REPUBLIC OF INDONESIA

MINISTRY OF COMMUNICATIONS
DIRECTORATE GENERAL OF LAND TRANSPORT
AND INLAND WATERWAYS

TENDER DOCUMENTS
FOR
NEW RAILWAY LINE FOR CENGKARENG AIRPORT CONSTRUCTION PROJECT

QUANTITIES CALCULATION SHEETS

PACKAGE I CIVIL AND ARCHITECTURAL WORK

1 of 5

AUGUST 1984

JAPAN INTERNATIONAL COOPERATION AGENCY
(JICA)

QUANTITIES CALCULATION SHEETS

CONTENTS

§§ 1. SUMMARY OF QUANTITIES

1. SURVEYING

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
1.01	004,019 021,022	RIGHT-OF-WAY STAKE	1,280	No.	

2. GEOLOGICAL SURVEY

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
2.01	008	BORING INVESTIGATION	240	L.M.	

3. EARTHWORKS

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
3.01	007	SAND MAT	55,170	C.M.	
3.02	007	EMBANKMENT	131,210	C.M.	
3.03	017	AGGREGATE SUBBALLAST	15,300	C.M.	
3.04	006	SODDING SLOPE PROTECTION	68,190	S.M.	
3.05	003	EXCAVATION OF EARTH SIDE DITCH	16,530	C.M.	
3.06	004	EXCAVATION -			
a.		CLASS A	6,200	C.M.	
b.		CLASS B	6.640	C.M.	
c.		CLASS C	7,350	C.M.	
d.		CLASS E	420	C.M.	
3.07	012	AGGREGATE SUBBASE (ASB-3)	1,910	C.M.	
3.08	-	SELECT STRUCTURE BACKFILL	420	C.M.	
3.09	005,016 022	REINFORCED CONCRETE PIPE, 300 MM DIAMETER	1,100	L.M.	
3.10	006	CONCRETE SLOPE PROTECTION	260	S.M.	
3.11	022	LEVELING CONCRETE	520	C.M.	
3.12	022	CONCRETE FOR -			
a.		SEMI-GRAVITY TYPE RETAINING WALL	1,590	C.M.	
b.		WATER CHANNEL	210	C.M.	

3. EARTHWORKS

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
3.13	022	REINFORCED CONCRETE FOR -			
a.		RETAINING WALL	920	C.M.	
b.		SIDE DITCH	4,330	C.M.	
c.		CATCH BASIN	40	C.M.	
d.		BOX CULVERT	1,770	C.M.	
e.		UNDERGROUND PASSAGE	160	C.M.	
3.14	012,022	CONCRETE PAVEMENT	2,630	S.M.	
3.15	-	DEMOLITION OF EXISTING REINFORCED CONCRETE STRUCTURE	130	C.M.	
3.16	-	BARBED WITH FENCE	21,890	L.M.	
3.17	019	CONCRETE REINFORCEMENT	370	M.T.	

4. BRIDGE AND VIADUCT

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
4.01	004	EXCAVATION -			
a.		CLASS A	29,340	C.M.	
b.		CLASS B	5,950	C.M.	
c.		CLASS C	5,740	C.M.	
d.		CLASS F	5,520	C.M.	
4.02	012	AGGREGATE SUBBASE (ASB-3)	3,940	C.M.	
4.03	008	PRESTRESSED CONCRETE PILES -			
a.		350 MM DIAMETER, A	54,530	L.M.	
b.		350 MM DIAMETER, B	73,510	L.M.	
c.		500 MM DIAMETER, A	12,950	L.M.	
d.		500 MM DIAMETER, B	26,660	L.M.	
4.04	022	LEVELING CONCRETE	1,970	C.M.	
4.05	018,022 106	REINFORCED CONCRETE FOR -			
a.		ABUTMENT FOUNDATION	720	C.M.	
b.		ABUTMENT WALL	710	C.M.	
c.		PIER FOUNDATION	6,930	C.M.	
d.		PIER WALL AND COLUMN	4,480	C.M.	
e.		GIRDER	2,800	C.M.	
f.		VIADUCT FOUNDATION	10,670	C.M.	
g.		VIADUCT SLAB, BEAM AND COLUMN	19,330	C.M.	

4. BRIDGE AND VIADUCT

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
4.06	019	CONCRETE REINFORCEMENT	6,100	M.T.	
4.07	018,019 023,106	PRESTRESSED CONCRETE GIRDER -			
a.		SPAN 20 M	7	L.S.	
b.		SPAN 25 M (A)	6	L.S.	
c.		SPAN 25 M (B)	5	L.S.	
d.		SPAN 26 M	1	L.S.	
e.		SPAN 28 M	1	L.S.	
f.		SPAN 30 M (A)	11	L.S.	
g.		SPAN 30 M (B)	3	L.S.	
h.		SPAN 33 M	1	L.S.	
i.		SPAN 35 M	4	L.S.	
j.		SPAN 40 M	3	L.S.	
4.08	106	FABRICATION AND DELIVERY OF THROUGH PLATE GIRDER	1	L.S.	
4.09	-	INSTALLATION OF THROUGH PLATE GIRDER	1	L.S.	

5. ROAD CONSTRUCTION WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
5.01	007	EMBANKMENT	31,670	C.M.	
5.02	012,014	ASPHALT CONCRETE CONSTRUCTION -			
		ASPHALT PAVEMENT -			
a.		TYPE A	4,950	S.M.	
b.		TYPE B	4,330	S.M.	
c.		TYPE C	12,730	S.M.	
d.		TYPE D	330	S.M.	
5.03		GURD RAILING	1,050	L.M.	
5.04	123	SAFETY MARKINGS	280	S.M.	
5.05	-	ROADWAY SIGN	50	No.	
5.06	022	CONCRETE CURBING	290	C.M.	

6. ARCHITECTURAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
6.01		AIRPORT TERMINAL STATION -			
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.	
b.	008,019 022,104	SUBSTRUCTURE AND SUPERSTRUCTURE	1	L.S.	
c.	021,101 102,103 105,106 110,111 125,126	EXTERNAL FINISH	1	L.S.	
d.	021,106 108,109 110,118 119,120 121,122 123,124 127,128 130	INTERNAL FINISH	1	L.S.	
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.	
f.	133	FURNISHINGS	1	L.S.	
g.	101	LANDSCAPING	1	L.S.	
h.	131,134 135,138 139,140 143,144 147,148	VENTILATING AND AIR CONDITIONING	1	L.S.	

6. ARCHITECTURAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
i.	136,137 141,142 146	PLUMBING	1	L.S.	
j.	145	ELECTRICAL	1	L.S.	
6.02		KOTA INTAN STATION -			
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.	
b.	008,011 014,017 019,022 104	SUBSTRUCTURE AND SUPERSTRUCTURE	1	L.S.	
c.	021,101 102,103 105,106 110,111 125,126	EXTERNAL FINISH	1	L.S.	

6. ARCHITECTURAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
d.	021,106 108,109 110,118 119,120 121,122 123,124 127,128 130	INTERNAL FINISH	1	L.S.	
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.	
f.	133	FURNISHINGS	1	L.S.	
g.	101	LANDSCAPING	1	L.S.	
h.	131,134 135,138 139,140 143,144 147,148	VENTILATING AND AIR CONDITIONING	1	L.S.	
i.	136,137 141,142 146	PLUMBING	1	L.S.	
j.	145	ELECTRICAL	1	L.S.	

6. ARCHITECTURAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
6.03		SIGNAL CABIN -			
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.	
b.	008,019 022,105 106	SUBSTRUCTURE AND SUPERSTRUCTURE	1	L.S.	
c.	021,102 103,108 110,111 126	EXTERNAL FINISH	1	L.S.	
d.	021,118 119,120 121,123 124	INTERNAL FINISH	1	L.S.	
e.	112,113 114,115 116,117	DOORS, WINDOWS AND LOUVERS	1	L.S.	
f.	134	VENTILATING AND AIR CONDITIONING	1	L.S.	
g.	136,137 141,142	PLUMBING	1	L.S.	
h.	145	ELECTRICAL	1	L.S.	

6. ARCHITECTURAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
6.04		CROSSING WATCHMAN'S BOX -			
a.	003,007	EXCAVATING, FILLING AND GRADING	15	LOT	
b.	019,022	SUBSTRUCTURE AND SUPERSTRUCTURE	15	LOT	
c.	102,103 110,111	EXTERNAL FINISH	15	LOT	
d.	020,118 120,123	INTERNAL FINISH	15	LOT	
e.	112,113 114	DOORS, WINDOWS AND LOUVERS	15	LOT	
f.	145	ELECTRICAL	15	LOT	
6.05		DUMP YARD -			
a.	003,007	EXCAVATING, FILLING AND GRADING	1	L.S.	
b.	019,022	SUBSTRUCTURE AND SUPERSTRUCTURE	1	L.S.	
c.	102,103	EXTERNAL FINISH	1	L.S.	
d.	132	FURNISHINGS	1	L.S.	

7. TRACK WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
7.01	027	TRACK LAYING	1,250	L.M.	
7.02	027	TRACK SHIFTING	1,620	L.M.	
7.03	026	REMOVAL OF TRACK	1,260	L.M.	

8. ELECTRICAL WORK

PAY ITEM NO.	REFERENCE SPEC. NO.	DESCRIPTION OF ITEM	ESTIMATED QUANTITY	UNIT	REMARKS
8.01	305	IMPROVEMENT OF OVERHEAD LINE	1	L.S.	
8.02	025	CHANGE OVER OF EXISTING SIGNALING EQUIPMENT	1	L.S.	

§§ 2. QUANTITIES CALCULATION SHEETS

§ 1. CUTTING AND EMBANKMENT

SIDE DRAIN CUTTING & EMBANKMENT FOR ROADWAY

QUANTITY CALUCULATION SHEET

STATION	CUTTING (m³)	EMBANKMENT (m³)	REMARKS
0Km030m ~ 1Km000m	606.4	16.382.6	
1Km000m ~ 2Km080m	37.2	6.590.7	
2Km080m ~ 2Km721m	943.1	1.932.4	
2Km721m ~ 3Km261m	668.3	5,155.5	
3Km261m ~ 3Km800m	696.7	4,170.0	
3Km800m ~ 4Km550m	1,089.5	5.666.0	
4Km550m ~ 5Km169m80	857.9	7,202.0	
5Km169m80 ~ 5Km900m	985.6	5.099.7	
5Km900m ~ 6Km850m	1,302.6	5.993.3	
6Km850m ~ 7Km950m	1.579.4	4,598.2	
7Km950m ~ 8Km700m	1,010.3	5. 659.5	
8Km700m ~ 9Km625m	1,356.2	4,452.1	
9Km625m ~ 10Km550m	1.344.2	9.926.6	
10Km550m ~ 11Km121m	579.2	11,592.2	
11Km121m ~ 11Km650m	661.7	5,256.8	
11Km650m ~ 12Km208m	731.1	10.825.7	
12Km208m ~ 12Km798m70	696.5	9.981.1	
12Km801m30 ~ 13Km390m70	731.2	3.648.8	
13Km390m70 ~ 13Km398m60	11.1	44.0	
14Km815m50 ~ 14Km842m60	-	1,757.7	
19Km438m40 ~ 20Km175m	650.3	413.7	
TOTAL	16.538.5	126.348.6	

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KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
SIDE DRAIN CUTTING						
0K 230		0.38				
0K 248.5	18.5	0.38	7.0			
SUB TOTAL			2.0 m³			
CHANNEL 500 DRAIN CUTTING						
0K 700 -						
0						
30	30	19.98	599.4			
SUB TOTAL			599.4			
TOTAL			606.4			
SIDE DRAIN CUTTING						
P1 ROAD SIDE						
2K064"7		0.7				
80"	15.3	0.7	10.7			
P2 ROAD SIDE						
2K064"7		0.97				
80"	15.3	0.9	14.3			
SUB TOTAL			25.0			

-0^km030 - 1^km000^m

1-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
-0.030				66.9		
-0.005	25			63.7	1632.5	
-0.005	0			44.4	0	
0.000	5			49.4	222	
0.000	0			42.0	0	
.50	50			47.2	2230.	
100	50			46.6	2345.	
100	0			46.1	0	
150	50			38.9	2125.	
200	50			37.1	1900.	
210	10			28.2	326.5	
250	40			3.4	632.	
286	36			0.8	75.6	
300	14			0	5.6	
314	14			0	0	
350	36			2.9	52.2	
370	20			3.4	63.0	
400	30			3.8	108.0	
408	8			3.9	30.8	
450	42			3.4	153.3	
478.18	28.18			-0.9	35.2	
500	21.82			7.4	70.9	
550	50			7.5	372.5	
600	"			10.1	440.0	
650	"			10.5	515.0	
700	"			10.8	532.5	
750	"			9.4	505.	
800	"			7.4	420.	
850	"			5.8	330.	
900	"			10.8	415	
950	"			7.9	467.5	
1^km000	"			7.2	377.5	
SUB TOTAL					16382.6	

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1Km000m – 2Km080m

3-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
1Km000m				7.2		
50	50.			7.6	370	
100	"			5.0	315	
150	"			3.3	207.5	
200	"			2.1	135.	
250	"			2.0	102.5	
300	"			0	50	
350	"			2.4	60	
400	"			4.8	180	
450	"			6.5	282.5	
500	"			7.0	322.5	
550	"			9.2	405.	
600	40			9.1	366	CUT. CROSING L=10m
650	50			10.7	495.	
700	"			9.1	495	
750	"			10.3	485	
800	"			9.2	487.5	
850	"			8.1	432.5	
900	"			9.5	440.	
950	"			7.7	430.	
2Km000	"			8.6	407.5	
010.15	10.15			9.0	89.3	
2Km0647		0		2.7		
80.	15.3	1.6	12.2	2.7	32.9	
SUBTOTAL			12.2		6590.7	

2Km080m ~ 2Km721m

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KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
2 080	-	1.4	-	0.0	-	
080 98	1	1.4	1.4	0.0	-	
100	19	2.0	32.3	0.0	-	
150	50	1.4	85.0	0.0	-	
200	50	1.4	70.0	0.0	-	
250	50	1.6	75.0	0.0	-	
257 69	7.7	1.8	13.1	0.0	-	
287 69	30	1.6	51.0	0.0	-	
317 69	30	1.8	51.0	0.0	-	
350	32.3	1.7	56.5	0.0	-	
400	50	1.1	70.0	5.3	132.5	
450	50	1.4	62.5	5.8	277.5	
464 69	14.7	1.4	20.6	5.8	85.3	
				0.2		Cb 2K466M
467 32	2.6	1.4	3.6	0.2 7.0	0.5	
477	9.7	1.4	13.6	7.0	67.9	
500	23	1.4	32.2	5.9	148.4	
550	50	2.0	85.0	5.0	272.5	
600	50	1.3	82.5	6.2	280.0	
629 19	29.2	1.3	38.0	6.2	181.0	
				0.2		Cb 2K630M5
631 82	2.6	1.5	3.6	0.2 4.1	0.5	
637 28	5.5	1.5	8.3	4.1	22.6	
667 28	30	1.4	43.5	2.8	103.5	
694	26.7	1.4	37.4	2.6	72.1	
"	-	0.7		6.9		Lc
697 28	3.3	0.7	2.3	6.9	22.8	"
700	2.7	0.7	1.9	7.5	19.4	"
704	4	0.7	2.8	7.5	30.0	"
"		0.0		12.7		"
721	17	0.0	-	12.7	215.9	"
SUB TOTAL			943.1		1932.4	

2Km721m ~ 3Km261m

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KILOMETER (km m)	DISTANCE (m)	CUTTING (m2)	CUTTING (m3)	EMBANKMENT (m2)	EMBANKMENT (m3)	REMARKS
2 721	-	0.8	-	8.1	-	LC
726	5	0.8	4.0	8.1	40.5	"
"	-	1.5	-	3.1	-	
750	24	1.5	36.0	0.3	40.8	
783	33	1.3	46.2	5.2	90.8	
"	-	0.7	-	5.0	-	
800	17	0.7	11.9	5.0	85.0	
815.56	15.6	0.7	10.9	5.0	78.0	
					16.2	Cb 2K820M
824.45	-	30×(0.8+1.0)×½=	27.0	4.6	-	
825	0.6	27×(1.0+0.6)×½=	21.6	4.3	2.7	RELOCATION OF WATERWAY
850	25	(4+4)×0.6=	4.8	4.5	110.0	
853.50	3.5			4.5	15.8	
					9.8	Cb 2K855M
856.50	-	1.4	-	4.5	-	
900	43.5	1.3	58.7	8.6	284.9	
942	42	1.1	50.4	10.8	407.4	
"	-	0.7	-	64.0	-611.0	Substation (FOUNDATION)
986	44	0.7	30.8	64.0	2,816.0	"
"	-	-	-	5.0		LC
3 001	15	-	-	16.7	162.8	"
"	-	0.7	-	10.2		"
005	4	0.7	2.8	10.2	40.8	"
"	-	1.4		4.7		
050	45	1.5	65.3	6.8	258.8	
100	50	1.4	72.5	8.5	382.5	
150	50	"	70.0	7.4	397.5	
200	50	"	70.0	3.8	280.0	
250	50	"	70.0	4.2	200.0	
261	11	1.4	15.4	4.2	46.2	
SUB TOTAL			668.3		5,155.5	

3Km261m ~ 3Km800m

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KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
3 261	-	-	-	8.5	-	LC
264.5	3.5	-	-	8.5	29.8	"
"	-	-	-	13.0	-	"
271	6.5	-	-	13.0	84.5	"
"	-	0.7	-	8.5	-	"
276	5	0.7	3.5	8.5	42.5	"
"	-	1.4	-	0.8	-	
300	24	1.4	33.6	0.8	19.2	
332	32	1.4	44.8	0.8	25.6	
"	-	-	-	30.4	-	EMPANG
350	18	-	-	30.4	547.2	"
371	21	-	-	30.4	638.4	"
"	-	0.7	-	5.9	-	
375	4	0.7	2.8	5.9	23.6	
400	25	1.7	30.0	8.7	182.5	
450	50	1.4	77.5	7.3	400.0	
500	50	1.4	70.0	5.8	327.5	
550	50	1.5	72.5	4.8	265.0	
589	39	1.4	56.6	8.2	253.5	
"	-	1.4	-	14.0	-	SIGNAL
595	6	1.4	8.4	14.0	84.0	"
"	-	1.4	-	8.2	-	
598 70	3.7	1.4	5.2	8.2	30.3	
				0.2		Cb 3K600M
601 30	2.6	1.4	3.6	0.2 8.2	0.5	
650	48.7	"	68.2	6.4	355.5	
700	50	"	70.0	5.2	290.0	
703 16	3.2	"	4.5	5.2	16.0	
733 16	30	"	42.0	6.6	177.0	
763 16	30	1.7	46.5	4.7	169.5	
800	36.8	1.4	57.0	6.6	207.9	
SUBTOTAL			696.7		4,170.0	

3K 800M ~ 4K 550M

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KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
3 800		1.4		6.6		
850	50	1.5	72.5	5.8	310.0	
900	50	1.4	72.5	5.0	270.0	
943	43	〃	60.2	4.9	212.9	
950	7	〃	9.8	4.9	34.3	
4 000	50	〃	70.0	4.7	240.0	
050	50	〃	70.0	6.5	280.0	
099	49	〃	68.6	5.7	298.9	
〃	-	〃	-	10.5	-	SIGNAL
100	1	〃	1.4	10.5	10.5	〃
105	5	〃	7.0	10.5	52.5	〃
〃	-	〃	-	5.7	-	
122.94	17.9	〃	25.1	7.1	114.6	
152.94	30	〃	42.0	5.1	183.0	
182.94	30	1.4	42.0	6.0	166.5	
200	17.1	1.7	26.5	5.9	101.7	
248.70	48.7	1.4	75.5	7.2	319.0	
				0.2		Cb 4K 250M
251.30	2.6	1.4	3.6	0.2 7.2	0.5	
300	48.7	〃	68.2	6.2	326.3	
339	39	〃	54.6	6.2	241.8	
〃	-	〃	-	10.8	-	
350	11	1.4	15.4	10.8	118.8	
400	50	2.0	85.0	11.7	562.5	
432	32	1.4	54.4	12.8	392.0	
〃	-	〃	-	18.6	-	SIGNAL
438	6	〃	8.4	18.6	111.6	〃
〃	-	〃	-	12.8	-	
450	12	〃	16.8	12.8	153.6	
500	50	〃	70.0	11.1	597.5	
550	50	〃	70.0	11.6	567.5	
SUBTOTAL			1,089.5		5,666.0	

4KM550M ~ 5KM169M80 8-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
4 550	-	0.7×35.0 = 24.5 / 1.4 = -		32.0×32.9÷2 = 1,052.8 / 11.6 = -		CABIN BOX
600	50	〃	70.0	14.9	662.5	
642	~~42~~	〃	58.8	14.5	617.4	
〃	-	〃	-	21.1	-	SIGNAL
648	6	〃	8.4	21.1	126.6	〃
〃	-	〃	-	14.5	-	
672	24	〃	33.6	14.5	348.0	
700	28	〃	39.2	18.1	456.4	
743	43	〃	60.2	16.5	743.9	
〃	-	〃	-	8.2	-	
748 70	5.7	〃	8.0	8.2	46.7	
				0.2		cb 4K750M
751 30	2.6	1.4	3.6	0.2 / 8.2	0.5	
764 31	13.0	1.8	20.8	7.7	103.4	
794 31	30	1.6	51.0	8.8	247.5	
824 31	30	1.4	45.0	7.4	243.0	
850	25.7	〃	36.0	7.4	190.2	
900	50	〃	70.0	7.0	360.0	
907	7	〃	9.8	7.0	49.0	
〃	-	〃	-	12.3	-	SIGNAL
913	6	〃	8.4	12.3	73.8	
〃	-	〃	-	7.0	-	
950	37	〃	51.8	6.8	255.3	
997 05	47.1	〃	65.9	7.8	343.8	
5 000	3	〃	4.2	7.7	23.3	
048 70	48.7	〃	68.2	7.6	372.6	
				0.2		cb 5K050M
051 30	2.6	1.4	3.6	0.2 / 7.6	0.5	
100	48.7	〃	68.2	7.4	365.3	
150	50	〃	70.0	7.4	370.0	
169 80	19.8	〃	27.7	7.7	149.5	
SUB TOTAL			857.9		7,202.0	

5KM169M80 ~ 5KM900M

9-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
5.169 80	-	1.4	-	7.7	-	
199 80	30	〃	42.0	7.6	229.5	
229 80	30	〃	42.0	2.4	150.0	
250	20.2	〃	28.3	2.0	44.4	
300	50	〃	70.0	8.4	260.0	
312	12	1.4	16.8	8.4	100.8	
〃	-	0.7	-	16.7	-	LC
316	4	0.7	2.8	16.7	66.8	〃
〃	-	-	-	19.9	-	〃
325	9	-	-	19.9	179.1	〃
325 80	0.8	-	-	19.9	15.9	
					18.7	CD 5K333M
340.20	-	1.4	-	7.7	-	
350	9.8	〃	13.7	7.7	75.5	
400	50	〃	70.0	5.9	340.0	
407	7	〃	9.8	5.9	41.3	
〃	-	〃	-	10.8	-	SIGNAL
413	6	〃	8.4	10.8	64.8	〃
〃	-	〃	-	5.9	-	
450	37	〃	51.8	3.7	177.6	
500	50	〃	70.0	6.1	245.0	
550	50	〃	70.0	7.5	340.0	
600	50	〃	70.0	8.0	387.5	
650	50	〃	70.0	9.1	427.5	
700	50	〃	70.0	7.5	415.0	
750	50	〃	70.0	8.0	387.5	
798.70	48.7	〃	68.2	7.8	384.7	
				0.2		CD 5K800M
80/30	2.6	1.4	3.6	0.2 7.8	0.5	
850	48.7	〃	68.2	7.4	370.1	
900	50	〃	70.0	7.7	377.5	
SUB TOTAL			985.6		5,099.7	

5Km900M ~ 6Km850M

10 - 21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
5 900	-	1.4	-	7.7	-	
950	50	〃	70.0	7.7	385.0	
6 000	50	〃	70.0	8.4	402.5	
050	50	〃	70.0	7.9	407.5	
100	50	〃	70.0	6.6	362.5	
150	50	〃	70.0	7.8	360.0	
200	50	〃	70.0	7.4	380.0	
250	50	〃	70.0	7.1	362.5	
300	50	〃	70.0	7.0	352.5	
350	50	〃	70.0	5.7	317.5	
398.70	50	〃	68.2	5.5	272.7	
				0.2		cb 6K400M
401.30	2.6	1.4	3.6	0.2 5.5	0.5	
437.5	36.2	〃	50.7	0.2	103.2	
〃		0.7	-	3.3	-	LC
441	3.5	0.7	2.5	3.3	11.6	〃
〃	-	-	-	6.4		〃
447.5	6.5	-	-	6.4	41.6	〃
〃	-	0.7	-	3.3	-	〃
450	2.5	0.7	1.8	3.3	8.3	〃
452.5	2.5	0.7	1.8	3.3	8.3	〃
〃	-	1.4	-	0.2	-	
500	47.5	1.4	66.5	5.5	135.4	
539	39	〃	54.6	1.6	138.5	
550	11	〃	15.4	5.8	40.7	
600	50	〃	70.0	6.0	295.0	
650	50	〃	70.0	7.4	335.0	
700	50	〃	70.0	6.1	337.5	
750	50	〃	70.0	5.6	292.5	
800	50	〃	70.0	6.6	305.0	
850	50	0.9	57.5	6.9	337.5	
SUB TOTAL			1,302.6		5,993.3	

6Km850m ~ 7Km950m

11-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
6 850	—	0.9	—	6.9	—	
900	50	1.4	57.5	6.6	337.5	
948.70	48.7	1.4	68.2	5.6	297.1	
				0.2		Cb 6K950M
951.30	2.6	1.4	3.6	0.2 5.6	0.5	
7 000	48.7	1.4	68.2	6.2	287.3	
050	50	〃	70.0	6.1	307.5	
100	50	〃	70.0	6.0	302.5	
150	50	〃	70.0	6.7	317.5	
200	50	〃	70.0	5.5	305.0	
250	50	〃	70.0	5.0	262.5	
300	50	〃	70.0	4.7	242.5	
350	50	1.8	80.0	5.7	260.0	
400	50	1.7	87.5	4.9	265.0	
448.70	48.7	1.4	75.5	5.2	245.9	
				0.2		Cb 7K450M
451.30	2.6	1.4	3.6	0.2 5.2	0.5	
500	48.7	1.9	80.4	3.5	211.8	
550	50	1.4	82.5	3.6	177.5	
600	50	1.4	70.0	3.3	172.5	
626.23	26.2	1.5	38.0	1.7	65.5	
656.23	30	1.4	47.5	0.1	27.0	
686.23	30	0.9	34.5	3.1	48.0	
700	13.8	1.5	16.6	2.4	38.0	
750	50	1.4	72.5	1.1	87.5	
800	50	1.4	70.0	0.2	32.5	
850	50	1.7	62.5	2.4	65.0	
898.70	48.7	1.4	75.5	2.6	121.8	
				0.2		Cb 7K900M
901.30	2.6	1.4	3.6	0.2 2.6	0.5	
950	48.7	1.3	65.7	2.3	119.3	
SUB TOTAL			1,579.4		4598.2	

JICA

7Km950m ~ 8Km700m

12-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
7 950	-	1.3	-	2.3	-	
8 000	50	1.4	67.5	2.8	127.5	
014 58	14.6	1.4	20.4	2.6	39.4	
050	35.4	1.4	49.6	1.3	69.0	
100	50	"	70.0	3.0	107.5	
150	50	"	70.0	1.8	120.0	
200	50	"	70.0	1.4	80.0	
250	50	"	70.0	4.0	135.0	
298.70	48.7	"	68.2	3.4	180.2	
				0.2		Cb 8K300M
301.30	2.6	1.4	3.6	0.2 3.4	0.5	
342.93	41.6	"	58.2	4.9	172.6	
372 93	30	"	42.0	8.4	199.5	
402 93	30	"	42.0	12.4	312.0	
450	47.1	"	65.9	16.3	675.9	
500	50	"	70.0	16.9	830.0	
527	27	"	37.8	16.9	456.3	
531	4	0.0	2.8	0.1	34.0	
531 39	0.4	0.0	0.0	0.1	0.1	
						Cb 8K535M50
539 62	-	-	-	1.2	-	
540.5	0.9	-	-	1.2	1.1	〃
542	1.5	-	-	1.2	1.8	〃
550	8	-	-	22.0	92.8	〃
552	2	-	-	22.0	44.0	〃
〃	-	0.7		12.4		
559	7	0.7	4.9	12.4	86.8	
〃	-	1.4	-	13.5	-	
600	41	〃	57.4	13.5	553.5	
650	50	〃	70.0	13.5	675.0	
700	50	〃	70.0	13.1	665.0	
SUBTOTAL			1,010.3		5,659.5	

: : C A

8km700m ~ 9km625m

13-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
8 700		1.4		13.1		
750	50	1.8	80.0	1.4	362.5	
800	50	1.8	90.0	0.1	37.5	
810	10	1.8	14.0	0.1	1.0	
		1.4		8.5		
850	40	"	56.0	8.5	340.0	
900	50	"	70.0	11.3	495.0	
950	50	"	70.0	5.7	425.0	
951 88	1.9	"	2.7	5.7	10.8	
						cb 8k955m
958 12	-	1.4	-	5.7	-	
9 000	41.9	"	58.7	4.5	213.7	
050	50	"	72.5	3.6	202.5	
100	50	"	72.5	5.1	217.5	
150	50	"	70.0	5.0	252.5	
200	50	"	70.0	7.1	302.5	
250	50	2.1	87.5	8.2	382.5	
300	50	1.4	87.5	7.2	385.0	
350	50	"	70.0	2.5	242.5	
398.70	48.7	"	68.2	4.8	177.6	
				0.2		cb 9k400m
401 30	2.6	1.4	3.6	0.2 4.8	0.5	
450	48.7	1.6	73.1	5.1	241.1	
493.52	43.5	1.4	65.3	0.3	117.5	
523.52	30	"	42.0	0.2	7.5	
553.52	30	1.5	43.5	0.2	6.0	
600	46.5	1.4	67.4	0.2	9.3	
615 5	15.5	"	21.7	0.2	3.1	
"	-	-	-	2.0	-	Lc
625	9.5	-	-	2.0	19.0	
"	-	0.7	-	1.1	-	
SUBTOTAL			1,356.2		4.452.1	

9Km625M ~ 10Km550M　　14 - 21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
9 625	-	0.7	-	1.1	-	〃
633 5	8.5	0.7	6.0	1.1	9.4	〃
〃	-	1.3	-	4.4	-	
650	16.5	1.3	21.5	4.4	72.6	
700	50	1.4	67.5	4.3	217.5	
703 90	3.9	1.4	5.5	4.2	16.6	
750	46.1	2.0	78.4	4.1	191.3	
798.70	48.7	1.7	90.1	5.3	228.9	
				0.2		Cb 9K800M
801 30	2.6	1.7	4.4	0.2 5.3	0.5	
850	48.7	1.4	75.5	5.6	265.4	
854.27	4.3	1.4	6.0	5.4	23.7	
884.27	30	1.4	42.0	6.3	175.5	
914 27	30	1.4	42.0	6.7	195.0	
950	35.7	1.4	50.0	8.2	266.0	
10 000	50	1.4	70.0	9.0	430.0	
050	50	1.6	75.0	10.3	482.5	
100	50	1.4	75.0	12.0	557.5	
150	50	1.4	70.0	15.6	690.0	
200	50	1.4	70.0	15.8	785.0	
250	50	1.4	70.0	12.1	697.5	
298.60	48.6	1.4	68.0	16.3	690.1	
				0.2		Cb 10K300M
301 40	2.8	1.4	3.9	0.2 16.3	0.6	
350	48.6	1.9	80.2	15.6	775.2	
400	50	1.4	82.5	14.2	745.0	
449	49	1.6	73.5	16.8	759.5	
					19.2	Cb 10K452750
456	-	1.6	-	16.8	-	
500	44	1.0	57.2	20.0	809.6	
550	50	1.4	60.0	12.9	822.5	
SUBTOTAL			1,344.2		9,926.6	

10Km 550m ~ 11Km 121m

15-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
10 550	-	1.4	-	12.9	-	
600	50	1.0	60.0	14.8	692.5	
624 70	24.7	1.0	24.7	14.8	365.6	
				0.2		CL 10K626M
627 30	2.6	1.4	3.1	0.2 14.3	0.5	
650	22.7	1.4	31.8	14.3	324.6	
700	50	1.4	70.0	17.6	797.5	
750	50	1.4	70.0	15.8	835.0	
774.62	24.6	1.4	34.4	15.8	388.7	
					10.9	CL 10K776M50
778 39	-	1.4	-	15.8	-	
800	21.6	1.4	30.2	23.9	428.8	
850	50	1.4	70.0	22.9	1,170.0	
900	50	1.4	70.0	31.4	1,357.5	
950	50	1.4	70.0	19.7	1,277.5	
955.5	5.5	0.7	5.8	19.7	108.4	
"	"	0.7	-	32.9	-	〃
967.5	12	0.7	8.4	32.9	394.8	〃
"	-	-	-	36.3	-	〃
975.8	8.3	-	-	36.3	301.3	〃
"	-	-	-	47.9	-	
978.5	2.7	-	-	47.9	129.3	
						B 11K019M
11 059.5	-	-	-	46.3	-	
62.2	2.7	-	-	46.3	125.0	
"	-	-	-	43.6	-	
077	14.8	-	-	43.6	645.3	〃
"	-	0.7	-	59.0	-	〃
100	23.	0.7	16.1	59.0	1357.0	〃
121	21	0.7	14.7	59.0	1,239.0	〃
"	-	1.4	-	13.0	-357.0	SUBSTATION (FOUNDATION)
SUBTOTAL			579.2		11,592.2	

JICA

11Km 121m ~ 11Km 650m

16 - 21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
11 121	-	1.4	-	13.0	-	
150	29	1.4	40.6	12.4	368.3	
157	7	1.4	9.8	12.4	86.8	
"	-	1.4	-	19.6		SIGNAL
163	6	1.4	8.4	19.6	117.6	"
"	-	1.4	-	12.4	-	
188.60	25.6	1.4	35.8	29.7	538.9	
				0.2	8.7	cb 11K190m
191 40	2.8	1.4	3.9	0.2 29.7	0.6	
200	8.6	2.7	17.6	29.7	255.4	
240	40	2.7	108.0	29.7	1,188.0	
"	-	0.7	-	12.0	-	
250	10	0.7	7.0	12.0	120.0	
300	50	0.8	37.5	5.7	442.5	
350	50	0.7	37.5	0.1	145.0	
400	50	0.7	35.0	1.2	32.5	
450	50	0.7	35.0	-	30.0	
"	-	-	-	3.1	-	cc
459	9	-	-	3.1	27.9	"
"	-	-	-	6.0	-	"
473	14	-	-	6.0	84.0	"
"	-	0.7	-	2.9	"	"
489	16	0.7	11.2	2.9	46.4	"
"	-	1.3	-	15.1	-	
500	11	1.3	14.3	15.1	166.1	
550	50	1.4	67.5	8.2	582.5	
600	50	2.5	97.5	10.3	462.5	
605.61	5.6	2.5	14.0	10.3	57.7	
					10.8	cb 11K607m
608 39	-	2.5	-	10.3	-	
650	41.6	1.4	81.1	13.0	484.6	
SUBTOTAL			661.7		5,256.8	

JICA

11K^m650^m ~ 12K^m208^m

17-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m2)	CUTTING (m3)	EMBANKMENT (m2)	EMBANKMENT (m3)	REMARKS
11 650		1.4		13.0		
658	8	1.4	11.2	13.0	104.0	
"	-	1.4	-	21.0	-	SIGNAL
664	6	1.4	8.4	21.0	126.0	
"	-	1.4	-	13.0	-	
700	36	1.5	52.2	0.9	250.2	
738.5	38.5	1.4	55.8	0.5	27.0	
"	-	0.7	-	3.1	-	LC
743.5	5.0	0.7	3.5	3.1	15.5	"
"	-	-	-	7.5	-	"
762.5	19.0	-	-	7.5	142.5	"
"	-	0.7	-	4.5	-	"
765	2.5	0.7	1.8	4.5	11.3	"
"	-	1.4	-	0.5	-	
800	35	1.4	49.0	0.2	12.3	
850	50	1.4	70.0	2.0	55.0	
900	50	1.4	70.0	5.1 6.1	177.5	
950	50	1.4	70.0	12.1	455.0	
992	42	1.3	56.7	21.0	695.1	
"	-	1.3	-	28.1	-	SIGNAL
998	6	1.3	7.8	28.1	168.6	"
"	-	1.3	-	21.0	-	
12 000	2	1.3	2.6	21.0	42.0	
050	50	1.6	72.5	27.7	1,217.5	
100	50	0.7×18= 1.4	-26.6 75.0	32×87.7 28.2	2,806.4 1,397.5	CABIN BOX
150	50	1.4	70.0	28.3	1,412.5	
200	50	1.4	70.0	28.7	1,425.0	
202	2	1.4	2.8	28.7	57.4	
"	-	1.4	-	37.9	-	SIGNAL
208	6	1.4	8.4	37.9	227.4	"
"	-	1.4	-	28.7	-	
SUBTOTAL			731.1		10,825.7	

JICA

12Km 208M ~ 12Km 798M 70 — 18 -21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
12 208	-	1.4		28.7	-	
232	24	1.4	33.6	28.7	688.8	
250	18	1.4	25.2	31.4	540.9	
300	50	1.4	70.0	37.4	1.720.0	
303	3	1.4	4.2	37.4	112.2	
"	-	1.4	-	21.9	-	
328.60	25.6	1.4	35.8	21.9	560.6	
				0.2	7.8	Cb 12K330M
331 40	2.8	1.4	3.9	21.9 0.2	0.6	
350	18.6	1.4	26.0	3.5	236.2	
400	50	1.4	70.0	3.5	175.0	
416 5	16.5	1.4	23.1	3.5	57.8	
"	-	0.7	-	18.6	-	LC.
420	3.5	0.7	2.5	18.6	65.1	"
"	-	-	-	26.3	-	"
443	23	-	-	26.3	604.9	"
"	-	0.7	-	17.9	-	"
445	2	0.7	1.4	17.9	35.8	"
"	-	1.4	-	11.5	-	
450	5	1.4	7.0	11.5	57.5	
466	16	1.4	22.4	11.5	24.0	
"	-	1.4	-	19.1	-	SIGNAL
472	6	1.4	8.4	19.1	114.6	
"	-	1.4	-	11.5	-	
500	28	1.4	39.2	13.8	354.2	
550	50	1.4	70.0	14.0	695.0	
600	50	1.4	70.0	21.0	875.0	
650	50	0.8	55.0	16.2	930.0	
700	50	0.8	40.0	14.8	775.0	
750	50	1.0	45.0	13.2	700.0	
798 70	48.7	0.8	43.8	13.5	650.1	
SUBTOTAL			696.5		9.981.1	

JICA

12^km 80/^m 30 ~ 13^km 390^m 70 19-21

KILOMETER (km m)	DISTANCE (m)	CUTTING		EMBANKMENT		REMARKS
		(m²)	(m³)	(m²)	(m³)	
						Cb 12^K 800^M
12 80/ 30		0.8	-	13.5	-	
850	48.7	0.6	34.1	14.0	669.6	
900	50	0.6	30.0	15.7	742.5	
950	50	1.4	50.0	9.8	637.5	
967	17	1.4	23.8	9.8	166.6	
"	-	1.4	-	16.1	-	SIGNAL
973	6	1.4	8.4	16.1	96.6	"
"	-	1.4	-	9.8	-	
13 000	27	1.4	37.8	3.6	180.9	
015 89	15.9	1.5	23.1	9.4	103.4	
045 89	30	1.5	45.0	9.5	283.5	
075 89	30	1.2	40.5	10.6	301.5	
090 53	14.6	1.4	19.0	3.0	99.3	
100	9.5	2.0	16.2	2.4	25.7	
105 17	5.2	0.6	6.8	3.0	14.0	
135 17	30	1.4	30.0	0.2	48.0	
165 17	30	1.4	42.0	0.5	10.5	
200	34.8	1.4	48.7	0.2	12.2	
250	50	2.1	87.5	0.0	5.0	
300	50	1.4	87.5	0.2	5.0	
307.5	7.5	1.4	10.5	0.2	1.5	
"	-	0.7	-	3.2	-	LC
310.5	3	0.7	2.1	3.2	9.6	"
"	-	-	-	6.2	-	"
323.	12.5	-	-	6.2	77.5	"
"	-	0.7	-	3.2	-	"
332.5	9.5	0.7	6.7	3.2	30.4	"
"	-	1.4	-	0.2	-	
350	17.5	1.4	24.5	0.7	7.9	
390.7	40.7	1.4	57.0	5.2	120.1	
SUBTOTAL			731.2		3,648.8	

JICA

13Km390m70 ~ 13Km398m60
14Km815m50 ~ 14Km842m60

20 -21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
13 390.7		1.4		5.2		
396 2	5.5	1.4	7.7	10.8	44.0	
397.4	1.2	1.4	1.7			
398.6	1.2	1.4	1.7			
SUB TOTAL			11.1		44.0	
14 815 5	-	-	-	-	205.5	
818 62	2.1	-	-	72.2	-	
829 86	11.2	-	-	72.2	808.6	
〃	-	-	-	59.9	-	
839 88	10.0	-	-	59.9	599.0	
84260	2.7		-	-	117.1	
SUB TOTAL	-		-		1757.7	

19km438m40 ~ 20km175m

21-21

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
19 438.4		0.7		9.0		
439.6	1.2	0.7	0.8	9.0	10.8	
450	10.4	0.8	7.8	5.1	78.0	
476.31	26.3	0.7	19.7	1.5	86.8	
490	13.7	0.6	8.9	0.0	10.3	
506.31	16.3	0.6	9.8	2.1	17.1	
536.31	30	0.7	19.5	1.0	46.5	
550	13.7	0.8	10.3	0.0	6.9	
600	50.	0.8	40.0	0.1	2.5	
626.08	26.1	0.8	20.9	0.1	2.6	
〃	-	2.3	-	0.0	-	〃
643	16.9	2.3	38.9	0.0	0.0	〃
649.93	6.9	2.0	14.8	〃	〃	〃
651.22	1.3	2.8	3.1	〃	〃	
700	48.8	1.6	107.4	〃	〃	
750	50	1.0	65.0	〃	〃	
766.14	16.1	0.4	11.3	〃	〃	
796.14	30	0.2	9.0	0.2	3.0	
826.14	30	0.6	12.0	0.6	12.0	
850	23.9	0.2	9.6	0.3	10.8	
900	50	1.1	32.5	0.1	10.0	
922.45	22.5	1.1	24.8	0.1	2.3	
						B 19×931M
939.55	-	0.4	-	1.1	-	
950	10.5	0.4	4.2	1.1	11.6	
20 000	50	0.3	17.5	1.0	52.5	
050	50	0.2	12.5	0.3	32.5	
100	50	0.4	15.0	0.2	12.5	
150	50	2.5	72.5	0.0	5.0	
175	25	2.5	62.5	0.0	0.0	
SUBTOTAL			650.3		413.7	

-0Km130 ~ 0Km150 ROAD EMBANKMENT 1

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
-0Km130m				130.7		
- 100	30			130.7	3.921	
- 50	50			75.0	5.142.5	
000	50			44.2	2.980.	
50	50			57.6	2.545.	
100	50			56.8	2.860	
150	50			49.7	2.662.5	
TOTAL					20.111	

SIDE DRAIN CUTTING . B
TYPE - B

Z

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
Cz. Pz	SIDE					
- 0k 130		2.5				
- 100	30	0.8	49.5			
- 50	50	1.2	50.0			
- 000	50	2.3	82.5			
50	50	2.3	115.0			
100	"	2.4	117.5			
150	"	3.0	135.0			
200	"	2.3	132.5			
250	"	2.3	115.0			
300	"	2.0	107.5			
350	"	2.0	100.0			
400	"	2.0	100.0			
450	"	2.3	107.5			
478.18	28.18	2.3	64.8			
500	21.82	2.3	50.2			
550	50	2.5	120.0			
600	"	2.5	125.0			
650	"	2.7	130.0			
700	"	2.7	135.0			
750	"	2.6	132.5			
800	"	2.6	130.0			
850	"	2.5	127.5			
900	"	2.3	120.0			
950	"	2.5	120.0			
1k 000	"	2.5	125.0			
TOTAL			2596.5			

3

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
1Km 000m		2.5				
50	50	2.5	125.0			
100	"	2.5	125.0			
150	"	2.4	122.5			
200	"	2.3	117.5			
250	"	2.3	115.0			
300	"	2.3	115.0			
350	"	2.5	120.0			
400	"	2.6	127.5			
450	"	2.7	132.5			
500	"	3.2	147.5			
550	"	3.7	172.5			
600	"	3.1	170.0			
650	"	2.9	150.0			
700	"	3.1	150.0			
750	"	3.1	155.0			
800	"	3.1	155.0			
850	"	3.1	155.0			
900	"	3.1	155.0			
950	"	4.4	187.5			
2K 000	"	3.3	192.5			
10.15	10.15	3.3	33.5			
TOTAL			2923.5			

JICA

4

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
C/ SIDE						
-0.130		0				
- 100	30	0.8	12.°			
- 50	50	1.2	50.°			
000	-	2.3	90.°			
50	-	2.3	115.°			
100	-	2.4	117.5			
150	-	3.0	135.°			
200	-	2.3	132.5			
TOTAL			652.°			
Σ. TOTAL			6172.°			

JICA

SIDE DRAIN CUTTING 5
TYPE C.

KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
0K 200		2.3				
250	50	2.3	115.0			
300	"	2.0	107.5			
350	"	2.0	100.0			
400	"	2.0	100.0			
450	"	2.3	107.5			
478.18	28.18	2.3	64.8			
500	21.82	2.3	50.2			
550	50	2.5	120.0			
600	"	2.5	125.0			
650	"	2.7	135.0			
700	"	2.7	135.0			
750	"	2.6	132.5			
800	"	2.6	130.0			
850	"	2.5	127.5			
900	"	2.3	120.0			
950	"	2.5	120.0			
1Km 000	"	2.5	125.0			
TOTAL			1915.0			

JICA

6

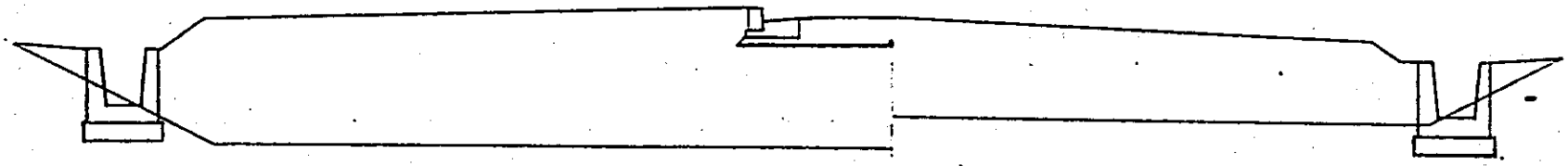
KILOMETER (km m)	DISTANCE (m)	CUTTING (m²)	CUTTING (m³)	EMBANKMENT (m²)	EMBANKMENT (m³)	REMARKS
1Km 000m		2.5				
50	50	2.5	125.0			
100	"	2.5	125.0			
150	"	2.4	122.5			
200	"	2.3	117.5			
250	"	2.3	115.0			
300	"	2.3	115.0			
350	"	2.5	120.0			
400	"	2.6	127.5			
450	"	2.7	132.5			
500	"	2.7	135.0			
550	"	3.1	145.0			
600	"	3.9	175.0			
650	"	3.5	185.0			
700	"	3.1	165.0			
750	"	3.1	155.0			
800	"	3.1	155.0			
850	"	3.1	155.0			
900	"	3.1	155.0			
950	"	4.4	187.5			
2Km 000	"	3.3	192.5			
10.15	10.15	3.2	33.0			
TOTAL			2938.0			
Σ TOTAL			4853.0			

JICA

NOTE: B AND C IS KIND OF EXCUVATION.

-0 km 100 m 00

S = 1 : 200

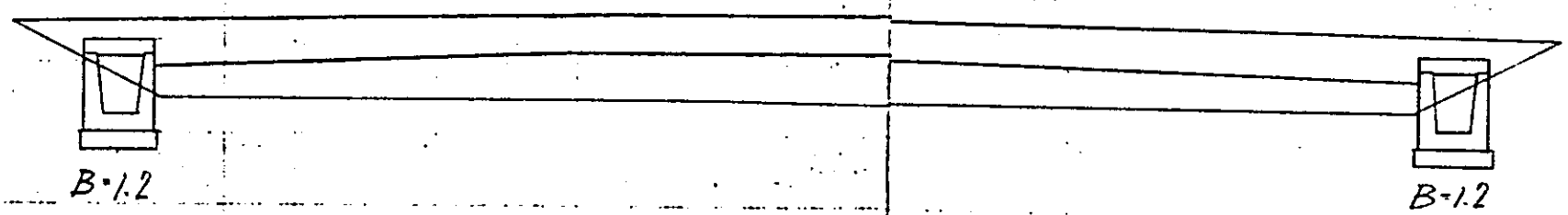


B=0.8

B=0.8

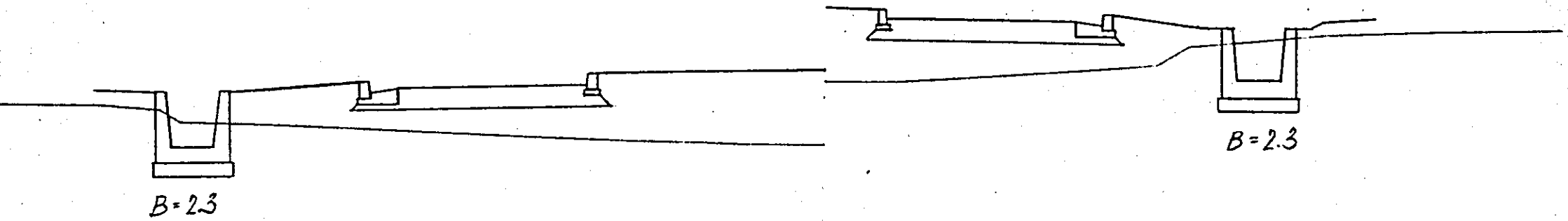
-0km050m00

S = 1 : 200

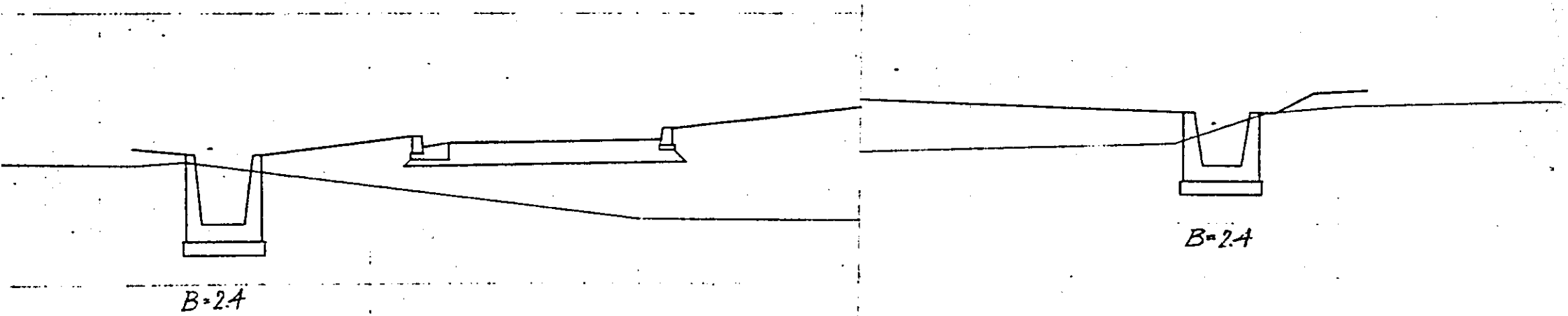


0 km 000 m 00

S = 1 : 100

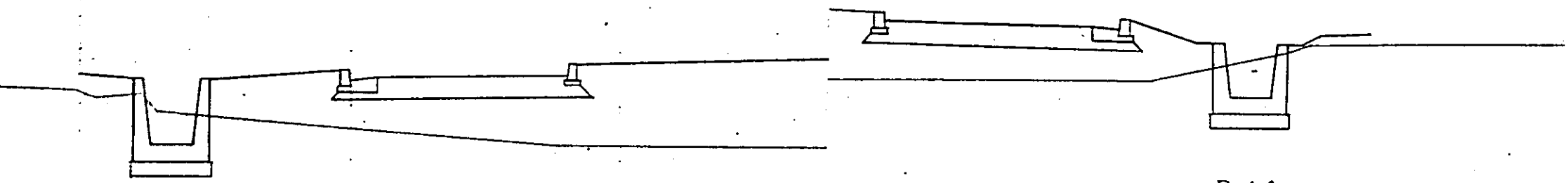


0km100m00



0km050m00

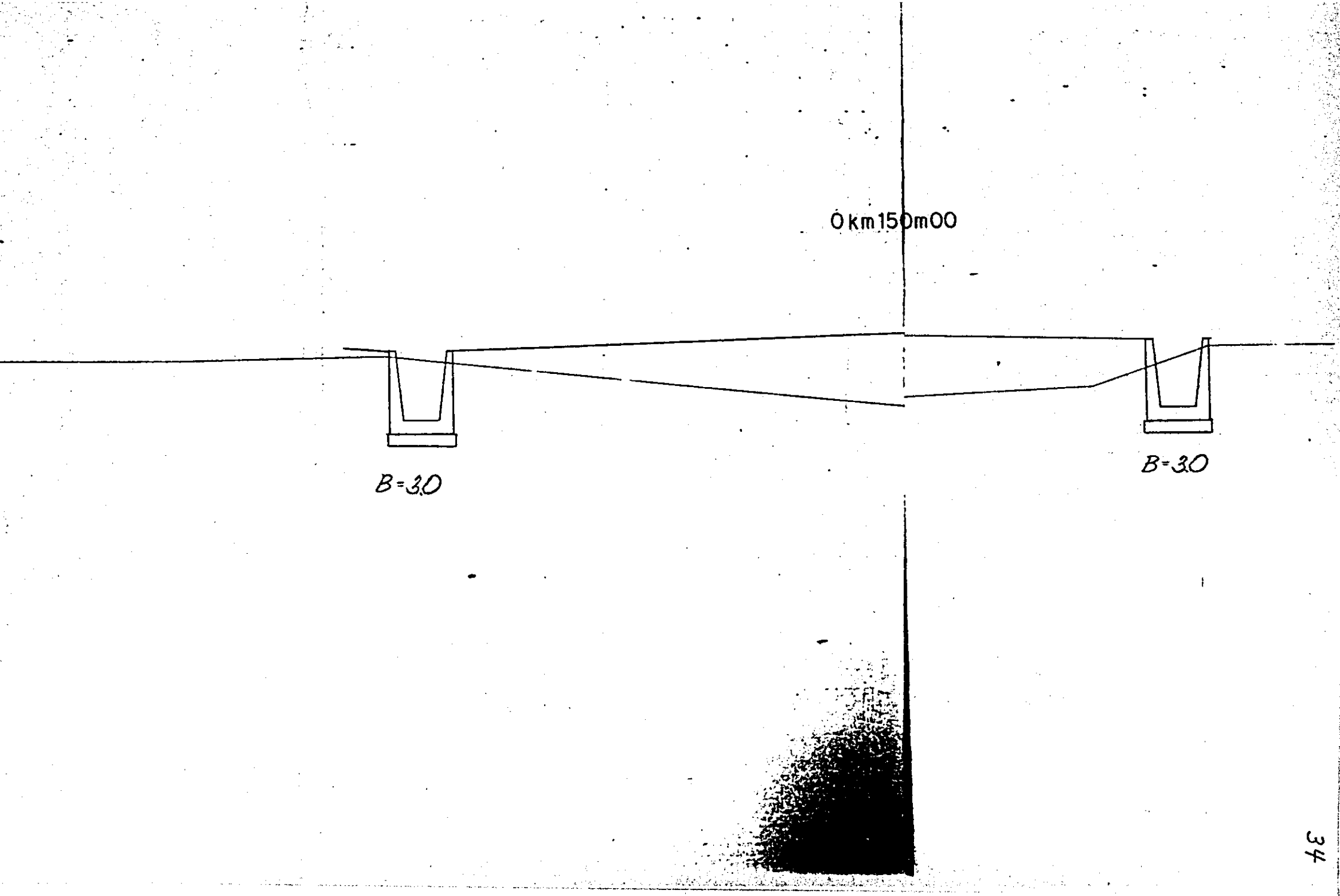
S = 1 : 100

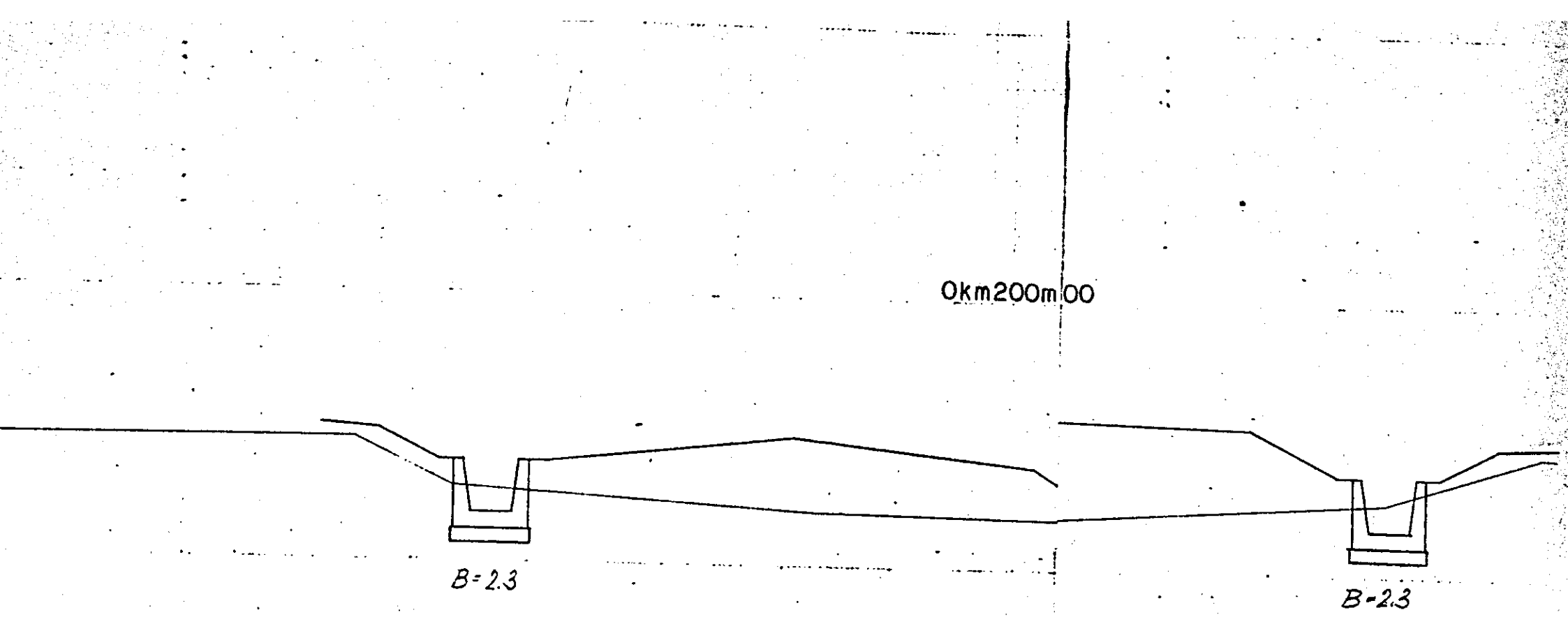


B = 2.3

B = 2.3

33-1

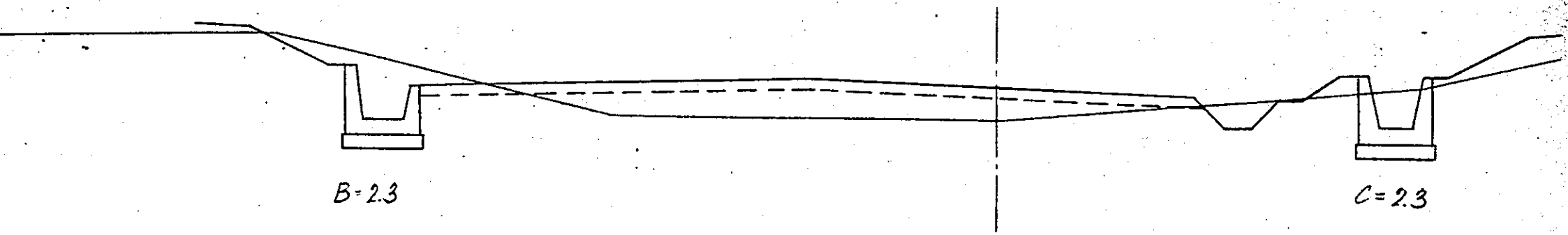

0km150m00
B=3.0
B=3.0


0km200m00
B=2.3
B=2.3

0km250m00

B =5.6

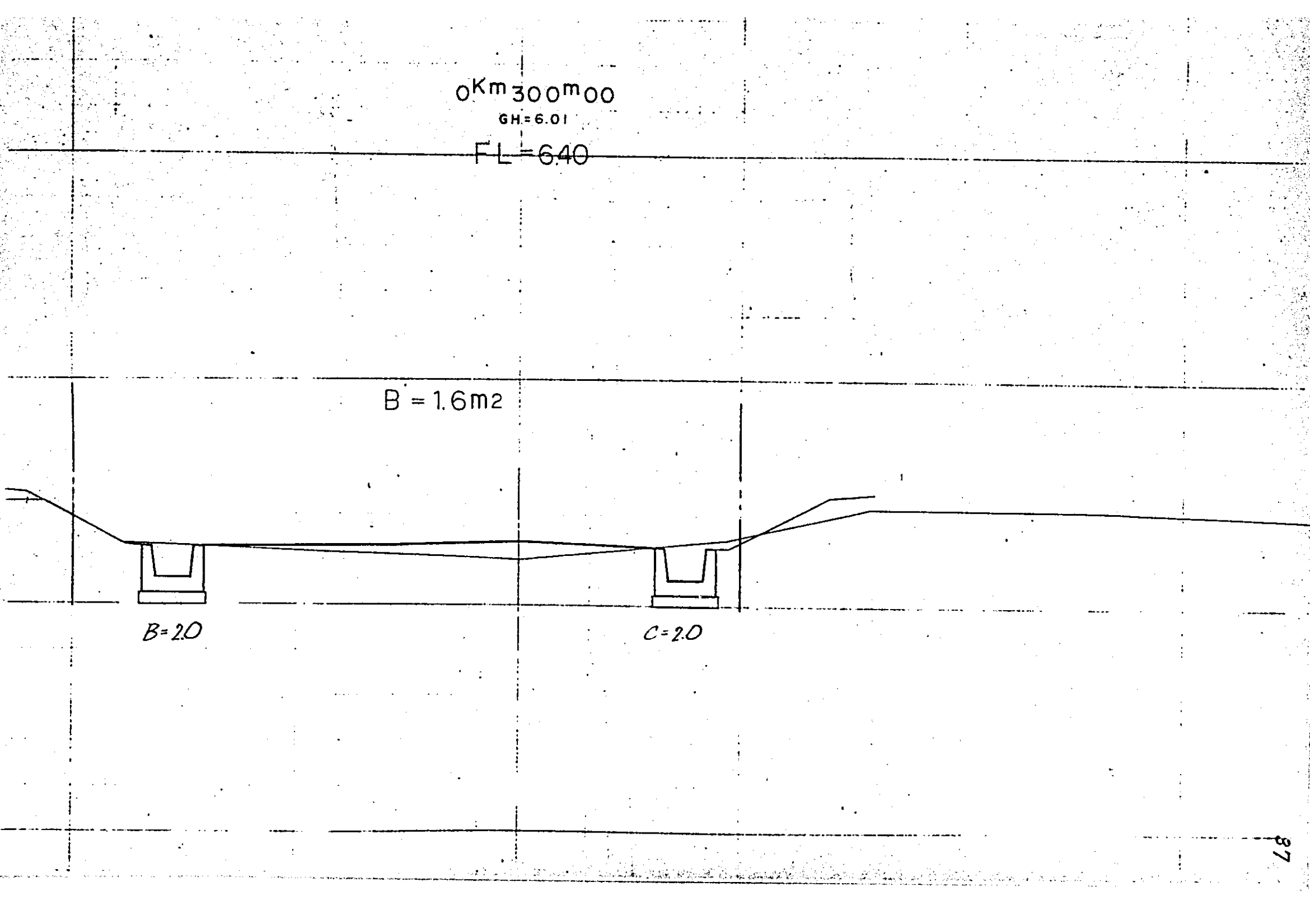
P, C,

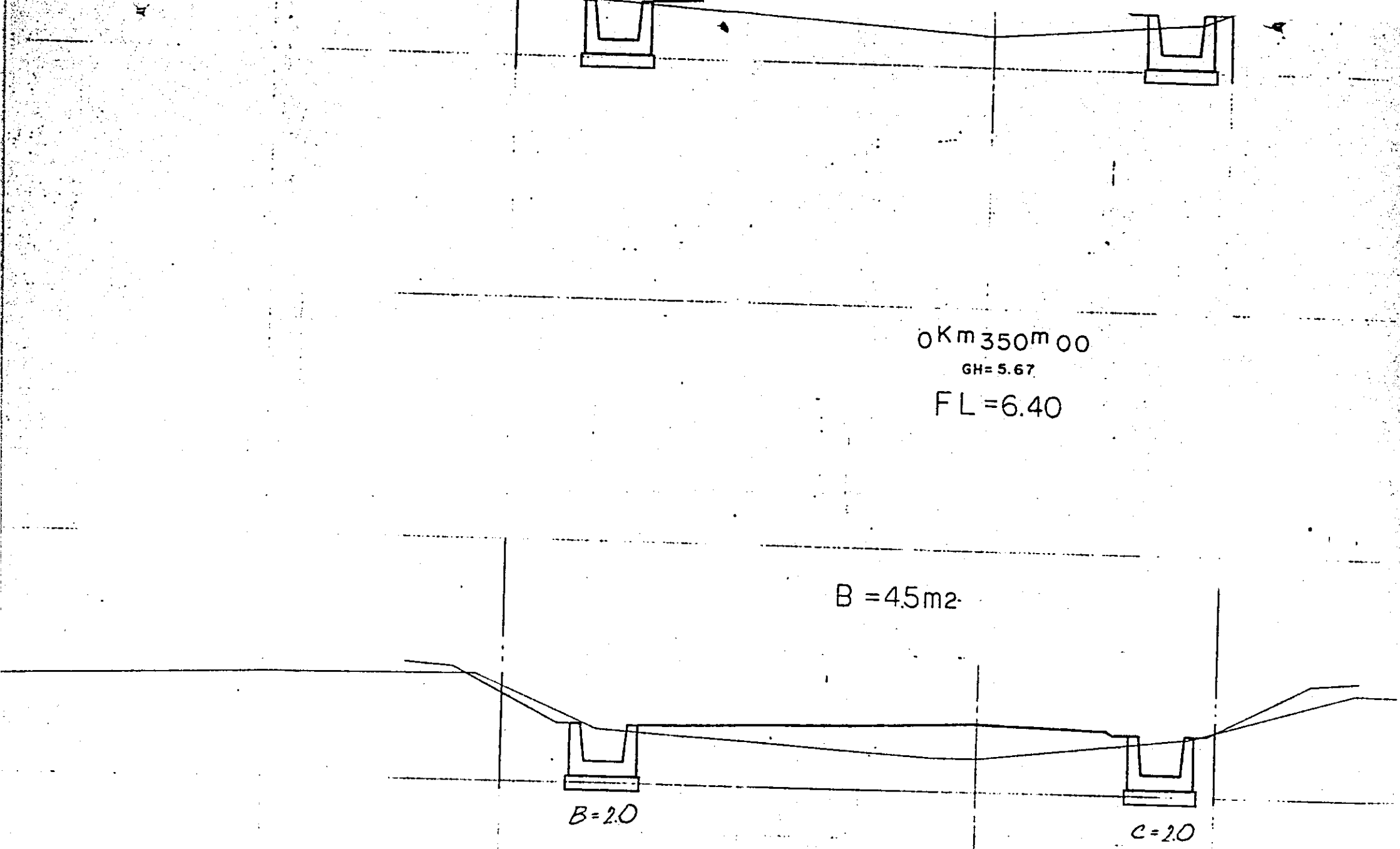


0 Km 200 m00

GH= 5.73

FL =6.400


0Km300m00
GH=6.01
FL=640
B=1.6m2
B=2.0
C=2.0

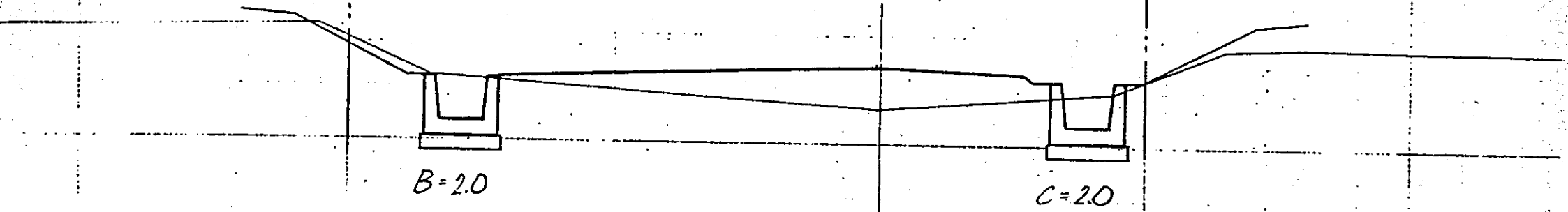

0Km350m00
GH= 5.67
FL =6.40
B =4.5m2
B=2.0
C=2.0

0 Km 400 m 00

GH = 5.66

FL = 6.40

B = 5.0m2



0 Km 350 m 00

GH = 5.67

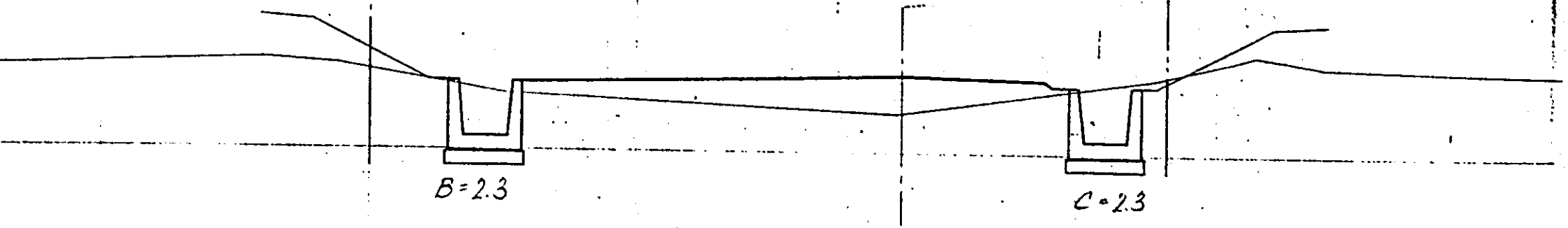
FL = 6.40

0Km450m00

GH = 5.73

FL = 6.40

B = 4.5 m2

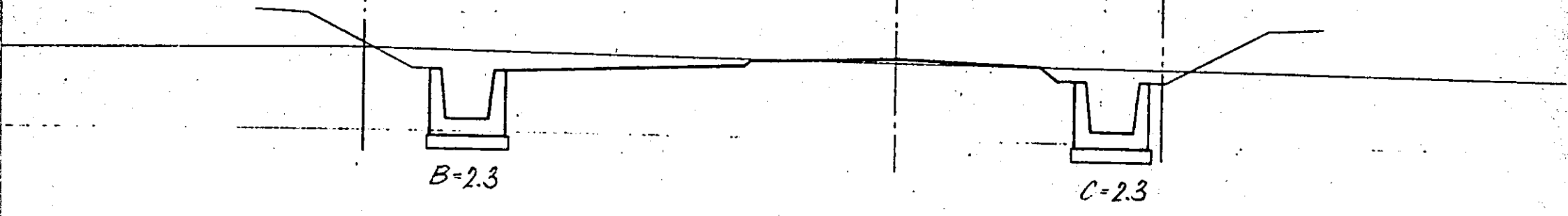


0Km478m18

GH=6.45

FL=6.48

B =0.2 m2



0Km450m00

GH=5.73

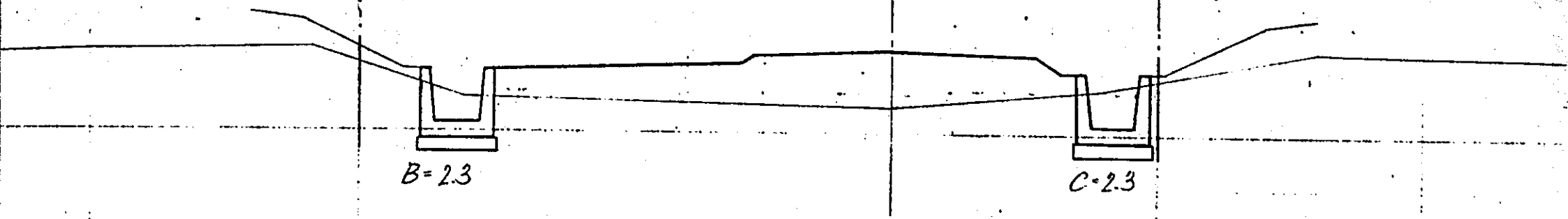
FL=6.40

0Km500m00

GH=5.44

FL=6.52

B=8.5m2



0Km478m18

GH=6.45

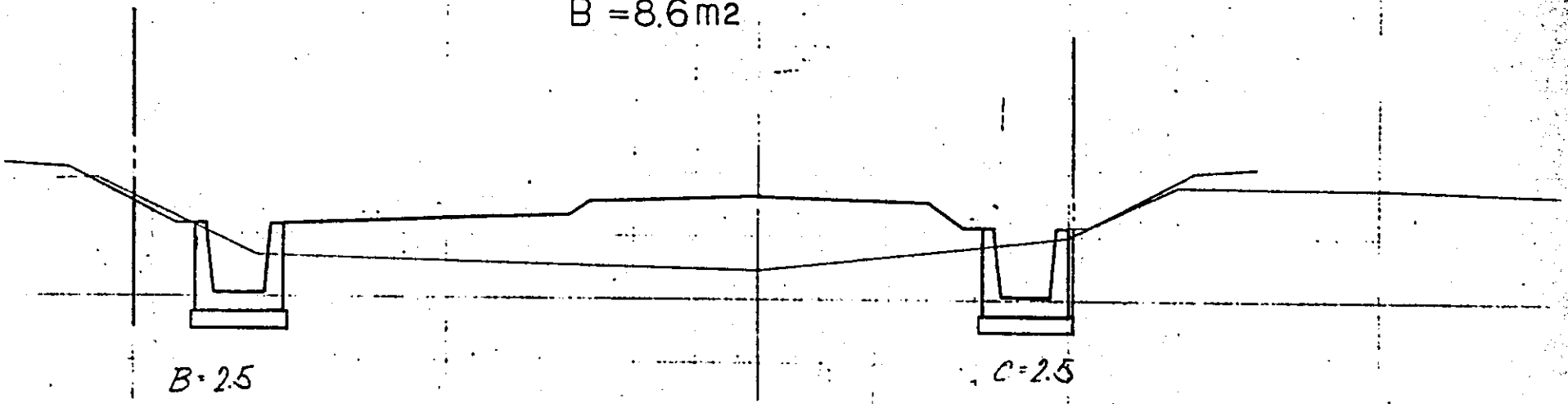
FL=6.48

0Km 550m 00

GH = 5.44

FL = 6.62

B = 8.6 m2

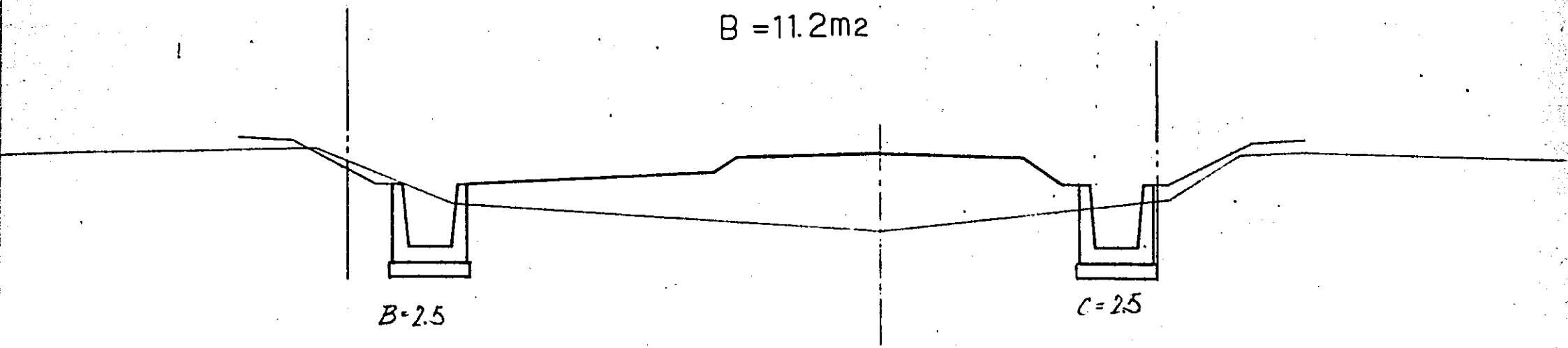


0Km 600m 00

GH = 5.28

FL = 6.72

B = 11.2m2



0Km 550m 00

GH = 5.44

FL = 6.62

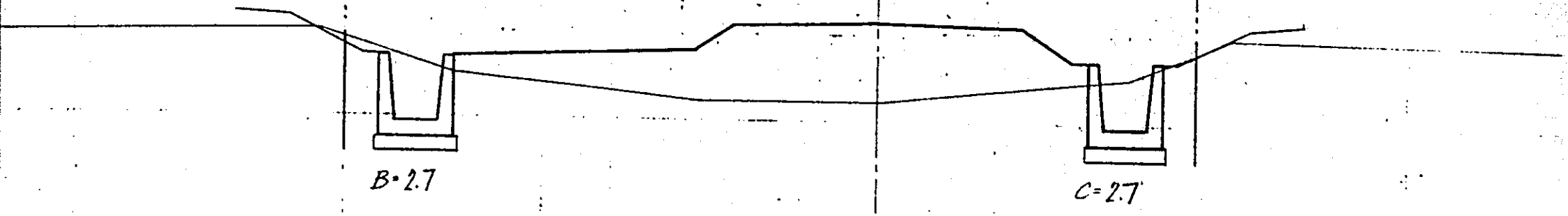
44

0 Km 650 m 00

GH = 5.37

FL = 6.82

B = 11.6 m2



0 Km 600 m 00

GH = 5.28

FL = 6.72

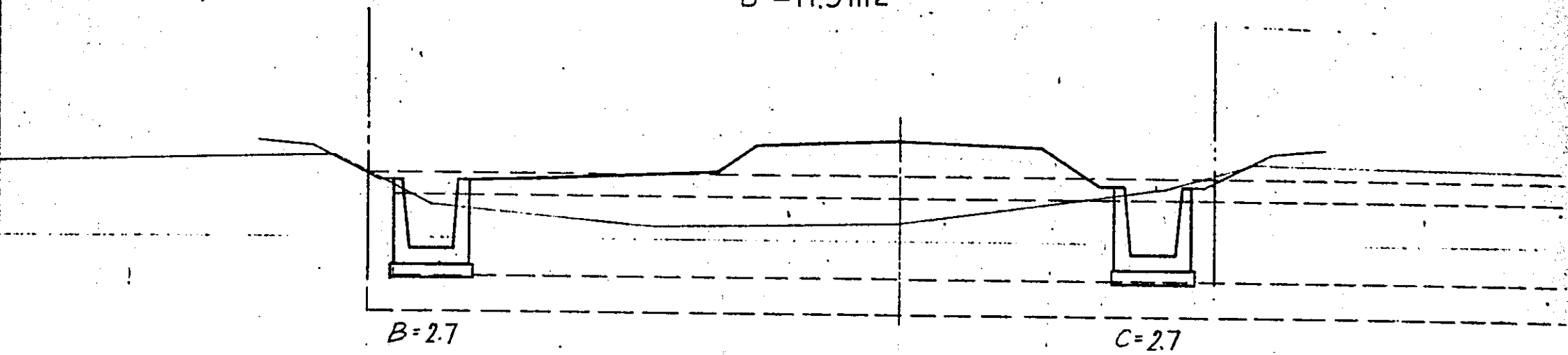
45

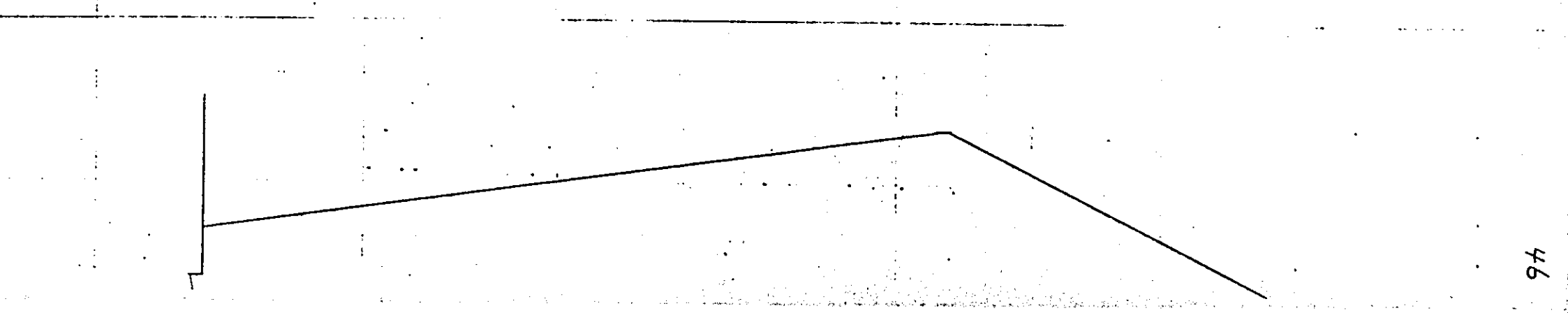
0 Km 700 m 00

GH = 5.34

FL = 6.84

B = 11.9 m2



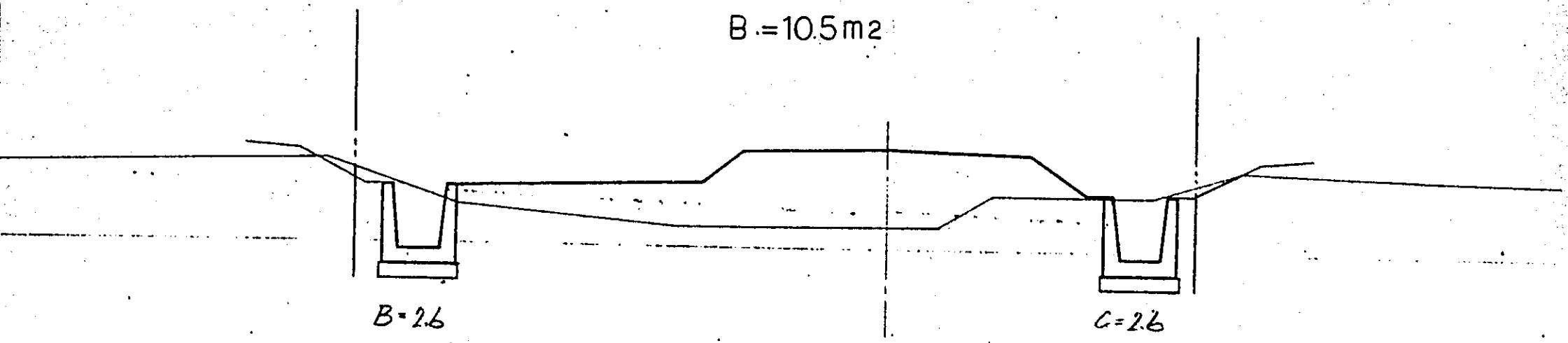


0 Km 750 m 00

GH = 5.43

FL = 6.84

B = 10.5 m 2



0 Km 700 m 00

GH = 5.34

FL = 6.84

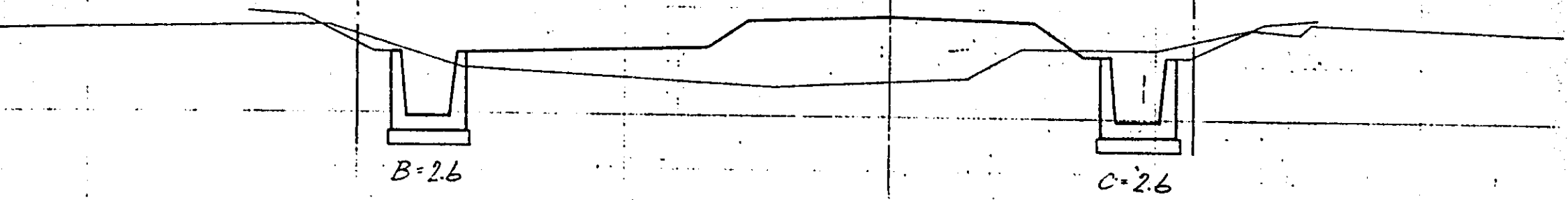
47

0 Km 800 m 00

GH = 5.63

FL = 6.84

B = 8.4 m2



0 Km 750 m 00

GH = 5.43

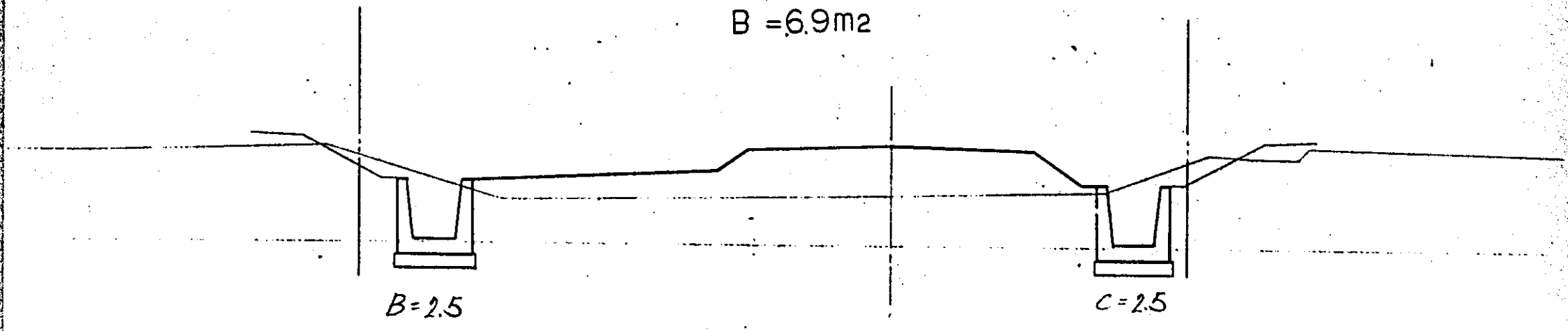
FL = 6.84

0 Km 850 m 00

GH = 5.90

F L = 6.84

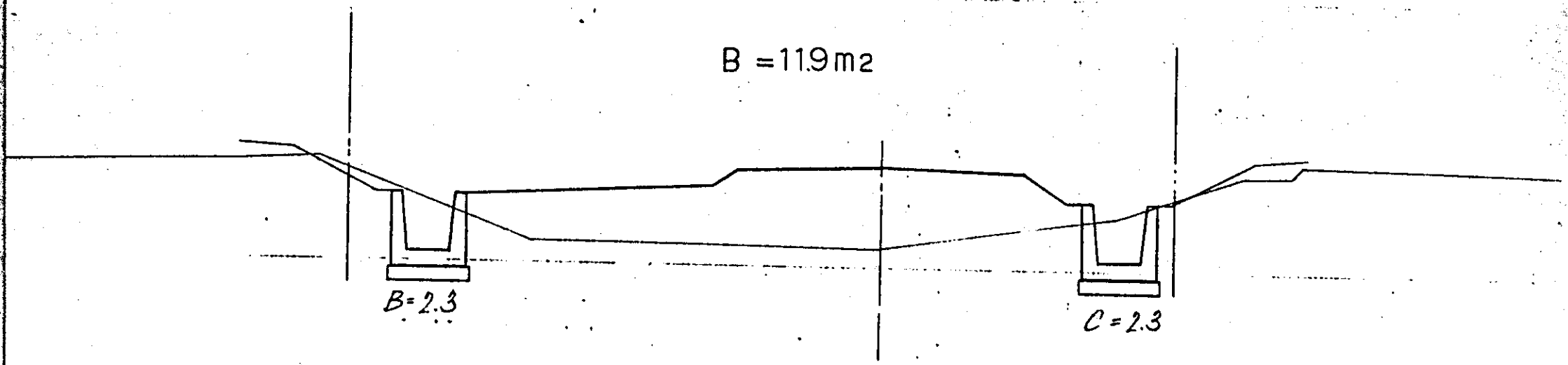
B = 6.9 m2



0 Km 90.0 m 00

GH = 5.38

FL = 6.84



0 Km 850 m 00

GH = 5.90

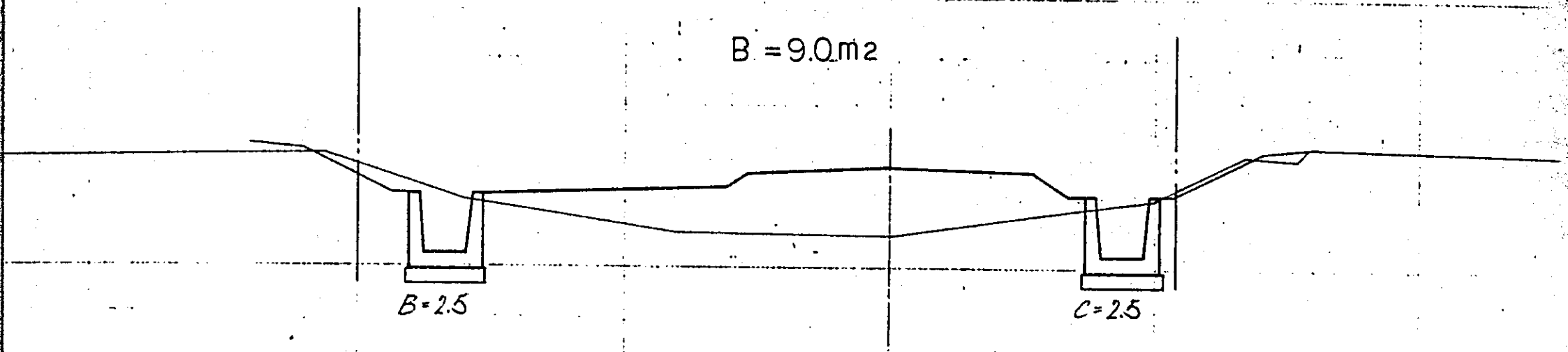
FL = 6.84

0 Km 950 m 00

GH = 5.48

FL = 6.84

B = 9.0 m 2



0 Km 900 m 00

GH = 5.38

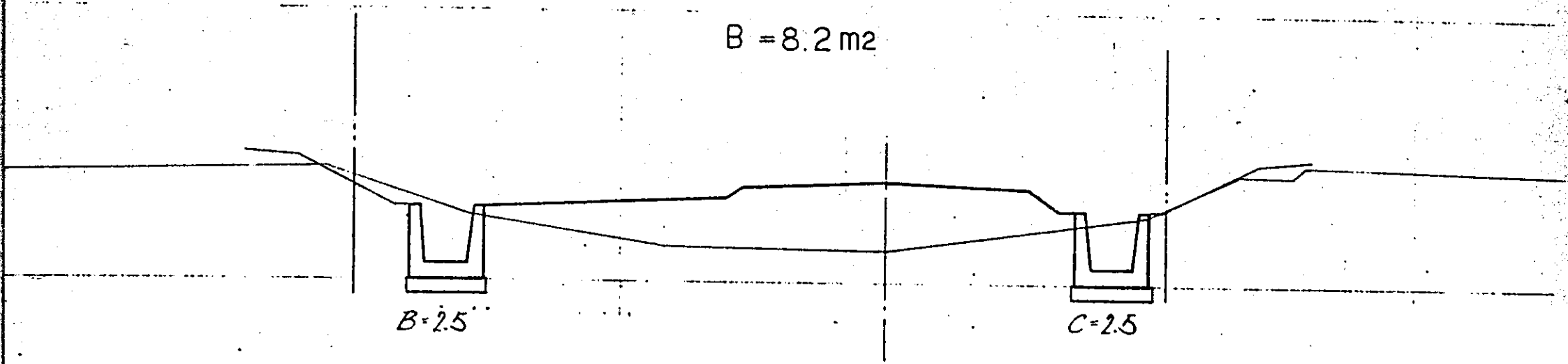
FL = 6.84

1 Km 000 m 00

GH = 5.60

FL = 6.84

B = 8.2 m2

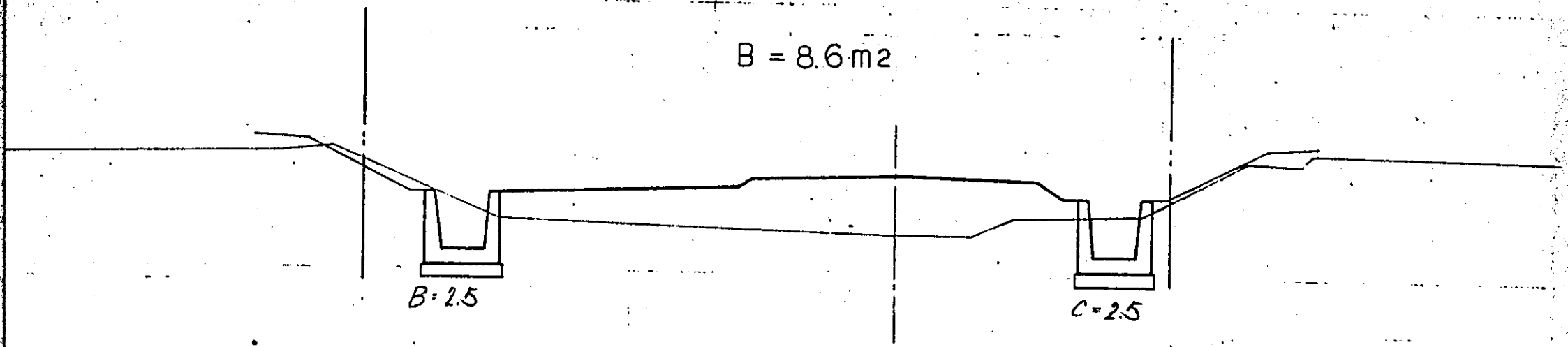


1 Km 050 m 00

GH = 5.73

FL = 6.84

B = 8.6 m2



1 Km 000 m 00

GH = 5.60

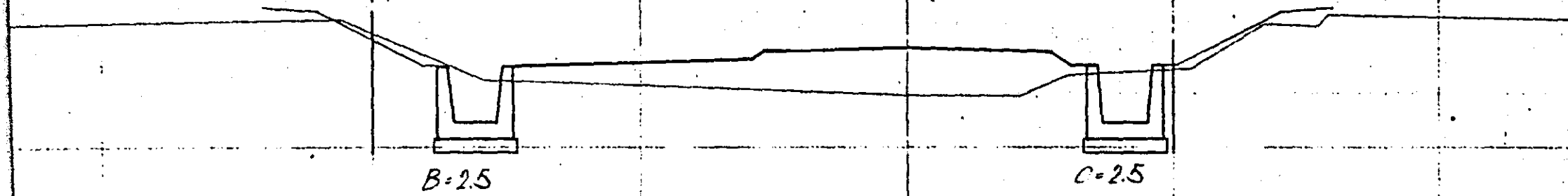
FL = 6.84

1 Km 100 m 00

GH = 5.97

FL = 6.84

B = 6.0 m2



1 Km 050 m 00

GH = 5.73

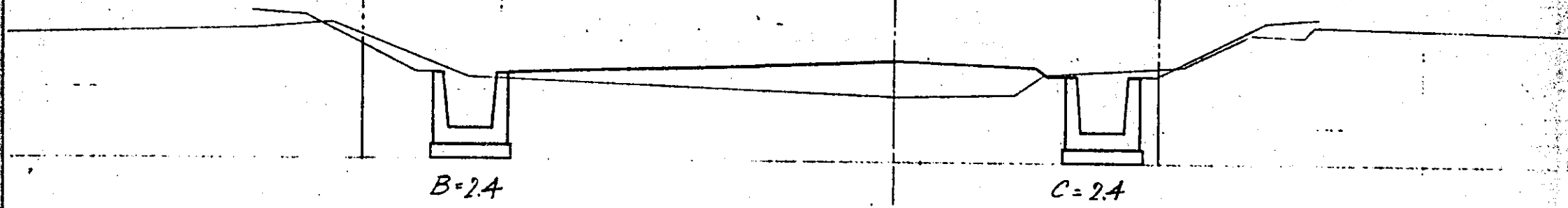
FL = 6.84

1 Km 150 m 00

GH = 6.28

FL = 6.84

B = 4.3 m2

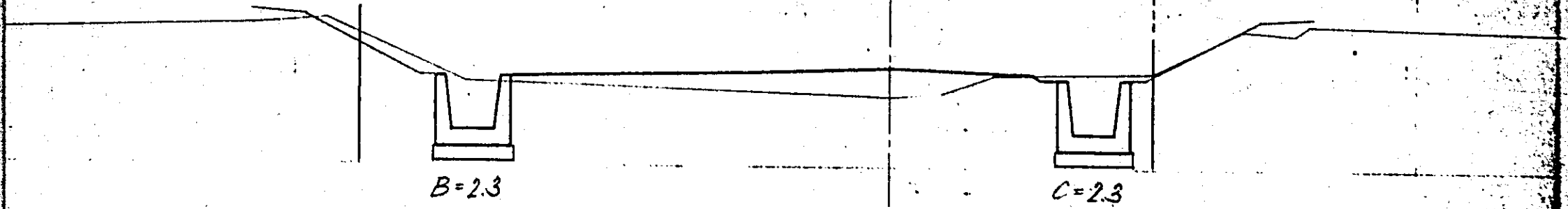


1 Km 200 m 00

GH = 6.30

FL = 6.84

B = 3.1 m2



1 Km 1.50 m 00

GH = 6.28

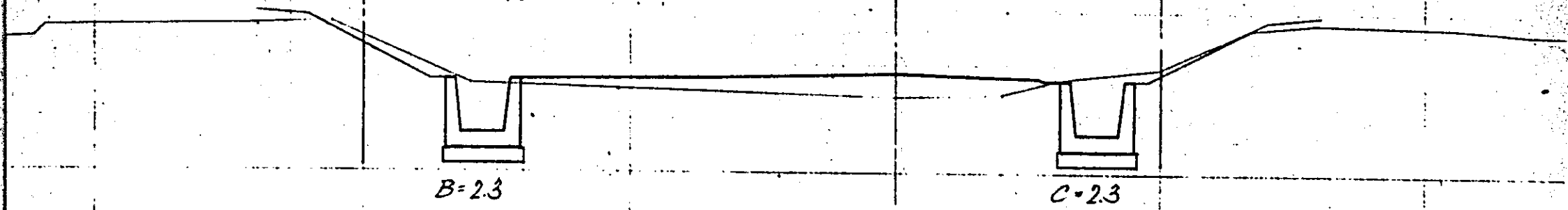
FL = 6.84

1 Km 250 m 00

GH = 6.40

FL = 6.84

B = 3.0 m2



1 Km 200 m 00

GH = 6.30

FL = 6.84

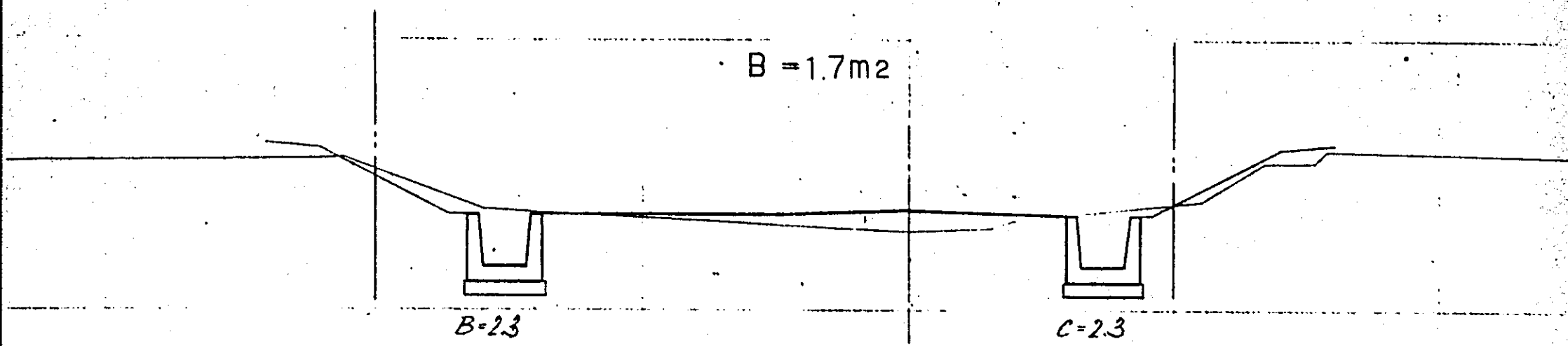
57

1 Km 300 m 00

GH = 6.45

F L = 6.84

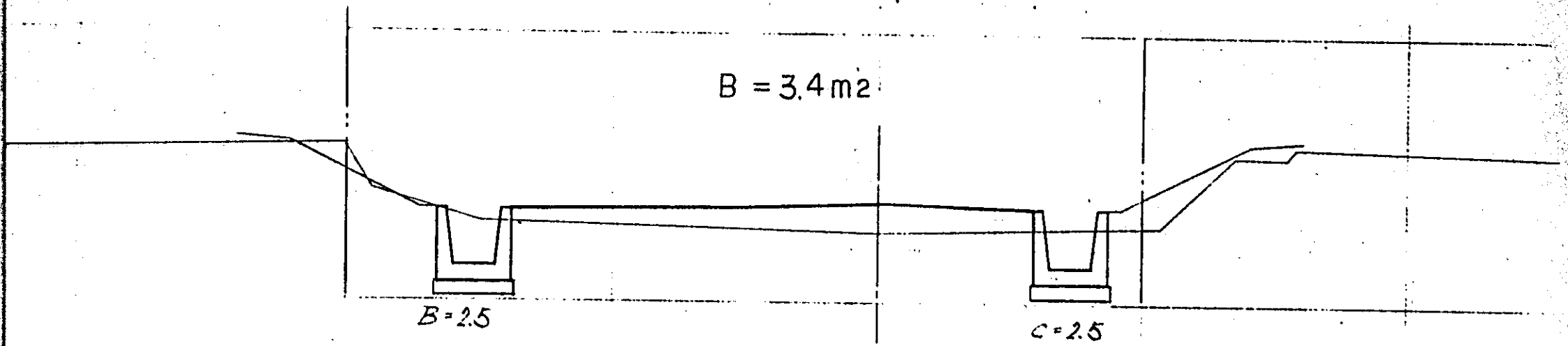
B = 1.7 m2



1 Km 350 m 00

GH = 6.32

FL = 6.84



1 Km 300 m 00

GH = 6.45

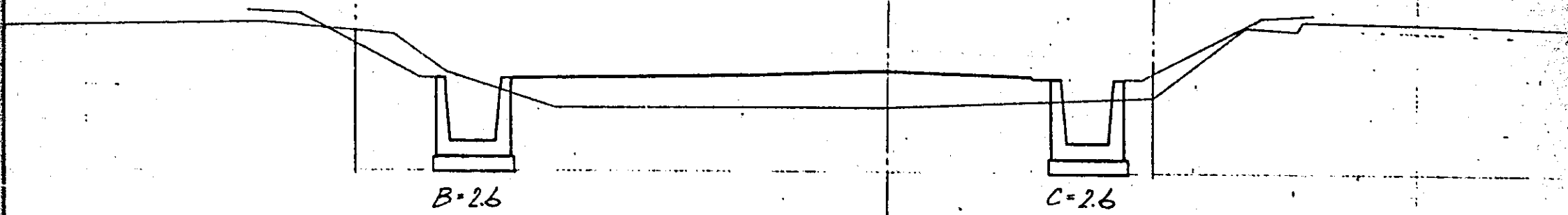
FL = 6.84

1 Km 400 m 00

GH = 6.20

FL = 6.84

B = 5.7 m2



1 Km 350 m 00

GH = 6.32

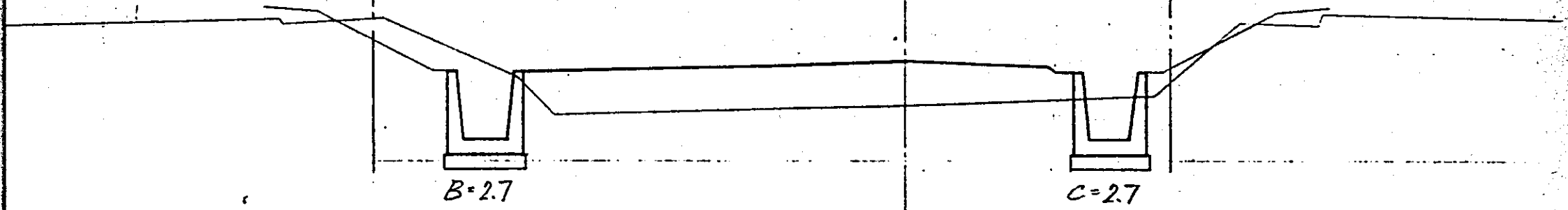
FL = 6.84

1 Km 450 m 00

GH = 6.06

FL = 6.84

B = 7.5 m2

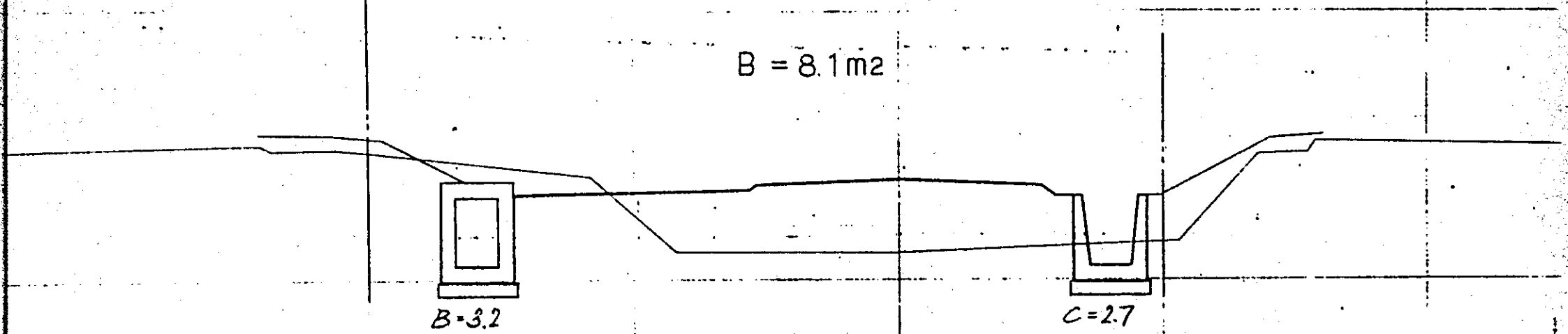


1 Km 500m 00

GH = 5.51

FL = 6.84

B = 8.1 m2



1 Km 450m 00

GH = 6.06

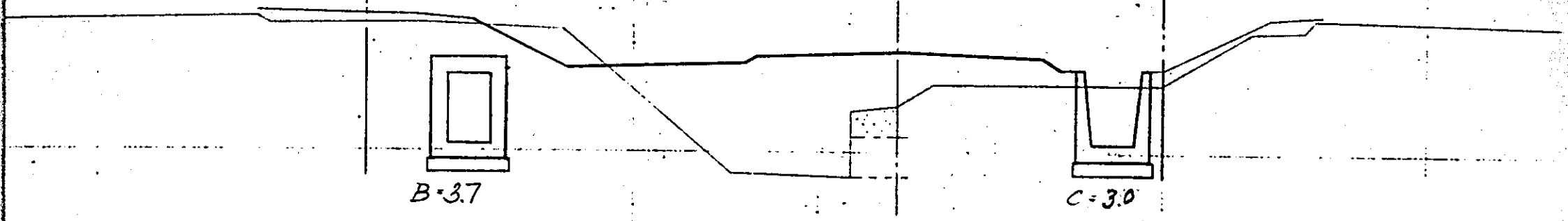
FL = 6.84

1 Km 550m00

GH = 5.86

FL = 6.84

B = 10.3m2



1 Km 500m00

GH = 5.51

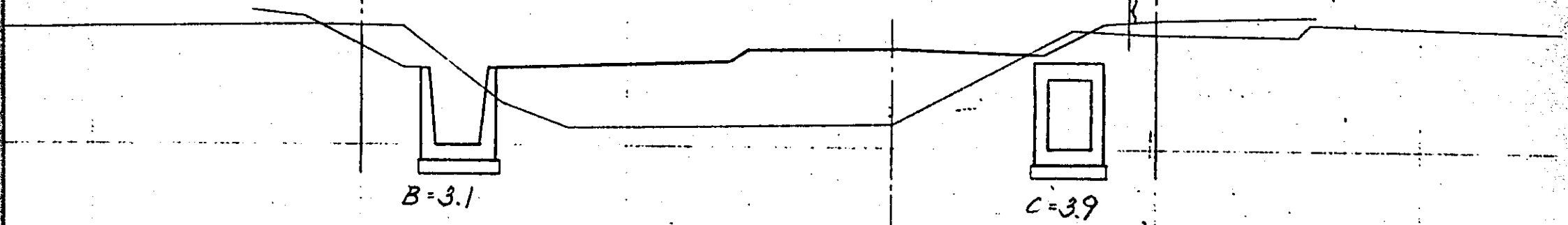
FL = 6.84

1 Km 600 m 00

GH = 5.48

FL = 6.84

B = 10.2 m2



1 Km 571 m 30

GH = 7.33

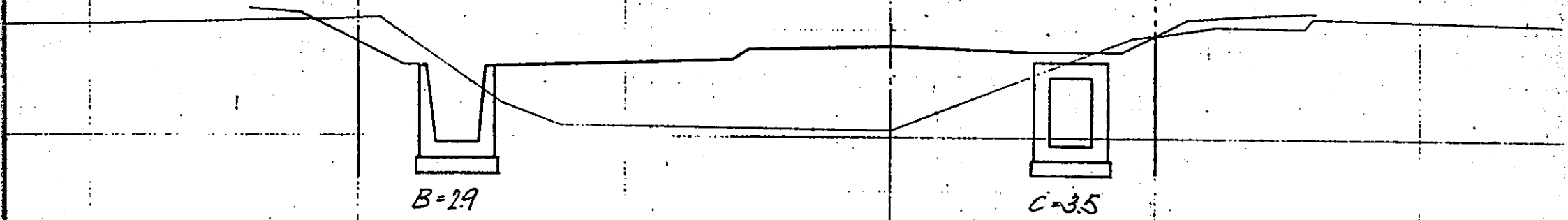
FL = 6.84

1 Km 650 m 00

GH = 5.16

FL = 6.69

B = 11.7 m2



1 Km 600 m 00

GH = 5 48

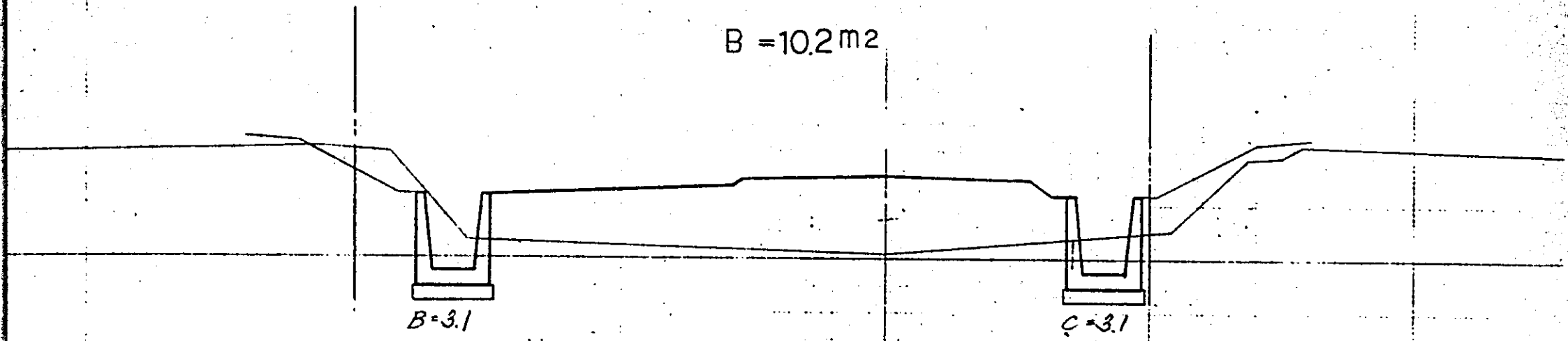
FL = 6.84

i Km 700m00

GH = 5.10

FL = 6.54

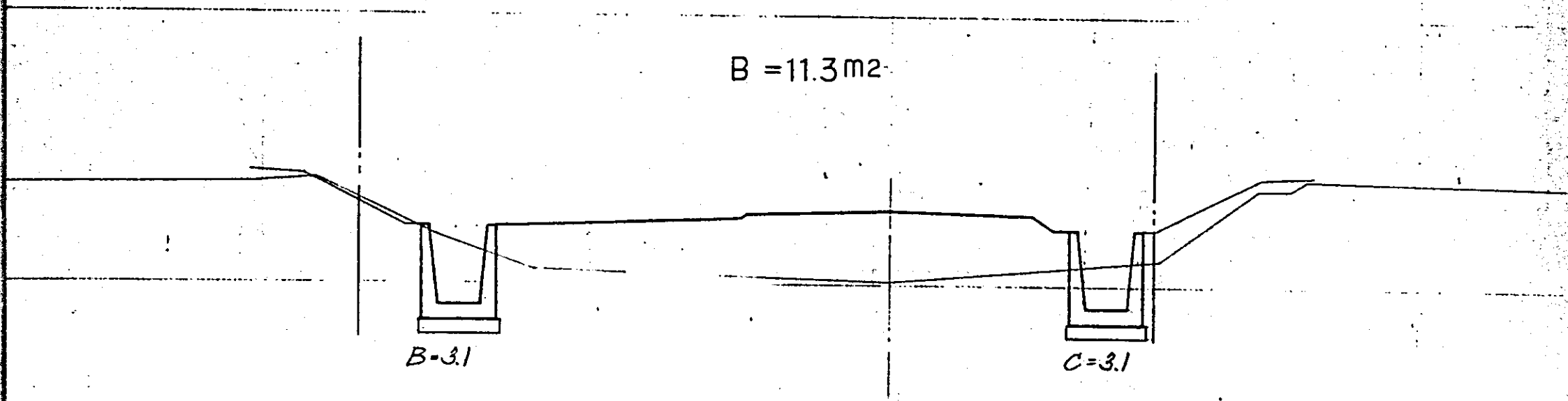
B = 10.2 m2



Km 750 m 00

GH = 5.03

FL = 6.39



Km 700 m 00

GH = 5.10

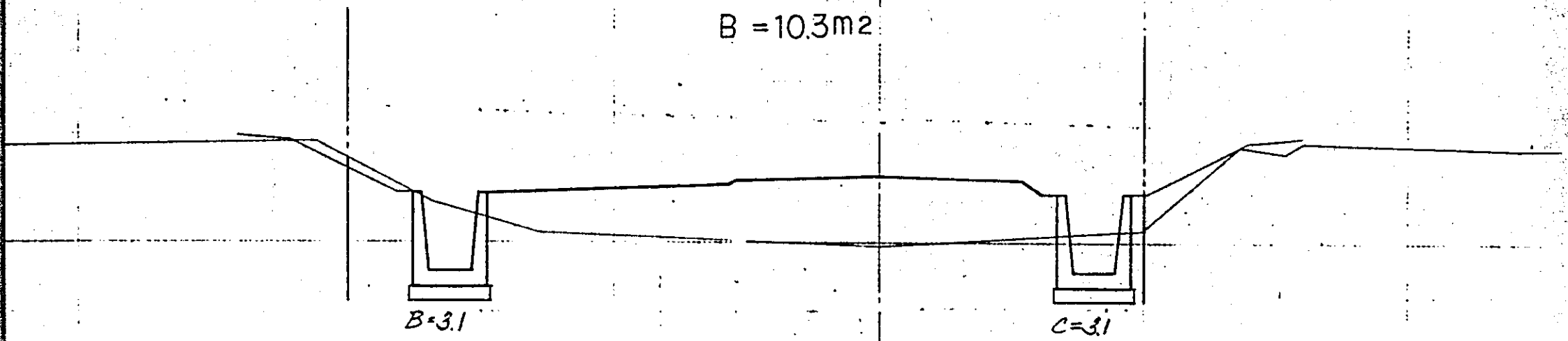
FL = 6.54

1 Km 800 m 00

G H = 4.93

F.L = 6.24

B = 10.3 m2



1 Km 750 m 00

GH = 5.03

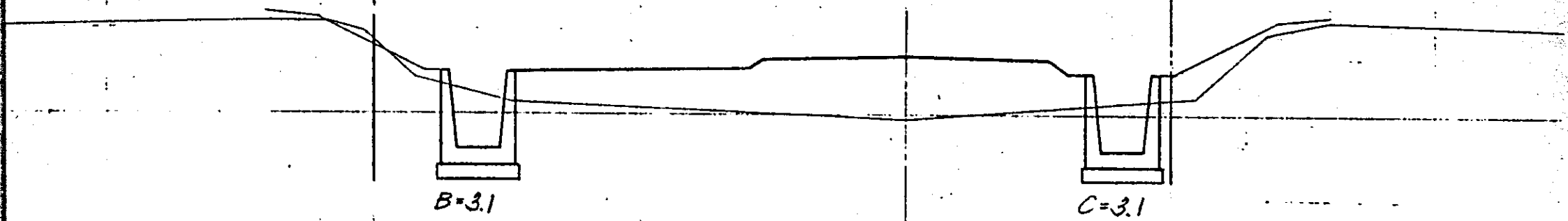
F L = 6.39

1 Km 850 m 00

GH = 4.91

FL = 6.09

B = 9.4 m2

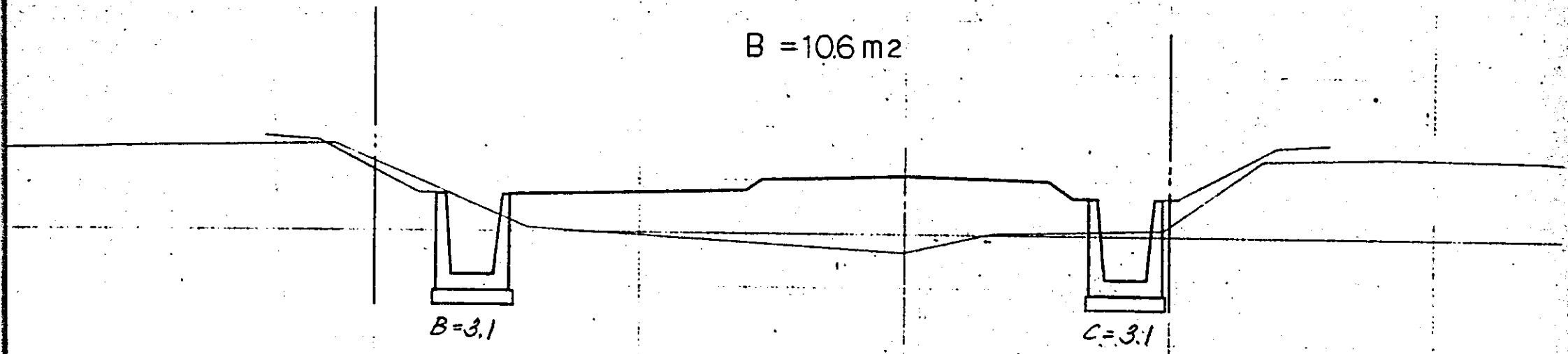


1 Km 900 m 00

GH = 4.64

FL = 6.09

B = 10.6 m2



1 Km 850 m 00

GH = 4.91

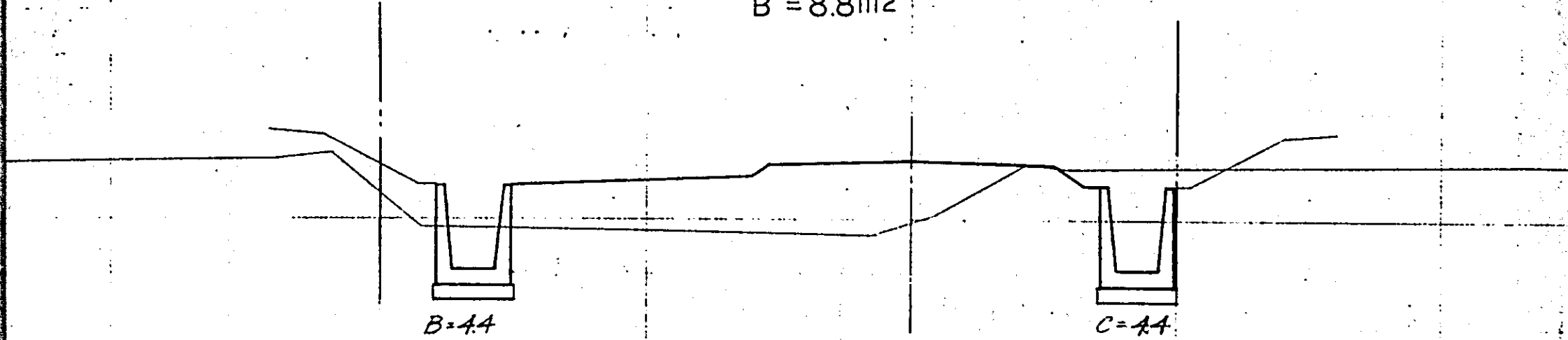
FL = 6.09

1 Km 950m00

GH=4.99

FL=6.09

B = 8.8m2



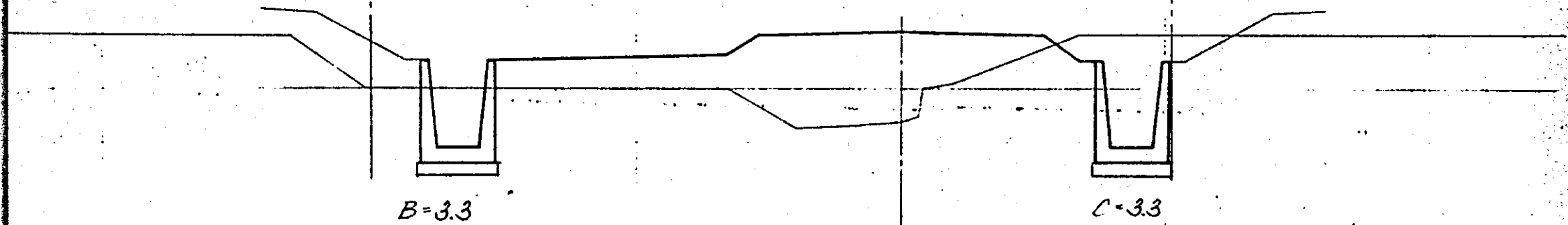
1 Km 900m00

GH=4.64

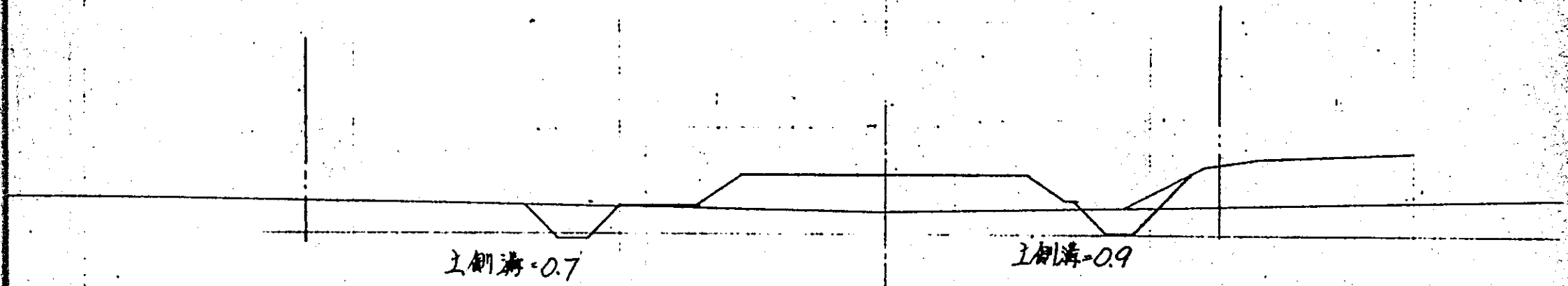
FL=6.09

2km000m00

B = 9.6 m2



2km064m70



2Km 031m 68

GH=5.94

FL=6.09

§ 2. SUBBALLAST AND SANDMAT

SUBBALLAST & SANDMAT

QUANTITY CALUCULATION SHEET

STATION	SUBBALLAST (m3)	SANDMAT (m3)	REMARKS
0Km000m ~ 2Km080m	2,632.3	-	
2Km080m ~2Km824m45	848.7	2,040.6	
2Km824m45 ~ 3Km700m	991.8	4,040.9	
3Km700m ~ 4Km743m	1,582.9	5,896.5	
4Km743m ~ 5Km600m	971.2	3,939.0	
5Km600m ~ 6Km850m	1,476.0	5,850.0	
6Km850m ~ 7Km950m	1,257.4	4,651.9	
7Km950m ~ 8Km950m	1,088.1	4,603.4	
8Km950m ~ 9Km914m27	1,102.0	3,703.9	
9Km914m27 ~ 10Km900m	1,105.3	5,710.9	
10Km900m ~ 11Km950m	1,143.6	4,610.7	
11Km950m ~ 13Km015m89	1,536.5	6,869.5	
13Km015m89 ~13Km397m40	445.1	1,230.5	
14Km815m50 ~ 14Km842m60	54.2	-	
19Km439m60 ~ 19Km490m	56.5	169.6	
TOTAL	16,291.6	53,317.4	

0K000M — 2K080M

1 – 14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST		SANDMAT		REMARKS
		(m²)	(m³)	(m²)	(m³)	
0K000M		2.24				
100	100	2.24	224.0			
100		2.68				
210	110	2.68	294.8			
286	76	1.88	173.3			
314	28.	1.88	52.6			
370	56	1.44	93.0			
408	38	1.08	47.9			
2K 010.15	1602.15	1.08	1730.2			
0647		1.08				
2K 080.	15.3	1.08	16.5			
SUB TOTAL			2632.3			

2K080M ~ 2K824M45 2-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
2 080		1.14		3.3		
080.98	1	"	1.1	3.3	3.3	
100	19	"	21.7	0.7	38.0	
150	50	"	57.0	0.1	20.0	
200	50	"	57.0	0.0	2.5	
250	50	"	57.0	0.2	5.0	
257.69	7.7	"	8.8	0.0	0.8	
287.69	30	1.18	34.8	0.2	3.0	
317.69	30	"	35.4	0.1	4.5	
350	32.3	"	38.1	1.4	24.2	
400	50	"	59.0	4.4	145.0	
450	50	"	59.0	4.8	230.0	
464.69	14.7	"	17.3	4.8	70.6	
						cb 2K466M
467.32	-	1.18	-	4.8	-	
477	9.7	"	11.4	4.8	46.6	
500	23.	"	27.1	4.7	109.3	
550	50	"	59.0	4.5	230.0	
600	50	"	59.0	4.4	222.5	
629.19	29.2	"	34.4	4.5	129.9	
						cb 2K630M50
631.82	-	1.18		4.5		
637.28	5.5	"	6.5	4.5	24.8	
667.28	30	"	35.4	4.1	129.0	
697.28	30	1.14	34.8	3.9	120.0	
700	2.7	"	3.1	3.9	10.5	
750	50	"	57.0	3.9	195.0	
800	50	"	57.0	4.4	207.5	
815.56	15.6	"	17.8	4.4	68.6	
						cb 2K820M
824.45		1.14		4.0		
SUB TOTAL			848.7		2.040.6	

2Km824m45 ~ 3Km700m　　3-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
2 824.45	-	1.14	-	4.0	-	
825	0.6	〃	0.7	4.0	2.4	
850	25	〃	28.5	4.3	103.8	
853.50	3.5	〃	4.0	4.3	15.1	
						cb 2K855M
856.50	-	1.14	-	4.3		
900	43.5	〃	49.6	5.1	204.5	
950	50	〃	57.0	5.1	255.0	
990	40	〃	45.6	2.1	144.0	
3 000	10	〃	11.4	4.5	33.0	
050	50	〃	57.0	4.8	232.5	
100	50	〃	57.0	5.1	247.5	
150	50	〃	57.0	5.0	252.5	
200	50	〃	57.0	3.9	222.5	
250	50	〃	57.0	3.8	192.5	
300	50	〃	57.0	3.5	182.5	
332	32	〃	36.5	3.5	112.0	
〃	-	〃	-	7.5	-	
350	18	〃	20.5	7.5	135.0	
371	21	〃	23.9	7.5	157.5	
〃	-	〃	-	6.1	-	
375	4	〃	4.6	6.1	24.4	
400	25	〃	28.5	5.2	141.3	
450	50	〃	57.0	4.8	250.0	
500	50	〃	57.0	4.6	235.0	
550	50	〃	57.0	4.2	220.0	
598.70	48.7	〃	55.5	4.9	221.6	
						cb 3K600M
601.30	-	1.14	-	4.9	-	
650	48.7	〃	55.5	4.6	231.3	
700	50	〃	57.0	4.4	225.0	
SUB TOTAL			991.8		4.040.9	

3K700M ~ 4K743M.

4-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
3 700		1.14		4.4		
703.16	3.2	〃	3.6	4.4	14.1	
733.16	30	1.18	34.8	4.9	139.5	
763.16	30	〃	35.4	4.4	139.5	
800	36.8	〃	43.4	4.8	169.3	
850	50	〃	59.0	4.8	240.0	
900	50	〃	59.0	4.5	232.5	
943	43	〃	50.7	4.5	193.5	
950	7	〃	8.3	4.5	31.5	
4 000	50	〃	59.0	4.4	222.5	
050	50	〃	59.0	4.7	227.5	
100	50	〃	59.0	4.6	232.5	
122.94	22.9	〃	27.0	4.9	108.8	
152.94	30	〃	35.4	4.8	145.5	
182.94	30	1.14	34.8	4.6	141.0	
200	17.1	〃	19.5	4.6	78.7	
248.70	48.7	〃	55.5	4.8	228.9	
						cb 4K250M
251.30	-	1.14	-	4.8		
300	48.7	〃	55.5	4.6	228.9	
339	39	1.14 2.0	44.5	4.6	179.4	SIGNAL Stn.
350	11	2.0	22.0	6.8	62.7	〃
400	50	〃	100.0	7.0	345.0	〃
450	50	〃	100.0	7.0	350.0	〃
500	50	〃	100.0	6.9	347.5	〃
550	50	〃	100.0	7.1	350.0	
600	50	〃	100.0	7.3	360.0	〃
650	50	〃	100.0	7.3	365.0	〃
700	50	2.4	110.0	8.5	395.0	
743	43	2.6	107.5	8.6	367.7	〃
SUB TOTAL			1,582.9		5,896.5	

4Km743m ~ 5Km600m .

5-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST		SANDMAT		REMARKS
		(m²)	(m³)	(m²)	(m³)	
4 743	-	1.19	-	5.0	-	
748.70	5.7	〃	6.5	5.0	28.5	
						Cb 4K750M
751.30	-	1.14	-	5.0	-	
769.31	13.0	〃	14.8	5.0	65.0	
794.31	30	1.18	34.8	5.4	156.0	
824.31	30	〃	35.4	4.9	154.5	
850	25.7	〃	30.3	4.9	125.9	
900	50	〃	59.0	4.8	242.5	
950	50	〃	59.0	4.9	242.5	
997.05	47.1	〃	55.6	4.9	230.8	
5.000	3.0	〃	3.5	5.0	14.9	
048.70	48.7	〃	57.5	5.0	243.5	
						Cb 5K050M
051.30	-	1.18	-	5.0	-	
100	48.7	〃	57.5	4.9	241.1	
150	50	〃	59.0	4.9	245.0	
169.80	19.8	〃	23.4	4.8	96.0	
199.80	30.	〃	35.4	4.8	144.0	
229.80	30.	1.14	34.8	3.9	130.5	
250	20.2	〃	23.0	3.8	77.8	
300	50.	〃	57.0	4.3	202.5	
325.80	25	〃	28.5	4.1	105.0	
						Cb 5K333M
340.20	-	1.14	-	4.9	-	
350	9.8	〃	11.2	4.9	48.0	
400	50	〃	57.0	4.6	237.5	
450	50	〃	57.0	4.1	217.5	
500	50	〃	57.0	4.5	215.0	
550	50	〃	57.0	4.8	232.5	
600	50	〃	57.0	4.9	242.5	
SUB TOTAL			971.2		3,939.0	

5Km600m ~ 6Km850m

6-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
5 600	50.	1.14	57.0	4.9		
650	50	〃	〃	5.1	250.0	
700	50	〃	〃	4.9	250.0	
750	50	〃	〃	4.9	245.0	
798.70	48.7	〃	55.5	4.9	238.6	
						Cb 5K800M
801.30	-	1.14	-	4.9		
850	48.7	〃	55.5	4.9	238.6	
900	50	〃	57.0	4.9	245.0	
950	〃	〃	〃	4.9	245.0	
6 000	〃	〃	〃	5.1	250.0	
050	〃	〃	〃	4.9	250.0	
100	〃	〃	〃	4.8	242.5	
150	〃	〃	〃	4.9	242.5	
200	〃	〃	〃	4.9	245.0	
250	〃	〃	〃	4.8	242.5	
300	〃	〃	〃	4.8	240.0	
350	〃	〃	〃	4.5	232.5	
398.70	48.7	〃	55.5	4.5	219.2	
						Cb 6K400M
401.30	-	1.14	-	4.5	-	
450	48.7	〃	55.5	3.2	187.5	
500	50	〃	57.0	4.5	192.5	
539	39	〃	44.5	3.7	159.9	
550	11	〃	12.5	4.7	46.2	
600	50	〃	57.0	4.7	235.0	
650	〃	〃	〃	4.8	237.5	
700	〃	〃	〃	4.7	237.5	
750	〃	〃	〃	4.4	227.5	
800	〃	〃	〃	4.5	222.5	
850	〃	〃	〃	4.6	227.5	
SUB TOTAL			1,476.0		5,850.0	

6Km850M ~ 7Km950M

7-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
6 850	-	1.14	-	4.6		
900	50	〃	57.0	4.7	232.5	
948.70	48.7	〃	55.5	4.5	224.0	
						Cb 6K950M
951.30	-	1.14	-	4.5	-	
7 000	48.7	〃	55.5	4.6	221.6	
050	50	〃	57.0	4.7	232.5	
100	50	〃	〃	4.7	235.0	
150	50	〃	〃	4.9	240.0	
200	50	〃	〃	4.5	235.0	
250	50	〃	〃	4.5	225.0	
300	50	〃	〃	4.4	222.5	
350	50	〃	〃	4.4	220.0	
400	50	〃	〃	4.4	220.0	
448.70	48.7	〃	55.5	4.5	216.7	
						Cb 7K450M
451.30	-	1.14	-	4.5	-	
500	48.7	〃	55.5	4.2	211.8	
550	50	〃	57.0	4.1	207.5	
600	50	〃	57.0	4.2	207.5	
626.23	26.2	〃	29.9	3.6	102.2	
656.23	30	1.18	34.8	2.1	85.5	
686.23	30	〃	35.4	4.4	97.5	
700	13.8	〃	16.3	3.7	55.9	
750	50	〃	59.0	3.9	190.0	
800	50	〃	59.0	3.3	180.0	
850	50	〃	59.0	4.1	185.0	
898.70	48.7	〃	57.5	4.2	202.1	
						Cb 7K900M
901.30	-	1.18	-	4.2	-	
950	48.7	〃	57.5	4.1	202.1	
SUB TOTAL			1,257.4		4651.9	

7km950m ~ 8km950m

8-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST		SANDMAT		REMARKS
		(m²)	(m³)	(m²)	(m³)	
7 950	-	1.18	-	4.1	-	
8 000	50	〃	59.0	4.0	202.5	
014 58	14.6	〃	17.2	4.0	58.4	
050	35.4	〃	41.8	4.0	141.6	
100	50	〃	59.0	4.1	202.5	
150	50	〃	59.0	3.9	200.0	
200	50	〃	59.0	3.8	192.5	
250	50	〃	59.0	3.7	187.5	
298.70	48.7	〃	57.5	4.2	192.4	
						Cb 8K300m
301.30	-	1.18	-	4.2	-	
342.93	41.6	〃	49.1	4.5	181.0	
372.93	30	〃	35.4	5.1	144.0	
402.93	30	1.14	34.8	5.5	159.0	
450	47.1	〃	53.7	6.2	275.5	
500	50	〃	57.0	6.2	310.0	
527	27	〃	30.8	6.2	167.4	
531.39	4.4	〃	5.0	1.4	16.7	
						Cb 8K535m50
539.62	-	1.14	-	0.0	-	
542	2.4	〃	2.7	0.0	0.0	
550	8	〃	9.1	5.1	20.4	
600	50	〃	57.0	5.8	272.5	
650	50	〃	〃	5.8	290.0	
700	50	〃	〃	5.7	287.5	
750	50	〃	〃	3.9	240.0	
800	50	〃	〃	2.9	170.0	
810	10	〃	11.4	2.9	29.0	
850	40	〃	45.6	5.0	158.0	
900	50	〃	57.0	5.3	257.5	
950	50	〃	57.0	4.6	247.5	
			1,088.1		4,603.4	

8Km950m ~ 9Km914m27 — 9-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
8 950	-	1.14	-	4.6	-	
951.88	1.9	〃	2.2	4.6	8.7	
						cb 8K955M
958.12	-	1.14	-	4.6	-	
9 000	41.9	〃	47.8	4.3	186.5	
050	50	〃	57.0	4.3	215.0	
100	50	〃	〃	4.4	217.5	
150	50	〃	〃	4.5	222.5	
200	50	〃	〃	4.8	232.5	
250	50	〃	〃	4.9	242.5	
300	50	〃	〃	4.7	240.0	
350	50	〃	〃	4.2	222.5	
398.70	48.7	〃	55.5	4.3	207.0	
						cb 9K400M
401.30	-	1.14	-	4.3		
450	48.7	〃	55.5	4.4	211.8	
493.52	43.5	〃	49.6	2.3	145.7	
523.52	30	1.18	34.8	1.0	49.5	
553.52	30	〃	35.4	0.0	15.0	
600	46.5	〃	54.9	0.1	2.3	
650	50	〃	59.0	4.4	112.5	
700	50	〃	59.0	4.4	220.0	
703.90	3.9	〃	4.6	4.4	17.2	
750	46.1	〃	54.4	4.1	195.9	
798.70	48.7	〃	57.5	4.6	211.8	
						cb 9K800M
801.30	-	1.18	-	4.6	-	
850	48.7	〃	57.5	4.6	224.0	
854.27	4.3	〃	5.1	4.7	20.0	
884.27	30	〃	35.4	4.7	141.0	
914.27	30	1.14	34.8	4.8	142.5	
			1,102.0		3,703.9	

9K-914M-27 ~ 10K-900M

10-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
9 914 27	-	1.14	-	4.8		
950	35.7	〃	40.7	4.9	173.1	
10 000	50	〃	57.0	5.0	247.5	
050	50	〃	〃	5.3	257.5	
100	50	〃	〃	5.6	272.5	
150	50	〃	〃	5.9	287.5	
200	50	〃	〃	6.1	300.0	
250	50	〃	〃	5.1	280.0	
298.60	48.6	〃	55.9	6.1	272.2	
						Cb 10K300M
301.40	-	1.14	-	6.1	-	
350	48.6	〃	55.9	5.8	289.2	
400	50	〃	57.0	5.9	292.5	
449	49	〃	55.9	5.4	276.9	
						Cb 10K452M50
456.01	-	1.14	-	5.4	-	
500	44.	〃	50.2	5.8	246.4	
550	50	〃	57	5.6	285.0	
600	50	〃	57	6.0	290.0	
624 70	24.7	〃	28.2	6.0	148.2	
						Cb 10K626M
627 30	-	1.14	-	6.0		
650	22.7	〃	25.9	6.0	136.2	
700	50	〃	57.0	6.1	302.5	
750	50	〃	57.0	6.2	307.5	
774.62	24.6	〃	28.0	6.2	152.5	
						Cb 10K776M50
778.39	-	1.14	-	7.0	-	
800	21.6	〃	24.6	7.0	151.2	
850	50	〃	57.0	7.4	360.0	
900	50	〃	57.0	7.9	382.5	
SUB TOTAL			1,105.3		5,710.9	

10Km 900m ~ 11K+950m

11-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
10 900	-	1.14	-	7.9		
950	50	〃	57.0	6.8	367.5	
971	21	〃	23.9	6.2	136.5	
975 80	4.8	〃	5.5	6.2	29.8	
		10.2+2.7+0.2+2.2	11.0			B 11K019m
11 062 20	-	1.14	-	7.2		
100	37.8	〃	43.1	5.6	241.9	
150	50	〃	57.0	5.6	280.0	
188 60	38.6	〃	44.0	7.8	258.6	
						cb
191 40	-	1.14	-	7.8	-	
200	8.6	〃	9.8	7.8	67.1	
240	40	〃	45.6	7.8	312.0	
250	10	〃	11.4	5.0	69.0	
300	50	〃	57.0	4.4	235.0	
350	50	〃	〃	0.6	125.0	
400	50	〃	〃	3.1	92.5	
450	50	〃	〃	3.3	160.0	
500	50	〃	〃	5.6	232.5	
550	50	〃	〃	5.2	270.0	
600	50	〃	〃	5.2	260.0	
605.61	5.6	〃	6.4	5.2	29.1	
						cb 11K607m
608 39	-	1.14	-	5.2	-	
650	41.6	〃	47.4	5.7	226.7	
700	50	〃	57.0	3.3	225.0	
750	50	〃	〃	3.3	165.0	
800	50	〃	〃	2.7	150.0	
850	50	〃	〃	3.8	162.5	
900	50	1.14 1.9	〃	4.3 6.3	202.5	
950	50	2.0	97.5	6.8	327.5	
			1,143.6		4,610.7	

11Km950m ~ 13Km015m89

12-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
11 950		2.0		6.8		
12 000	50	1.9	97.5	7.8	365.0	
050	50	2.0	97.5	8.9	417.5	
100	50	2.0	100.0	8.5	435.0	
150	50	2.0	100.0	8.6	427.5	
200	50	2.0	100.0	8.6	430.0	
250	50	2.3	107.5	9.0	440.0	
300	50	2.5	120.0	10.3	482.5	
303	3	2.5	7.5	10.3	30.9	
"	-	1.14	-	4.1	-	
328.60	25.6	"	29.2	4.1	105.0	
						Cb 12K330M
331.40	-	1.14	-	4.1		
350	18.6	"	21.2	4.1	76.3	
400	50	"	57.0	4.1	205.0	
427	27	"	30.8	5.1	124.2	
450	23	"	26.2	5.1	117.3	
500	50	"	57.0	5.9	275.0	
550	50	"	"	6.0	297.5	
600	50	"	"	6.8	320.0	
650	50	"	"	6.0	320.0	
700	50	"	"	5.7	292.5	
750	50	"	"	5.6	282.5	
798.70	48.7	"	55.5	5.7	275.2	
						Cb 12K800M
801 30	-	1.14	-	5.7	-	
850	48.7	"	55.5	5.8	280.0	
900	50	"	57.0	5.9	292.5	
950	50	"	"	5.2	277.5	
13 000	50	"	"	3.9	227.5	
015.89	15.9	"	18.1	5.3	73.1	
			1536.5		6.869.5	

JICA

13Km015M89 ~ 13Km397M40
14Km815M50 ~ 14Km842M60

13-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
13 015.89		1.14		5.3		
045.89	30	1.18	34.8	5.3	159.0	
075.89	30	〃	35.4	5.2	157.5	
090.53	14.6	〃	17.2	4.7	72.3	
100	9.5	〃	11.2	3.9	40.9	
105.17	5.2	〃	6.1	3.8	20.0	
135.17	30	〃	35.4	2.6	96.0	
165.17	30	1.19	34.8	2.0	69.0	
200	34.8	〃	39.7	2.9	85.3	
250	50	〃	57.0	0.1	75.0	
300	50	〃	57.0	3.5	90.0	
315	15	〃	17.1	3.3	51.0	
350	35	〃	39.9	3.5	119.0	
390.70	40.7	〃	46.4	4.3	158.7	
396.20	5.5	1.9	8.4	6.3	29.2	
397.40	1.2	〃	2.3	6.3	7.6	
		10.2×1.2×0.2=	2.4			
SUB TOTAL			445.1		1,230.5	
14 815.5	-	10.2×0.2 = 2.0	-	-	-	
14 842.6	27.1	2.0	54.2	-	-	
SUB TOTAL			54.2		-	

19Km439m60 ~ 19Km490m　　14-14

KILOMETER (km m)	DISTANCE (m)	SUBBALLAST (m²)	SUBBALLAST (m³)	SANDMAT (m²)	SANDMAT (m³)	REMARKS
19 439 60		4.7+1.2 ×0.2= 1.1	1.1	3.8		
450	10.4	〃	11.4	3.6	38.5	
476.31	26.3	〃	28.9	3.3	90.7	
490.	13.7	〃	15.1	2.6	40.4	
SUBTOTAL			56.5		169.6	

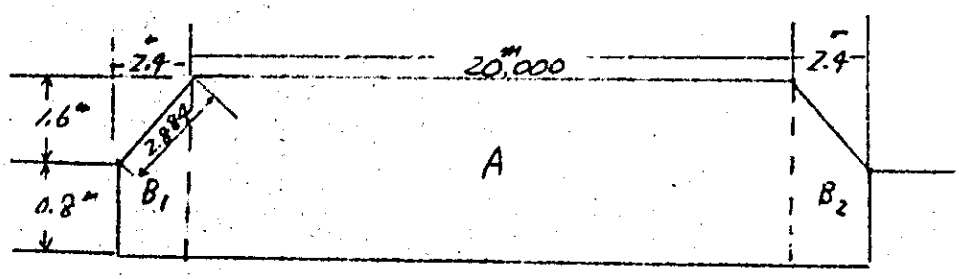
§ 3. RETAINING WALL

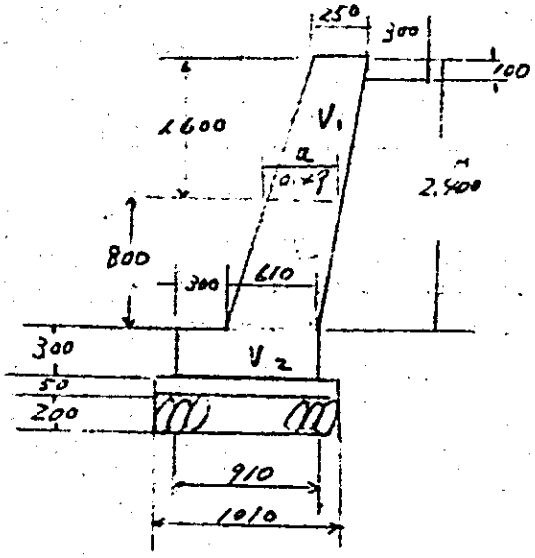
RETAINING WALL CONCRETE

	(1) SEMI-GRAVITY TYPE FOR SIGNAL Stn	(2) RETAING WALL FOR STOP	(3) BOX CULVERT OF ENGINE ENTRANCE	TOTAL
CONCRETE (CLASS E)	31 m³	16.2 m³		47.2 m³
LEVEE CROWN CONCRETE (CLASS E)	0.8 m³			0.8 m³
CONCRETE (CLASS F)	1.3 m³			1.3 m³
BUS BALLAST (ASB-3)	5.0 m³	2.9 m³		7.9 m³
BACK FILL	10.8 m³			10.8 m³
FOM ARER	133.7 m²	67.3 m²	18 m²	219.0 m²
CONCRETE (CLASS D)			1.4 m³	1.4 m³

II. RETAINING WALL

(1) SEMI-GRAVITY TYPE FOR SIGNAL STATION AT STA. 0K 200 m





$$a = 0.25 + \left(\frac{0.61 - 0.25}{2.4} \times 1.6\right) = 0.49$$

1) A. CONCRETE VOLUME

$$V_1 = \frac{(0.25 + 0.61)}{2} \times 2.4 \times 20 = 20.64\ m^3$$

$$V_2 = 0.91 \times 0.3 \times 20 = 5.46$$

$$V_1 + V_2 = 20.64 + 5.46 = 26.10\ m^3$$

B1 CONCRETE VOLUME

$$V_3 = \left[\left(\frac{0.25 + 0.61}{2}\right) \times 2.4\right] + \left[\left(\frac{0.49 - 0.01}{2}\right) \times 0.8\right] \times \frac{1}{2} \times 2.4 = 1.7664\ m^3$$

B2 $V_4 = V_3 = 1.7664\ m^3$

$$V_5 = 0.3 \times 0.91 \times 2.4 \times 2 = 1.3104$$

TOTAL CONCRETE VOLUME CLASS E

$$\Sigma V = V_1 + V_2 + V_3 + V_4 + V_5$$

$$= 20.64 + 5.46 + 1.77 + 1.77 + 1.31$$

$$= 30.95$$ $31\ m^3$

2) LEVEE CROWN CONCRETE CLASS E

$$V = 0.3 \times 0.1 \times (20 + 2.9 + 2.9)$$

$$= 0.774$$ $0.8\ m^3$

3) CONCRETE CLASS F

$$V = 1.01 \times (20 + 2.5 + 2.5) \times 0.05 = 1.2624\ m^3$$ $1.3\ m^3$

4) BUS BALLAST (ASB-3)

$$V = 1.01 \times (20 + 2.5 + 2.5) \times 0.2 = 5.05\ m^3$$ $5.0\ m^3$

5) BACK FILL

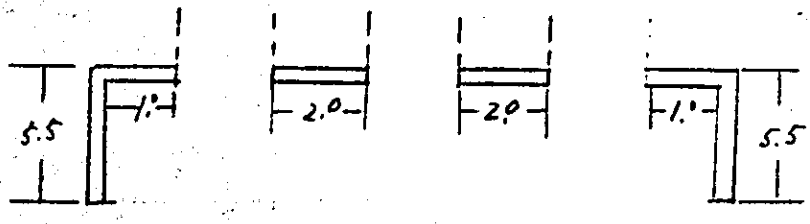
$$V = 0.3 \times 1.6 \times \left(20 + \frac{24 + 24}{2}\right) = 10.752\ m^3$$ $10.8\ m^3$

6) FOM ARER

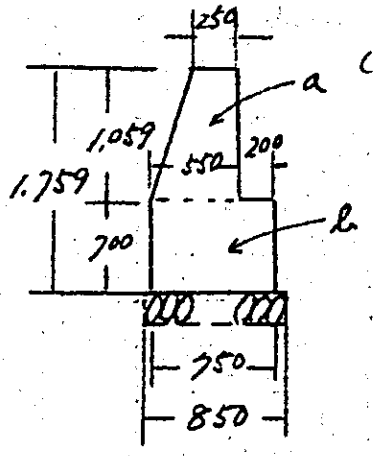
$$\left(\frac{20 + 24.8}{2}\right) \times 1.6 + (0.8 \times 24.8) + (0.3 \times 24.8)$$

$$\times 2 + (0.3 \times 24.8) = 63.12 \times 2 + 7.44 = 133.68$$ $133.7\ m^2$

(2) RETAINING WALL FOR BUFFER STOP



$$\ell = 5.5 + 1 + 2.0 + 2.0 + 1. + 5.5 = 17^{m}$$



(1) SECTION AREA

$$A = a + b = \left(\frac{0.25 + 0.55}{2} \times 1.059\right)$$

$$+ (0.75 \times 0.7) = 0.4236 + 0.525$$

$$= 0.9486 \fallingdotseq 0.95\ m^2$$

(2) CONCRETE VOLUME (CLASS E)

$$V = 0.95 \times 17 = 16.15\ m^3$$

$16.2\ m^3$

(3) SUB BALLAST (ASB-3)

$$V = 0.85 \times 0.2 \times 17 = 2.89\ m^3$$

$2.9\ m^3$

(4) FOM ARER

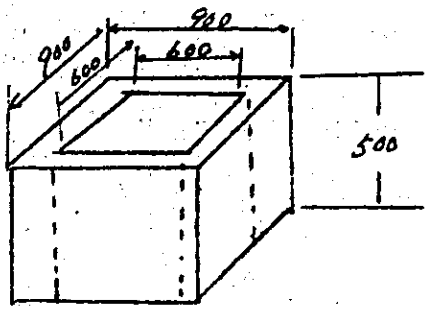
$$(1.759 \times 7) + (2 \times 17) + (0.2 \times 17)$$

$$= 67.303\ m^2$$

$67.3\ m^2$

(3) BOX CULVERT OF ENGINE ENTRANCE WALL

NO 6



(1) CONCRETE VOLUME (CLASS O)

$V = (0.90^2 - 0.6^2) \times 0.5 \times 6 = 1.35\ m^3$ 1.4 m^3

(2) IRON PLATE WEIGHT

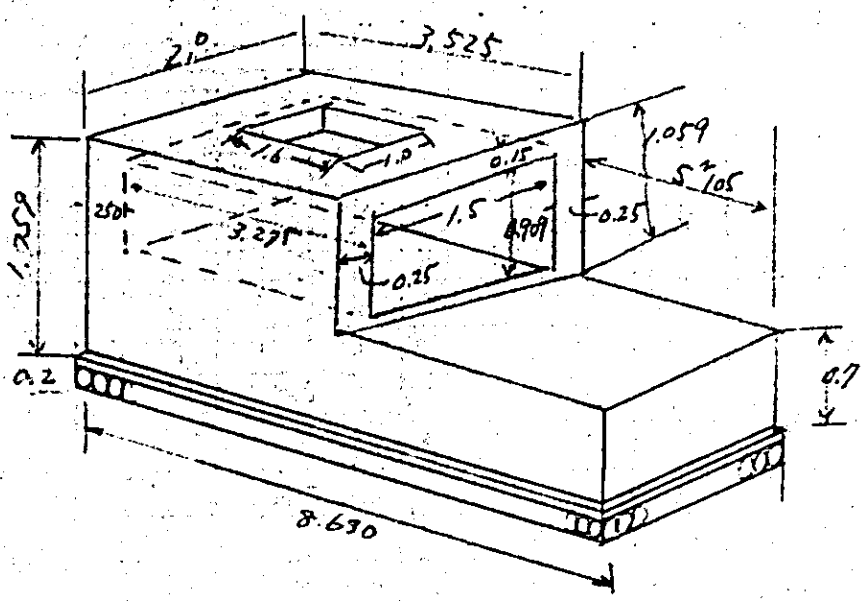
$W = (0.9^2 \times 0.01) \times 6 \times 7.4 = 0.3596\ t$ 360 kg

3. FOM ARER

$A = (0.9 \times 0.5 \times 4) + (0.6 \times 0.5 \times 4) \times 6$

$= 3.0\ m^2 \times 6 = 18\ m^2$ 18 m^2

(3 PLACE)



CONCRETE

$$V = (2.0 \times 8.630 \times 1.759) - [(5.105 \times 2.0 \times 1.059) + (1.5 \times 0.909 \times 3.275) + (1.6 \times 1.0 \times 0.15)] =$$

$$30.3603 - (10.812 + 4.466 + 0.24) = 14.842 \fallingdotseq 14.8\ m^3$$

BOULDER

$$V = [(5.155 \times 2.1) + (2.0 \times 3.525)] \times 0.2 = 3.5751 \fallingdotseq 3.6\ m^3$$

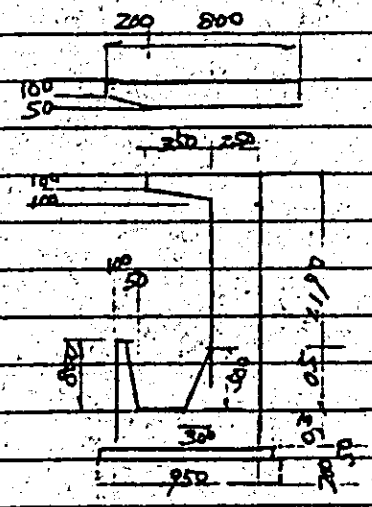
LEVELING CONCRETE $V = [(5.155 \times 2.1) + (2.0 \times 3.525)] \times 0.05 = 0.8938 \fallingdotseq 0.9\ m^3$

REINFORCING BAR $V = 40\ kg/m^3$ $V = 16.7\ m^3 \times 40\ kg = 668\ kg$

TOTAL

CONCRETE	15.1 × 3 =	45.3 m^3
BOULDER	3.6 × 3 =	10.8 m^3
REINFORCED BAR	668 × 3 =	2,004 $kg \fallingdotseq 2\ t$
LEVELING CONCRETE	0.9 × 3 =	2.7 m^3

RETAINING WALL OF PLATFORM



CONCRETE OF COVER

$V = 0.8 \times 0.15 + \frac{0.1+0.15}{2} \times 0.2$

$= 0.12 + 0.025$

$= 0.123 \quad \times 200 = 24.6\ m^3$

CONCRETE

$V = 0.25 \times 1.69 + \frac{0.1+0.2}{2} \times 0.35 + 0.3 \times 0.5 \times \frac{1}{2} + \frac{0.1+0.15}{2} \times 0.8 + 0.85 \times 0.3$

$= 0.936 \quad \times 200 = 187.2\ m^3$

LEVELING CONCRETE

$V = 1.05 \times 0.05$

$= 0.053 \quad \times 200 = 10.6\ m^3$

BOULDER

$V = 1.03 \times 0.2$

$= 0.206 \quad \times 200 = 41.2\ m^3$

FORM

COVER $A = 1 + 0.1 + 0.15$

$= 1.25 \quad \times 200 = 250\ m^2$

$A = 1.1 + 0.8 + 1.69 + 0.35 + 1.99$

$= 5.93 \quad \times 200 = 1186\ m^2$

	COVER	FANDATION CONCRETE OF BUFFER STOP	TOTAL
CONCRETE	24.6	$187.2 \quad 55.6$	$236.4\ m^3$
LEVELING CONCRETE	-	10.6 -	$10.6\ m^3$
BOULDER	-	$41.2 \quad 13.3$	$54.5\ m^3$
FORM	$(250 + 1186) \div (24.6 + 187.2) =$		$6.8\ m^2/m^3$
REINFOCED BAR	$11.219^{kg} \div (24.6 + 187.2) =$		$53^{kg}/m^3$
EXCUVATION	$1.050 \times 1.00 \times 200 =$		210.00

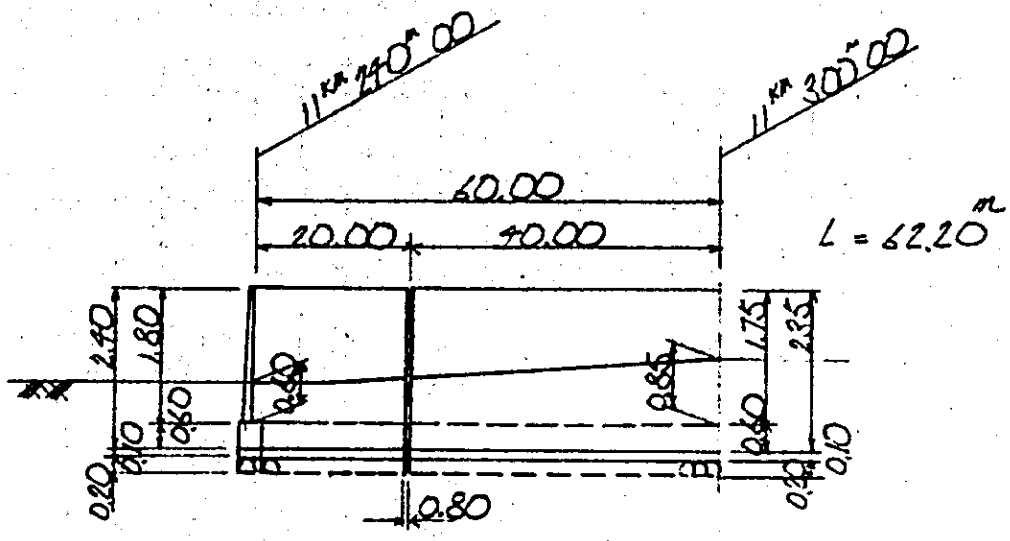
GRAVITY TYPE RETAINING WALL FOR EMBANKMENT

QUANTITY CALCULATION SHEET

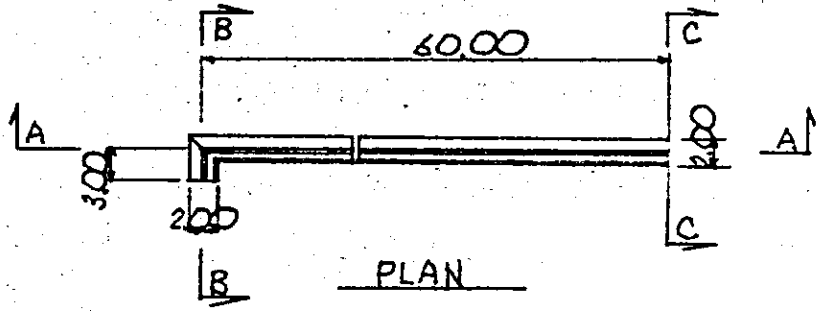
STATION	CONCRETE (CLASS D) (m^3)	FORM AREA (m^2)	AGGREGATE SUB-BASE-3 (m^3)	LEVELING CONCRETE (CLASS F) (m^3)	EXPANSION JOINTS (m^2)	REINFORCING BAR (SD-30) (kg)	DESIGN EXCA (m^3)	SURPLUS SOILS (m^3)	BACK FILLING	REMARKS
11K240M~300M	146.3	407.2	27.4	13.7	11.8	1355.9	222	180	42	
300~328	66.2	187.9	12.0	6.0	2.4	602.6	104	82	22	
328~350	58.5	191.2	9.6	4.8	8.0	541.1	121	88	33	
350~380	75.6	246.4	13.3	6.6	5.0	740.3	164	117	47	
381~400	39.7	104.4	8.4	4.2	4.2	400.1	59	49	10	
400~450	94.4	262.9	20.1	10.1	7.7	972.0	146	121	25	
450~466	36.1	106.0	7.6	3.8	1.8	369.4	57	48	9	
19K438M~490M	114.8	320.8	21.0	10.5	6.7	1020.6	157	132	25	
TOTAL	632	1827	119	60	48	6002	1030	817	213	

JICA

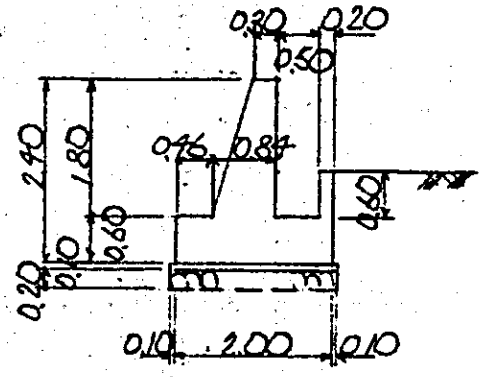
No. 10



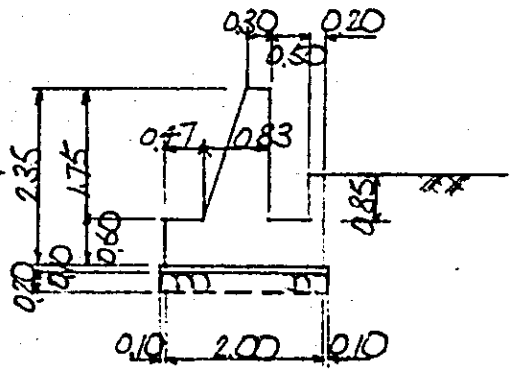
SECTION A-A



PLAN



SECTION B-B



SECTION C-C

CONCRETE VOLUME

$$V = \{2.00 \times 0.60 + (0.20 \times 0.60 + 0.20 \times 0.85) \times \frac{1}{2} + \{(0.30+0.84) \times 1.80 \times \frac{1}{2} + (0.30+0.83) \times 1.75 \times \frac{1}{2}\} \times \frac{1}{2}\} \times 62.20 + 0.54 \times 1.80 \times \frac{1}{2} \times 0.54 - (0.80+1.00) \times 0.60 \times 0.20 - 0.30 \times 0.30 \times 1.80 = 146.3 \ m^3$$

FORM AREA

$$A = \{2.00 \times 0.60 + (0.20 \times 0.60 + 0.20 \times 0.85) \times \frac{1}{2} + \{(0.30+0.84) \times 1.80 \times \frac{1}{2} + (0.30+0.83) \times 1.75 \times \frac{1}{2}\} \times \frac{1}{2}\} \times 8 + \{0.60 \times 2 + (0.60+0.85) \times \frac{1}{2} \times 2 + (1.80+1.75) \times \frac{1}{2} + (\sqrt{1.80^2+0.54^2} + \sqrt{1.75^2+0.53^2}) \times \frac{1}{2}\} \times 62.20 + (\sqrt{1.80^2+0.54^2}) \times 0.54 - (0.80+1.00) \times 0.60 \times 2 - 1.80 \times 0.30 \times 2 = 407.2 \ m^2$$

AGGREGATE SUB-BASE

$$V = 2.20 \times 0.20 \times 62.20 = 27.4 \ m^3$$

LEVELING CONCRETE

$$V = 2.20 \times 0.10 \times 62.20 = 13.7 \ m^3$$

EXPANSION JOINTS

$$A = \{2.00 \times 0.60 + (0.20 \times 0.60 + 0.20 \times 0.85) \times \frac{1}{2} + \{(0.30+0.84) \times 1.80 \times \frac{1}{2} + (0.30+0.83) \times 1.75 \times \frac{1}{2}\} \times \frac{1}{2}\} \times 5 = 11.8 \ m^2$$

RATIO

$V = (2.00 \times 0.60 + 0.20 \times 0.60) \times 10.00 = 13.2\ m^3$

REINFORCING BAR (PER 10^m) $= 213.2\ kg$

$\frac{213.2}{13.2} = 16.2\ kg/m^3$

REINFORCING BAR

$W = 83.7\ m^3 \times 16.2\ kg/m^3 = 1355.9\ kg$

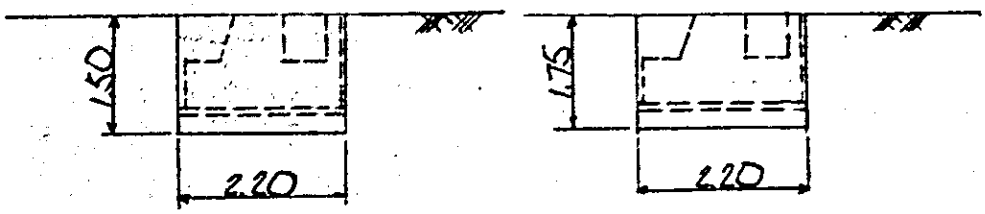
PER 10m

No. 14

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
F 1	D13	0.995	2 000	51	101 5	⌐¬
2	"	"	1 200	51	60 9	⌊
3	D10	0.56	10 000	9	50 4	——
	TOTAL				213 2	

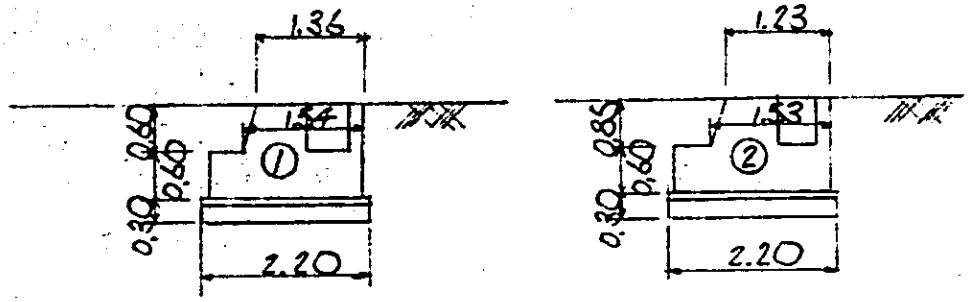
JICA

DESIGN EXCA



$V = (2.20 \times 1.50 + 2.20 \times 1.75) \times \frac{1}{2} \times 62.20 = 222\ m^3$

SURPLUSSOILS



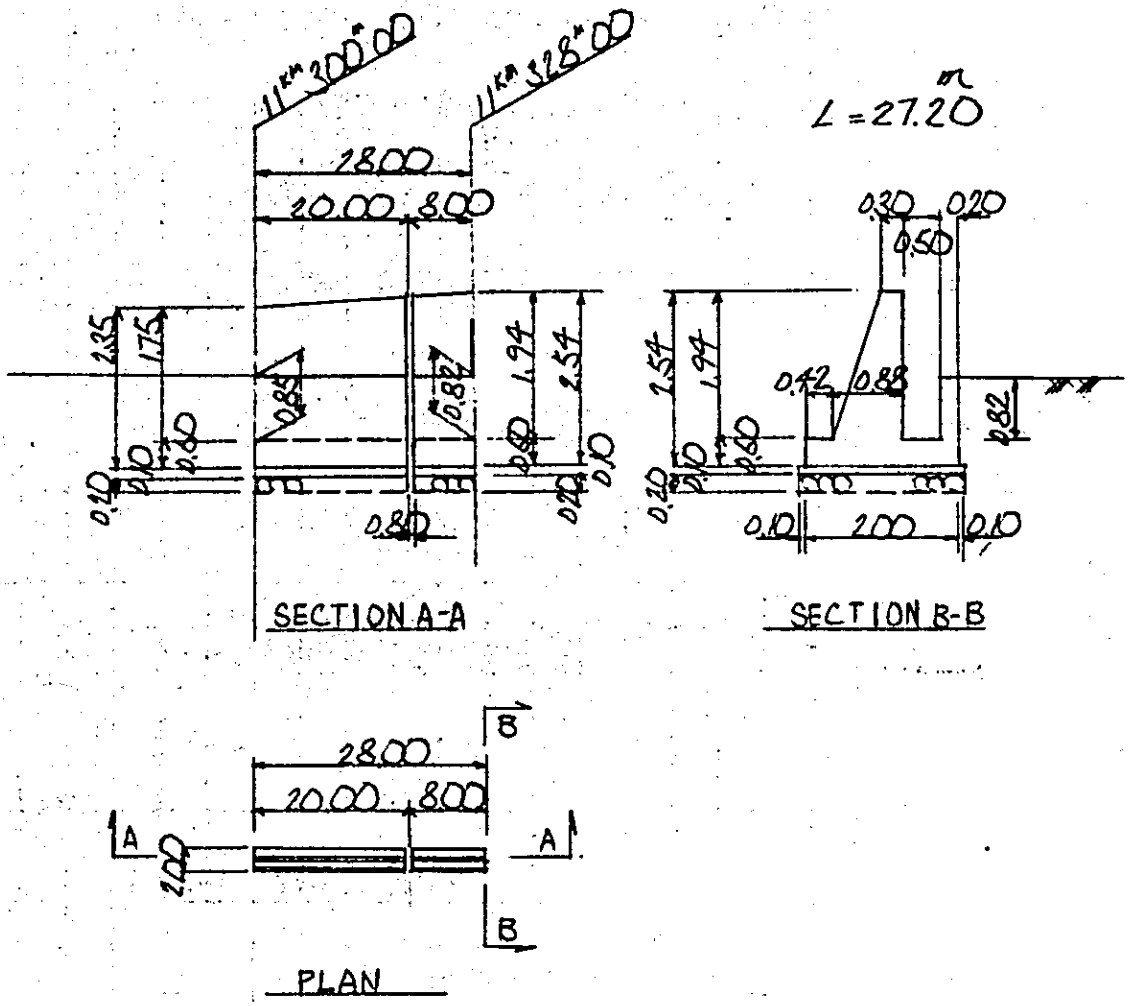
① $A = 2.73\ m^2$

② $A = 3.05$

$V = (2.73 + 3.05) \times \frac{1}{2} \times 62.20 = 180\ m^3$

BACK FILLING

$V = 222 - 180 = 42\ m^3$



CONCRETE VOLUME

$$V = \{2.00 \times 0.60 + (0.20 \times 0.85 + 0.20 \times 0.82) \times \frac{1}{2} + \{(0.30 + 0.83) \times 1.75 \times \frac{1}{2} + (0.30 + 0.88) \times 1.94 \times \frac{1}{2}\} \times \frac{1}{2}\} \times 27.20 = 66.2 \ m^3$$

FORM AREA

$$A = \{2.00 \times 0.60 + (0.20 \times 0.85 + 0.20 \times 0.82) \times \frac{1}{2} + \{(0.30 + 0.83) \times 1.75 \times \frac{1}{2} + (0.30 + 0.88) \times 1.94 \times \frac{1}{2}\} \times \frac{1}{2}] \times 3 + \{0.80 \times 2 + (0.85 + 0.82) \times \frac{1}{2} \times 2 + (1.75 + 1.94) \times \frac{1}{2} \times 2 + (\sqrt{1.75^2 + 0.53^2} + \sqrt{1.94^2 + 0.58^2}) \times \frac{1}{2} \times 2\} \times 27.20 = 187.9 \ m^2$$

AGGREGATE SUB-BASE

$$V = 2.20 \times 0.20 \times 27.20 = 12.0 \ m^3$$

LEVELING CONCRETE

$$V = 2.20 \times 0.10 \times 27.20 = 6.0 \ m^3$$

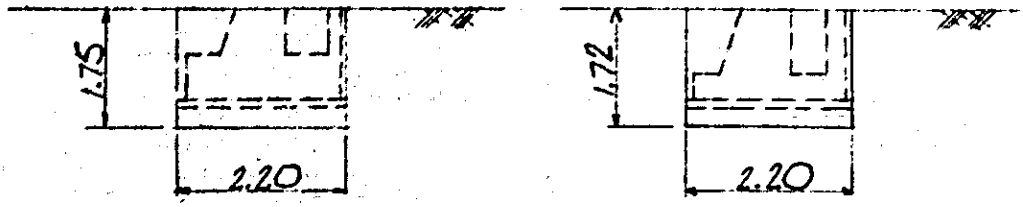
EXPANSION JOINTS

$$A = \{2.00 \times 0.60 + 0.20 \times 0.85 + (0.30 + 0.83) \times 1.75 \times \frac{1}{2}\} = 2.4 \ m^2$$

REINFORCING BAR

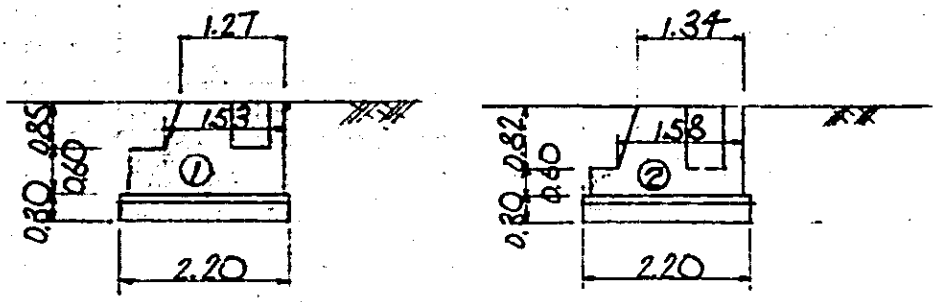
$$W = 37.2 \times 16.2 = 602.6 \ kg$$

DESION EXCA



$V = (2.20 \times 1.75 - 2.20 \times 1.72) \times \frac{1}{2} \times 27.20 = 104\ m^3$

SURPLUSSOILS



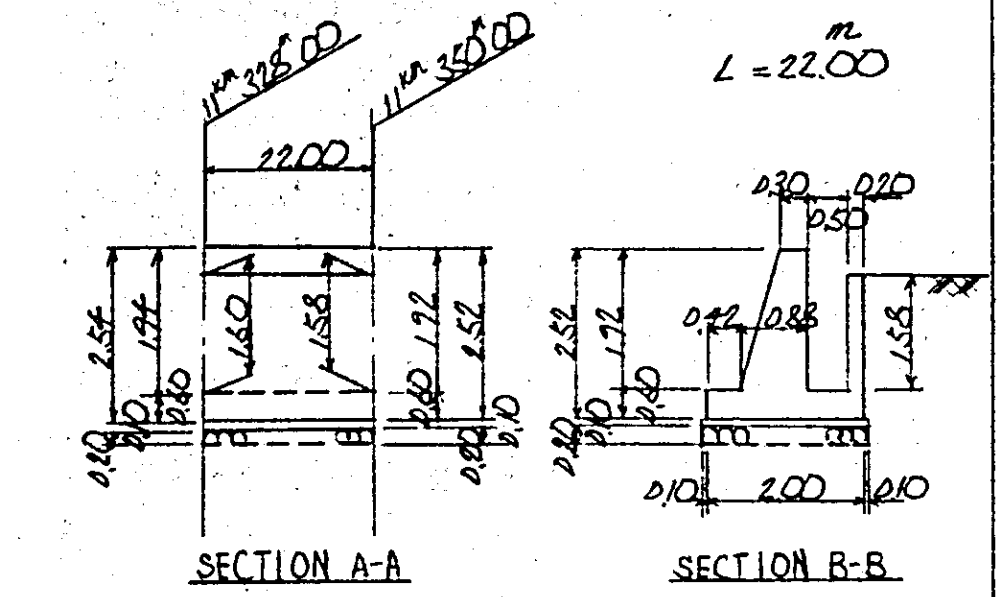
① $A = 2.978\ m^2$

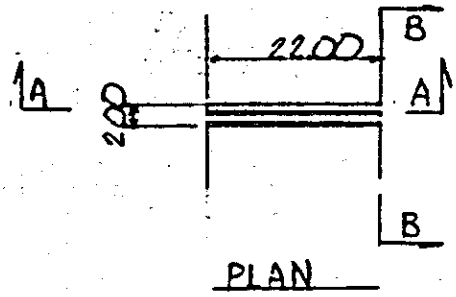
② $A = 3.057$ "

$V = (2.978 + 3.057) \times \frac{1}{2} \times 27.20 = 82\ m^3$

BACK FILLING

$V = 104 - 82 = 22\ m^3$





CONCRETE VOLUME

$$V = \{2.00 \times 0.60 + (0.20 \times 1.60 + 0.20 \times 1.58) \times \frac{1}{2} + \{(0.30 + 0.88) \times 1.94 \times \frac{1}{2} + (0.30 + 0.88) \times 1.92 \times \frac{1}{2}\} \times \frac{1}{2}\} \times 22.00 = 58.5 \ m^3$$

FORM AREA

$$A=\{2.00\times0.60+(0.20\times1.60+0.20\times1.58)\times\frac{1}{2}$$
$$+\{(0.30+0.88)\times1.94\times\frac{1}{2}+(0.30+0.88)\times1.92\times\frac{1}{2}\}$$
$$\times3+\{0.60\times2+(1.60+1.58)\times\frac{1}{2}\times2+(1.94+1.92)\times\frac{1}{2}$$
$$+(\sqrt{1.94^2+0.58^2}+\sqrt{1.92^2+0.58^2})\times\frac{1}{2}\}\times22.00 = 191.2\ m^2$$

AGGREGATE SUB-BASE

$$V = 2.20\times0.20\times22.00 = 9.6\ m^3$$

LEVELING CONCRETE

$$V = 2.20\times0.10\times22.00 = 4.8\ m^3$$

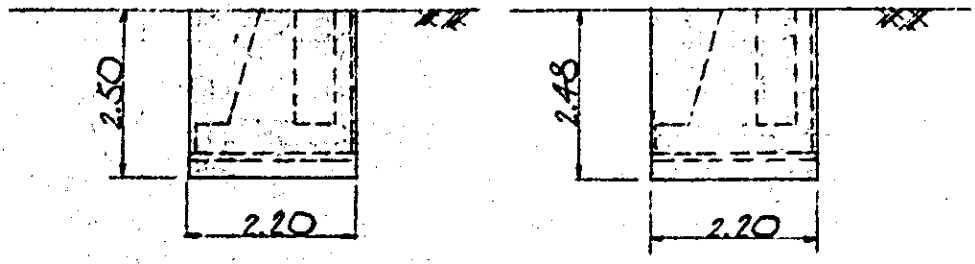
EXPANSION JOINTS

$$A = \{2.00\times0.60+(0.20\times1.60+0.20\times1.58)\times\frac{1}{2}$$
$$+\{(0.30+0.88)\times1.94\times\frac{1}{2}+(0.30+0.88)\times1.92\times\frac{1}{2}\}\times\frac{1}{2}\}$$
$$\times3 = 8.0\ m^2$$

REINFORCING BAR

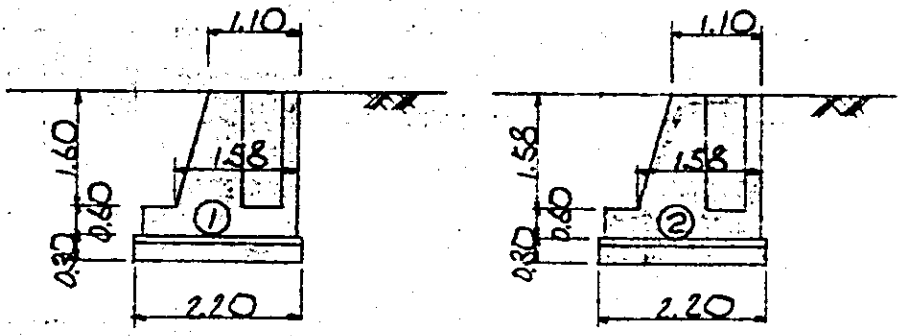
$$W = 33.4\ m^3\times16.2\ kg/m^3 = 541.1\ kg$$

DESIGN EXCA



$V = (2.20 \times 2.50 + 2.20 \times 2.48) \times \frac{1}{2} \times 22.00 = 121\ m^3$

SURPLUSSOILS



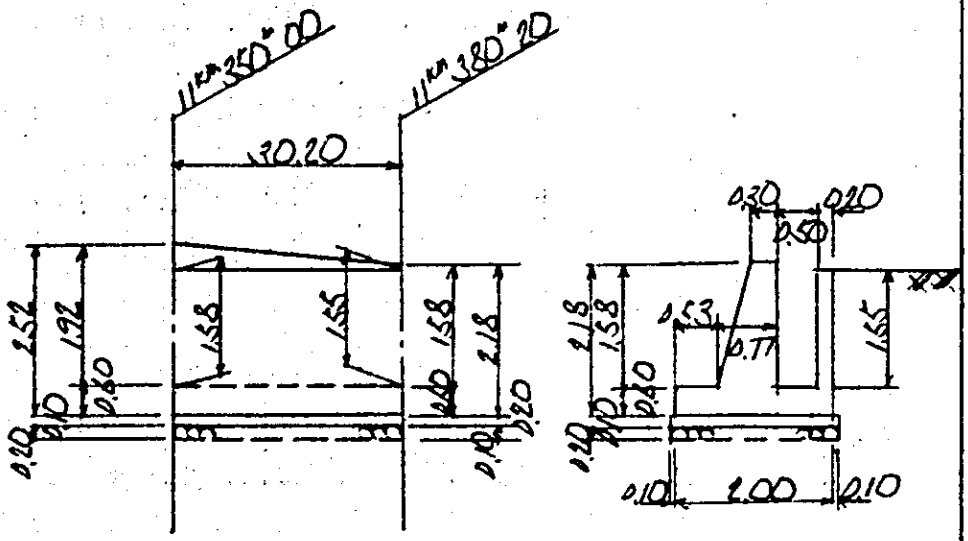
① $A = 4.004\ m^2$

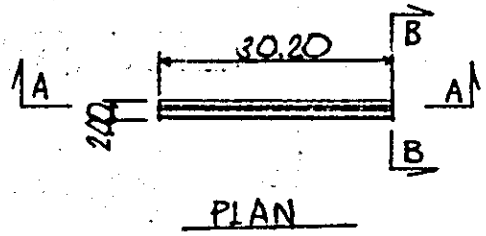
② $A = 3.977$ "

$V = (4.004 + 3.977) \times \frac{1}{2} \times 22.00 = 88\ m^3$

BACK FILL

$V = 121 - 88 = 33\ m^3$





CONCRETE VOLUME

$$V = \{2.00 \times 0.60 + (0.20 \times 1.58 + 0.20 \times 1.55) \times \frac{1}{2}$$

$$+ \{(0.30 + 0.88) \times 1.92 \times \frac{1}{2} + (0.30 + 0.77) \times 1.58 \times \frac{1}{2}\} \times \frac{1}{2}\}$$

$$\times 30.20 = 75.6 \ m^3$$

FORM AREA

$$A = \{2.00 \times 0.60 + (0.20 \times 1.58 + 0.20 \times 1.55) \times \tfrac{1}{2}$$
$$+ \{(0.30 + 0.88) \times 1.92 \times \tfrac{1}{2} + (0.30 + 0.77) \times 1.58 \times \tfrac{1}{2}\} \times 3$$
$$+ \{0.60 \times 2 + (1.58 + 1.55) \times \tfrac{1}{2} \times 2 + (1.92 + 1.58) \times \tfrac{1}{2}$$
$$+ (\sqrt{1.92^2 + 0.58^2} + \sqrt{1.58^2 + 0.47^2}) \times \tfrac{1}{2}\} \times 30.20 = 246.4 \ m^2$$

AGGREGATE SUB-BASE

$$V = 2.20 \times 0.20 \times 30.20 = 13.3 \ m^3$$

LEVELING CONCRETE

$$V = 2.20 \times 0.10 \times 30.20 = 6.6 \ m^3$$

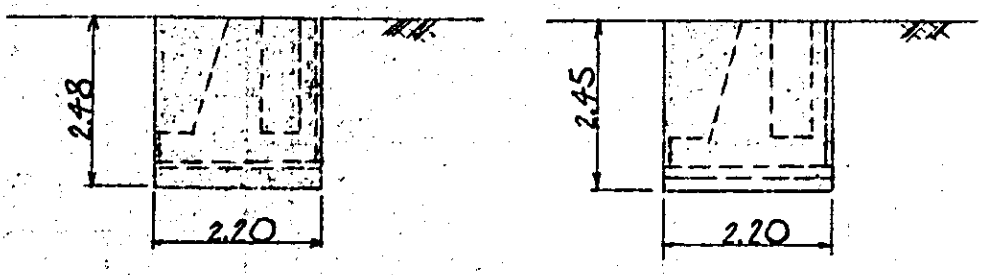
EXPANSION JOINTS

$$A = \{2.00 \times 0.60 + (0.20 \times 1.58 + 0.20 \times 1.55) \times \tfrac{1}{2}$$
$$+ \{(0.30 + 0.88) \times 1.92 \times \tfrac{1}{2} + (0.30 + 0.77) \times 1.58 \times \tfrac{1}{2}\} \times \tfrac{1}{2}]$$
$$\times 2 = 5.0 \ m^2$$

REINFORCING BAR

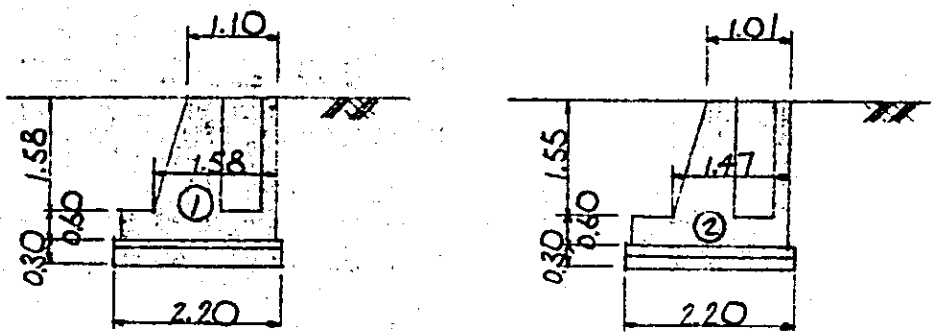
$$W = 45.7 \ m^3 \times 16.2 \ kg/m^3 = 740.3 \ kg$$

DESIGN EXCA



$V = (2.20 \times 2.48 + 2.20 \times 2.45) \times \frac{1}{2} \times 30.20 = 164\ m^3$

SURPLUSSOILS



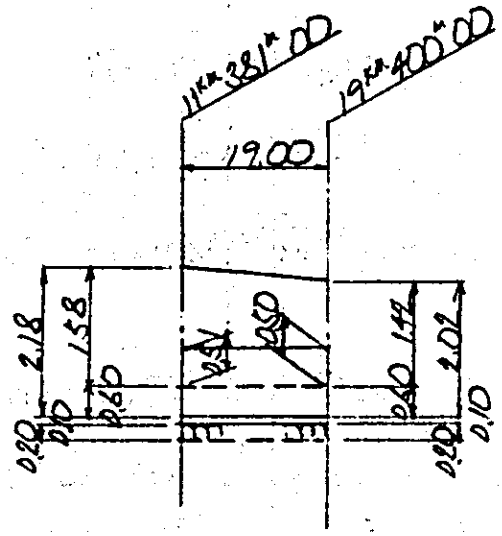
① $A = 3.977\ m^2$

② $A = 3.782$ "

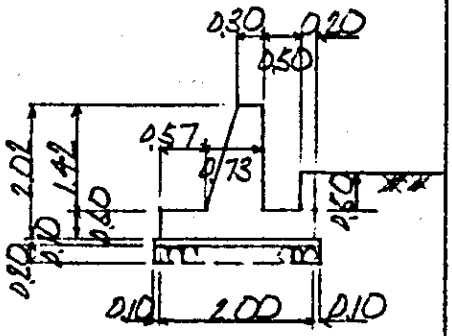
$V = (3.977 + 3.782) \times \frac{1}{2} \times 30.20 = 117\ m^3$

BACK FILLING

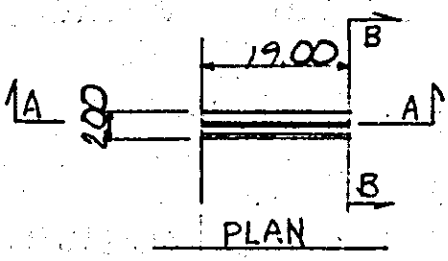
$V = 164 - 117 = 47\ m^3$



SECTION A-A



SECTION B-B



PLAN

CONCRETE VOLUME

$$V = \{ 2.00 \times 0.60 + (0.20 \times 0.51 + 0.20 \times 0.50) \times \frac{1}{2}$$

$$+ \{ (0.30 + 0.77) \times 1.58 \times \frac{1}{2} + (0.30 + 0.73) \times 1.42 \times \frac{1}{2} \} \times \frac{1}{2} \}$$

$$\times 19.00 = 39.7 \ m^3$$

FORM AREA

$$A = \{2.00 \times 0.60 + (0.20 \times 0.51 + 0.20 \times 0.50) \times \tfrac{1}{2} + \{(0.30+0.77) \times 1.58 \times \tfrac{1}{2} + (0.30+0.73) \times 1.42 \times \tfrac{1}{2}\} \times \tfrac{1}{2}\} \times 2 + \{0.60 \times 2 + (0.51+0.50) \times \tfrac{1}{2} \times 2 + (1.58+1.42) \times \tfrac{1}{2} + (\sqrt{1.58^2+0.47^2} + \sqrt{1.42^2+0.43^2}) \times \tfrac{1}{2}\} \times 19.00 = 104.4 \ m^2$$

AGGREGATE SUB-BASE

$$V = 2.20 \times 0.20 \times 19.00 = 8.4 \ m^3$$

LEVELING CONCRETE

$$V = 2.20 \times 0.10 \times 19.00 = 4.2 \ m^3$$

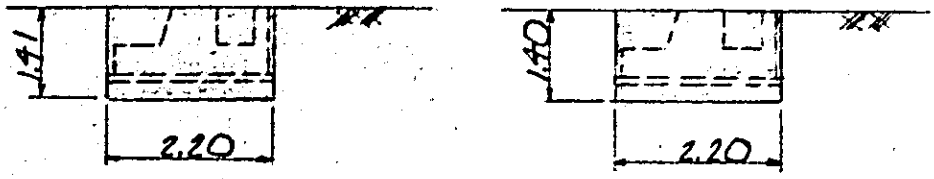
EXPANSION JOINTS

$$A = \{2.00 \times 0.60 + (0.20 \times 0.51 + 0.20 \times 0.50) \times \tfrac{1}{2} + \{(0.30+0.77) \times 1.58 \times \tfrac{1}{2} + (0.30+0.73) \times 1.42 \times \tfrac{1}{2}\} \times \tfrac{1}{2}\} \times 2 = 4.2 \ m^2$$

REINFORCING BAR

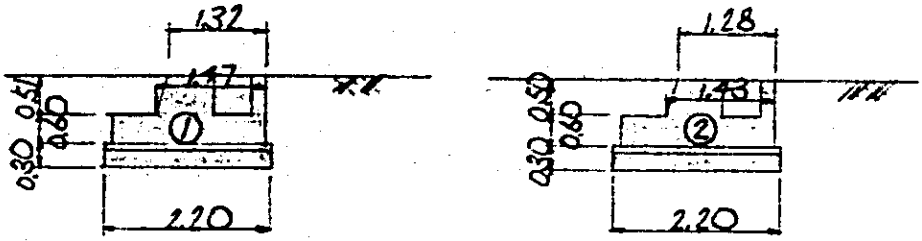
$$W = 24.7 \ m^3 \times 16.2 \ kg/m^3 = 400.1 \ kg$$

DESIGN EXCA



$V = (2.20 \times 1.41 + 2.20 \times 1.40) \times \frac{1}{2} \times 19.00 = 59\ m^3$

SURPLUSSOILS



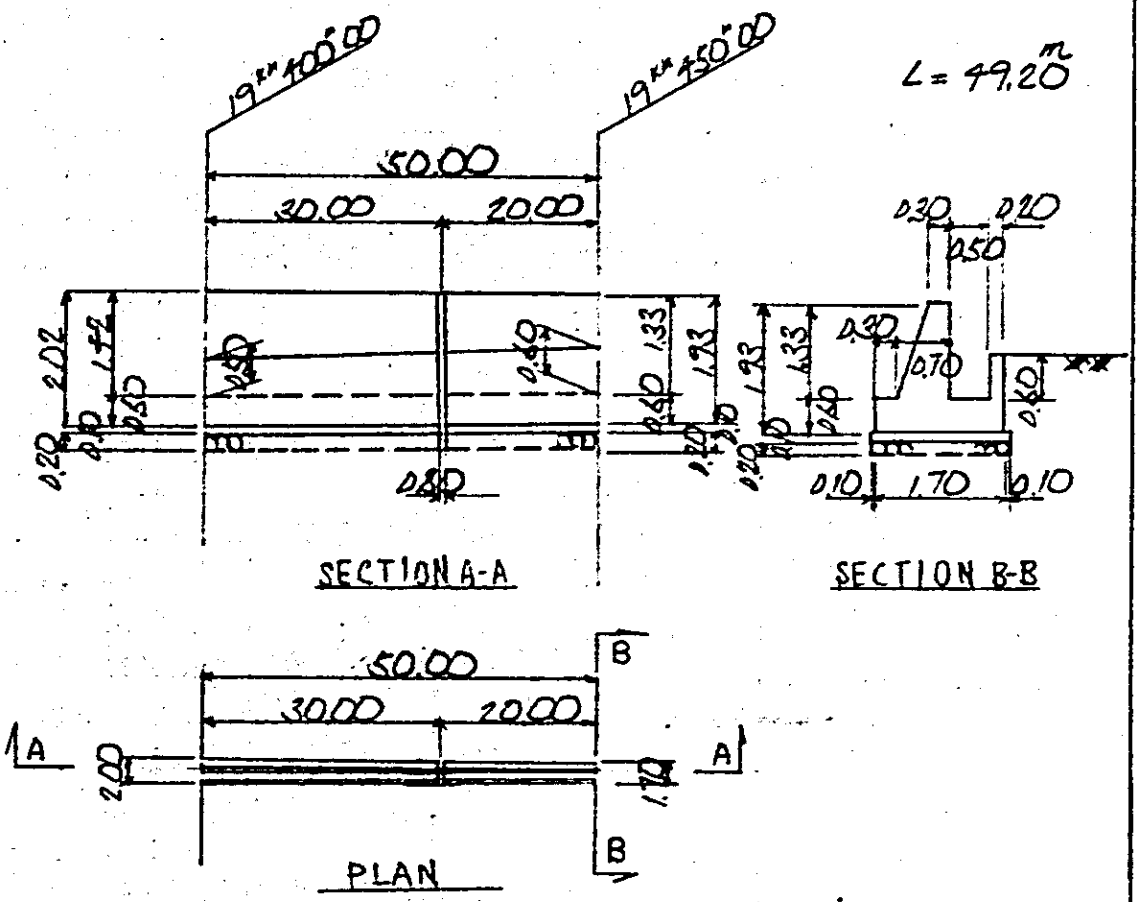
① $A = 2.571\ m^2$

② $A = 2.538$ "

$V = (2.571 + 2.538) \times \frac{1}{2} \times 19.00 = 49\ m^3$

BACK FILLING

$V = 59 - 49 = 10\ m^3$



CONCRETE VOLUME

$$V = \{(2.00+1.70)\times 0.60\times\tfrac{1}{2} + (0.20\times 0.50 + 0.20\times 0.60)\times\tfrac{1}{2} + \{(0.30+0.73)\times 1.42\times\tfrac{1}{2} + (0.30+0.70)\times 1.33\times\tfrac{1}{2}\}\times\tfrac{1}{2}\} \times 49.20 = 94.4\ m^3$$

FORM AREA

$$A = [(2.00+1.70)\times 0.60\times\tfrac{1}{2} + (0.20\times 0.50 + 0.20\times 0.60)\times\tfrac{1}{2}$$
$$+\{(0.30+0.73)\times 1.42\times\tfrac{1}{2} + (0.30+0.70)\times 1.33\times\tfrac{1}{2}\}\times\tfrac{1}{2}]$$
$$\times 6 + [0.60\times 2 + (0.50+0.60)\times\tfrac{1}{2}\times 2 + (1.42+1.33)\times\tfrac{1}{2}$$
$$+(\sqrt{1.42^2+0.43^2} + \sqrt{1.33^2+0.40^2})\times\tfrac{1}{2}]\times 49.20 = 262.9\ m^2$$

AGGREGATE SUB-BASE

$$V = (2.20+1.90)\times 0.20\times\tfrac{1}{2}\times 49.20 = 20.1\ m^3$$

LEVELING CONCRETE

$$V = (2.20+1.90)\times 0.10\times\tfrac{1}{2}\times 49.20 = 10.1\ m^3$$

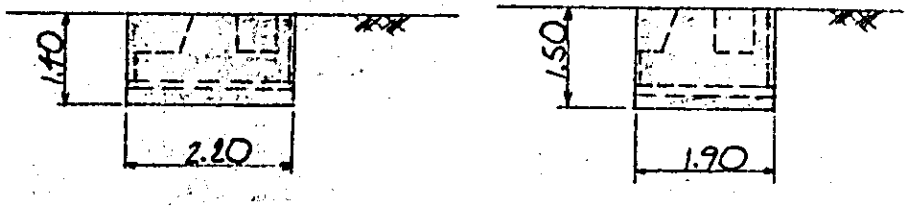
EXPANSION JOINTS

$$A = [(2.00+1.70)\times 0.60\times\tfrac{1}{2} + (0.20\times 0.50+0.20\times 0.60)$$
$$\times\tfrac{1}{2} + \{(0.30+0.73)\times 1.42\times\tfrac{1}{2} + (0.30+0.70)\times 1.33\times\tfrac{1}{2}\}$$
$$\times 4 = 7.7\ m^2$$

REINFORCING BAR

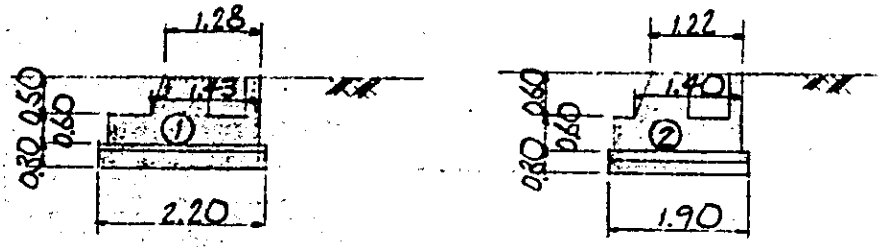
$$W = 60.0\ kg/m^3 \times 16.2\ m^3 = 972.0\ kg$$

DESIGN EXCA



$V = (2.20 \times 1.40 + 1.90 \times 1.50) \times \frac{1}{2} \times 49.20 = 146\ m^3$

SURPLUSSOILS



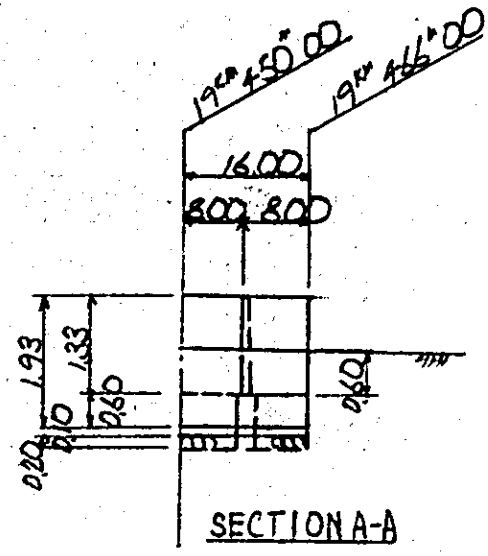
① $A = 2.538\ m^2$

② $A = 2.376$ "

$V = (2.538 + 2.376) \times \frac{1}{2} \times 49.20 = 121\ m^3$

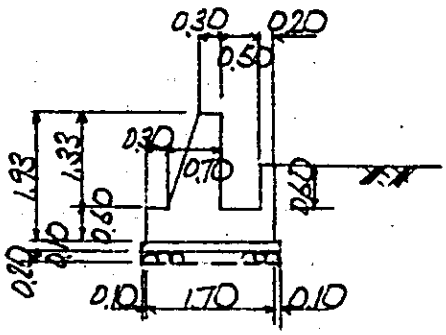
BACK FILLING

$V = 146 - 121 = 25\ m^3$

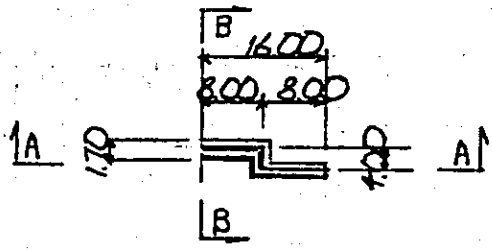


SECTION A-A

L = 20.00 m



SECTION B-B



PLAN

CONCRETE VOLUME

$$V = \{1.70 \times 0.60 + 0.20 \times 0.60 + (0.30+0.70) \times 1.33 \times \tfrac{1}{2}\} \times 20.00 = 36.1\ m^3$$

FORM AREA

$$A = \{1.70 \times 0.60 + 0.20 \times 0.60 + (0.30+0.70) \times 1.33 \times \tfrac{1}{2}\} \times 2 + (0.60 \times 4 + 1.33 + \sqrt{1.33^2+0.40^2}) \times 20.00 = 106.0 \ m^2$$

AGGREGATE SUB-BASE

$$V = 1.90 \times 0.20 \times 20.00 = 7.6 \ m^3$$

LEVELING CONCRETE

$$V = 1.90 \times 0.10 \times 20.00 = 3.8 \ m^3$$

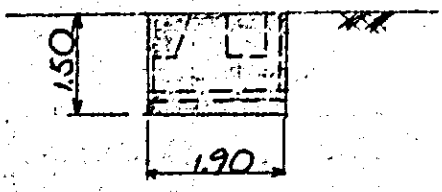
EXPANSION JOINTS

$$A = \{1.70 \times 0.60 + 0.20 \times 0.60 + (0.30+0.70) \times 1.33 \times \tfrac{1}{2}\} = 1.8 \ m^2$$

REINFORCING BAR

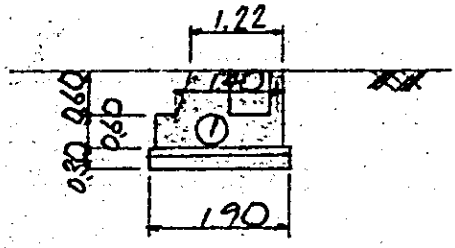
$$W = 22.8 \ m^3 \times 16.2 \ kg/m^3 = 369.4 \ kg.$$

DESIGN EXCA



$V = 1.90 \times 1.50 \times 20.00 = 57\ m^3$

SURPLUSSOILS

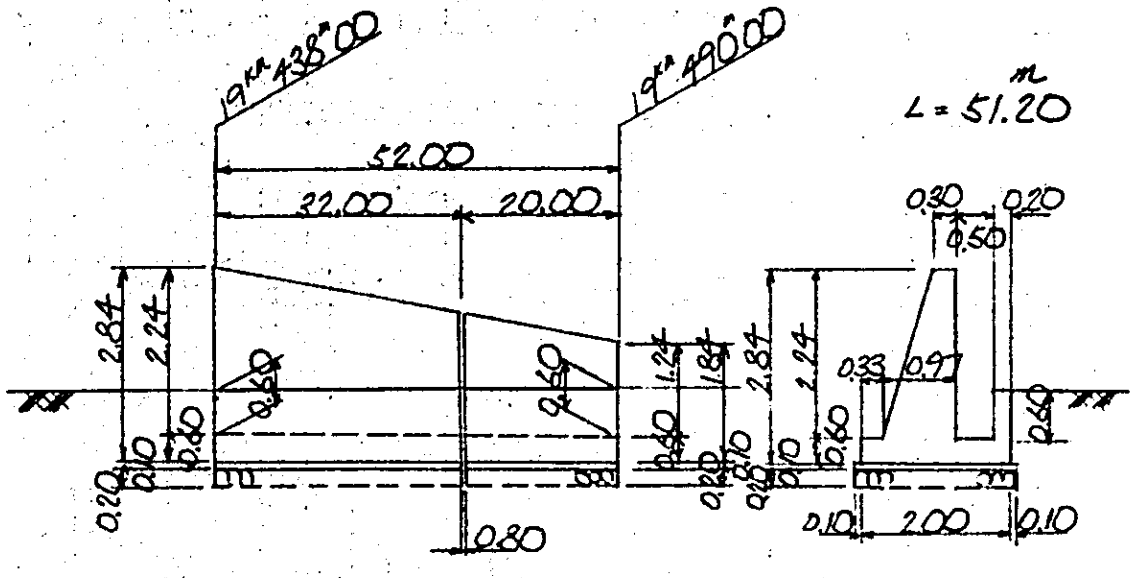


① $A = 2.376\ m^2$

$V = 2.376 \times 20.00 = 48\ m^3$

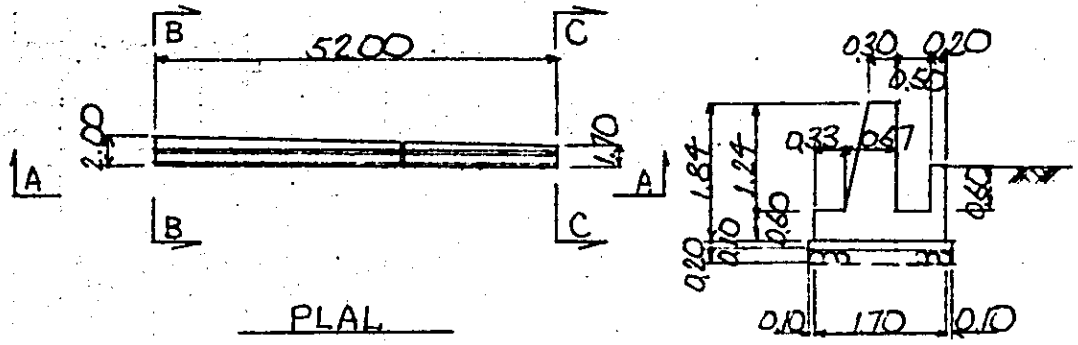
BACK FILLING

$V = 57 - 48 = 9\ m^3$



SECTION A-A

SECTION B-B



PLAL

SECTION C-C

CONCRETE VOLUME

$$V = \left[(2.00 + 1.70) \times 0.60 \times \frac{1}{2} + 0.20 \times 0.60 + \left\{ (0.30 + 0.97) \times 2.24 \times \frac{1}{2} + (0.30 + 0.67) \times 1.24 \times \frac{1}{2} \right\} \times \frac{1}{2} \right] \times 51.20 = 114.8 \ m^3$$

FORM AREA

$$A = [(2.00+1.70)\times 0.60\times\tfrac{1}{2} + 0.20\times 0.60 + \{(0.30+0.97)\times 2.24\times\tfrac{1}{2} + (0.30+0.67)\times 1.24\times\tfrac{1}{2}\}] \times 7 + \{0.60\times 4 + (2.24+1.24)\times\tfrac{1}{2} + (\sqrt{2.24^2+0.67^2} + \sqrt{1.24^2+0.37^2})\times\tfrac{1}{2}\}\times 51.20 = 320.8\ m^2$$

AGGREGATE SUB-BASE

$$V = (2.20+1.90)\times 0.20\times\tfrac{1}{2}\times 51.20 = 21.0\ m^3$$

LEVELING CONCRETE

$$V = (2.20+1.90)\times 0.10\times\tfrac{1}{2}\times 51.20 = 10.5\ m^2$$

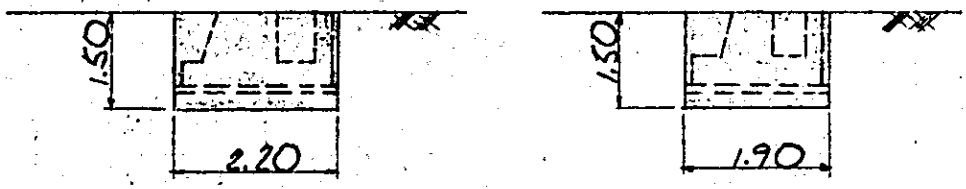
EXPANSION JOINTS

$$A = [(2.00+1.70)\times 0.60\times\tfrac{1}{2} + 0.20\times 0.60 + \{(0.30+0.97)\times 2.24\times\tfrac{1}{2} + (0.30+0.67)\times 1.24\times\tfrac{1}{2}\}] \times 3 = 6.7\ m^2$$

REINFORCING BAR

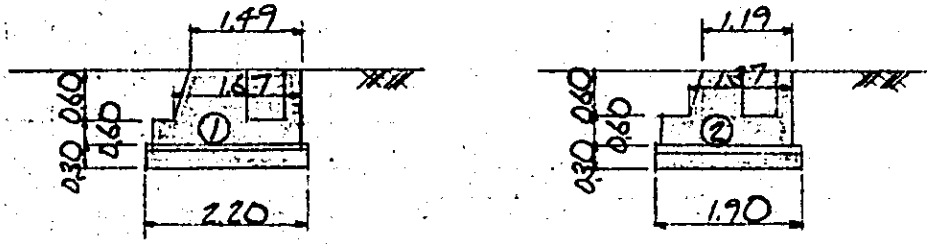
$$W = 63.0\ m^3 \times 16.2\ kg/m^3 = 1020.6\ kg$$

DESIGN EXCA



$V = (2.20 + 1.90) \times 1.50 \times \frac{1}{2} \times 51.20 = 157\ m^3$

SURPLUSSOILS



① $A = 2.808\ m^2$

② $A = 2.358$ "

$V = (2.808 + 2.358) \times \frac{1}{2} \times 51.20 = 132\ m^3$

BACK FILLING

$V = 157 - 132 = 25\ m^3$

RETAINING WALL FOR BOX CULVERT

QUANTITY CALCULATION SHEET

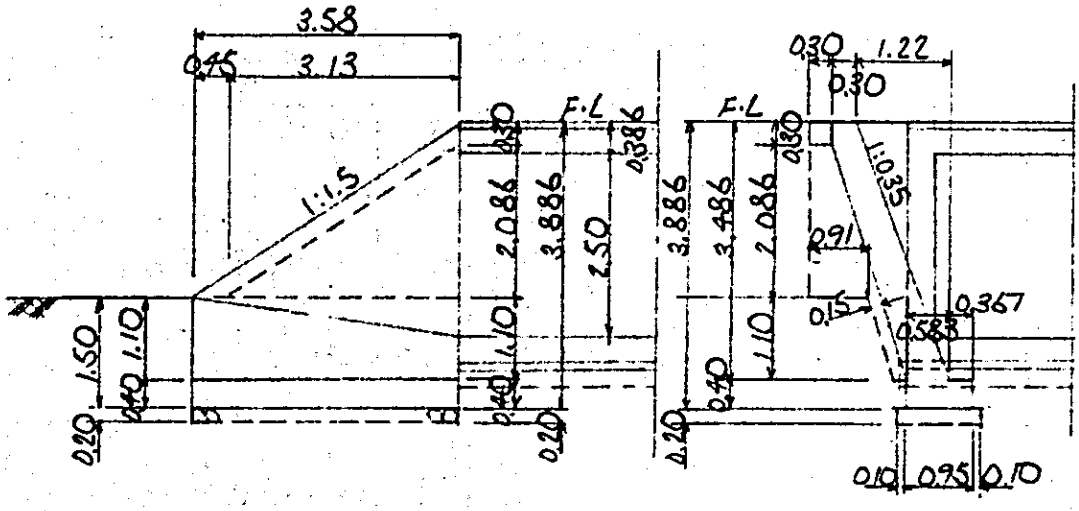
Cb No	OPENING OF BOX CULVERT B×H (m)	ANGLE	CONCRETE (CLASS E) (m^3)	FORM. AREA (m^2)	AGGREGATE SUB-BASE-3 (m^3)	GRANULAR BACKFILL (m^2)	SOIL (m^3)	U.P.V.C (EACH)	DESIGN EXCA (m^3)	SURPLV SSOILS (m^3)	BACK FILLING (m^3)	REMARKS
02	2.0×2.0	81°	12.7	43.2	2.3	6.0	0.9	8	23	15	8	
03	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
04	6.5×1.5	60°	8.2	31.6	1.5	2.8	0.6	〃	19	15	4	
05	2.0×1.5	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
06	2.0×2.0	90°	12.5	42.7	2.3	5.9	0.9	8	23	15	8	
07	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
08	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
09	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
10	6.05×2.5×2	〃	(24.7+6.3)=31.0	(16.9+2.4)=8.73	(2.9+1.2)=4.1	(9.3+3.0)=12.3	(0.4+0.5)=0.9	(14+4)=18	(53+11)=64	(43+7)=50	(10+4)=14	
11	2.0×2.0	〃	12.5	42.7	2.3	5.9	0.9	8	23	15	8	
12	2.0×1.5	〃	8.2	30.4	1.5	3.0	0.7	8	16	11	5	
13	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
14	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
15	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
16	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
17	7.0×1.5	85°	(45.2+4.1)=49.3	(133.9+15.2)=149.1	(8.1+0.7)=8.8	(10.3+1.5)=11.8	(1.5+0.4)=1.9	(32+4)=36	(96+8)=104	(78+6)=84	(18+2)=20	
18	5.0×2.0	74°	13.1	44.4	2.4	6.2	1.0	8	23	16	7	
19	2.0×1.5	90°	8.2	30.4	1.5	3.0	0.7	8	16	11	5	
20	—〃—	〃	〃	〃	〃	〃	〃	〃	〃	〃	〃	
21	2.0×2.5	〃	18.4	56.5	3.0	11.4	1.2	12	29	20	9	
22	4.5×3.0	53°	28.1	84.9	3.8	16.1	1.5	10	49	44	5	
23	2.0×2.0	90°	12.5	42.7	2.3	5.9	0.9	8	23	15	8	
24	2.0×2.5	48°	24.8	76.1	4.0	15.4	1.6	16	38	26	12	
25	—〃—	90°	18.4	56.5	3.0	11.4	1.2	12	29	20	9	
26	2.0×2.0	69°	13.4	45.7	2.4	6.3	1.0	10	24	15	9	
27	2.0×2.5	90°	18.4	56.5	3.0	11.4	1.2	12	29	20	9	

JICA

Cb No	OPENING OF BOX CULVERT B × H (m)	ANGLE	CONCRETE (CLASS E.) (m^3)	FORM AREA (m^2)	AGGREGATE SUB-BASE-3 (m^3)	GRANULAR BACK FILL (m^3)	SOIL (m^3)	U.P.V.C (EACH)	DESIGN EXCA (m^3)	SURPLV SSOILS (m^3)	BACK FILLING (m^3)	REMARKS
28	2.0 × 2.0	90°	12.5	42.7	2.3	5.9	0.9	8	23	15	8	
TOTAL			402	1318	69	182	26	278	746	537	209	

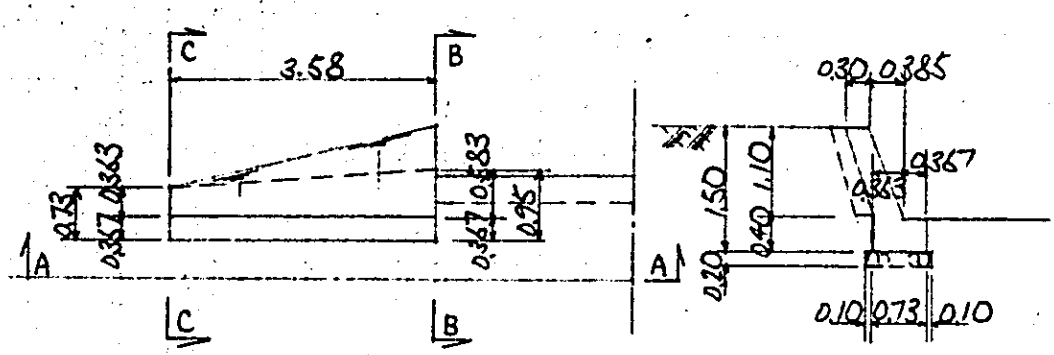
FOR 2.0m × 2.5m

4 EACH PER BOX



SECTION A-A

SECTION B-B



PLAN

SECTION C-C

CONCRETE VOLUME

$$V = \{(0.30+0.58)\times 3.49\times\tfrac{1}{2} + (0.30+0.36)\times 1.10\times\tfrac{1}{2}\}$$

$$\times\tfrac{1}{2}\times 3.58\times 4 + (0.95\times 0.40 + 0.73\times 0.40)\times\tfrac{1}{2}\times 3.58$$

$$\times 4 = 18.4\ m^3$$

FORM AREA

$$A = \{(0.30+0.58)\times 3.49\times\tfrac{1}{2} + (0.30+0.36)\times 1.10\times\tfrac{1}{2}\}\times 4$$
$$+ (0.95\times 0.40 + 0.73\times 0.40)\times 4 + (\sqrt{3.49^2+1.22^2}$$
$$+\sqrt{1.10^2+0.39^2})\times\tfrac{1}{2}\times 3.58\times 4 + 0.40\times 2\times 3.58\times 4 = 56.5\ m^2$$

AGGREGATE SUB-BASE

$$V = (1.15\times 0.20 + 0.93\times 0.20)\times\tfrac{1}{2}\times 3.58\times 4 = 3.0\ m^3$$

GRANULAR BACKFILL

$$V = \{(0.30+0.91)\times 2.09\times\tfrac{1}{2} + 0\}\times\tfrac{1}{2}\times 3.58\times 4$$
$$+ 1.10\times 0.15\times 3.58\times 4 = 11.4\ m^3$$

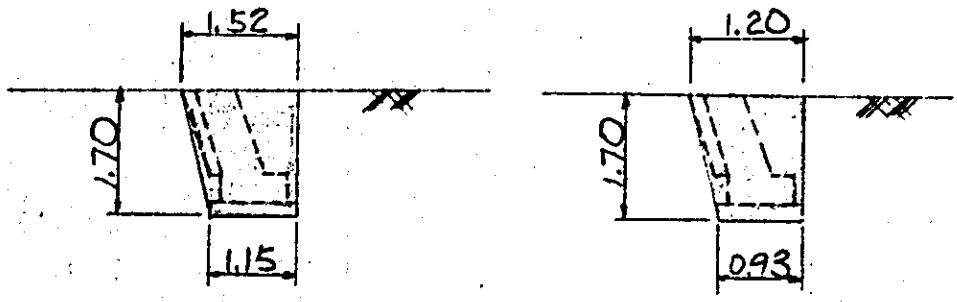
SOIL

$$V = 0.30\times 0.30\times 3.13\times 4 + (0.30\times 0.30+0)\times\tfrac{1}{2}$$
$$\times 0.45\times 4 = 1.2\ m^3$$

U.P.V.C

$n = 12$

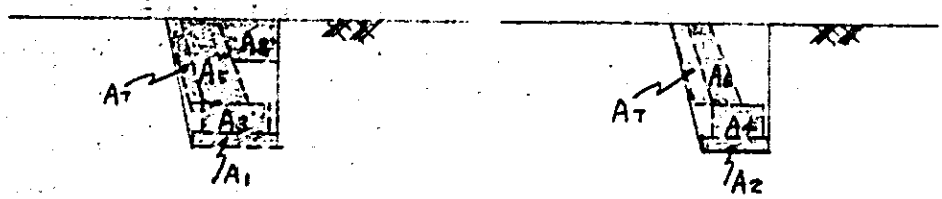
DESION EXCA



$$V = \{(1.15 + 1.52) \times 1.70 \times \tfrac{1}{2} + (0.93 + 1.20) \times 1.70 \times \tfrac{1}{2}\} \times \tfrac{1}{2}$$

$$\times 3.58 \times 4 = 29 \ m^3$$

SURPLVSSOILS



$$V_1 = (1.15 \overset{A1}{\times} 0.20 + 0.93 \overset{A2}{\times} 0.20) \times \tfrac{1}{2} \times 3.58 \times 4 = 2.979$$

$$V_2 = (0.95 \overset{A3}{\times} 0.40 + 0.73 \overset{A4}{\times} 0.40) \times \tfrac{1}{2} \times \text{〃} \times \text{〃} = 4.812$$

$$V_3 = \{(0.52 \overset{A5}{+} 0.58) \times 1.10 \times \tfrac{1}{2} + (0.30 \overset{A6}{+} 0.36) \times 1.10 \times \tfrac{1}{2}\}$$

$$\times \tfrac{1}{2} \times 3.58 \times 4 = 6.931$$

$$V_4 = 0.15 \overset{A7}{\times} 1.10 \times 3.58 \times 4 = 2.363$$

$$V_5 = \{(0.68 + 0.85) \times 0.50 \times \tfrac{1}{2} + 0\} \times \tfrac{1}{2} \times 3.58 \times 4 = 2.742$$

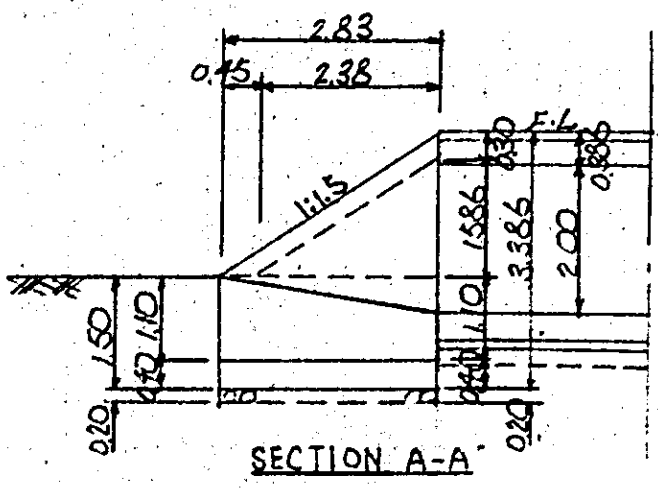
TOTAL V = 20 m^3

BACK FILLING

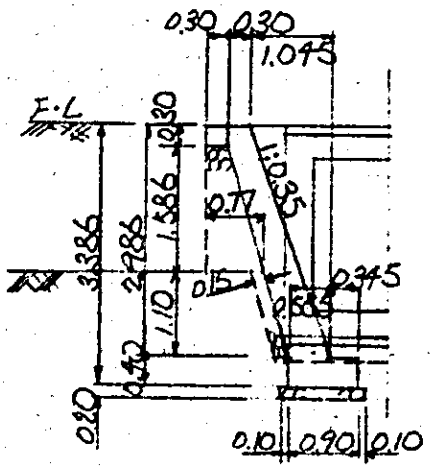
$V = 29 - 20$ = $9\ m^3$

FOR 2.0m x 2.0m

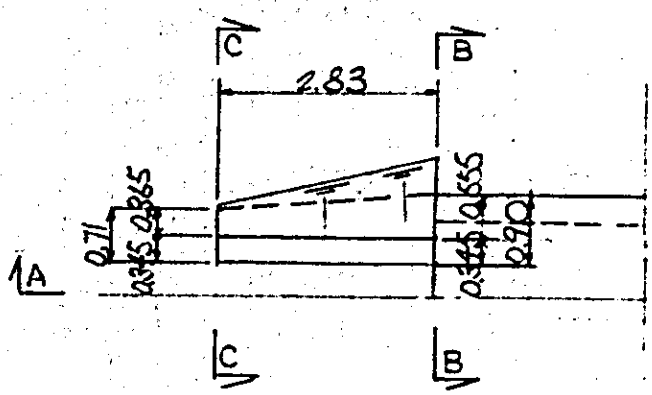
4 EACH PER BOX



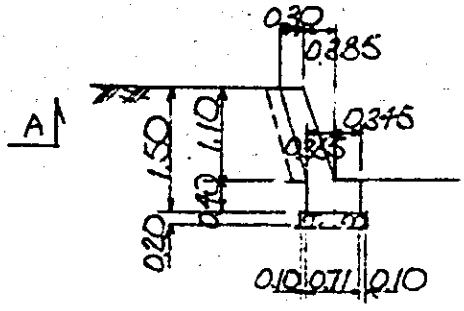
SECTION A-A



SECTION B-B



PLAN



SECTION C-C

CONCRETE VOLUME

$$V = \{(0.30+0.56)\times 2.99\times\tfrac{1}{2} + (0.30+0.37)\times 1.10\times\tfrac{1}{2}\}\times\tfrac{1}{2}$$

$$\times 2.83 \times 4 + (0.90\times 0.40 + 0.71\times 0.40)\times\tfrac{1}{2}\times 2.83$$

$$\times 4 = 12.5 \ m^3$$

FORM AREA

$$A = \{(0.30+0.56)\times 2.99\times\tfrac{1}{2} + (0.30+0.36)\times 1.10\times\tfrac{1}{2}\}$$
$$\times 4 + (0.90\times 0.40 + 0.71\times 0.40)\times 4$$
$$+(\sqrt{1.05^2+2.99^2} + \sqrt{0.39^2+1.10^2})\times\tfrac{1}{2}\times 2.83\times 4$$
$$+ 0.40\times 2\times 2.83\times 4 = 42.7 \ m^2$$

AGGREGATE SUB-BASE

$$V = (1.10\times 0.20 + 0.71\times 0.20)\times\tfrac{1}{2}\times 2.83\times 4 = 2.3 \ m^3$$

GRANULAR BACKFILL

$$V = \{(0.30+0.77)\times 1.59\times\tfrac{1}{2} + 0\}\times\tfrac{1}{2}\times 2.38\times 4$$
$$+0.15\times 1.10\times 2.83\times 4 = 5.9 \ m^3$$

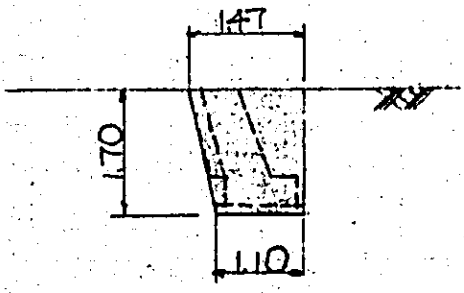
SOIL

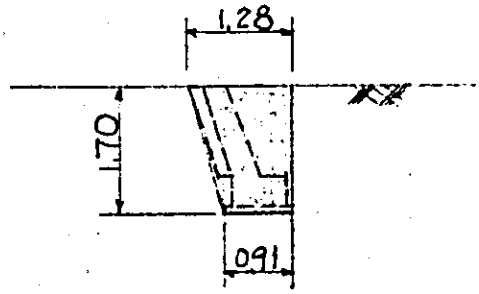
$$V = 0.30\times 0.30\times 2.38\times 4 + (0.30\times 0.30+0)\times\tfrac{1}{2}$$
$$\times 0.45\times 4 = 0.9 \ m^3$$

U.P.V.C

$n = 8$

DESIGN EXCA

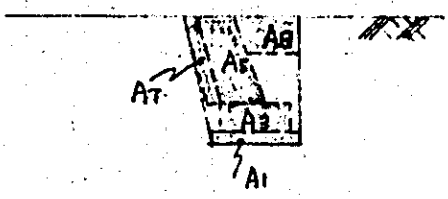


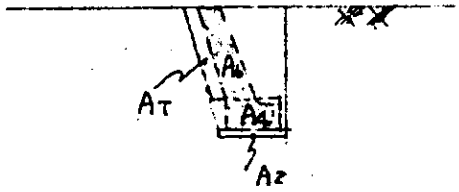


$$V = \{(1.10+1.47)\times 1.70\times\tfrac{1}{2} + (0.91+1.28)\times 1.70\times\tfrac{1}{2}\}\times\tfrac{1}{2}$$

$$\times 2.83 \times 4 = 23 \ m^3$$

SURPLVSSOILS





$V_1 = (1.10 \times 0.20 + 0.91 \times 0.20) \times \frac{1}{2} \times 2.83 \times 4 = 2.275$ (A1, A2)

$V_2 = (0.90 \times 0.40 + 0.71 \times 0.40) \times \frac{1}{2} \times \frac{1}{2} \times \frac{1}{2} = 3.645$ (A3, A4)

$V_3 = \{(0.49+0.56)\times 1.10\times\frac{1}{2} + (0.30+0.36)\times 1.10\times\frac{1}{2}\}$

$\times \frac{1}{2} \times 2.83 \times 4 = 5.326$ (A5, A6)

$V_4 = 0.15 \times 1.10 \times 2.83 \times 4 = 1.868$ (A7)

$V_5 = \{(0.66+0.83)\times 0.50\times\frac{1}{2} + 0\}\times\frac{1}{2}\times 2.83\times 4 = 2.117$ (A8)

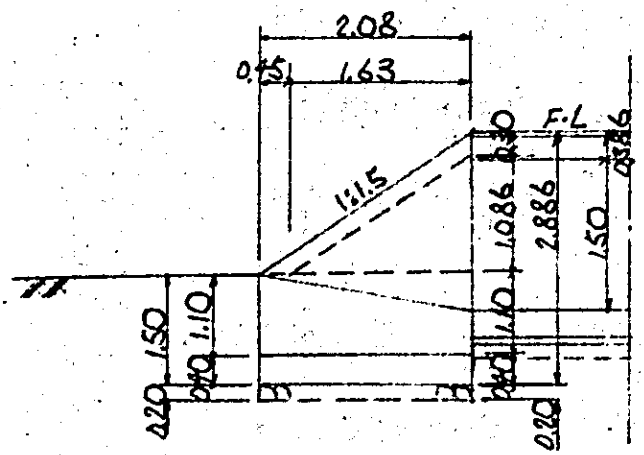
TOTAL V = 15 m^3

BACK FILLING

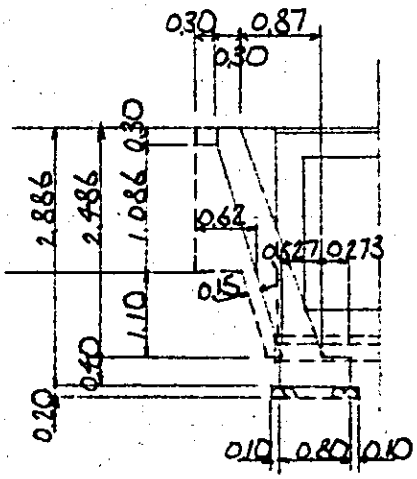
$V = 23 - 15 = 8\ m^3$

FOR 2.0^{m} × 1.5^{m}

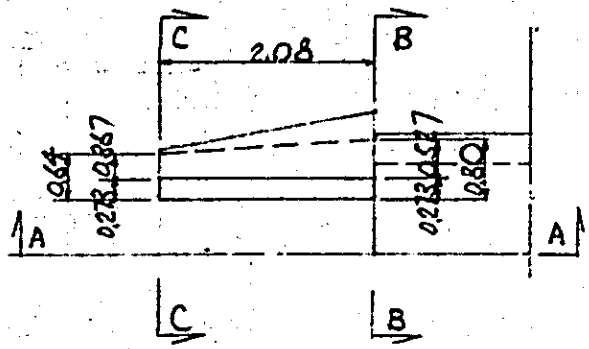
4 EACH PER BOX



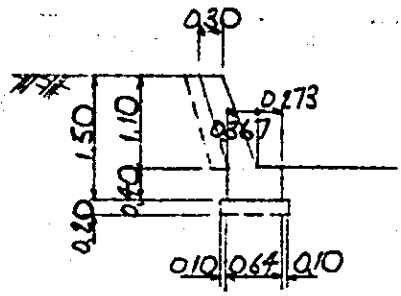
SECTION A-A



SECTION B-B



PLAN



SECTION C-C

CONCRETE VOLUME

$$V = \left\{ \frac{1}{2}(0.30+0.53) \times 2.49 \times \frac{1}{2} + (0.30+0.36) \times 1.10 \times \frac{1}{2} \right\} \times \frac{1}{2} \times 2.08 \times 4 + (0.80 \times 0.40 + 0.64 \times 0.40) \times \frac{1}{2} \times 2.08 \times 4 = 8.2 \ m^3$$

FORM AREA

$$A = \{(0.30+0.53)\times 2.49\times\tfrac{1}{2} + (0.30+0.36)\times 1.10\times\tfrac{1}{2}\}\times 4$$
$$+ (0.80\times 0.40 + 0.64\times 0.40)\times 4$$
$$+ (\sqrt{2.49^2+0.87^2} + \sqrt{1.10^2+0.39^2})\times\tfrac{1}{2}\times 2.08\times 4$$
$$+ 0.40\times 2\times 2.08\times 4 = 30.4\ m^2$$

AGGREGATE SUB-BASE

$$V = (1.00\times 0.20 + 0.84\times 0.20)\times\tfrac{1}{2}\times 2.08\times 4 = 1.5\ m^3$$

GRANULAR BACKFILL

$$V = \{(0.30+0.62)\times 1.09\times\tfrac{1}{2} + 0\}\times\tfrac{1}{2}\times 1.63\times 4$$
$$+ 0.15\times 1.10\times 2.08\times 4 = 3.0\ m^3$$

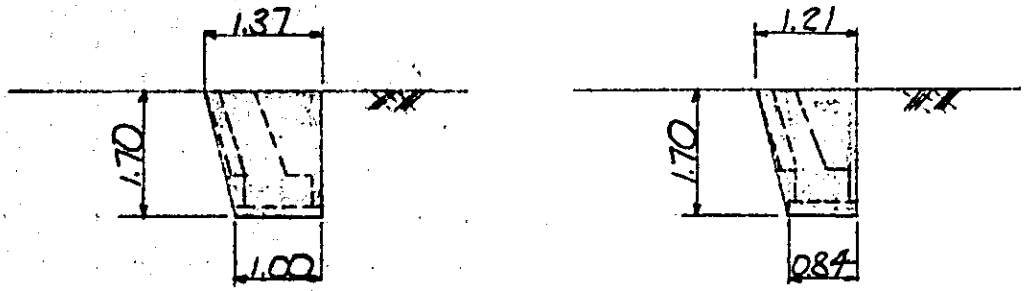
SOIL

$$V = 0.30\times 0.30\times 1.63\times 4 + (0.30\times 0.30+0)\times\tfrac{1}{2}$$
$$\times 0.45\times 4 = 0.7\ m^3$$

U·P·V·C

$n = 8$

DESIGN EXCA



$$V = \{(1.00+1.37)\times 1.70\times\tfrac{1}{2} + (0.84+1.21)\times 1.70\times\tfrac{1}{2}\}$$
$$\times\tfrac{1}{2}\times 2.08\times 4 = 16\ m^3$$

SURPLVSSOILS

$$V_1 = (\overset{A_1}{1.00}\times 0.20 + \overset{A_2}{0.84}\times 0.20)\times\tfrac{1}{2}\times 2.08\times 4 = 1.531$$

$$V_2 = (\overset{A_3}{0.80}\times 0.40 + \overset{A_4}{0.64}\times 0.40)\times\tfrac{1}{2}\times\ 〃\ \times\ 〃 = 2.396$$

$$V_3 = \{(\overset{A_5}{0.47}+0.53)\times 1.10\times\tfrac{1}{2} + (\overset{A_6}{0.30}+0.36)\times 1.10\times\tfrac{1}{2}\}$$
$$\times\tfrac{1}{2}\times 2.08\times 4 = 3.798$$

$$V_4 = \overset{A_7}{0.15}\times 1.10\times 2.08\times 4 = 1.373$$

$$V_5 = \{(0.58+0.76)\times 0.50\times\tfrac{1}{2}+0\}\times\tfrac{1}{2}\times 2.08\times 4 = 1.394$$

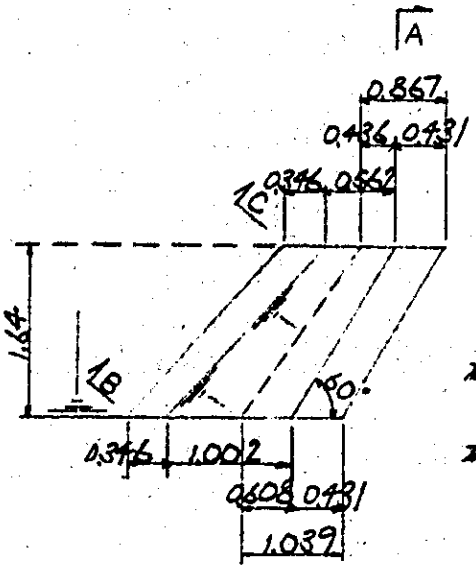
TOTAL V = 11 m^3

BACK FILLING

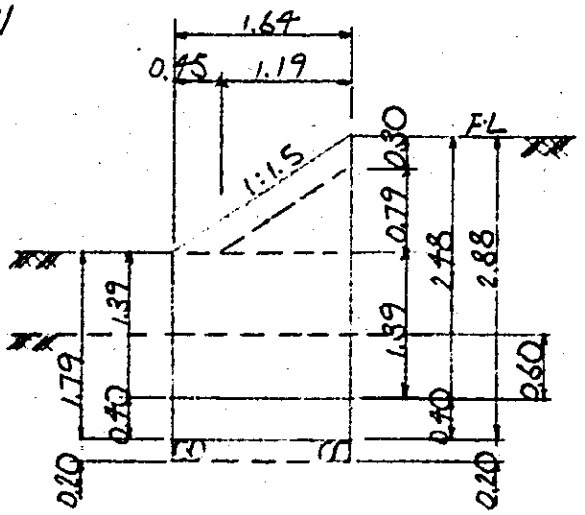
$V = 16 - 11$ = $5\ m^3$

FOR 6.5m x 1.5m , FOR 2.0m x 1.5m

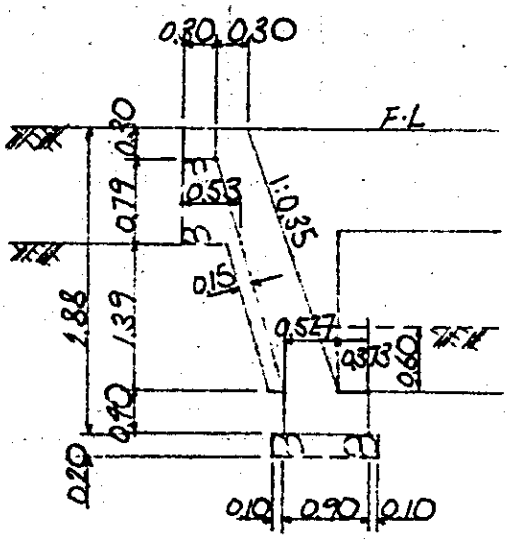
4 EACH PER BOX



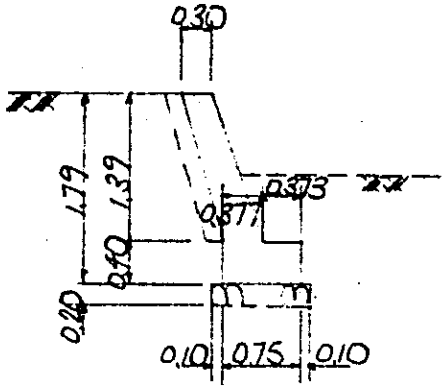
PLAN



SECTION A-A



SECTION B-B



SECTION C-C

CONCRETE VOLUME

$$V = \{(0.30+0.53)\times 2.48\times\tfrac{1}{2} + (0.30+0.38)\times 1.39\times\tfrac{1}{2}\}\times\tfrac{1}{2}$$

$$\times 1.89\times 4 + (0.90\times 0.40 + 0.75\times 0.40)\times\tfrac{1}{2}\times 1.89$$

$$\times 4 = 8.2\ m^3$$

FORM AREA

$$A = \{(0.35+0.61)\times 2.48\times\tfrac{1}{2} + (0.35+0.44)\times 1.39\times\tfrac{1}{2}\}$$
$$\times 4 + (1.04\times 0.40 + 0.87\times 0.40)\times 4$$
$$+ (\sqrt{2.48^2+0.87^2} + \sqrt{1.39^2+0.49^2})\times\tfrac{1}{2}\times 1.89\times 4$$
$$+ 0.40\times 1.89\times 2\times 4 = 31.6\ m^2$$

AGGREGATE SUB-BASE

$$V = (1.10\times 0.20 + 0.95\times 0.20)\times\tfrac{1}{2}\times 1.89\times 4 = 1.5\ m^3$$

GRANULAR BACK FILL

$$V = \{(0.30+0.53)\times 0.79\times\tfrac{1}{2} + 0\}\times\tfrac{1}{2}\times 1.89\times 4$$
$$+ 0.15\times 1.39\times 1.89\times 4 = 2.8\ m^3$$

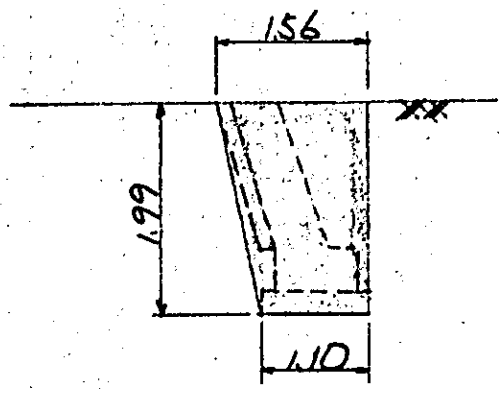
SOIL

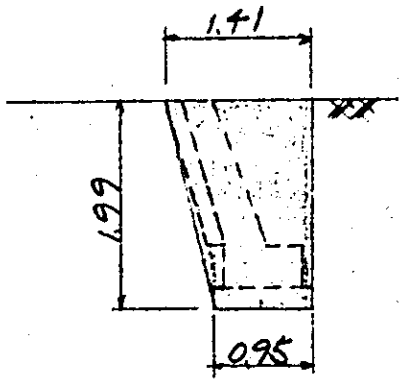
$$V = 0.30\times 0.30\times 1.37\times 4 + (0.30\times 0.30+0)\times\tfrac{1}{2}$$
$$\times 0.52\times 4 = 0.6\ m^3$$

U·P·V·C

$$n = 8$$

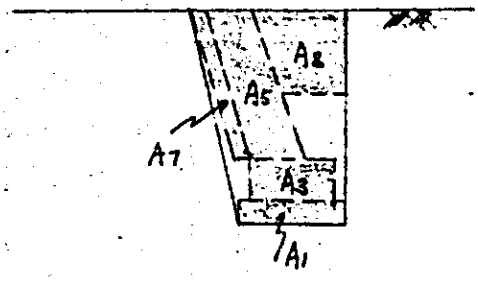
DESIGN EXCA

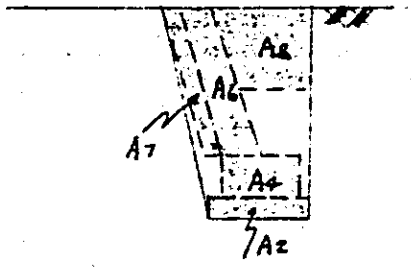




$$V = \{(1.56+1.10)\times 1.99\times\tfrac{1}{2} + (1.41+0.95)\times 1.99\times\tfrac{1}{2}\} \times\tfrac{1}{2}\times 1.89\times 4 = 19\ m^3$$

SURPLVSSOILS





$V_1 = (1.10\times 0.20 + 0.95\times 0.20)\times\tfrac{1}{2}\times 1.89\times 4 = 1.550$ (A1, A2)

$V_2 = (0.90\times 0.40 + 0.75\times 0.40)\times\tfrac{1}{2}\times\ ''\ \times\ '' = 2.495$ (A3, A4)

$V_3 = \{(0.45+0.53)\times 1.39\times\tfrac{1}{2} + (0.30+0.38)\times 1.39\times\tfrac{1}{2}\} \times\tfrac{1}{2}\times 1.89\times 4 = 4.362$ (A5, A6)

$V_4 = 0.15\times 1.39\times 1.89\times 4 = 1.576$ (A7)

$V_5 = (0.96+0.68)\times 0.79\times\tfrac{1}{2}\times 1.89\times 4 = 4.897$

TOTAL V = 15 m^3

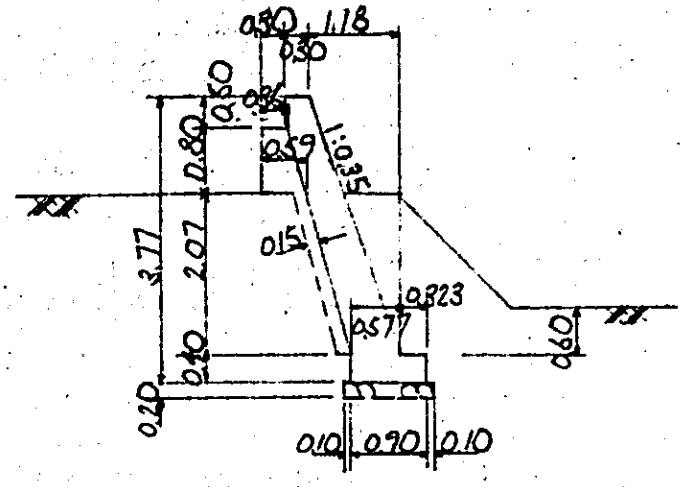
BACK FILLING

$V = 19 - 15$ = $4\ m^3$

FOR 6.05^{m} x 2.5^{m} x 2

2 EACH PER BOX

TOTAL LENGHT = 4.7 + 8.7 = 13.40^{m}



CROSS SECTION

CONCRETE VOLUME

$V = \{(0.30+0.58) \times 3.37 \times \frac{1}{2} + 0.90 \times 0.40\}$

$\times 13.40$ = 24.7 m^3

FORM AREA

$A = \{(0.30+0.58) \times 3.37 \times \frac{1}{2} + 0.90 \times 0.40\} \times 4$

$+ (0.40 \times 2 + \sqrt{3.37^2+1.18^2}) \times 13.40$ = 65.9 m^2

AGGREGATE SUB-BASE

$V = 1.10 \times 0.20 \times 13.40$ = 2.9 m^3

GRANULAR BACKFILL

$V = \{(0.36+0.59) \times 0.80 \times \frac{1}{2} + 0.15 \times 2.07\} \times 13.40 = 9.3\ m^3$

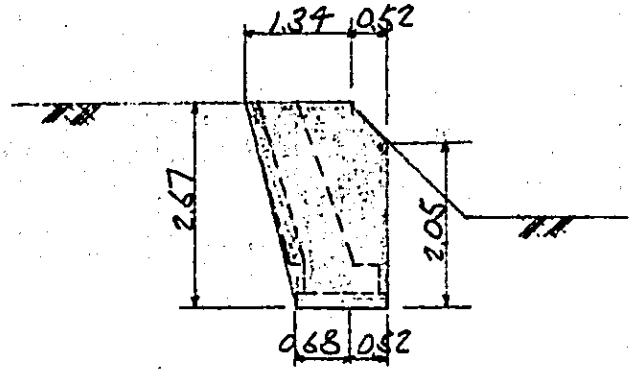
SOIL

$V = 0.30 \times 0.30 \times 4.80 = 0.4\ m^3$

U.P.V.C

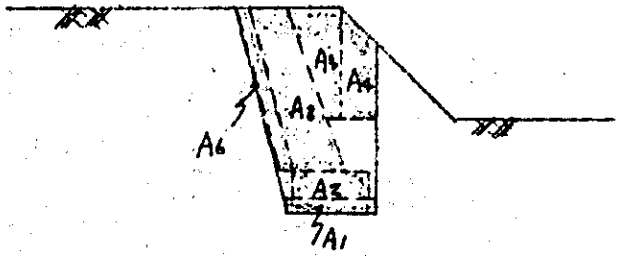
$n = 14$

DESIGN EXCA



$V = \{(2.05+2.67) \times 0.52 \times \frac{1}{2} + (0.68+1.34) \times 2.67 \times \frac{1}{2}\} \times 13.40 = 53\ m^3$

. SURPLVSSOILS



$$V = \{ 1.10^{A1} \times 0.20 + 0.90^{A2} \times 0.40 + (0.46 + 0.58)^{A3} \times 2.07 \times \frac{1}{2} + (0.85 + 1.47)^{A4} \times 0.52 \times \frac{1}{2} + (0.11 + 0.73)^{A5} \times 1.47 \times \frac{1}{2} + 0.15^{A6} \times 2.07 \} \times 13.40 = 43 \ m^3$$

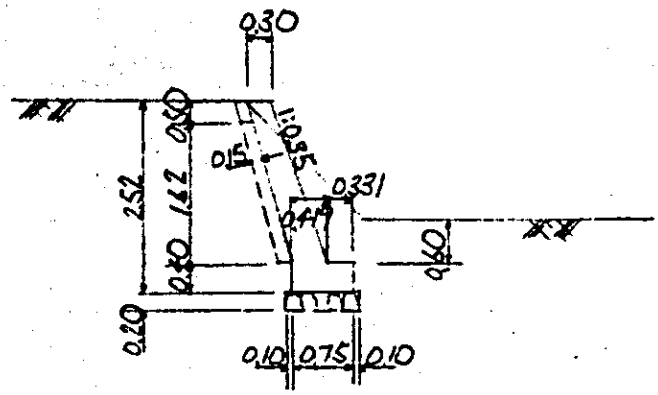
BACK FILLING

$$V = 53 - 43 = 10 \ m^3$$

FOR 7.0^{m} x 1.5^{m}

2 EACH PER BOX

TOTAL LENGHT = 23.0 + 19.5 = 42.5^{m}



CROSS SECTION

CONCRETE VOLUME

$V = \{(0.30+0.42) \times 2.12 \times \frac{1}{2} + 0.75 \times 0.40\} \times 42.5 =$ 45.2 m^3

FORM AREA

$A. = \{(0.30+0.42) \times 2.12 \times \frac{1}{2} + 0.75 \times 0.40\} \times 4$

$+(0.40 \times 2 + \sqrt{2.12^2+0.74^2}) \times 42.50$ = 133.9 m^2

AGGREGATE SUB-BASE

$V = 0.95 \times 0.20 \times 42.50$ = 8.1 m^3

GRANULAR BACKFILL

$V = 0.15 \times 1.62 \times 42.50$ = 10.3 m^3

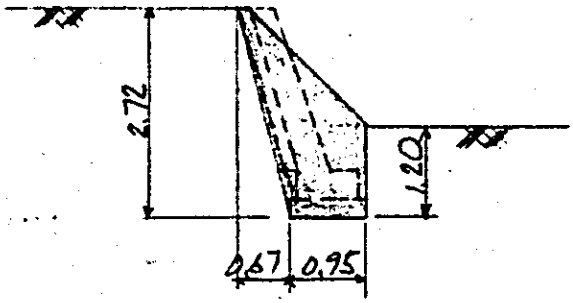
SOIL

$V = 0.15 \times 0.30 \times 33.9 = 1.5\ m^3$

U.P.V.C

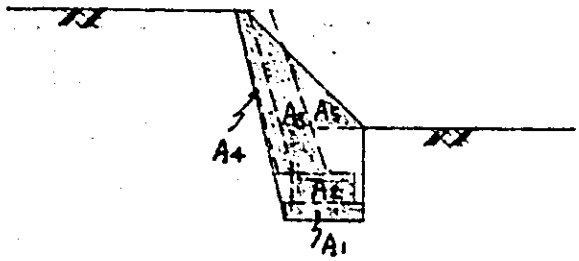
$n = 32$

DESIGN EXCA



$V = \{(1.20+2.72) \times 1.62 \times \frac{1}{2} - 0.67 \times 2.72 \times \frac{1}{2}\} \times 42.5 = 96\ m^3$

SURPLVSSOILS



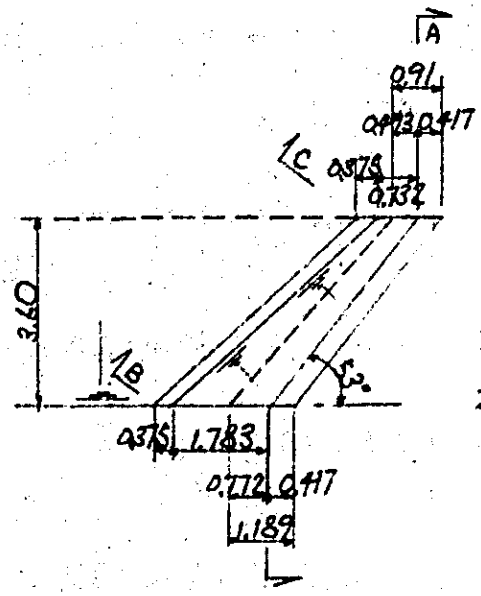
$V = \{0.95 \times 0.20\ (A_1) + 0.75 \times 0.40\ (A_2) + (0.30+0.42) \times 2.12\ (A_3) \times \frac{1}{2} + 0.15 \times 1.82\ (A_4) + 0.64 \times 1.00\ (A_5) \times \frac{1}{2}\} \times 42.5 = 78\ m^3$

BACK FILLING

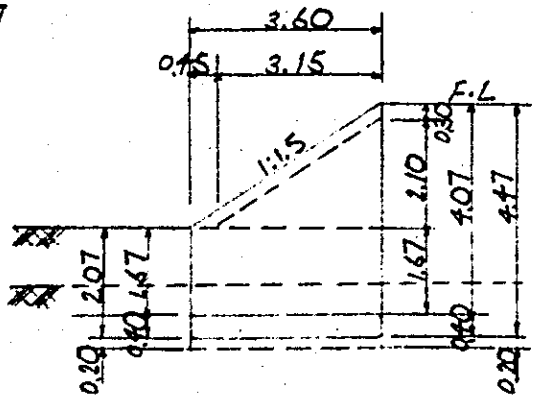
$V = 96 - 78 = 18\ m^3$

FOR 4.5m x 3.0m

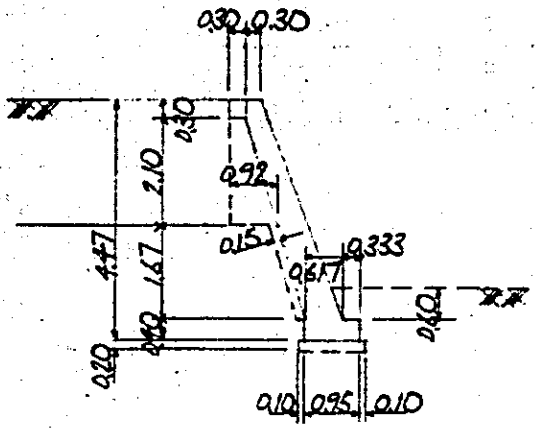
4 EACH PER BOX



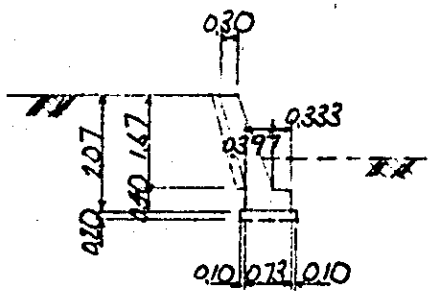
PLAN



SECTION A-A



SECTION B-B



SECTION C-C

CONCRETE VOLUME

$$V = \{(0.30+0.62)\times 4.07\times\tfrac{1}{2} + (0.30+0.40)\times 1.67\times\tfrac{1}{2}\}$$
$$\times\tfrac{1}{2}\times 4.51\times 4 + (0.95\times 0.40 + 0.73\times 0.40)\times\tfrac{1}{2}$$
$$\times 4.51\times 4 = 28.1\ m^3$$

FORM AREA

$A = \{(0.38+0.77)\times 4.07\times\frac{1}{2} + (0.38+0.49)\times 1.67\times\frac{1}{2}\}$

$\times 4 + (1.19\times 0.40 + 0.91\times 0.40)\times 4$

$+(\sqrt{4.07^2+1.42^2} + \sqrt{1.67^2+0.58^2})\times\frac{1}{2}\times 4.51\times 4$

$+ 0.40\times 2\times 4.51\times 4$ $= 84.9$ m^2

AGGREGATE SUB-BASE

$V = (1.15\times 0.20 + 0.93\times 0.20)\times\frac{1}{2}\times 4.51\times 4$ $= 3.8$ m^3

GRANULAR BACKFILL

$V = \{(0.30+0.92)\times 2.10\times\frac{1}{2} + 0\}\times\frac{1}{2}\times 4.51\times 4$

$+ 0.15\times 1.67\times 4.51\times 4$ $= 16.1$ m^3

SOIL

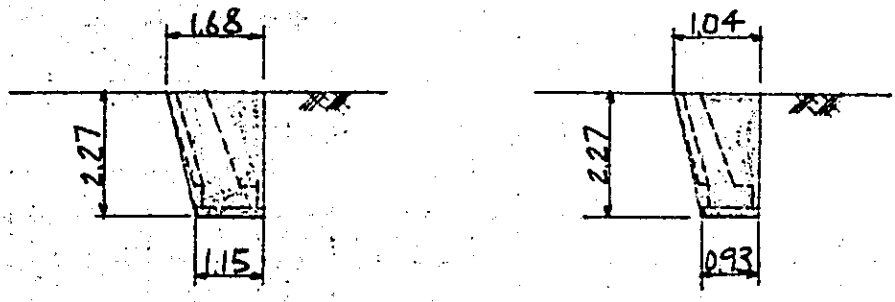
$V = 0.30\times 0.30\times 3.94\times 4 + (0.30\times 0.30 + 0)\times\frac{1}{2}\times 0.56$

$\times 4$ $= 1.5$ m^3

U.P.V.C

n $= 10$

DESIGN EXCA



$$V = \{(1.15+1.68)\times 2.27\times\tfrac{1}{2} + (0.93+1.04)\times 2.27\times\tfrac{1}{2}\}$$
$$\times\tfrac{1}{2}\times 4.51\times 4 \quad = \quad 49\ m^3$$

SURPLVSSOILS

$$V_1 = (1.15\overset{A1}{\times} 0.20 + 0.93\overset{A2}{\times} 0.20)\times\tfrac{1}{2}\times 4.51\times 4 = 3.752$$

$$V_2 = (0.95\overset{A3}{\times} 0.40 + 0.73\overset{A4}{\times} 0.40)\times\tfrac{1}{2}\times 1\times 1 = 6.061$$

$$V_3 = \{(0.52\overset{A5}{+} 0.62)\times 1.67\times\tfrac{1}{2} + (0.30\overset{A6}{+} 0.39)\times 1.67\times\tfrac{1}{2}\}$$
$$\times\tfrac{1}{2}\times 4.51\times 4 = 13.783$$

$$V_4 = 0.15\overset{A7}{\times} 1.67\times 4.51\times 4 = 4.519$$

$$V_5 = (0.64+1.02)\times 1.07\times\tfrac{1}{2}\times 4.51\times 4 = 16.021$$

TOTAL V $= 44\ m^3$

BACK FILLING

$V = 49 - 44$ = $5\ m^3$

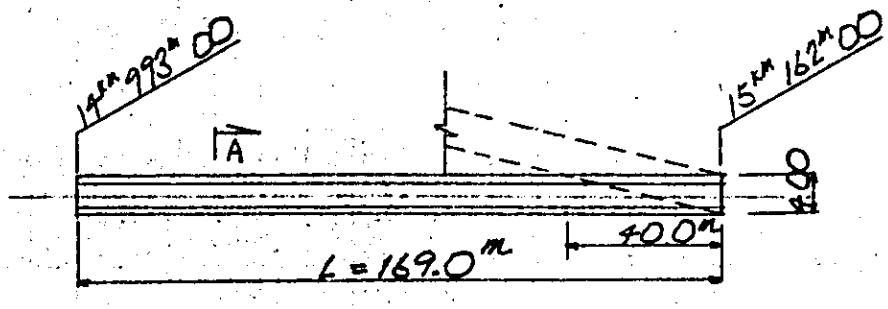
§ 4 RELOCATION OF RIVER AND WATER WAY

	STATION	DESIGN EXCA (m^3)	SURPLUS SOILS (m^3)	CONCRETE (CLASS E) (m^3)	FORM AREA (m^2)	AGGREGATE SUB-BASE-3 (m^3)	SOIL (m^3)	GRANULAR BACKFILL (m^3)	EXPANSION JOINTS (m^2)	REMARKS
RELOCATION RIVER	2K795M ~860M	99	99	209	499	80	21	71	20	
RELOCATION OF WATER WAY	14K993M ~15K162M	784	784							
TOTAL		883	883	209	499	80	21	71	20	

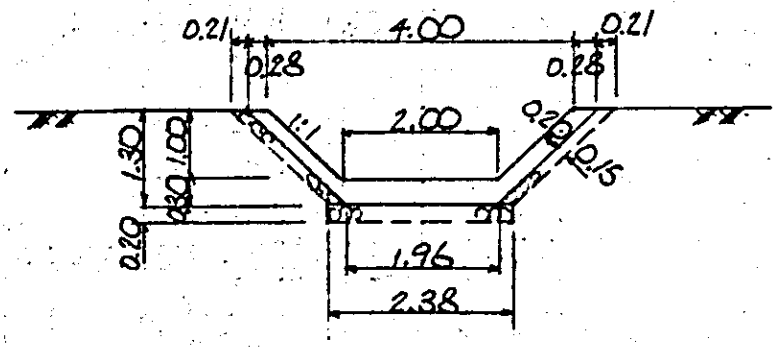
JICA

No. 2

RELOCATION OF WATER WAY



A PLAN



SECTION A-A

CONCRETE VOLUME

$$V = \{(1.96+4.56)\times 1.30\times\tfrac{1}{2} - (2.00+4.00)\times 1.00\times\tfrac{1}{2}\} \times 169.0 = 209 \ m^3$$

FORM AREA

$$A = \{(1.96+4.56)\times 1.30\times\tfrac{1}{2} - (2.00+4.00)\times 1.00\times\tfrac{1}{2}\} \times 18 + \sqrt{1.00^2+1.00^2}\times 169.0\times 2 = 499 \ m^2$$

AGGREGATE SUB-BASE

$$V = 2.38\times 0.20\times 169.0 = 80 \ m^3$$

SOIL

$V = 0.21 \times 0.30 \times 169.0 \times 2 = 21\ m^3$

GRANULAR BACKFILL

$V = 0.21 \times 1.00 \times 169.0 \times 2 = 71\ m^3$

EXPANSION JOINTS

$A = \{(1.96+4.56) \times 1.30 \times \frac{1}{2} - (2.00+4.00) \times 1.00 \times \frac{1}{2}\}$

$\times 16 = 20\ m^2$

DESIGN EXCA

$V = \{(2.38+4.98) \times 1.30 \times \frac{1}{2} + 2.38 \times 0.20\} \times 129.00$
$+ (5.26+0) \times \frac{1}{2} \times 40.00 = 784\ m^3$

SURPLUSSOILS

$V = 784\ m^3$

RELOCATION OF RIVER

$2^{KM}825^{M}$ $2^{KM}800^{M}$

TOTAL LENGTH = 43^{M}

DESIGN EXCA

$V = (2.80 + 1.80) \times 43.0 \times \frac{1}{2}$ = 99^{M^3}

SURPLUSSOILS

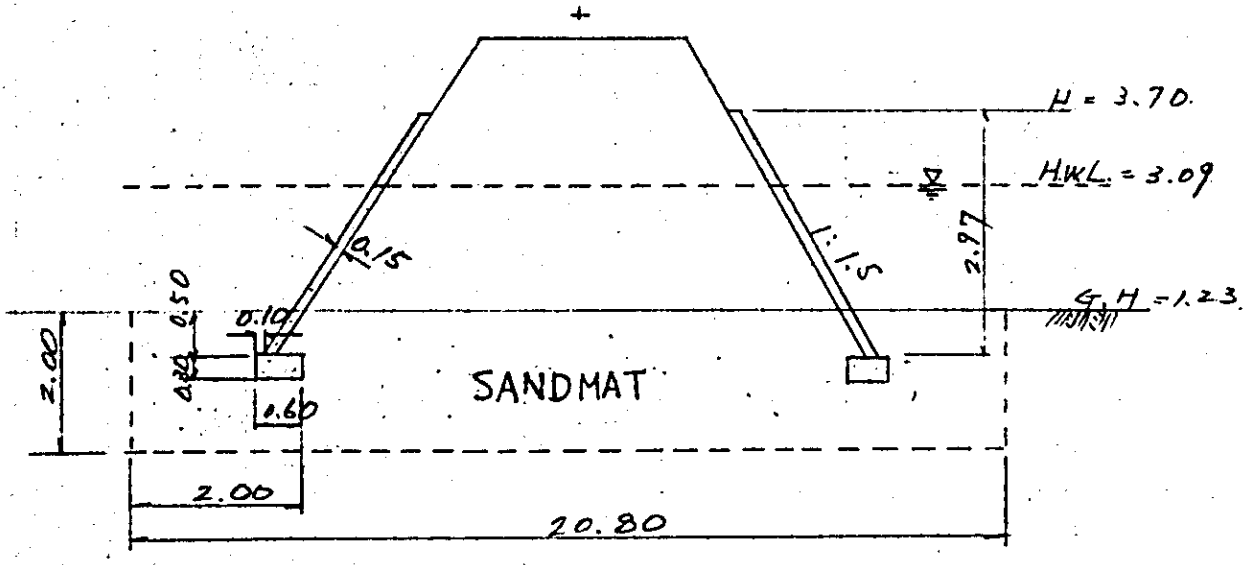
V = 99^{M^3}

§5 SLOPE PROTECTION

SLOPE PROTECTION QUANTITY CALUCULATION SHEET

3K315M ~ 3K326M L = 11.0m

3K332M ~ 3K371M L = 32.0 + 46.0 = 78.0m



CLASS E CONCRETE

2.97 × 1.5 × (11.0 + 78.0) × 0.15 = 59.5 m³

0.60 × 0.30 × (11.0 + 78.0) = 16.0 m³ } Σ = 75.5m³

SANDMAT

10.40 × 2.00 × (11.0 + 78.0) = 1,851.2 m³

DESIGN EXCA. 1,851.2 m³

SURPIUS SOILS 1,851.2 m³

§ 6. FENCING

SUMMARY OF FENCING (ONLY EMBANKMENT SECTION)

SECTION	LENGTH (m) (LEFT)	LENGTH (m) (RIGHT)	TOTAL (m)
1. 2K387M ~ 2K710M	340	320	660
2. 2K710M ~ 2K933M	255	304	559
3. 2K933M ~ 3K266M	275	278	553
4. 3K266M ~ 5K323M	2.029	2.100	4.129
5. 5K323M ~ 6K443M	1.105	1.120	2.225
6. 6K443M ~ 8K544M	2.081	2.102	4.183
7. 8K544M ~ 9K620M	1.075	1.082	2.157
8. 9K620M ~ 10K973M	1.357	1.368	2.725
9. 11K067M ~ 11K465M	370	453	823
10. 11K465M ~ 11K752M	299	281	580
11. 11K752M ~ 12K431M	640	701	1.341
12. 12K431M ~ 13K317M	865	908	1.773
13. 13K317M ~ 13K400M	93	80	173
TOTAL	10.784	11.097	21.881

PROTECTIVE FENCE

QUANTITY CALCULATION SHEET

	TOTAL LENGHT (m)	CONCRETE (CLASS D) (m^3)	FORM AREA (m^2)	ANGLE (kg)	BOLT (kg)	WASHER (kg)	BARBED WIRE (m)	REINFORCING BAR (SR-24) (kg)	DESIGN EXCA (m^3)	SURPLV SSOILS (m^3)	REMARKS
TRACK AT GRADE	21881	345	5470	89712	2785	547	207870	18599	306	306	

JICA

No. 4

PROTECTIVE FENCE

TOTAL LENGTH = 21881 m

CONCRETE VOLUME

$V = 0.063\ m^3 \times \frac{21881}{4} = 345\ m^3$

FORM AREA

$A = 1.00\ m^2 \times \frac{21881}{4} = 5470\ m^2$

ANGLE

$W = 16.4\ kg \times \frac{21881}{4} = 89712\ kg$

BOLT

$W = 0.5\ kg \times \frac{21881}{4} = 2735\ kg$

WASHER

$W = 0.1\ kg \times \frac{21881}{4} = 547\ kg$

BARBED WIRE

$L = 38.0\ m \times \frac{21881}{4} = 207870\ m$

REINFORCING BAR

$W = 3.4\ kg \times \frac{21881}{4} = 18599\ kg$

DESIGN EXCA

$V = 0.056 \times \frac{21\,881}{4}$ = 306 m^3

SURPLYSSOILS

V = 306 m^3

PER 4m QUANTITY

CONCRETE VOLUME

$V = 0.25 \times 0.25 \times 0.50 \times 2 = 0.063\ m^3$

FORM AREA

$A = 0.25 \times 0.50 \times 4 \times 2 = 1.00\ m^2$

ANGLE

L-50×50×6×1850

$W = 4.43\ kg/m \times 1.85 \times 2 = 16.4\ kg$

BOLT

φ12×25

$W = 0.038\ kg \times 14 = 0.5\ kg$

WASHER

φ26 t=2.6

$W = 0.005\ kg \times 14 = 0.1\ kg$

BARBED WIRE

φ2.0

$L = 4.0\ m \times 7 + 2.5\ m \times 4 = 38.0\ m$

No. 8

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
F 1	φ6	0.222	680	8	12	1
2	〃	〃	1000	10	22	□
	TOTAL				34	

JICA

DESIGN EXCA

$V = 0.25 \times 0.25 \times 0.45 \times 2 = 0.056\ m^3$

SURPLUSSOILS

$V = 0.056\ m^3$

§ 7. RECLAMATION

(FISH POND AND LOW GROUND)

EARTHWORK VOLUME OF FISH POND AND LOW GROUND

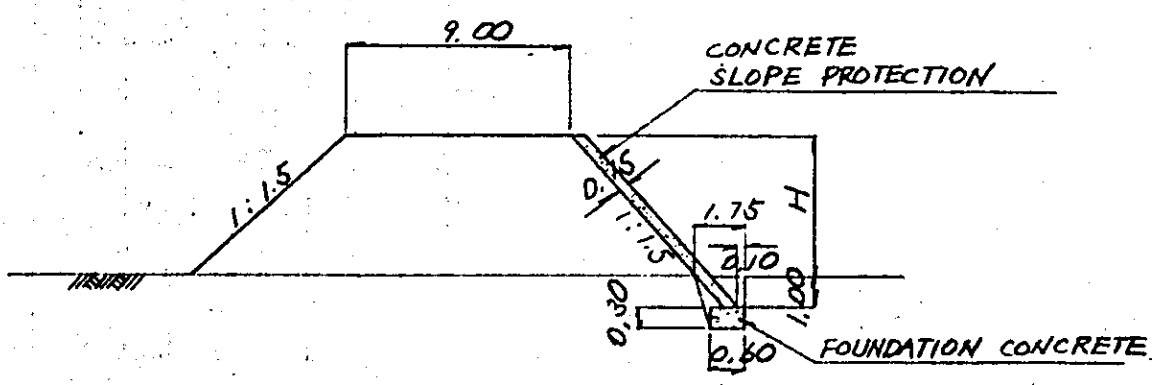
	RECLAMATION (m^3)	CONCRETE SLOPE PROTECTION	FOUNDATION CONCRETE (m^3)	REMARKS
①	278	19	10	FISH POND
②	1.276	35	9	DO
③	63	—	—	LOW GROUND
④	128	5	2	FISH POND
⑤	118	4	1	DO
⑥	135	5	1	DO
⑦	1.179	35	10	DO
⑧	735	32	13	DO
⑨	120	—	—	WATER CHANNEL
⑩	536	—	—	LOW GROUND
TOTAL	4.568	135	46	

EXCAVATION

$$(0.60 + 1.75) \times 1.30 \times \tfrac{1}{2} \times 257 = 393\ m^3$$

REFILLING

$$393 - (0.30 \times 0.60 + 1.50 \times 0.15) \times 257 = 289\ m^3$$



① $H = 0.5^{m}$, $L = 57^{m}$

RECLAMATION

$(9.00 + 10.5) \times 0.50 \times 1/2 \times 57 = 277.9^{m^3}$

CONCRETE SLOPE PROTECTION

$1.5 \times 1.5 \times 0.15 \times 57 = 19.2^{m^3}$

FOUNDATION CONCRETE

$0.3 \times 0.6 \times 57 = 10.3^{m^3}$

② $H = 2.1^{m}$, $L = 50^{m}$

RECLAMATION

$(9.0 + 15.3) \times 2.1 \times 1/2 \times 50 = 1,275.8^{m^3}$

CONCRETE SLOPE PROTECTION

$3.1 \times 1.5 \times 0.15 \times 50 = 34.9^{m^3}$

FOUNDATION CONCRETE

$0.3 \times 0.6 \times 50 = 9.0^{m^3}$

③ H = 0.5m, L = 13m

RECLAMATION
(9.00 + 10.50) × 0.50 × 1/2 × 13 = 63.4 m³

④ H = 1.3m L = 9m

RECLAMATION
(9.00 + 12.90) × 1.30 × 1/2 × 9 = 128.1 m³

CONCRETE SLOPE PROTECTION
2.30 × 1.50 × 0.15 × 9 = 4.7 m³

FOUNDATION CONCRETE
0.30 × 0.60 × 9 = 1.6 m³

⑤ H = 1.5m, L = 7m

RECLAMATION
(9.00 + 13.5) × 1.50 × 1/2 × 7 = 118.1 m³

CONCRETE SLOPE PROTECTION
2.50 × 1.50 × 0.15 × 7 = 3.9 m³

FOUNDATION CONCRETE
0.30 × 0.60 × 7 = 1.3 m³

⑥ H = 1.5m, L = 8m

RECLAMATION
(9.00 + 13.50) × 1.5 × 1/2 × 8 = 135.0 m³

CONCRETE SLOPE PROTECTION
2.50 × 1.50 × 0.15 × 8 = 4.5 m³

FOUNDATION CONCRETE
0.30 × 0.60 × 8 = 1.4 m³

⑦ H = 1.8m, L = 56m

RECLAMATION
(9.00 + 14.40) × 1.80 × 1/2 × 56 = 1,179.4 m³

CONCRETE SLOPE PROTECTION
2.80 × 1.50 × 0.15 × 56 = 35.3 m³

FOUNDATION CONCRETE
0.30 × 0.60 × 56 = 10.1 m³

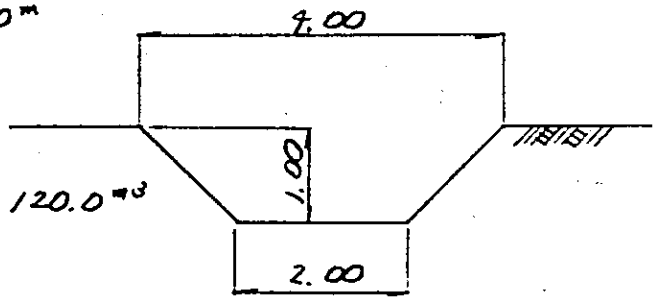
⑧ H = 1.0m, L = 70m

RECLAMATION
(9.00 + 12.00) × 1.00 × 1/2 × 70 = 735.0 m³

CONCRETE SLOPE PROTECTION
2.00 × 1.50 × 0.15 × 70 = 31.5 m³

FOUNDATION CONCRETE
0.30 × 0.60 × 70 = 12.6 m³

⑨ H = 1.0m, L = 40m



RECLAMATION
(2.00 + 4.00) × 1.00 × 1/2 × 40 = 120.0 m³

⑩ H = 0.5m, L = 110m

RECLAMATION
(9.00 + 10.50) × 0.50 × 1/2 × 110 = 536.3 m³

§8. CONCRETE PAVING

(PLATFORM IN AIPORT STATION)

JIA - CENGKARENG Stn

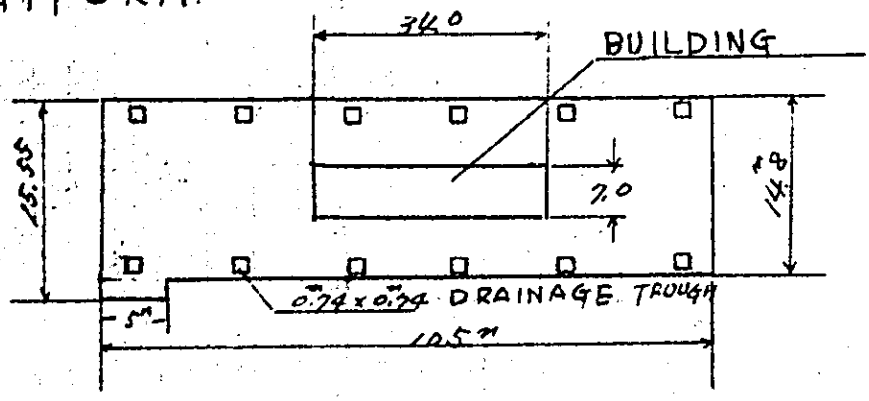
CONCRETE PAVING

ITEM	CONCRETE VOLUME (m^3)	FORM AREA (m^2)	REINFORCING BAR (Kg)	RATIO (Kg/m^3)
PLATFORM	262.6	2626.4	–	–
STATION SIDEWALK	62.9	629.2	–	–
TOTAL	325.6	3255.6	–	–

	UNIT	QUANTITY	REMARKS
LEVELING CONCRETE	m^3	–	
REGULATED AGGREGATE	m^3	651.1	
EXCAVATION	m^3	0	
BEARING BASE MORTEAR	m^3	0	
PILE	m x NUMBER	0	

PAVING AREA

(1) PLATFORM.



$$A = (100 \times 14.8) + (15.55 \times 5) - [(34. \times 7) + (0.74 \times 0.74 \times 12)]$$

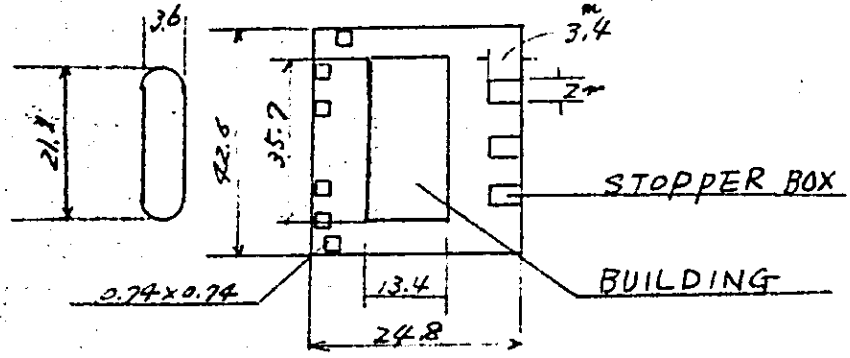
$$= 1557.75 - 244.57 = 1318.18$$

PLATFORM 2 NO.

$$\Sigma A = 1318.18 \times 2 = 2626.36\ m^2$$

2626.4 m^2

(2) STATION. SIDEWALK AREA



$$A = \left\{(24.8 \times 42.6) + \left[\left(\frac{3.6}{2}\right)^2 \pi + (17.5 \times 3.6)\right]\right\} - [(13.4 \times 35.7) + (2 \times 3.4 \times 3) + (0.74 \times 0.74 \times 3)] = 1129.6588 - 500.4228 = 629.236\ m^2$$

629.2 m^2

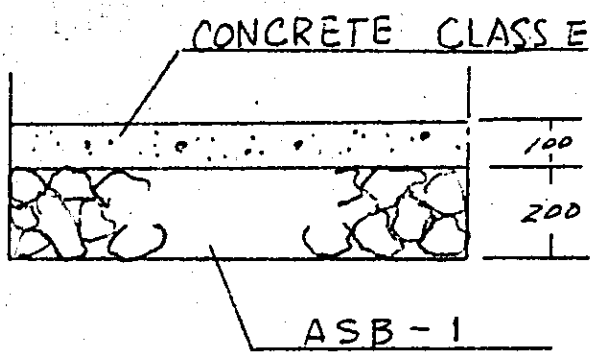
TOTAL 3255.6 m^2

3) CONCRETE VOLUME

$V = 3255.6\ m^3 \times 0.1 = 325.56$ $325.6\ m^3$

4) REGULATED AGGREGATE

$V = 3255.6\ m^3 \times 0.2 = 651.12$ $651.1\ m^3$



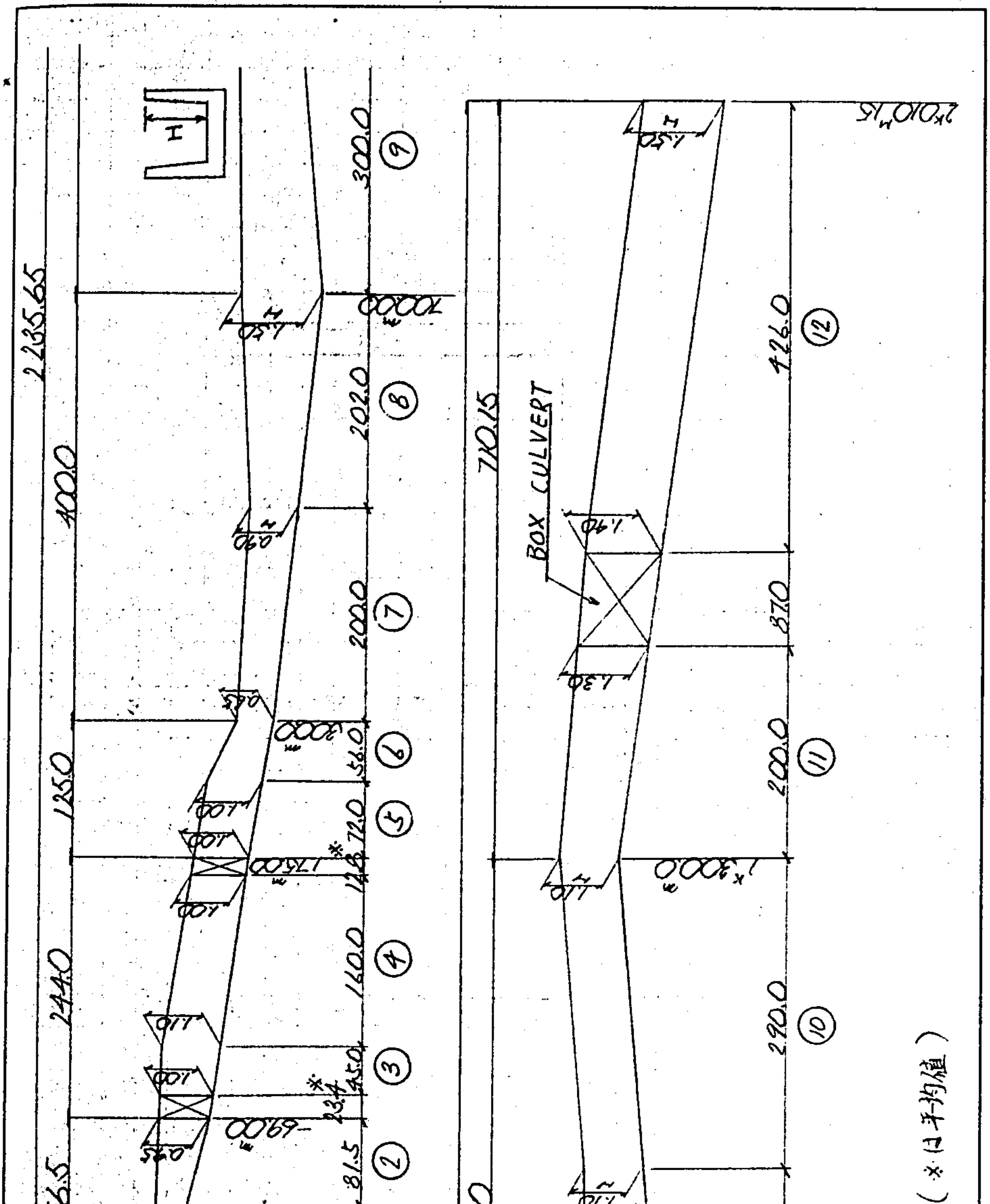
5) EXCAVATION 0 m^3.

§9 DRAIN DITCH

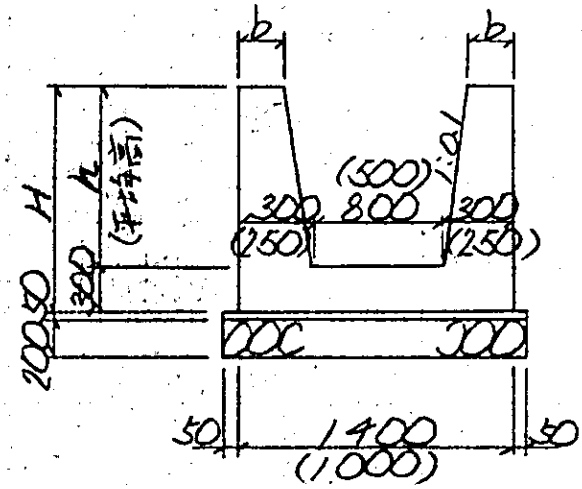
SIDE DITCHES REINFRCED CONCRETE

ITEM	CONCRETE VOLUME (m^3)	FORM AREA (m^2)	REINFORCING BAR (kg)	RATIO (kg/m^3)
SIDE DITCHES REINFRCED. COC	4027.7	25.766	135,773.6	33.7

I T E M	UNIT	QUANTITY	REMARKS
LEVELING CONCRETE	m^3	302.0	CLESS F
REGULATED AGGREGETA	m^3	1208.0	A.S.B.-3
EXCAVATION	m^3	11.025.0	B. 6172.0 C 4853.0
PILE B.	m	2661.2	SINGLE PILE
〃 C	m	1810.2	DOUBLE PILE


2 235.65
400.0
125.0
244.0
156.5
300.0
202.0
200.0
56.0
72.0
14.8
160.0
45.0
23.4
81.5
75.0
710.15
600.0
426.0
87.0
200.0
290.0
BOX CULVERT
H
1.50
0.90
0.85
1.00
1.10
1.40
1.30
(※は平均値)

1. SIDE DITCHES REINFRCED CONCRETE



( ) ··· ①, ② BLOCK

1-1. CONCRETE (class D)

1) SIDE WALL

① BLOCK

$h = \frac{1}{2} \times (0.48 + 0.55) = 0.515^{m}$

$b = 0.25 - 0.0515 = 0.199^{m}$

$\therefore V_1 = (0.199 + 0.250) \times 0.515 \times \frac{1}{2} \times 75.0 \times 2 = 17.343^{m^3}$

② BLOCK

$h = \frac{1}{2} \times (0.55 + 0.95) = 0.75^{m}$

$b = 0.25 - 0.075 = 0.175^{m}$

$\therefore V_2 = (0.175 + 0.250) \times 0.75 \times \frac{1}{2} \times 81.5 \times 2 = 25.778^{m^3}$

③ BLOCK

$h = \frac{1}{2} \times (1.00 + 1.10) = 1.05^{m}$

$b = 0.30 \div 0.105 = 0.195^{m}$

$\therefore V_3 = (0.195 + 0.300) \times 1.05 \times \frac{1}{2} \times 45.0 \times 2 = 23.389^{m^3}$

④ BLOCK

$h = \frac{1}{2} \times (1.10 + 1.00) = 1.05^{m}$

$b = 0.30 - 0.105 = 0.195^{m}$

$\therefore V_4 = (0.195 + 0.300) \times 1.05 \times \frac{1}{2} \times 162.8 \times 2 = 84.615^{m^3}$

⑤ BLOCK

$h = 1.00^{m}$

$b = 0.20^{m}$

$\therefore V_5 = (0.20 + 0.30) \times 1.00 \times \frac{1}{2} \times 69.0 \times 2 = 34.500^{'}$

⑥ BLOCK

$h = \frac{1}{2} \times (1.00 + 0.65) = 0.825^{m}$

$b = 0.30 - 0.0825 = 0.218^{m}$

$\therefore V_6 = (0.218 + 0.30) \times 0.825 \times \frac{1}{2} \times 56.0 \times 2 = 23.932^{'}$

⑦ BLOCK

$h = \frac{1}{2} \times (0.65 + 0.90) = 0.775^{m}$

$b = 0.30 - 0.0775 = 0.223^{m}$

$\therefore V_7 = (0.223 + 0.30) \times 0.775 \times \frac{1}{2} \times 200.0 \times 2 = 81.065^{''}$

⑧ BLOCK

$h = \frac{1}{2} \times (0.90 + 1.50) = 1.20^{m}$

$b = 0.30 - 0.12 = 0.18^{m}$

$\therefore V_8 = (0.18 + 0.30) \times 1.20 \times \frac{1}{2} \times 200.0 \times 2 = 115.200^{'}$

⑨ BLOCK

$h = \frac{1}{2} \times (1.50 + 1.10) = 1.30^{m}$

$b = 0.30 - 0.13 = 0.17^{m}$

$\therefore V_9 = (0.17 + 0.30) \times 1.30 \times \frac{1}{2} \times 300.0 \times 2 = 183.300^{m^3}$

⑩ BLOCK

$h = 1.10^{m}$

$b = 0.30 - 0.11 = 0.19^{m}$

$\therefore V_{10} = (0.19 + 0.30) \times 1.10 \times \frac{1}{2} \times 300.0 \times 2 = 161.700^{"}$

⑪ BLOCK

$h = \frac{1}{2} \times (1.10 + 1.30) = 1.20^{m}$

$b = 0.30 - 0.12 = 0.18^{m}$

$\therefore V_{11} = (0.18 + 0.30) \times 1.20 \times \frac{1}{2} \times 200.0 \times 2 = 115.200^{"}$

⑫ BLOCK

$h = \frac{1}{2} \times (1.40 + 1.50) = 1.45^{m}$

$b = 0.30 - 0.145 = 0.155^{m}$

$\therefore V_{12} = (0.155 + 0.30) \times 1.45 \times \frac{1}{2} \times 423.15 \times 2 = 279.173^{"}$

$\Sigma V = 1145.395^{m^3}$

2) BASE. CONCRETE

$L_1 = 45.0 + 162.8 + 69.0 + 56.0$

$+ 200.0 + 200.0 + 300.0 + 300.0 + 200.0$,
$+ 423.15 = 1955.^{m}95$

$L_2 = 75.0 + 81.5 = 156.50^{m}$

$V_1 = 0.30 \times 1.40 \times 1955.95 = 821.499^{m^3}$

$V_2 = 0.30 \times 1.00 \times 156.50 = 46.950$

$\Sigma V = 868.449^{m^3}$ → 868.4^{m^3}

3) CONCRETE VOLUME TOTAL

$\Sigma V = 1145.395 + 868.449$

$= 2013.844^{m3}$

$\therefore 2 \cdot \Sigma V = 2 \times 2013.844$

$= 4027.688^{m3}$ → 4027.7^{m3}

1-2. SUB BASE CONCRETE (CLESS F)

$V_1 = 0.05 \times 1.50 \times 1955.95 \times 2 = 293.393^{m^3}$

$V_2 = 0.05 \times 1.10 \times 156.5 = 8.608^{m^3}$

$\Sigma V = 302.001^{m^3}$ → 302.0^{m^3}

1-3. SUB BASE COURSE (A. S. B. - 5)

$V_1 = 0.20 \times 1.50 \times 1955.95 \times 2 = 1173.570^{m^3}$

$V_2 = 0.20 \times 1.10 \times 156.5 = 34.430^{m^3}$

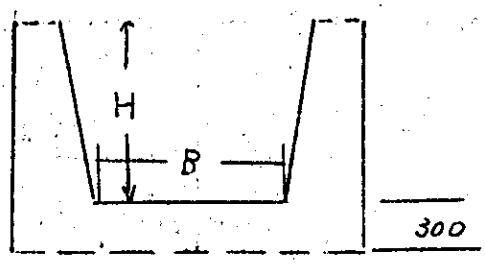
$\Sigma V = 1208.000^{m^3}$ → 1208.0^{m^3}

1-4 DEFORMED BAR RATIO $620.2^{kg}/18.4^{m^3} = 33.71^{kg}/_{m^3}$

$W = 4027.688 \times 33.71 = 135773.632^{kg}$ → 135773^{kg}

1-5

FORM.. AREA



$L = 2112.^{m}45$

$$A = \left[\left(\frac{H_1 + H_2}{2}\right) \times 2 \times L\right] + \left[\left(\frac{(H_1+300)+(H_2+300)}{2} \times 2 \times L\right)\right] + B \times L =$$

① $\left(\frac{0.48+0.55}{2} \times 2 \times 75\right) + \left(\frac{0.78+0.85}{2} \times 2 \times 75\right) + (0.5 \times 75) = 237\ m^2$ — 237.

② $\left(\frac{0.55+0.95}{2} \times 2 \times 81.5\right) + \left(\frac{0.85+1.25}{2} \times 2 \times 81.5\right) + (0.5 \times 81.5) = 334.15$ — 334.15

③ $\left(\frac{1.0+1.1}{2} \times 2 \times 45\right) + \left(\frac{1.3+1.4}{2} \times 2 \times 45\right) + (1.0 \times 45) = 261.0$ — 261.

④ $\left(\frac{1.1+1.0}{2} \times 2 \times 160.\right) + \left(\frac{1.4+1.3}{2} \times 2 \times 160\right) + (1.0 \times 160) = 928$ — 928

⑤ $(1.0 \times 2 \times 72) + (1.3 \times 2 \times 72) + (1.0 \times 72) = 403.2$ — 403.2

⑥ $\left(\frac{1.0+0.65}{2} \times 2 \times 56\right) + \left(\frac{1.3+0.95}{2} \times 2 \times 56\right) + (1.0 \times 56) = 274.4$ — 274.4

⑦ $\left(\frac{0.65+0.9}{2} \times 2 \times 200\right) + \left(\frac{0.95+1.2}{2} \times 2 \times 200\right) + (1.0 \times 200) = 940$ — 940

⑧ $\left[\left(\frac{0.9+1.5}{2}\right)\times 2\times 202\right]+\left[\left(\frac{1.2+1.8}{2}\right)\times 2\times 202\right]$
$+(1.0\times 202)=1292.8$ — 1292.8

⑨ $\left[\left(\frac{1.5+1.1}{2}\right)\times 2\times 300\right]+\left[\left(\frac{1.8+1.4}{2}\right)\times 2\times 300\right]$
$+(1.0\times 300)=2040.0$ — 2040.

⑩ $(1.1\times 2\times 290)+(1.4\times 2\times 290)+(1.0\times 290)=1740.0$ — 1740

⑪ $\left[\left(\frac{1.1+1.3}{2}\right)\times 2\times 200\right]+\left[\left(\frac{1.4+1.6}{2}\right)\times 2\times 200\right]$
$+(1.0\times 200)=1280.$ — 1280

⑫ $\left[\left(\frac{1.4+1.5}{2}\right)\times 2\times 426\right]+\left[\left(\frac{1.7+1.8}{2}\right)\times 2\times 426\right]$
$+(1.0\times 426)=3152.4$ — 3152.4

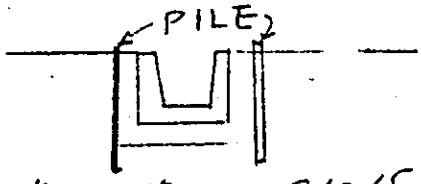
m^2

片側 TOTAL — 12882.95

$\Sigma A \quad 12.882.95^{m^2}\times 2=25765.9$ — 25.766^{km^2}

1-6 PILE

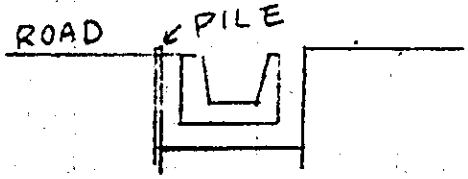
PILE. C



$0^K200 \sim 2^K010.15 = 1810.15$ — 1810.2^m

PILE B

$(2235.65\times 2)-1810.15=2661.15$ — 2661.2^m



§10. DRAIN PIPE

DRAIN PIPE ϕ 300 mm

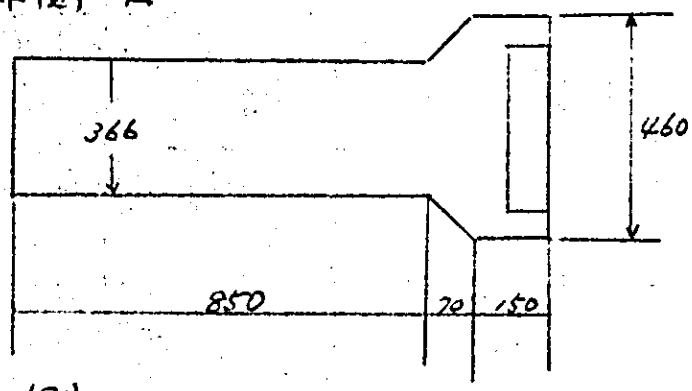
PIPE NO.	LENGTH	① LENGTH	② LENGTH OF CATCH INLET		③ = ① - ② LENGTH
D.P-1		45^{5}	$3^{5} \times 0^{5}$ =	$1.^{75}$	43^{75}
2		50^{5}	"	$1.^{75}$	48^{75}
3		73^{5}	5^{5}	2^{75}	70^{75}
4		79^{5}	6^{5}	3^{25}	75^{75}
5		67^{5}	5^{5}	2^{75}	64^{75}
6		72^{5}	"	2^{75}	69^{75}
B a-3	×3	$2^{5} \times 3$	$0^{5} \times 0^{5} \times 3$		
		7^{5}		$0^{.75}$	6^{75}
C 2-1		25	1	0^{5}	24^{5}
C 2·3·B5	$20 + 11 + 5 + 2^{5}$	38^{5}	3^{5}	$1.^{75}$	36^{75}
C4 - 3		20	1	0^{5}	19^{5}
C4 - 5		20	1	0^{5}	19^{5}
C6 - 5		20	1	0^{5}	19^{5}
C6 ~ B12	20 + 10 + 6 + 2	38	3^{5}	$1.^{75}$	36^{25}
C9 - B15	$20 + 13^{5} + 5$	38^{5}	2^{5}	$1.^{25}$	37^{25}
C10 - 11	10	10	0^{5}	0^{25}	9^{75}
					$= 583^{45}$

DRAIN PIPE ϕ 300mm

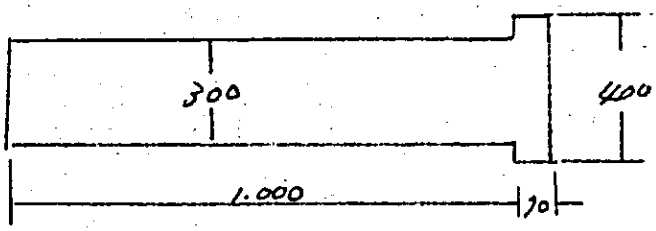
PIPE NO.	LENGTH	① LENGTH	② LENGTH OF CATCH INLET ×0.5		③ = ① - ② LENGTH
$D_2 - A_6$	20 + 25	45	2	1	44
$D_2 - D_4$	20 + 20	40	2	1	39
$D_7 - A_{17}$	25	25	1	0.5	24.5
D_7 ~~D_8~~ $- E_5$	20 + 15 + 6 + 2	43	3.5	1.75	41.25
$D_9 - D_8$	20	20	1	0.5	19.5
$D_9 - D_{10}$	20	20	1	0.5	19.5
$D_{11,12} - D_{16}$	20 + 20 + 22.5	62.5	2.5	1.25	61.25
$D_{13,15} - D_{17}$	20 + 20 + 17	57	2.5	1.25	55.75
E_4		2	0.5	0.25	1.75
E_8		7	0.5	1	1.75
$F_{1,3} - F_4$	15 + 6 + 3	24	2.5	1.25	22.75
$H_1 - 2$		—			
$H_3 - 4$		4.5	0.5	0.25	4.25
$G_5 - A_2$	20 + 20	40	2	1	39
$G_9 - A_3$	13.5 + 8 + 20	41.5	3	1.5	40
$G_{10} - A_8$	14 + 7 + 18	39	3	1.5	37.5
$G_{13} - A_7$	20 + 20	40	2	1	39
$G_2 - G_1$	8	8	0.5	0.25	7.75
$G_4 - G_3$	8	8	0.5	0.25	7.75
					= 506 m

REINFORCED CONCRETE PIPE

外側 A



内側 B



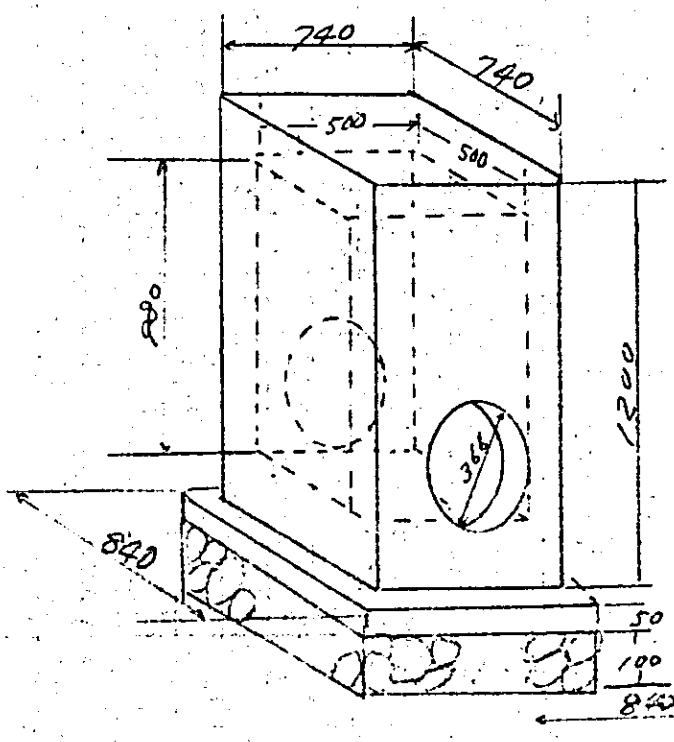
$$A.A = \left(\frac{0.366^2}{2}\pi \times 0.850\right) + \left[\left(\frac{\frac{0.366^2}{2}\pi + \frac{0.4^2}{2}\pi}{2}\right) \times 0.07\right] + \left(\frac{0.46^2}{2}\pi \times 0.15\right)$$

$$= 0.3088 = 0.309$$

$$B.A = \left(\frac{0.3^2}{2}\pi \times 1.0\right) + \left(\frac{0.4^2}{2}\pi \times 0.07\right) = 0.2309 = 0.231$$

$$A.A - B.A = 0.309 - 0.231 = 0.078\ m^3$$

CATCH INLET



CONCRETE

$V_1 = (0.74 \times 0.74 \times 1.2) - (0.5 \times 0.5 \times 0.98) - (\frac{0.366^2}{2}\pi \times 0.12 \times 2)$

$= 0.3869$

LEVELING CONCRETE

$V = 0.84 \times 0.84 \times 0.05$

$= 0.0353\ m^3$

BALLAST

$V = 0.84 \times 0.84 \times 0.1$

$= 0.0706\ m^3$

CONCRETE

$(0.74 \times 1.20 \times 4) + (0.5 \times 0.98 \times 4) = 5.512\ m^2$

$0.61 \times 0.61 \times 2 = 0.7442$

$5.512 + 0.7442 = 6.2562\ m^2 = 6.3\ m^3$

TOTAL ∇ @ $0.3869 \times 81 = 31.33 = 31.3\ m^3$

CHTCH INLET QUANTITY

DRAIN DITCH LINE NO.	APPELLATION	QUANTITY
A	A_2. A_3. A_4 A_5. A_6. A_7 A_8. A_9 A_{11}. A_{12}. A_{13}. A_{14}. A_{15} A_{16} A_{17}	15
B	B_2. B_4. B_6. B_8. B_{10} B_{12}. B_{14} B_{16}. B_{17}. B_{18} B_{19} B_{20}	12
C	C_1. C_2. C_3. C_4 C_5. C_6 C_7. C_8 C_9. C_{10} C_{12}. C_{13} C_{14} C_{15} C_{16} C_{17}	16
D	D_1. D_2. D_3. D_4. D_5. D_6. D_7. D_8 D_9. D_{10} D_{11} D_{12} D_{13} D_{14} D_{15}	15
E	E_2. E_4 E_6 E_8 E_{10} E_{11}. E_{12} E_{13}	8
F	F_1 F_2 F_3	3
G	G_2 G_4 G_5 G_6 G_7 G_8 G_9 G_{10} G_{11} G_{12} G_{13} G_{14}	12
TOTAL		81

§ 11. TURFING

TURFING QUANTITY CALUCULATION SHEET

STATION	LEFT (m^2)	RIGHT (m^2)	SUB TOTAL (m^2)
2Km080m ~ 2Km750m	1,031.1	1,097.5	2,128.6
2Km750m ~ 3Km450m	1,772.2	1,892.3	3,669.5
3Km450m ~ 4Km350m	2,458.5	2,460.4	4,918.9
4Km350m ~ 5Km229m80	2,739.6	2,814.7	5,554.3
5Km229m80 ~ 6Km350m	3,119.2	3,269.2	6,388.4
6Km350m ~ 7Km448m70	2,796.0	2,799.2	5,595.2
7Km448m70 ~ 8Km450m	1,994.1	2,025.7	4,019.8
8Km450m ~ 9Km493m52	3,028.7	2,941.9	5,970.6
9Km493m52 ~ 10Km449m	2,761.9	2,792.4	5,554.3
10Km456m01 ~ 11Km250m	3,285.6	3,358.3	6,643.9
11Km250m ~ 12Km200m	2,837.7	2,395.5	5,233.2
12Km200m ~ 13Km075m89	3,196.6	3,374.5	6,571.1
13Km075m89 ~ 13Km399m70	370.0	426.6	796.6
19Km439m60 ~ 19Km506m31	143.2	—	143.2
TOTAL	31,534.9	31,648.2	63,182.6

2K080m ~ 2K750m

1-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
2 080		1.5		0.8		
100	20	0.8	23.0	0.8	16.0	
150	50	0.5	32.5	0.7	37.5	
200	50	0.2	17.5	0.3	25.0	
250	50	0.5	17.5	0.6	22.5	
257 69	7.7	0.5	3.9	0.6	4.6	
287 69	30	0.7	18.0	0.7	19.5	
317 69	30	0.8	22.5	0.9	24.0	
350	32.3	0.9	27.5	1.4	37.1	
400	50	1.1	50.0	2.7	102.5	
450	50	2.8	97.5	2.9	140.0	
464 69	14.7	2.8	41.2	2.9	42.6	
						Cb 2K466m
467 32	-	2.8	-	2.9	-	
477	9.7	2.8	27.2	2.8	27.6	
500	23	2.8	64.4	2.7	63.3	
550	50	2.7	137.5	2.4	127.5	
600	50	2.4	127.5	1.9	107.5	
629 19	29.2	2.6	73.0	2.5	64.2	
						Cb 2K630m5
631 82		2.6		2.5		
637 28	5.5	2.6	14.3	2.5	13.8	
667 28	30	2.0	69.0	2.0	67.5	
697 28	30	2.0	60.0	1.8	57.0	
700	2.7	2.2	5.7	2.0	5.1	
705.1	5.1	2.2	11.2	2.0	10.2	
		(2+4) × 2.2 =	13.2	(4+4) × 2.0	16.0	LC
715	-	2.2	-	2.0	-	
750	35	2.2	77.0	1.8	66.5	
SUB TOTAL			1,031.1		1,097.5	

2^km 750^m ~ 3^km 450^m

2 - 13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
2 750		2.2		1.8		
800	50	2.3	112.5	2.1	97.5	
815.56	15.6	1.9	32.8	2.0	32.0	
						cb 2^K820^M
824.45		1.9		2.0		
825	0.6	1.9	1.1	2.0	1.2	
850	25	1.7	45.0	2.7	58.8	
853.50	3.5	1.7	6.0	2.7	9.5	
						cb 2^K855^M
856.50		1.7		2.7		
900	43.5	3.2	106.6	3.3	130.5	
950	50	2.5	142.5	3.4	167.5	
989.5	49.5	2.5	123.8	3.4	168.3	
				27 x 3.4 =	91.8	Substation
		(2+4) x 2.5 =	15.0	4 x 2.5 =	10.0	LC
996.5	-	2.7	-	2.5	-	
3 000	3.5	2.7	9.5	2.5	8.8	
050	50	3.0	142.5	2.8	132.5	
100	50	3.4	160.0	3.3	152.5	
150	50	3.2	165.0	3.2	162.5	
200	50	2.5	142.5	2.1	132.5	
250	50	1.9	110.0	1.8	97.5	
264.5	14.5	1.9	27.6	1.8	26.1	
						LC
267.5		1.9		1.8		
300	32.5	1.2	50.4	1.5	53.6	
332	32	1.2	38.4	1.5	48.0	
350	18	2.1	29.7	2.1	32.4	
375	25	3.7	72.5	2.1	52.5	
400	25	3.2	86.3	3.4	68.8	
450	50	2.9	157.5	2.9	157.5	
SUBTOTAL			1,772.2		1,892.3	

3Km 450m ~ 4Km 350m

3 - 13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
3 450		2.9		2.9		
500	50	2.8	142.5	2.7	140.0	
550	50	2.6	135.0	2.6	132.5	
598 70	48.7	3.1	138.8	3.1	138.8	
				3 x 3.1 =	9.3	SIGNAL
						cb 3K600M
601 30		3.1		3.1		
650	48.7	2.6	138.8	2.8	143.7	
700	50	2.6	130.0	2.5	132.5	
703 16	3.2	2.7	8.5	2.5	8.0	
733 16	30	2.9	84.0	3.0	82.5	
763 16	30	2.7	84.0	2.8	87.0	
800	36.8	2.8	101.2	2.8	103.0	
850	50	2.8	140.0	2.8	140.0	
900	50	2.4	130.0	2.4	130.0	
943	43	2.5	105.4	2.5	105.4	
950	7	2.5	17.5	2.5	17.5	
4.000	50	2.4	122.5	2.4	122.5	
050	50	2.7	127.5	2.7	127.5	
100	50	2.6	132.5	2.6	132.5	
		(3+3)x2.6=	15.6	(2+3)2.6=	15.6	SIGNAL
122.94	22.9	2.9	63.0	3.0	64.1	
152 94	30	2.7	84.0	2.7	85.5	
182 94	30	2.7	81.0	2.7	81.0	
200	17.1	2.8	47.0	2.7	46.2	
248 70	48.7	2.9	138.8	2.9	136.4	
						cb 4K250M
251 30	-	2.9	-	2.9	-	
300	48.7	2.7	136.4	2.7	136.4	
350	50	3.0	142.5	3.0	142.5	
		4 x 3.0 =	12.0			Signal sta.
SUBTOTAL			2,458.5		2,460.4	

4KM350M ~ 5KM229M80 4-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
4 350		3.0		3.0		
400	50	3.1	152.5	3.2	155.0	
450	50	3.2	157.5	3.1	157.5	
				(3+3) ×3.1 =	18.6	
500	50	3.1	157.5	3.1	155.0	
550	50	3.4	162.5	3.1	155.0	
600	50	3.6	175.0	3.6	167.5	
650	50	3.5	177.5	3.6	180.0	
				(1+3) ×3.6 =	21.6	
700	50	3.4	172.5	3.5	177.5	
748 70	48.7	3.1	158.3	3.2	163.1	
				7 ×3.2 =	22.4	
						cb 4K750M
751 30		3.1		3.2		
764 31	13.	3.2	41.0	3.1	41.0	
794 31	30	3.2	96.0	3.0	91.5	
824 31	30	3.0	93.0	3.0	90.0	
850	25.7	3.0	77.1	3.0	77.1	
900	50	2.9	147.5	2.9	147.5	
				(3+3) ×2.9	17.4	
950	50	2.9	145.0	3.0	147.5	
997 05	47.1	3.1	141.3	3.0	141.3	
5 000	3.	3.1	9.3	3.1	9.2	
048 70	48.7	3.0	148.5	3.0	148.5	
						cb 5K050M
051 30		3.0		3.0		
100	48.7	2.9	143.7	3.0	146.1	
150	50	3.0	147.5	2.9	147.5	
169 80	19.8	3.0	59.4	3.0	58.4	
199 80	30	3.0	90.0	3.0	90.0	
229 80	30	2.8	87.0	2.9	88.5	
SUBTOTAL			2,739.6		2,814.7	

JICA

5Km229m80 ~ 6Km350m

5-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
5 229.80		2.8		2.9		
250	20.2	1.7	45.5	1.7	46.5	
300	50	1.3	75.0	3.5	130.0	
321	21	1.9	33.6	2.4	62.0	
		4×1.3=	5.2	4×3.5=	14.0	LC
						Cb 5K333M
340.20		3.1		3.1		
350	9.8	3.1	30.4	3.1	30.4	
400	50	2.7	145.0	2.8	147.5	
				(3+3)×2.8	16.8	
450	50	1.5	105.0	2.2	125.0	
500	50	2.7	105.0	2.6	120.0	
550	50	3.0	142.5	3.0	140.0	
600	50	3.1	152.5	3.2	155.0	
650	50	3.3	160.0	3.3	162.5	
700	50	3.1	160.0	3.1	160.0	
750	50	3.0	152.5	3.1	155.0	
798.70	48.7	3.1	148.5	3.1	151.0	
						Cb 5K800M
801.30		3.1		3.1		
850	48.7	3.0	148.5	3.1	151.0	
900	50	3.0	150.0	3.1	155.0	
950	50	3.1	152.5	3.0	152.5	
6 000	50	3.3	160.0	3.3	157.5	
050	50	3.1	160.0	3.1	160.0	
100	50	3.0	152.5	2.9	150.0	
150	50	3.0	150.0	3.0	147.5	
200	50	2.9	147.5	3.0	150.0	
250	50	3.0	147.5	2.9	147.5	
300	50	3.0	150.0	2.9	145.0	
350	50	2.6	140.0	2.6	137.5	
SUBTOTAL			3,119.2		3,269.2	

6Km350m ~ 7Km448m70 6-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
6 350	-	2.6	-	2.6	-	
398 70	48.7	2.6	126.6	2.5	124.2	
						Cb 6K400M
401 30	-	2.6	-	2.5	-	
441 50	40.2	1.2	76.4	1.3	76.4	
		4×1.2=	4.8	(4+4)×1.3=	10.4	LC
444 50		1.2		1.3		
450	5.5	1.2	6.6	1.3	7.2	
500	50	2.5	92.5	2.5	95.0	
539	39	1.6	80.0	1.7	81.9	
550	11	2.8	24.2	2.7	24.2	
600	50	2.7	137.5	2.7	135.0	
650	50	2.9	140.0	2.9	140.0	
700	50	2.8	142.5	2.8	142.5	
750	50	2.4	130.0	2.5	132.5	
800	50	2.6	125.0	2.6	127.5	
850	50	2.7	132.5	2.7	132.5	
900	50	2.8	137.5	2.7	135.0	
948 70	48.7	2.6	131.5	2.6	129.1	
						Cb 6K950M
951 30		2.6		2.6		
7 000	48.7	2.7	129.1	2.7	129.1	
050	50	2.7	135.0	2.7	135.0	
100	50	2.8	137.5	2.7	135.0	
150	50	3.0	145.0	3.0	142.5	
200	50	2.6	140.0	2.6	140.0	
250	50	2.5	127.5	2.6	130.0	
300	50	2.5	125.0	2.5	127.5	
350	50	2.5	125.0	2.3	120.0	
400	50	2.4	122.5	2.6	122.5	
448 70	48.7	2.6	121.8	2.5	124.2	
SUBTOTAL			2,796.0		2,799.2	

7Km448m70 ~ 8Km450m 7-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
7 448 70	-	2.6	-	2.5	-	
						Cb 7K450m
451 30	-	2.6		2.5	-	
500	48.7	2.1	114.4	2.3	116.9	
550	50	2.1	105.0	2.1	110.0	
600	50	2.2	107.5	2.2	107.5	
626 23	26.2	1.5	48.5	1.4	47.2	
656 23	30	1.0	37.5	1.2	39.0	
686 23	30	1.9	43.5	1.2	36.0	
700	13.8	1.8	25.5	1.3	17.3	
750	50	1.7	87.5	1.9	80.0	
800	50	1.2	72.5	1.3	80.0	
850	50	2.0	80.0	1.9	80.0	
898.70	48.7	2.0	97.4	2.1	97.4	
						Cb 7K900m
901 30		2.0		2.1		
950	48.7	1.3	80.4	1.9	97.4	
8 000	50	1.9	80.0	2.0	97.5	
014 58	14.6	1.9	27.7	1.9	28.5	
050	35.4	1.8	65.5	1.9	67.3	
100	50	2.1	97.5	1.9	95.0	
150	50	1.8	97.5	1.8	92.5	
200	50	1.7	87.5	1.7	87.5	
250	50	1.5	80.0	1.5	80.0	
298 70	48.7	2.1	87.7	2.1	87.7	
						Cb 8K300m
301 30	-	2.1		2.1		
342 93	41.6	2.5	95.7	2.5	95.7	
372 93	30	3.1	84.0	3.1	84.0	
402 93	30	3.6	100.5	3.8	103.5	
450	47.1	4.5	199.8	4.6	197.8	
SUB TOTAL			1,994.1		2,025.7	

8Km450m ~ 9Km493m52 8-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
8 450	-	4.5	-	4.6	-	
500	50	4.6	227.5	4.6	230.0	
527	27	4.6	124.2	4.6	124.2	
531.39	4.4	1.1	12.5	0.9	12.1	
						Cb 8K535M5
		4×4.0	16.0	4×2.5	10.0	LC
547.5	-	4.0	-	2.5	-	
550	2.5	4.0	10.0	2.5	6.3	
600	50	4.2	205.0	4.2	167.5	
650	50	4.1	207.5	4.0	205.0	
700	50	4.1	205.0	4.0	200.0	
750	50	1.7	145.0	2.5	162.5	
800	50	2.0	92.5	0.9	85.0	
850	50	3.1	127.5	3.2	102.5	
900	50	3.5	165.0	3.5	167.5	
951 88	51.9	2.7	160.9	2.0	142.7	
						Cb 8K955M
958 12	-	2.7	-	2.0	-	
9 000	41.9	2.3	104.8	2.4	92.2	
050	50	2.3	115.0	2.5	122.5	
100	50	2.5	120.0	2.4	122.5	
150	50	2.6	127.5	2.6	125.0	
200	50	2.9	137.5	2.9	137.5	
250	50	2.9	145.0	3.1	150.0	
300	50	2.9	145.0	2.7	145.0	
350	50	2.3	130.0	2.2	122.5	
398 70	48.7	2.4	114.4	2.3	109.6	
						Cb 9K400M
401 30	-	2.4	-	2.3	-	
450	48.7	2.4	116.9	2.6	119.3	
493.52	43.5	1.0	74.0	1.1	80.5	
SUBTOTAL			3,028.7		2,941.9	

9Km493m52 ~ 10Km449m

9-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
9 493 52		1.0		1.1		
523 52	30	0.4	21.0	0.6	25.5	
553 52	30	0.0	6.0	0.3	13.5	
600	46.5	0.4	9.3	0.5	18.6	
617.9	17.9	0.4	7.2	0.5	9.0	
		4×0.4=	1.6	4×2×0.5=	4.0	LC 9K620M
622.1		0.4		0.5		
650	27.9	2.3	37.7	1.9	33.5	
700	50	2.3	115.0	2.3	105.0	
703.90	3.9	2.4	9.2	2.4	9.2	
750	46.1	2.1	103.7	2.5	112.9	
798.70	48.7	2.5	112.0	2.3	116.9	
						Cb 9K800M
801.30		2.5		2.3		
850	48.7	2.6	124.2	2.6	119.3	
854.27	4.3	2.7	11.4	2.5	11.0	
884.27	30	2.8	82.5	2.8	79.5	
914.27	30	3.0	87.0	2.8	84.0	
950	35.7	3.0	107.1	3.0	103.5	
10.000	50	3.2	155.0	3.3	157.5	
050	50	3.5	167.5	3.6	172.5	
100	50	3.8	182.5	3.8	185.0	
150	50	4.0	195.0	4.4	205.0	
200	50	4.6	215.0	4.5	222.5	
250	50	3.4	200.0	3.3	195.0	
298.60	48.6	4.3	187.1	4.4	187.1	
						Cb 10K300M
301.40		4.3		4.4		
350	48.6	4.5	213.8	4.4	213.8	
400	50	4.2	217.5	4.2	215.0	
449.	49	3.7	193.6	3.7	193.6	
SUBTOTAL			2,761.9		2,792.4	

10K"456"01 ~ 11K"250"

10-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
						Cb 10K452"50
10 456.01	-	3.7	-	3.7	-	
500	44	4.2	173.8	4.2	173.8	
550	50	3.8	200.0	4.0	205.0	
600	50	4.2	200.0	4.0	200.0	
624.70	24.7	4.2	103.7	4.0	98.8	
						Cb 10K626"4
627.30		4.4		4.4		
650	22.7	4.4	99.9	4.4	99.9	
700	50	4.5	222.5	4.5	222.5	
750	50	4.9	235.0	4.3	220.0	
774.62	24.6	4.9	120.5	4.3	105.8	
						Cb 10K776"50
778.39		5.3		4.3		
800	41.6	5.3	114.5	5.7	108.0	
850	50	5.2	262.5	6.0	292.5	
900	50	6.5	292.5	6.8	320.0	
950	50	5.1	290.0	5.4	305.0	
970.3	20.3	5.2	104.5	4.0	95.4	
		4×5.2=	20.8	4×4.0=	16.0	LC 10K973"4
						B 11K019"4
		4×3.9 =	15.6	21.0×4.3=	90.3	LC 11K067"4
11 071.2	-	3.9	-	4.3	-	
100	28.8	3.9	112.3	4.0	119.5	
150	50	3.8	192.5	4.0	200.0	
				3×2×3.8=	22.8	SIGNAL
188.60	38.6	6.6	200.7	6.3	198.8	
						Cb 11K190"4
191.40		6.6		6.3		
200	8.6	6.6	56.8	6.3	54.2	
250	50	4.1	267.5	2.1	210.0	
SUBTOTAL			3,285.6		3,358.3	

11Km250m ~ 12Km200m

11-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
11.250	-	4.1	-	2.1	-	
300	50	3.1	180.0	1.1	80.0	
350	50	0.6	92.5	0.0	27.5	
400	50	1.6	55.0	0.0	0.0	
450	50	1.3	72.5	0.0	0.0	
458.3	8.3	1.3	10.8	0.0	0.0	
		(2+4)×4.0=	24.0	4×3.2=	12.8	LC 11K465M
471.7	-	4.0	-	3.2	-	
500	28.3	9.0	113.2	3.2	90.6	
550	50	3.3	182.5	2.8	150.0	
600	50	4.3	190.0	2.6	135.0	
605.61	5.6	4.3	24.1	2.6	14.6	
						Cb 11K607M
608.39	-	4.3	-	2.6	-	
650	41.6	4.1	174.7	4.0	137.3	
				3×4.0×2=	24.0	SIGNAL
700	50	1.1	130.0	1.3	132.5	
747.7	47.7	1.8	69.2	1.0	54.9	
		(2+9)×1.8=	10.8	4×2×1.0=	8.0	LC 11K752M
756.3	-	1.8	-	1.0	-	
800	43.7	1.1	63.4	1.1	45.9	
850	50	1.6	67.5	1.7	70.0	
900	50	1.7	82.5	2.7	110.0	
950	50	2.9	115.0	2.9	140.0	
12.000	50	4.5	185.0	3.5	160.0	
				4×2.7=	10.8	Signal Stn.
				3×3.5×2=	21.0	SIGNAL
050	50	4.9	235.0	4.6	202.5	
100	50	5.1	250.0	4.9	237.5	
150	50	5.1	255.0	5.0	247.5	
200	50	5.1	255.0	5.1	252.5	
				3×5.1×2=	30.6	SIGNAL
SUBTOTAL			2,837.7		2,395.5	

12K200M ~ 13KM 075M 89 — 12 - 13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
12 200	-	5.1	-	5.1	-	
250	50	5.1	255.0	5.2	257.5	
300	50	5.3	260.0	5.3	262.5	
				7×5.3 =	37.1	SIGNAL
328,60	28.6	5.3	151.6	5.3	151.6	
						cb 12K330M
331,40		2.1		2.1		
350	18.6	2.1	39.1	2.1	39.1	
400	50	2.0	102.5	2.1	105.0	
425.9	25.9	3.2	67.3	3.5	72.5	
		(2+4)×3.2=	19.2	4×3.5×2 =	28.0	LC 12K431M
436,2	-	3.2	-	3.5	-	
450	13.8	4.0	49.7	2.6	42.1	
	-			3×2.6×2 =	15.6	SIGNAL
500	50	4.2	205.0	4.2	170.0	
550	50	3.7	197.5	5.0	230.0	
600	50	4.6	207.5	4.5	237.5	
650	50	4.1	217.5	4.0	212.5	
700	50	3.6	192.5	3.6	190.0	
750	50	3.7	182.5	3.7	182.5	
798.70	48.7	3.5	175.3	3.5	175.3	
						cb 12K800M
801.30	-	3.5	-	3.5	-	
850	48.7	3.6	172.9	3.6	172.9	
900	50	3.6	180.0	3.6	180.0	
950	50	3.4	175.0	3.5	177.5	
				3×3.5×2 =	21.0	SIGNAL
13 000	50	1.1	112.5	2.7	155.0	
015,89	15.9	3.8	39.0	3.5	49.3	
045.89	30	3.5	109.5	3.5	105.0	
075.89	30	2.2	85.5	3.5	105.0	
SUBTOTAL			3,196.6		3,374.5	

JICA

13Km075m89 ~ 13Km399m70
19Km439m60 ~ 19Km506m31

13-13

KILOMETER (km m)	DISTANCE (m)	LEFT VEGETATION (m)	LEFT VEGETATION (m²)	RIGHT VEGETATION (m)	RIGHT VEGETATION (m²)	REMARKS
13 075.89	-	2.2	-	3.5	-	
090.53	14.6	1.6	27.7	3.8	53.3	
100	9.5	0.9	11.9	1.6	25.7	
105.17	5.2	1.0	4.9	0.8	6.2	
135.17	30	1.4	36.0	0.9	25.5	
165.17	30	1.1	37.5	0.8	25.5	
200	34.8	1.2	40.0	1.2	34.8	
250	50	0.0	30.0	0.9	52.5	
300	50	1.1	27.5	1.1	50.0	
313.2	13.2	1.2	15.2	1.2	15.2	
		(2+4)×1.2	7.2	4×1.2×2	9.6	∠C 13K317M
320.8	-	1.2	-	1.2	-	
350	29.2	1.5	39.4	1.4	38.0	
397.4	47.4	2.3	90.1	2.3	87.7	
399.7	2.3	0.0	2.6	0.0	2.6	
SUB TOTAL			370.0		426.6	
		0.0				
19 439.6	3.6	3.6	6.5	-	-	
450	10.4	3.1	34.8	-	-	
476.31	26.3	1.8	64.4	-	-	
506.31	30	0.7	37.5	-	-	
SUB TOTAL			143.2		0.0	

JICA

§ 12. TEMPORARY LINE

SUMMARY OF TEMPORARY LINE

		TRACK			EARTHWORK
		NEW TRACK LAYING	TRACK SHIFTING	TRACK REMOVAL	EMBANKMENT
		(M)	(M)	(M)	(M³)
SECTION OVERPASSING WESTERN LINE	STAGE 1 REROUTING	721	261	156	3,870
	STAGE 2 REROUTING	199	836	764	343
SUB TOTAL		920	1.097	920	4.213
SECTION OVERPASSING KOTA STATION	WESTERN LINE	197	382	213	648
	TANJUNG PRIOK LINE	126	139	126	—
SUBTOTAL		323	521	323	648
TOTAL		1.243	1.618	1.259	4.861

JICA

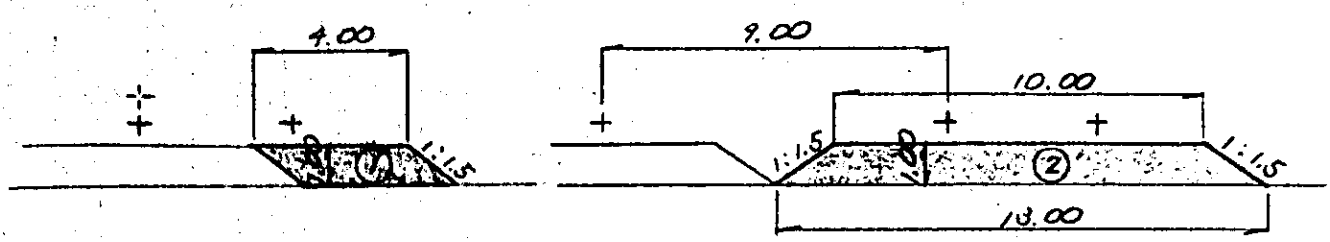
No. 2

QUANTITY CALCULATION OF TEMPORARY LINE

EMBANKMENT

I. SECTION OVERPASSING WESTERN LINE

A) STAGE 1 REROUTING



① $A = 4.00 \times 1.00 = 4.0^{m^2}$

② $A = (10.00 + 13.00) \times 1.00 \times 1/2 = 11.5^{m^2}$

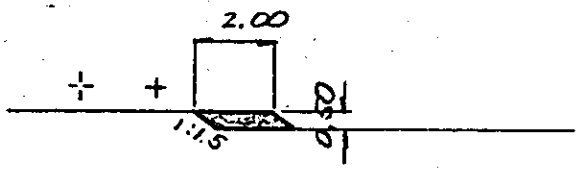
1.) $A = 0.0^{m^2} \sim 4.0^{m^2}$ $L = 129^{m}$ $V = 4.0 \times 129 \times 1/2 = 258^{m^3}$

2.) $A = 4.0^{m^2} \sim 11.5^{m^2}$ $L = 147^{m}$ $V = (4.0 + 11.5) \times 147 = 1,139^{m^3}$

3.) $A = 11.5^{m^2}$ $L = 215^{m}$ $V = 11.5 \times 215 = 2,473^{m^3}$

$\Sigma V = 3,870^{m^3}$

B) STAGE 2 REROUTING



$A = 2.00 \times 0.50 = 1.0^{m^2}$

1.) $A = 0.0^{m^2} \sim 1.0^{m^2}$ $L = 385^{m}$ $V = 1.0 \times 385 \times 1/2 = 193^{m^3}$

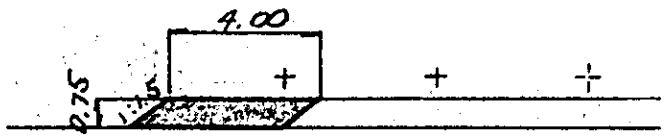
2.) $A = 1.0^{m^2}$ $L = 150^{m}$ $V = 1.0 \times 150 = 150^{m^3}$

$\Sigma V = 343^{m^3}$

QUANTITY CALCULATION OF TEMPORARY LINE

EMBANKMENT

II. SECTION OVERPASSING KOTA STATION (ONLY WESTERN LINE)



$A = 4.00 \times 0.75 = 3.0\ m^2$

1). $A = 0.0\ m^2 \sim 3.0\ m^2$ $L = 242\ m$ $V = 3.0 \times 242 \times 1/2 = 363\ m^3$

2). $A = 3.0\ m^2$ $L = 95\ m$ $V = 3.0 \times 95 = 285\ m^3$

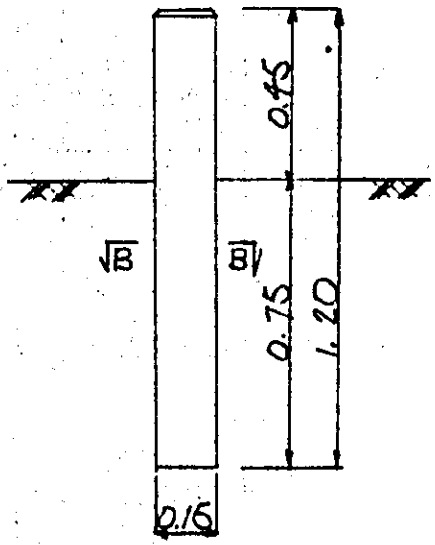
$\Sigma V = 648\ m^3$

§ 13. RIGHT OF WAY POST

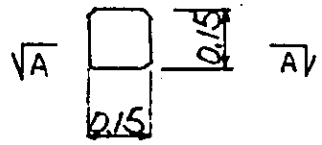
RIGHT OF WAY POST QUANTITY CALCULATION SHEET

	TOTAL NUMBER	CONCRETE (CLASS D) (m^3)	FORM AREA (m^2)	REINFORCING BAR (SR-24) (Kg)	DESIGN EXCA (m^3)	SURPLUSSOILS (m^3)	REMARKS
TRACK AT GRADE	1273	34	917	2546	22	22	
ELEVATED TRACK	37	1	27	74	1	1	

RIGHT-OF-WAY POST



SECTION A-A



SECTION B-B

TRACK AT GRADE

TOTAL NUMBER	=	1273
CONCRETE VOLUME		
$V = 0.027\ m^3 \times 1273$	=	$34\ m^3$
FORM AREA		
$A = 0.72\ m^2 \times 1273$	=	$917\ m^2$
REINFORCING BAR		
$W = 2.0\ kg \times 1273$	=	$2546\ kg$

DESIGN EXCA		
V = 0.017 m × 1273	=	22 m³
SURPLUSSOILS		
V	=	22 m³
ELEVATED TRACK		
TOTAL NUMBER	=	37
CONCRETE VOLUME		
V = 0.027 m³ × 37	=	1 m³
FORM AREA		
A = 0.72 m² × 37	=	27 m²
REINFORCING BAR		
W = 2.0 kg × 37	=	74 kg
DESIGN EXCA		
V = 0.017 m³ × 37	=	1 m³
SURPLUSSOILS		
V	=	1 m3

PER EACH QUANTITY

CONCRETE VOLUME

$V = 0.15 \times 0.15 \times 1.20 = 0.027\ m^3$

FORM AREA

$A = 0.15 \times 1.20 \times 4 = 0.72\ m^2$

DESIGN EXCA

$V = 0.15 \times 0.15 \times 0.75 = 0.017\ m^3$

SURPLUSSILS $= 0.017\ m^3$

No. 6

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
G 1	φ 6	0.222	1 340	4	1 2	1
2	〃	〃	660	6	0 8	[illegible]
	TOTAL				2 0	

JICA

§ 14. RIGHT OF WAY AREA

SUMMARY OF RIGHT OF WAY

BLOCK NUMBER	AREA OF PROPOSED GROUND LINE (m²)	REMARKS
1. (0K000m ~ 2K060m)	39.152	
2. (2K060m ~ 2K300m)	4.364	
3. (2K300m ~ 2K500m)	8.230	
4. (2K500m ~ 2K900m)	11.231	
5. (2K900m ~ 3K050m)	4.547	
6. (3K050m ~ 3K220m)	3.726	
7. (3K220m ~ 3K320m)	2.086	
8. (3K320m ~ 5K225m)	45.509	
9. (5K225m ~ 5K542m)	6.454	
10. (5K542m ~ 6K400m)	18.915	
11. (6K400m ~ 6K550m)	3.186	
12. (6K550m ~ 7K600m)	22.473	
13. (7K600m ~ 8K540m)	19.695	
14. (8K540m ~ 8K950m)	8.901	
15. (8K950m ~ 9K450m)	10.640	
16. (9K450m ~ 9K700m)	6.905	
17. (9K700m ~ 10K400m)	16.144	
18. (10K400m ~ 11K020m)	14.734	
19. (11K020m ~ 11K465m)	8.169	

SUMMARY OF RIGHT OF WAY

BLOCK NUMBER	AREA OF PROPOSED GROUND LINE (m²)	REMARKS
20. (11K765m ~ 11K658m)	4.249	
21. (11K658m ~ 12K000m)	6.849	
22. (12K000m ~ 12K330m)	11.340	
23. (12K330m ~ 12K550m)	6.055	
24. (12K550m ~ 13K073m)	10.615	
25. (13K073m ~ 13K408m)	7.700	
26. (13K408m ~ 13K650m)	3.155	
27. (13K650m ~ 13K680m)	283	
28. (13K680m ~ 13K815m)	1.499	
29. (13K815m ~ 13K891m)	615	
30. (13K891m ~ 14K350m)	4.415	
31. (14K350m ~ 14K800m)	4.933	
32. (14K800m ~ 14K992m)	2.647	
33. (14K992m ~ 15K608m)	8.091	
34. (15K608m ~ 15K855m)	3.003	
35. (15K855m ~ 16K240m)	4.712	
36. (16K240m ~ 16K452m)	2.700	
37. (16K452m ~ 17K074m)	6.978	
38. (16K872m ~ 16K957m) (17K003m ~ 17K074m)	795	

SUMMARY OF RIGHT OF WAY

BLOCK NUMBER	AREA OF PROPOSED GROUND LINE (m²)	AREA OF PROPOSED ELEVATED LINE (m²)	AREA OF PROPOSED ELEVATED CENTRAL LINE (m²)
39. (17K074m ~ 17K135m)	613		
40. (17K074m ~ 17K506m)	2.104		
41. (17K218m ~ 17K506m)	2.949		
42. (17K442m ~ 17K506m)	868		
43 (17K218m ~ 17K460m)	7.120		
44. (17K506m ~ 17K775m)	3.918		
45. (17K775m ~ 18K122m)	2.688		
46. (17K775m ~ 18K122m)	2.085		
47. (18K122m ~ 18K608m)	5.690		
48. (18K608m ~ 18K706m)	962		
49. (18K653m ~ 18K800m)	2.453		
50. (18K860m ~ 18K908m)	785		
51. (18K908m ~ 19K011m)	2.299		
52. (19K118m ~ 19K643m)	3.906	2.352	2.843
53. (19K426m ~ 19K643m)	542	3.803	—
54. (19K643m ~ 19K928m)	1.517	374	1.517
55. (19K735m ~ 19K928m)	431	6.076	2.191
56. 19K928m ~ 20K132m GROUND LINE 19K928m ~ 20K150m ELEVATED LINE	1.372	3.936	2.000
TOTAL	387.697	16.541	8.551

§.15. RIGHT OF WAY TABLE

RIGHT-OF-WAY TABLE -0km030m ~ 1km400m 1-31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
-0 030	0	25.6	17.6	
0 000	30	25.6	17.6	
050	50	25.6	17.6	
100	"	25.6	17.6	
150	"	25.6	17.6	
160	10	25.6	17.6	
160	0	43.0	39.0	
200	40	26.8	23.0	
250	50	12.3	8.3	
300	"	10.0	5.0	
350	"	10.0	5.0	
400	"	10.0	5.0	
450	"	10.0	5.0	
500	"	10.0	5.0	
550	"	10.0	5.0	
600	"	10.0	5.2	
650	"	10.0	6.0	
700	"	10.0	5.9	
750	"	10.0	5.8	
800	"	10.0	5.7	
850	"	10.0	5.6	
900	"	10.0	5.5	
950	"	10.0	5.4	
1 000	"	10.0	5.3	
050	"	10.0	5.2	
100	"	10.0	5.0	
150	"	10.0	5.0	
200	"	10.0	5.0	
250	"	10.0	5.0	
300	"	10.0	5.0	
350	"	10.0	5.0	
400	"	10.0	5.0	

RIGHT-OF-WAY TABLE 1KM450M ~ 2KM480M 2-31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
1 450	0	10.0	5.0	
500	50	10.0	5.0	
550	〃	10.0	5.0	
564	14	10.0	5.0	
567	3	10.0	-	
				ROAD
580	0	-	5.0	
583	3	10.0	5.0	
600	17	10.0	5.0	
650	50	10.0	5.0	
700	〃	10.0	5.0	
750	〃	10.0	5.0	
800	〃	10.0	5.0	
850	〃	10.0	5.0	
900	〃	10.0	5.0	
950	〃	10.0	5.0	
2 000	〃	10.0	5.0	
010	10	10.0	5.0	
				WATERWAY ROAD
082	0	10.9	6.3	
100	18	10.9	6.3	
150	50	10.0	6.1	
200	〃	9.7	5.7	
250	〃	10.0	6.0	
257.7	7.7	10.3	6.2	
317.7	60	10.7	6.3	
350	32.3	10.8	6.7	
387	37	-	8.3	ROAD
400	13	11.8	-	〃
450	50	12.5	-	〃
468	18	13.5	-	〃
480	12	13.5	-	〃

RIGHT-OF-WAY TABLE 2Km503m ~ 2Km986m 3 - 31

STATION (Km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
2 503	0	-	8.7	ROAD
543	40	13.3	-	"
550	7	13.3	8.5	
600	50	13.1	8.1	
625	25	-	8.6	
628	3	13.2	-	
				ROAD
630	0	-	8.6	
633	3	13.2		
650	17	13.2	8.6	
667 3	17.3		8.2	
685	17.7	12.3		
691	6		7.9	ROAD
715	24	15.0		"
721	6	17.0		"
740	19		8.0	"
781	41		8.0	" WATERWAY
794	13		14.0	" "
797	3	19.0		" "
808	11	12.1		" "
821	13		14.0	" "
824	3		8.5	" "
850	26		8.8	" "
854	4	12.1		" "
900	46	14.0	9.2	" "
900	0	12.8		
940	40		9.3	
940	0		33.5	
950	10	12.6		
984 5	34.5	12.6		
986	1.5		33.5	
986	0		42.1	

RIGHT-OF-WAY TABLE 2Km 989m ~ 3Km 597m 4 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
2 989	0		42.1	
				ROAD
997	0		42.1	
997	0	12.9	19.0	
999	2		17.0	
999	0		9.1	
3 005	6		9.1	
005	0		8.6	
050	45	13.1	8.8	
100	50	13.4	9.2	
150	"	13.2	9.1	
200	"	12.6	8.2	
250	"	12.1	8.0	
263	13	12.1	8.0	
264	1	20.0	19.5	
268	4	20.0	19.5	
269	1	12.1	8.0	
300	31	11.5	7.8	
315	15		7.8	
315	0		10.4	
350	35	11.8	10.4	
360	10	11.8		
360	0	13.6		
378	18		9.7	
378	0		9.3	
400	22	13.2	9.3	
450	50	12.9	8.9	
500	"	12.9	8.7	
550	"	12.6	8.7	
584	34		8.7	
587	3		12.0	
597	10		12.0	

RIGHT-OF-WAY TABLE 3km600m ~ 4km530m 5 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
3 600	0	13.0	9.1	
650	50	12.7	8.8	
700	〃	12.7	8.6	
733.2	33.2	13.2	9.0	
763.2	30	13.2	8.8	
800	36.8	13.2	8.8	
850	50	13.2	8.9	
900	〃	13.0	8.5	
950	〃	13.1	8.5	
4 000	〃	13.0	8.5	
050	〃	13.3	8.8	
095	45		8.7	
098	3		12.0	
100	2	13.3		
107	7		12.0	
110	3		8.7	
122.9	12.9	13.4	9.0	
152.9	30	13.0	8.8	
182.9	30	12.7	8.8	
200	17.1	12.9	8.8	
250	50	12.9	8.9	
300	〃	12.8	8.8	
350	〃	13.1	9.0	
400	〃	13.1	9.2	
426	26		9.1	
430	4		12.4	
439	9		12.4	
443	4		9.1	
450	7	13.2	9.1	
500	50	13.1	9.1	
530	30	13.3		
530	0	26.8		

RIGHT-OF-WAY TABLE 4Km550m ~ 5Km169m8 6 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
4 550	0	26.8	9.1	
565	15	26.8		
565	0	22.0		
573	8	22.0		
598	25	19.5		
600	2		9.5	
617	17	19.5		
635	18		9.5	
640	5		12.8	
650	10	19.5	12.8	
653	3		9.5	
672	19		9.5	
700	28	19.5	12.2	
749	49		17.1	
749	0		9.1	
750	1	19.1		
764.3	14.3	19.1		
794.3	10	19.3	8.9	
824.3	30	19.5	9.0	
850	25.7	19.6	9.0	
865	15	19.6		
877	12	13.6		
900	23	13.4	8.8	
904	4		12.1	
914	10		12.1	
918	4		8.8	
950	32	13.5	9.0	
5 000	50	13.5	9.1	
050	"	13.5	9.1	
100	"	13.5	9.1	
150	"	13.5	9.0	
169.8	19.8	13.5		

RIGHT-OF-WAY TABLE · 5Km200m ~ 6Km200m 7 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
5 200	0	13.3	9.0	
229 8	29.8	12.0		
250	20.2	11.9	8.0	
300	50	11.6	9.5	
318	18	11.6	9.5	
320	2	27.0		
321	1	27.0		
322	11		27.0	
				ROAD WATERWAY
338	0	13.1	9.1	
350	12	13.1	9.1	
400	50	13.7		
402	2		8.8	
406	4		12.1	
414	18		12.1	
418	4		8.8	
450	32	11.5	8.4	
500	50	12.2	8.7	
550	"	11.9	9.0	
600	"	13.2	9.2	
650	"	13.3	9.3	
700	"	13.1	9.1	
750	"	13.1	9.0	
800	"	13.0	9.1	
850	"	13.1	9.1	
900	"	13.1	9.1	
950	"	13.1	9.0	
6 000	"	13.2	9.3	
050	"	13.1	9.2	
100	"	13.1	8.9	
150	"	13.0	9.1	
200	"	12.9	9.0	

RIGHT-OF-WAY TABLE 6km250m ~ 7km550m 8 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
6 250	0	13.1	8.9	
300	50	13.0	9.0	
350	〃	12.4	8.7	
400	〃	12.7	8.7	
439	39		8.2	ROAD
440	1	12.7		〃
441	1	19.0	19.5	
444	3	19.0	19.5	
446	2	12.7	8.2	
500	54	12.6	8.6	
539	39	11.8	7.9	
550	11	12.8	8.8	
600	50	12.8	8.8	
650	〃	13.0	9.0	
700	〃	12.8	8.8	
750	〃	12.6	8.6	
800	〃	12.7	8.7	
850	〃	12.8	8.8	
900	〃	12.8	8.7	
950	〃	12.7	8.7	
7 000	〃	12.8	8.8	
050	〃	12.8	8.8	
100	〃	12.8	8.8	
150	〃	13.0	9.1	
200	〃	12.7	8.7	
250	〃	12.7	8.7	
300	〃	12.6	8.6	
350	〃	12.6	8.4	
400	〃	12.6	8.7	
450	〃	12.6	8.7	
500	〃	12.4	8.5	
550	〃	12.3	8.3	

RIGHT-OF-WAY TABLE 7Km600m ~ 8Km700m 9 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
7 600	0	12.4	8.3	
626 2	26.2	11.8	7.7	
656 2	30	12.7	7.7	
686 2	30	12.1	8.0	
700	13.8	11.9	8.0	
750	50	12.0	8.5	
800	"	11.5	8.0	
850	"	12.2	8.6	
900	"	12.1	8.7	
950	"	11.5	8.6	
8 000	"	12.0	8.7	
014.6	14.6	12.1	8.6	
050	35.4	12.0	8.6	
100	50	12.3	8.6	
150	"	12.0	8.5	
200	"	11.9	8.4	
250	"	11.7	8.3	
300	"	12.2	8.7	
342.9	42.9		9.0	
350	7.1	12.2	9.0	
372.9	22.9	13.1	9.3	
402.9	30	13.6	9.7	
450	47.1	14.3	10.4	
500	50	14.4	10.4	
525	25	14.4		
528	3		10.4	
				WATERWAY ROAD
551	0	13.8		
553	2		10.5	
600	47	14.0	9.9	
650	50	13.9	9.8	
700	"	13.4	9.8	

RIGHT-OF-WAY TABLE 8Km750m ~ 9Km750m 10 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
8 750	0	11.9	8.5	
800	50	12.4	7.3	
804	4	13.0		
820	16		9.2	
850	30	13.0	9.2	
900	50	13.4	9.5	
950	〃	12.8	8.2	
963	13	12.4		
9 000	37	12.4	8.5	
050	50	12.5	8.6	
100	〃	12.7	8.5	
150	〃	12.6	8.7	
200	〃	12.9	8.9	
250	〃	12.9	9.1	
300	〃	12.9	8.7	
350	〃	12.5	8.3	
400	〃	12.5	8.5	
450	〃	12.5	8.7	
493.5	43.5	11.0	7.5	
500	6.5	11.0	7.5	
523.5	23.5	10.7	7.2	
553.5	30	10.6	7.3	
600	46.5	10.8	7.4	
613	13	10.8		
614	1		7.4	
620	6		8.4	
				ROAD
625	0	12.4		
635	10		8.6	
650	15	12.4	8.6	
700	50	12.5	8.9	
750	〃	13.5	9.0	

RIGHT-OF-WAY TABLE 9KM800M ~ 10KM953M 11 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
9 800	0	12.6	8.9	
854 3	54.3	12.8	9.1	
884 3	30	12.8	9.0	
900	15.7	12.8	9.0	
914 3	14.3	13.0	8.9	
950	35.7	13.0	9.0	
10 000	50	13.2	9.2	
050	"	13.4	9.5	
100	"	13.7	9.7	
150	"	14.0	10.2	
200	"	14.4	10.2	
250	"	13.4	9.3	
300	"	14.1	10.2	
350	"	13.9	10.2	
400	"	14.0	10.0	
450	"	13.7	9.6	
500	"	14.1	10.0	
550	"	13.7	9.9	
600	"	14.0	9.8	
650	"	14.2	10.2	
700	"	14.2	10.3	
750	"	14.6	10.1	
765	15		10.1	ROAD
768	3		11.3	"
787	19	14.6		
791	4	14.9		
800	9	14.9	11.3	
850	50	14.9	11.5	
900	"	15.9	12.1	
950	"	14.6	11.0	
953	3		11.0	
953	0		12.0	

RIGHT-OF-WAY TABLE 10km957m ~ 11km656m 12 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
10 957	0		12.0	
975	18	14.5		
				WATER WAY ROAD
11 056	0		27.0	
075	19		27.0	
084	9	13.8		
100	16	13.8		
123	23		27.0	
123	0		9.8	
150	27	13.6	9.8	
152	2		9.8	
155	3		13.1	
166	11		13.1	
168	2		11.8	
200	32	14.6	11.8	
242	42		11.8	
242	0		6.0	
250	8	10.0		
300	50	9.1	5.1	
350	"	8.2	4.2	
400	"	8.2	4.2	
438	38	8.2		
456	18		4.2	
				ROAD
460	0	13.9		
487	27		9.2	
500	13	13.9	9.2	
550	50	13.7	8.8	
600	"	14.3	9.5	
650	"	14.1	9.8	
653	3		9.8	
656	3		13.1	

RIGHT-OF-WAY TABLE 11km665m ~ 12km231m 13 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
11 665	0		13.1	
669	4		9.8	
700	31	11.8	7.6	
738	38		8.1	
749	11	11.5		
752	3	11.5	8.1	ROAD
762	10		8.1	
765	3	11.4		
800	35	11.4	7.4	
850	50	11.8	8.0	
900	"	11.9	8.8	
950	"	13.0	9.0	
986	36		9.4	
989	3		12.7	
12 000	11	14.3		
001	1		12.7	
003	2		9.4	
050	47	14.6	10.3	
089	39	14.7		
089	0	28.3		
100	11	28.3	10.6	
127	27	28.3		
127	0	26.3		
133	6	26.3		
150	17	24.4	10.7	
153	3	23.7		
195	42		10.8	
198	3		14.1	
200	2	23.8		
210	10		14.1	
213	3		10.8	
231	18	23.8	10.8	

RIGHT-OF-WAY TABLE 12Km250m ~ 13Km075m 14 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
12 250	0	23.8	12.6	
300	50	24.0	17.8	
310	10		18.8	
310	0		11.0	
350	40	22.6	8.3	
400	50	21.2	8.2	
415	15		9.4	
435	20	21.5	8.7	ROAD
444	9		8.7	
447	3	13.9		
461	14		9.5	
464	3		12.8	
474	10		12.8	
477	3		9.5	
500	23	14.1	10.0	
550	50	13.6	10.8	
600	"	14.7	10.7	
650	"	14.1	10.1	
700	"	13.8	9.8	
750	"	13.7	9.7	
800	"	13.7	9.7	
850	"	13.7	9.8	
900	"	13.8	9.9	
950	"	13.4	9.4	
963	13		9.4	
966	3		12.7	
975	9		12.7	
978	3		9.4	
13 000	22	11.5		
015 9	15.9	13.8	9.4	
045 9	30	13.6	9.4	
075	29.1	12.3		

RIGHT-OF-WAY TABLE 13Km075m ~ 13Km650m 15 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
13 075	0	15.0		
075	0	24.5		
075 9	0.9		9.5	
090 5	14.6		9.7	
100	9.5	24.0	8.6	
107	7.0		7.2	
125	18		7.4	
150	25	23.4		
165 2	15.2	23.4		
200	34.8	23.4		
244	44	23.4		
250	6		7.3	
252	2	23.4		
257	5		7.3	
265	8		7.3	
275	10	23.4		
296	21	23.4		
300	4		7.5	
310	10		8.0	
				ROAD
319	0	11.4		
326	7		8.0	
333	7		8.0	
350	17	11.7	7.6	
400	50	12.4	8.5	
400	0	9.5	4.0	
450	50	9.5	4.0	
500	"	9.5	4.0	
550	"	9.5	4.0	
600	"	9.5	4.0	
628	28	9.5		
650	22		4.0	

RIGHT-OF-WAY TABLE 13Km652m ~ 13Km791m 16 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
13 652	0	9.5		
667	15		4.0	
672	5	9.5		
679	0	9.5	4.0	
700	21	9.5	4.0	
750	50	9.5	4.0	
757	7		4.0	
757	0		4.5	
765	8		4.5	
765	0		4.0	
791	26	9.5	4.0	
				WATERWAY

RIGHT-OF-WAY TABLE 13Km839m ~ 14Km200m 17 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
13 839	0		40	
841	2	9.5		
850	9	9.5	40	
885	35	9.8	40	
				ROAD
897.5	0	9.8	40	
900	2.5	9.8	40	
930	30	9.8	40	
				ROAD
938	0	9.8		
943	5		40	
950	7		40	
973	23	9.8		
992	19	9.8		
14 000	8	9.8	40	
040	40		40	
050	10	9.8		
051	1	9.8		
				ROAD
052.5	0		40	
068	15.5	9.8		
098	30		40	
100	2	9.5		
106	6		40	
112	6	9.5		
120	8	9.5		
149	29		40	
150	1	9.5		
158	8		40	
164	6	9.5		
172	8	9.5		
200	28	9.5	40	

RIGHT-OF-WAY TABLE 14Km 209M ~ 14Km 850M 18 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
14 209	0	9.5	4.0	
220	11	9.5		
221.5	11.5		4.0	
233	11.5		4.0	
250	17	9.5	4.0	
264	14		4.0	
269	5	9.5		
281	12		4.0	
				WATER WAY
401	0	9.5		
416	15		4.0	
426	10		4.0	
426	0		4.5	
430	4		4.5	
430	0		4.0	
450	20	9.5	4.0	
500	50	9.8	4.0	
550	"	9.8	4.0	
600	"	9.5	4.0	
650	"	9.5	4.0	
698	48		4.0	
698	0		4.5	
700	2	9.5	4.5	
706	6		4.5	
706	0		4.0	
750	44	9.5	4.0	
767.5	17.5	9.5		
773.5	6		4.0	
				WATER WAY
818	0	9.5		
824.5	6.5		4.0	
850	25.5	9.5	4.0	

RIGHT-OF-WAY TABLE 14Km900m ~ 15Km800m 19 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
14 900	0	9.5	4.0	
950	50	9.5	4.0	
993	43	9.5	4.0	
993	0	9.5	8.0	
15 000	7	9.5	8.0	
050	50	9.5	7.8	
096	46	9.5	9.5	
100	4	9.5	9.5	
150	50	9.5	9.0	
162	12	9.5	9.5	
162	0	9.5	4.0	
200	38	9.5	4.0	
250	50	9.5	4.0	
300	"	9.5	4.0	
350	"	9.5	4.0	
400	"	9.5	4.0	
401	1	9.5	4.0	
401	0	9.5	4.5	
409	8	9.5	4.5	
409	0	9.5	4.0	
450	41	9.5	4.0	
500	50	9.5	4.0	
550	"	9.5	4.0	
576	26	9.5		
577 5	1.5		4.0	
				ROAD
6305	0	9.5		
631	0.5		4.0	
650	19	9.5	4.0	
700	50	9.5	4.0	
750	"	9.5	4.0	
800	"	9.5	4.0	

RIGHT-OF-WAY TABLE 15Km850M ~ 16Km160M 20 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
15 850	0	9.5	4.0	
853	3	9.5	4.0	
				ROAD
856	0	9.5	4.0	
900	44	9.5	4.0	
950	50	9.5	4.0	
964 5	14.5		4.0	ROAD
978 5	14		4.0	"
16 000	21.5	9.5	4.0	
013	13	9.5	4.0	
				ROAD
018	0	9.5	4.0	
050	32	9.5	4.0	
097	47	9.5		
099	2		4.0	
				ROAD
100	0	9.5		
102	2		4.0	
117	15	9.5		
119	2		4.0	
				ROAD
119 5	0	9.5		
121 5	2		4.0	
138	16.5	9.5		
140	2		4.0	
				ROAD
141	0	9.5		
143	2		4.0	
150	7	9.5	4.0	
157	7	9.5		
160	3		4.0	
				ROAD

RIGHT-OF-WAY TABLE 16Km160m ~ 16Km510m 21 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
16 160	0	9.5		
162	2		4.0	
181	19	9.5		
182 5	1.5		4.0	
				ROAD
183 5	0	9.5		
185	1.5		4.0	
195	10		4.0	
195	0		4.5	
200	5	9.5	4.5	
203	3		4.5	
203	0		4.0	
250	47	9.5	4.0	
300	50	9.5	4.0	
340	40	9.5	4.0	
				ROAD
347	0	9.5	4.0	
350	3	9.5	4.0	
372	22	9.5	4.0	
				ROAD
374	0	9.5		
375 5	1.5		4.0	
397 5	22	9.5		
400	2.5		4.0	
402 5	2.5	9.5		
416 5	14		4.0	
416 5	0		4.5	
422 5	6		4.5	
422 5	0		4.0	
450	27.5	9.5	4.0	
500	50	9.5	4.0	
510	10	9.5	4.0	

RIGHT-OF-WAY TABLE 16Km513m5 ~ 17Km000m 22 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
				ROAD
16 513 5	0	9.5	4.0	
533	19.5		4.0	
536	3	9.5		
				ROAD
537	0		4.0	
538	1	9.5		
550	12	9.5	4.0	
600	50	9.5	4.3	
639	39	9.5		
640	1		4.3	
				ROAD
645	0	9.5	4.3	
650	5	9.5	4.3	
700	50	9.5	4.3	
750	50	9.5	4.3	
750	0		6.9	
776	26	9.5	4.8	
				ROAD
778	0		4.5	
779	1	9.5		
800	21	9.5	3.8	
850	50	9.5	3.4	
870	20		3.4	
872	2	9.5		
				ROAD
872 5	0		3.4	
875	2.5	9.5		
900	25	9.5	3.0	
950	50	9.5	1.6	
950	0		4.7	
17 000	50	9.5	4.7	

RIGHT-OF-WAY TABLE 17km050m ~ 17km462m 23 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
17 050	0	9.5	4.7	
055	5		8.5	
061	6	9.5	8.5	
				ROAD
089 5	0	9.5	7.0	
100	10.5	9.5	6.7	
126	26	9.5		
129	3		6.7	
				ROAD
142	0	9.5	4.0	
150	8	9.5	4.0	
200	50	9.5	4.0	
209	9		4.0	
215	6	9.5	7.8	
				ROAD
220 5	0		7.0	
221 5	1	16.5		
223	1.5	14.5	6.0	
250	27	16.5	6.0	
296 5	46.5	20.0		
298 5	2.0	22.0		
300	1.5		6.0	ROAD
305	5	13.0		
332.5	27.5	13.0		
				ROAD
336	0	13.0		
350	14	13.0	6.4	
400	50	13.0	6.0	
409 5	9.5		6.0	
441	31.5		8.0	
450	9	13.0	8.5	
462	12	13.0	8.5	

RIGHT-OF-WAY TABLE 17km462m ~ 17km950m 24 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
17 462	0	9.5		
473	11		8.5	
473	0		5.4	
496	23	9.5		
500	4		4.4	
				ROAD
507	0	9.5		
509	2		9.0	
515.5	6.5			
550	34.5	9.5	7.5	
600	50	9.5	7.2	
601.5	1.5	9.5		
				WATERWAY
621	0	9.5	7.8	
640	19		7.8	
640	0		5.6	
650	10	9.5	5.6	
686	36		5.6	
700	14	9.5	6.0	
712	12		6.4	
750	38	9.5	6.4	
759	9		6.4	
759	0		7.4	
768	9	9.5		
769.5	1.5		7.4	
				ROAD
780.5	0	9.5		
781.5	1		7.8	
800	18.5	9.5	7.8	
850	50	9.5	8.0	
900	"	10.1	7.9	
950	"	10.1	4.2	

RIGHT-OF-WAY TABLE 17Km966m ~ 18Km656m5 25 -31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
17 966	0		4.0	
982	16		2.2	
18 000	18	10.1	2.0	
050	50	10.1	8.0	
100	50	10.1	8.8	
104	4		8.8	
106	2		11.8	
110	4	10.1		
118	8		12.8	
				WATER WAY
133	0	10.1		
141	8		11.5	
150	9	10.1	10.5	
154 5	4.5		11.7	
160	5.5		11.0	
164	4		6.4	
200	36	10.1	3.4	
250	50	10.1	2.5	
300	"	9.5	1.8	
350	"	9.7	1.8	
400	"	9.5	1.0	
450	"	9.5	1.5	
500	"	9.5	2.0	
550	"	9.5	2.0	
600	"	9.5	0.6	
607 5	7.5		0.0	
607 5	0		3.0	
627	19.5	9.5	1.5	
650	23	9.5		ROADWAY
654	4		16.0	"
654	0		12.5	"
656 5	2.5	9.5		"

RIGHT-OF-WAY TABLE 18Km669m ~ 19Km232m 26 - 31

(Proposed Temporary Ground Line, 19Km118m ~)

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
18 669	0		10.0	ROADWAY
684	15	14.8	7.0	"
684	0		9.0	"
700	16		4.0	"
700	0		8.5	"
706	6	21.5		"
706	0	14.5		"
711	5		4.0	"
730	19	10.1		
750	20	10.1	4.0	
789	39		4.0	
800	11	10.1		
809	9	10.1		
				ROADWAY
858.5	0		4.0	
863	4.5	10.1		
900	37	10.1	4.0	
950	50	10.1	4.0	
19 000	"	10.1	4.0	
014	14		4.0	
				ROADWAY
118	0		0.8	
118	0		8.8	
126	8		9.7	
127	1	1.7		
				ROAD
129	0		9.7	
130	1	1.7		
150	20	1.7	9.7	
200	50	1.7	9.7	
231	31		9.7	
232	1	1.7		

JICA

RIGHT-OF-WAY TABLE 19km237m ~ 19km924m 27 - 31

(Proposed Temporary Ground Line)

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
				ROAD
19 237	0		9.7	
238	1	1.7		
250	12	1.7	9.7	
300	50	1.7	9.7	
310	10		9.7	
310	0		14.0	
350	40	1.7		
400	50	1.7	9.7	
426	26	4.3		
433	7	8.0		
452	19	7.4		
459	7	7.4	10.2	
				ROAD
468	9	8.4		
470	2	6.5		
498	28	5.5		
504	6	7.0		
505	1	5.0		
536	31	4.7		
550	14	4.0	10.5	
600	50	1.5	12.7	
623	23	0.5	12.5	
				ROAD
650	0	7.4		
700	50	7.4		
750	"	6.9	14.5	
766	16	6.7		
800	34	6.0	15.3	
826	26	6.0		
850	24	6.0	13.2	
900	50	6.0	13.4	
917	17	6.0		WATERWAY
924	7	1.8		

RIGHT-OF-WAY TABLE 19km950m - 20km150m 28 - 31

(Proposed Temporary Ground Line)

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
19 950	0	0.6		
20 ~~000~~	50	5.5		
050	〃	6.1		
070	20	5.5		
098	28	6.2		
100	2	6.5		
131 5	31.5	9.5		
150	18.5	10.0		

RIGHT-OF-WAY TABLE 19KM118M ~ 19KM470M 29-31

(Proposed Elevated Line)

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
19 118	0	9.7	0.8	
127	9		1.7	
128.5	1.5	9.7		
				ROAD
130	0		1.7	
132	2	9.7		
150	18	9.7	1.7	
200	50	10.0	1.7	
232	32		1.7	
234	2	11.7		
				ROAD
238	0		1.7	
239	1	11.8		
250	11	12.5	1.7	
300	50	14.7	1.7	
350	"	16.0	1.7	
365	15	15.4		
366	1	20.4		
400	34		1.7	
401	1	20.4		
402	1		1.7	
				ROAD
407	0	22.0		
408	1	20.4		
426	18		4.3	
433	7		8.0	
452	19	20.4	7.4	
459	7		7.4	
465	6	20.4		
				ROAD
468	0		8.4	
470	2		6.5	

RIGHT-OF-WAY TABLE 19km475m ~ 20km098m 30 -31

(Proposed Elevated Line)

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
19 475	0	22.5		
476 5	1.5	20.4		
498	21.5		5.5	
500	2	20.4		
504	4		7.0	
505	1	20.4	5.0	
511 5	6.5	22.5		
513	1.5	20.5		
536	23		4.7	
550	14	21.5	4.0	
600	50	22.8	1.5	
623	23		0.5	
633	10	23.5		
				ROAD
650	0		7.4	
675	25	19.0		
700	25	19.5	7.4	
750	50	20.5	6.9	
766	16		6.7	
800	34	21.5	6.0	
826	26		6.0	
850	24	21.5	6.0	
886	36	21.5		
898	12	21.5		
900	2	21.5	6.0	
917	17		6.0	
924	7		1.8	
950	26	21.0	0.6	
20 000	50	19.5	5.5	
050	〃	14.5	6.1	
070	20		5.5	
098	28		6.2	

RIGHT-OF-WAY TABLE

20 Km 100 M ~ 20 Km 150 M (Proposed Elevated Line)

31 - 31

STATION (km m)	DISTANCE (m)	LEFT SIDE (m)	RIGHT SIDE (m)	REMARKS
20 100	0	7.0	6.5	
131.5	31.5	2.0	9.5	
150	18.5	0.5	10.0	

§ 16 BOX CULVERT

CONTENTS

1. SUMMARY

	CONCRETE VOLUME	FORM AREA	REINFORCING BAR	GRADING CONCRETE	LEVELING CONCRETE	AGGREGATE SUB BASE	EXCAVATION
	M^3	M^2	KG	M^3	M^3	M^3	M^3
Cb00	98.6	355.7	10457.2	6.3	9.9	19.9	250.7
01	447.5	526.7	57857.6	14.1	22.8	45.6	343.5
02	18.2	81.5	1847.2	0.9	1.6	3.2	20.0
03	18.3	81.9	1847.2	0.9	1.6	3.2	20.0
04	78.3	144.2	10867.2	3.0	5.1	10.2	82.8
05	20.1	88.0	2228.8	1.0	1.8	3.6	22.7
06	18.0	80.6	1827.2	0.9	1.6	3.1	20.7
07	18.0	80.6	1826.7	0.9	1.6	3.1	22.3
08	18.0	80.6	1826.7	0.9	1.6	3.1	20.6
09	18.0	80.6	1826.7	0.9	1.6	3.1	21.3
10	126.4	238.5	12143.5	4.6	7.8	15.6	124.5
11	18.0	80.6	1826.7	0.9	1.6	3.1	21.0
12	15.8	65.4	1706.5	0.9	1.6	3.1	17.5
13	15.8	65.4	1708.0	0.9	1.6	3.1	17.3
14	15.8	65.4	1708.0	0.9	1.6	3.1	18.0
15	15.8	65.4	1708.0	0.9	1.6	3.1	23.0
16	15.8	65.4	1708.0	0.9	1.6	3.1	21.7
17	70.2	121.0	9870.8	2.8	4.7	9.4	77.9
18	51.0	121.9	6068.5	2.1	3.6	7.2	50.9
19	15.8	65.4	1708.0	0.9	1.6	3.1	19.1
20	15.8	65.4	1708.0	0.9	1.6	3.1	18.0
21	20.7	99.5	2094.4	0.9	1.6	3.3	18.1
22	67.5	193.9	9394.2	2.3	4.0	8.0	58.0
23	29.6	144.7	2983.4	1.2	2.1	4.2	24.3
24	21.7	103.6	2184.5	0.9	1.7	3.4	21.1
25	21.9	108.1	2207.4	0.9	1.6	3.1	18.1
26	18.0	80.6	1826.7	0.9	1.6	3.1	13.3
27	22.1	109.7	2226.2	0.9	1.6	3.1	18.1
28	18.0	80.6	1826.7	0.9	1.6	3.1	14.6
29	146.4	264.1	16951.7	6.4	9.5	19.0	402.6
TOTAL	1495.1	3805.0	175971.7	61.8	103.4	205.4	1821.7

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STATION	CONCRETE VOLUME	FORM AREA	REINFORC-ING-BAR	LEVELING CONCRETE	AGGREGATE SUB BASE
-0K050M	42.1 m³	224.6 m²	3 304.1 kg	2.6 m³	10.3 m³
0K170M	35.8 "	179.2 "	2 498.6 "	1.9 "	7.7 "
1K510M	278.4 "	1392.0 "	19 818.6 "	13.1 "	52.2 "
TOTAL	356.3 m³	1795.8 m²	25 621.3 kg	17.6 m³	70.2 m³

JICA

No. 1-1

2. Cb01

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	447.5	526.7	57 857.6	129.2
WING				
TOTAL	447.5	526.7	57 857.6	129.2

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	14.1	
LEVELING CONCRETE	m^2	22.8	
AGGREGATE SUB BASE	m^3	45.6	
EXCAVATION	m^3	343.5	

CbO1

REINFORCING. BAR

	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	2983.9	——	——	12941.3	5484.6	36447.8	57857.6
WING							
TOTAL kg	2983.9	——	——	12941.3	5484.6	36447.8	57857.6

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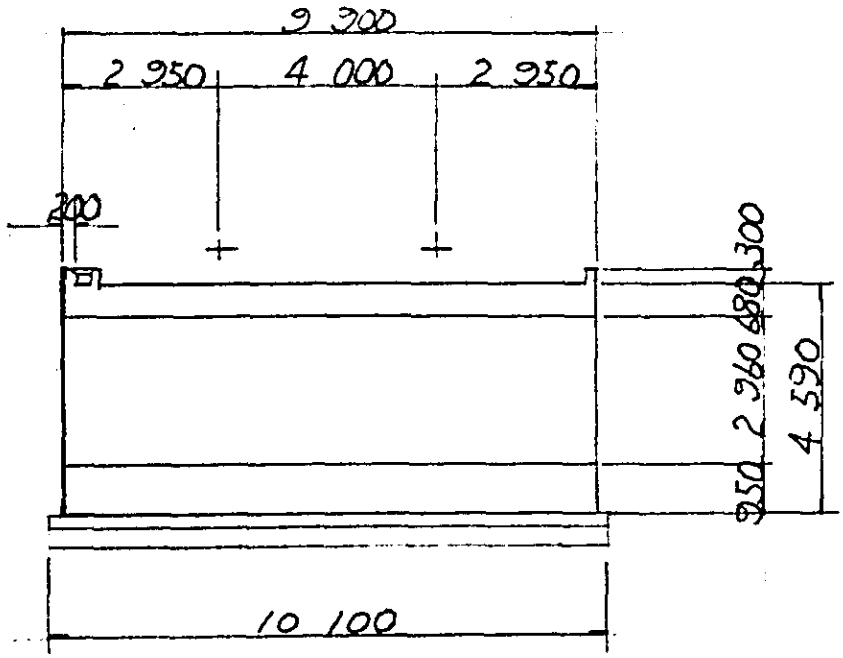
No. 3

CONCRETE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4 000
2 950
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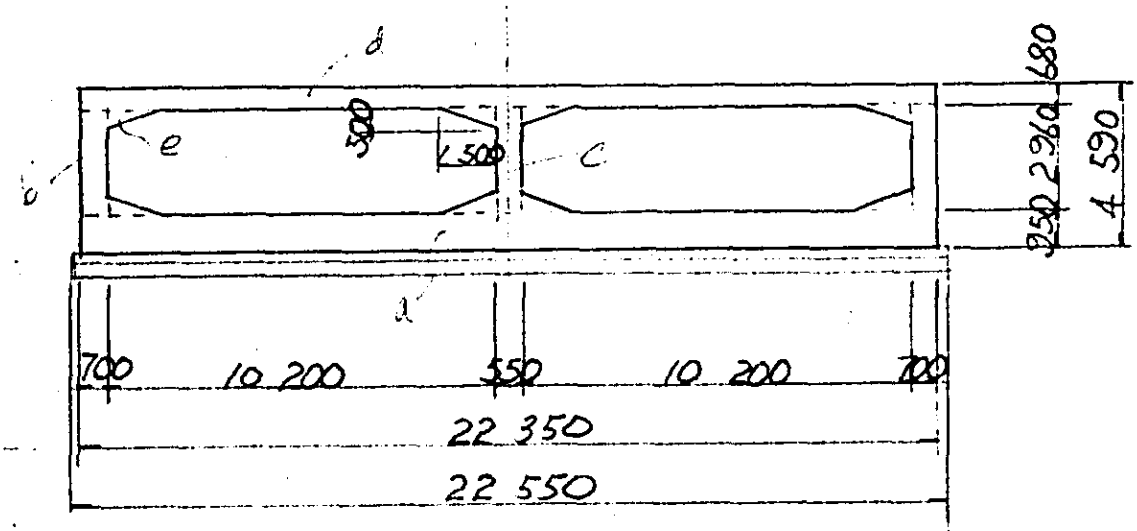
680
2 960
950
4 590
10 100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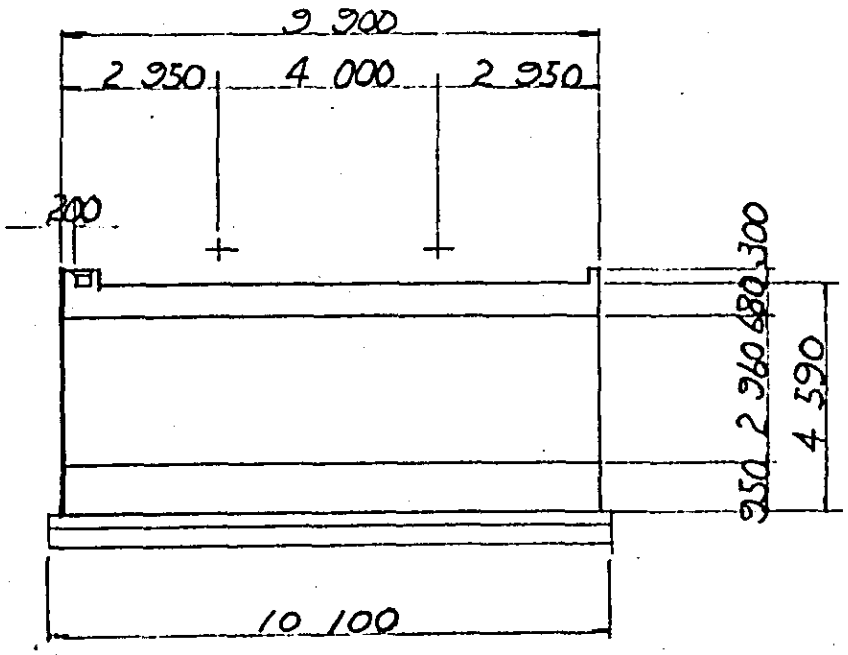
e
500
500
c
b
a
680
2 960
950
4 590
700
10 200
550
10 200
700
22 350
22 550

CONCRETE VOLUME

BOX CULVERT

$V_a = 22.350 \times 0.950 \times 9.900$	=	210.202 m^3
$V_b = 0.700 \times 2.960 \times 9.900 \times 2$	=	41.026 "
$V_c = 0.550 \times 2.960 \times 9.900$	=	16.117 "
$V_d = 22.350 \times 0.680 \times 9.900$	=	150.460 "
$V_e = 1/2 \times 1.500 \times 0.500 \times 9.900 \times 8$	=	29.700 "
		447.505 "

FORM AREA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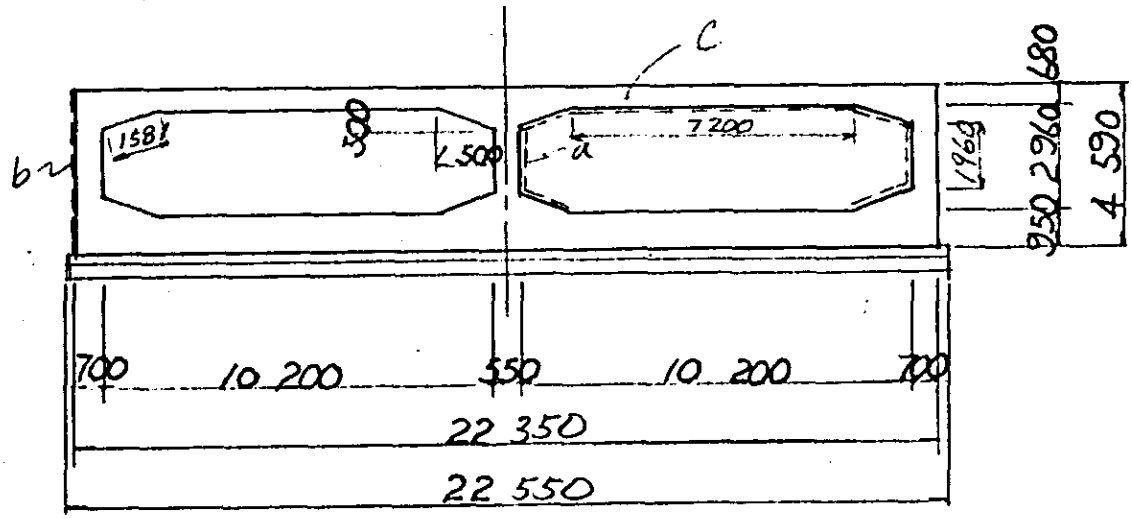
2 960
4 590
950
10 100


C
680
1964
2960
4 590
950
1581
500
500
7200
a
b
700
10 200
550
10 200
700
22 350
22 550

FORM AREA

1. BOX CULVERT

$A_a = (1.960 \times 4 + 1.581 \times 8 + 7.200 \times 2) \times 9.9 =$ 345.391

$A_b = 4.590 \times 9.900 \times 2 =$ 90.882

$A_{C'} = (0.680 + 0.950) \times 22.35$

$+ (0.700 + 0.550 + 0.700) \times 2.96$

$+ (\frac{1}{2} \times 1.600 \times 0.5 \times 8) = 45.203$

$A_C = 45.203 \times 2 =$ 90.407

526.679

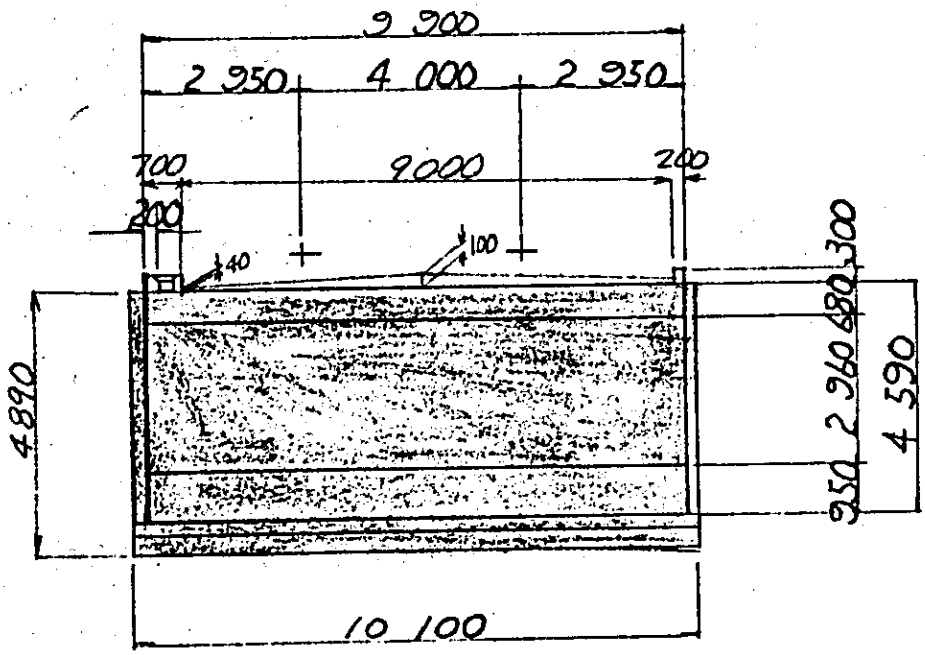
BAR SCHEDULE

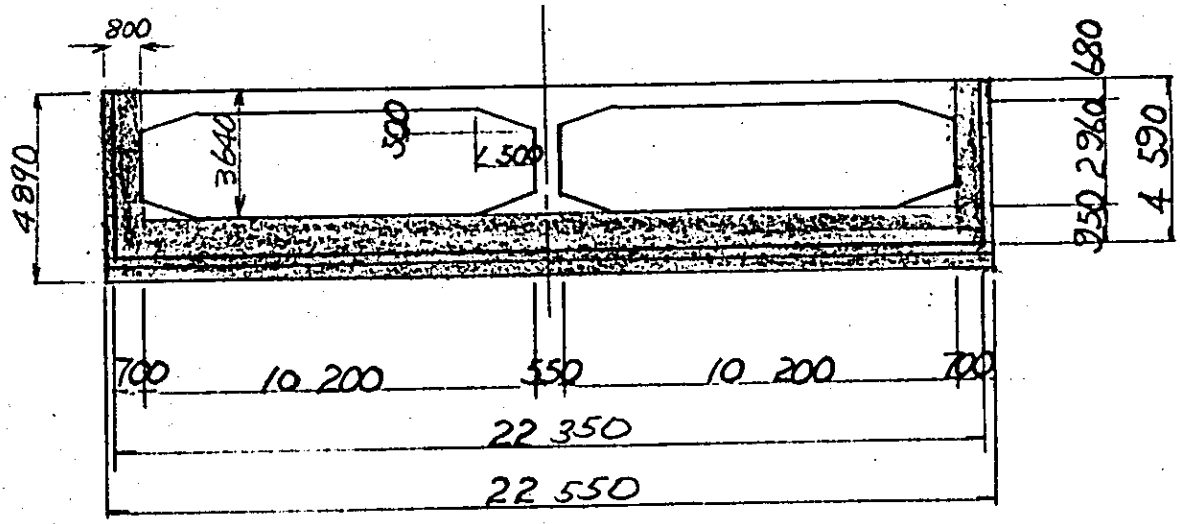
No 8

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D 29	5.04	8560	4	1726	
2	〃	〃	8310	4	1675	
3	〃	〃	11420	8	4605	
4	〃	〃	4470	8	1802	
5	〃	〃	11330	4	2284	
6	〃	〃	5770	2	582	
7	〃	〃	6300	2	635	
8	〃	〃	6700	4	1351	
9	〃	〃	5200	2	524	
10	〃	〃	5610	2	565	
11	〃	〃	7200	4	1452	
12	〃	〃	6270	2	632	
13	〃	〃	5700	2	575	
14	D 25	3.98	4350	16	2770	
15	D 22	3.04	1000	215	6536	
C° 1	D 13	0.995	2420	16	385	
2	〃	〃	1930	16	307	
3	〃	〃	760	9	68	
4	〃	〃	650	3	19	
5	〃	〃	3050	24	728	
		TOTAL OF PER METER			2922.1	
		D29	1840.8	× 2 × 9.9m	36,447.8	
		D25	2770	〃 〃	5,484.6	
		D22	6536	〃 〃	12,941.3	
		D13	1507	〃 〃	2983.9	

JICA

GRADING , LEVELING
AGGREGATE , EXCAVATION





GRADING CONCRETE

$V = \frac{1}{2}(0.04 + 0.10) \times 9.000 \times 22.350 = 14.081\ m^3$

LEVELING CONCRETE

$V = 22.550 \times 0.100 \times 10.100 = 22.776\ m^3$

AGGREGATE SUB BASE

$V = 22.550 \times 0.200 \times 10.100 = 45.551\ m^3$

EXCAVATION

$V = (0.800 \times 3.640 \times 2 + 22.550 \times 1.250) \times 10.100 = 343.516\ m^3$

3. Cb04

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	74.2	113.0	10 352.9	139.5
WING	4.1	31.2	514.3	125.4
TOTAL	78.3	144.2	10 867.2	138.8

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	3.0	
LEVELING CONCRETE	m^3	5.1	
AGGREGATE SUB BASE	m^3	10.2	
EXCAVATION	m^3	82.8	

Cb04

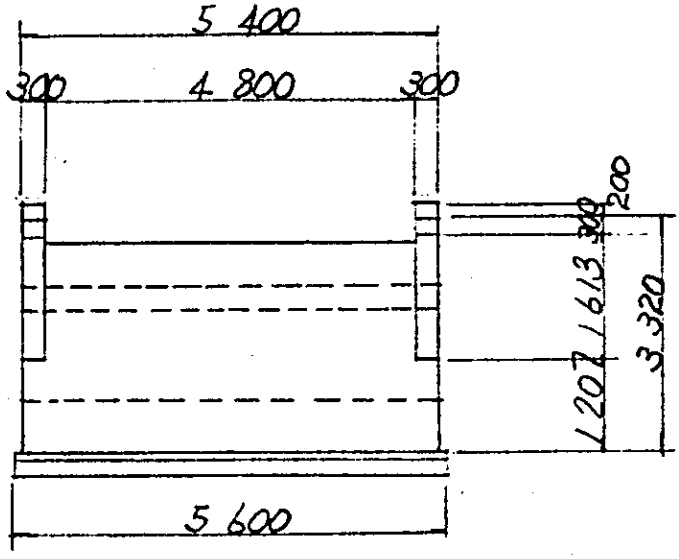
REINFORCING BAR

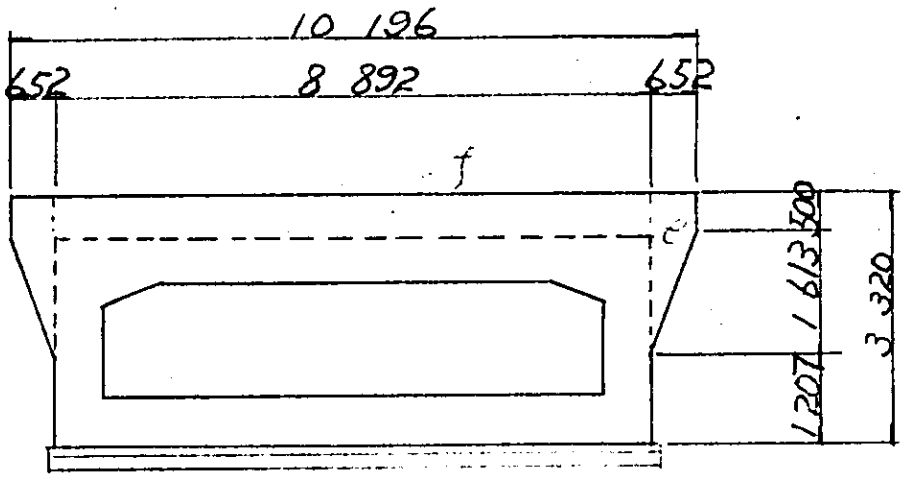
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	487.1	——	2311.2	712.8	4556.5	2285.3	10 352.9
WING	208.1	306.2	——	——	——	——	514.3
TOTAL kg	695.2	306.2	2311.2	712.8	4556.5	2285.3	10 867.2

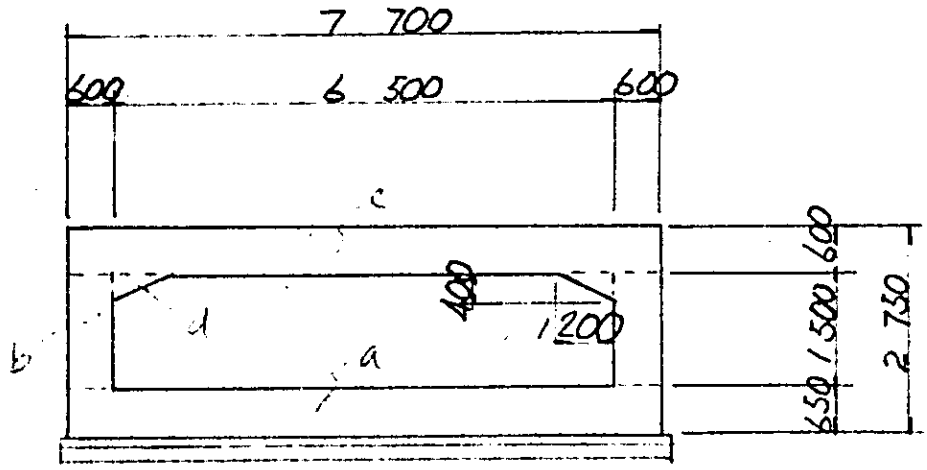
JICA

No. /2

CONCRETE


5 400
300
4 800
300
200
300
1 613
1 207
3 320
5 600


10 196
652
8 892
652
f
e
500
1 613
1 207
3 320


7 700
600
6 500
600
c
600
400
1 200
d
b
a
1 500
650
2 750

CONCRETE VOLUME

1. BOX CULVERT

$$Va = 7.700 \times 0.650 \times 5.400 \underset{1.15603}{\text{cosec}}\, 60^\circ = 31.209\ m^3$$

$$Vb = 1.500 \times 0.600 \times 5.400 \text{ cosec } 60^\circ \times 2 = 11.224\ "$$

$$Vc = 7.700 \times 0.600 \times 5.400 \text{ cosec } 60^\circ = 28.808\ "$$

$$Vd = \tfrac{1}{2} \times 1.200 \times 0.400 \times 5.400 \text{ cosec } 60^\circ \times 2 = 2.993\ "$$

$$74.234\ "$$

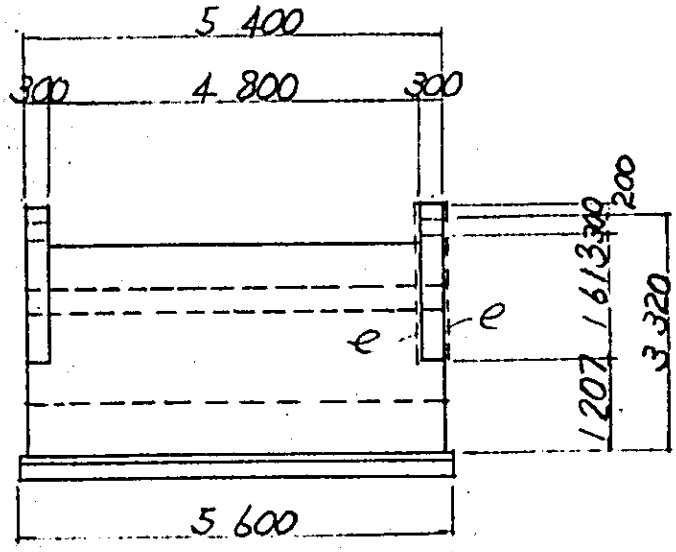
2. WING

$$Ve' = (0.500 + 2.113) \times \tfrac{1}{2} \times 0.652 \times 0.300 \times 2 = 0.511$$

$$Vf' = 0.300 \times 0.570 \times 8.892 = 1.520$$

$$V = (0.511 + 1.520) \times 2 = 4.062\ m^3$$

FORM AREA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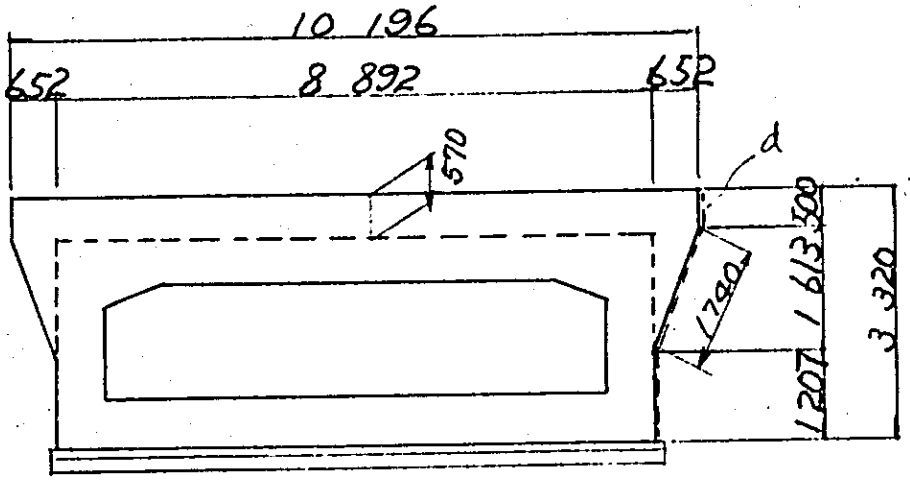
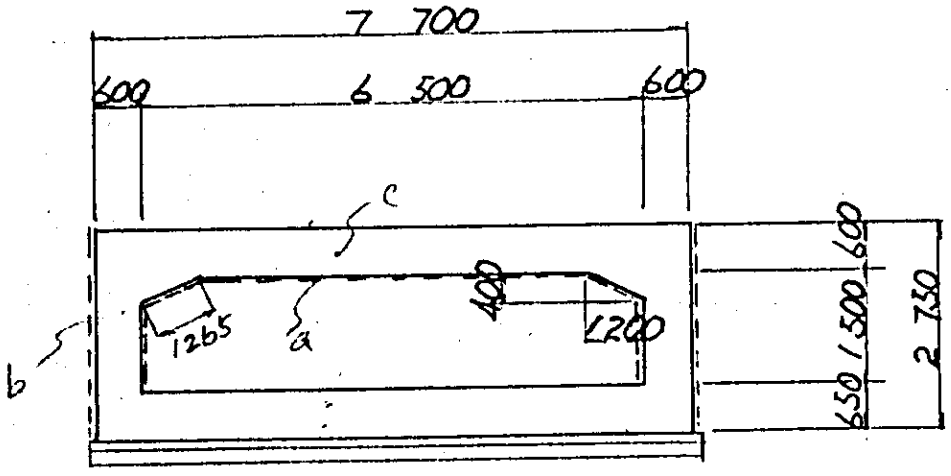
300
4 800
300
200
1 613
3 320
1 207
e
e
5 600


10 196
652
8 892
650
570
d
500
1 613
3 320
1 207
1 790


7 700
600
6 300
600
c
b
a
1265
400
1200
600
1 500
650
2 730

FORM AREA

1. BOX CULVERT

$$Aa = \{(1.100 + 1.265) \times 2 + 4.100\} \times 5.400 \operatorname{cosec} 60^\circ = 55.060 \text{ m}^2$$

$$Ab = 2.750 \times 4.800 \operatorname{cosec} 60^\circ \times 2 = 30.485''$$

$$Ac' = 7.700 \times 2.750 - 6.500 \times 1.500 + \tfrac{1}{2} \times 1.200 \times 0.400 \times 2 = 11.905$$

$$Ac = 11.905 \operatorname{cosec} 60^\circ \times 2 = 27.494''$$

$$113.039''$$

2. WING

$$Ad' = (1.207 + 1.740 + 0.500) \times 0.300 \times 2 = 2.068$$

$$Ae' = \{(0.500 + 2.113) \times \tfrac{1}{2} \times 0.652 \times 2 + 8.892 \times 0.570\} \times 2 = 13.544$$

$$A = (2.068 + 13.544) \times 2 = 31.224 \text{ m}^2$$

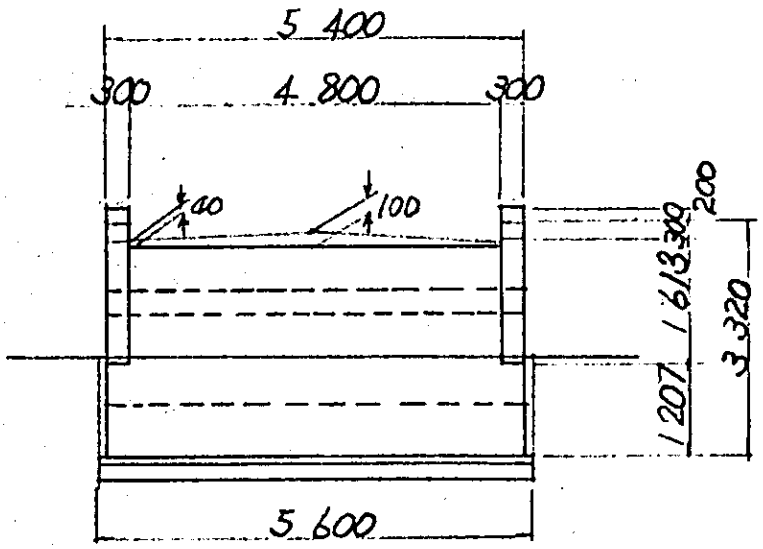
BAR SCHEDULE

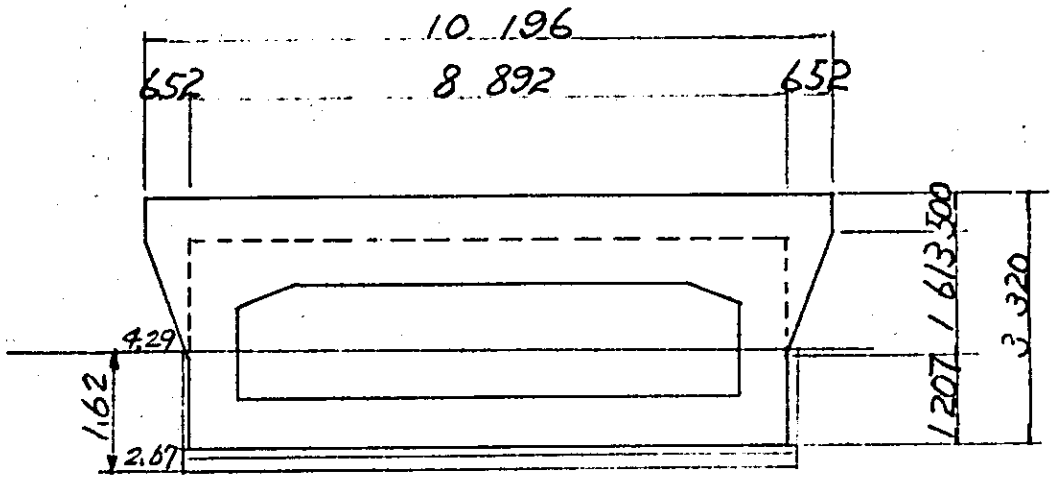
No. 17

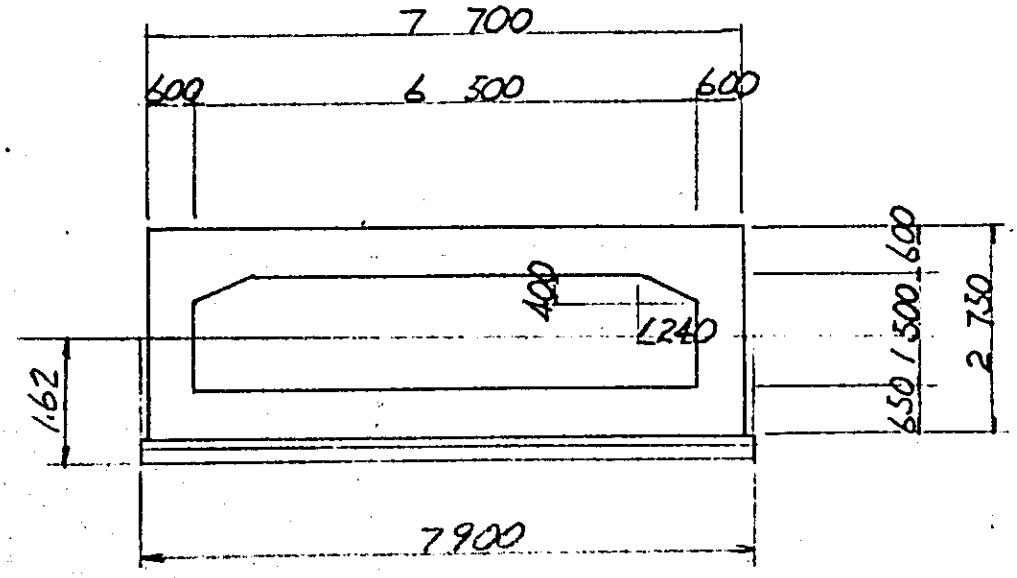
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D 29	5.04	6 100	8	246 0	
2	D 25	3.98	6 050	8	192 6	
3	〃	〃	8 790	4	139 9	
4	〃	〃	2 630	8	83 7	
5	〃	〃	3 680	4	58 6	
6	〃	〃	4 180	4	66 5	
7	〃	〃	3 650	4	58 1	
8	〃	〃	4 150	4	66 1	
9	〃	〃	5 600	8	178 3	
10	D 22	3.04	3 550	8	86 3	
11	D 19	2.25	1 160	164	428 0	
12	D 29	5.04	8 790	4	177 2	
13	D 22	3.04	1 880	8	45 7	
C' 1	D 13	0.995	1 900	15	28 4	
2	〃	〃	1 850	12	22 1	
3	〃	〃	750	10	7 5	
		TOTAL	OF PER METER		1885 0	
			(PER METER)			
		D 29	423 2	× 5.4m	2285 3	
		D 25	843 8	〃	4556 5	
		D 22	132 0	〃	712 8	
		D 19	428 0	〃	2311 2	
		D 13	90 2	〃	487 1	
W 1	D 16	1.56	10 480	4	65 4	
2	〃	〃	10 260	4	64 0	
3	〃	〃	1 900	8	23 7	
4	D 13	0.995	2 280	34	77 1	
5	〃	〃	1 720	12	20 5	
6	〃	〃	2 650	4	10 5	
		TOTAL OF PAR WING			261 2	
		D 16	153 1	× 2	306 2	
		D 13	108 1	〃	208 1	

JICA

GRADING, LEVELING, AGGREGATE, EXCAVATION







GRADING CONCRETE

$V = \frac{1}{2}(0.04+0.10) \times 4.800 \times 8.892 = 2.988 \text{ m}^3$

LEVELING CONCRETE

$V = 7.900 \times 0.100 \times 5.6 \operatorname{cosec} 60° = 5.109 \text{ m}^3$

AGGREGATE SUB BASE

$V = 7.900 \times 0.200 \times 5.6 \operatorname{cosec} 60° = 10.217 \text{ m}^3$

EXCAVATION

$V = 7.900 \times 1.620 \times 5.6 \operatorname{cosec} 60° = 82.758 \text{ m}^3$

4. Cb06

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	15.8	62.3	1620.0	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.0	80.6	1827.2	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	20.7	

Cb 06

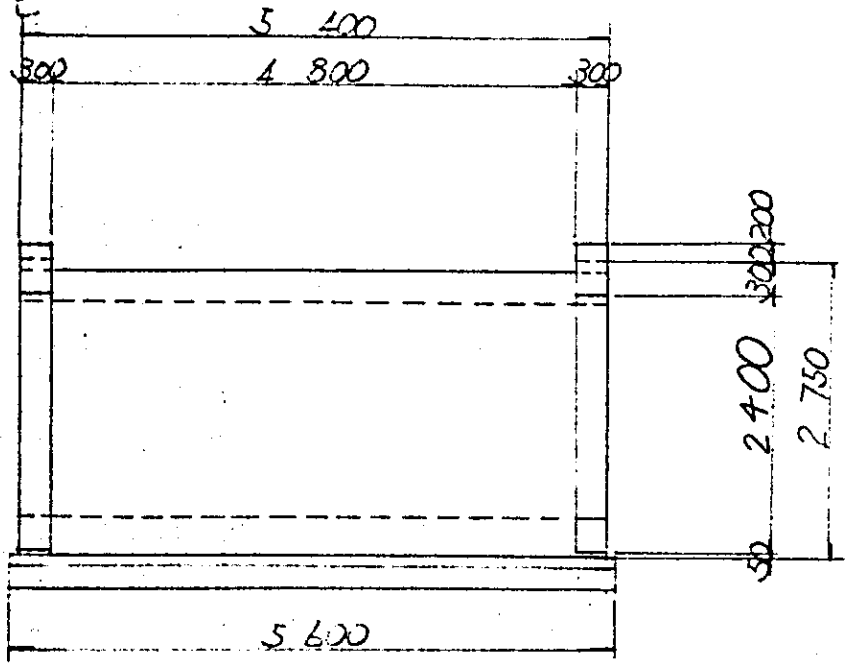
REINFORCING BAR

	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	681.5	938.5	—	—	—	—	1620.0
WING	207.2	—	—	—	—	—	207.2
TOTAL kg	888.7	938.5	—	—	—	—	1827.2

JICA

No. 21

CONCRETE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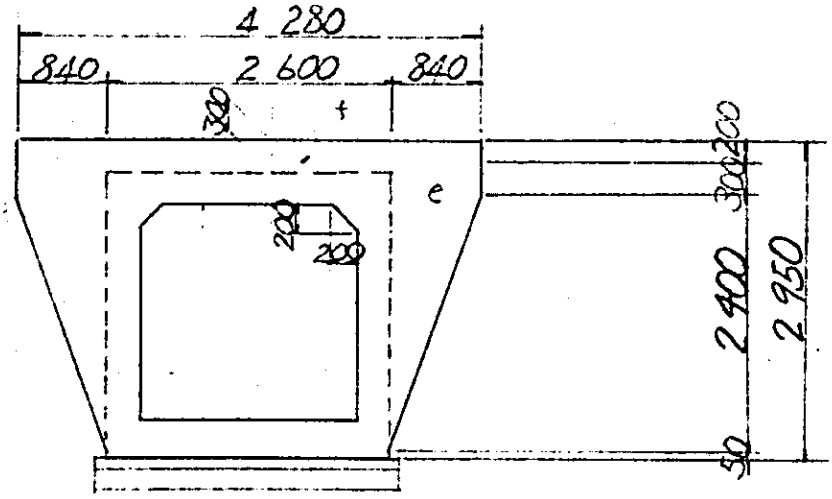
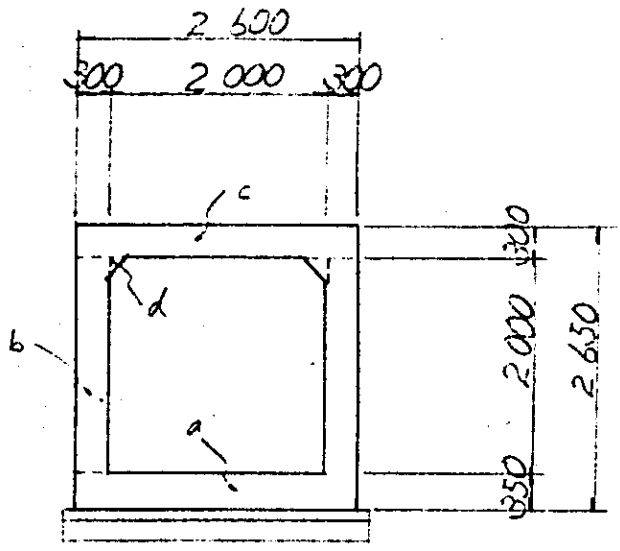
300
4 800
300
300
200
2 400
2 750
50
5 600


4 280
840
2 600
840
200
e
200
200
300
200
2 400
2 950
50


2 600
300
2 000
300
c
d
b
a
300
2 000
2 650
350

CONCRETE VOLUME

1. BOX CULVERT

$Va = 2.600 \times 5.400 \times 0.350$	=	4.914 m³
$Vb = 2.000 \times 5.400 \times 0.300 \times 2$	=	6.480 "
$Vc = 2.600 \times 5.400 \times 0.300$	=	4.212 "
$Vd = \frac{1}{2} \times 0.300 \times 0.200 \times 5.400 \times 2$	=	0.216 "
		15.822 "

2. WING

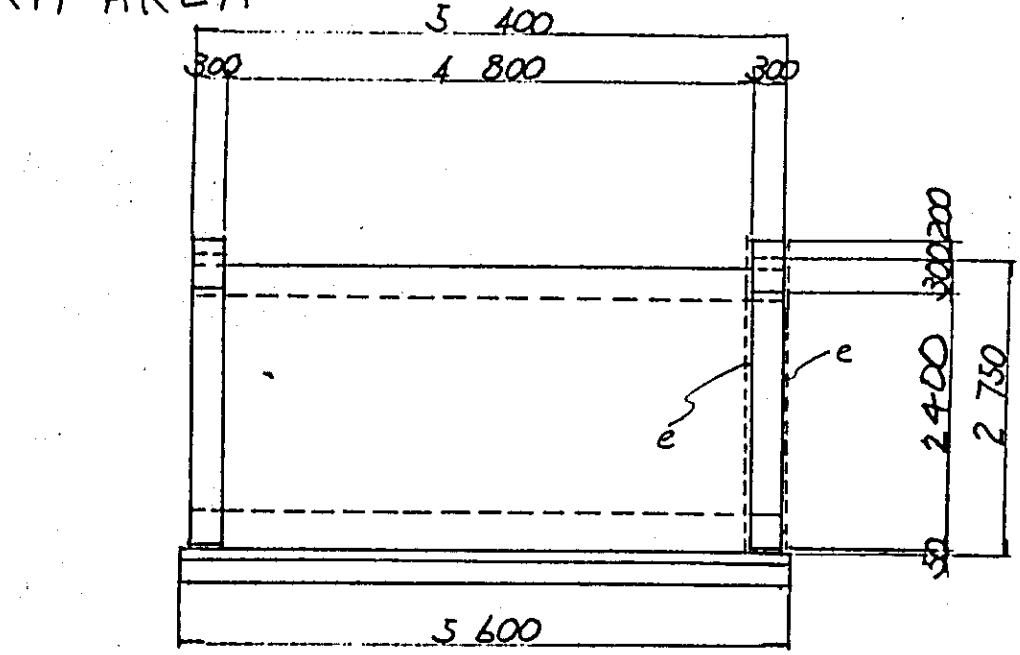
$Ve' = (0.500 + 2.900) \times \frac{1}{2} \times 0.840$

$\times 0.300 \times 2 = 0.857$

$Vf' = 2.600 \times 0.300 \times 0.300 = 0.234$

$V = (0.857 + 0.234) \times 2 = 2.18$ m³

FORM AREA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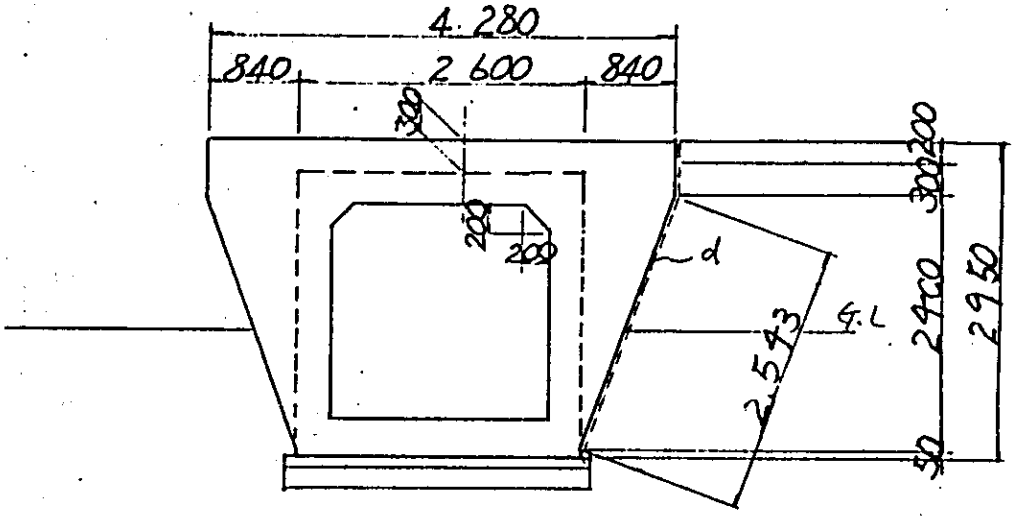
300
200
2400
2 750
50
e
e
5 600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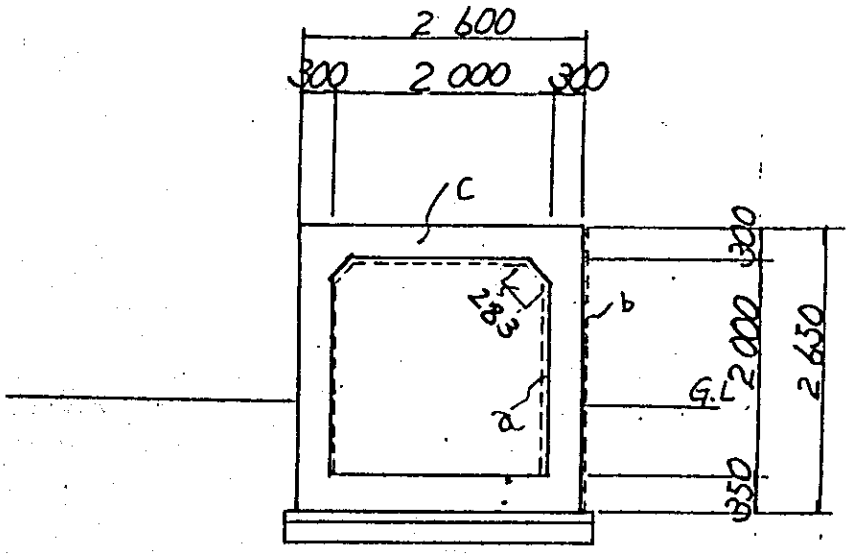
840
2 600
840
300
200
200
d
300
200
2400
2950
G.L
2573
50


2 600
300
2 000
300
c
283
b
a
300
2000
2650
G.L
350

FORM AREA

1. BOX CULVERT

$A_a = \{(1.800 + 0.283) \times 2 + 1.600\} \times 5.400 = 31.136$ m²

$A_b = 2.650 \times 4.800 \times 2 = 25.440$ "

$A_c' = 2.600 \times 2.650 - 2.000 \times 2.000 + 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 2.85$

$A_c = 2.85 \times 2 = 5.700$ "

62.276 "

2. WING

$A_d' = (0.050 + 2.543 + 0.500) \times 0.300 \times 2 = 1.856$

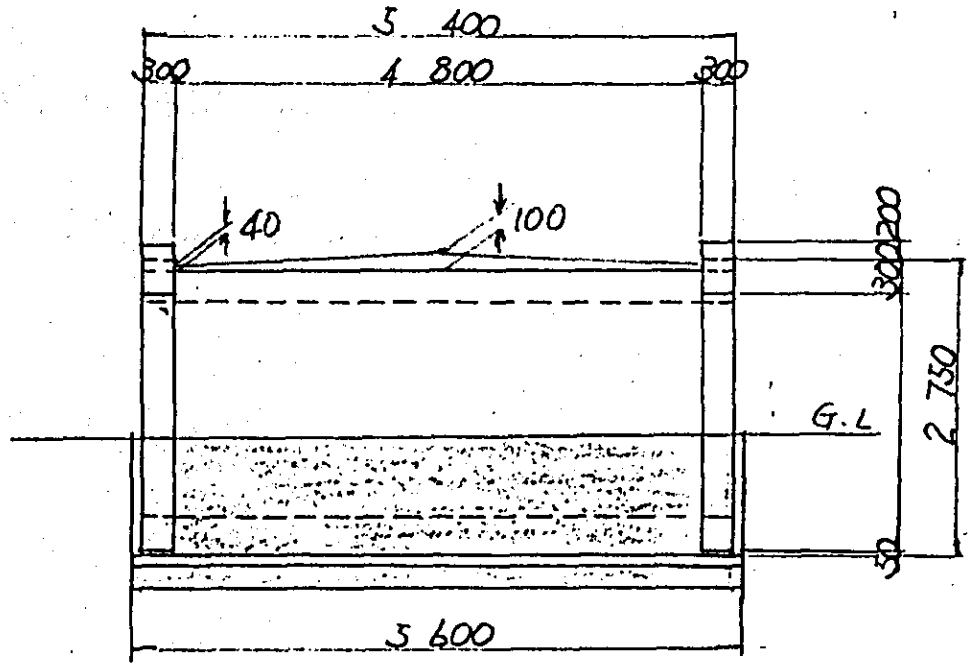
$A_e' = \{(0.500 + 2.900) \times 1/2 \times 0.840 \times 2 + 2.600 \times 0.300\} \times 2 = 7.272$

$A = (1.856 + 7.272) \times 2 = 18.256$ m²

C - 06 No 26

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D16	1.56	5180	8	64.6	
2	〃	〃	2290	8	28.6	
3	〃	〃	2260	8	28.2	
4	〃	〃	2500	8	31.2	
5	D13	0.995	2530	8	20.1	
6	D16	1.56	1700	8	21.2	
7	D13	0.995	1290	8	10.3	
8	〃	〃	1000	76	75.6	
9	〃	〃	760	8	6.0	
C' 1	D13	0.995	1210	4	4.8	
2	〃	〃	1160	4	4.6	
3	〃	〃	400	12	4.8	
		TOTAL	OF PER METER		300.0	
			(PER METER)			
		D16	173.8	× 5.4m	938.5	
		D13	126.2	〃	681.5	
W 1	D13	0.995	4570	4	18.2	
2	〃	〃	1900	14	26.5	
3	〃	〃	1500	8	11.9	
4	〃	〃	2110	16	33.6	
5	〃	〃	2950	4	11.7	
W' 1	D13	0.995	420	4	1.7	
		TOTAL	OF PER WING		103.6	
		D13	103.6	× 2	207.2	

JICA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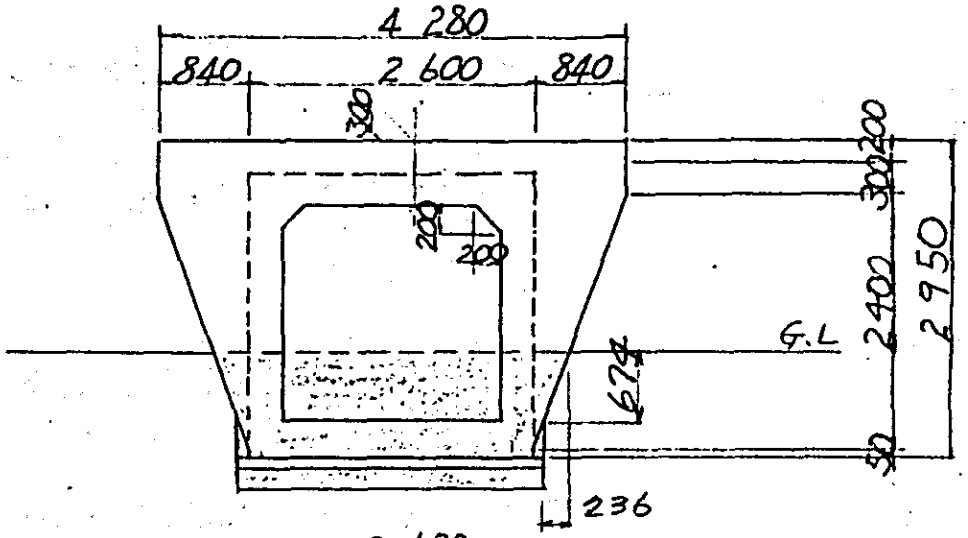
300
4 800
300
40
100
300
200
2 750
G.L
50
5 600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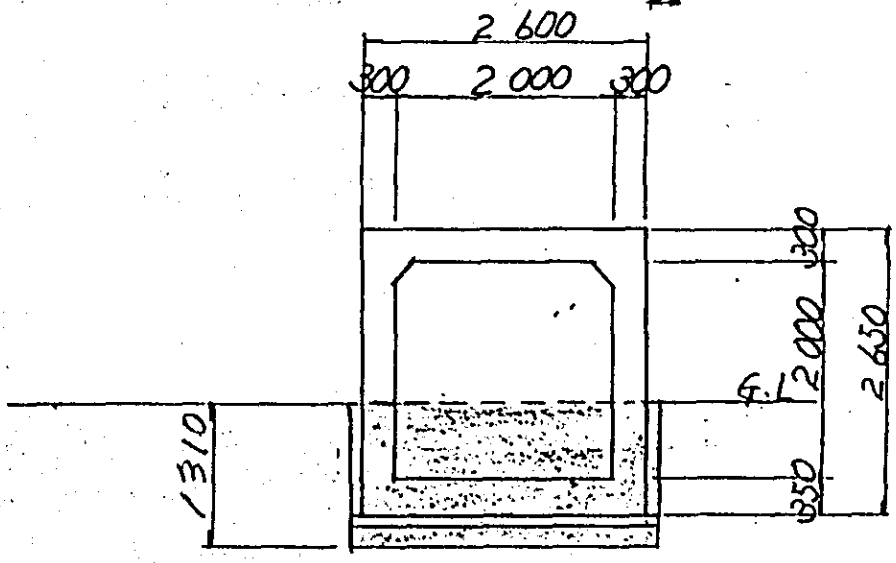
840
2 600
840
300
250
200
300
200
2400
2 950
G.L
674
50
236


2 600
300
2 000
300
300
2000
2 650
G.L
1310
350

GRADING CONCRETE

$V = (0.100 + 0.04) \times 2.4 \times 2.6 = 0.874\ m^3$

LEVELING CONCRETE

$V = 2.800 \times 5.600 \times 0.100 = 1.568\ m^3$

AGGREGATE SUB BASE

$V = 2.800 \times 5.600 \times 0.200 = 3.136\ m^3$

EXCAVATION

$Va = 2.800 \times 1.31 \times 5.600 = 20.541\ m^3$

$Vb' = 0.236 \times 0.674 \times \frac{1}{2} \times 0.500 \times 2 = 0.080$

$Vb = 0.080 \times 2 = 0.160\ "$

$20.701\ "$

5

Cb10

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (Kg/m^3)
BOX CULVERT	120.7	195.1	12475.1	100.6
WING	5.7	43.4	668.4	117.3
TOTAL	126.4	238.5	12143.5	96.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	4.6	
LEVELING CONCRETE	m^3	7.8	
AGGREGATE SUB BASE	m^3	15.6	
EXCAVATION	m^3	124.5	

Cb10

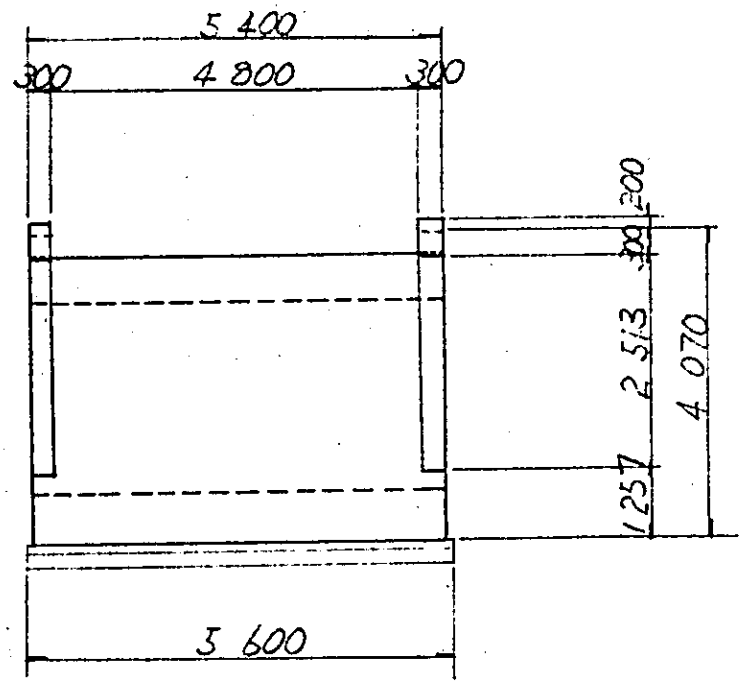
REINFORCING BAR

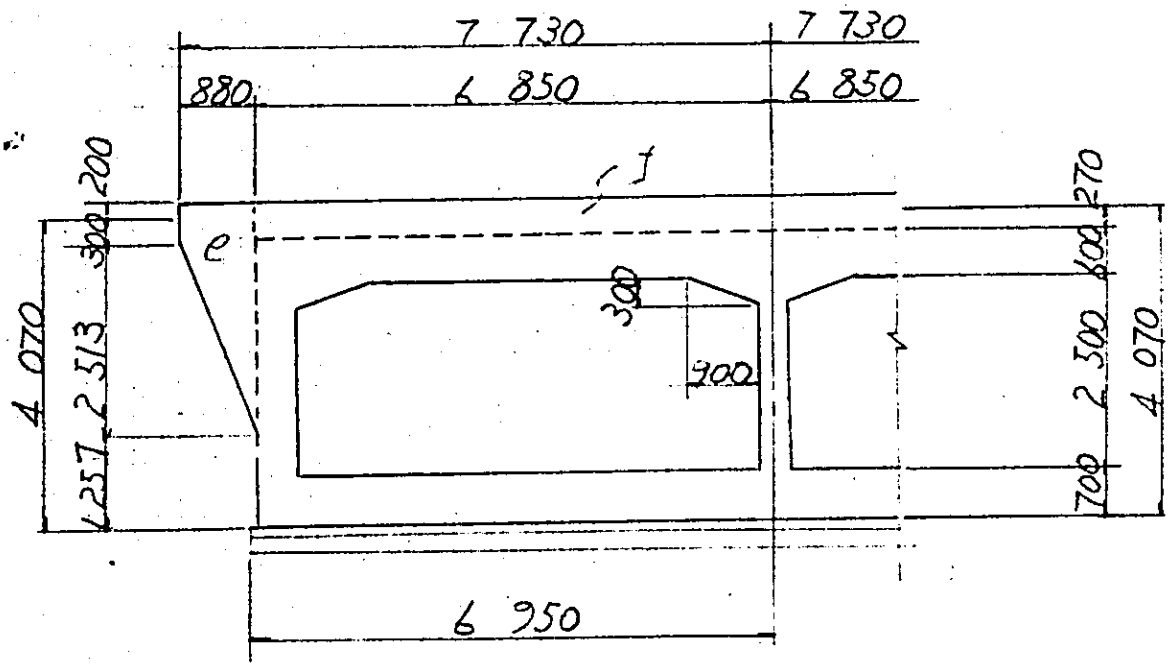
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	717.1	1449.4	2066.0	6420.6	1822.0	——	12475.1
WING	341.6	326.8	——	——	——	——	668.4
TOTAL kg	1058.7	1776.2	2066.0	6420.6	1822.0	——	13143.5

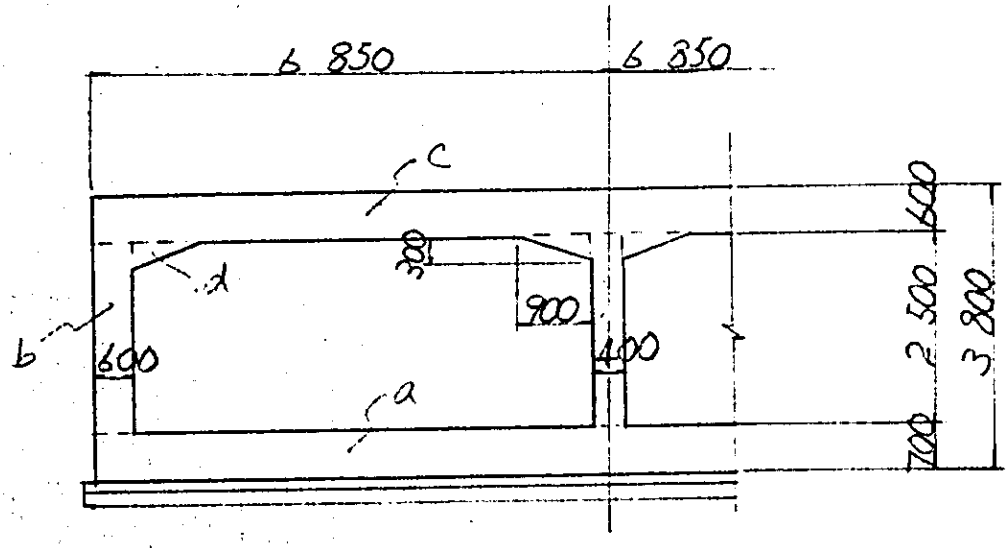
JICA

No. 80

CONCRETE


5 400
300
4 800
300
200
300
2 513
4 070
1257
3 600


7 730
7 730
880
6 850
6 850
f
e
200
300
270
400
300
900
4 070
2 513
1257
2 500
4 070
700
6 950


6 850
6 850
c
d
300
900
b
600
400
a
400
2 500
3 800
700

CONCRETE VOLUME

1. BOX CULVERT

$Va = 13.700 \times 0.700 \times 5.400 = 51.786\ m^3$

$Vb = (0.600 \times 2.500 \times 2 + 0.400 \times 2.500) \times 5.400 = 21.6\ "$

$Vc = 13.700 \times 0.600 \times 5.400 = 44.388\ "$

$Vd = \frac{1}{2} \times 0.300 \times 0.900 \times 5.400 \times 4 = 2.916\ "$

$120.690\ "$

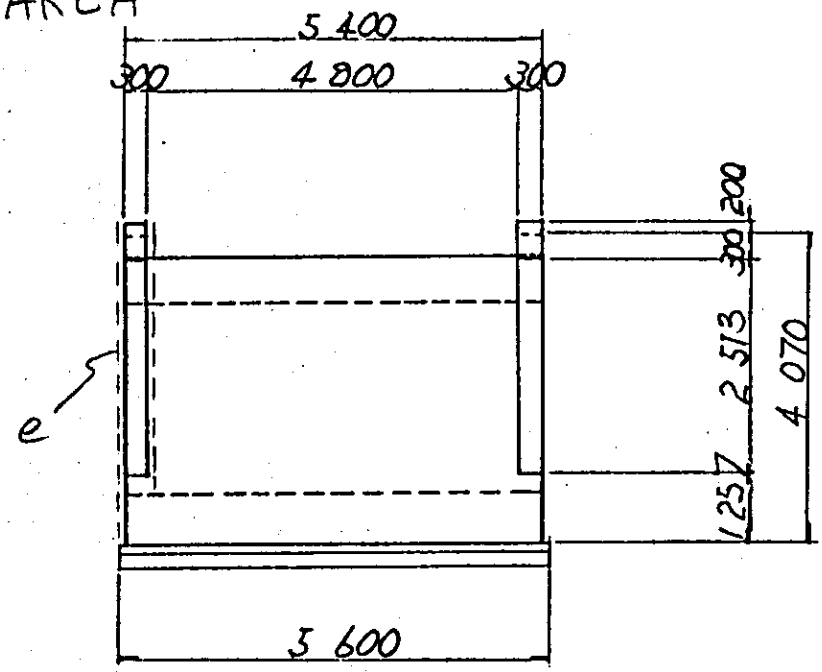
2. WING

$Ve' = (0.500 + 3.013) \times \frac{1}{2} \times 0.880 \times 0.300 \times 2 = 0.927$

$Vf' = 13.700 \times 0.300 \times 0.470 = 1.932$

$V = (0.927 + 1.932) \times 2 = 5.718\ m^3$

FORM AREA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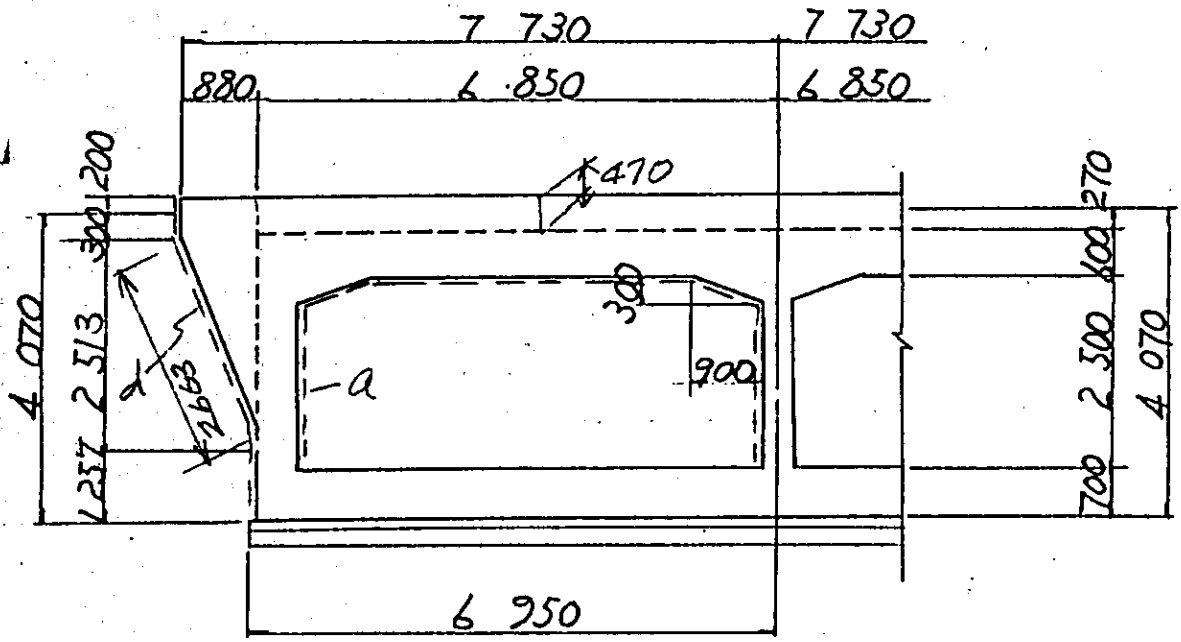
300
200
300
2 513
4 070
257
e
3 600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7 730
880
6 850
6 850
200
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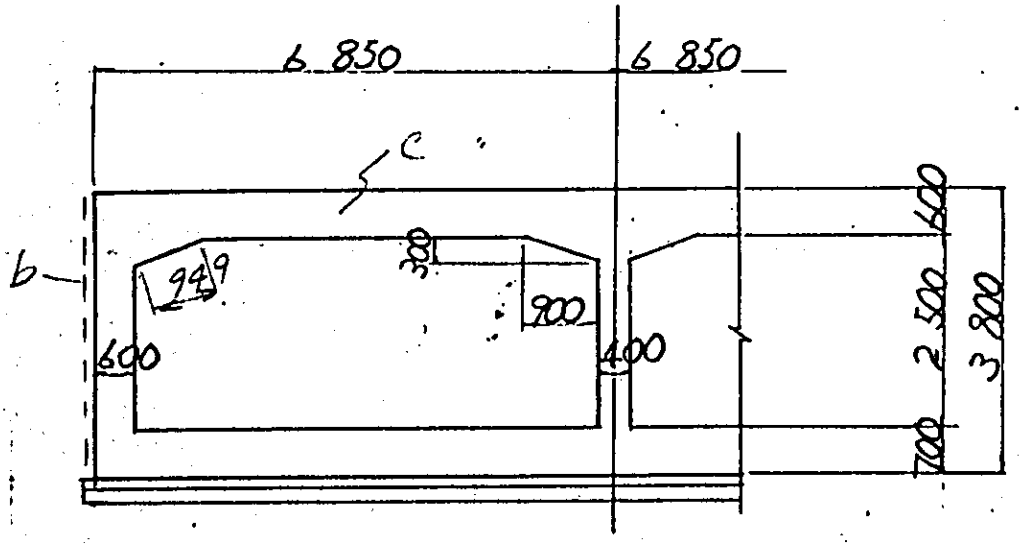
470
270
600
4 070
2 513
257
1663
a
300
900
2 500
4 070
700
6 950


6 850
6 850
c
b
949
300
900
600
400
400
2 500
3 800
700

FORM AREA

1. BOX CULVERT

$A_a = \{(2.200 + 0.949) \times 4 + 4.250 \times 2\}$

$\times 5.400 = 113.918$ m²

$A_b = 3.800 \times 4.800 \times 2 = 36.48$ "

$A_c' = 6.850 \times 3.800 - 6.050 \times 2.500$

$+ \frac{1}{2} \times 0.300 \times 0.900 \times 2 = 11.175$

$A_c = 11.175 \times 4 = 44.70$ "

195.098 "

2. WING

$A_d' = (1.257 + 2.663 + 0.500) \times 0.300 \times 2$

$= 2.652$

$A_e' = \{(0.500 + 3.013) \times \frac{1}{2} \times 0.880 \times 2$

$+ 6.850 \times 2 \times 0.470\} \times 2 = 19.061$

$A = (2.652 + 19.061) \times 2 = 43.43$ m²

BAR SCHEDULE

No. 55

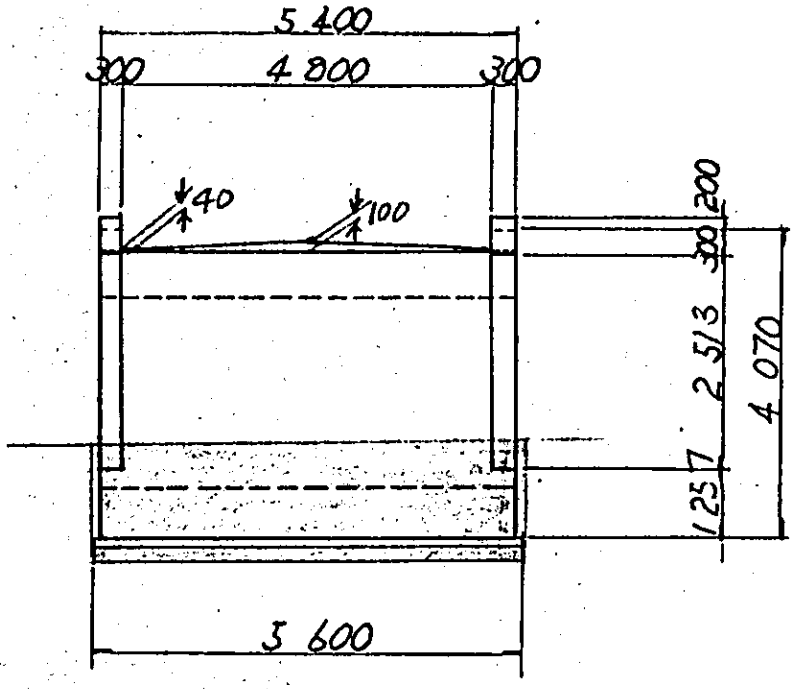
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D 25	3.98	7 000	2	55 7	
2	〃	〃	7 100	4	113 0	
3	D 22	3.04	5 780	8	140 6	
4	〃	〃	6 950	2	42 3	
5	〃	〃	3 680	8	89 5	
6	〃	〃	3 570	2	21 7	
7	〃	〃	3 160	2	19 2	
8	〃	〃	2 920	2	17 8	
9	〃	〃	3 360	2	20 4	
10	〃	〃	4 670	8	113 6	
11	〃	〃	3 660	2	22 3	
12	〃	〃	3 420	2	20 8	
13	D 19	2.25	3 100	4	27 9	
14	〃	〃	3 100	4	27 9	
15	〃	〃	1 000	54	121 5	
16	D 16	1.56	1 000	86	134 2	
17	D 22	3.04	7 100	4	86 3	
L 18	D 19	2.25	1 560	4	14 0	
C° 1	D 13	0.995	1 920	12	22 9	
2	〃	〃	1 770	8	14 1	
3	〃	〃	720	8	5 7	
4	〃	〃	520	3	1 6	
5	〃	〃	1 940	2	3 9	
6	〃	〃	2 290	8	18 2	
		TOTAL OF PER METER			1 151.4	
			(PER METER)			
		D 25	168.7	× 2 × 5.4m	1 822.0	
		D 22	594 5	〃	6 420 6	
		D 19	191 3	〃	2 066 0	
		D 16	134 2	〃	1 449 4	
		D 13	66 4	〃	717.1	

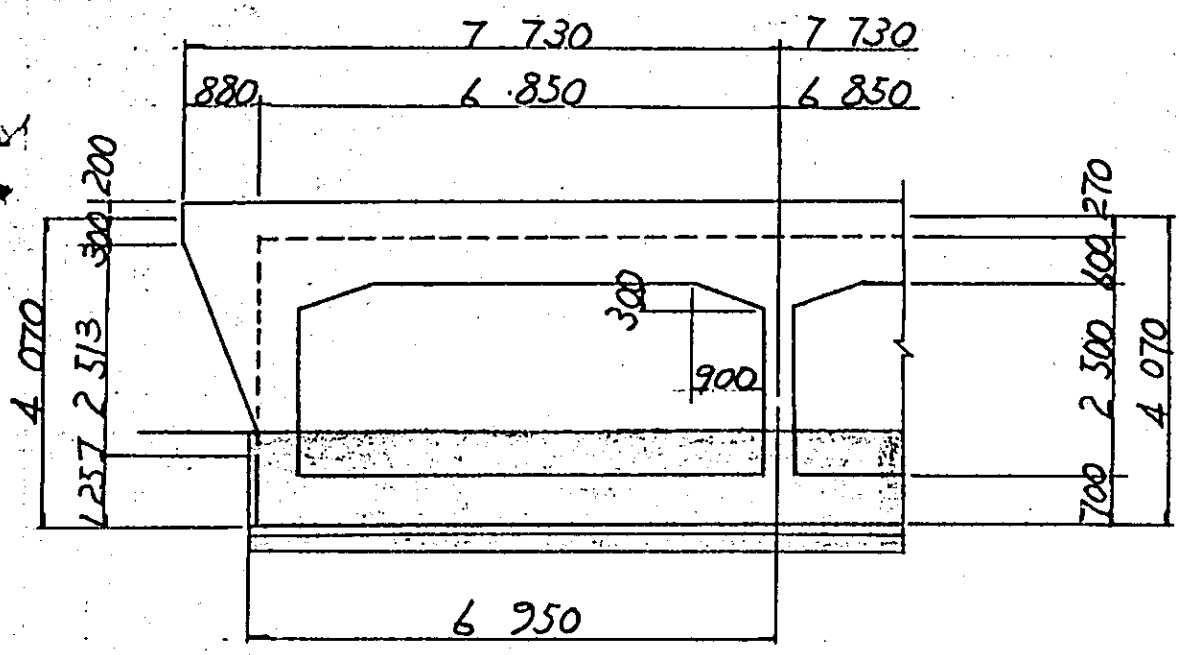
JICA

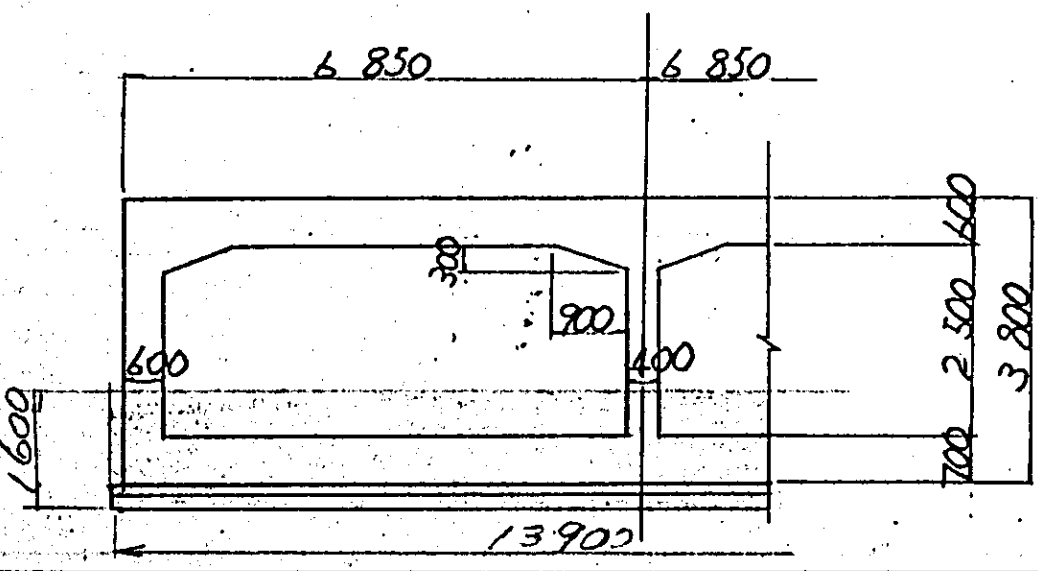
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
W 1	D16	1.56	8100	4	50.5	
2	〃	〃	2500	8	31.2	
3	D13	0.995	2090	26	54.1	
4	〃	〃	2250	10	22.4	
5	〃	〃	3800	2	7.6	
W° 1	D13	0.995	420	3	1.3	
		TOTAL OF PER WING			167.1	
		D16	817	× 2	163.4	
		D13	854	〃	170.8	

JICA

GRADING, LEVELING, AGGREGATE, EXCAVATION







GRADING CONCRETE

$V = \frac{1}{2}(0.04+0.10) \times 4.800 \times 13.700 = 4.603\ m^3$

LEVELING CONCRETE

$V = 13.900 \times 0.10 \times 5.600 = 7.784\ "$

AGGREGATE SUB BASE

$V = 13.900 \times 0.20 \times 5.600 = 15.568\ "$

EXCAVATION

$V = 13.900 \times 1.600 \times 5.600 = 124.544\ "$

6.

Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.1	104.7
WING	1.6	13.8	220.4	138.3
TOTAL	15.8	65.4	1706.5	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	17.5	

Cb 12

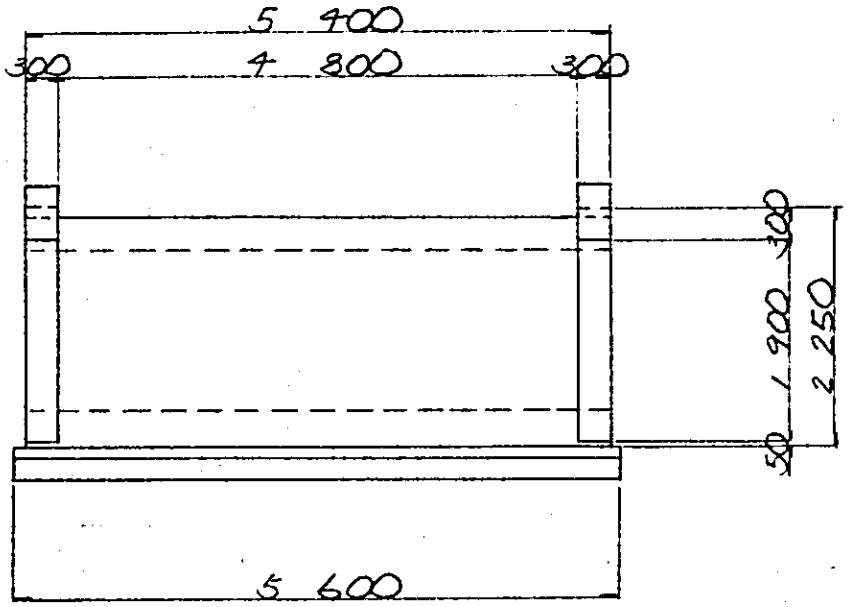
REINFORCING. BAR

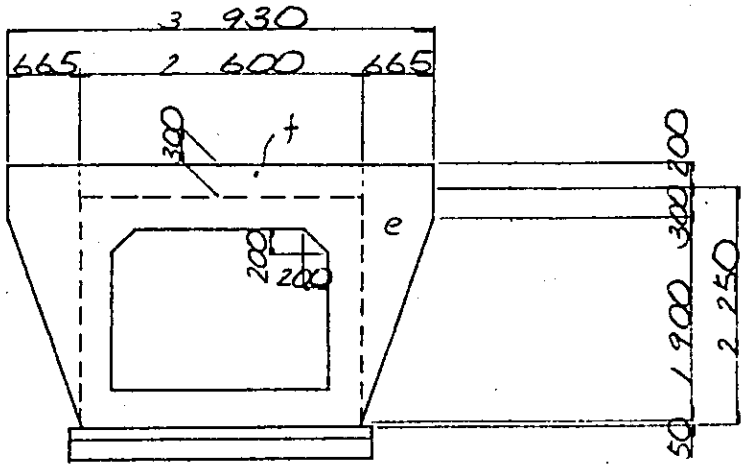
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	615.6	870.5	—	—	—	—	1486.1
WING	220.4	—	—	—	—	—	220.4
TOTAL kg	836.0	870.5	—	—	—	—	1706.5

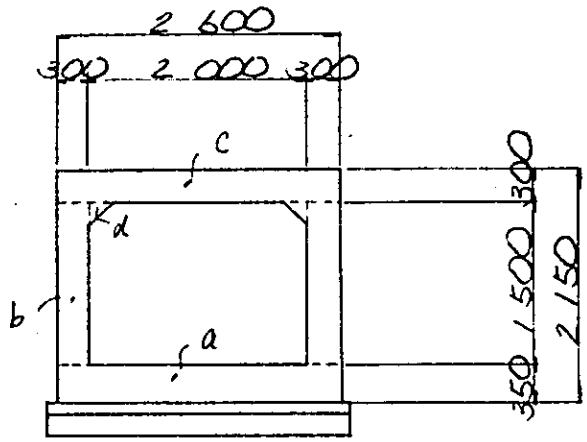
JICA

No. 40

CONCRETE


5 400
300
4 800
300
300
1 900
2 250
50
5 600


3 930
665
2 600
665
300
t
e
200
200
300
300
1 900
2 250
50


2 600
300
2 000
300
c
d
b
a
300
1 500
2 150
350

CONCRETE VOLUME

1. BOX CULVERT

$Va = 2.600 \times 0.350 \times 5.400$	=	4.914 m^3
$Vb = 0.300 \times 1.500 \times 5.400 \times 2$	=	4.860 "
$Vc = 2.600 \times 0.300 \times 5.400$	=	4.212 "
$Vd = 0.200 \times 0.200 \times \frac{1}{2} \times 5.400 \times 2$	=	0.216 "
		14.202 "

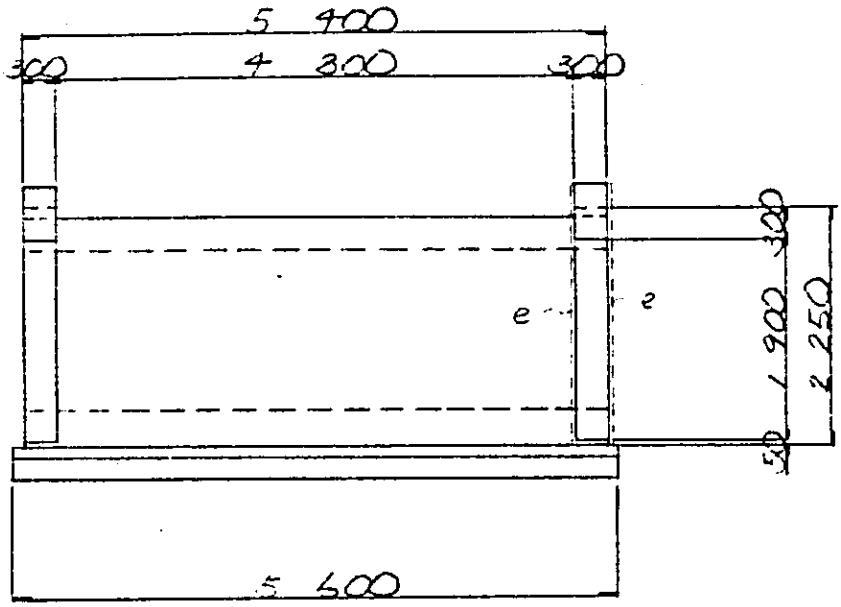
2. WING

$Ve' = (0.500 + 2.400) \times \frac{1}{2} \times 0.665 \times 0.300 \times 2 = 0.579$

$Vf' = 2.600 \times 0.300 \times 0.300 = 0.234$

$V = 0.579 + 0.234 = 0.813 \times 2$	=	1.626 m^3

FORM AREA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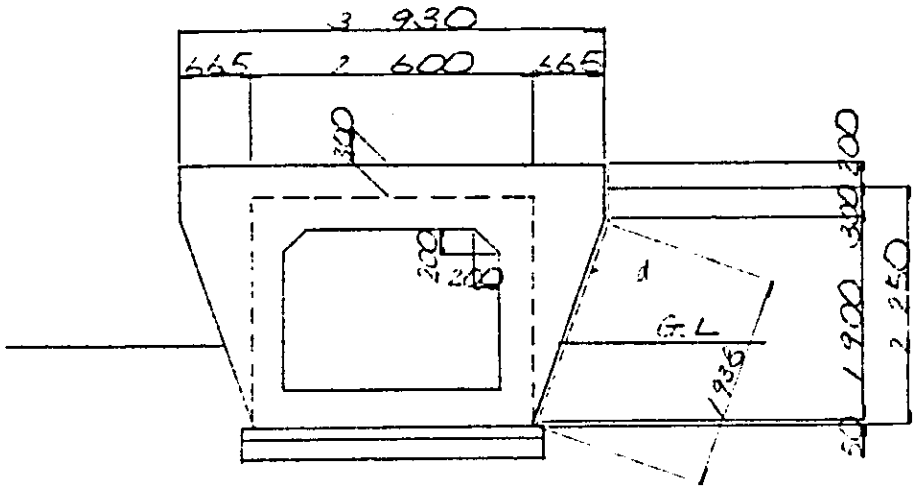
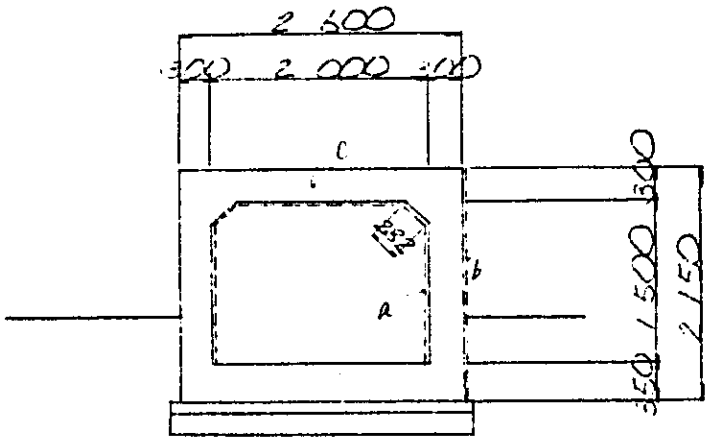
300
4 300
300
e
e
300
1 900
2 250
50
5 600


3 930
465
2 600
465
300
200
200
d
G.L
1936
300
300
1 900
2 250
50


2 600
300
2 000
300
c
150
150
A
b
300
1 500
2 150
350

FORM AREA

1. BOX CULVERT

$Aa = \{(1.300 + 0.283) \times 2 + 1.600\} \times 5.900 =$ 25.736 m^2

$Ab = 2.150 \times 4.800 \times 2 =$ 20.640

$Ac' = (2.600 \times 2.150 - 2.000 \times 1.500 + 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 2.630$

$Ac = 2.630 \times 2 =$ 5.260

51.636 m^2

2. WING

$Ad' = (1.938 + 0.500) \times 0.300 \times 2 = 1.463$

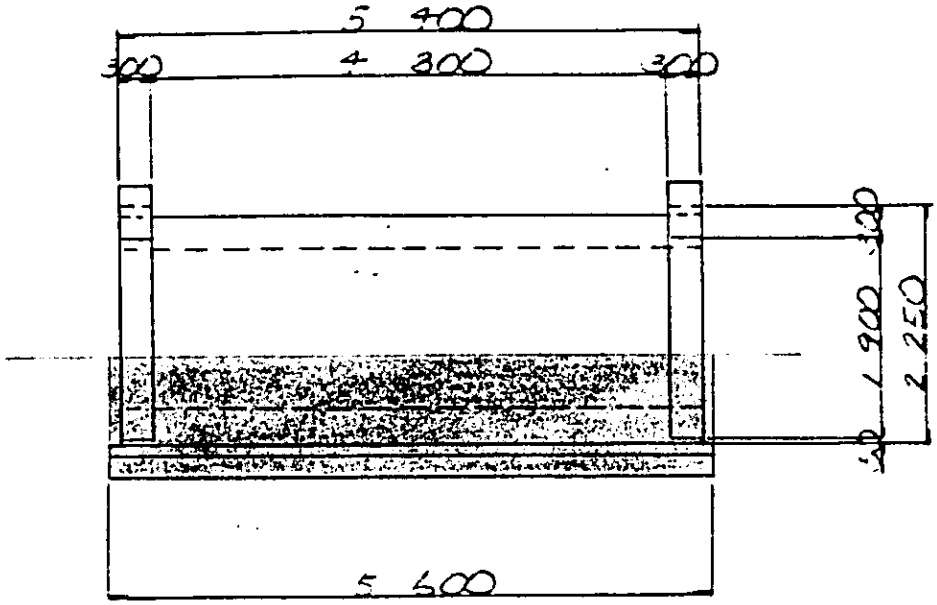
$Ae' = \{(0.500 + 2.400) \times \frac{1}{2} \times 0.665 \times 2 + 1.600 \times 0.300\} \times 2 = 5.417$

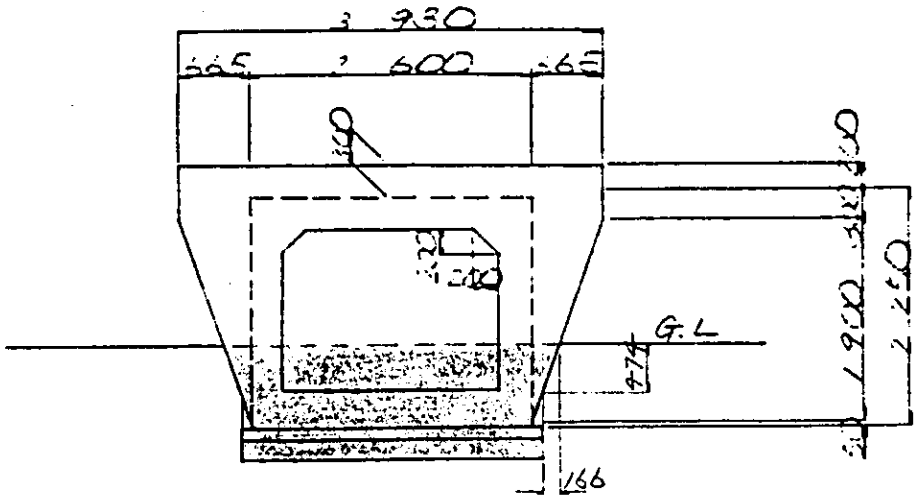
$A = 1.463 + 5.417 = 6.880 \times 2 =$ 13.760 m^2

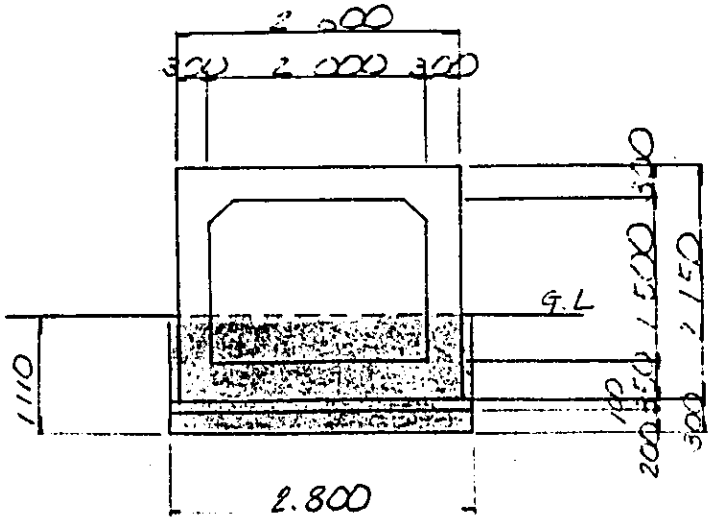
BAR SCHEDULE

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D16	1.56	4680	8	58.4	
2	〃	〃	2030	8	25.3	
3	〃	〃	2010	8	25.1	
4	〃	〃	2500	8	31.2	
5	D13	0.995	2030	8	16.2	
6	D16	1.56	1700	8	21.2	
7	D13	0.995	1240	8	9.9	
8	〃	〃	1000	68	67.7	
9	〃	〃	860	8	6.8	
C' 1	D13	0.995	1210	4	4.8	
2	〃	〃	1160	4	4.6	
3	〃	〃	400	10	4.0	
		TOTAL OF PER METER			275.2	
		D16	161.2	× 5.4m	870.5	
		D13	114.0		615.6	
W 1	D13	0.995	4210	4	16.8	
2	〃	〃	1600	14	39.1	
3	〃	〃	1500	8	11.9	
4	〃	〃	1940	16	30.9	
5	〃	〃	2450	4	9.8	
W' 1	D13	0.995	420	4	1.7	
		TOTAL OF PER WING			110.2	
		D13	110.2	× 2	220.4	

LEVELING, AGGREGATE, EXCAVATION







LEVELING CONCRETE

$V = 2.800 \times 0.100 \times 5.600$ = 1.568 m³

AGGREGATE SUB BASE

$V = 2.800 \times 0.200 \times 5.600$ = 3.136 m³

EXCAVATION

$V_a = 2.800 \times 1.110 \times 5.600$ = 17.405 m³

$V_b' = 0.166 \times 0.474 \times \frac{1}{2} \times 0.50 = 0.039$

$V_b = 0.039 \times 2$ = 0.078 "

17.483 "

7. Cb 17

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	67.9	102.2	9535.4	140.4
WING	2.3	18.8	335.4	145.8
TOTAL	70.2	121.0	9870.8	140.6

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	2.8	
LEVELING CONCRETE	m^3	4.7	
AGGREGATE SUB BASE	m^3	9.4	
EXCAVATION	m^3	77.9	

Cb17

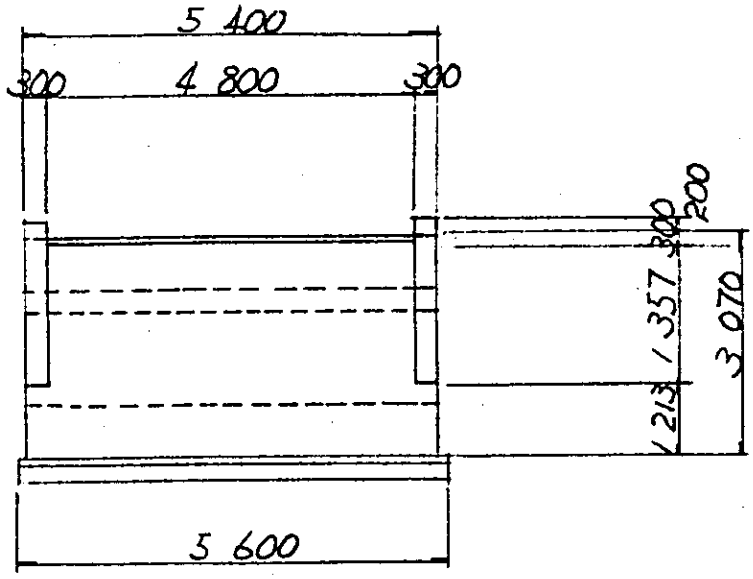
REINFORCING. BAR

	D 13	D 16	D 19	D 22	D25	D 29	TOTAL kg
BOX CULVERT	452.0	——	1895.4	678.8	4354.6	2154.6	9535.4
WING	174.6	160.8	——	——	——	——	335.4
TOTAL kg	626.6	160.8	1895.4	678.8	4354.6	2154.6	9870.8

JICA

No. 47

CONCRETE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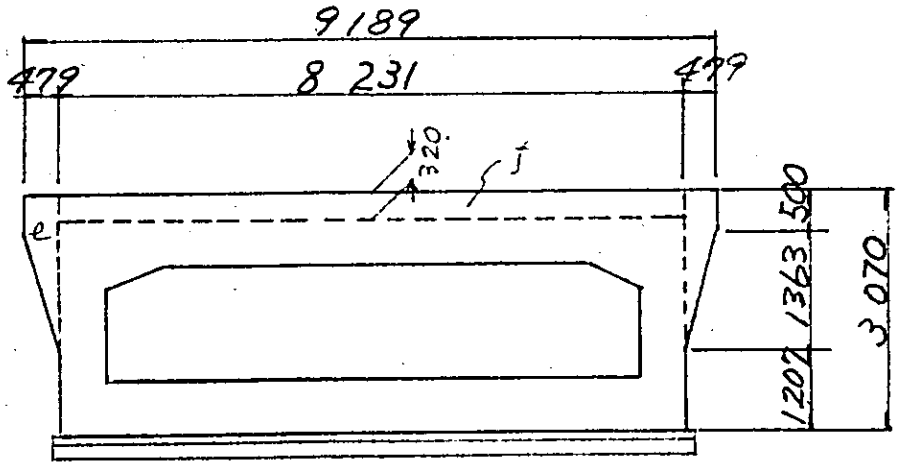
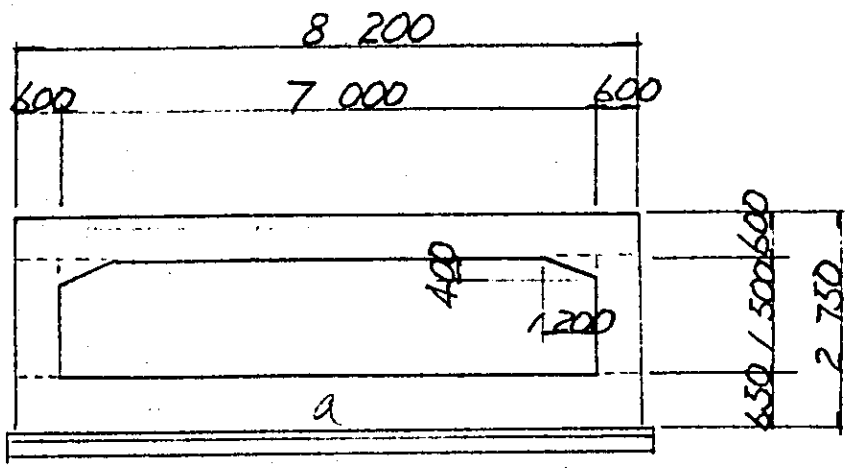
300
200
300
1 357
213
3 070
5 600


9189
479
8 231
479
320
e
f
500
1363
1202
3 070


8 200
600
7 000
600
400
1200
600
1 500
450
2 750
a

CONCRETE VOLUME

1. BOX CULVERT

$Va = 8.200 \times 0.650 \times 5.400 \operatorname{cosec} 85°$	=	28.892 m^3
$Vb = 0.600 \times 1.500 \times 5.400 \operatorname{cosec} 85° \times 2$	=	9.757 "
$Vc = 8.200 \times 0.600 \times 5.400 \operatorname{cosec} 85°$	=	26.669 "
$Vd = \frac{1}{2} \times 1.200 \times 0.400 \times 5.400 \operatorname{cosec} 85° \times 2$	=	2.602 "
		67.92 "

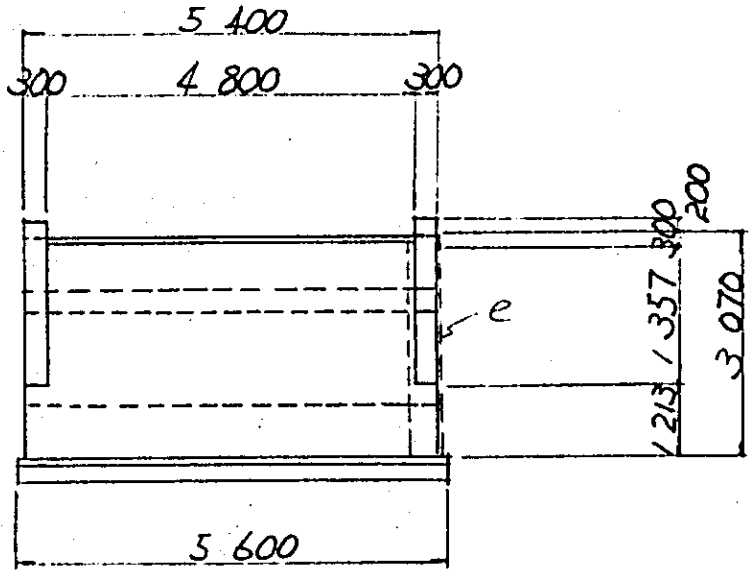
2. WING

$Ve' = (0.500 + 1.863) \times \frac{1}{2} \times 0.479 \times 0.300 \times 2 = 0.340$

$Vf' = 8.231 \times 0.320 \times 0.300 = 0.790$

$V = (0.340 + 0.790) \times 2 = 2.26$ m^3

FORM AREA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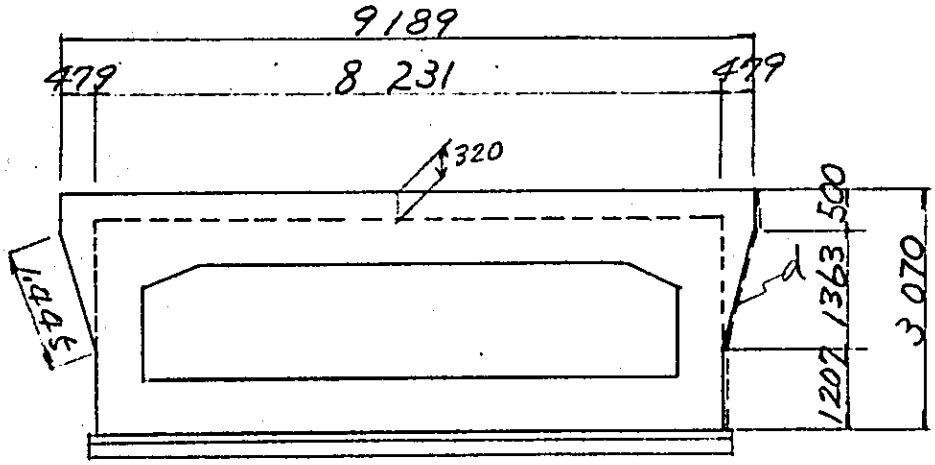
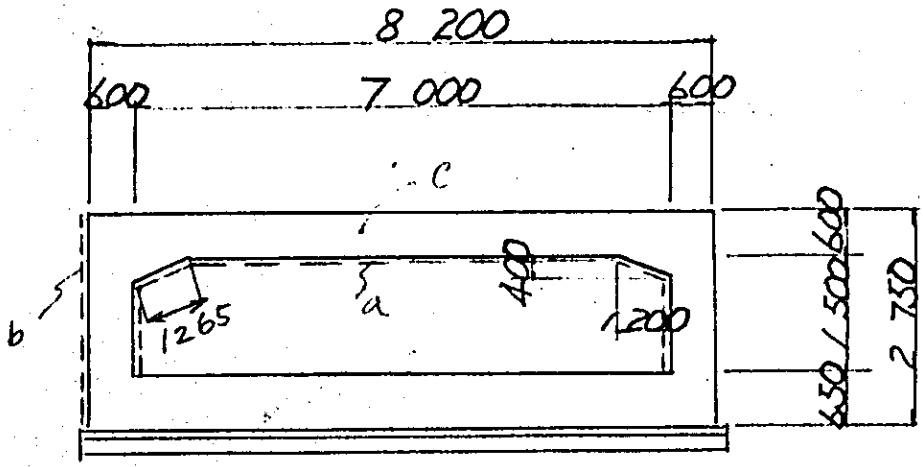
300
4 800
300
200
300
1 357
1 213
3 070
e
5 600


9189
479
8 231
479
320
500
1363
1202
3 070
1495
d


8 200
600
7 000
600
c
600
500
650
2 750
400
1200
1265
a
b

FORM AREA

1. BOX CULVERT

$A_a = \{(1.100 + 1.265) \times 2 + 4.600\} \times 5.400 \operatorname{cosec} 85^\circ$ = 50.574 m²

$A_b = 2.750 \times 4.800 \operatorname{cosec} 85^\circ \times 2$ = 26.501 "

$A_c' = 8.200 \times 2.750 - 7.000 \times 1.500 + 1.200 \times 0.400 \times \frac{1}{2} \times 2 = 12.53$

$A_c = 12.53 \operatorname{cosec} 85^\circ \times 2$ = 25.155 "

102.23 "

2. WING

$A_d' = (1.207 + 1.445 + 0.500) \times 0.300 \times 2 = 1.891$

$A_e' = \{(0.500 + 1.863) \times \frac{1}{2} \times 0.479 \times 2 + 8.231 \times 0.320\} \times 2 = 7.532$

$A = (1.891 + 7.532) \times 2$ = 18.846 m²

BAR SCHEDULE

No. 54

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D29	5.04	5830	8	235.1	
2	〃	〃	8130	4	163.9	
3	D25	3.98	5810	8	185.0	
4	〃	〃	8130	4	129.4	
5	〃	〃	2630	8	83.7	
6	〃	〃	3720	4	59.2	
7	〃	〃	4250	4	67.7	
8	〃	〃	3690	4	58.7	
9	〃	〃	4190	4	66.7	
10	〃	〃	4900	8	156.0	
11	D22	3.04	3500	8	85.1	
12	D19	2.25	1000	156	351.0	
13	D22	3.04	1670	8	40.6	
C° 1	D13	0.995	1820	14	25.4	
2	〃	〃	1770	10	17.6	
3	〃	〃	670	10	6.7	
4	〃	〃	1220	4	4.9	
5	〃	〃	2440	12	29.1	
		TOTAL OF PER METER			1765.8	
		D29	3990 ×	5.4m	2154.6	
		D25	8064	〃	4354.6	
		D22	1257	〃	678.8	
		D19	3510	〃	1895.4	
		D13	837	〃	452.0	

JICA

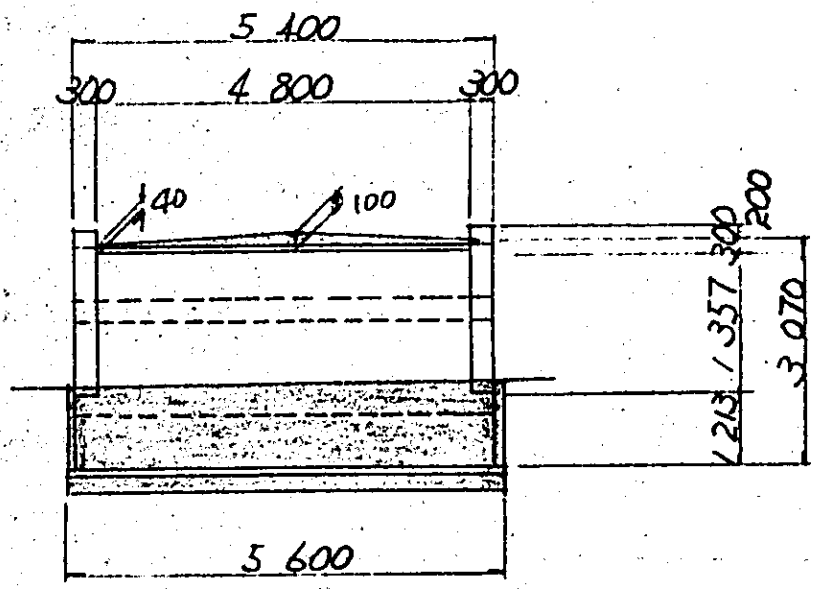
C-17-2

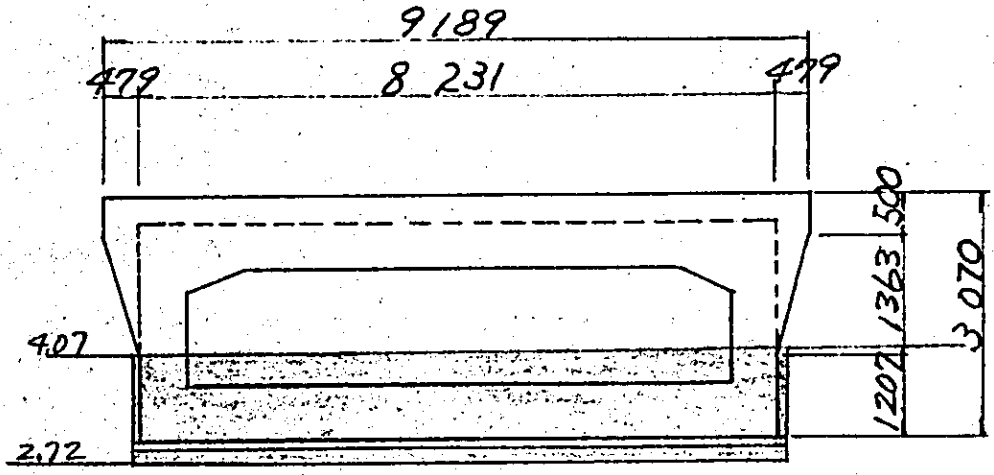
No. 55

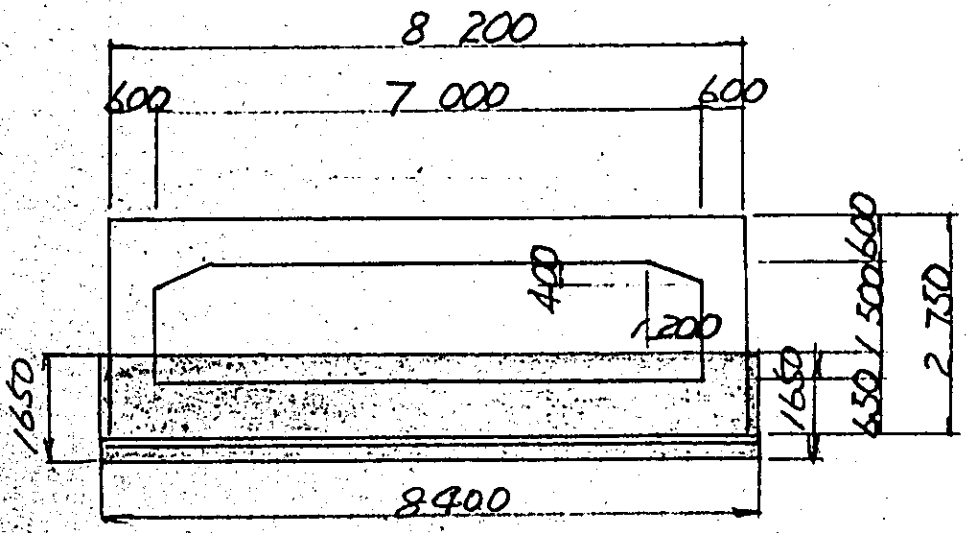
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
W 1	D16	1.56	9490	4	59.2	
2	"	"	1700	8	21.2	
3	D13	0.995	1780	30	53.1	
4	"	"	1950	12	23.3	
5	"	"	2750	4	10.9	
		TOTAL OF PER WING			167.7	
		D16	804	× 2	160.8	
		D13	873	"	174.6	

JICA

GRADING, LEVELING, AGGREGATE, EXCAVATION.







GRADING CONCRETE

$V = \frac{1}{2}(0.04 + 0.10) \times 4.800 \times 8.200 \operatorname{cosec} 85° = 2.766\ m^3$

1.00381

LEVELING CONCRETE

$V = 8.400 \times 0.100 \times 5.600 \operatorname{cosec} 85° = 4.722$

AGGREGATE SUB BASE

$V = 8.400 \times 0.200 \times 5.600 \operatorname{cosec} 85° = 9.444$

EXCAVATION

$V = 8.400 \times 1.650 \times 5.600 \operatorname{cosec} 85° = 77.912$

8. Cb.18

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	48.1	100.1	5680.3	118.1
WING	2.9	21.8	388.2	133.9
TOTAL	51.0	121.9	6068.5	119.0

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	2.1	
LEVELING CONCRETE	m^3	3.6	
AGGREGATE SUB BASE	m^3	7.2	
EXCAVATION	m^3	50.9	

Cb18

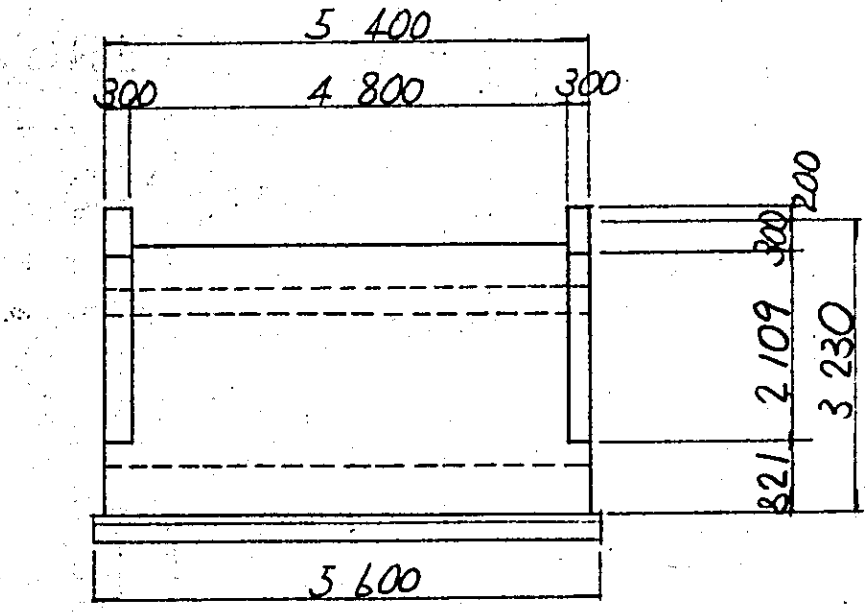
REINFORCING BAR

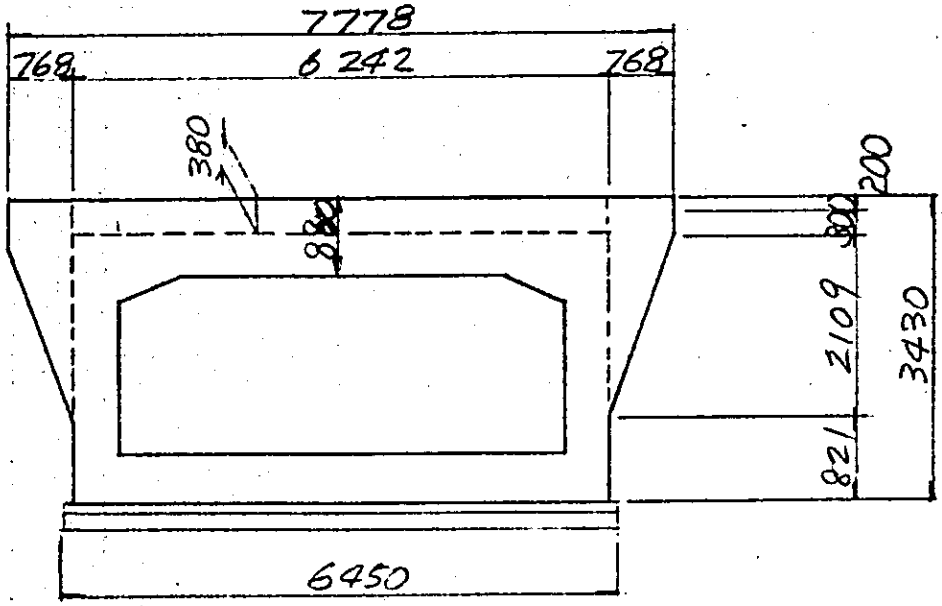
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	342.4	1191.2	406.1	3740.6	—	—	5680.3
WING	169.6	218.6	—	—	—	—	388.2
TOTAL kg	512.0	1409.8	406.1	3740.6	—	—	6068.5

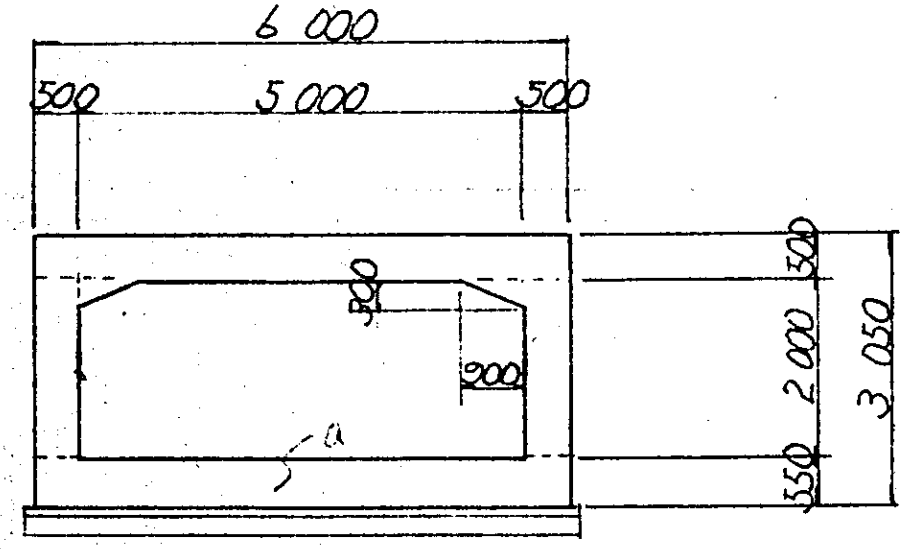
JICA

No. 57

CONCRETE


5 400
300
4 800
300
200
300
2 109
3 230
821
5 600


7778
768
6 242
768
380
882
200
300
2109
3430
821
6450


6 000
500
5 000
500
500
300
200
2 000
3 050
350

CONCRETE VOLUME

1. BOX CULVERT

1.041026

$V_a = 6.000 \times 0.550 \times 5.400 \operatorname{cosec} 74^\circ = 18.537\ m^3$

$V_b = 0.500 \times 2.000 \times 5.400 \operatorname{cosec} 74^\circ \times 2 = 11.236$ "

$V_c = 6.000 \times 0.500 \times 5.400 \operatorname{cosec} 74^\circ = 16.852$ "

$V_d = \frac{1}{2} \times 0.900 \times 0.300 \times 5.400 \operatorname{cosec} 74^\circ \times 2 = 1.517$ "

48.141 "

2. WING

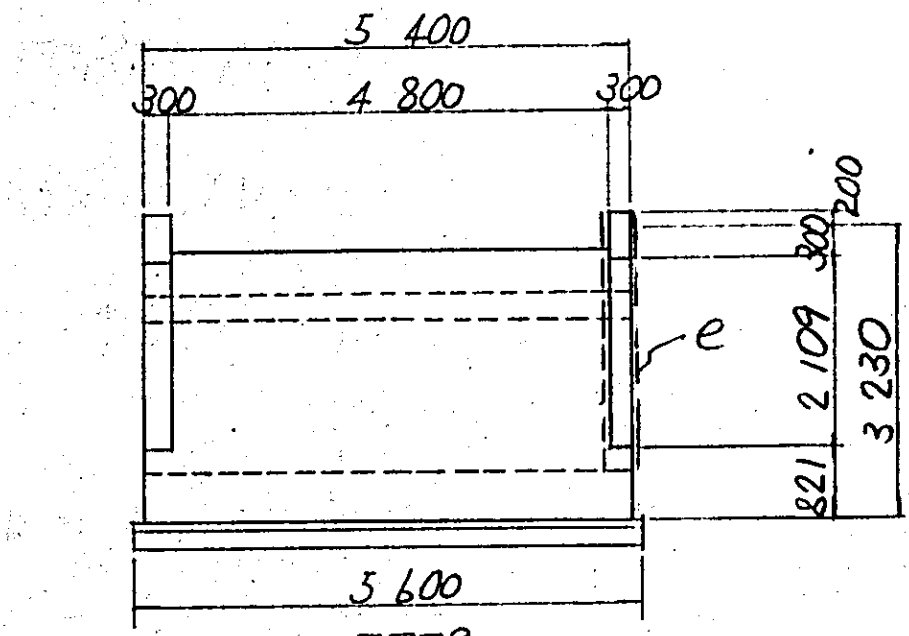
$V_e' = (0.500 + 2.609) \times \frac{1}{2} \times 0.768$

$\times 0.300 \times 2 = 0.716$

$V_f' = 6.242 \times 0.380 \times 0.300 = 0.712$

$V = (0.716 + 0.712) \times 2 = 2.856\ m^3$

FORM AREA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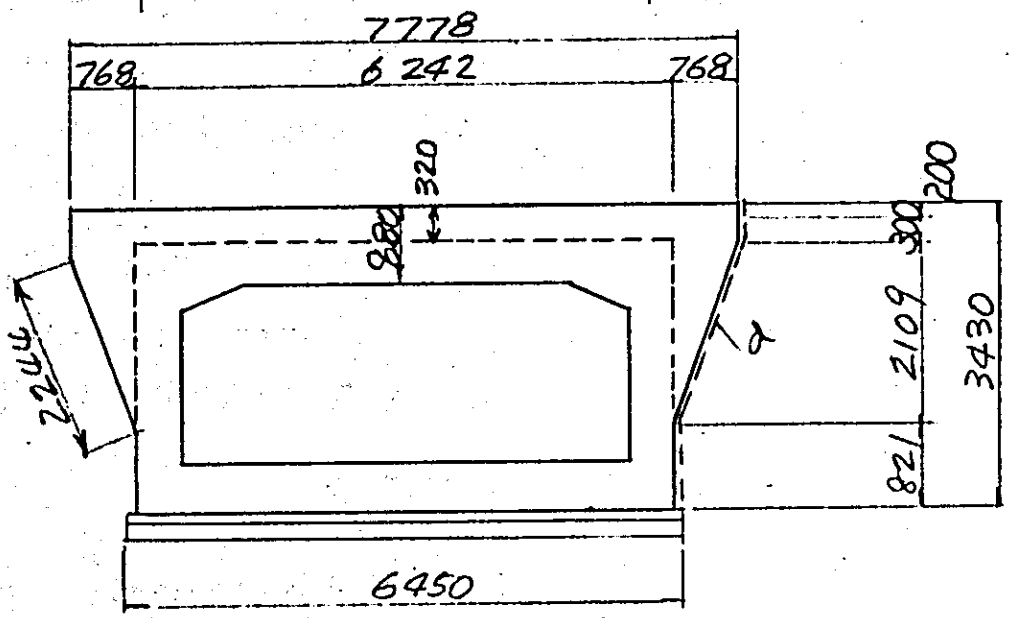
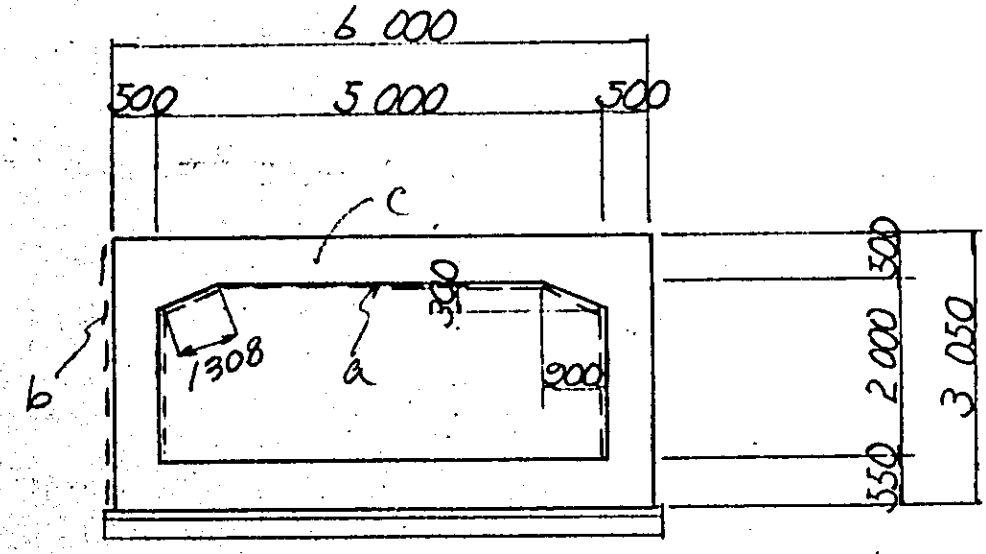
300
4 800
300
200
300
e
2 109
3 230
821
3 600


7778
768
6 242
768
320
880
200
300
2246
a
2109
3430
821
6450


6 000
500
5 000
500
c
300
300
1308
a
900
b
2 000
3 050
550

FORM AREA

1. BOX CULVERT

$Aa = \{(1.700 + 1.308) \times 2 + 3.200\} \times 5.400 \overset{1.04026}{\text{cosec}} 74° = 51.770\ m^2$

$Ab = 3.050 \times 4.800 \text{ cosec } 74° \times 2 = 30.459$"

$Ac' = 6.000 \times 3.050 - 5.000 \times 2.000 + \frac{1}{2} \times 0.900 \times 0.300 \times 2 = 8.57$

$A = 8.57 \text{ cosec } 74° \times 2 = 17.830$"

100.059"

2. WING

$Ad' = (0.821 + 2.244 + 0.500) \times 0.300 \times 2 = 2.139$

$Ae' = \{(0.500 + 2.609) \times \frac{1}{2} \times 0.768 \times 2 + 6.242 \times 0.32\} \times 2 = 8.770$

$A = (2.139 + 8.770) \times 2 = 21.818\ m^2$

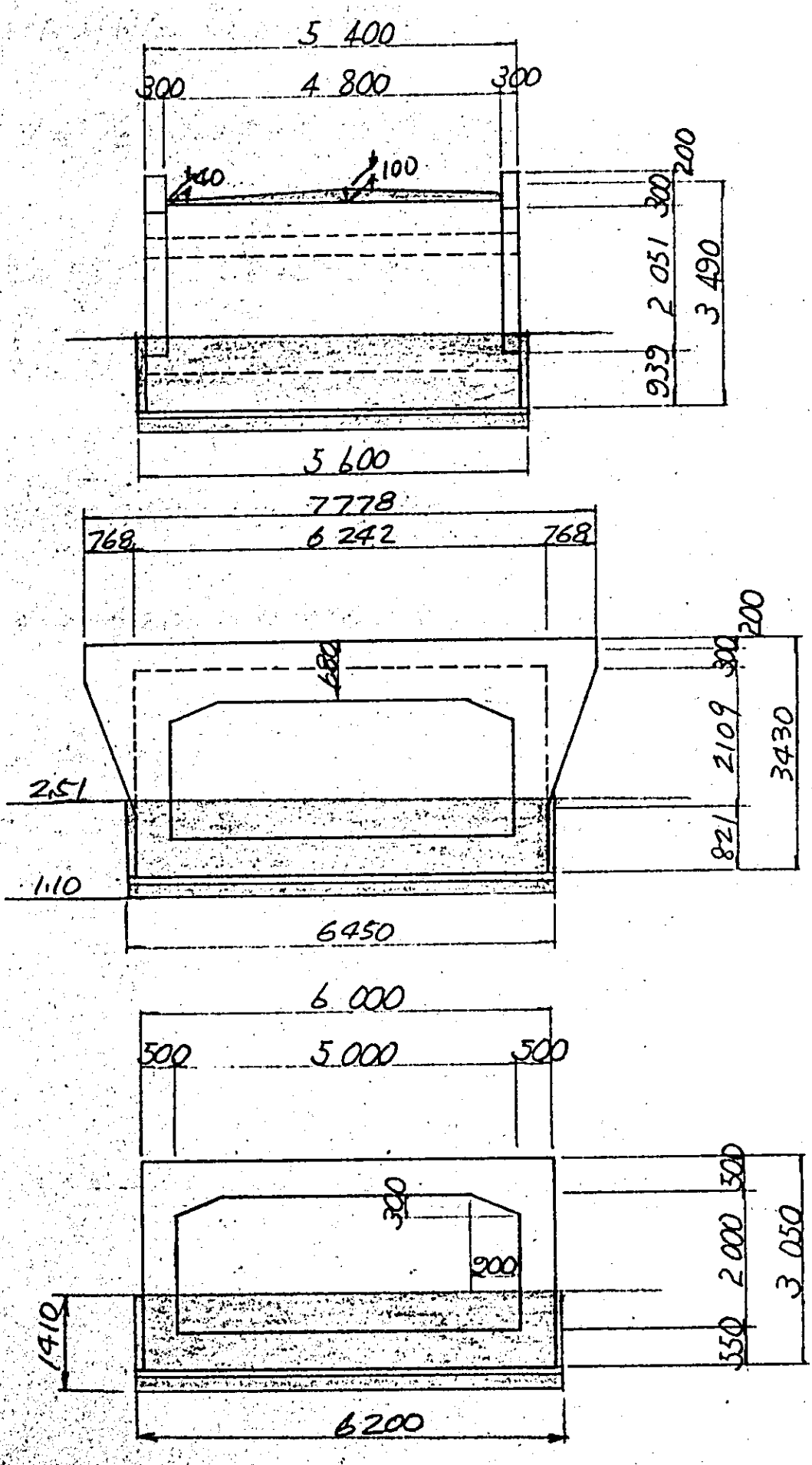
BAR SCHEDULE

No. 64

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D 22	3.04	4 880	16	237.4	
2	〃	〃	6 140	8	149.3	
3	〃	〃	2 930	8	71.3	
4	〃	〃	2 670	4	32.5	
5	〃	〃	3 170	4	38.5	
6	〃	〃	2 580	4	31.4	
7	〃	〃	3 080	4	37.5	
8	〃	〃	3 900	8	94.8	
9	D 19	2.25	2 750	8	49.5	
10	D 16	1.56	1 040	136	220.6	
11	D 19	2.25	1 430	8	25.7	
C' 1	D 13	0.995	1 640	10	16.3	
2	〃	〃	1 590	8	12.7	
3	〃	〃	590	12	7.0	
4	〃	〃	1 610	4	6.4	
5	〃	〃	2 110	10	21.0	
		TOTAL OF PER METER			1051.9	
		D 22	692.7	× 5.4m	3740.6	
		D 19	75.2	〃	406.1	
		D 16	220.6	〃	1191.2	
		D 13	63.4	〃	342.4	
W 1	D 16	1.56	8 080	6	75.6	
2	〃	〃	1 800	12	33.7	
3	D 13	0.995	1 700	23	38.9	
4	〃	〃	2 050	16	32.6	
5	〃	〃	3 350	4	13.3	
		TOTAL OF PER WING			194.1	
		D 16	109.3	× 2	218.6	
		D 13	84.8	〃	169.6	

JICA

GRADING, LEVELING, AGGREGATE, EXCAVATION



GRADING CONCRETE

$V = \frac{1}{2}(0.04+0.10) \times 4.800 \times 6.000 \operatorname{cosec} 74^\circ$ (1.04026) $= 2.097\ m^3$

LEVELING CONCRETE

$V = 6.200 \times 0.100 \times 5.600 \operatorname{cosec} 74^\circ = 3.612''$

AGGREGATE SUB BASE

$V = 6.200 \times 0.200 \times 5.600 \operatorname{cosec} 74^\circ = 7.224''$

EXCAVATION

$V = 6.200 \times 1.410 \times 5.600 \operatorname{cosec} 74^\circ = 50.926''$

9.

Cb22

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	61.2	138.9	8658.4	141.5
WING	7.3	55.0	735.8	100.8
TOTAL	67.5	193.9	9394.2	139.2

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	2.3	
LEVELING CONCRETE	m^3	4.0	
AGGREGATE SUB BASE	m^3	8.0	
EXCAVATION	m^3	58.0	

Cb 22

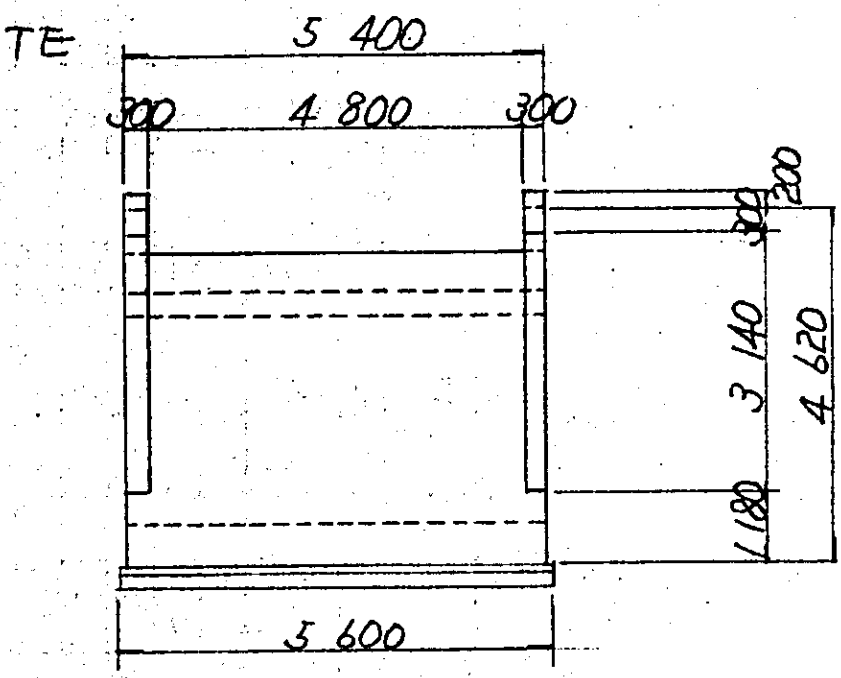
REINFORCING BAR

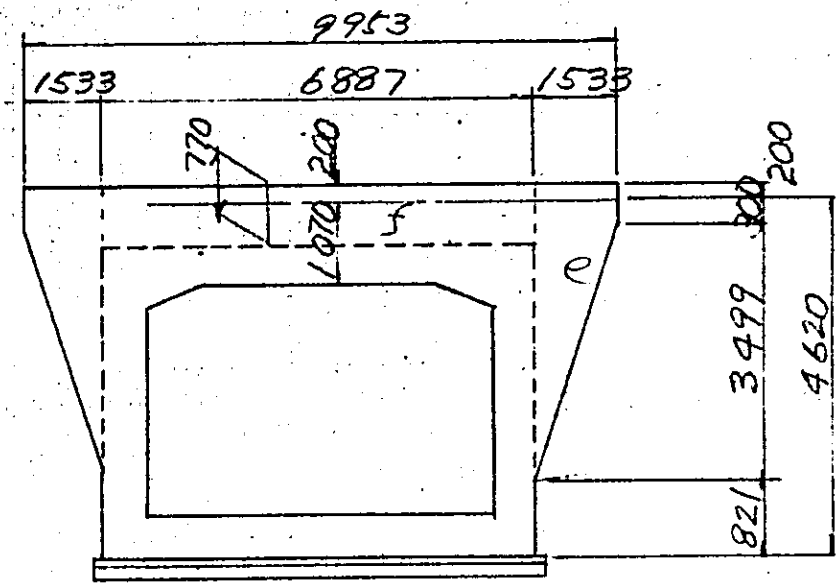
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	391.0	252.7	2065.5	1858.7	4090.5	——	8658.4
WING	334.6	401.2	——	——	——	——	735.8
TOTAL kg	725.6	653.9	2065.5	1858.7	4090.5	——	9394.2

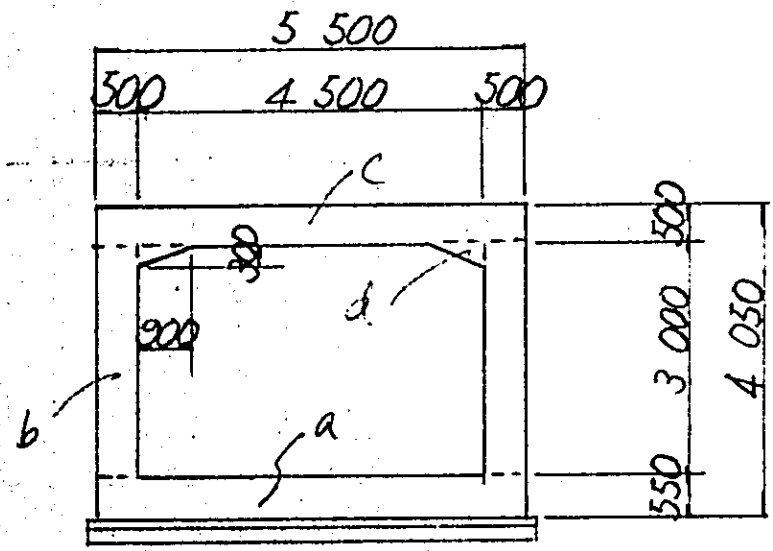
JICA

No. 68

CONCRETE


5 400
300
4 800
300
200
300
3 140
4 620
1180
5 600


9953
1533
6887
1533
770
200
200
300
1670
f
e
3499
4620
821


5 500
500
4 500
500
c
300
500
d
900
3 000
4 050
b
a
550

CONCRETE VOLUME

1. BOX CULVERT

$V_a = 5.500 \times 0.550 \times 5.400 \text{ cosec } 53° = 1.25219$	=	20.455 m³
$V_b = 0.500 \times 3.000 \times 5.400 \text{ cosec } 53° \times 2$	=	20.285 "
$V_c = 5.500 \times 0.500 \times 5.400 \text{ cosec } 53°$	=	18.595 "
$V_d = \frac{1}{2} \times 0.900 \times 0.300 \times 5.400 \text{ cosec } 53° \times 2$	=	1.826 "
		61.161 "

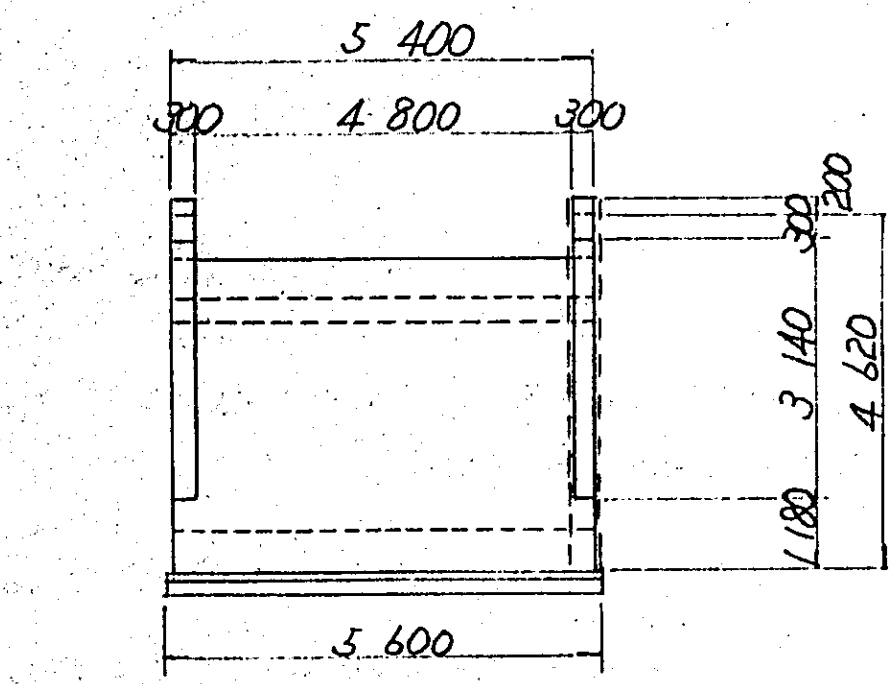
2. WING

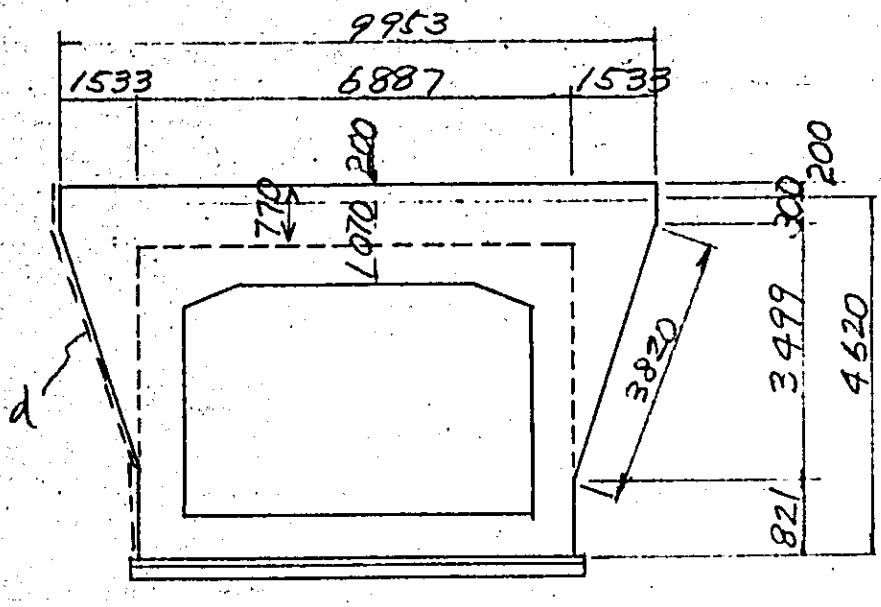
$V_e' = (0.500 + 3.999) \times \frac{1}{2} \times 1.533 \times 0.300 \times 2 = 2.069$

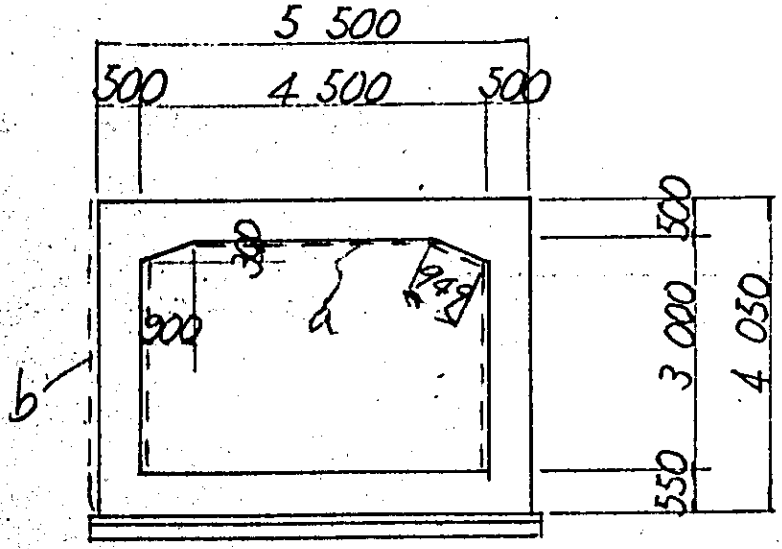
$V_f' = 6.887 \times 0.770 \times 0.300 = 1.589$

$V = (2.069 + 1.589) \times 2 = 7.316 \text{ m}^3$

FORM


5 400
300
4 800
300
200
300
3 140
4 620
1 180
5 600


9953
1533
6887
1533
200
770
1070
200
300
3499
4620
3820
821
a


5 500
500
4 500
500
500
300
900
a
b
3 000
4 050
550

FORM AREA

1. BOX CULVERT

$Aa = \{(2.700 + 0.949) \times 2 + 2.700\}$
$\times 5.400 \operatorname{cosec} 53^\circ$ ($\operatorname{cosec} 53^\circ = 1.25219$) $= 67.605\ m^2$

$Ab = 4.050 \times 4.800 \operatorname{cosec} 53^\circ \times 2 = 48.685$"

$Ac' = 5.500 \times 4.050 - 4.500 \times 3.000$
$+ 0.900 \times 0.300 \times \frac{1}{2} \times 2 = 9.045$

$Ac = 9.045 \operatorname{cosec} 53^\circ \times 2 = 22.652$"

138.942"

2. WING

$Ad' = (0.821 + 3.820 + 0.500)$
$\times 0.300 \times 2 = 3.085$

$Ae' = \{(0.500 + 3.999) \times \frac{1}{2} \times 1.533 \times 2$
$+ 6.887 \times 0.770\} \times 2 = 24.4$

$A = (3.085 + 24.4) \times 2 = 54.97\ m^2$

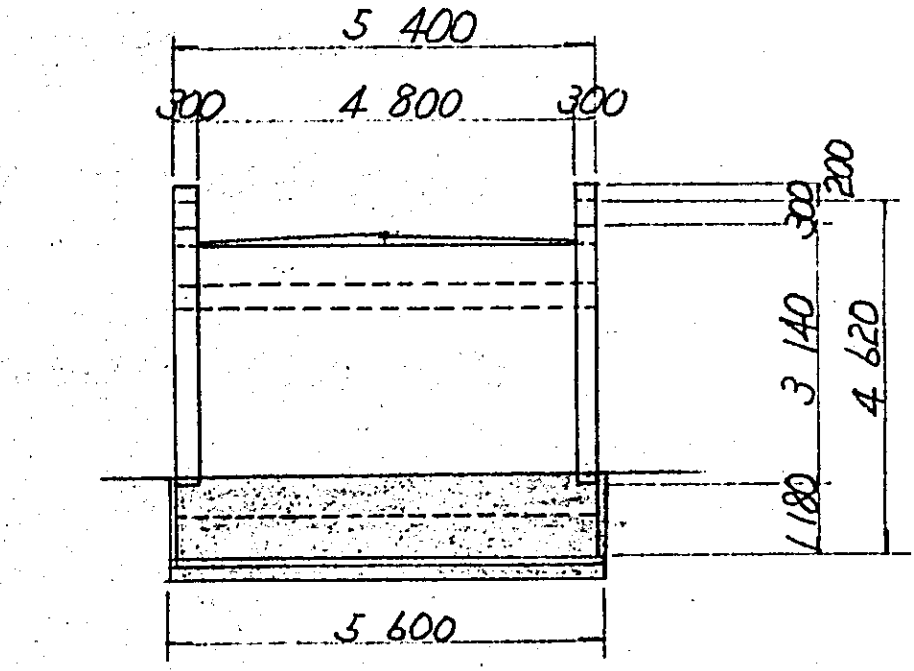
BAR SCHEDULE

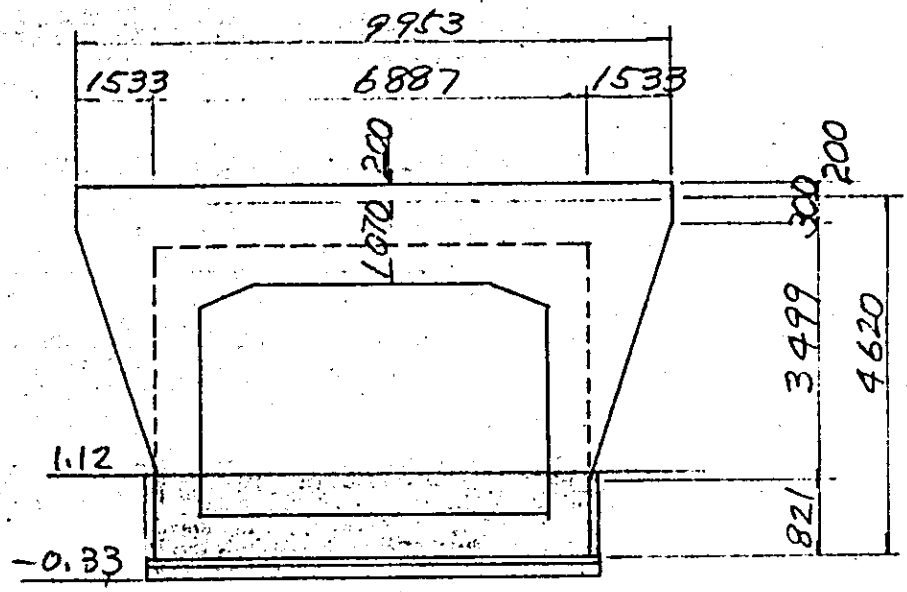
No. 73

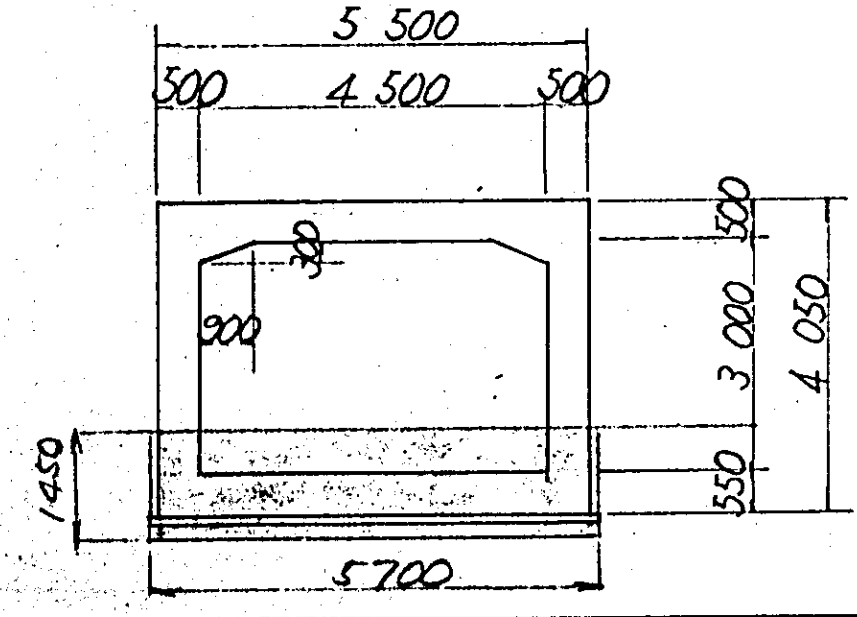
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D25	3.98	5 720	16	364.2	
2	〃	〃	6 790	8	216.2	
3	〃	〃	3 160	4	50.3	
4	〃	〃	3 660	4	58.3	
5	〃	〃	4 300	4	68.5	
6	D22	3.04	3 930	8	95.6	
7	〃	〃	3 000	4	36.5	
8	〃	〃	3 500	4	42.6	
9	〃	〃	4 300	4	52.3	
10	〃	〃	3 250	8	79.0	
11	D19	2.25	1 250	136	382.5	
12	D16	1.56	1 250	24	46.8	
13	D22	3.04	1 570	8	38.2	
C 1	D13	0.995	1 610	11	17.6	
2	〃	〃	1 570	7	10.9	
3	〃	〃	670	18	12.0	
4	〃	〃	1 700	4	6.8	
5	〃	〃	2 100	12	25.1	
		TOTAL OF PER METER			1603.4	
		D25	7575	×5.4m	40905	
		D22	3442	〃	18587	
		D19	3825	〃	20655	
		D16	468	〃	2527	
		D13	724	〃	3910	

JICA

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
W 1	D16	1.56	10 240	6	95 8	
2	〃	〃	2 800	24	104 8	
3	D13	0.995	2 480	26	64 2	
4	〃	〃	2 700	28	75 2	
5	〃	〃	4 750	4	18 9	
W° 1	D13	0.995	430	21	9 0	
		TOTAL OF PER WING			367 9	
		D16	2006	× 2	401 2	
		D13	1673	〃	334 6	


5 400
300
4 800
300
200
300
3 140
4 620
1 180
5 600


9953
1533
6887
1533
200
1670
200
300
3499
4620
1.12
821
-0.33


5 500
500
4 500
500
500
300
900
3 000
4 050
1450
550
5700

GRADING CONCRETE

$V = \frac{1}{2}(0.04+0.10) \times 4.800 \times 6.887 = 2.314\ m^3$

LEVELING CONCRETE

$V = 5.700 \times 0.100 \times 5.600 \underset{1.25219}{\text{cosec}}\ 53^\circ = 3.997\ m^3$

AGGREGATE SUB BASE

$V = 5.700 \times 0.200 \times 5.600\ \text{cosec}\ 53^\circ = 7.994\ m^3$

EXCAVATION

$V_a = 5.700 \times 1.450 \times 5.600\ \text{cosec}\ 53^\circ = 57.956\ m^3$

10.

Cb29

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	146.4	264.1	16 951.7	115.8
WING	—	—	—	—
TOTAL	146.4	264.1	16 951.7	115.8

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	6.4	
LEVELING CONCRETE	m^3	9.5	
AGGREGATE SUB BASE	m^3	19.0	
EXCAVATION	m^3	402.6	

Cb29

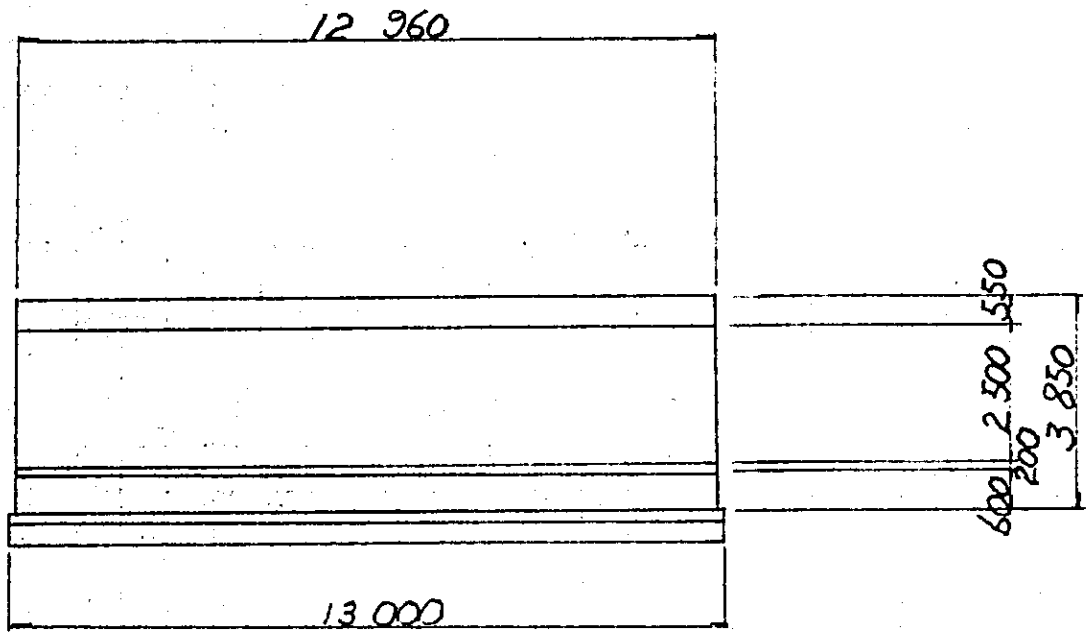
REINFORCING. BAR

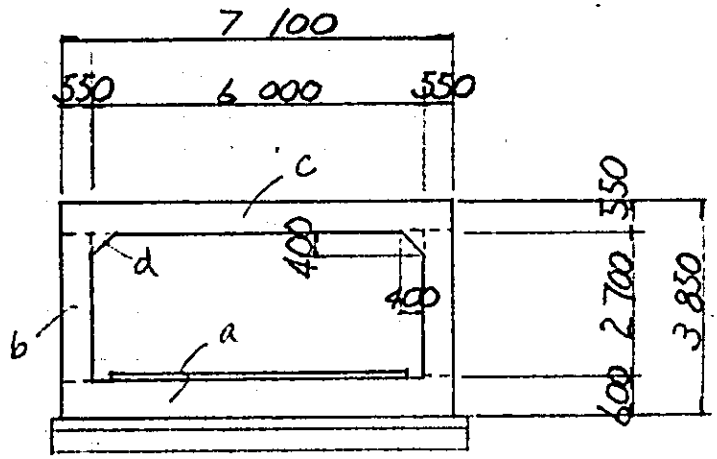
	D 13	D 16	D 19	D 22	D 25	D 29	TOTAL kg
BOX CULVERT	872.2	1577.2	3269.8	7501.2	3824.5	——	16951.7
WING	——	——	——	——	——	——	——
TOTAL kg	872.2	1577.2	3269.8	7501.2	3824.5	——	16951.7

JICA

No. 73

CONCRETE


12 960
550
2 500
200
600
3 850
13 000

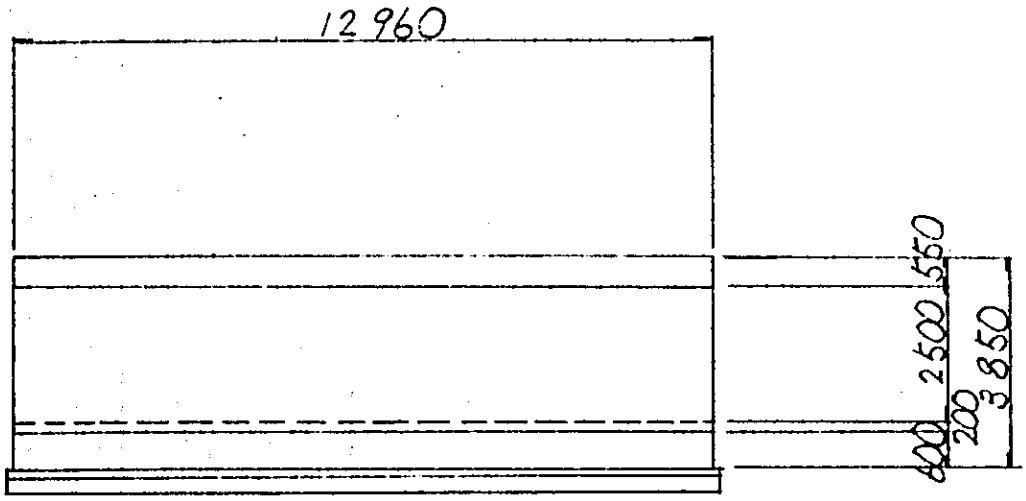

7 100
550
6 000
550
c
d
400
400
b
a
550
2 700
600
3 850

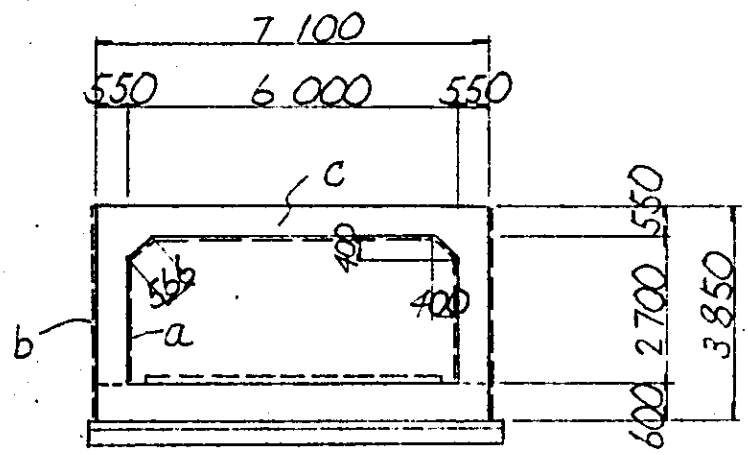
CONCRETE VOLUME

1. BOX CULVERT

			m^3
V_a =	$7.100 \times 12.960 \times 0.600$	=	55.210
V_b =	$2.700 \times 12.960 \times 0.550 \times 2$	=	38.491
V_c =	$7.100 \times 12.960 \times 0.550$	=	50.609
V_d =	$1/2 \times 0.400 \times 0.400 \times 12.960 \times 2$	=	2.074
			146.384

FORM AREA


12 960
550
2500
200
3850
600


7 100
550
6 000
550
c
100
566
400
b
a
550
2700
3850
600

FORM AREA

$$A_a = \{(2.30 + 0.566) \times 2 + 5.20\} \times 12.96 = 141.679 \ m^2$$

$$A_b = 3.85 \times 12.96 \times 2 = 99.792 \ "$$

$$A_c = \{3.85 \times 7.10 - 6.00 \times 2.70 + \frac{1}{2} \times 0.40^2 \times 2\} \times 2 = 22.590 \ "$$

$$\text{TOTAL} = 264.061 \ m^2$$

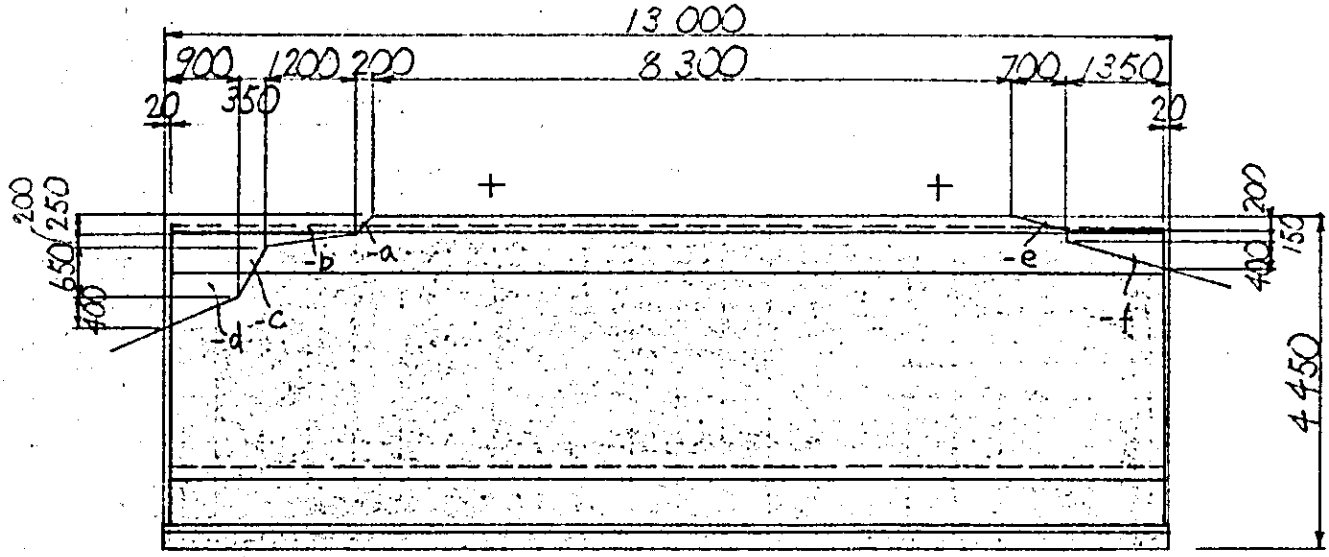
BAR SCHEDULE

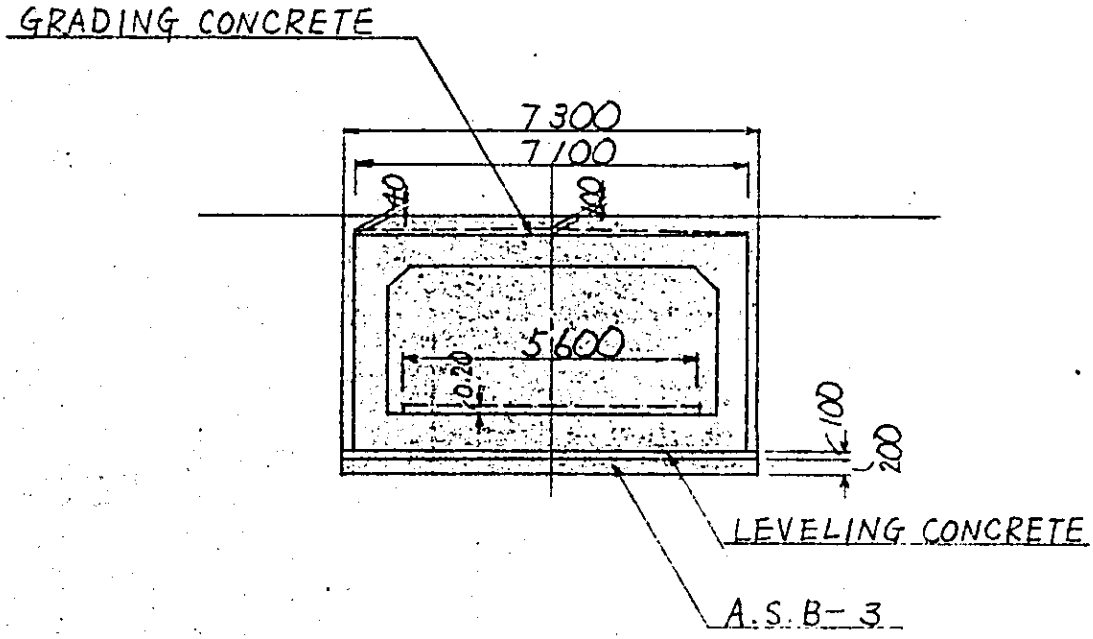
No. 83

REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
C 1	D 25	3.98	5 770	8	183 7	
2	〃	〃	7 000	4	111 4	
3	D 22	3.04	5 730	8	139 4	
4	〃	〃	7 000	4	85 1	
5	〃	〃	3 730	8	90 7	
6	〃	〃	2 970	4	36 1	
7	〃	〃	3 470	4	42 2	
8	〃	〃	4 500	8	109 4	
9	〃	〃	2 870	4	34 9	
10	〃	〃	3 370	4	41 0	
11	D 19	2.25	2 230	8	40 1	
12	〃	〃	1 000	82	184 5	
13	D 16	1.56	1 000	78	121 7	
14	D 19	2.25	1 540	8	27 7	
C' 1	D 13	0.995	1 720	12	20 5	
2	〃	〃	1 670	12	19 9	
3	〃	〃	690	16	11 0	
4	〃	〃	1 670	4	6 6	
5	〃	〃	2 340	4	9 3	
		TOTAL OF PER METER			1315 2	
		D 25	295 1	× 12.96m	3824 5	
		D 22	578 8	〃	7501 2	
		D 19	252 3	〃	3269 8	
		D 16	121 7	〃	1577 2	
		D 13	67 3	〃	872 2	

JICA

GRADING CONCRETE, AGGREGATE SUB BASE, EXCAVATION





GRADING CONCRETE

$V = \frac{1}{2} \times (0.04 + 0.10) \times 7.10 \times 12.96 = 6.411\ m^3$

LEVELING CONCRETE

$V = 0.10 \times 7.30 \times 13.00 = 9.490\ m^3$

AGGREGATE SUB BASE

$V = 0.20 \times 7.30 \times 13.00 = 18.980\ m^3$

EXCAVATION

$A = 4.45 \times 13.00 = 57.850\ m^2$

$-a = \frac{1}{2} \times 0.20 \times 0.25 = -0.025$ "

$-b = \frac{1}{2} \times (0.25 + 0.45) \times 1.20 = -0.420$ "

$-c = \frac{1}{2} \times (0.45 + 1.10) \times 0.35 = -0.271$ "

$-d = \frac{1}{2} \times (1.10 + 1.50) \times 0.90 = -1.170$ "

$-e = \frac{1}{2} \times 0.20 \times 0.70 = -0.070$ "

$-f = \frac{1}{2} \times (0.35 + 0.75) \times 1.35 = -0.743$ "

$55.151\ m^2$

$V = 55.151 \times 7.30 = 402.602\ m^3$

11. Cb00

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	92.6	322.8	9695.2	104.7
WING	6.0	32.9	762.0	127.0
TOTAL	98.6	355.7	10457.2	106.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	6.3	
LEVELING CONCRETE	m^3	9.9	
AGGREGATE SUB BASE	m^3	19.9	
EXCAVATION	m^3	250.7	

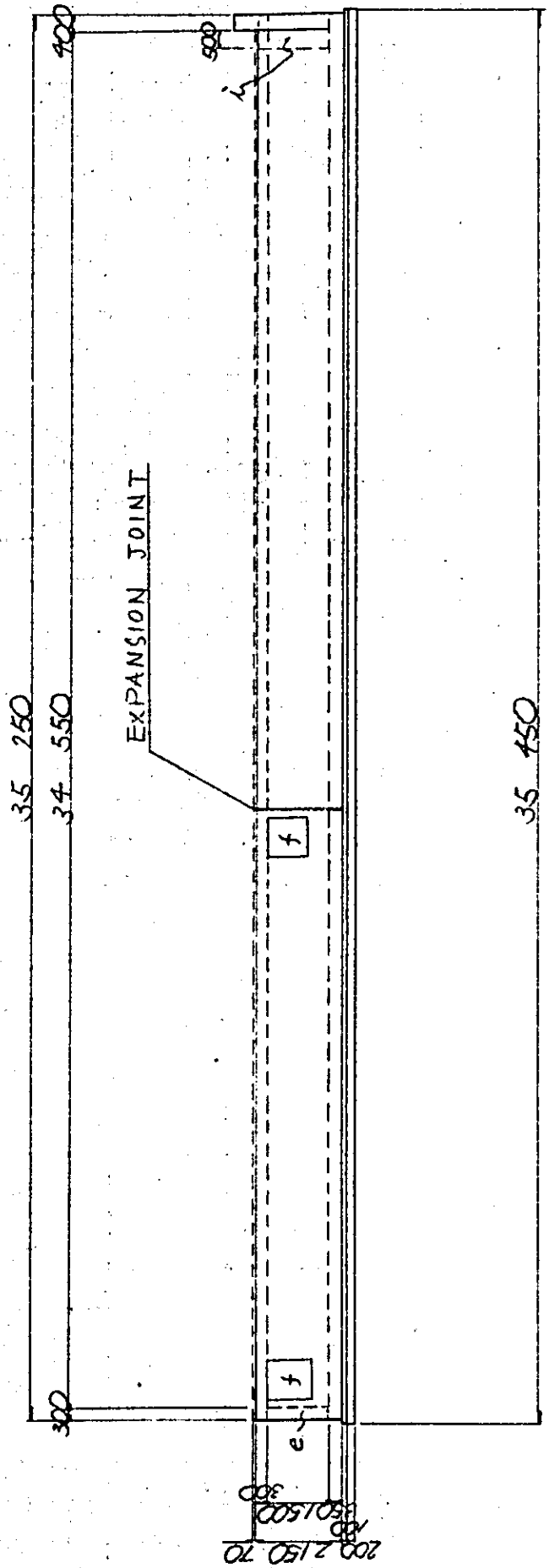
CbOO

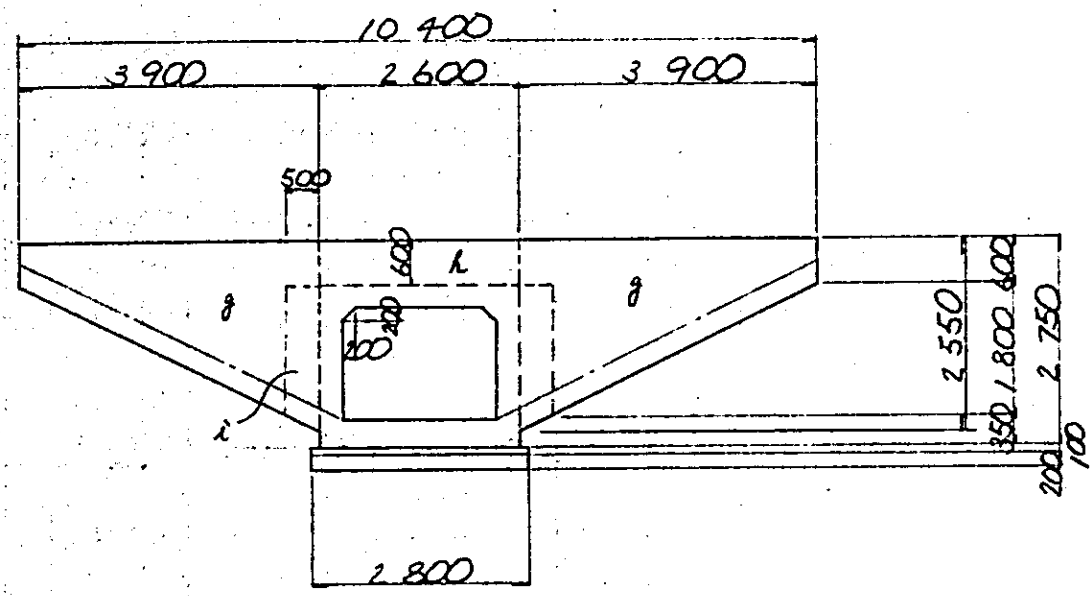
REINFORCING. BAR

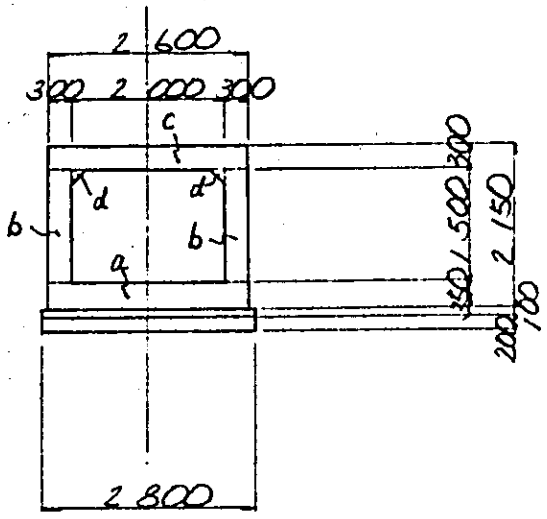
	D 13	D 16	D 19	D 22	D25	D29	TOTAL kg
BOX CULVERT	——	——	——	——	——	——	——
WING	12.4	213.4	536.4	——	——	——	762.0
TOTAL kg	——	——	——	——	——	——	——

JICA

CONCRETE




10 400
3 900
2 600
3 900
500
600
h
g
g
200
200
i
2 550
1 800
600
2 750
350
100
200
2 800


2 600
300
2 000
300
c
d
d
b
b
a
300
1 500
2 150
350
100
200
2 800

CONCRETE VOLUME

1. BOX CULVERT

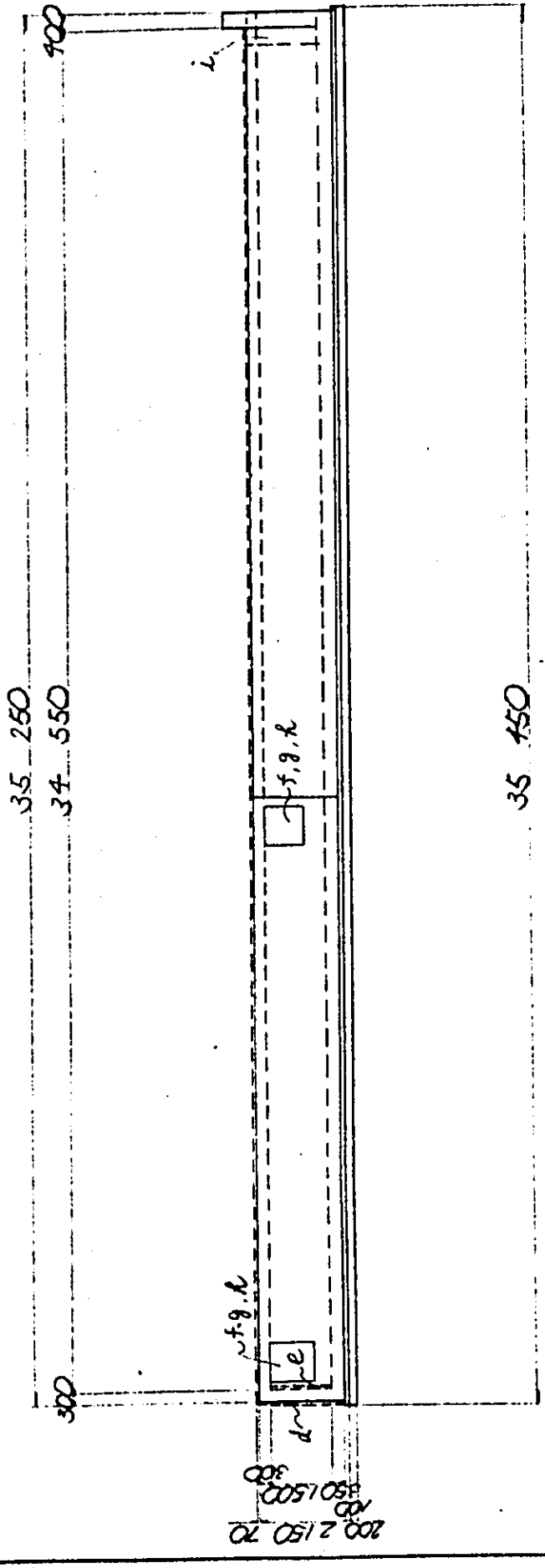
$V_a = 2.600 \times 0.350 \times 35.350$	=	$32.169\ m^3$
$V_b = 0.300 \times 1.500 \times 35.350 \times 2$	=	$31.815\ m^3$
$V_c = 2.600 \times 0.300 \times 35.350$	=	$27.573\ m^3$
$V_d = 0.200 \times 0.200 \times 1/2 \times (35.350 - 0.300 - 1.000 \times 2) \times 2$	=	$1.322\ m^3$
$V_e = 2.000 \times 1.500 \times 0.300$	=	$0.900\ m^3$
$- V_f = 1.000 \times 1.000 \times 0.300 \times 4$	=	$-1.200\ m^3$
		$92.579\ m^3$

2. WING

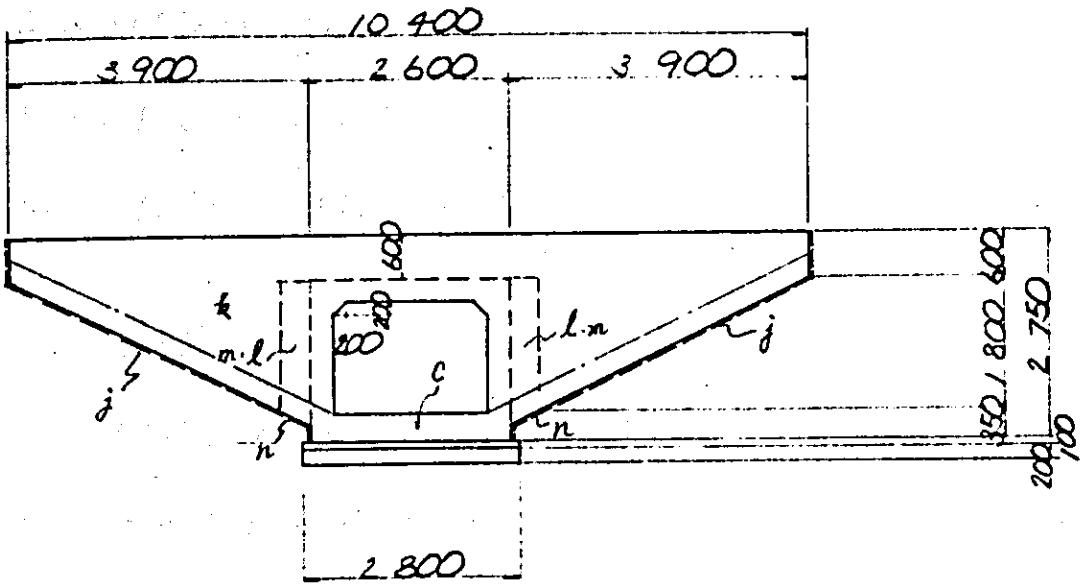
$V_g = (0.600 + 2.550) \times 1/2 \times 3.900 \times 0.400 \times 2$	=	$4.914\ m^3$
$V_h = 2.600 \times 0.600 \times 0.400$	=	$0.624\ m^3$
$V_i = 0.500 \times 0.600 \times 1/2 \times (1.700 + 1.950) \times 1/2 \times 2$	=	$0.456\ m^3$
		$5.994\ m^3$

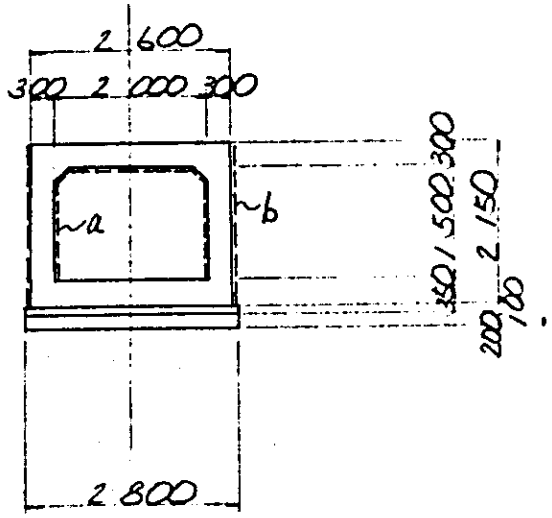
No. 91

FORM AREA



JICA


10 400
3 900
2 600
3 900
600
200
200
k
m·l
l·n
j
j
c
n
n
600
1 800
2 750
350
200
100
2 800


2 600
300
2 000
300
a
b
300
1 500
150
350
200
100
2 800

FORM AREA

1. BOX CULVERT

$A_a = \{(1.300 + 0.283) \times 2 + 1.600\} \times (35.350 - 0.300)$	=	167.048 m²
$A_b = 2.150 \times (35.350 - 0.400) \times 2$	=	150.285 "
$A_c = 2.600 \times 2.150 - 2.000 \times 1.500 + 0.200 \times 0.200 \times 1/2 \times 2$	=	2.630 "
$A_d = 2.600 \times 2.150$	=	5.590 "
$A_e = 2.000 \times 1.500 - 0.200 \times 0.200 \times 1/2 \times 2$	=	2.960 "
$- A_f = (0.800 + 0.283) \times 1.000 \times 4$	=	- 4.332 "
$- A_g = 1.000 \times 1.000 \times 4$	=	- 4.000 "
$A_h = (0.300 \times 1.000 \times 3 + 0.200 \times 1.000 + 0.200 \times 0.200 \times 1/2 \times 2) \times 4$	=	4.560 "
$- A_i = 0.500 \times 1.950 \times 2$	=	- 1.950 "
		322.791 m²

2. WING

$A_j = (0.600 + 4.360 + 0.200) \times 0.400 \times 2$	=	4.128 m²
$A_k = \{(0.600 + 2.550) \times 1/2 \times 3.900 \times 2 + 2.600 \times 0.600\} \times 2$	=	27.690 "
$- A_l = (1.700 + 1.950) \times 1/2 \times 0.500 \times 2$	=	- 1.825 "
$A_m = (1.700 + 1.950) \times 1/2 \times 0.707 \times 2$	=	2.581 "
$A_n = 0.500 \times 0.559 \times 1/2 \times 2$	=	0.280 "
		32.854 m²

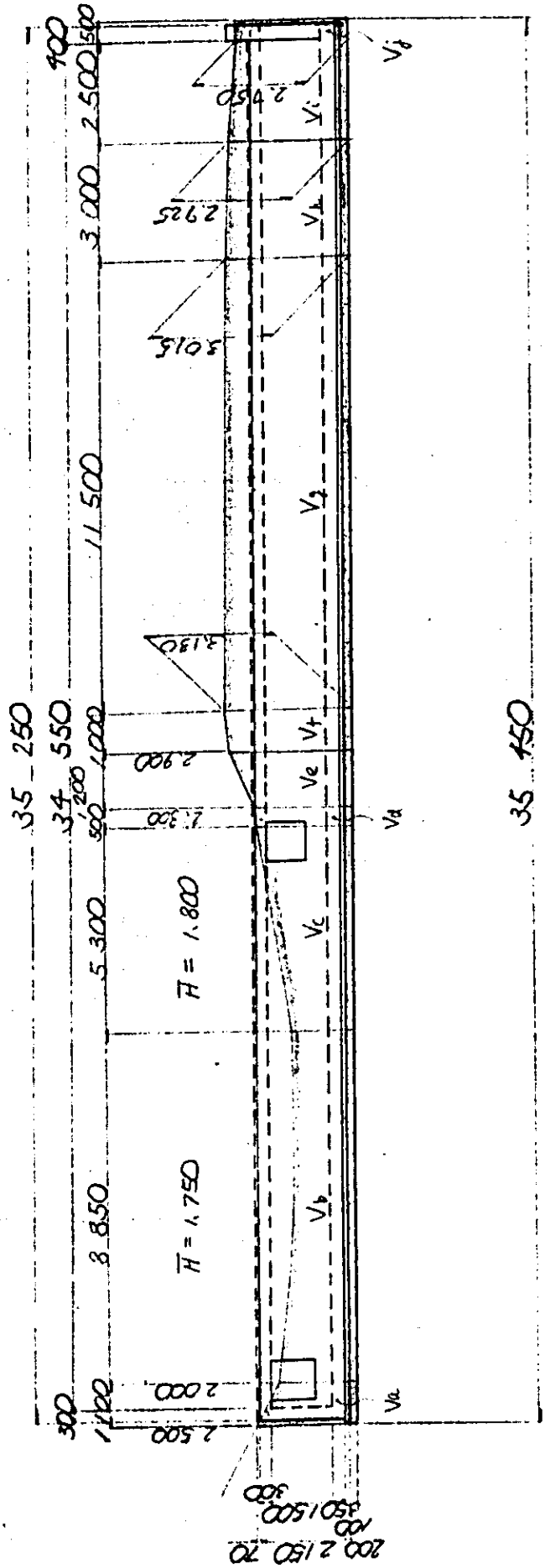
BAR SCHEDULE

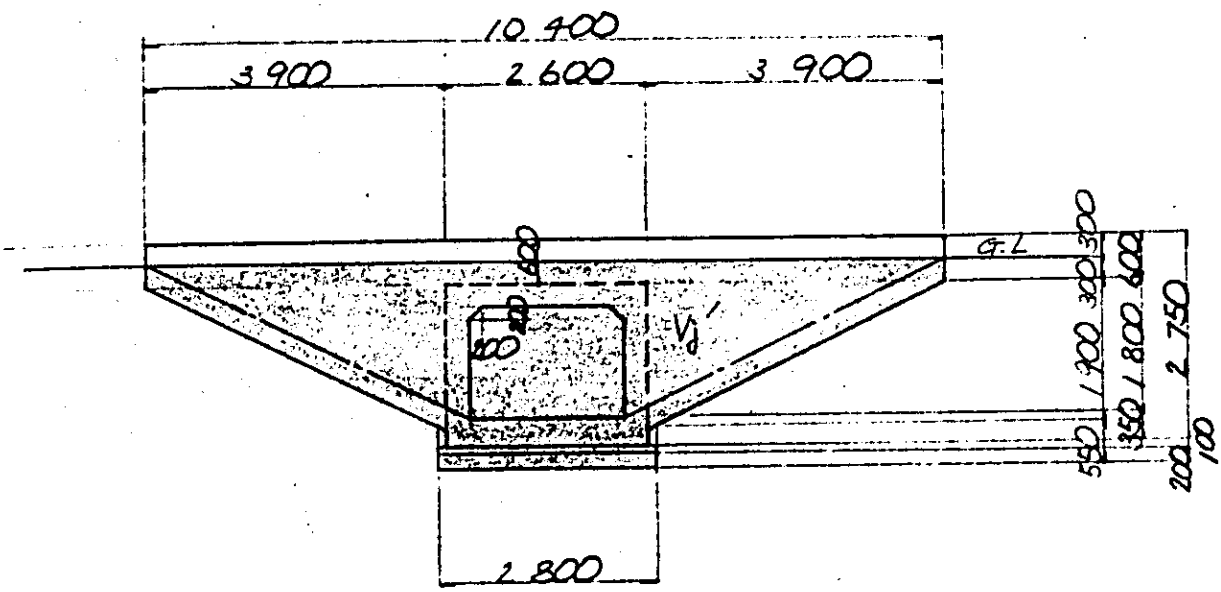
No. 94

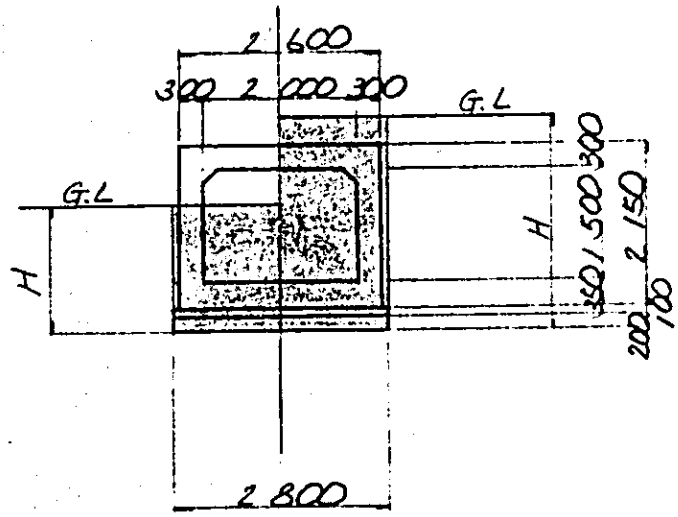
REINF. NO.	DIA. (mm)	U. WEIGHT (kg/m)	LENGTH (mm)	NUMBER	WEIGHT (kg)	REMARKS
W 1	D19	2.25	10 500	6	141.8	
2	〃	〃	2 820	14	88.8	
3	〃	〃	2 820	14	88.8	
4	〃	〃	2 380	8	42.8	
5	〃	〃	2 070	6	27.9	
6	〃	〃	1 830	24	98.8	
7	〃	〃	5 250	4	47.3	
8	D16	1.56	1 830	64	182.7	
9	〃	〃	2 190	9	30.7	
W° 1	D13	0.995	540	23	12.4	
				D19	536.2 kg	
				D16	213.4 〃	
				D13	12.4 〃	
				TOTAL	762.0 kg	

JICA

GRADING, LEVELING, AGGREGATE, EXCAVATION




10 400
3 900
2 600
3 900
G.L
300
300
600
1 200
1 800
2 750
350
550
200
100
2 800


2 600
300
2 000
300
G.L
G.L
H
H
300
1 500
2 150
350
200
100
2 800

GRADING CONCRETE

$V = 2.600 \times 0.070 \times 34.850 = 6.343\ m^3$

LEVELING CONCRETE

$V = 2.800 \times 0.100 \times 35.450 = 9.926\ m^3$

AGGREGATE SUB BASE

$V = 2.800 \times 0.200 \times 35.450 = 19.852\ m^3$

EXCAVATION

$V_a = 2.800 \times \frac{1}{2} (2.500 + 2.000) \times 1.100 = 6.930\ m^3$

$V_b = 2.800 \times 1.750 \times 8.850 = 43.365$ "

$V_c = 2.800 \times 1.800 \times 5.300 = 26.712$ "

$V_d = 2.800 \times 2.300 \times 0.500 = 3.220$ "

$V_e = 2.800 \times \frac{1}{2} (2.300 + 2.900) \times 1.200 = 8.736$ "

$V_f = 2.800 \times \frac{1}{2} (2.900 + 3.130) \times 1.000 = 8.442$ "

$V_g = 2.800 \times \frac{1}{2} (3.130 + 3.015) \times 11.500 = 98.935$ "

$V_h = 2.800 \times \frac{1}{2} (3.015 + 2.725) \times 3.000 = 24.945$ "

$V_i = 2.800 \times \frac{1}{2} (2.725 + 2.750) \times 2.500 = 17.863$ "

$V_j' = 2.800 \times 0.550 + \frac{1}{2}(2.800 + 10.400) \times 1.900$

$+ 10.400 \times 0.300 = 17.200$

$V_j'' = \frac{1}{2} \times 0.600^2 \times 2 = 0.360$

$V_j = 17.200 \times 0.500 + 0.360 \times 2.750 = 9.590 \text{ m}^3$

250.741 m^3

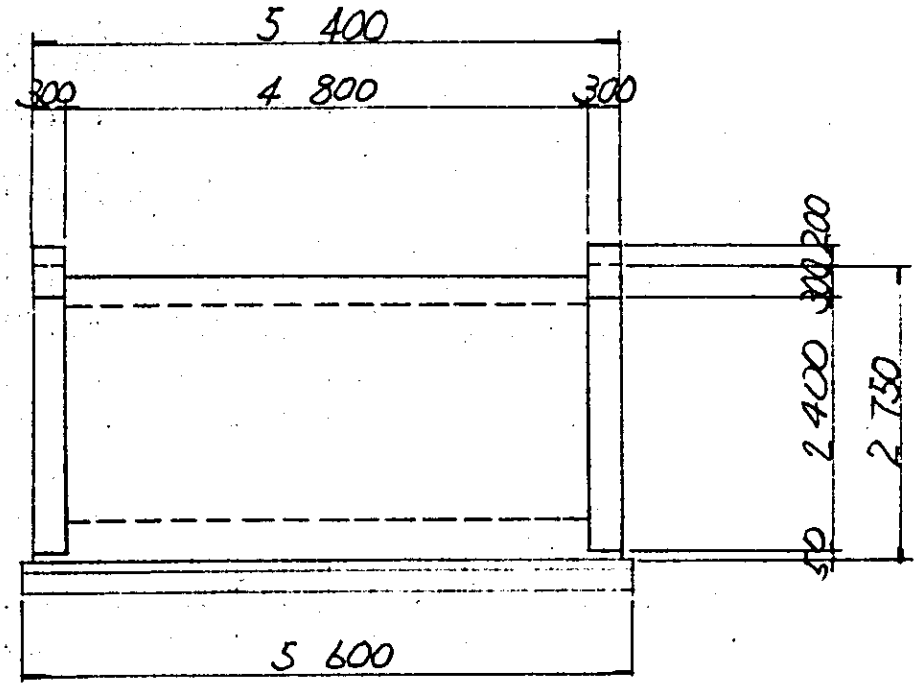
Cb02

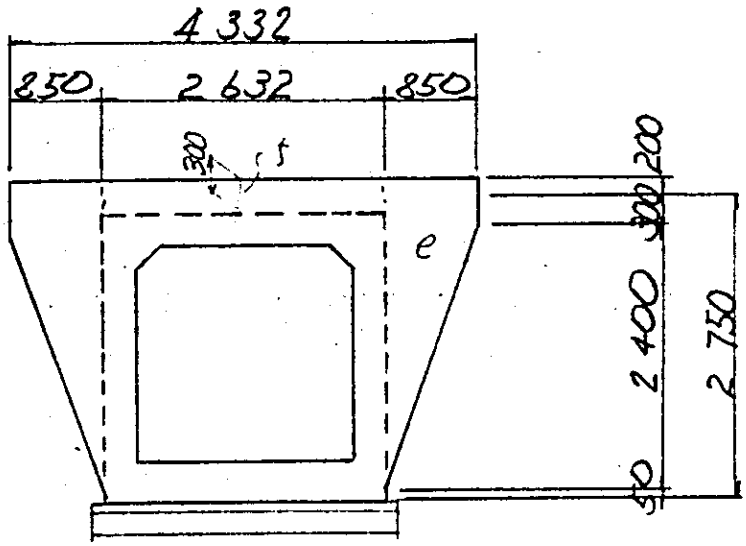
BOX CULVERT

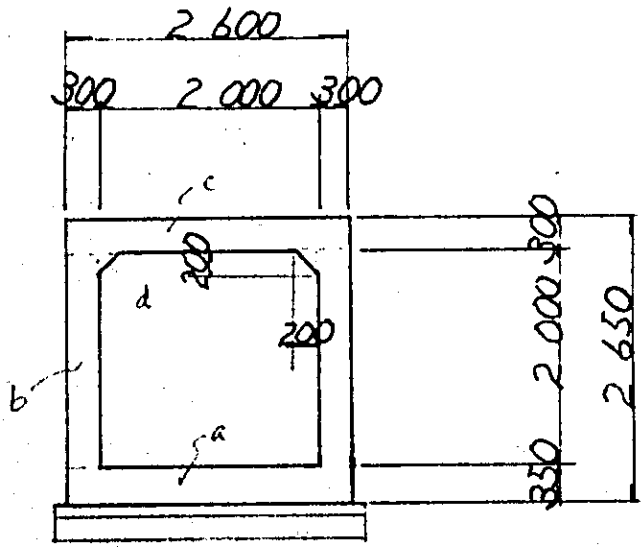
	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	16.0	63.2	1 640.0	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.2	81.5	1 847.2	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.2	
EXCAVATION	m^3	20.0	

CONCRETE


5 400
300
4 800
300
200
300
2 400
50
2 750
5 600


4 332
850
2 632
850
300
f
e
200
300
2 400
50
2 750


2 600
300
2 000
300
c
400
d
200
b
a
300
2 000
350
2 650

CONCRETE VOLUME

1. BOX CULVERT

$V_a = 2.600 \times 0.350 \times 5.400 \operatorname{cosec} 81° = 4.975\ m^3$

$V_b = 0.300 \times 2.000 \times 5.400 \operatorname{cosec} 81° \times 2 = 6.560$ "

$V_c = 2.600 \times 0.300 \times 5.400 \operatorname{cosec} 81° = 4.264$ "

$V_d = 0.200 \times 0.200 \times \frac{1}{2} \times 5.400 \operatorname{cosec} 81° \times 2 = 0.219$ "

16.018 "

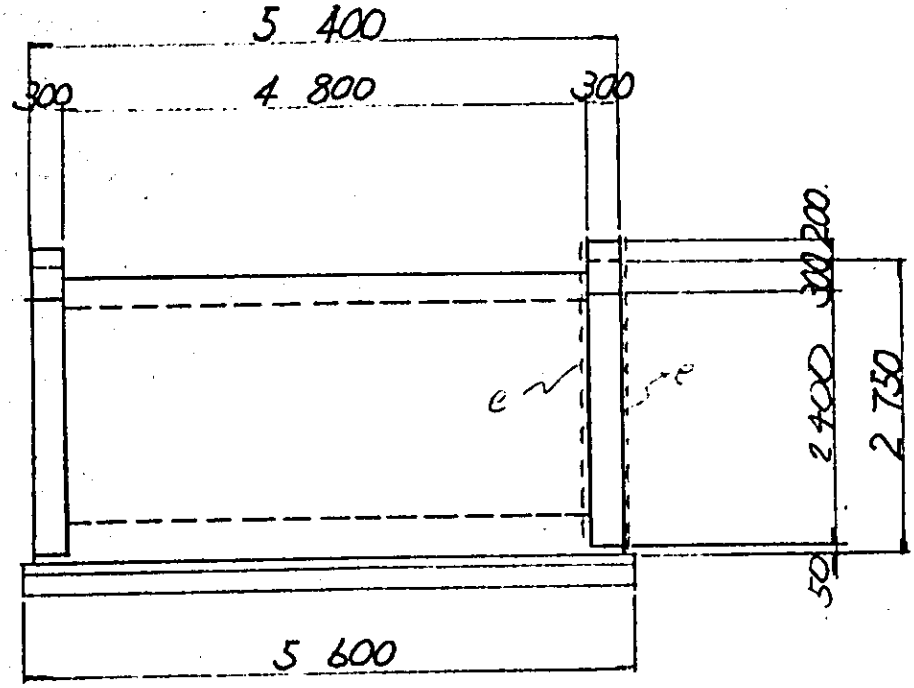
2. WING

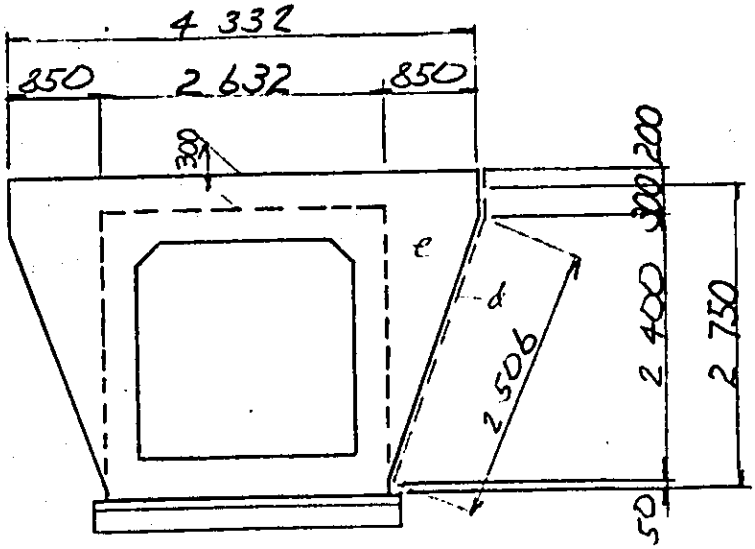
$V_e' = (0.500 + 2.900) \times \frac{1}{2} \times 0.850 \times 0.300 \times 2 = 0.867$

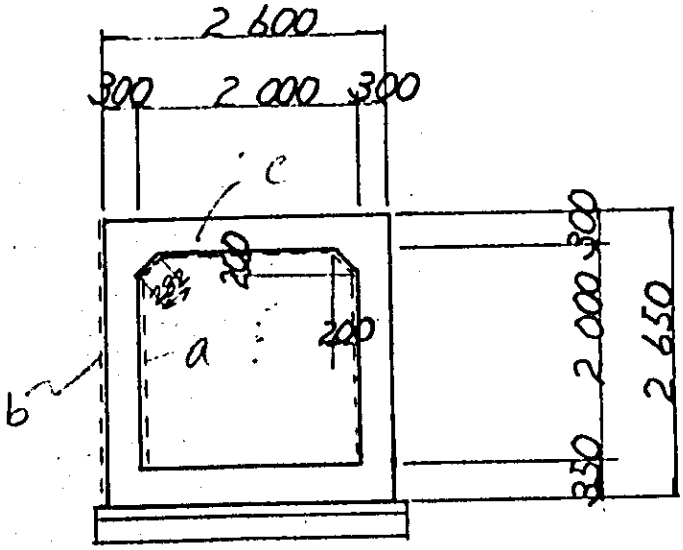
$V_f' = 2.632 \times 0.300 \times 0.300 = 0.237$

$V = (0.867 + 0.237) \times 2 = 2.208\ m^3$

FORM AREA


5 400
300
4 800
300
300
200
2 400
2 750
50
e
e
5 600


4 332
850
2 632
850
300
300
200
2 400
2 750
50
e
d
2 506


2 600
300
2 000
300
c
200
200
a
b
300
2 000
2 650
350

FORM AREA

1. BOX CULVERT

$A_a = \{(1.800 + 0.283) \times 2 + 1.600\}$

$\times 5.400 \operatorname{cosec} 81° = 31.523$ m²

$A_b = 2.650 \times 4.800 \operatorname{cosec} 81° \times 2 = 25.756$ "

$A_c' = 2.600 \times 2.650 - 2.000 \times 2.000$

$+ 0.200 \times 0.200 \times 1/2 \times 2 = 2.93$

$A_c = 2.93 \operatorname{cosec} 81° \times 2 = 5.932$ "

63.211 "

2. WING

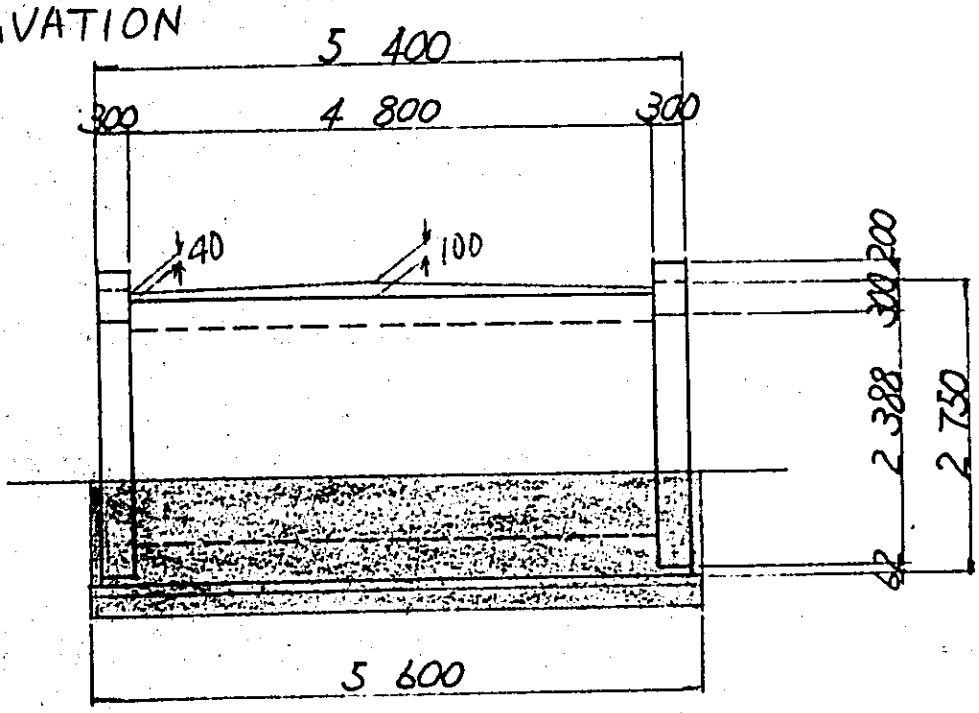
$A_d' = (2.506 + 0.500) \times 0.300 \times 2 = 1.804$

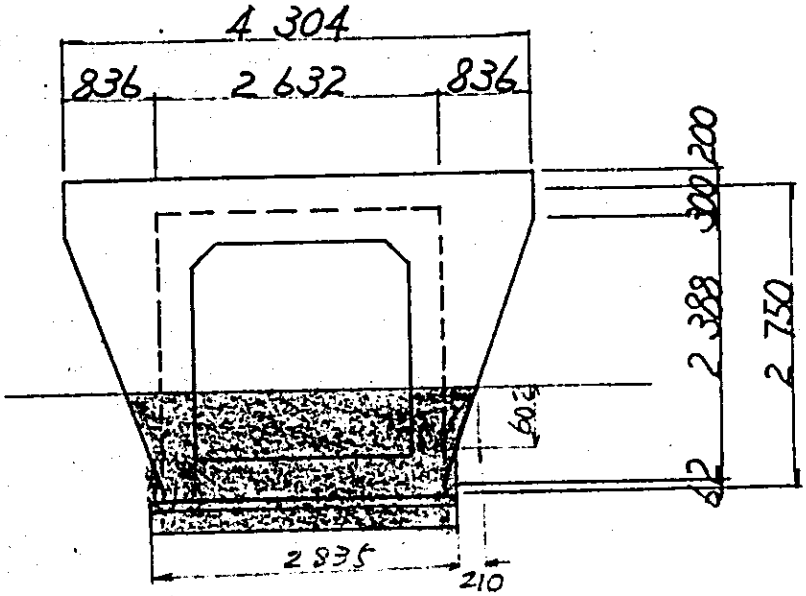
$A_e' = \{(0.500 + 2.700) \times 1/2 \times 0.850 \times 2$

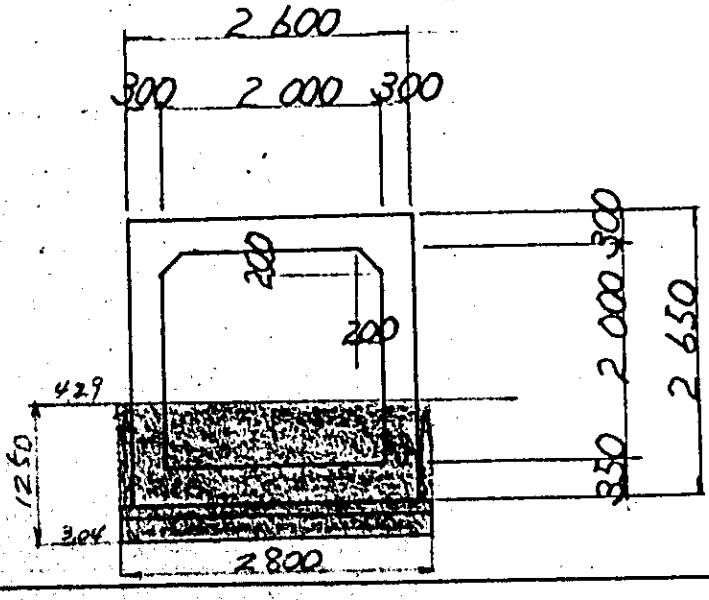
$+ 2.632 \times 0.300\} \times 2 = 7.360$

$A = (1.804 + 7.360) \times 2 = 18.328$ m²

GRADING, LEVELING, AGGREGATE, EXCAVATION







GRADING CONCRETE

$V = \frac{1}{2}(0.04 + 0.10) \times 4.800 \times 2.632 = 0.884\ m^3$

LEVELING CONCRETE

$V = 2.800 \times 0.100 \times 5.6 \overset{1.0124}{\text{cosec}}\ 81^\circ = 1.587\ m^3$

AGGREGATE SUB BASE

$V = 2.800 \times 0.200 \times 5.6\ \text{cosec}\ 81^\circ = 3.175\ m^3$

EXCAVATION

$V_a = 2.800 \times 1.250 \times 5.6\ \text{cosec}\ 81^\circ = 19.843\ m^3$

$V_b' = 0.210 \times 0.602 \times \frac{1}{2} \times 0.500 \times 2 = 0.063$

$V_b = 0.063 \times 2 = 0.126$ "

19.769 "

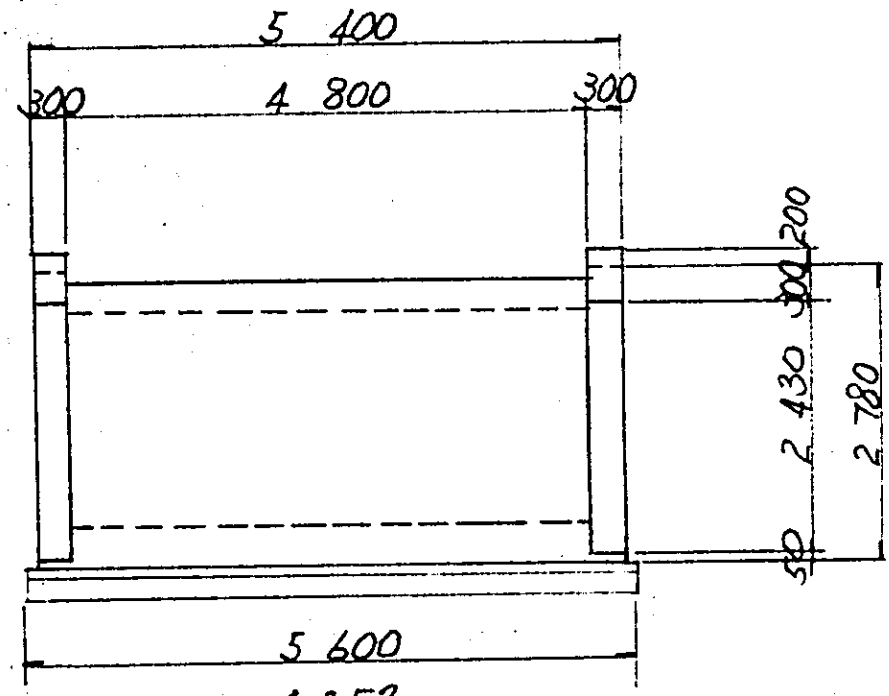
13. Cb03

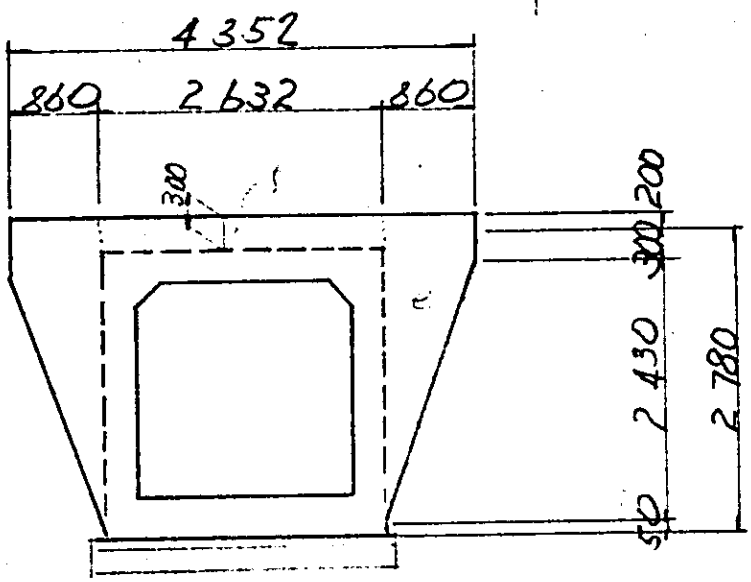
BOX CULVERT

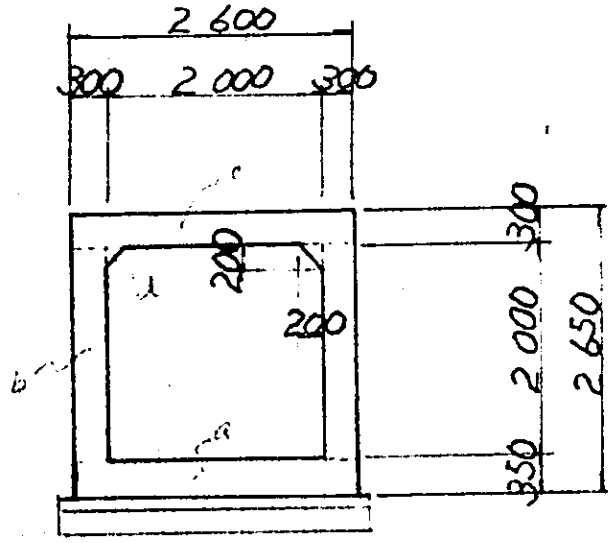
	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	16.0	63.2	1640.0	102.5
WING	2.3	18.7	207.2	92.2
TOTAL	18.3	81.9	1847.2	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.2	
EXCAVATION	m^3	20.0	

CONCRETE


5 400
300
4 800
300
200
300
2 430
2 780
500
5 600


4 352
860
2 632
860
300
200
300
2 430
2 780
500


2 600
300
2 000
300
300
200
200
2 000
2 650
350

CONCRETE VOLUME

1. BOX CULVERT

refer to C_{02}

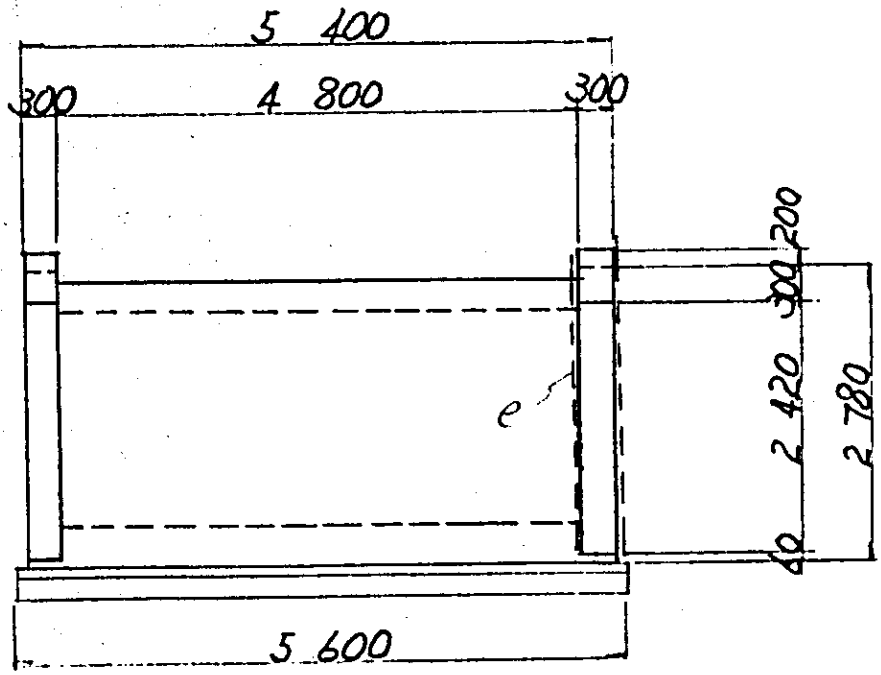
2. WING

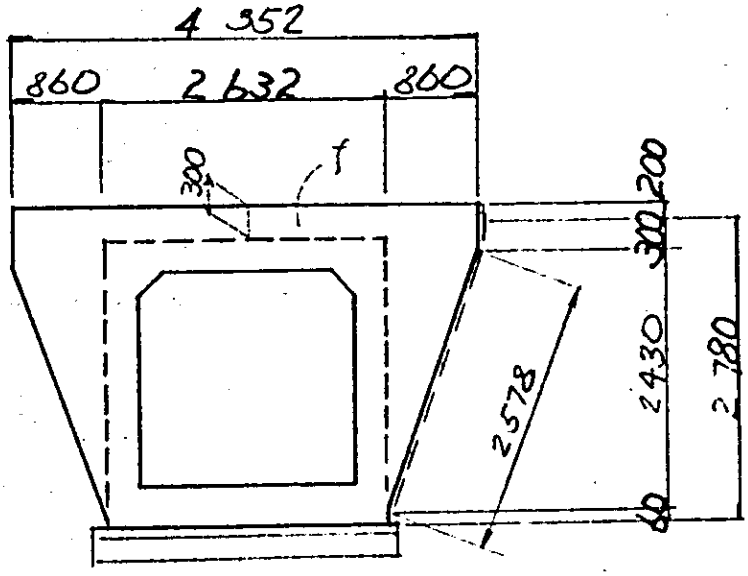
$$Ve' = (0.500 + 2.930) \times \frac{1}{2} \times 0.867 \times 0.300 \times 2 = 0.892$$

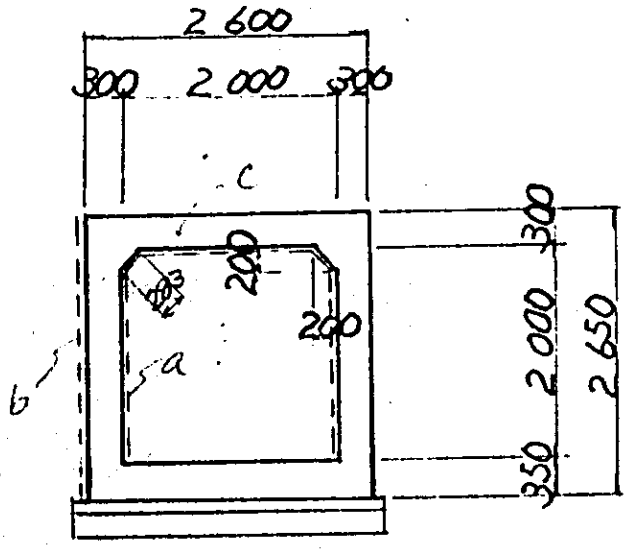
$$V_J' = 2.632 \times 0.300 \times 0.300 = 0.237$$

$$V = (0.892 + 0.237) \times 2 = 2.258 \ m^3$$

FORM AREA


5 400
300
4 800
300
200
300
2 420
2 780
e
40
5 600


4 352
860
2 632
860
300
f
200
300
2430
2 780
2578
40


2 600
300
2 000
300
c
300
200
200
200
2 000
2 650
b
a
350

FORM AREA

1. BOX CULVERT

refer to Co2

2. WING

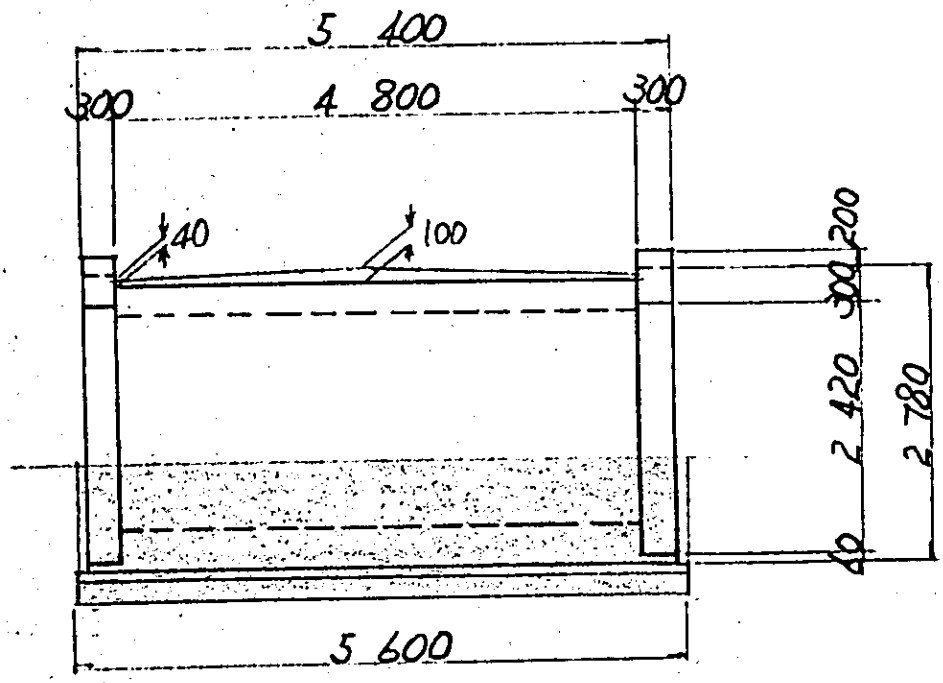
$Ad' = (2.578 + 0.500) \times 0.300 \times 2 = 1.847$

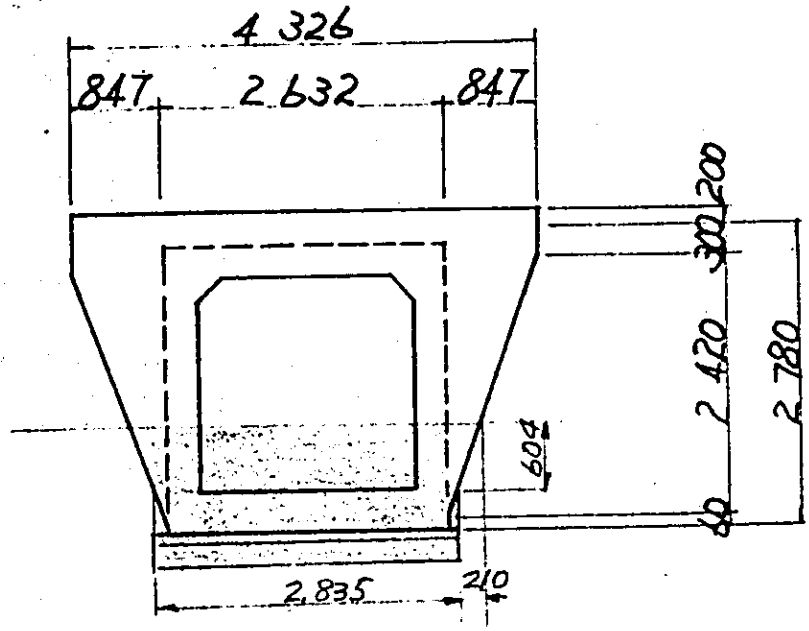
$Ae' = \{(0.500 + 2.930) \times 1/2 \times 0.860 \times 2$

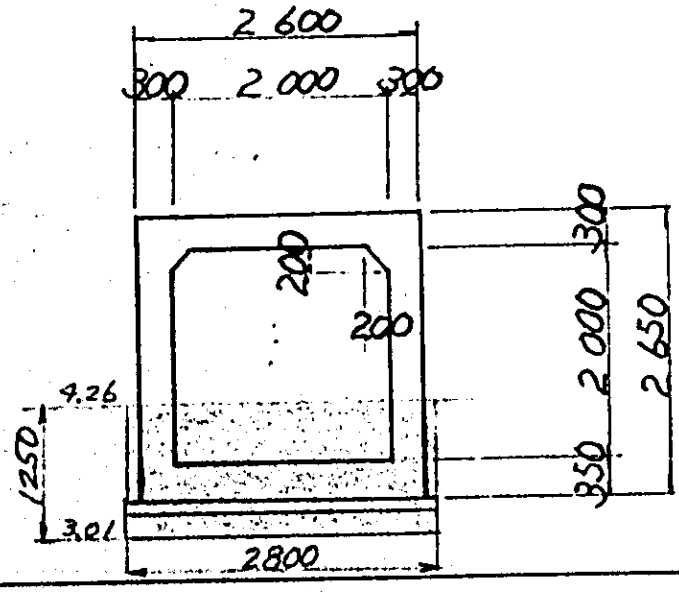
$+ 2.632 \times 0.300\} \times 2 = 7.479$

$A = (1.847 + 7.479) \times 2 = 18.652$

GRADING, LEVELING, AGGREGATE, EXCAVATION







REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer To Co2

EXCAVATION

$$V_a = 2.800 \times 1.250 \times 5.6 \underset{1.0124}{\operatorname{cosec} 81^\circ} = 19.843 \text{ m}^3$$

$$V_b' = 0.210 \times 0.604 \times \tfrac{1}{2} \times 0.500 \times 2 = 0.063$$

$$V_b = 0.063 \times 2 = 0.126 \text{ "}$$

$$19.969$$

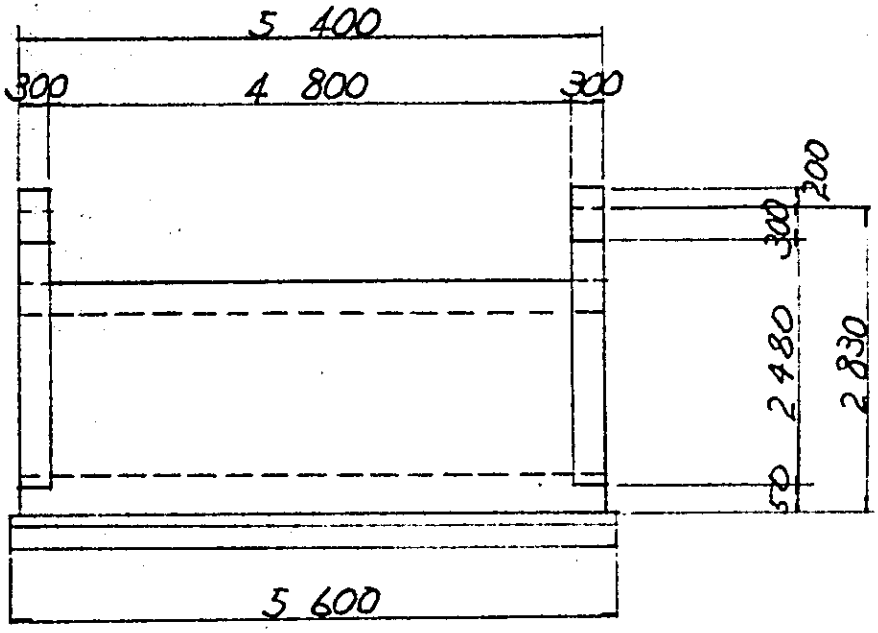
14. Cb05 REFER. TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	16.4	59.6	1 717.1	104.7
WING	3.7	28.4	511.7	138.3
TOTAL	20.1	88.0	2 228.8	110.9

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	1.0	
LEVELING CONCRETE	m^3	1.8	
AGGREGATE SUB BASE	m^3	3.6	
EXCAVATION	m^3	22.7	

CONCRETE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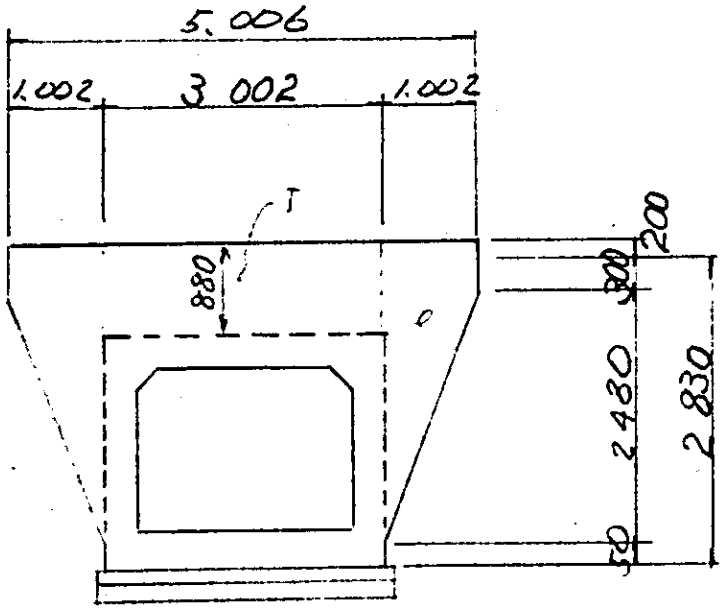
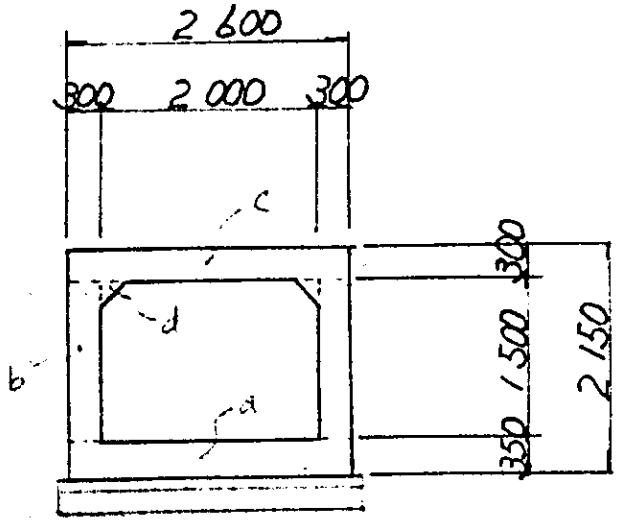
300
4 800
300
200
300
2 480
2 830
50
5 600


5 006
1 002
3 002
1 002
T
880
200
300
2 480
2 830
50


2 600
300
2 000
300
c
d
b
a
300
1 500
2 150
350

CONCRETE VOLUME

1. BOX CULVERT

$V_a = 2.600 \times 0.350 \times 5.400 \operatorname{cosec} 60^\circ$ (1.1547) $= 5.674\ m^3$

$V_b = 1.500 \times 0.300 \times 5.400 \operatorname{cosec} 60^\circ \times 2 = 5.612\ "$

$V_c = 2.600 \times 0.300 \times 5.400 \operatorname{cosec} 60^\circ = 4.864\ "$

$V_d = \frac{1}{2} \times 0.200 \times 0.200 \times 5.400 \operatorname{cosec} 60^\circ \times 2 = 0.249\ "$

$16.399\ "$

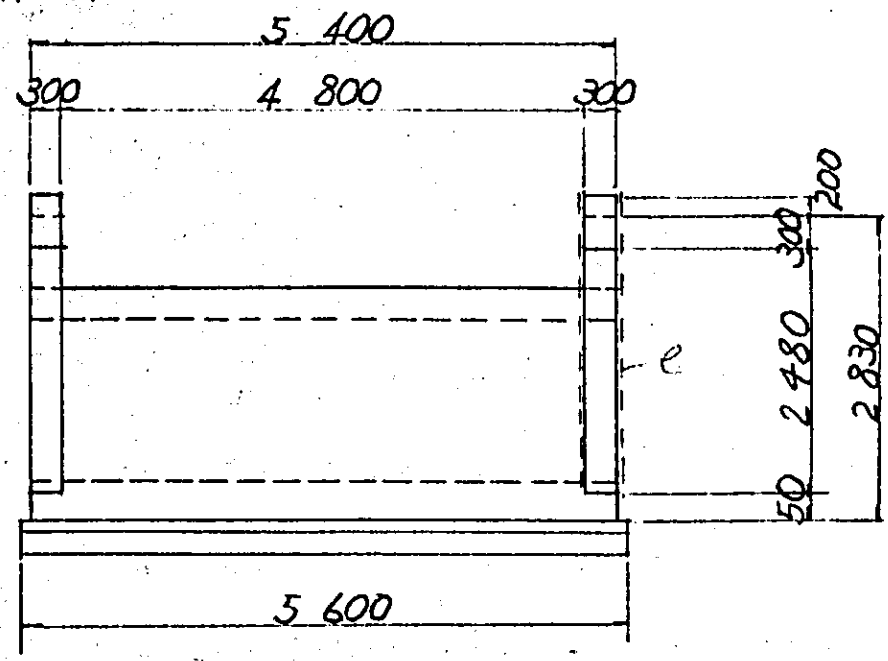
2 WING

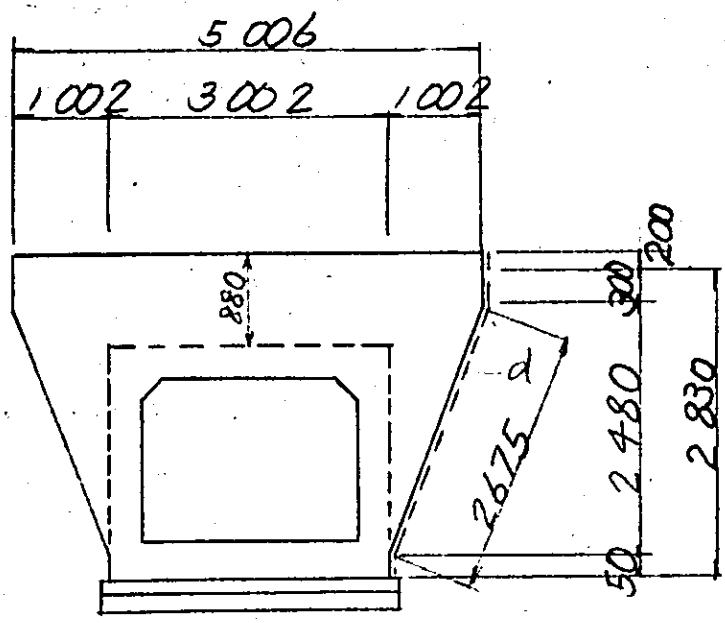
$V_e' = (0.500 + 2.980) \times \frac{1}{2} \times 1.002 \times 0.300 \times 2 = 1.046$

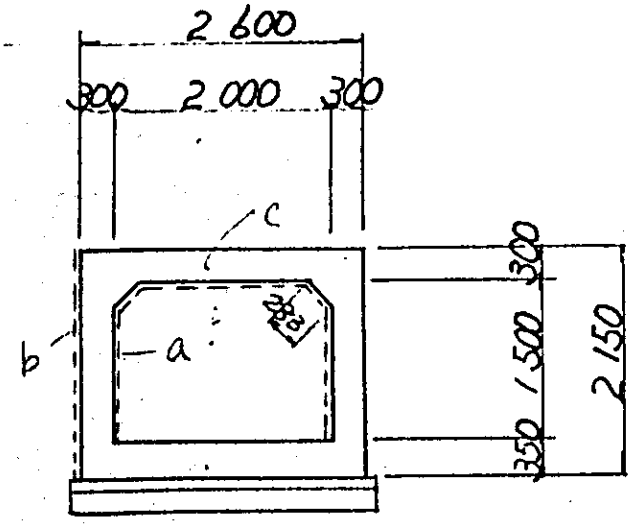
$V_f' = 0.880 \times 0.300 \times 3.002 = 0.793$

$V = (1.046 + 0.793) \times 2 = 3.678\ m^3$

FORM AREA


5 400
300
4 800
300
200
300
2 480
2 830
50
e
5 600


5 006
1 002
3 002
1 002
280
200
300
2 480
2 830
50
d
2 675


2 600
300
2 000
300
c
b
a
280
300
1 500
350
2 150

FORM AREA

1. BOX CULVERT

$A_a = \{(1.300 + 0.283) \times 2 + 1.600\}$

$\times 5.400 \text{ cosec } 60°$ (1.15473) $= 29.719 \text{ m}^2$

$A_b = 2.150 \times 4.800 \text{ cosec } 60° \times 2 = 23.833$ ″

$A_c' = 2.600 \times 2.150 - 2.000 \times 1.500$

$+ 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 2.63$

$A_c = 2.63 \text{ cosec } 60° \times 2 = 6.074$ ″

59.626

2. WING

$A_d' = (0.050 + 2.675 + 0.500) \times 0.300 \times 2$

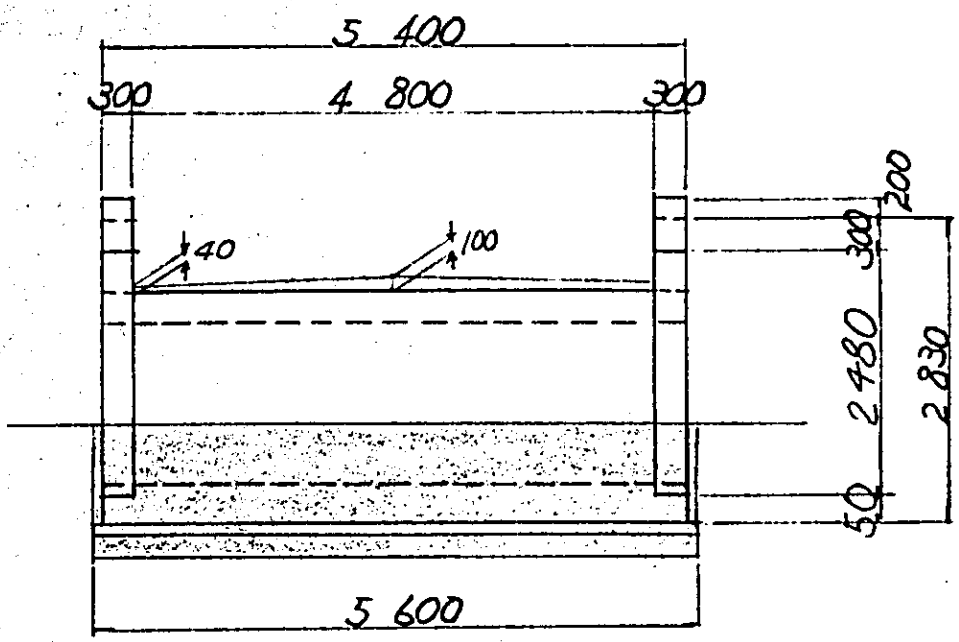
$= 1.935$

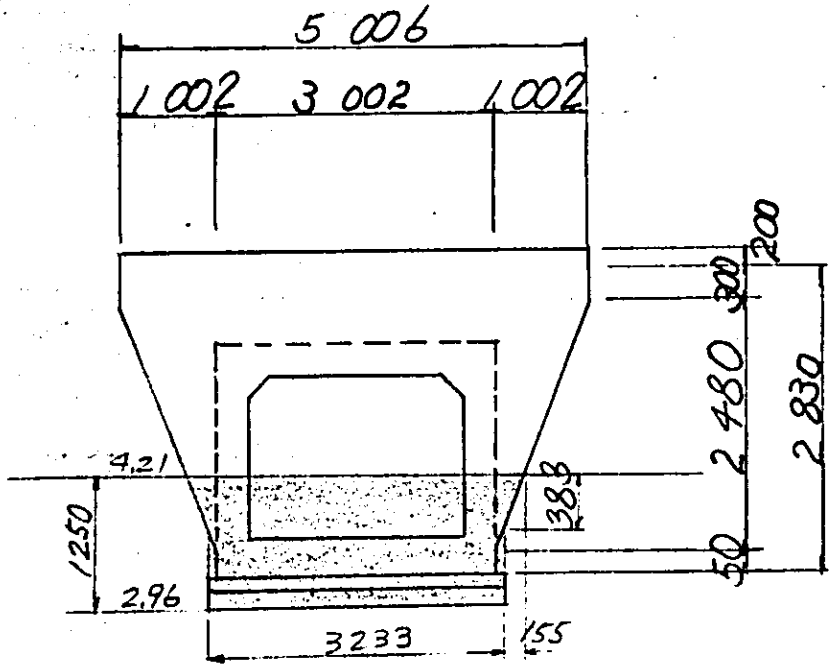
$A_e' = \{(0.500 + 2.980) \times \frac{1}{2} \times 1.002 \times 2$

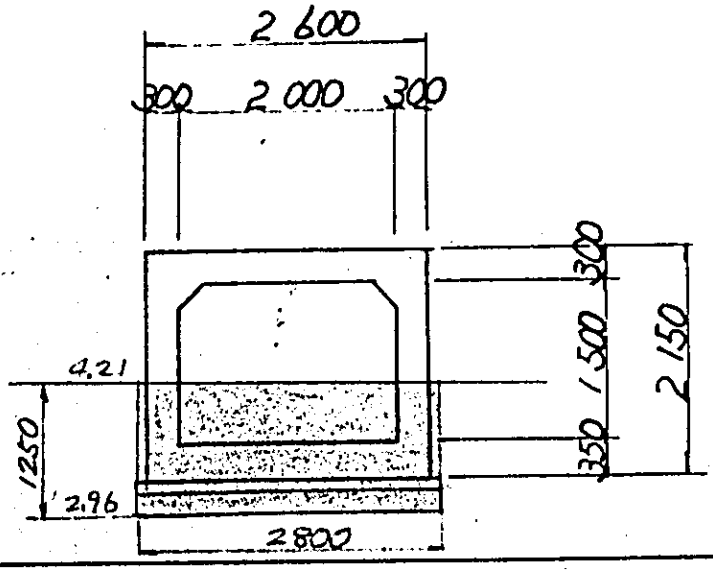
$+ 3.002 \times 0.880\} \times 2 = 12.257$

$A = (1.935 + 12.257) \times 2 = 28.384 \text{ m}^2$

GRADING, LEVELING, AGGREGATE, EXCAVATION







GRADING CONCRETE

$V = \frac{1}{2}(0.04 + 0.100) \times 4.800 \times 3.002 = 1.009\ m^3$

LEVELING CONCRETE

$V = 2.800 \times 0.100 \times 5.600 \underset{1.15473}{\text{cosec}}\, 60^\circ = 1.811\ m^3$

AGGREGATE SUB BASE

$V = 2.800 \times 0.200 \times 5.600 \text{ cosec } 60^\circ = 3.621\ m^3$

EXCAVATION

$V_a = 2.800 \times 1.250 \times 5.600 \text{ cosec } 60^\circ = 22.633\ m^3$

$V_b' = 0.155 \times 0.383 \times \frac{1}{2} \times 0.500 \times 2 = 0.029$

$V_b = 0.029 \times 2 = 0.058\ m^3$

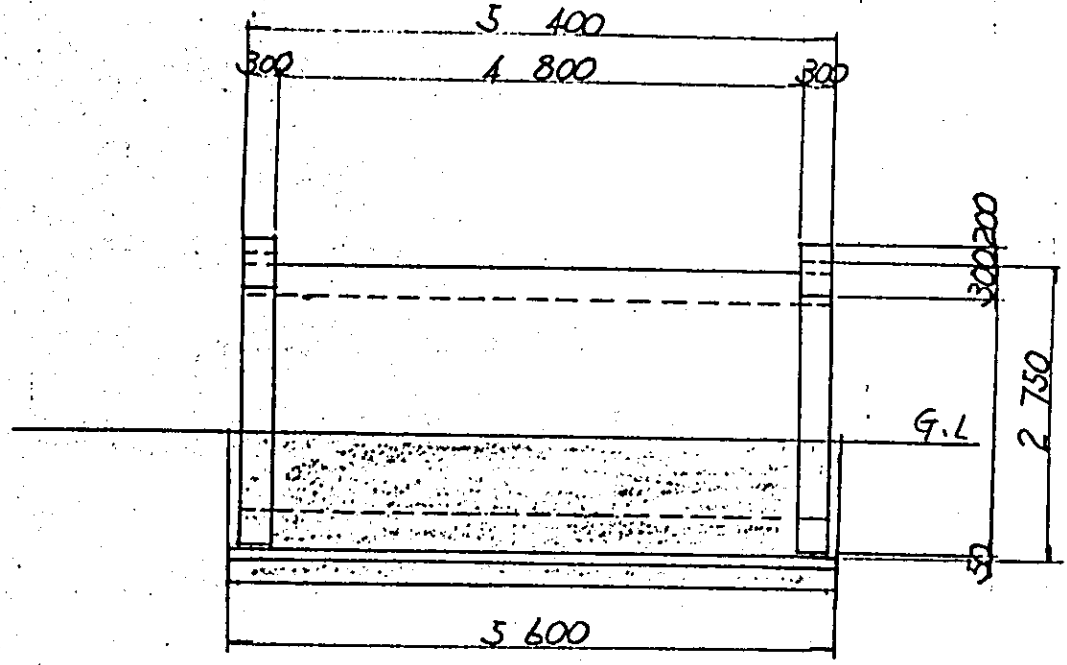
$22.691\ m^3$

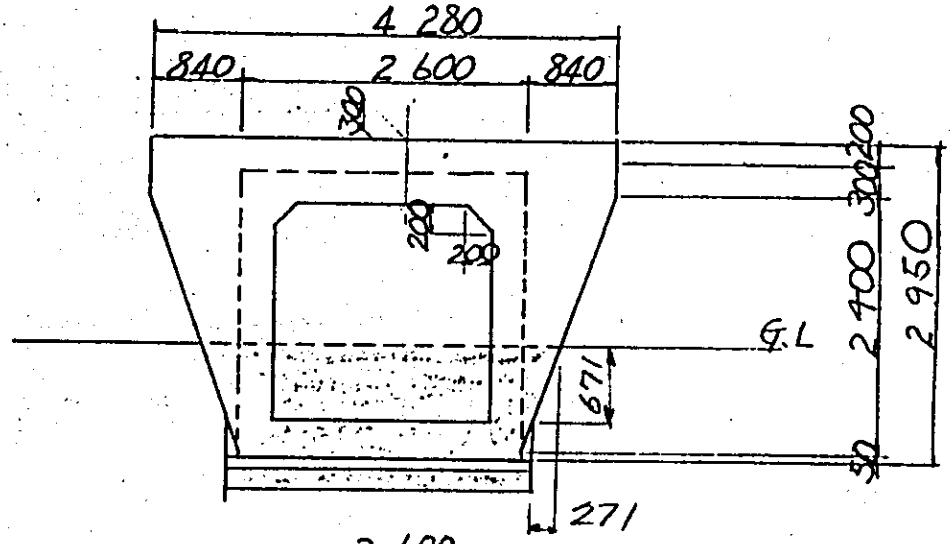
15. Cb07 REFER. TO Cb06

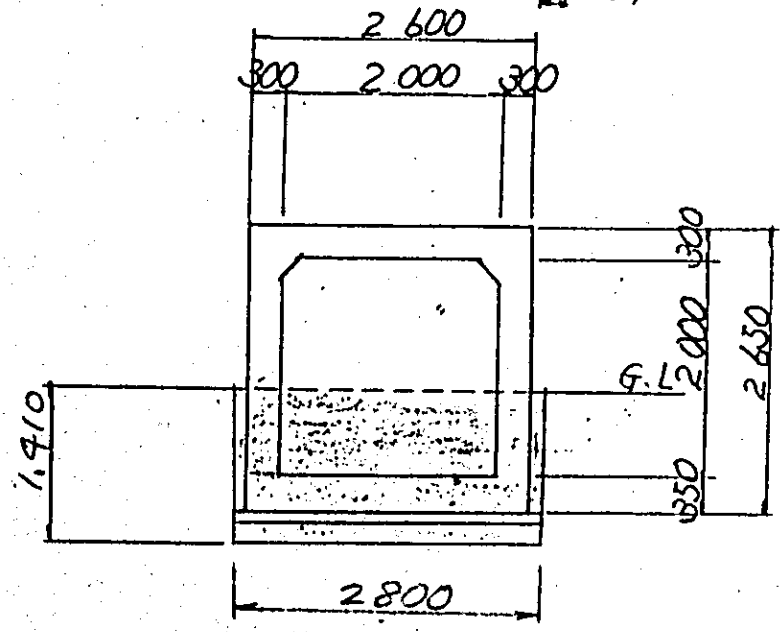
BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	15.8	62.3	1619.5	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.0	80.6	1826.7	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	22.3	


5 400
300
4 800
300
300
200
2 750
G.L
50
5 600


4 280
840
2 600
840
300
200
200
300
200
2 950
2 400
G.L
671
50
271


2 600
300
2 000
300
300
2 000
2 650
G.L
350
1 410
2800

CONCRETE VOLUME

FORM AREA

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

Refer. to C06

EXCAVATION

		m^3
$Va = 2.800 \times 1.41 \times 5.600$	=	22.109
$Vb' = 0.271 \times 0.674 \times 1/2 \times 0.500 \times 2 = 0.091$		
$Vb = 0.091 \times 2$	=	0.182
		22.291

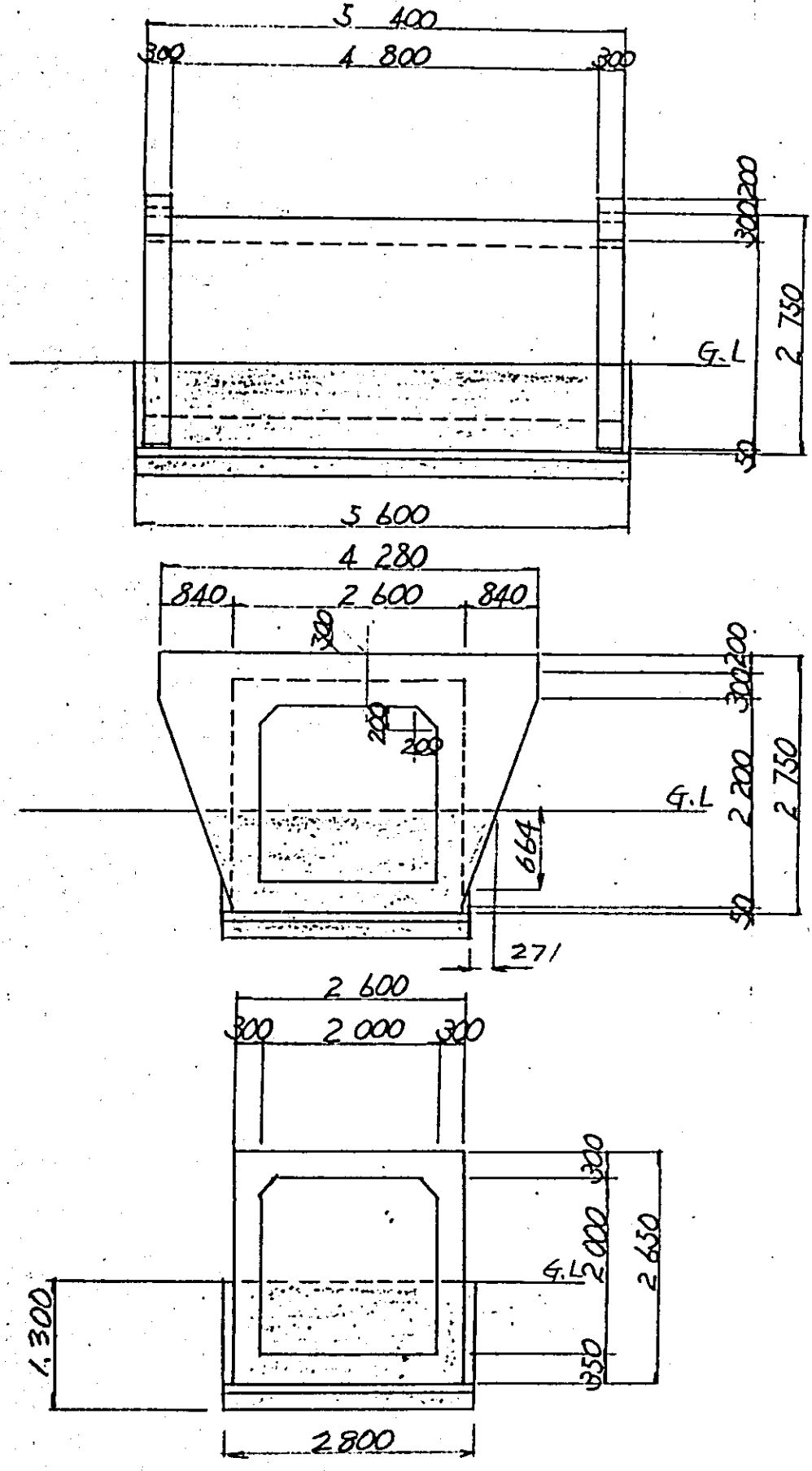
Cb08

REFER. TO Cb06

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	15.8	62.3	1619.5	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.0	80.6	1826.7	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	20.6	


5 400
300
4 800
300
300
200
2 750
G.L
50
5 600
4 280
840
2 600
840
300
200
200
300
200
2 750
G.L
664
50
271
2 600
300
2 000
300
300
2 000
2 650
G.L
1 300
350
2800

CONCRETE VOLUME

FORM AREA

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

Refer to C06

EXCAVATION

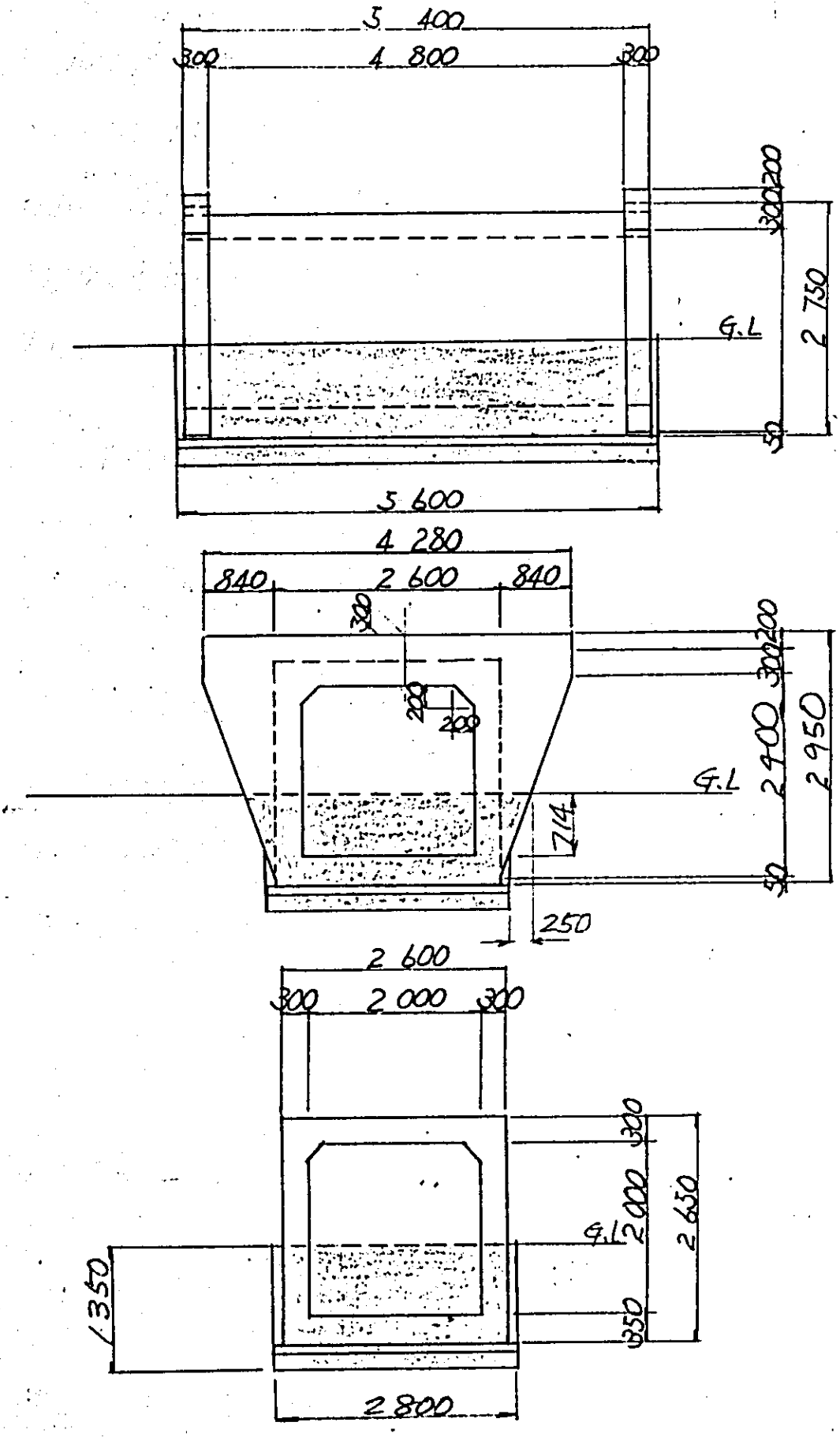
		m^3
$Va = 2.800 \times 1.300 \times 5.600$	=	20.384
$Vb' = 0.271 \times 0.664 \times 1/2 \times 0.500 \times 2 = 0.090$		
$Vb = 0.090 \times 2$	=	0.180 "
		20.564 "

17. Cb09 REFER. TO Cb06

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	15.8	62.3	1619.5	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.0	80.6	18267	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	21.3	


5 400
300
4 800
300
300
200
2 750
G.L
50
5 600
4 280
840
2 600
840
300
200
200
300
200
2400
2950
G.L
714
50
250
2 600
300
2 000
300
300
2000
2650
G.L
350
1350
350
2800

CONCRETE VOLUME

FORM AREA

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

Refer to Co6

EXCAVATION

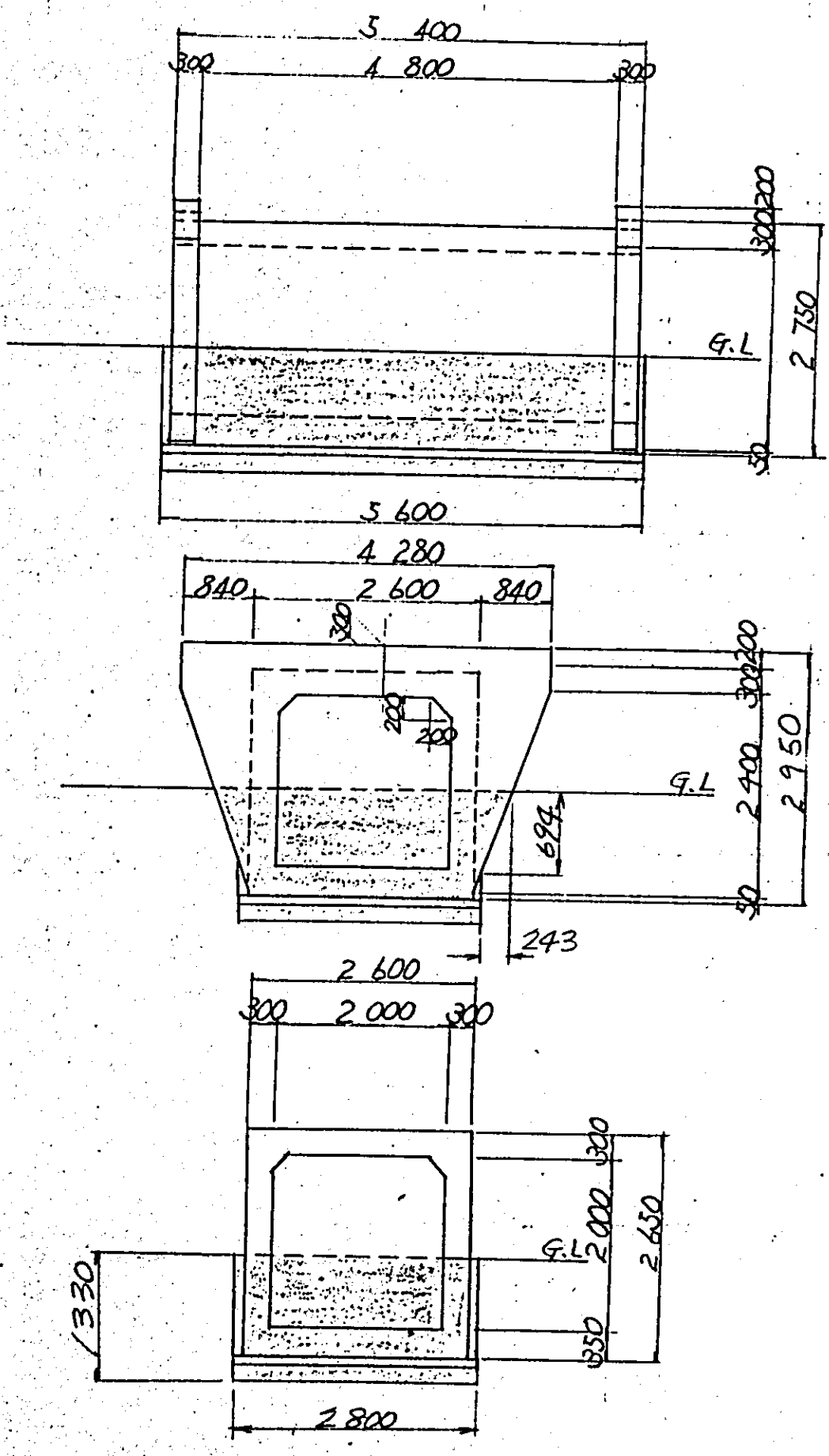
$Va = 2.800 \times 1.350 \times 5.600$	=	21.168 m^3
$Vb' = 0.250 \times 0.714 \times 1/2 \times 0.500 \times 2 = 0.089$		
$Vb = 0.089 \times 2$	=	0.178 "
		21.346 "

18. Cb 11 REFER. TO Cb06

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	15.8	62.3	1619.5	102.5
WING	2.2	18.3	207.2	94.2
TOTAL	18.0	80.6	1826.7	101.5

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	21.0	


5 400
300
4 800
300
300
200
2 750
G.L
50
5 600
4 280
840
2 600
840
300
200
200
300
200
2 950
2 400
G.L
694
50
243
2 600
300
2 000
300
300
2 000
2 650
G.L
1330
350
2 800

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer. to Co6

EXCAVATION

$Va = 2.800 \times 1.330 \times 5.600$	=	20.854 m^3
$Vb' = 0.243 \times 0.694 \times 1/2 \times 0.500 \times 2 = 0.084$		
$Vb = 0.084 \times 2$	=	0.169 "
		21.023 "

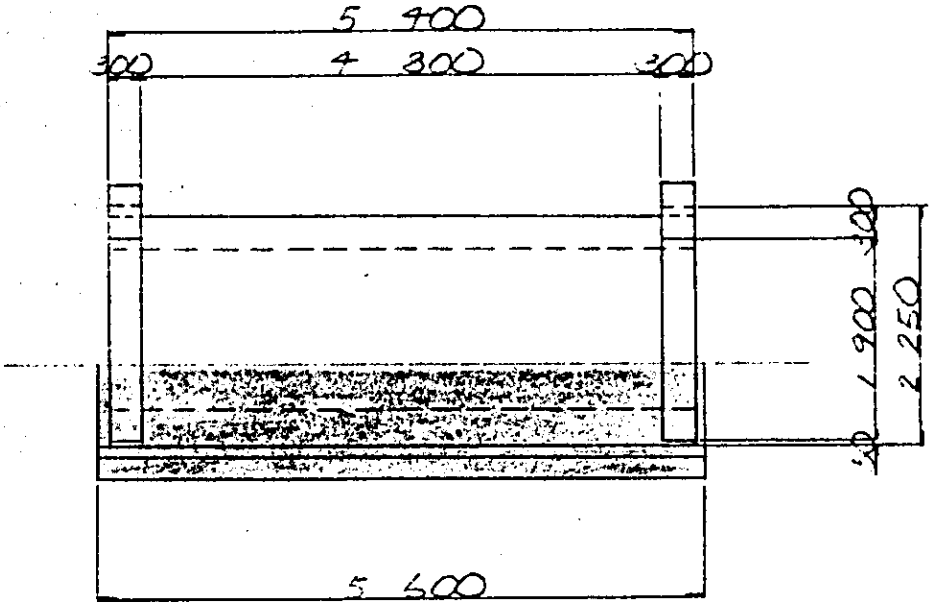
19. Cb13 REFER TO Cb12

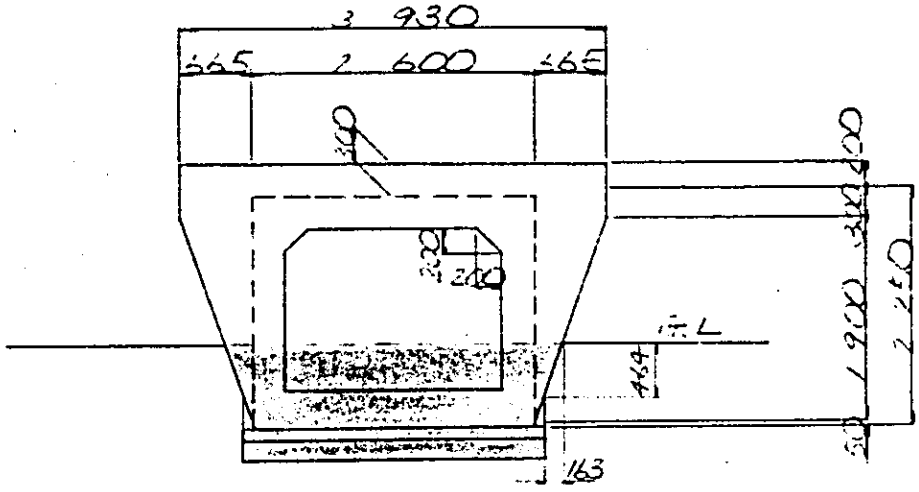
BOX CULVERT

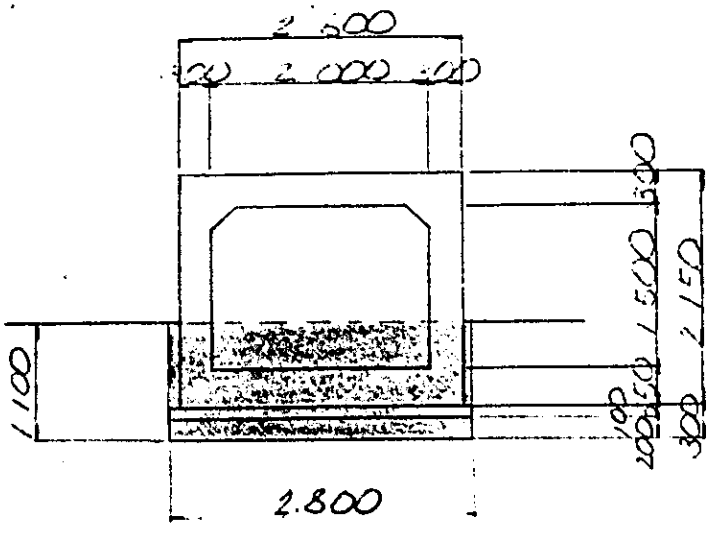
	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	17.3	

LEVELING, AGGREGATE, EXCAVATION







CONCRETE VOLUME

FORM AREA

LEVELING CONCRETE

AGGREGATE SUB BASE

refer. to C12

EXCAVATION

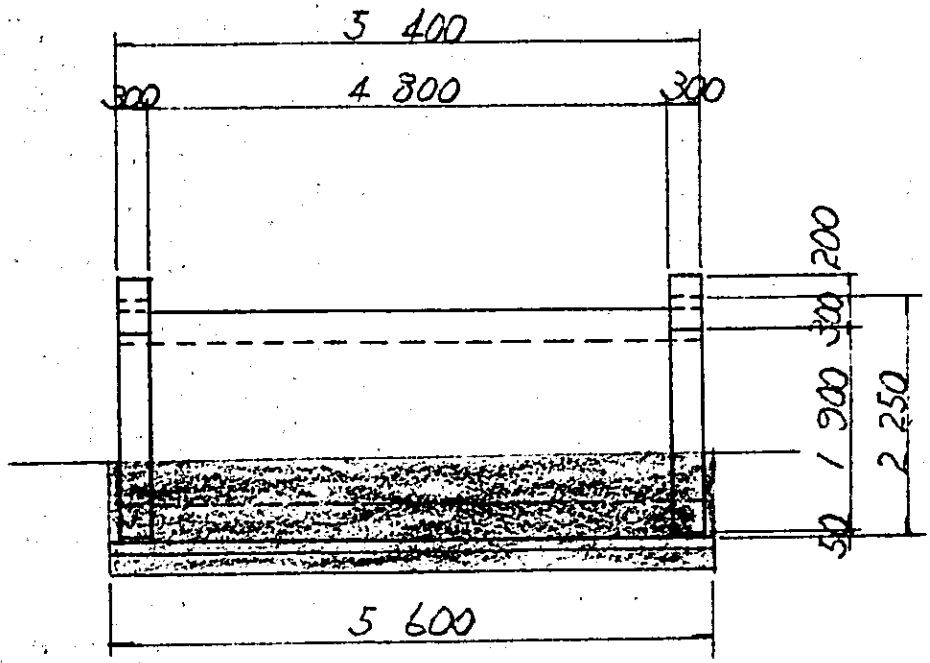
		m^3
$V_a = 2.800 \times 1.100 \times 5.600$	=	17.248
$V_b' = 0.163 \times 0.464 \times \frac{1}{2} \times 2 \times 0.50 = 0.038$		
$V_b = 0.038 \times 2$	=	0.076
		17.324 "

20. Cb14 REFER. TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	18.0	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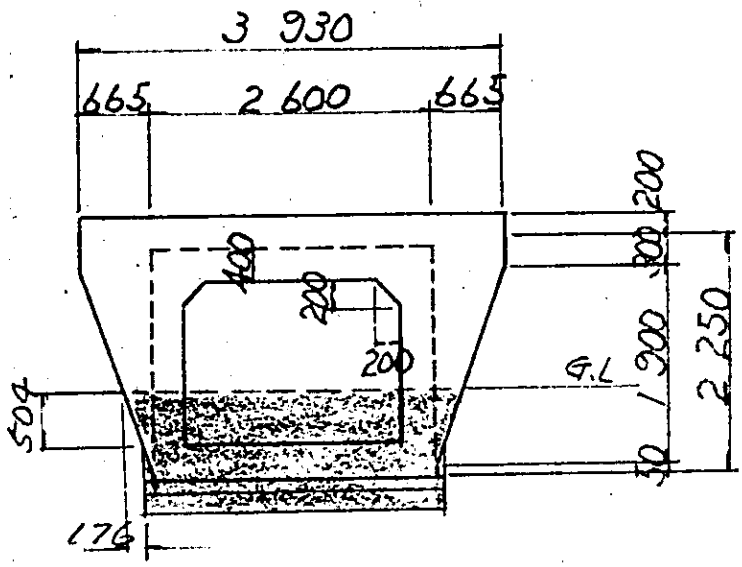
300
200
300
1 900
2 250
50
5 600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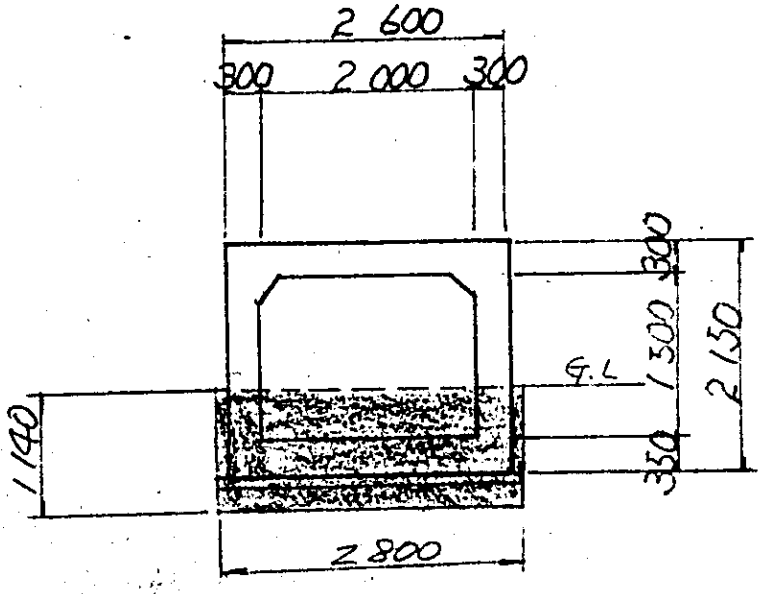
665
2 600
665
200
300
400
200
200
G.L
1 900
2 250
500
50
170


2 600
300
2 000
300
300
1 300
2 150
G.L
350
1 140
2 800

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer. to C_{12}

EXCAVATION

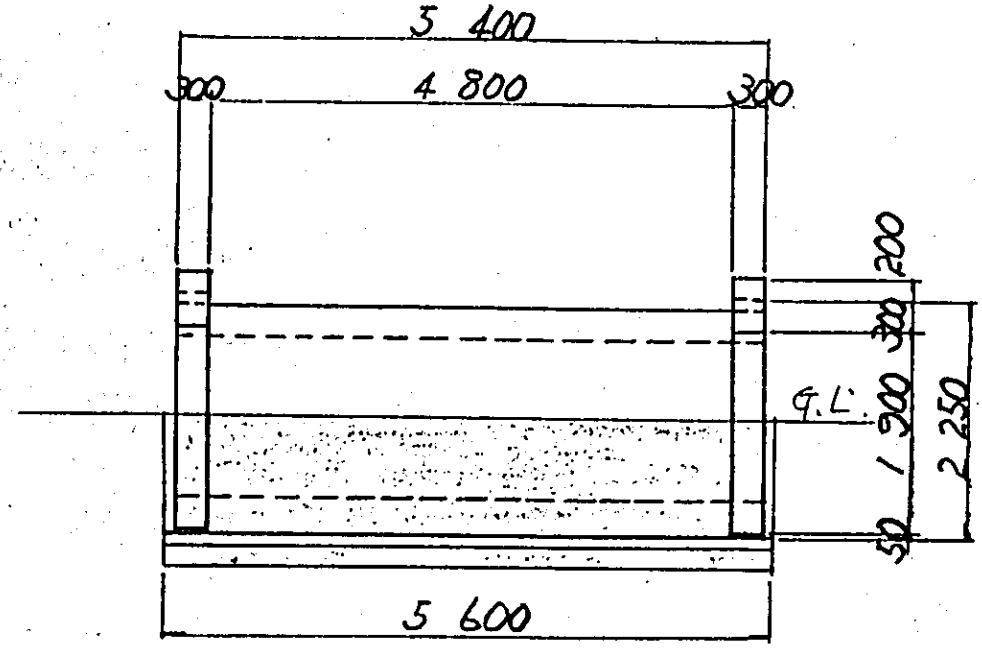
		m^3
$V_a = 2.800 \times 1.140 \times 5.600$	=	17.875
$V_b' = 0.176 \times 0.504 \times 1/2 \times 0.500 \times 2 = 0.044$		
$V_b = 0.044 \times 2$	=	0.088
		17.963

21. Cb15 REFER. TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	23.0	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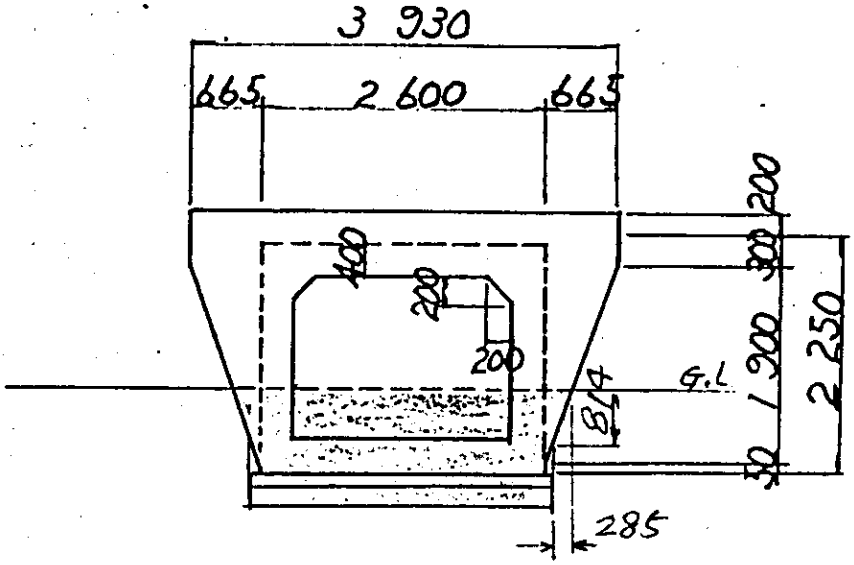
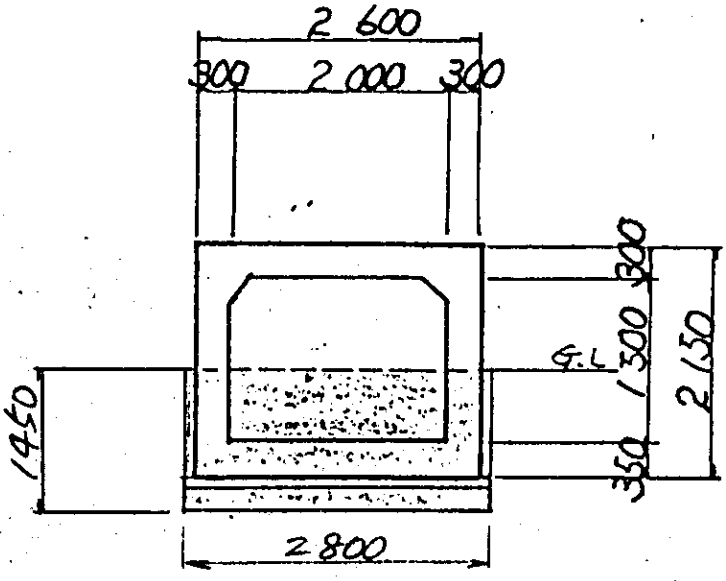
300
4 800
300
200
300
1 900
2 250
G.L.
50
5 600


3 930
665
2 600
665
200
300
1 900
2 250
G.L
50
400
220
200
814
285


2 600
300
2 000
300
300
1 300
2 150
G.L
350
1450
2 800

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer to C_{12}

EXCAVATION

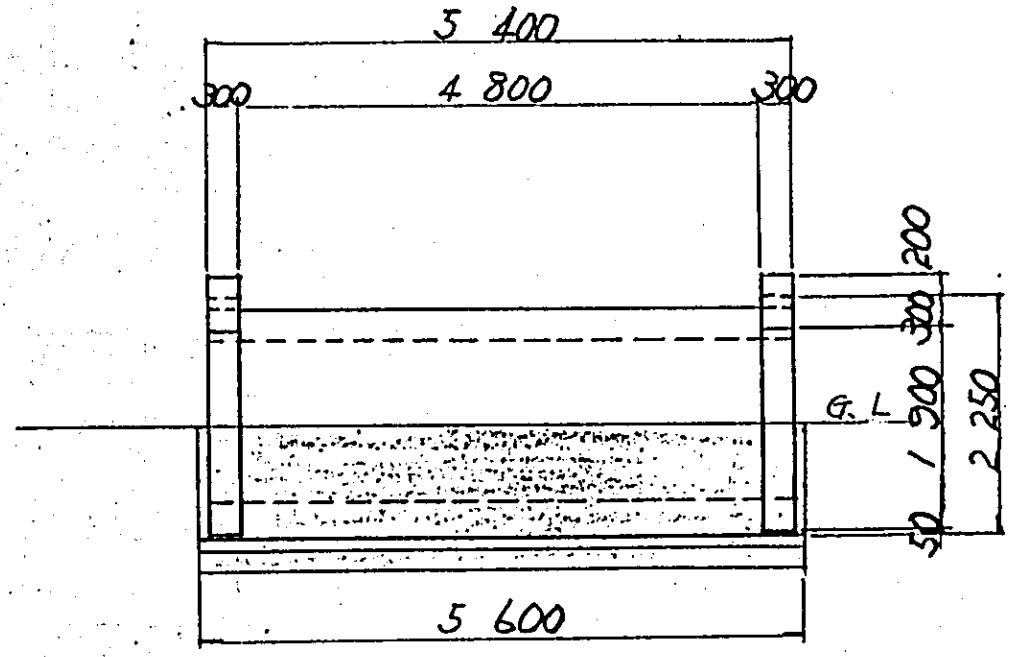
		m^3
$V_a = 2.800 \times 1.450 \times 5.600$	=	22.736
$V_b' = 0.285 \times 0.814 \times 1/2 \times 0.500 \times 2 = 0.116$		
$V_b = 0.116 \times 2$	=	0.232
		22.968

22. Cb16 REFER TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	21.7	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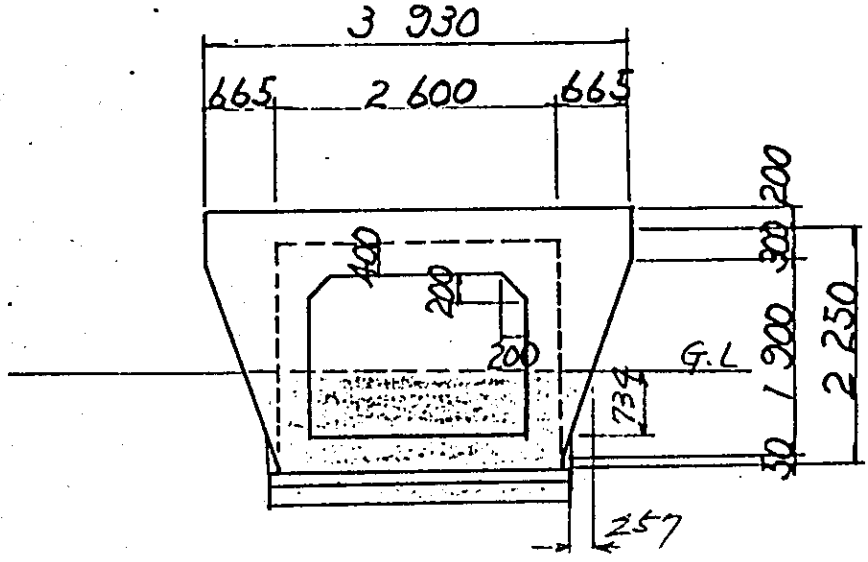
300
4 800
300
200
300
1 900
2 250
G.L
50
5 600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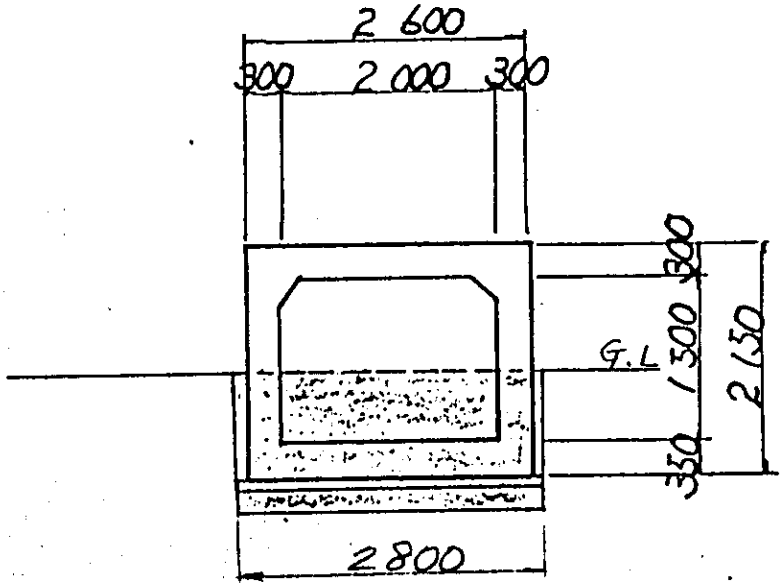
665
2 600
665
200
300
400
200
200
1 900
2 250
G.L
734
50
257


2 600
300
2 000
300
300
1 500
2 150
G.L
350
2800

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer to C_{12}

EXCAVATION

		m^3
$V_a = 2.800 \times 1.370 \times 5.600$	=	21.482
$V_b' = 0.257 \times 0.734 \times 1/2 \times 0.500 \times 2 = 0.094$		
$V_b = 0.094 \times 2$	=	0.188 "
		21.670 "

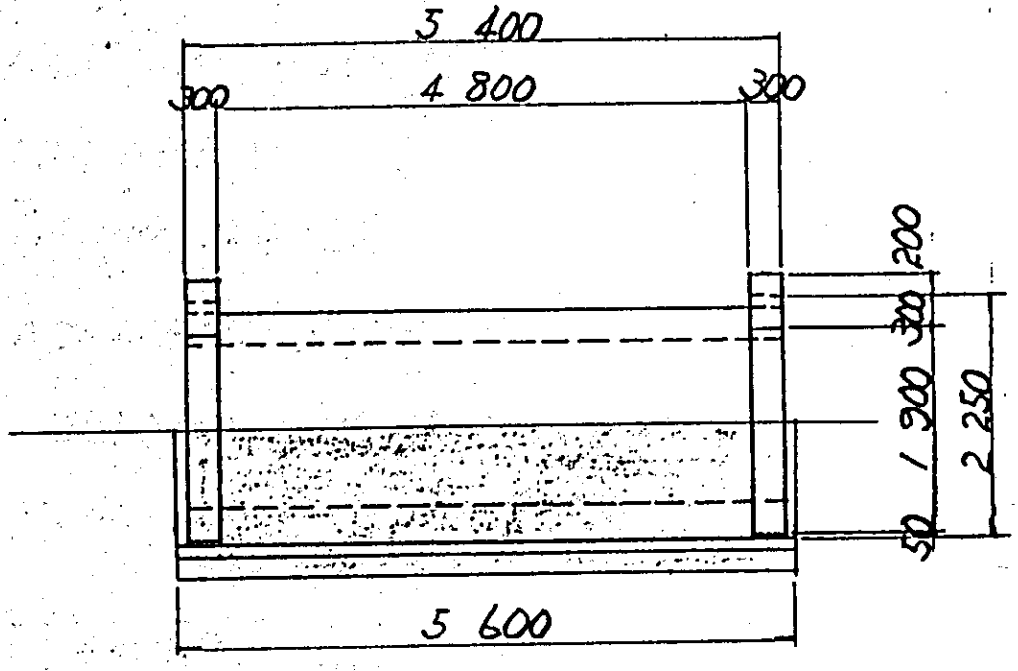
23. Cb19

REFER. TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	19.1	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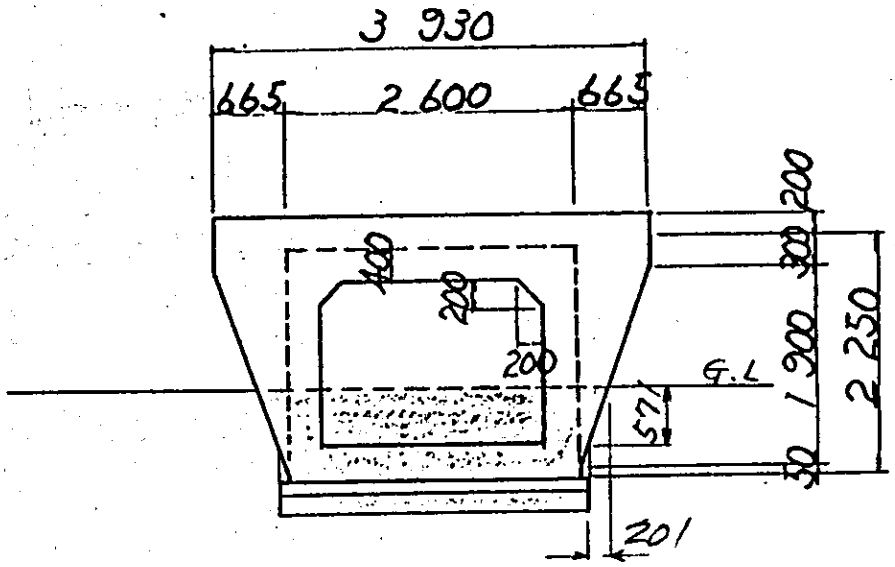
300
4 800
300
200
300
1 900
2 250
50
5 600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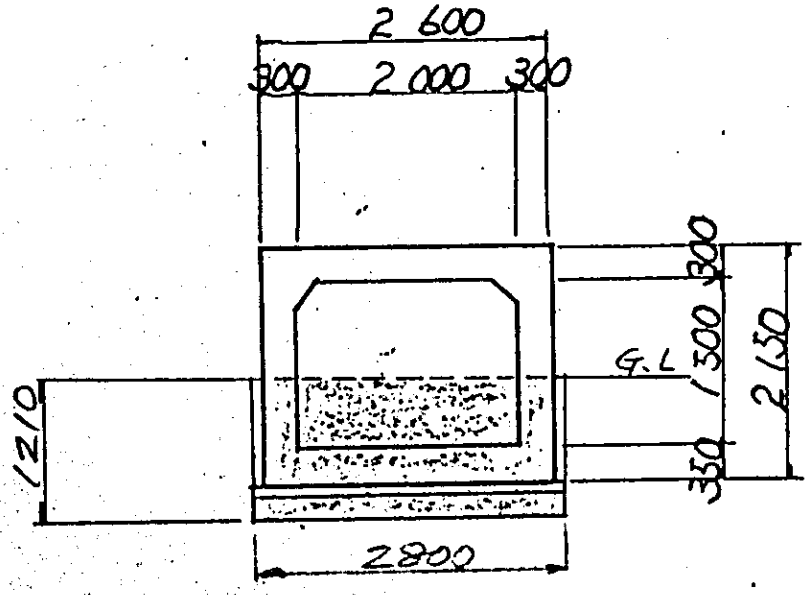
665
2 600
665
200
300
400
200
200
G.L
1 900
2 250
577
50
201


2 600
300
2 000
300
300
1 300
G.L
2 150
1210
350
2800

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer to C12

EXCAVATION

		m^3
$Va = 2.800 \times 1.210 \times 5.600$	=	18.973
$Vb' = 0.201 \times 0.574 \times 1/2 \times 0.500 \times 2 = 0.058$		
$Vb = 0.058 \times 2$	=	0.116 "
		19.089 "

24. Cb20

REFER. TO Cb12

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (Kg/m^3)
BOX CULVERT	14.2	51.6	1486.7	104.7
WING	1.6	13.8	221.3	138.3
TOTAL	15.8	65.4	1708.0	108.1

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.1	
EXCAVATION	m^3	18.0	

CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

Refer. to C12

EXCAVATION

		m³
$V_a = 2.800 \times 1.140 \times 5.600$	=	17.875
$V_b' = 0.176 \times 0.504 \times 1/2 \times 0.500 \times 2 = 0.044$		
$V_b = 0.044 \times 2$	=	0.088
		17.963

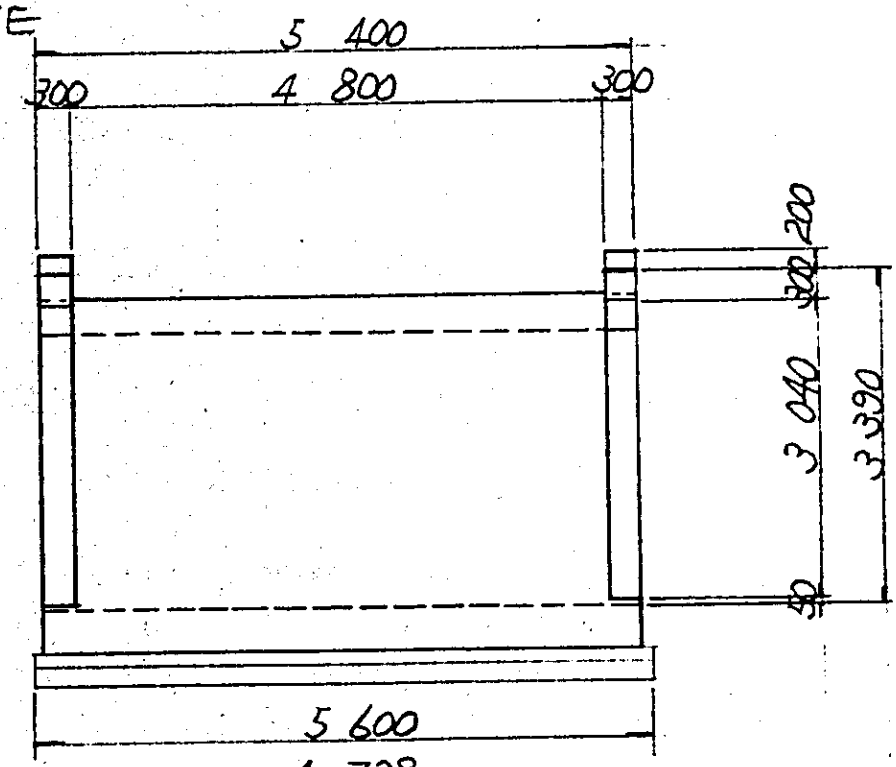
25. Cb21 REFER. TO Cb02

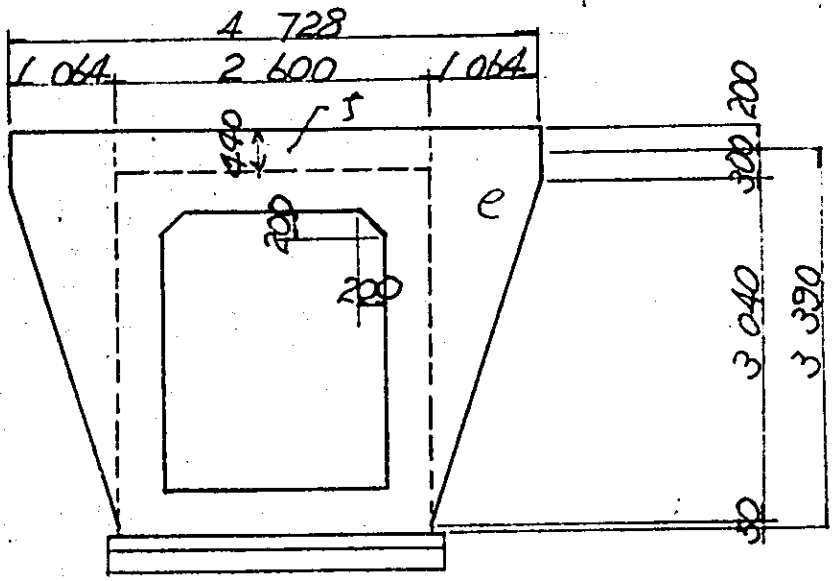
BOX CULVERT

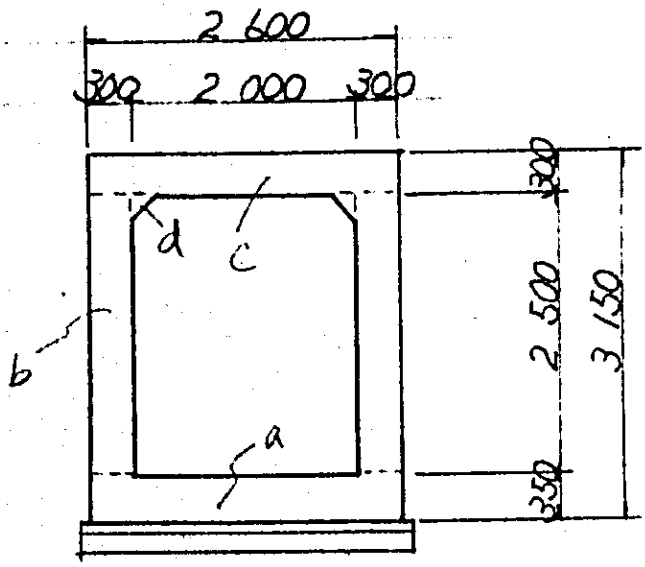
	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (kg/m^3)
BOX CULVERT	17.4	73.2	1783.5	102.5
WING	3.3	26.3	310.9	94.2
TOTAL	20.7	99.5	2094.4	101.2

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	0.9	
LEVELING CONCRETE	m^3	1.6	
AGGREGATE SUB BASE	m^3	3.3	
EXCAVATION	m^3	18.1	

CONCRETE


5 400
300
4 800
300
200
300
3 040
3 390
50
5 600


4 728
1 064
2 600
1 064
200
300
3 040
3 390
50
e
f
200
200


2 600
300
2 000
300
300
2 500
3 150
350
a
b
c
d

CONCRETE VOLUME

1. BOX CULVERT

$Va = 2.600 \times 0.350 \times 5.400$	=	4.914 m³
$Vb = 0.300 \times 2.500 \times 5.400 \times 2$	=	8.100 "
$Vc = 2.600 \times 0.300 \times 5.400$	=	4.212 "
$Vd = \frac{1}{2} \times 0.200 \times 0.200 \times 5.400 \times 2$	=	0.216 "
		17.442 "

2. WING

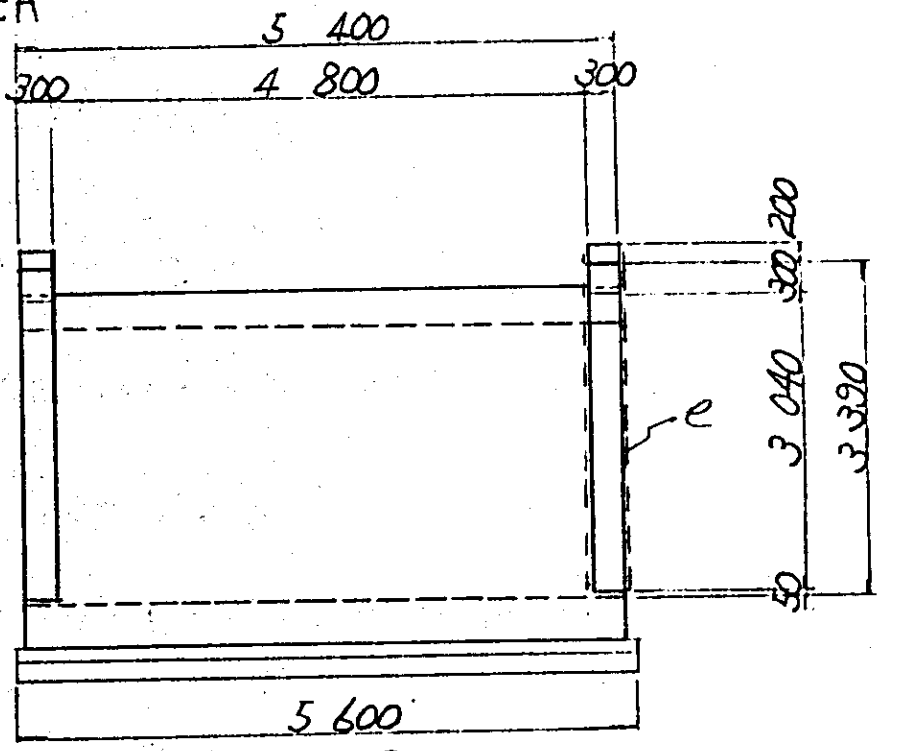
$Ve' = (0.500 + 3.540) \times \frac{1}{2} \times 1.064$

$\times 0.300 \times 2 = 1.290$

$Vf' = 2.600 \times 0.440 \times 0.300 = 0.343$

$V = (1.290 + 0.343) \times 2 = 3.266$ m³

FORM AREA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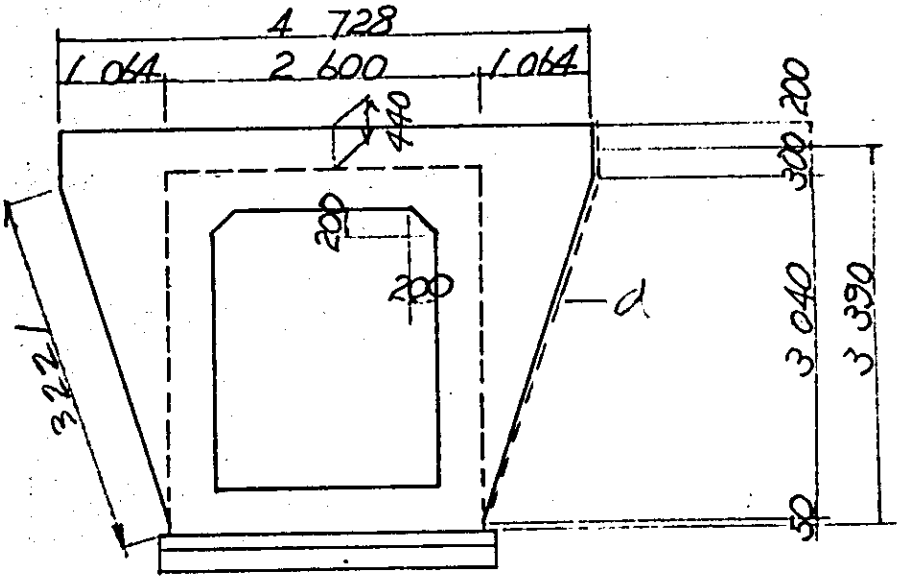
4 800
300
200
300
3 040
3 390
50
e
5 600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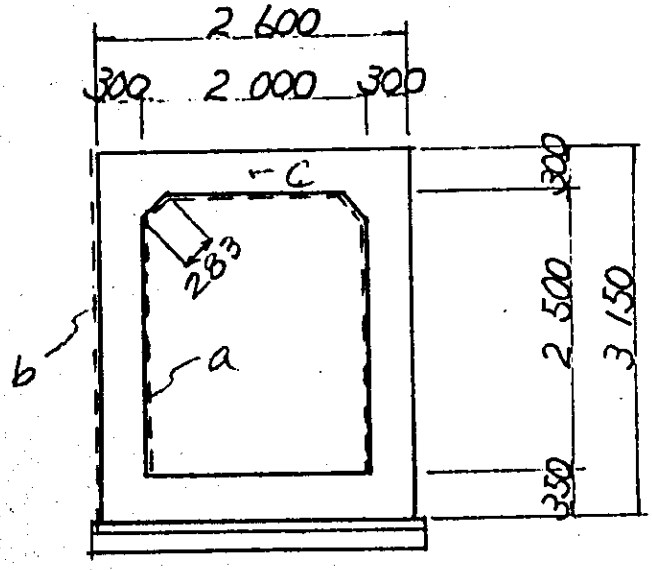
2 600
1 064
440
200
200
200
300
3 040
3 390
50
d
3221


2 600
300
2 000
300
c
283
b
a
300
2 500
3 150
350

FORM AREA

1. BOX CULVERT

$Aa = \{(2.300 + 0.283) \times 2 + 1.600\} \times 5.400 = 36.536$ m²

$Ab = 3.150 \times 4.800 \times 2 = 30.24$ "

$Ac' = 2.600 \times 3.150 - 2.000 \times 2.500 + 0.200 \times 0.200 \times 1/2 \times 2 = 3.23$

$Ac = 3.23 \times 2 = 6.46$ "

73.236 m²

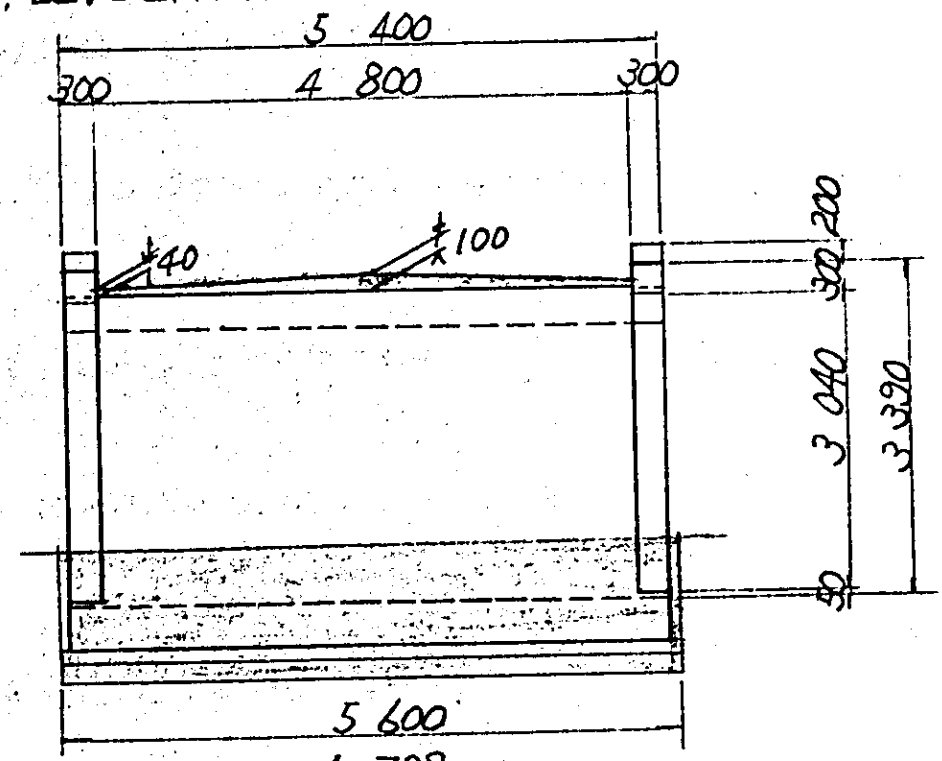
2. WING

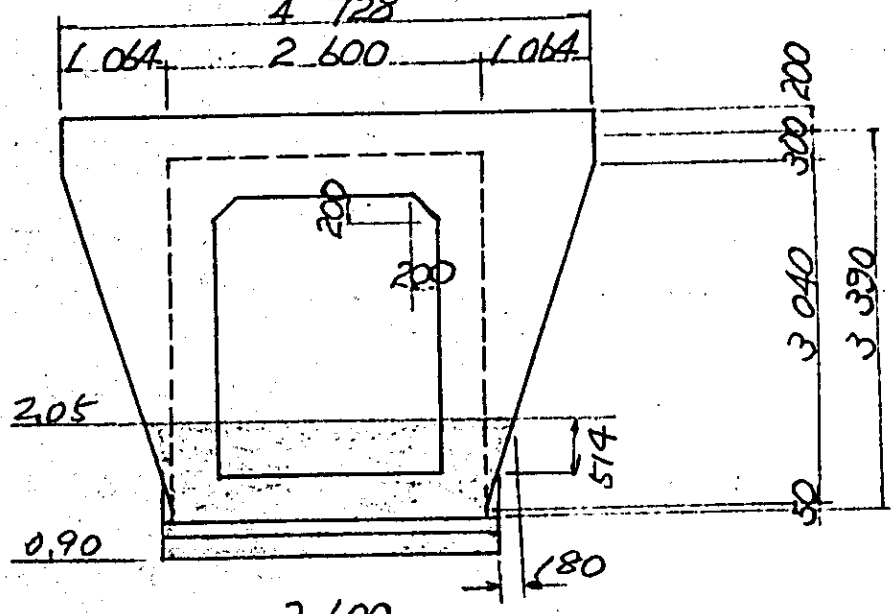
$Ad' = (0.050 + 3.221 + 0.500) \times 0.300 \times 2 = 2.263$

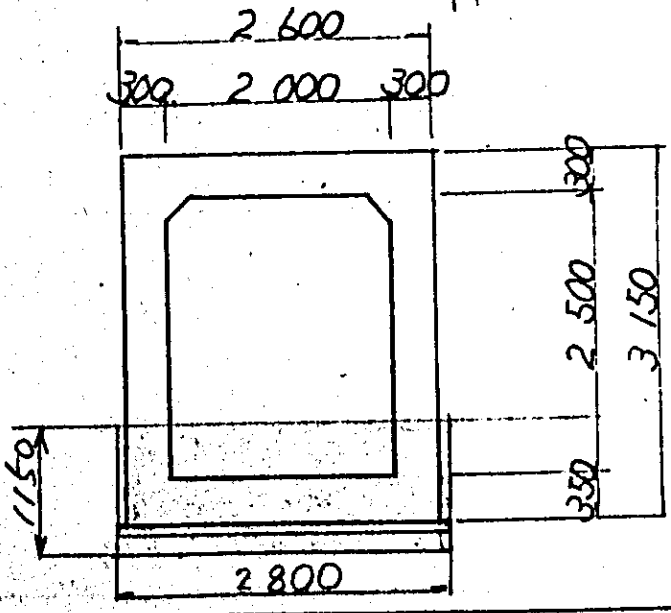
$Ae' = \{(0.500 + 3.540) \times 1/2 \times 1.064 \times 2 + 2.600 \times 0.440\} \times 2 = 10.885$

$A = (2.263 + 10.885) \times 2 = 26.296$ m²

GRADING, LEVELING, AGGREGATE, EXCAVATION







GRADING CONCRETE

$V = \frac{1}{2}(0.04+0.10) \times 4.800 \times 2.600 = 0.874\ m^3$

LEVELING CONCRETE

$V = 2.800 \times 0.100 \times 5.600 = 1.568$ "

AGGREGATE SUB BASE

$V = 2.800 \times 0.200 \times 5.600 = 3.316$ "

EXCAVATION

$V_a = 2.800 \times 1.150 \times 5.600 = 18.032\ m^3$

$V_b' = 0.180 \times 0.514 \times \frac{1}{2} \times 2 \times 0.500 = 0.046$

$V_b = 0.046 \times 2 = 0.092$ "

18.078 "

26.

Cb23

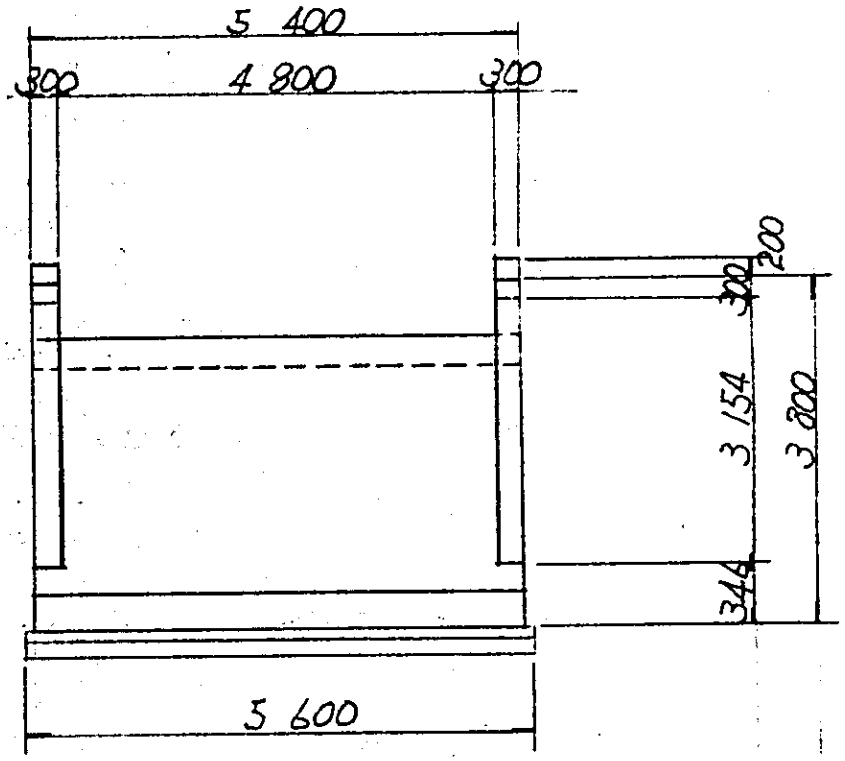
REFER TO Cb02

BOX CULVERT

	CONCRETE VOLUME(m^3)	FORM AREA (m^2)	REINFORCING BAR(kg)	RATIO (Kg/m^3)
BOX CULVERT	23.5	98.6	2408.8	102.5
WING	6.1	46.1	574.6	94.2
TOTAL	29.6	144.7	2983.4	100.8

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m^3	1.2	
LEVELING CONCRETE	m^3	2.1	
AGGREGATE SUB BASE	m^3	4.2	
EXCAVATION	m^3	24.3	

CONCRETE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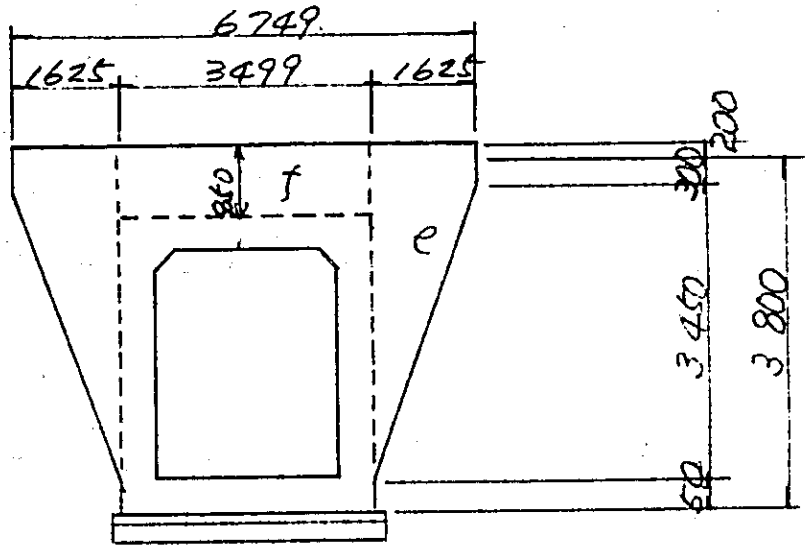
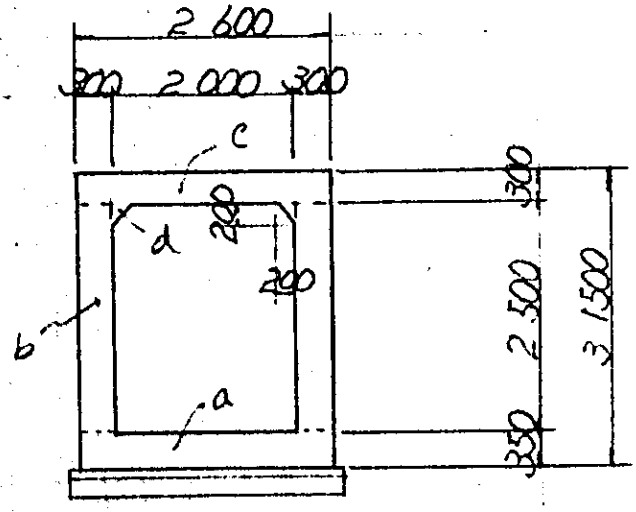
300
4 800
300
200
300
3 154
3 800
344
5 600


6749
1625
3499
1625
340
f
e
200
300
3 450
3 800
50


2 600
300
2 000
300
c
d
200
200
b
a
300
2 500
3 1500
250

CONCRETE VOLUME

1. BOX CULVERT

$V_a = 2.600 \times 0.350 \times 5.400 \operatorname{cosec} 48^\circ$	=	6.613 m³
$V_b = 0.300 \times 2.500 \times 5.400 \operatorname{cosec} 48^\circ \times 2$	=	10.900 "
$V_c = 2.600 \times 0.300 \times 5.400 \operatorname{cosec} 48^\circ$	=	5.668 "
$V_d = \frac{1}{2} \times 0.200 \times 0.200 \times 5.400 \operatorname{cosec} 48^\circ \times 2$	=	0.291 "
		23.472 "

2. WING

$V_e' = (0.500 + 3.950) \times \frac{1}{2} \times 1.625 \times 0.300 \times 2 = 2.169$

$V_f' = 3.499 \times 0.850 \times 0.300 = 0.892$

$V = (2.169 + 0.892) \times 2 = 6.122$ m³