2.700	:	2	=	14.075 (m2)
S2=	(	c2	)	x	H1	:	2	=	
=	(	4.230	)	x	2.700	:	2	=	14.075 (m2)
S3=	(	c3	)	x	H1	:	2	=	
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S4=	(	c4	)	x	H1	:	2	=	
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S5=	(	c5	)	x	H1	:	2	=	
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S6=	(	c6	)	x	H1	:	2	=	
=	(	1.713	)	x	2.700	:	2	=	4.625 (m2)
S7=	L	x	(W+0.2)	=					
=	10.120	x	6.100	=	61.732				(m2)
1. APRON CONCRETE:									
A1=	(	L1a	)	x	L3	:	2	=	
=	(	4.516	)	x	2.500	:	2	=	13.565 (m2)
A2=	(	L1b	)	x	L3	:	2	=	
=	(	4.516	)	x	2.500	:	2	=	13.565 (m2)
	(	A1	)	x	0.3	+	(	L2a	+
=	(	13.565	)	x	0.3	+	(	6.336	+
									L2b
									) x 0.45 x 0.5
									) x 0.45 x 0.5
									=
									=
									10.99 (m3)
2. CONCRETE FOUNDATION OF CULVERT:									
L	x	(W+0.2)	x	0.2	=	10.120	x	6.100	x
									0.2
									=
									12.35 (m3)

3. LEAN CONCRETE:

$$\begin{aligned}
 &= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 = \\
 &= (14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = \underline{4.67} \text{ (m3)} \\
 \\
 &= (S3 + S4 + S5 + S6) \times 25 \times 5:100 = \\
 &= (4.625 + 4.625 + 4.625 + 4.625) \times 25 \times 5:100 = \underline{100.29} \text{ (100m)}
 \end{aligned}$$

4. WOOD PILE:

$$\begin{aligned}
 &^*L=5M \\
 W5 &= (S3 + S4 + S5 + S6) \times 25 \times 5:100 = \\
 &= (4.625 + 4.625 + 4.625 + 4.625) \times 25 \times 5:100 = \\
 \\
 &^*L=3M \\
 W3 &= (S1 + S2 + 0 + 0.000) \times 25 \times 3:100 = \\
 &= (14.075 + 14.0751 + 0 + 0.000) \times 25 \times 3:100 = \underline{21.11} \text{ (100m)}
 \end{aligned}$$

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

5. SAND BEDDING:

$$\begin{aligned}
 &= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 = \\
 &= (14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 61.732) \times 0.15 = \underline{16.26} \text{ (m3)}
 \end{aligned}$$

6. FORM

$$\begin{aligned}
 &= (L2a + L2b) \times 0.75 \times 2 = \\
 &= (6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}
 \end{aligned}$$

7. SCAFFOLDING

$$\begin{aligned}
 &= (L2a + L2b) \times 0.75 \times 2 = \\
 &= (6.336 + 6.336) \times 0.75 \times 2 = 19.008 \text{ (m2)}
 \end{aligned}$$

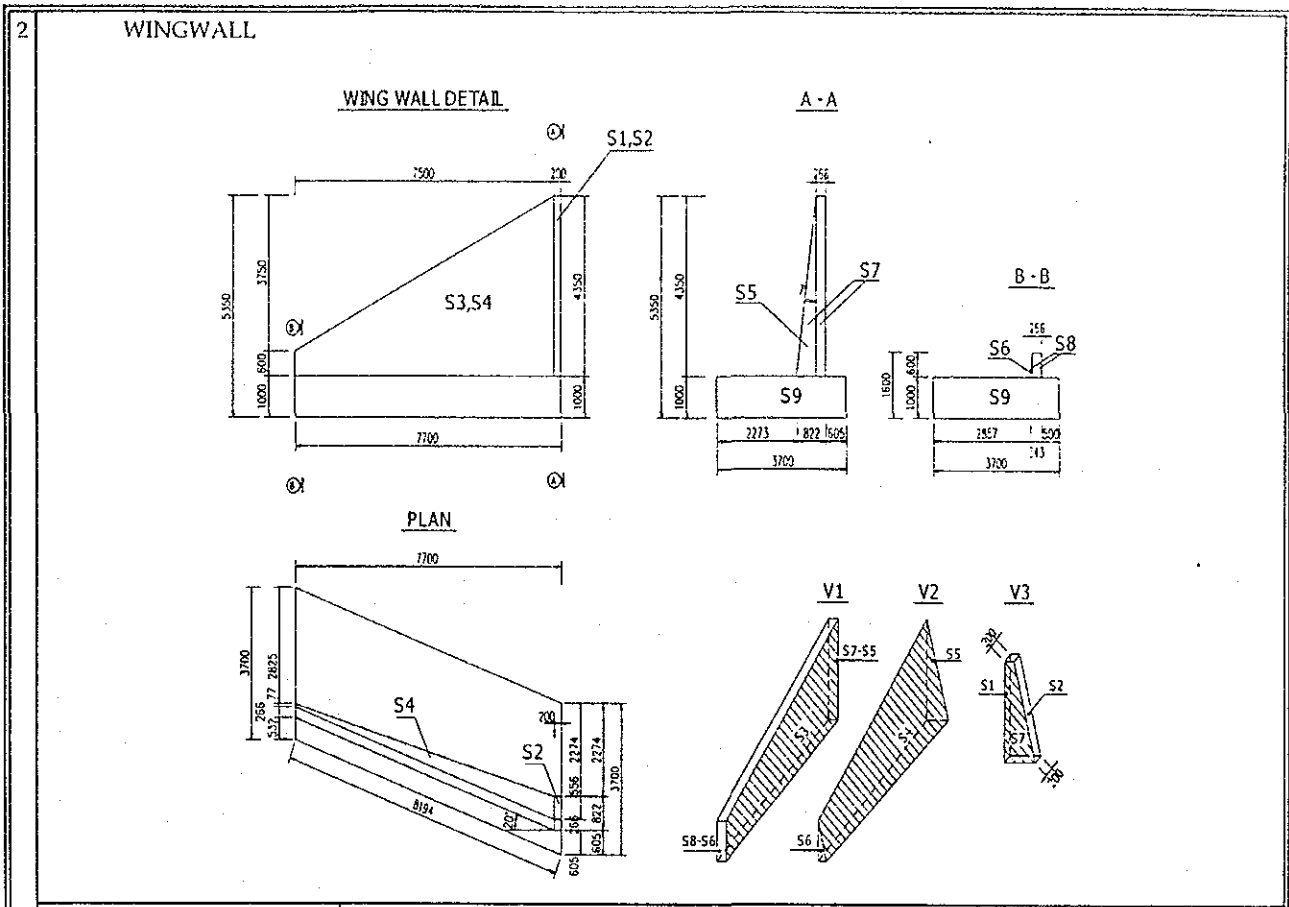
2.22. Box culvert at interchange 3 – ramp
“C” – station 0+300

BOX CULVERT AT INTERCHANGE 3 RAMP "C" - 0+300

I BOX CULVERT AT INTERCHANGE 3 RAMP "C" 0+300		QUANTITIES
L	= 13.460	
1 CULVERT		
+ CONCRETE (M3)		
S	= 5.800 x 4.750 - 5.000 x 4.000 + 2 x 0.300 x 0.300 =	7.730
VOLUME	= S x 13.460 + 5.800 x 0.200 x 0.300 x 2 =	<u>104.74</u>
<p>SINGLE BOX CULVERT</p>		
+ FORM (M2)		<u>321.80</u>
* INSIDE FORM (M2)		173.594
BOX BULWARK	= (4.000 + 2 x 0.300 x (1: SIN45° - 1)) x 13.460 x 2 =	114.370
BOTTOM OF THE BOX	= (5.000 - 0.300 x 2) x 13.460 x 1 =	59.224
* OUTSIDE FORM (M2)		148.210
BOX BULWARK	= 4.750 x 2 x 13.460 + 4 x 0.300 x 0.200 =	128.110
THE END OF CULVERT	= S x 2 + 5.800 x 0.200 x 4 =	20.100
+ SCAFFOLDING (M2)	= 4.750 x 2.000 x 13.460 + 4.000 x 0.300 x 0.200 =	<u>128.11</u>
+ SUPPORT		
AREA (M2)	= 5.800 x 4.750 - S	= 19.820
VOLUME (M3)	= AREA x L	= <u>266.78</u>

BOXCULVERT AT INTERCHANGE 3 - Ramp "C" 0+300
QUANTITIES TABLE OF REINFORCEMENT

SYMBOL OF BAR	UNIT LENGTH (mm)	SPACE (mm)	DIAMETER (mm)	NUMBER OF BAR	UNIT WEIGHT (kg/m)	TOTAL LENGTH (m)	TOTAL WEIGHT (kg)
1	7770	250	20	108	2.466	839.2	2069.5
2	4610	250	20	106	2.466	488.7	1205.1
3	6604	250	22	53	2.984	350.0	1044.4
4	6360	250	20	108	2.466	686.9	1693.9
5	3220	250	12	108	0.888	347.8	308.7
6	6645	250	22	53	2.984	352.2	1050.9
7	5170	250	16	108	1.578	558.4	881.3
8	1567	250	12	108	0.888	169.2	150.2
9	1638	250	12	108	0.888	176.9	157.0
10	1560	250	12	48	0.888	74.9	66.5
11	5660	180	12	4	0.888	22.6	20.1
12	14105	250	12	48	0.888	677.0	601.1
13	14205	250	12	112	0.888	1591.0	1412.5
14	1410	250	14	162	1.208	228.4	276.0
15	1440	250	12	162	0.888	233.3	207.1
REINFORCEMENT : D<=14				3199.3	TOTAL :		
REINFORCEMENT : 16=D<=25				7945.2	REINFORCEMENT (KG):		11144.5
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		104.74

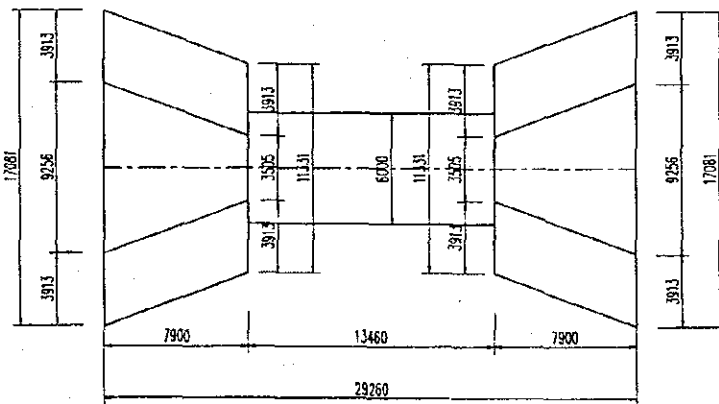
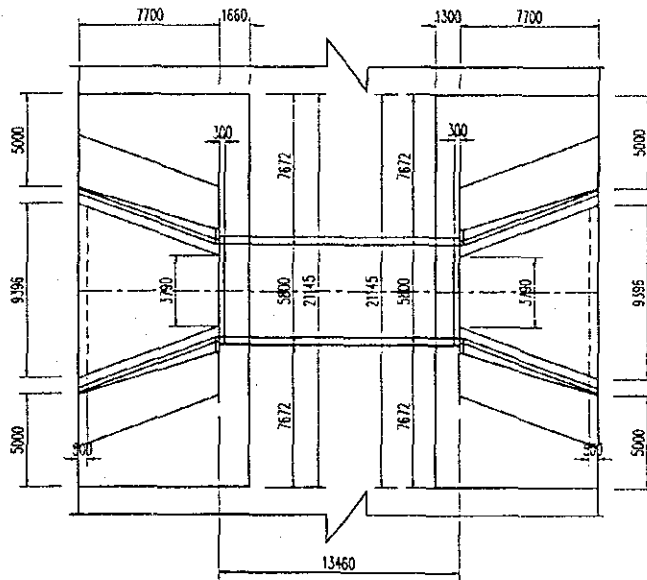


+ CALCULATING VALUES			
S1	=	0.200 x 4.350	= 0.870
S2	=	S1 : cos 7°	= 0.870 : 0.993 = 0.877
S3	=	(4.350 + 0.600) x (7.700 - 0.200) : 2 x cos 20°	= 19.754
S4	=	S3 : cos 7°	= 19.754 : 0.993 = 19.902
S5	=	(0.822 - 0.266) x 4.350 : 2	= 1.209
S6	=	(0.343 - 0.266) x 0.600 : 2	= 0.023
S7	=	S5 + (4.350 x 0.266)	= 1.209 + 1.157 = 2.366
S8	=	S6 + (0.600 x 0.266)	= 0.023 + 0.160 = 0.183
S9	=	3.700 x 1.000	= 3.700
+ CONCRETE (m³)			
- Footing	=	S9 x 7.700	= 3.700 x 7.700 = 28.490
- Wing wall	=	V1 + V2 + V3	= 5.255 + 3.500 + 0.473 = 9.228
V1	=	S3 x 0.266	= 19.754 x 0.266 = 5.255
V2	=	(7.700 - 0.200) : 3 x (S5 + S6 + (S5 x S6) ^{0.5})	= 2.500 x (1.209 + 0.023 + 0.167) = 3.500
V3	=	S7 x 0.200	= 2.366 x 0.200 = 0.473
+ FORM (m²)			
- Footing	=	(7.700 : cos 20° + 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 + 2.366 + 0.183 = 43.952
+ SCAFFOLDING (m²)			
- Footing	=	(7.700 : cos 20° + 1.000 + 3.700 + 1.000) x 2 x 1.000	= 27.788
- Wing wall	=	S3 + S4 + 0.600 x (0.343 + 1.000)	= 19.754 + 19.902 + 0.806 = 40.462

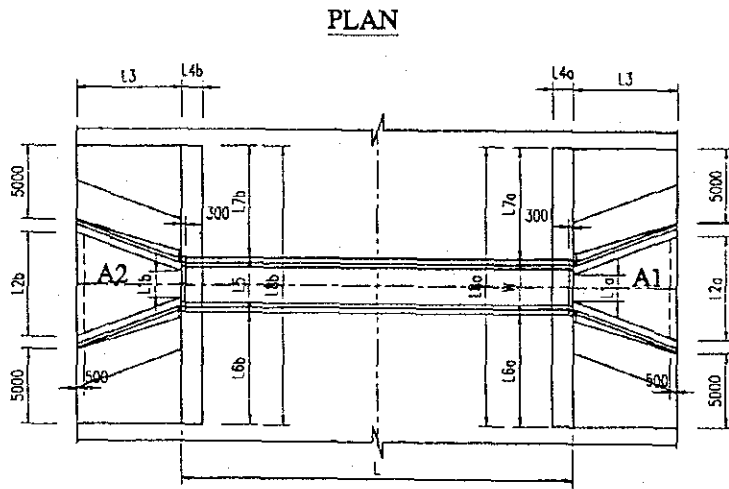
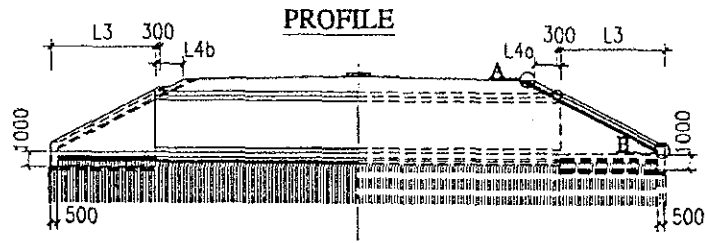
**BOX CULVERT AT INTERCHANGE 3 RAMP "C" 0+300
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)	(MM)				
1a	3561	12	48	0.888	170.9	151.8
1b	3694	18	48	1.998	177.3	354.1
2a	8212	12	6	0.888	49.3	43.7
2b	4816	12	38	0.888	183.0	162.5
2c	592	12	48	0.888	28.4	25.2
3	9217	12	2	0.888	18.4	16.4
4	9149	12	34	0.888	311.1	276.2
5a	5141	12	35	0.888	179.9	159.7
5b	3631	12	20	0.888	72.6	64.5
5c	4135	22	35	2.984	144.7	431.9
5d	2625	22	20	2.984	52.5	156.6
6	2944	14	80	1.208	235.5	284.6
7	4001	12	4	0.888	16.0	14.2
8	4001	12	6	0.888	24.0	21.3
9	8075	12	6	0.888	48.5	43.0
10	1304	14	14	1.208	18.3	22.1
11	898	12	22	0.888	19.7	17.5
12	3385	12	3	0.888	10.2	9.0
REINFORCEMENT			D<=14		1311.7	KG
REINFORCEMENT			14< D<=25		942.6	KG
TOTAL REINFORCEMENT :					2254.3	KG

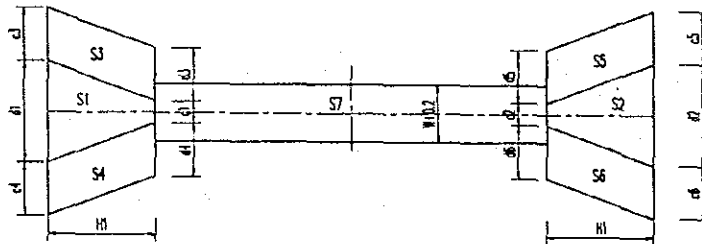
BOX CULVERT FOR DRAINAGE (INTERCHANGE 3 - RAMP "C" - STATION 0+300)



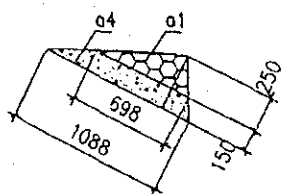
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

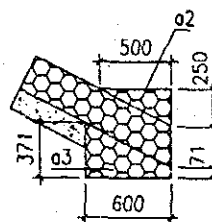


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM0+300 RAMP"C" INTERCHANGE 3

S1=	(	c1	)	x	H1	:	2	=	
=	(	3.505	)	x	7.900	:	2	=	50.406 (m2)
S2=	(	c2	)	x	H1	:	2	=	
=	(	3.505	)	x	7.900	:	2	=	50.406 (m2)
S3=	(	c3	)	x	H1	:	2	=	
=	(	3.913	)	x	7.900	:	2	=	30.913 (m2)
S4=	(	c4	)	x	H1	:	2	=	
=	(	3.913	)	x	7.900	:	2	=	30.913 (m2)
S5=	(	c5	)	x	H1	:	2	=	
=	(	3.913	)	x	7.900	:	2	=	30.913 (m2)
S6=	(	c6	)	x	H1	:	2	=	
=	(	3.913	)	x	7.900	:	2	=	30.913 (m2)
S7=	L	(W+0.2)	=						
=	13.460	x	6.000	=	80.760				(m2)
<u>1. APRON CONCRETE:</u>									
A1=	(	L1a	)	x	L3	:	2	=	
=	(	3.790	)	x	7.700	:	2	=	50.766 (m2)
A2=	(	L1b	)	x	L3	:	2	=	
=	(	3.790	)	x	7.700	:	2	=	50.766 (m2)
	(	A1	)	x	0.3	+	(	L2a	+
=	(	50.766	)	x	0.3	+	(	9.396	+
								L2b	) x 0.7 x 0.5
								9.396	) x 0.7 x 0.5
									= 37.04 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

$$L \times (W + 0.2) \times 0.2 = 13.460 \times 6.000 \times 0.2 = 16.15 \text{ (m3)}$$

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (50.406 + 50.40595 + 30.913 + 30.913 + 30.913 + 30.913) \times 0.1 = \underline{22.45} \text{ (m}^3\text{)}$$

4. WOOD PILE:

* L=5M

$$W5 = (S3 + S4 + S5 + S6 + S7) \times 25 \times 5 : 100 =$$

$$= (30.913 + 30.913 + 30.913 + 30.913 + 80.760) \times 25 \times 5 : 100 = \underline{255.51} \text{ (100md)}$$

* L=3M

$$W3 = (S1 + S2 + (0.8 \times 4.5 \times 4) + 14.400) \times 25 \times 3 : 100 =$$

$$= (50.406 + 50.40595 + 14.400) \times 25 \times 3 : 100 = \underline{86.41} \text{ (100md)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7 + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$= (50.406 + 50.406 + 30.913 + 30.913 + 30.913 + 30.913 + 80.760 + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$\underline{47.94} \text{ (m}^3\text{)}$$

6. STONE MASONRY

$$a1 = 0.695 \times 0.25 \times 0.5 = 0.087 \text{ (m}^2\text{)}$$

$$a2 = 0.5 \times 0.25 \times 0.5 = 0.063 \text{ (m}^2\text{)}$$

$$a3 = (0.071 + 0.371) \times 0.5 \times 0.6 = 0.133 \text{ (m}^2\text{)}$$

$$a4 = (0.698 + 1.088) \times 0.5 \times 0.15 = 0.134 \text{ (m}^2\text{)}$$

$$b1 = 0.300 \times L5 = 0.300 \times 5.800 = 1.740 \text{ (m}^2\text{)}$$

(b1 IS AREA OF HEAD WALL)

$$b2a = (L6a + 5.000) \times L3 \times 0.5 =$$

$$= (7.672 + 5.000) \times 7.700 \times 0.5 = 48.7872 \text{ (m}^2\text{)}$$

$$\begin{aligned}
& b2b = (L6b + 5.000) \times L3 \times 0.5 = \\
& = (7.672 + 5.000) \times 7.700 \times 0.5 = 48.7872 \text{ (m}^2\text{)} \\
& b3a = (L7a + 5.000) \times L3 \times 0.5 = \\
& = (7.672 + 5.000) \times 7.700 \times 0.5 = 48.7872 \text{ (m}^2\text{)} \\
& b3b = (L7b + 5.000) \times L3 \times 0.5 = \\
& = (7.672 + 5.000) \times 7.700 \times 0.5 = 48.7872 \text{ (m}^2\text{)} \\
& b4a = L8a \times L4a = 21.145 \times 1.300 = 27.489 \text{ (m}^2\text{)} \\
& b4b = L8b \times L4b = 21.145 \times 1.660 = 35.101 \text{ (m}^2\text{)} \\
& b5 = 0.6 \times 5 \times 2 = 6.000 \text{ (m}^2\text{)} \\
& V1a = a1 \times L8a = 0.087 \times 21.145 = 1.837 \text{ (m}^3\text{)} \\
& V1b = a1 \times L8b = 0.087 \times 21.145 = 1.837 \text{ (m}^3\text{)} \\
& V2 = (a2 + a3) \times 5 \times 4 = (0.063 + 0.133) \times 5 \times 4 = 3.902 \text{ (m}^3\text{)} \\
& V3a = (b4a - b1 + b2a + b3a) \times 0.25 = \text{COS}(26.56) = \\
& = (27.489 - 1.740 + 48.7872 + 48.7872) \times 0.25 = 34.486 \text{ (m}^3\text{)} \\
& V3b = (b4b - b1 + b2b + b3b) \times 0.25 = \text{COS}(26.56) = \\
& = (35.101 - 1.740 + 48.7872 + 48.7872) \times 0.25 = 36.615 \text{ (m}^3\text{)} \\
& \text{TOTAL} = (V1a + V1b + V2 + V3a + V3b) = \\
& = (1.837 + 1.837 + 3.902 + 34.486 + 36.615) = \underline{78.677} \text{ (m}^3\text{)}
\end{aligned}$$

7. BASE BEDDING:

V4a=	a4	x	L8a	=	0.134	x	21.145	=	2.832	(m3)
V4b=	a4	x	L8b	=	0.134	x	21.145	=	2.832	(m3)
V5a=	(b4a	+ b2a	+ b3a	-	b5	)	=	x 0.15	: COS(26.56)	=
=	(27.489	+ 48.7872	+ 48.7872	-	6.000	)	=	x 0.15	: 0.894	= 19.685
										(m3)
V5b=	(b4b	+ b2b	+ b3b	-	b5	)	=	x 0.15	: COS(26.56)	=
=	(35.101	+ 48.7872	+ 48.7872	-	6.000	)	=	x 0.15	: 0.894	= 20.962
										(m3)
TOTAL =	(	V4a	+ V4b	+ V5a	+ V5b) =				
	(	2.832	+ 2.832	+ 19.685	+ 20.962	) =	<u>46.31</u>		(m3)	

8. FORM:

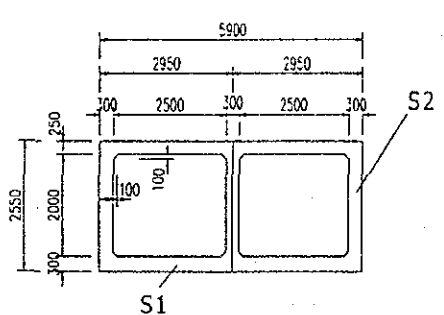
=	(L2a + L2b)	)	X 1	x	2	=
	(9.396 + 9.396	)	X 1	x	2	= 37.584 (m2)

9. SCAFFOLDING:

=	(L2a + L2b)	)	X 1	x	2	=
	(9.396 + 9.396	)	X 1	x	2	= 37.584 (m2)

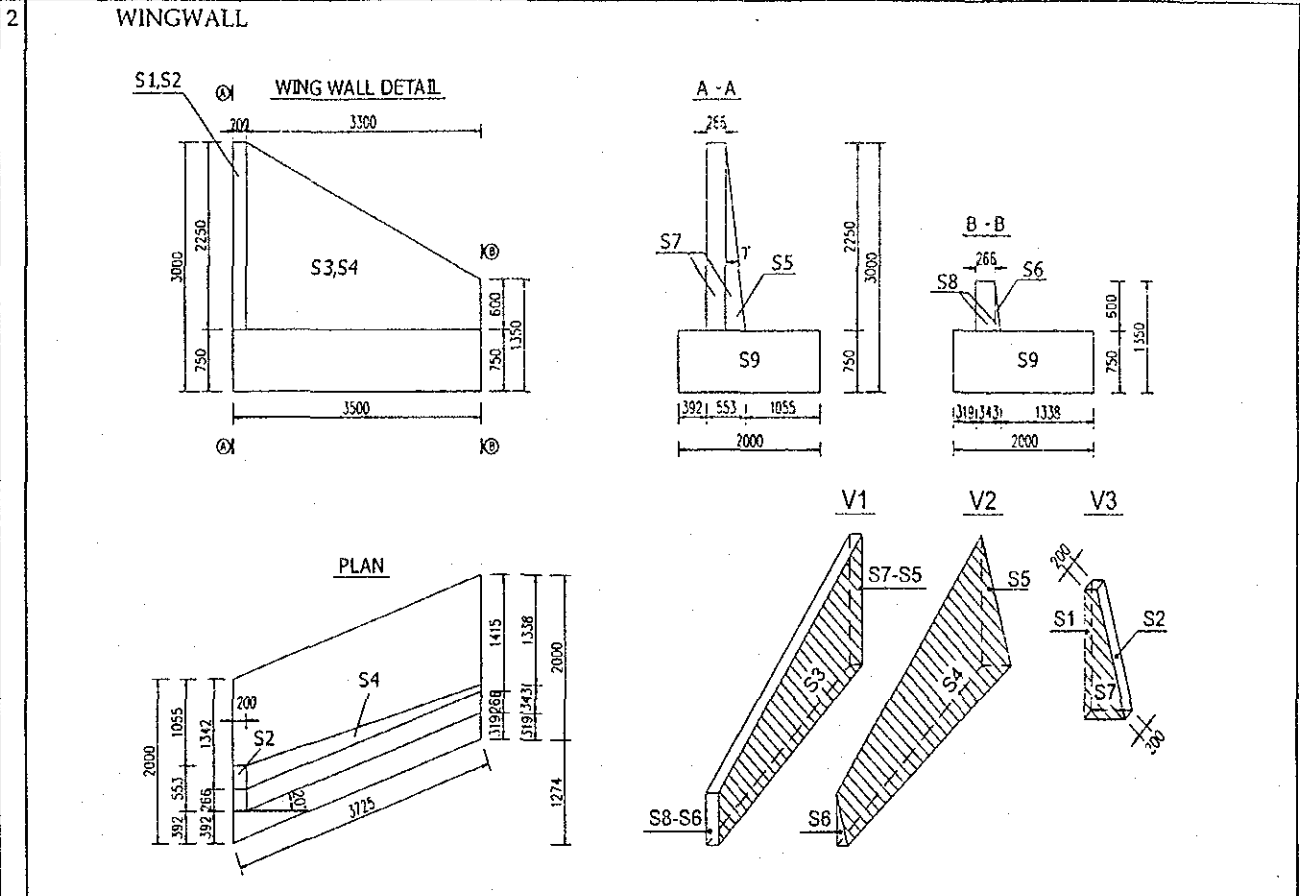
2.23. Box culvert at interchange 3 - ramp
"D" - station 0+100

BOX CULVERT AT INTERCHANGE 3 RAMP "D" - 0+100

I BOX CULVERT AT INTERCHANGE 3 RAMP "D" 0+100		QUANTITIES
	L = 10.120 = 10.120	
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 (13.340 + 13.340) + 5.900 x 0.200 x 0.300 x 2 =	<u>52.17</u>
	<p>DOUBLE BOX CULVERT</p> 	
+ FORM (M2)		<u>198.62</u>
* INSIDE FORM (M2)		131.877
BOX BULWARK	= (2.000 + 2 x 0.100 x (1: SIN45° - 1)) x 10.120 x 4 =	84.313
BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 10.120 x 2 =	47.564
* OUTSIDE FORM (M2)		66.742
BOX BULWARK	= 2.550 x 2 x 10.120 + 4 x 0.300 x 0.200 =	51.852
THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4 =	14.890
+ SCAFFOLDING (M2)	= 2.550 x 2.000 x 10.120 + 4.000 x 0.300 x 0.200 =	<u>51.85</u>
+ SUPPORT		
AREA (M2)	= 5.900 x 2.000 - S =	6.715
VOLUME (M3)	= AREA x L =	<u>67.96</u>

BOXCULVERT AT INTERCHANGE 3 - Ramp "D" 0+100
QUANTITIES TABLE OF REINFORCEMENT

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	162	1.208	673.9	814.4
2	2850	250	12	82	0.888	233.7	207.5
3	6270	250	14	82	1.208	514.1	621.3
4	1500	250	14	160	1.208	240.0	290.0
5	1550	125	18	162	1.998	251.1	501.6
6	1970	250	12	164	0.888	323.1	286.8
7	2850	125	12	162	0.888	461.7	409.9
8	1049	250	12	164	0.888	172.0	152.7
9	1120	250	12	164	0.888	183.7	163.1
10	10260	250	12	52	0.888	533.5	473.7
11	10360	250	12	100	0.888	1036.0	919.8
12	5780	250	12	4	0.888	23.1	20.5
13	1440	250	12	52	0.888	74.9	66.5
14	1180	250	12	242.88	0.888	286.6	254.4
REINFORCEMENT : D<=14				4680.6	TOTAL :		
REINFORCEMENT : 16=D<=25				501.6	REINFORCEMENT (KG):		5182.2
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		52.17

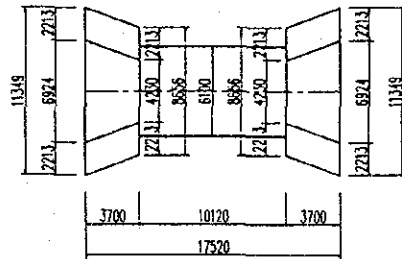
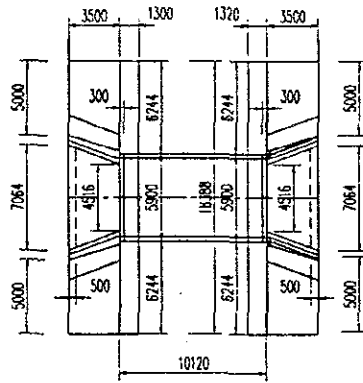


+ CALCULATING VALUES			
S1	=	0.200×2.250	= 0.450
S2	=	$S1 : \cos 7^{\circ}$	= 0.450 : 0.993 = 0.453
S3	=	$(2.250 + 0.600) \times (3.500 - 0.200) : 2 \times \cos 20^{\circ}$	= 5.004
S4	=	$S3 : \cos 7^{\circ}$	= 5.004 : 0.993 = 5.042
S5	=	$(0.553 - 0.266) \times 2.250 : 2$	= 0.323
S6	=	$(0.343 - 0.266)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

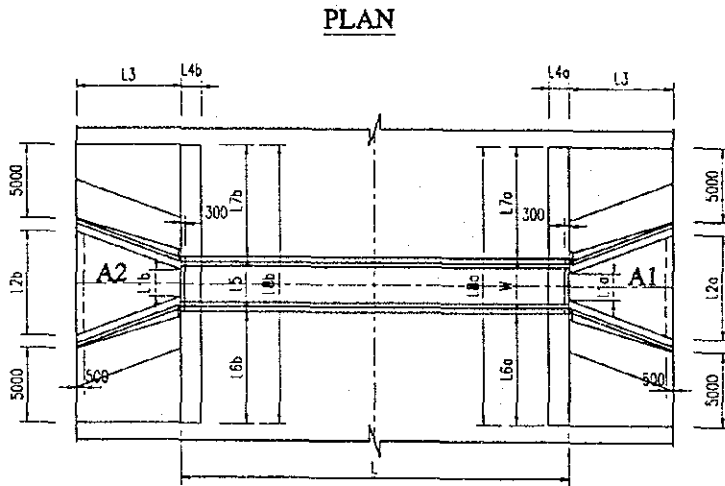
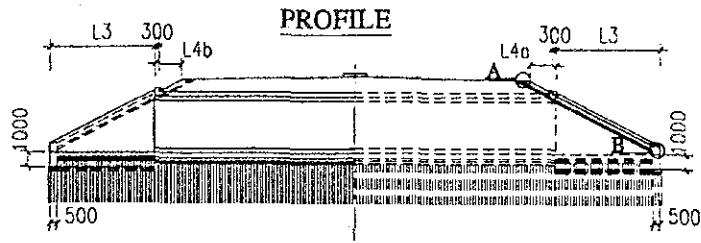
**BOX CULVERT AT INTERCHANGE 3 RAMP"D" 0+100
REINFORCEMENT OF WINGWALL**

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

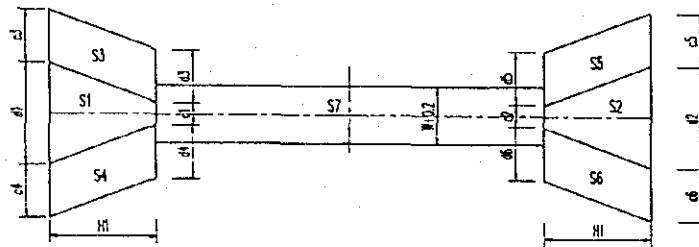
BOX CULVERT FOR DRAINAGE (INTERCHANGE 3 - RAMP "D" - STATION 0+100)



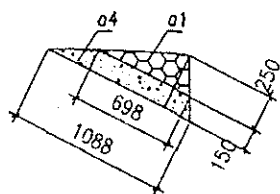
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

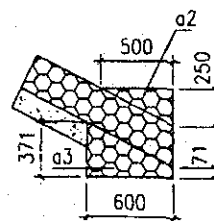


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM0+100 RAMP"D" INTERCHANGE 3

S1=	(	c1	+	d1	)	x	HI	:	2	=	
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635 (m2)
S2=	(	c2	+	d2	)	x	HI	:	2	=	
=	(	4.230	+	6.924	)	x	3.700	:	2	=	20.635 (m2)
S3=	(	c3	+	d3	)	x	HI	:	2	=	
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188 (m2)
S4=	(	c4	+	d4	)	x	HI	:	2	=	
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188 (m2)
S5=	(	c5	+	d5	)	x	HI	:	2	=	
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188 (m2)
S6=	(	c6	+	d6	)	x	HI	:	2	=	
=	(	2.213	+	2.213	)	x	3.700	:	2	=	8.188 (m2)
S7=	L	x	(W+0.2)	=							
=	10.120	x	6.100	=	61.732	(m2)					
<u>1. APRON CONCRETE:</u>											
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	+
=	(	20.265	+	20.265	)	x	0.3	+	(	7.064	+
										L2b	) x 0.45 x 0.5
										7.064	) x 0.45 x 0.5
											= 15.34 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

$$L \times (W + 0.2) \times 0.2 = 10.120 \times 6.100 \times 0.2 = 12.35 \text{ (m3)}$$

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (20.635 + 20.6349 + 8.188 + 8.188 + 8.188 + 8.188) \times 0.1 = \underline{7.40} \quad (m^3)$$

4. WOOD PILE:

* L=5M

$$W5 = (S3 + S4 + S5 + S6 + S7) \times 25 \times 5 : 100 =$$

$$= (8.188 + 8.188 + 8.188 + 8.188 + 61.732) \times 25 \times 5 : 100 = \underline{118.11} \quad (100m)$$

* L=3M

$$W3 = (S1 + S2 + (0.8 \times 4.5 \times 4) + 14.400) \times 25 \times 3 : 100 =$$

$$= (20.635 + 20.6349 + 14.400) \times 25 \times 3 : 100 = \underline{41.75} \quad (100m)$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$= (20.635 + 20.635 + 8.188 + 8.188 + 8.188 + 8.188 + 61.732) + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$\underline{22.52} \quad (m^3)$$

6. STONE MASONRY

$$a1 = 0.695 \times 0.25 \times 0.5 = 0.087 \quad (m^2)$$

$$a2 = 0.5 \times 0.25 \times 0.5 = 0.063 \quad (m^2)$$

$$a3 = (0.071 + 0.371) \times 0.5 \times 0.6 = 0.133 \quad (m^2)$$

$$a4 = (0.698 + 1.088) \times 0.5 \times 0.15 = 0.134 \quad (m^2)$$

$$b1 = 0.300 \times L5 = 0.300 \times 5.900 = 1.770 \quad (m^2) \quad (b1 IS AREA OF HEAD WALL)$$

$$b2a = (L6a + 5.000) \times L3 \times 0.5 =$$

$$= (6.244 + 5.000) \times 3.500 \times 0.5 = 19.677 \quad (m^2)$$

$$\begin{aligned}
& b2b = (L6b + 5.000) \times L3 \times 0.5 = \\
& = (6.244 + 5.000) \times 3.500 \times 0.5 = 19.677 \text{ (m2)} \\
& b3a = (L7a + 5.000) \times L3 \times 0.5 = \\
& = (6.244 + 5.000) \times 3.500 \times 0.5 = 19.677 \text{ (m2)} \\
& b3b = (L7b + 5.000) \times L3 \times 0.5 = \\
& = (6.244 + 5.000) \times 3.500 \times 0.5 = 19.677 \text{ (m2)} \\
& b4a = L8a \times L4a = 18.388 \times 1.320 = 24.272 \text{ (m2)} \\
& b4b = L8b \times L4b = 18.388 \times 1.300 = 23.904 \text{ (m2)} \\
& b5 = 0.6 \times 5 \times 2 = 6.000 \text{ (m2)} \\
& V1a = a1 \times L8a = 0.087 \times 18.388 = 1.597 \text{ (m3)} \\
& V1b = a1 \times L8b = 0.087 \times 18.388 = 1.597 \text{ (m3)} \\
& V2 = (a2 + a3) \times 5 \times 4 = (0.063 + 0.133) \times 5 \times 4 = 3.902 \text{ (m3)} \\
& V3a = (b4a - b1 + b2a + b3a) \times 0.25 = \text{COS}(26.56) = \\
& = (24.272 - 1.770 + 19.677 + 19.677) \times 0.25 = 17.298 \text{ (m3)} \\
& V3b = (b4b - b1 + b2b + b3b) \times 0.25 = \text{COS}(26.56) = \\
& = (23.904 - 1.770 + 19.677 + 19.677) \times 0.25 = 17.195 \text{ (m3)} \\
& \text{TOTAL} = (V1a + V1b + V2 + V3a + V3b) = \\
& = (1.597 + 1.597 + 3.902 + 17.298 + 17.195) = \underline{41.589} \text{ (m3)}
\end{aligned}$$

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)
=	(24.272	-	1.770	+	19.677	+	19.677	-	6.000)
									x 0.15	: COS(26.56)
									x 0.15	: 0.894
									=	=
V5b=	(b4b	-	b1	+	b2b	+	b3b	-	b5)
=	(23.904	-	1.770	+	19.677	+	19.677	-	6.000)
									x 0.15	: COS(26.56)
									x 0.15	: 0.894
									=	=
TOTAL =	(	V4a	+	V4b	+	V5a	+	V5b) =	
	(	2.463	+	2.463	+	9.372	+	9.310	) =	23.61 (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)

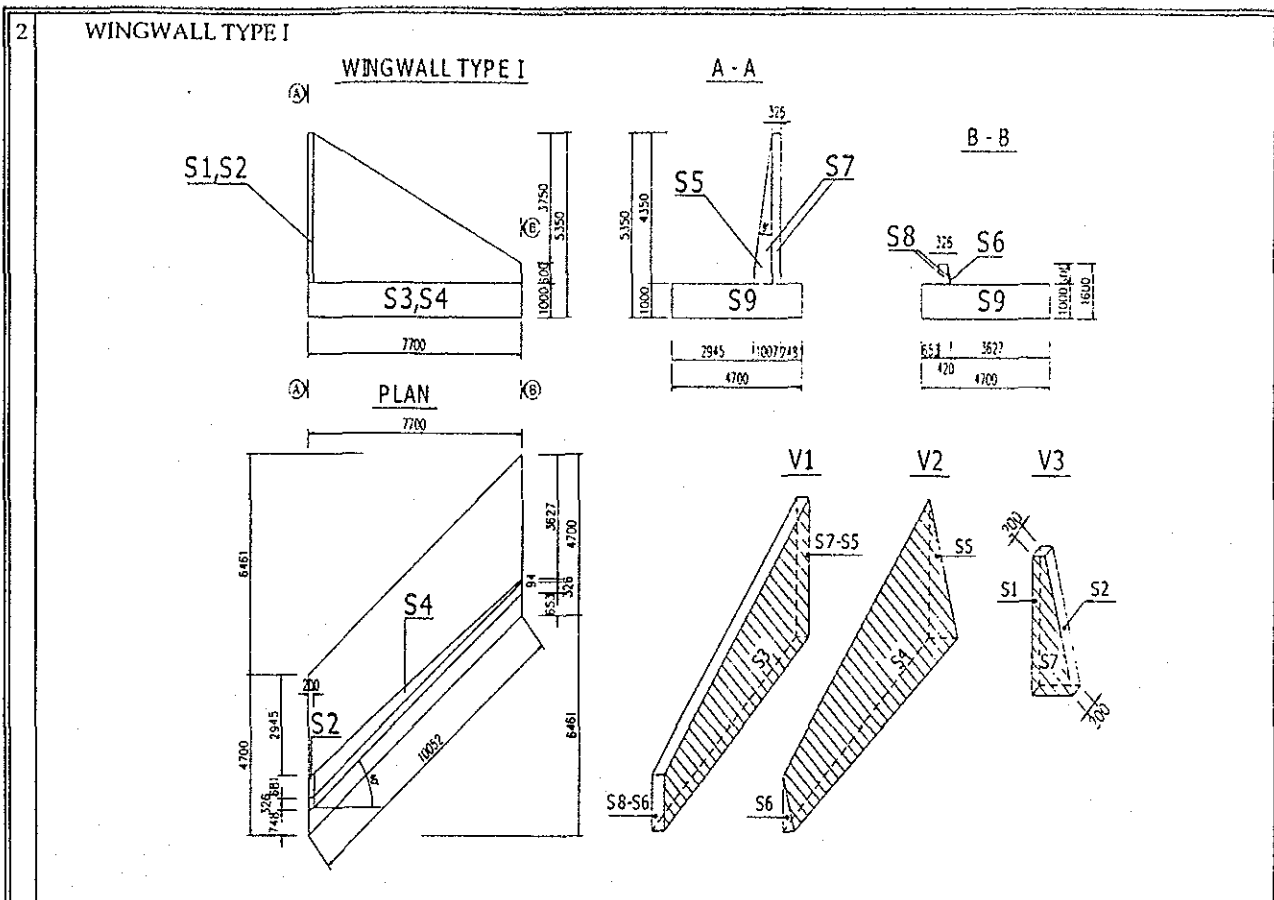
2.24. Box culvert at interchange 3 - ramp
"F" - station 0+180

BOX CULVERT AT INTERCHANGE 3 0+180 RAMP F

I BOX CULVERT AT INTERCHANGE 3 RAMP "F" 0+180		QUANTITIES
L	= 13.941	
1 CULVERT		
+ CONCRETE (M3)		
S	= 5.800 x 4.750 - 5.000 x 4.000 + 2 x 0.300 x 0.300	= 7.730
VOLUME	= S x 13.941 + 5.800 x 0.200 x 0.300 x 2	= <u>108.46</u>
<p>SINGLE BOX CULVERT</p>		
+ FORM (M2)		<u>338.98</u>
* INSIDE FORM (M2)		179.798
BOX BULWARK	= (4.000 + 2 x 0.300 x (1: SIN45° - 1)) x 13.941 x 2	= 118.457
BOTTOM OF THE BOX	= (5.000 - 0.300 x 2) x 13.941 x 1	= 61.340
* OUTSIDE FORM (M2)		159.183
BOX BULWARK	= 4.750 x 2 x 13.941 + 4 x 0.300 x 0.200	= 132.680
THE END OF CULVERT	= S x 2 : SIN45° + 5.800 x 0.200 x 4	= 26.504
+ SCAFFOLDING (M2)	= 4.750 x 2.000 x 13.941 + 4.000 x 0.300 x 0.200	= <u>132.68</u>
+ SUPPORT		
AREA (M2)	= 5.800 x 4.750 - S	= 19.820
VOLUME (M3)	= AREA x L	= <u>276.31</u>

BOXCULVERT AT INTERCHANGE 3 - RAMP "F" 0+180
QUANTITIES TABLE OF REINFORCEMENT

SYMBOL OF BAR	UNIT LENGTH	SPACE	DIAMETER	NUMBER	UNIT WEIGHT	TOTAL LENGTH	TOTAL WEIGHT
	(mm)	(mm)	(mm)	OF BAR	(kg/m)	(m)	(kg)
1a	7770	250	20	78	2.466	606.1	1494.6
1b	7973	250	20	18	2.466	143.5	353.9
2	4610	250	20	76	2.466	350.4	864.0
3a	6604	250	22	38	2.984	251.0	748.8
3b	6977	250	22	17	2.984	118.6	353.9
4a	6360	250	20	78	2.466	496.1	1223.4
4b	6723	250	20	18	2.466	121.0	298.4
5a	3220	250	12	78	0.888	251.2	223.0
5b	3427	250	12	36	0.888	123.4	109.5
6a	6645	250	22	38	2.984	252.5	753.5
6b	7023	250	22	17	2.984	119.4	356.3
7	5170	250	16	96	1.578	496.3	783.4
8a	1567	250	12	78	0.888	122.2	108.5
8b	1640	250	12	18	0.888	29.5	26.2
9a	1638	250	12	78	0.888	127.7	113.4
9b	1715	250	12	18	0.888	30.9	27.4
10	1560	250	12	48	0.888	74.9	66.5
11	6023	180	12	4	0.888	24.1	21.4
12	14221	250	12	96	0.888	1365.2	1212.1
13	14321	250	12	96	0.888	1374.8	1220.6
14	1410	250	14	224	1.208	315.8	381.7
15	1440	250	12	224	0.888	322.6	286.4
REINFORCEMENT : D<=14				3796.6	TOTAL :		
REINFORCEMENT : 16=D<=25				7230.4	REINFORCEMENT (KG):		11027.0
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		108.46



+ CALCULATING VALUES

S1	=	0.200 x 4.350	=	0.870
S2	=	S1 : cos9°	=	0.870 : 0.988 = 0.881
S3	=	(4.350 + 0.600) x (7.700 - 0.200) : 2 x cos40°	=	24.232
S4	=	S3 : cos9°	=	24.232 : 0.988 = 24.534
S5	=	(1.007 - 0.326) x 4.350 : 2	=	1.481
S6	=	(0.420 - 0.326) x 0.600 : 2	=	0.028
S7	=	S5 + (4.350 x 0.326)	=	1.481 + 1.418 = 2.899
S8	=	S6 + (0.600 x 0.326)	=	0.028 + 0.196 = 0.224
S9	=	4.700 x 1.000	=	4.700

+ CONCRETE (m³)

- Footing	=	S9 x 7.700	=	4.700 x 7.700 = 36.190
- Wing wall	=	V1 + V2 + V3	=	7.900 + 4.280 + 0.580 = 12.760
V1	=	S3 x 0.326	=	24.232 x 0.326 = 7.900
V2	=	(7.700 - 0.200) : 3 x (S5 + S6 + (S5 x S6) ^{0.5})	=	2.500 x (1.481 + 0.028 + 0.204) = 4.280
V3	=	S7 x 0.200	=	2.899 x 0.200 = 0.58

+ FORM (m²)

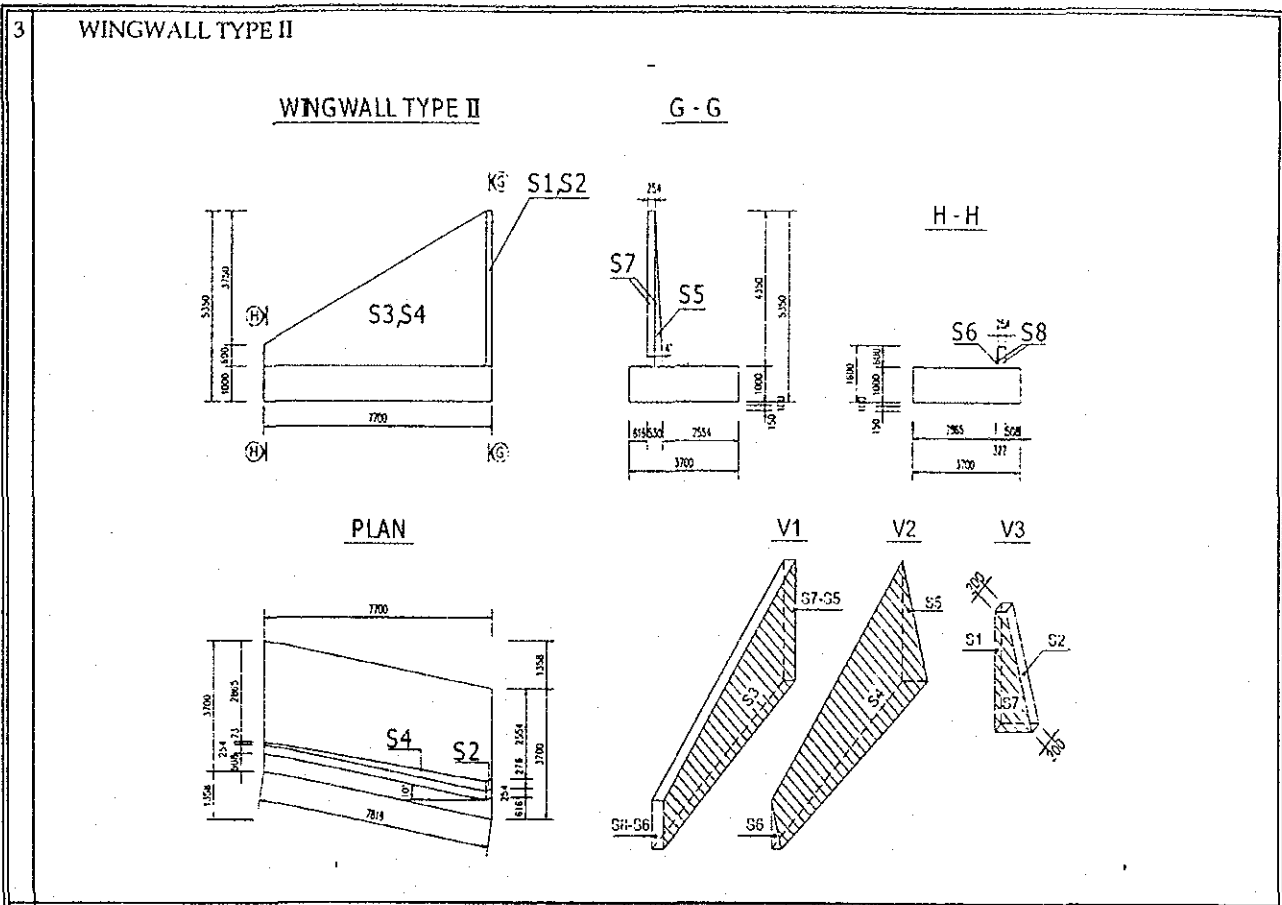
- Footing	=	(7.700 : cos40° + S9) x 2	=	(10.052 + 4.700) x 2 = 29.503
- Wing wall	=	S1 + S2 + S3 + S4 + S7 + S8	=	0.870 + 0.881 + 24.232 + 24.534 + 2.899 + 0.224 = 53.640

+ SCAFFOLDING (m²)

- Footing	=	(7.700 : cos40° + 1.000 + 4.700 + 1.000) x 2 x 1.000	=	33.503
- Wing wall	=	S3 + S4 + 0.600 x (0.420 + 1.000)	=	24.232 + 24.534 + 0.852 = 49.618

**BOX CULVERT AT INTERCHANGE 3 RAMP "F" 0+180
REINFORCEMENT OF WINGWALL TYPE I**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
1a	3555	12	50	0.888	177.8	157.8
1b	3698	18	50	1.998	184.9	369.3
2a	10112	12	6	0.888	60.7	53.9
2b	5705	12	36	0.888	205.4	182.3
2c	552	12	50	0.888	27.6	24.5
3	10086	12	2	0.888	20.2	17.9
4	10979	12	36	0.888	395.2	350.9
5a	5264	12	35	0.888	184.2	163.6
5b	3583	12	28	0.888	100.3	89.1
5c	4258	22	35	2.984	149.0	444.7
5d	2577	22	28	2.984	72.2	215.3
6	2944	14	96	1.208	282.6	341.5
7	4874	12	4	0.888	19.5	17.3
8	4874	12	6	0.888	29.2	26.0
9	9905	12	6	0.888	59.4	52.8
10	1304	14	14	1.208	18.3	22.1
11	1012	12	21	0.888	21.2	18.9
12	3317	12	3	0.888	9.9	8.8
REINFORCEMENT						1527.3 KG
REINFORCEMENT						1029.3 KG
TOTAL REINFORCEMENT :						2556.6 KG

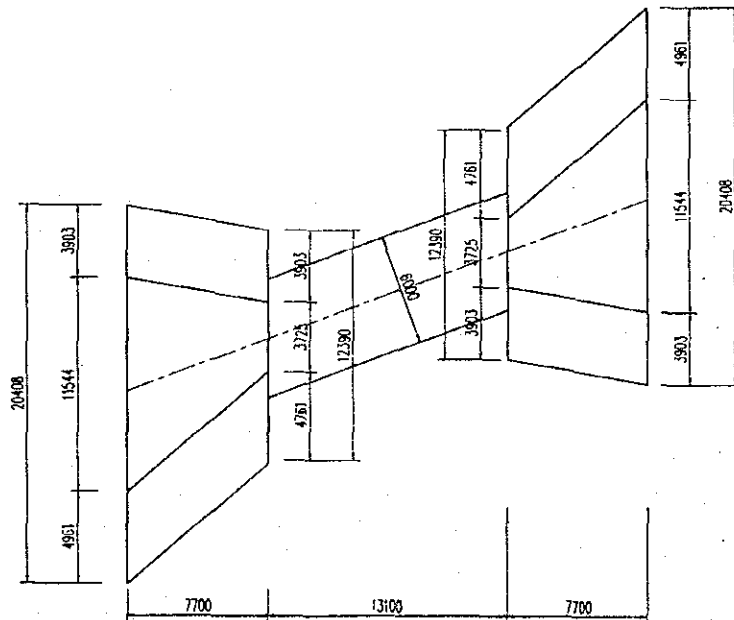
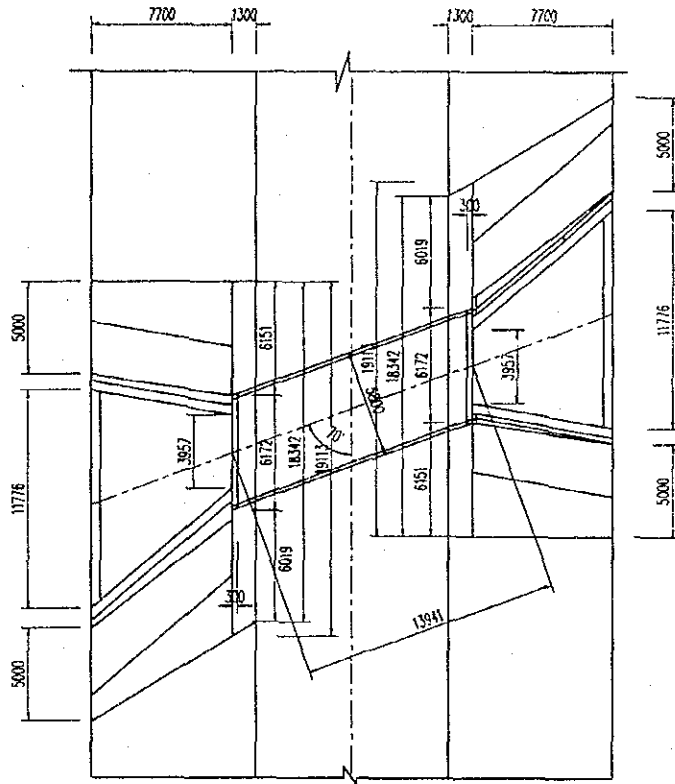


+ CALCULATING VALUES			
S1	=	0.200 x 4.350	= 0.870
S2	=	S1 : cos4°	= 0.870 : 0.998 = 0.872
S3	=	(4.350 + 0.600) x (7.700 - 0.200) : 2 x cos10°	= 18.849
S4	=	S3 : cos4°	= 18.849 : 0.998 = 18.895
S5	=	(0.530 - 0.254) x 4.350 : 2	= 0.6
S6	=	(0.327 - 0.254) x 0.600 : 2	= 0.022
S7	=	S5 + (4.350 x 0.254)	= 0.600 + 1.105 = 1.705
S8	=	S6 + (0.600 x 0.254)	= 0.022 + 0.152 = 0.174
S9	=	3.700 x 1.000	= 3.700
+ CONCRETE (m ³)			
- Footing	=	S9 x 7.700	= 3.700 x 7.700 = 28.490
- Wing wall	=	V1 + V2 + V3	= 4.788 + 1.840 + 0.341 = 6.969
V1	=	S3 x 0.254	= 18.849 x 0.254 = 4.788
V2	=	(7.700 - 0.200) : 3 x (S5 + S6 + (S5 x S6) ^{0.5})	= 2.500 x (0.600 + 0.022 + 0.115) = 1.840
V3	=	S7 x 0.200	= 1.705 x 0.200 = 0.341
+ FORM (m ²)			
- Footing	=	(7.700 : cos10° + S9) x 2	= (7.819 + 3.700) x 2 = 23.038
- Wing wall	=	S1 + S2 + S3 + S4 + S7 + S8	= 0.870 + 0.872 + 18.849 + 18.895 + 1.705 + 0.174 = 41.365
+ SCAFFOLDING (m ²)			
- Footing	=	(7.700 : cos10° + 1.000 + 3.700 + 1.000) x 2 x 1.000	= 27.038
- Wing wall	=	S3 + S4 + 0.600 x (0.327 + 1.000)	= 18.849 + 18.895 + 0.796 = 38.540

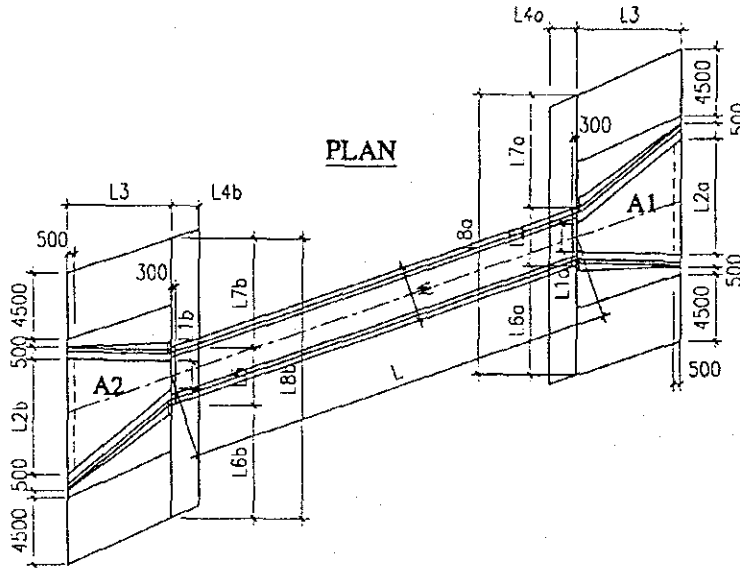
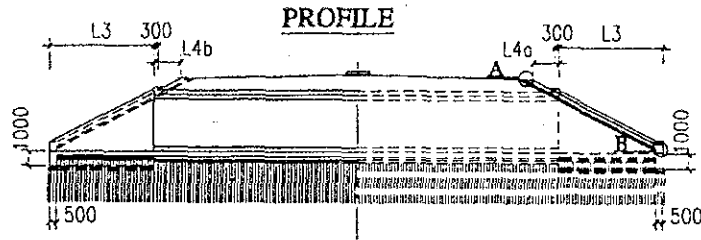
**BOX CULVERT AT INTERCHANGE 3 RAMP "F" 0+180
REINFORCEMENT OF WINGWALL TYPE II**

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	3672	18	40	1.998	146.9	293.4
2a	7854	12	6	0.888	47.1	41.8
2b	4509	12	36	0.888	162.3	144.1
2c	552	12	40	0.888	22.1	19.6
3	7898	12	2	0.888	15.8	14.0
4	8779	12	36	0.888	316.0	280.6
5a	5308	12	35	0.888	185.8	164.9
5b	3840	12	6	0.888	23.0	20.5
5c	4302	22	35	2.984	150.6	449.3
5d	2834	22	6	2.984	17.0	50.7
6	2944	14	72	1.208	212.0	256.1
7	4006	12	4	0.888	16.0	14.2
8	4006	12	6	0.888	24.0	21.3
9	7705	12	6	0.888	46.2	41.0
10	1304	14	14	1.208	18.3	22.1
11	723	12	21	0.888	15.2	13.5
12	3385	12	1	0.888	3.4	3.0
REINFORCEMENT				D<=14	1183.1	KG
REINFORCEMENT				14<D<=25	793.4	KG
TOTAL REINFORCEMENT :					1976.5	KG

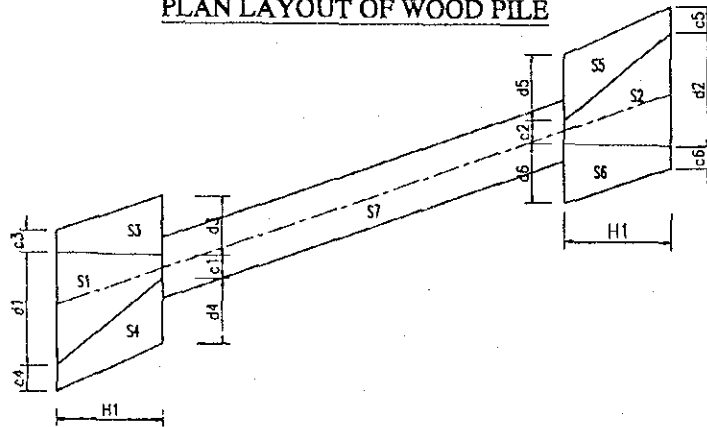
BOX CULVERT FOR DRAINAGE (INTERCHANGE 3 - RAMP "F" - STATION 0+180)



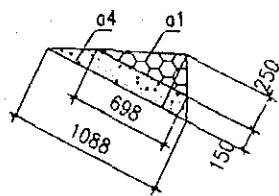
NOTATIONS FOR QUANTITY CALCULATION OF BOX CULVERT FOR DRAINAGE



PLAN LAYOUT OF WOOD PILE



DETAIL A



DETAIL B

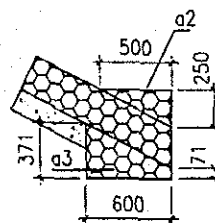


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT KM0+180 RAMP "F" INTERCHANGE 3

S1=	(	c1	)	x	H1	:	2	=	
=	(	3.725	)	x	7.700	:	2	=	58.786 (m2)
S2=	(	c2	)	x	H1	:	2	=	
=	(	3.725	)	x	7.700	:	2	=	58.787 (m2)
S3=	(	c3	)	x	H1	:	2	=	
=	(	3.903	)	x	7.700	:	2	=	30.053 (m2)
S4=	(	c4	)	x	H1	:	2	=	
=	(	4.961	)	x	7.700	:	2	=	38.200 (m2)
S5=	(	c5	)	x	H1	:	2	=	
=	(	4.961	)	x	7.700	:	2	=	38.200 (m2)
S6=	(	c6	)	x	H1	:	2	=	
=	(	3.903	)	x	7.700	:	2	=	30.053 (m2)
S7=	L	x	(W + 0.2)	=					
=	13.941	x	6.000	=	83.646				(m2)

1. APRON CONCRETE:

A1=	(	L1a	)	x	L3	:	2	=	
=	(	3.957	)	x	7.700	:	2	=	60.572 (m2)
A2=	(	L1b	)	x	L3	:	2	=	
=	(	3.957	)	x	7.700	:	2	=	60.572 (m2)
	(	A1	)	x	0.3	+	(	L2a	+
=	(	60.572	)	x	0.3	+	(	11.776	+
								L2b	) x 0.7 x 0.5
								11.776	) x 0.7 x 0.5
									= 44.59 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

$$L \times (W + 0.2) \times 0.2 = 13.941 \times 6.000 \times 0.2 = 16.73 \text{ (m3)}$$

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (58.786 + 58.786805 + 30.053 + 38.200 + 38.200 + 30.053) \times 0.1 = \underline{25.41} \text{ (m3)}$$

4. WOOD PILE:

*L=5M

$$W5 = (S3 + S4 + S5 + S6 + S7) \times 25 \times 5:100 =$$

$$= (30.053 + 38.200 + 38.200 + 30.053 + 83.646) \times 25 \times 5:100 = \underline{275.19} \text{ (100m)}$$

*L=3M

$$W3 = (S1 + S2 + (0.8 \times 4.5 \times 4) + 14.400) \times 25 \times 3:100 =$$

$$= (58.786 + 58.786805 + 14.400) \times 25 \times 3:100 = \underline{99.98} \text{ (100m)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7 + (0.8 \times 4.5 \times 4) \times 0.15 =$$

$$= (58.786 + 58.787 + 30.053 + 38.200 + 38.200 + 30.053 + 83.646 + (0.8 \times 4.5 \times 4) \times 0.15 = \underline{52.82} \text{ (m3)}$$

6. STONE MASONRY

$$a1 = 0.695 \times 0.25 \times 0.5 = 0.087 \text{ (m2)}$$

$$a2 = 0.5 \times 0.25 \times 0.5 = 0.063 \text{ (m2)}$$

$$a3 = (0.071 + 0.371) \times 0.5 \times 0.6 = 0.133 \text{ (m2)}$$

$$a4 = (0.698 + 1.088) \times 0.5 \times 0.15 = 0.134 \text{ (m2)}$$

$$b1 = 0.300 \times L5 = 0.300 \times 6.172 = 1.852 \text{ (m2)}$$

$$b2a = (L6a + 5.000) \times L3 \times 0.5 =$$

$$= (6.151 + 5.000) \times 7.700 \times 0.5 = 42.93 \text{ (m2)}$$

$$\begin{aligned}
& b2b = (L6b + 5.000) \times L3 \times 0.5 = \\
& = (6.019 + 5.000) \times 7.700 \times 0.5 = 42.42 \quad (m2) \\
& b3a = (L7a + 5.000) \times L3 \times 0.5 = \\
& = (6.019 + 5.000) \times 7.700 \times 0.5 = 42.42 \quad (m2) \\
& b3b = (L7b + 5.000) \times L3 \times 0.5 = \\
& = (6.151 + 5.000) \times 7.700 \times 0.5 = 42.93 \quad (m2) \\
& b4a = L8a \times L4a = 18.728 \times 1.300 = 24.35 \quad (m2) \\
& b4b = L8b \times L4b = 18.728 \times 1.300 = 24.35 \quad (m2) \\
& b5 = 0.6 \times 5 \times 2 = 6.000 \quad (m2) \\
& V1a = a1 \times L8a = 0.087 \times 18.728 = 1.627 \quad (m3) \\
& V1b = a1 \times L8b = 0.087 \times 18.728 = 1.627 \quad (m3) \\
& V2 = (a2 + a3) \times 5 \times 4 = (0.063 + 0.133) \times 5 \times 4 = 3.902 \quad (m3) \\
& V3a = (b4a - b1 + b2a + b3a) \times 0.25 = \\
& = (24.346 - 1.852 + 42.93135 + 42.42315) \times 0.25 = 30.159 \quad (m3) \\
& V3b = (b4b - b1 + b2b + b3b) \times 0.25 = \\
& = (24.346 - 1.852 + 42.42315 + 42.93135) \times 0.25 = 30.159 \quad (m3) \\
& TOTAL = (V1a + V1b + V2 + V3a + V3b) = \\
& = (1.627 + 1.627 + 3.902 + 30.159 + 30.159) = \underline{67.474} \quad (m3)
\end{aligned}$$

7. BASE BEDDING:

$$\begin{aligned}
 V4a &= a4 \times L8a \times 0.134 \times 18.728 = 2.509 \text{ (m3)} \\
 V4b &= a4 \times L8b \times 0.134 \times 18.728 = 2.509 \text{ (m3)} \\
 V5a &= (b4a - b1 + b2a + 42.93135 + b3a - b5) \times 0.15 : \text{COS}(26.56) = 17.089 \text{ (m3)} \\
 &= (24.346 - 1.852 + 42.93135 + 42.42 - 6.000) \times 0.15 : 0.894 \\
 V5b &= (b4b - b1 + b2b + 42.42 + b3b - b5) \times 0.15 : \text{COS}(26.56) = 17.089 \text{ (m3)} \\
 &= (24.346 - 1.852 + 42.42 + 42.93 - 6.000) \times 0.15 : 0.894 \\
 \text{TOTAL} &= (V4a + V4b + V5a + V5b) = 39.19 \text{ (m3)}
 \end{aligned}$$

24 12

8. FORM:

$$\begin{aligned}
 &= (L2a + L2b) \times 1 \times 2 = 47.104 \text{ (m2)} \\
 &= (11.776 + 11.776) \times 1 \times 2 = 47.104 \text{ (m2)}
 \end{aligned}$$

9. SCAFFOLDING:

$$\begin{aligned}
 &= (L2a + L2b) \times 1 \times 2 = 47.104 \text{ (m2)} \\
 &= (11.776 + 11.776) \times 1 \times 2 = 47.104 \text{ (m2)}
 \end{aligned}$$

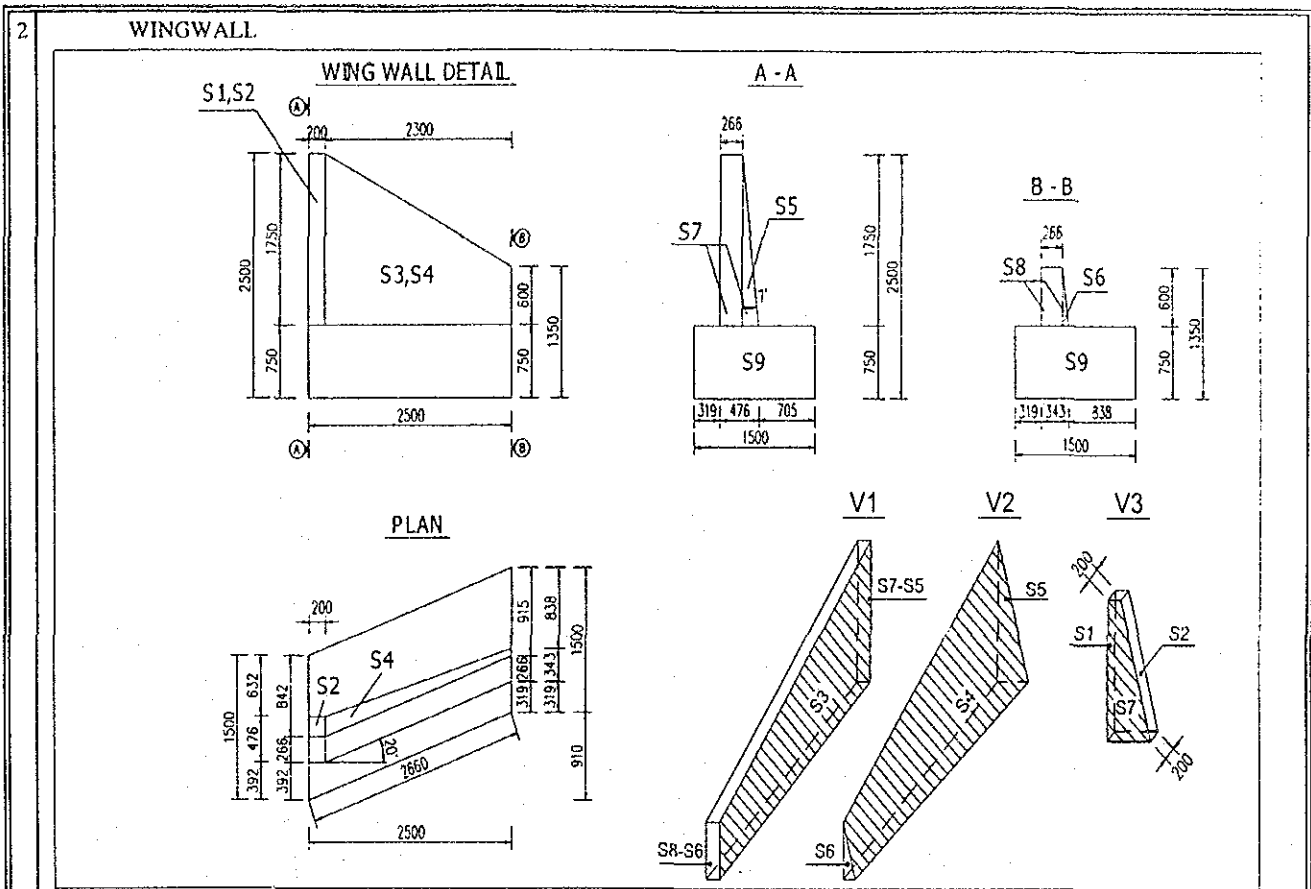
2.25. Box culvert at intersection 4 - ramp
"B" - station 0+223

BOX CULVERT AT INTERSECTION 4 RAMP "B" - 0+223

I BOX CULVERT AT INTERSECTION 4 RAMP "B" 0+223		QUANTITIES
L	= 12.500	
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 L + 5.900 x 0.200 x 0.300 x 2	= 58.65
<p>DOUBLE BOX CULVERT</p>		
+ FORM (M2)		203.37
* INSIDE FORM (M2)		137.892
BOX BULWARK	= (1.500 + 2 x 0.100 x (1: SIN45° - 1)) x 12.500 x 4 =	79.142
BOTTOM OF THE BOX	= (2.950 - 0.300 x 2) x 12.500 x 2	= 58.750
* OUTSIDE FORM (M2)		65.480
BOX BULWARK	= 2.050 x 2 x 12.500 + 4 x 0.300 x 0.200	= 51.490
THE END OF CULVERT	= S x 2 + 5.900 x 0.200 x 4	= 13.990
+ SCAFFOLDING (M2)	= 2.050 x 2 x 12.500 + 4 x 0.300 x 0.200	= 51.49
+ SUPPORT		
AREA (M2)	= 5.900 x 1.500 - S	= 4.215
VOLUME (M3)	= AREA x L	= 52.69

**BOXCULVERT AT INTERSECTION 4-RAMP"B" 0+223
QUANTITIES TABLE OF REINFORCEMENT**

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	202	1.208	739.32	893.4
2	2350	250	12	102	0.888	239.7	212.8
3	6270	250	14	102	1.208	639.54	772.8
4	1500	250	14	200	1.208	300	362.5
5	1550	125	18	202	1.998	313.1	625.4
6	1970	250	12	204	0.888	401.88	356.8
7	2350	125	12	202	0.888	474.7	421.4
8	1049	250	12	204	0.888	213.996	190.0
9	1120	250	12	204	0.888	228.48	202.8
10	12640	250	12	52	0.888	657.28	583.5
11	12740	250	12	88	0.888	1121.12	995.3
12	5780	250	12	4	0.888	23.12	20.5
13	1440	250	12	52	0.888	74.88	66.5
14	1180	250	12	300	0.888	354	314.3
15	1700		12	4	0.888	6.8	6.0
REINFORCEMENT : D<=14				5398.9	TOTAL :		
REINFORCEMENT : 16=D<=25				625.4	REINFORCEMENT (KG):		6024.3
REINFORCEMENT : 25<D=32					CONCRETE (M ³):		58.65



+ CALCULATING VALUES

S1	=	0.200 x 1.750	=	0.350
S2	=	S1 : $\cos 7^\circ$	=	0.350 : 0.993 = 0.353
S3	=	(1.750 + 0.600) x (2.500 - 0.200) : 2 x $\cos 20^\circ$	=	2.876
S4	=	S3 : $\cos 7^\circ$	=	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 (m³)

- 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 x 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 (m²)

- Footing	=	(2.500 : $\cos 20^\circ$ + 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 (m²)

- Footing	=	(2.500 : $\cos 20^\circ$ + 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 AT INTERSECTION 4 RAMP "B" 0+223
REINFORCEMENT OF WINGWALL**

BAR MARK	UNIT LENGTH	DIAMETER (MM)	NUMBER OF BAR	UNIT WEIGHT (KG/M)	TOTAL LENGTH (M)	TOTAL WEIGHT (KG)
	(MM)					
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 :						248.5 KG
REINFORCEMENT :						66.9 KG
TOTAL REINFORCEMENT :						315.4 KG

BOX CULVERT FOR DRAINAGE
 (INTERSECTION 4 - RAMP "B" - STATION 0+223)

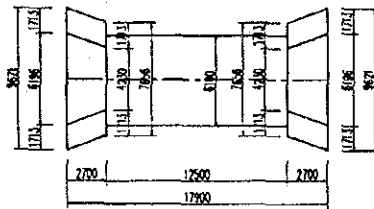
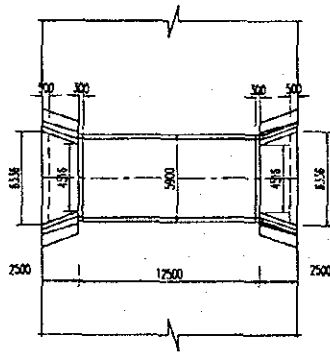


TABLE OF EXPLAINING QUANTITIES OF CULVERT

CULVERT STATION 0+223 RAMP"B" INTERSECTION 4

S1=	(	c1	+	d1	)	x	HI	:	2	=	
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075 (m2)
S2=	(	c2	+	d2	)	x	HI	:	2	=	
=	(	4.230	+	6.196	)	x	2.700	:	2	=	14.075 (m2)
S3=	(	c3	+	d3	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S4=	(	c4	+	d4	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S5=	(	c5	+	d5	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S6=	(	c6	+	d6	)	x	HI	:	2	=	
=	(	1.713	+	1.713	)	x	2.700	:	2	=	4.625 (m2)
S7=	L	x	(W+0.2)	=							
=	12.500	x	6.100	=			76.250				(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	L2a	+		=	
=	(	13.565	+	13.565	)	x	6.336	+		=	10.99 (m3)

2. CONCRETE FOUNDATION OF CULVERT:

L x (W+0.2) x 0.2 = 12.500 x 6.100 x 0.2 = 15.25 (m3)

3. LEAN CONCRETE:

$$= (S1 + S2 + S3 + S4 + S5 + S6) \times 0.1 =$$

$$= (14.075 + 14.0751 + 4.625 + 4.625 + 4.625 + 4.625) \times 0.1 = \underline{4.67} \text{ (m3)}$$

4. WOOD PILE:

* L=5M

$$W5 = (S3 + S4 + S5 + S6 + S7) \times 25 \times 5 : 100 =$$

$$= (4.625 + 4.625 + 4.625 + 4.625 + 76.250) \times 25 \times 5 : 100 = \underline{118.44} \text{ (100m)}$$

* L=3M

$$W3 = (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 25 \times 3 : 100 =$$

$$= (14.075 + 14.0751 + 0.000 + 4.625 + 4.625 + 4.625 + 21.11) \times 25 \times 3 : 100 = \underline{21.11} \text{ (100m)}$$

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

5. SAND BEDDING:

$$= (S1 + S2 + S3 + S4 + S5 + S6 + S7) \times 0.15 =$$

$$= (14.075 + 14.075 + 4.625 + 4.625 + 4.625 + 4.625 + 76.250) \times 0.15 = \underline{18.44} \text{ (m3)}$$

6. FORM

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

7. SCAFFOLDING

$$= (L2a + L2b) \times 0.75 \times 2 =$$

$$(6.336 + 6.336) \times 0.75 \times 2 = \underline{19.008} \text{ (m2)}$$

2.26. Summary of quantities for Culverts – Package 3

GENERAL QUANTITIES TABLE OF CULVERTS - PACKAGE 3

No.	STATION	DIMENSION W x H mm	LENGTH mm	REINFORCEMENT		CONCRETE			SCAFFOLDING		SUPPORT		WEEKLY PILE		SAND BEDDING		CONNECTION		PAVEMENT		PROTECTION SLUVE		NOTE
				D1 (← 14) (kg)	D1-D2 (25) (kg)	CLASS E (kg)	CLASS F (kg)	CLASS G (kg)	KUMI (kg)	SCAFFOLDING (kg)	SUPPORT (kg)	L=5M (100kg)	L=3M (100kg)	SAND BEDDING (kg)	JOINT (kg)	LAIBRTE (m)	SANDHILL (m)	STONE MASS/MT (m)	BASE BEDDING (m)	PVC PIPE (m)			
I. MAIN ROUTE																							
1	1+000	(1.0 x 3.0)	26.94	136.15	415.76	274.52	44.99	16.89	815.06	517.03	302.27	204.75	57.40	49.25	14.95	71.96	41.90	5.60					
2	1+150	(2.5 x 2.0 x 2)	26.70	1391.55	1793.60	165.38	47.91	7.40	615.15	247.76	179.29	241.53	41.75	37.09	18.03	41.49	23.55	5.60					
3	1+300	(2.5 x 2.0 x 2)	30.96	1659.60	1981.80	187.06	51.12	7.40	692.86	269.80	207.92	277.04	41.75	41.60	18.03	44.04	25.44	5.60					
4	1+450	(2.5 x 2.0 x 2)	37.85	1986.40	2328.50	222.06	61.52	7.40	817.28	304.11	254.15	329.55	41.75	47.90	18.03	67.06	38.89	5.60					
5	1+600	(2.5 x 1.5 x 2)	36.11	1635.60	2051.00	183.68	55.05	4.67	659.94	270.42	152.22	228.49	21.11	40.04	16.53	48.85	27.96	5.60					
6	1+750	(2.5 x 1.5 x 2)	31.53	1419.00	1727.00	162.47	49.46	4.67	571.03	211.72	132.90	203.54	21.11	39.85	16.53	48.85	27.96	5.60					
7	1+900	(2.5 x 1.5 x 2)	31.53	1419.00	1727.00	162.47	49.46	4.67	571.03	211.72	132.90	203.54	21.11	39.85	16.53	48.85	27.96	5.60					
8	1+950	(2.5 x 1.5 x 2)	26.70	7428.26	8500.22	140.04	43.56	4.67	498.43	191.92	112.54	226.71	21.11	31.43	16.53	64.63	37.43	5.60					
9	1+951	(2.5 x 1.5 x 2)	26.70	7428.26	8500.22	140.04	43.56	4.67	498.43	191.92	112.54	226.71	21.11	31.43	16.53	64.63	37.43	5.60					
10	1+980	(2.5 x 2.0 x 2)	31.20	16728.56	2086.53	188.26	53.40	7.40	717.41	270.21	209.51	278.84	41.75	41.61	16.53	83.69	48.09	5.60					
11	1+976.5	(5.0 x 4.0)	37.14	13900.09	19156.16	400.66	41.58	17.84	7139.86	631.12	36.91	399.41	51.39	58.21	19.55	59.64	48.07	5.60					
12	1+980	(2.5 x 2.0 x 2)	38.44	20112.06	2353.20	235.08	62.34	7.40	829.01	307.13	258.12	331.05	41.75	48.44	18.03	62.49	50.77	5.60					
13	1+982.5	(5.0 x 4.0)	38.69	14296.26	20191.63	417.39	44.00	18.23	1076.85	655.89	556.64	414.07	53.14	59.74	19.55	88.07	44.79	5.60					
14	1+975	(1.0 x 3.8)	29.49	15898.36	4625.78	302.18	49.39	18.93	558.15	504.77	310.83	294.65	62.01	47.76	14.75	76.75	44.79	5.60					
15	1+980	(2.5 x 1.5 x 2)	26.70	12438.29	1592.80	140.04	43.56	4.67	498.43	191.92	112.54	227.71	21.11	31.55	16.53	64.63	37.43	5.60					
16	1+987	(5.0 x 4.0)	28.69	14296.26	20191.63	417.39	44.00	18.23	1076.85	655.89	556.64	414.07	53.14	59.74	19.55	88.07	44.79	5.60					
17	1+980	(2.5 x 1.5 x 2)	26.70	12438.29	1592.80	140.04	43.56	4.67	498.43	191.92	112.54	227.71	21.11	31.55	16.53	64.63	37.43	5.60					
18	1+982.5	(2.5 x 1.5 x 2)	26.70	12438.29	1592.80	140.04	43.56	4.67	498.43	191.92	112.54	227.71	21.11	31.55	16.53	64.63	37.43	5.60					
19	1+980	(2.5 x 1.5 x 2)	28.56	13167.40	1679.50	148.67	45.83	4.67	526.39	191.92	120.38	240.90	21.11	31.13	16.53	64.63	37.43	5.60					
TOTAL																							
II. INTERCHANGE 3																							
1	Ramp "A" - Km 0+154	(3.0 x 1.5 x 2)	13.10	6656.50	917.80	77.11	26.97	4.67	290.58	136.24	55.22	123.01	21.11	18.98	18.98	40.31	5.60						
2	Ramp "B" - Km 0+286.5	(2.5 x 1.5 x 2)	18.12	5358.00	769.20	63.29	23.34	4.67	252.60	124.02	42.66	100.29	21.11	16.26	16.26	40.31	5.60						
3	Ramp "C" - Km 0+308	(5.0 x 4.0)	13.46	8446.10	11715.00	255.62	53.19	22.45	630.34	438.69	366.78	255.51	86.41	47.94	47.94	78.68	40.31	5.60					
4	Ramp "D" - Km 0+100	(2.5 x 2.0 x 2)	10.12	6219.40	960.00	81.17	37.69	7.40	369.81	162.80	67.96	118.11	41.75	22.52	22.52	41.58	23.61	5.60					
5	Ramp "E" - Km 0+180	(5.0 x 4.0)	18.52	9217.40	10875.80	277.28	61.32	26.07	681.16	477.18	276.31	379.62	101.27	53.81	53.81	60.78	38.72	5.60					
TOTAL																							
III. INTERCHANGE 4																							
1	Ramp "D" - Km 0+223	(2.5 x 1.5 x 2)	12.50	6392.90	893.00	74.33	26.24	4.67	281.90	133.78	52.69	118.44	21.11	18.44	18.44	40.31	5.60						
TOTAL																							
																		184.61	415.38	969.67	561.33	78.40	

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