

FORM AREA

1. BOX CULVERT

$$A_a = \{ (2,300 + 0.283) \times 2 + 1,600 \} \times 5,400 \operatorname{cosec} 48^\circ = 49.167 \text{ m}^2$$

1.30571

$$A_b = 3,150 \times 4,800 \operatorname{cosec} 48^\circ \times 2 = 40,694$$

$$A_c' = 2,600 \times 3,150 - 2,000 \times 2,500 + 0,200 \times 0,200 \times \frac{1}{2} \times 2 = 3,23$$

$$A_c = 3,23 \operatorname{cosec} 48^\circ \times 2 = 8,693$$

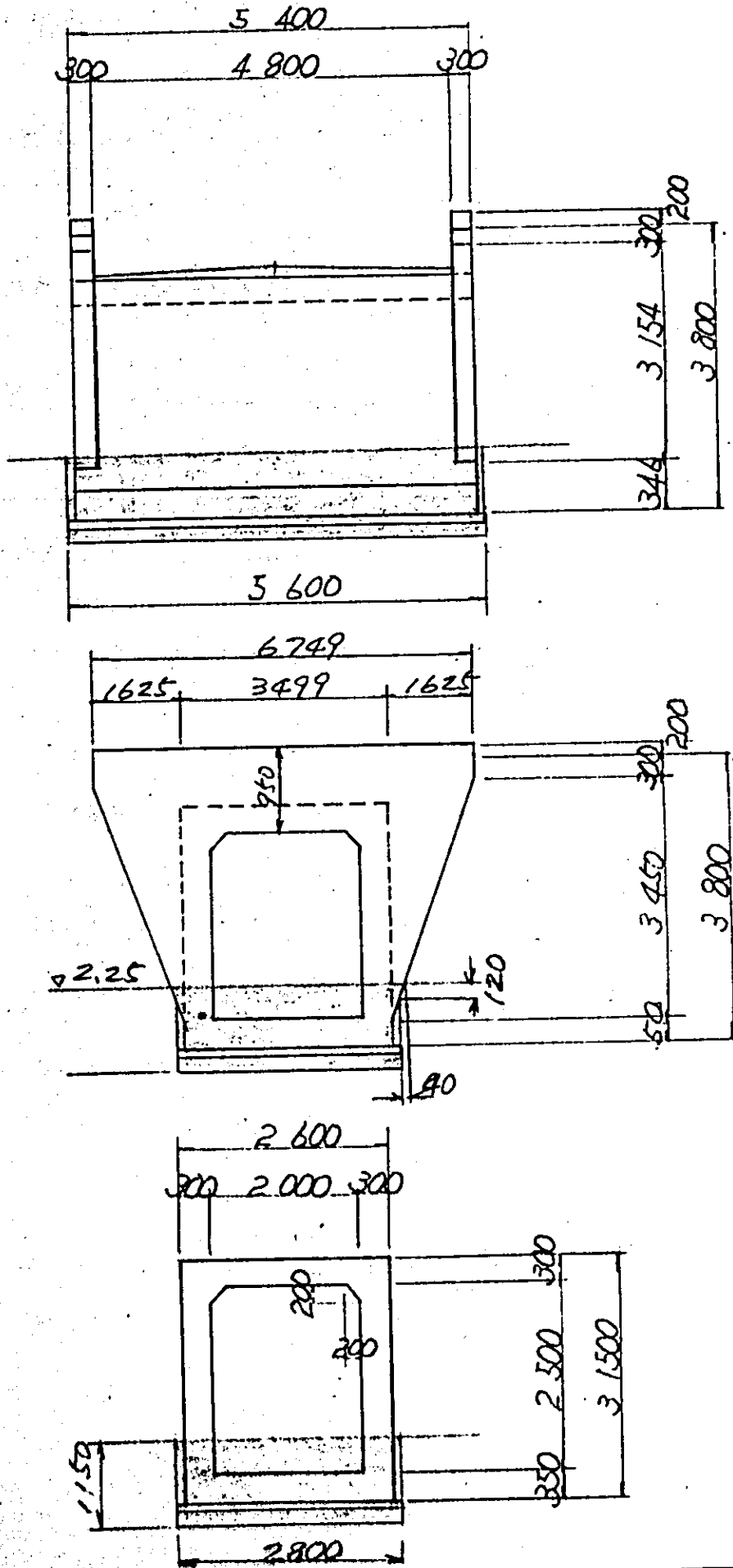
2. WING

$$A_d' = (0,050 + 3,814 + 0,500) \times 0,300 \times 2 = 2,618$$

$$A_e' = \{ (0,500 + 3,950) \times \frac{1}{2} \times 1,625 \times 2 + 3,499 \times 0,850 \} \times 2 = 20,411$$

$$A = (2,618 + 20,411) \times 2 = 46,058$$

98,554



GRADING CONCRETE

$$V = \frac{1}{2}(0.04 + 0.10) \times 4,800 \times 2,600 \operatorname{cosec} 48^\circ = 1,176 \text{ m}^3$$

1.34571

LEVELING CONCRETE

$$V = 2,800 \times 0.100 \times 5,600 \operatorname{cosec} 48^\circ = 2,110 \text{ m}^3$$

AGGREGATE SUB BASE

$$V = 2,800 \times 0.200 \times 5,600 \operatorname{cosec} 48^\circ = 4,220 \text{ m}^3$$

EXCAVATION

$$V_a = 2,800 \times 1.150 \times 5,600 \operatorname{cosec} 48^\circ = 24,266 \text{ m}^3$$

$$V_b' = 0.04 \times 0.120 \times \frac{1}{2} \times 0.400 \times 2 = 0.002$$

$$V_b = 0.002 \times 2 = 0.004$$

$$24,27''$$

27.

Cb 24

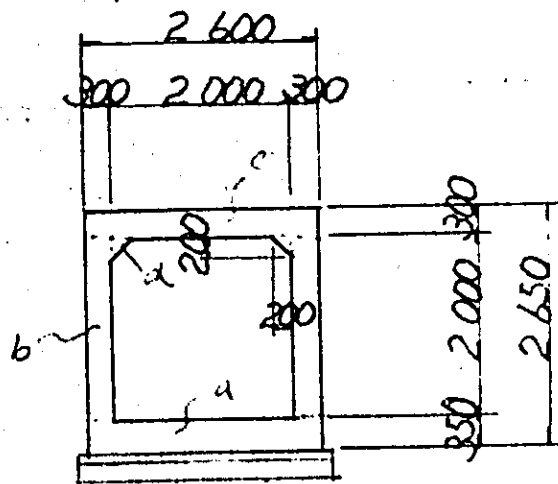
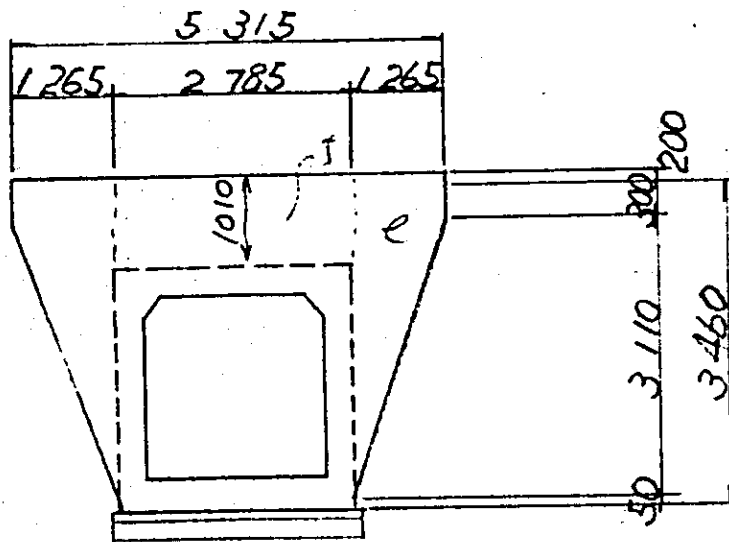
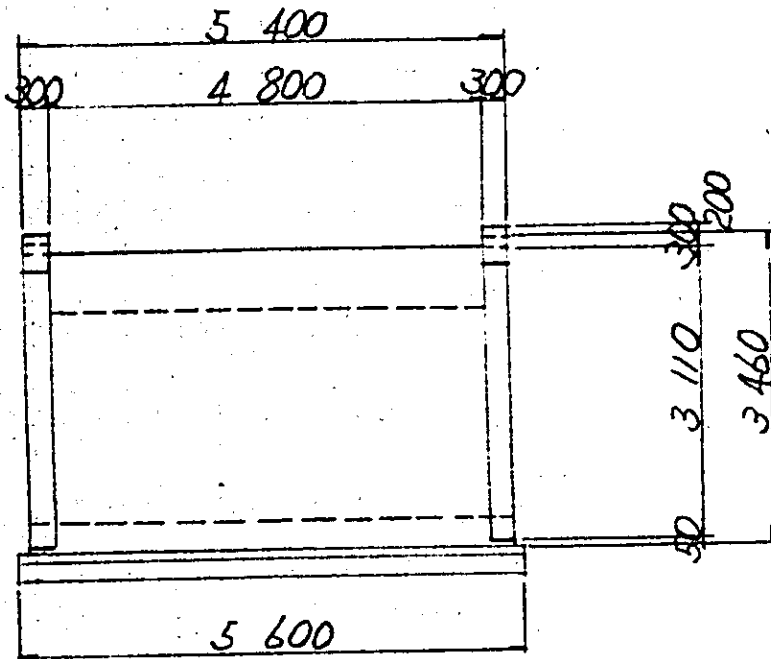
REFER. TO Cb02

BOX CULVERT

	CONCRETE VOLUME (m ³)	FORM AREA (m ²)	REINFORCING BAR (kg)	RATIO (kg/m ³)
BOX CULVERT	16.9	66.9	1732.3	102.5
WING	4.8	36.7	452.2	94.2
TOTAL	21.7	103.6	2184.5	100.7

	UNIT	QUANTITY	REMARKS
GRADING CONCRETE	m ³	0.9	
LEVELING CONCRETE	m ³	1.7	
AGGREGATE SUB BASE	m ³	3.4	
EXCAVATION	m ³	21.1	

CONCRETE



CONCRETE VOLUME

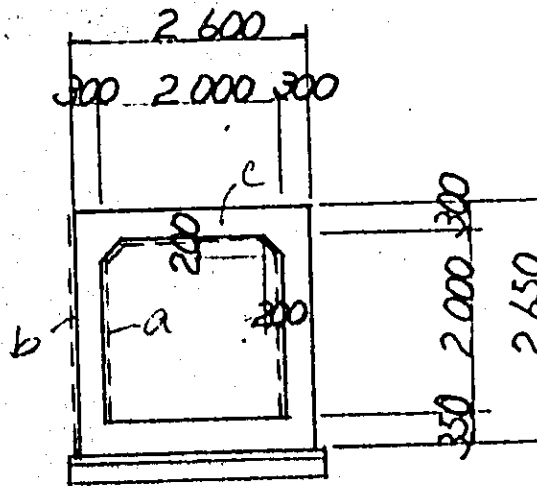
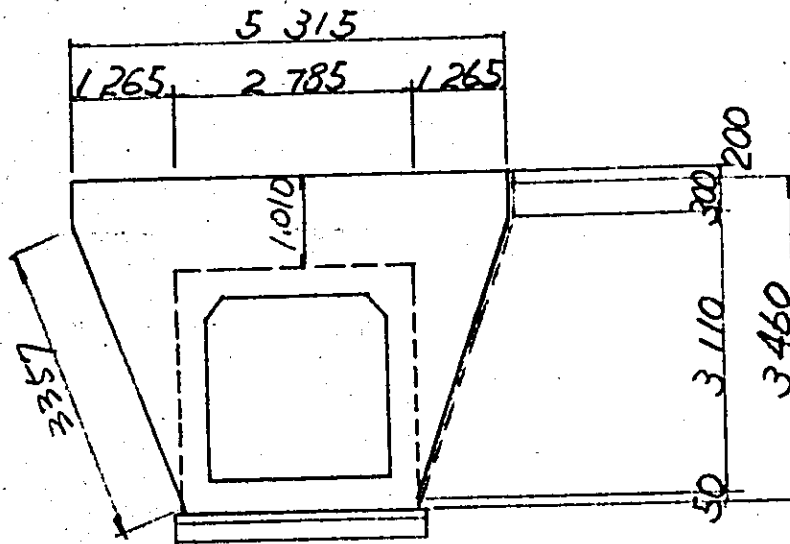
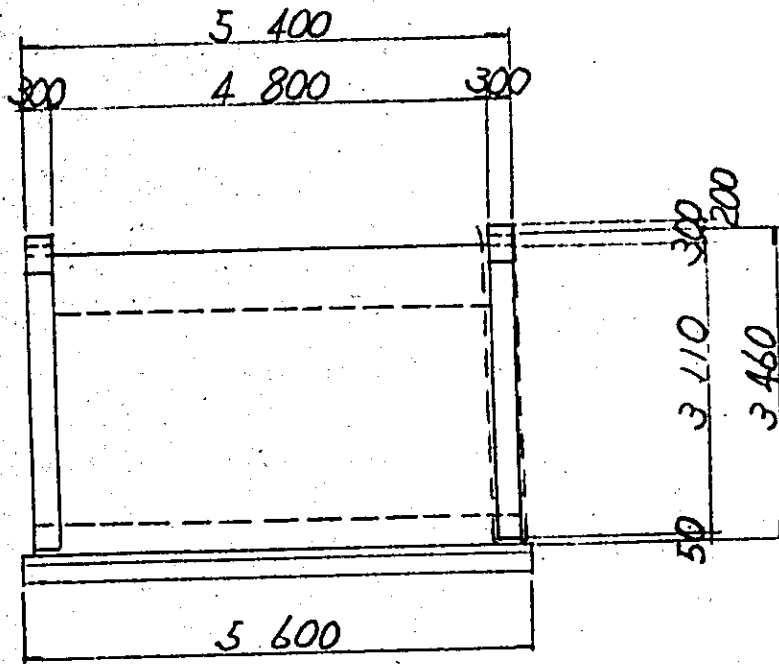
1. BOX CULVERT

$$\begin{aligned}
 V_a &= 2.600 \times 0.350 \times 5.400 \operatorname{cosec} 69^\circ = 5.263 \text{ m}^3 \\
 V_b &= 2.000 \times 0.300 \times 5.400 \operatorname{cosec} 69^\circ \times 2 = 6.941 \text{ m}^3 \\
 V_c &= 2.600 \times 0.300 \times 5.400 \operatorname{cosec} 69^\circ = 4.512 \text{ m}^3 \\
 V_d &= 0.200 \times 0.200 \times \frac{1}{2} \times 5.400 \operatorname{cosec} 69^\circ \times 2 = 0.231 \text{ m}^3 \\
 \hline
 &= 16.947 \text{ m}^3
 \end{aligned}$$

2. WING

$$\begin{aligned}
 V_e' &= (0.500 + 3.610) \times \frac{1}{2} \times 1.265 \\
 &\quad \times 0.300 \times 2 = 1.560 \\
 V_f' &= 2.785 \times 1.010 \times 0.300 = 0.844 \\
 V &= (1.560 + 0.844) \times 2 = 4.808 \text{ m}^3
 \end{aligned}$$

FORM AREA



FORM AREA

1. BOX CULVERT

$$A_a = \left\{ (1.800 + 0.283) \times 2 + 1.600 \right\} \times 5.400 \operatorname{cosec} 69^\circ = 33.351 \text{ m}^2$$

1.07112

$$A_b = 2.650 \times 4.8 \operatorname{cosec} 69^\circ \times 2 = 27.249$$

$$A_c' = 2.600 \times 2.650 - 2.000 \times 2.000 + 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 2.93$$

$$A_c = 2.93 \operatorname{cosec} 69^\circ \times 2 = 6.277$$

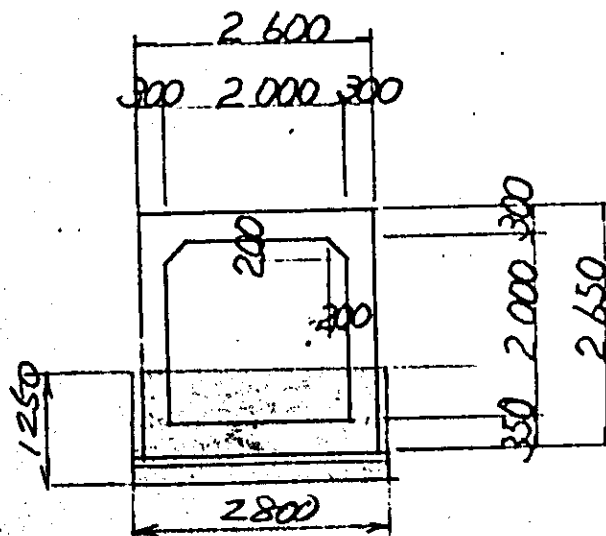
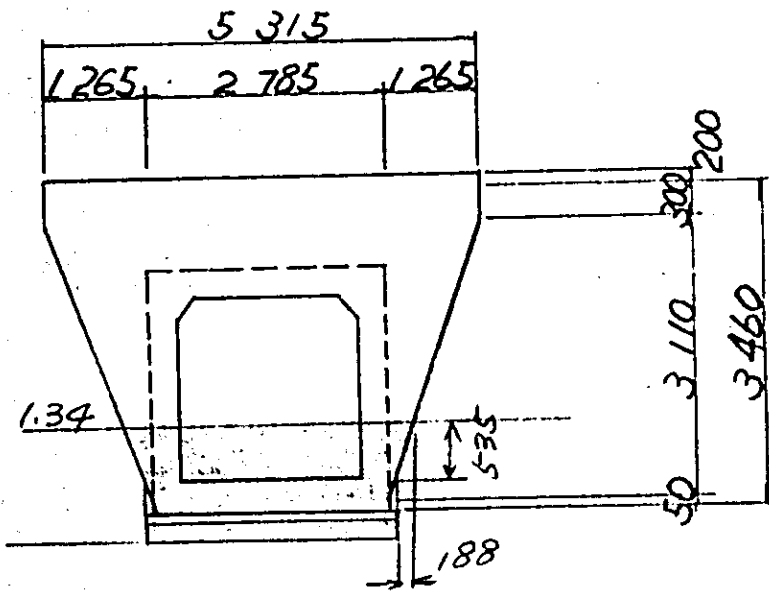
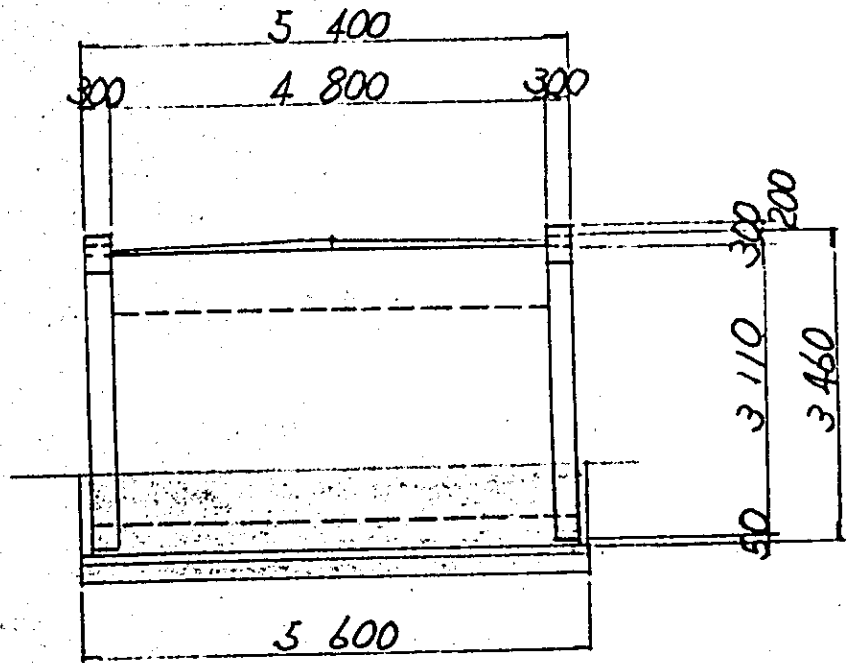
$$66.877$$

2. WING

$$A_d' = (0.05 + 3.357 + 0.500) \times 0.300 \times 2 = 2.344$$

$$A_e' = \left\{ (0.500 + 3.610) \times \frac{1}{2} \times 1.265 \times 2 + 2.785 \times 1.010 \right\} \times 2 = 16.024$$

$$A = (2.344 + 16.024) \times 2 = 36.736 \text{ m}^2$$



GRADING CONCRETE

$$V = \frac{1}{2}(0.04 + 0.10) \times 4.8 \times 2.785 = 0.936$$

LEVELING CONCRETE

$$V = 2.800 \times 0.100 \times 5.600 \operatorname{cosec} 69^\circ = 1.680$$

AGGREGATE SUB BASE

$$V = 2.800 \times 0.200 \times 5.600 \operatorname{cosec} 69^\circ = 3.359$$

EXCAVATION

$$V_a = 2.800 \times 1.250 \times 5.600 \operatorname{cosec} 69^\circ = 20.994$$

$$V_b = 0.188 \times 0.535 \times \frac{1}{2} \times 0.400 \times 2 = 0.04$$

$$V_b = 0.04 \times 2 = 0.08$$

$$21.074$$

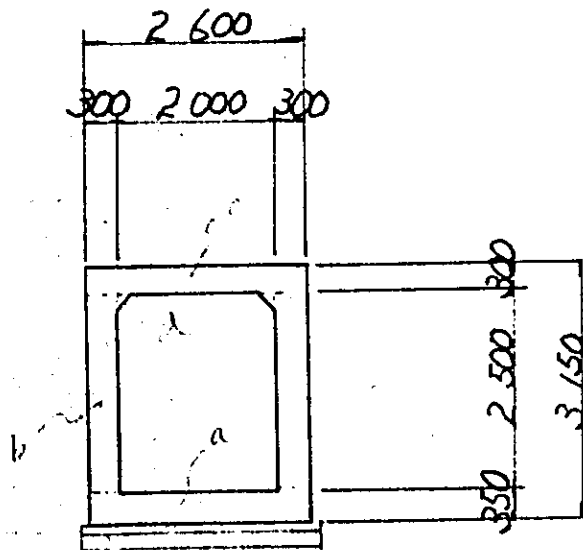
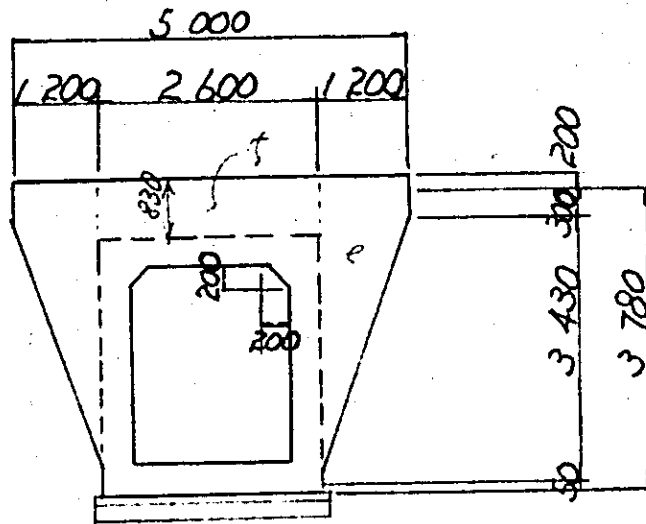
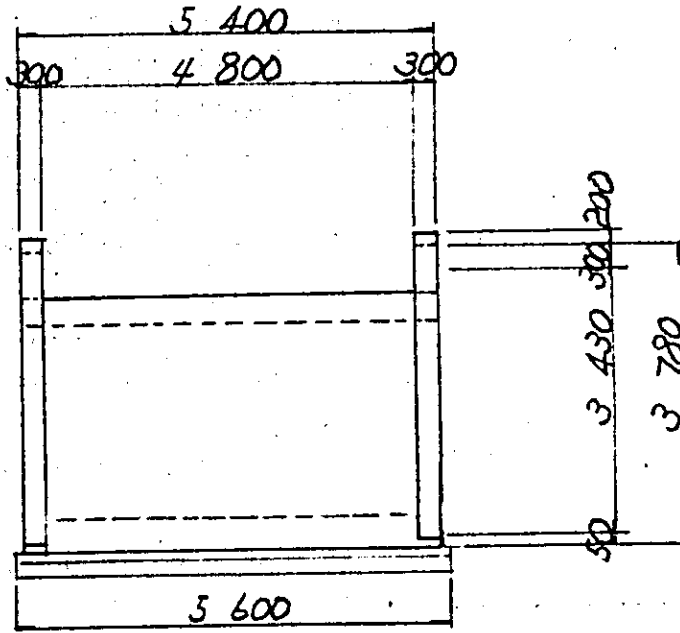
28.

Cb 25

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	4.5	34.9	423.9	94.2
TOTAL	21.9	108.1	2207.4	100.8

	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	18.1	



CONCRETE VOLUME

1. BOX CULVERT

$$\begin{aligned}
 V_a &= 2.600 \times 0.350 \times 5.400 &= 4.914 \text{ m}^3 \\
 V_b &= 0.300 \times 2.500 \times 5.400 \times 2 &= 8.100 \text{ m}^3 \\
 V_c &= 2.600 \times 0.300 \times 5.400 &= 4.212 \text{ m}^3 \\
 V_d &= 0.200 \times 0.200 \times \frac{1}{2} \times 5.400 \times 2 &= 0.216 \text{ m}^3
 \end{aligned}$$

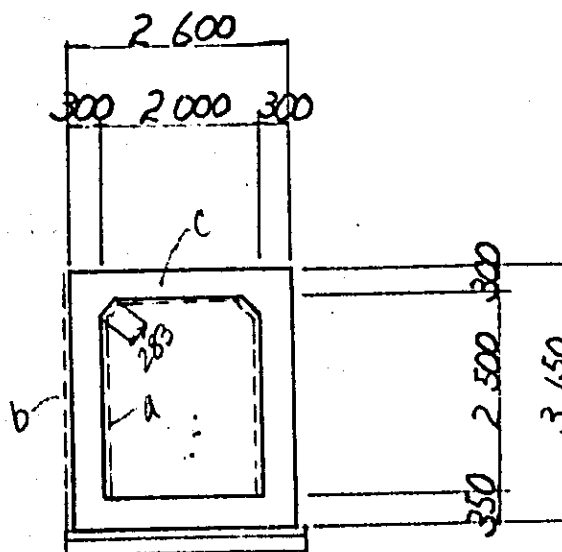
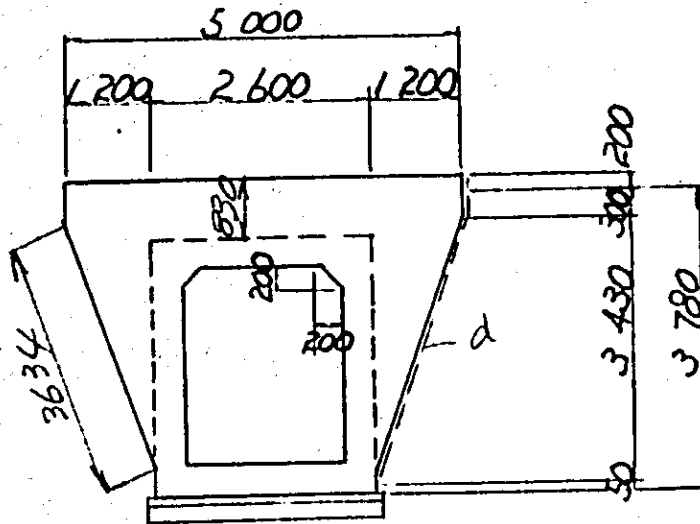
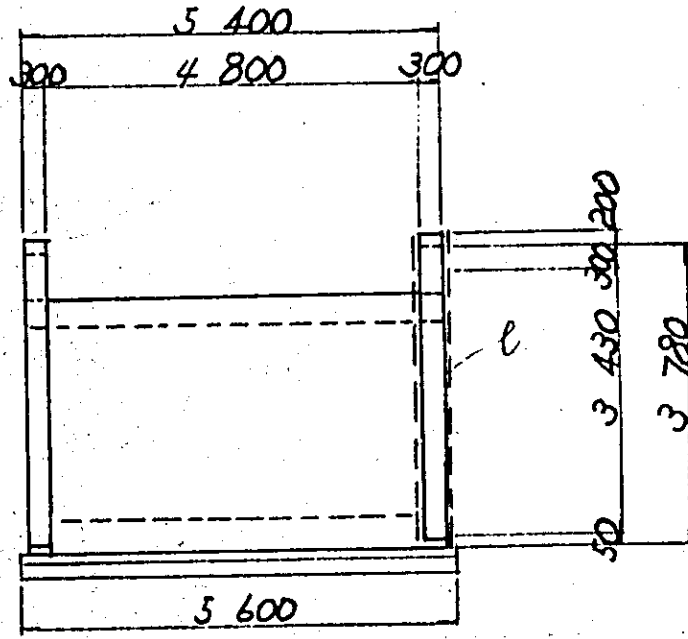
$$17.442 \text{ m}^3$$

2. WING

$$\begin{aligned}
 V_{e'} &= (0.500 + 3.930) \times \frac{1}{2} \times 1.200 \\
 &\quad \times 0.300 \times 2 = 1.595
 \end{aligned}$$

$$V_{f'} = 2.600 \times 0.830 \times 0.300 = 0.647$$

$$V = (1.595 + 0.647) \times 2 = 4.484 \text{ m}^3$$



FORM AREA

1. BOX CULVERT

$$A_a = \{(2.300 + 0.283) \times 2 + 1.600\} \times 5.400 = 36.536 \text{ m}^2$$

$$A_b = 3.150 \times 4.800 \times 2 = 30.24 \text{ m}^2$$

$$A_c' = 2.600 \times 3.150 - 2.000 \times 2.500 \\ + 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 3.23$$

$$A_c = 3.23 \times 2 = 6.46 \text{ m}^2$$

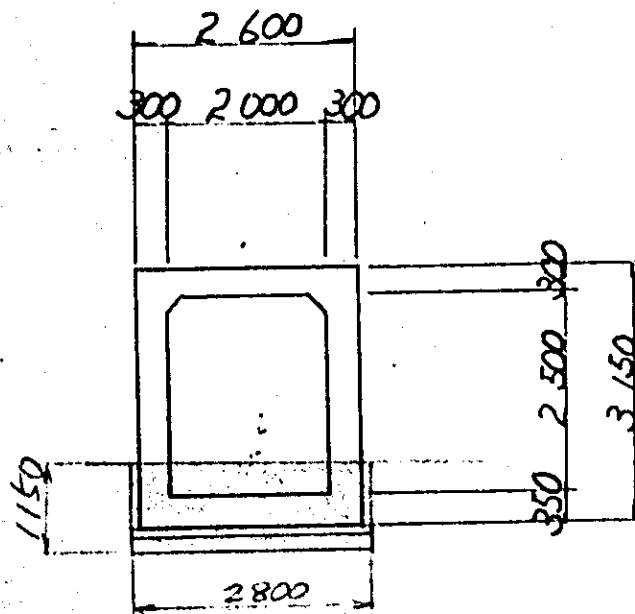
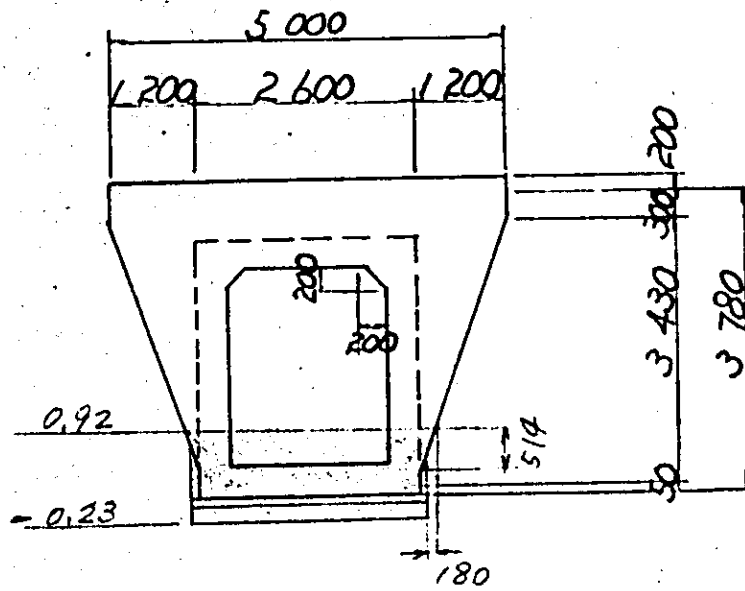
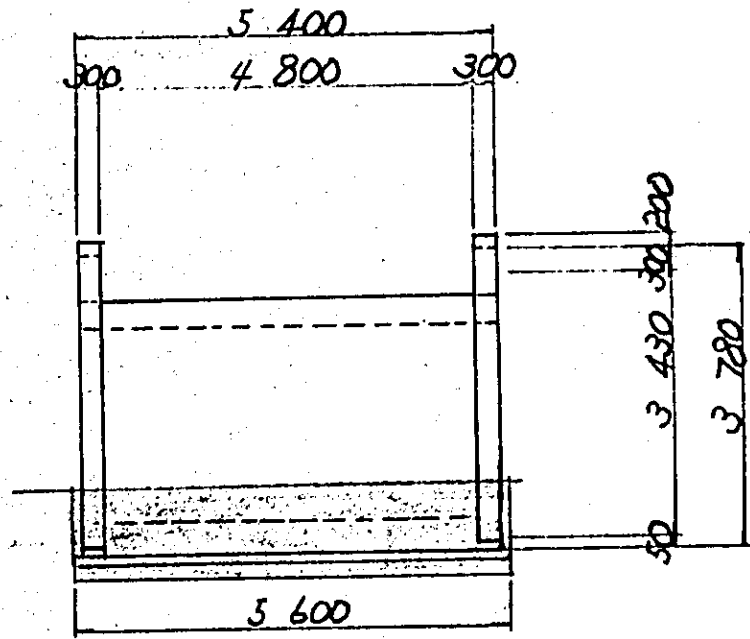
$$73.236 \text{ m}^2$$

2. WING

$$A_d' = (0.050 + 3.634 + 0.500) \\ \times 0.300 \times 2 = 2.510$$

$$A_e' = \{(0.500 + 3.930) \times \frac{1}{2} \times 1.200 \times 2 \\ + 2.600 \times 0.830\} \times 2 = 14.948$$

$$A = (2.510 + 14.948) \times 2 = 34.916 \text{ m}^2$$



GRADING CONCRETE

$$V = \frac{1}{2}(0.04 + 0.10) \times 4.800 \times 2.600 = 0.874 \text{ m}^3$$

LEVELING CONCRETE

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

AGGREGATE SUB BASE

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

EXCAVATION

$$V_a = 2.800 \times 1.150 \times 5.600 = 18.032 \text{ m}^3$$

$$V_b' = 0.180 \times 0.514 \times \frac{1}{2} \times 0.50 \times 2 = 0.046 \text{ m}^3$$

$$V_b = 0.046 \times 2 = 0.092 \text{ m}^3$$

$$18.124 \text{ m}^3$$

29.

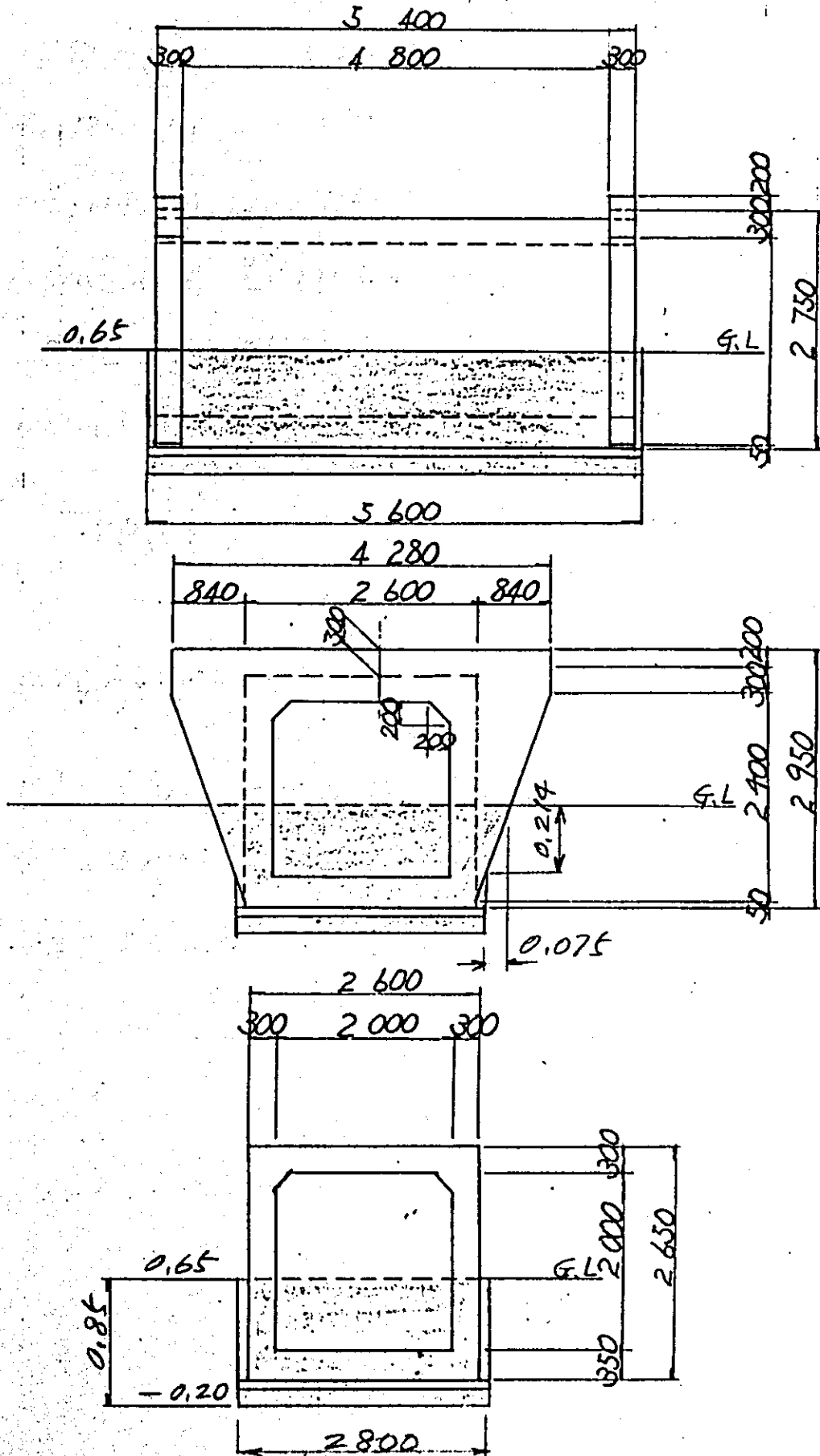
Cb26

REFER. TO Cb 02

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	13.3	



CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

refer to C06

EXCAVATION

$$V_a = 2.800 \times 0.850 \times 5.600 = 13.328 \text{ m}^3$$

$$V_b' = 0.075 \times 0.214 \times \frac{1}{2} \times 0.500 \times 2 = 0.008$$

$$V_b = 0.008 \times 2 = 0.016$$

$$13.344$$

30.

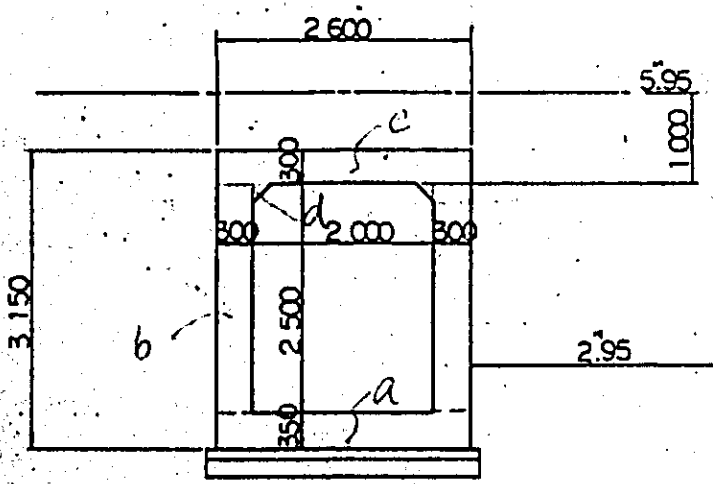
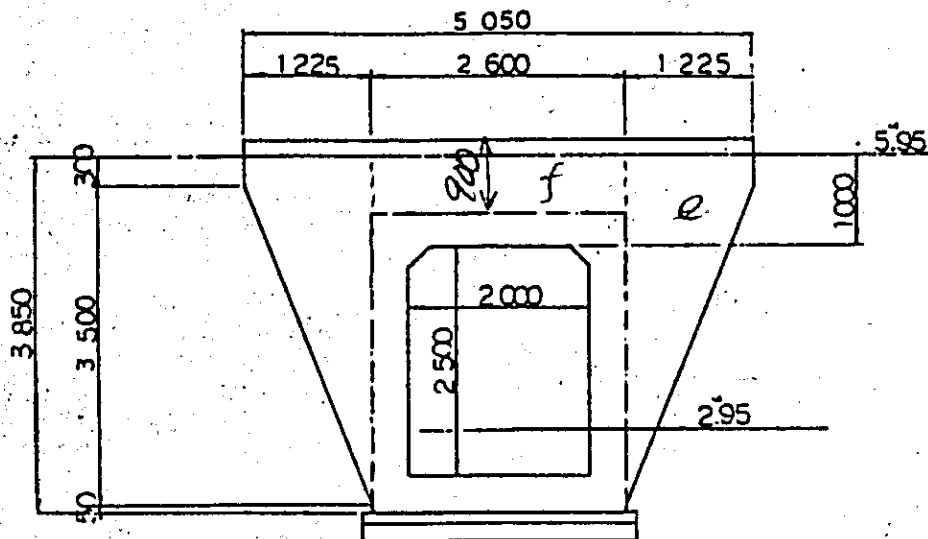
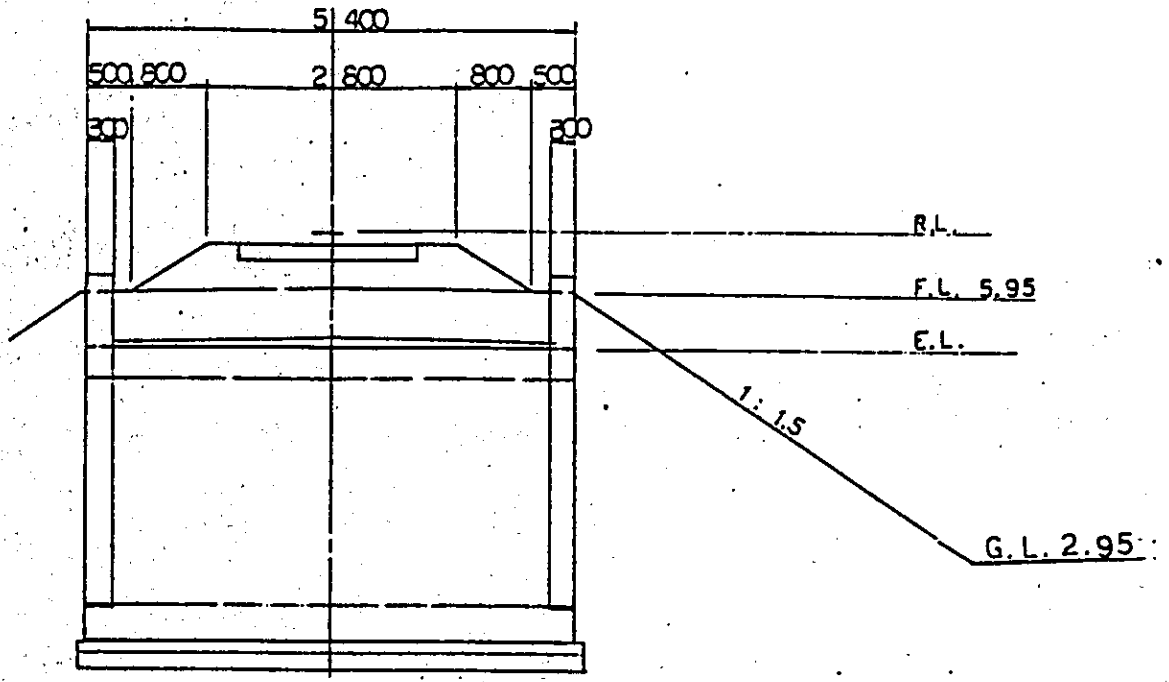
Cb 27

REFER. TO Cb 02

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	4.7	36.5	442.7	94.2
TOTAL	22.1	109.7	2226.2	100.7

	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	18.1	



CONCRETE VOLUME

1. BOX CULVERT

$$V_a = 2,600 \times 0,35 \times 5,400 = 4,914 \text{ m}^3$$

$$V_b = 0,300 \times 2,500 \times 5,400 \times 2 = 8,100 \text{ m}^3$$

$$V_c = 2,600 \times 0,300 \times 5,400 = 4,212 \text{ m}^3$$

$$V_d = 0,200 \times 0,200 \times \frac{1}{2} \times 5,400 \times 2 = 0,216 \text{ m}^3$$

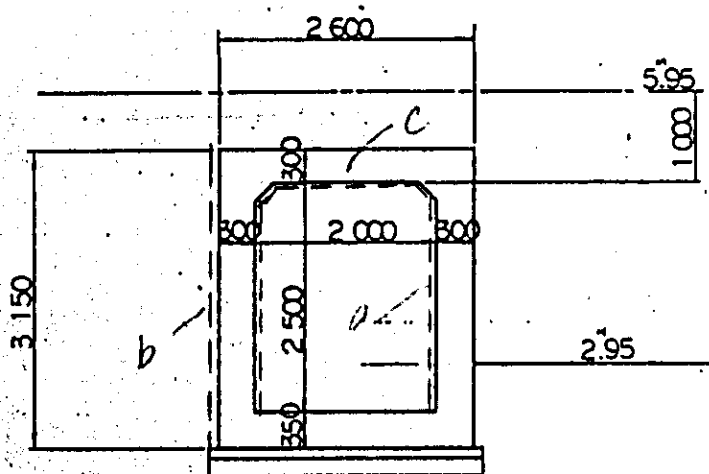
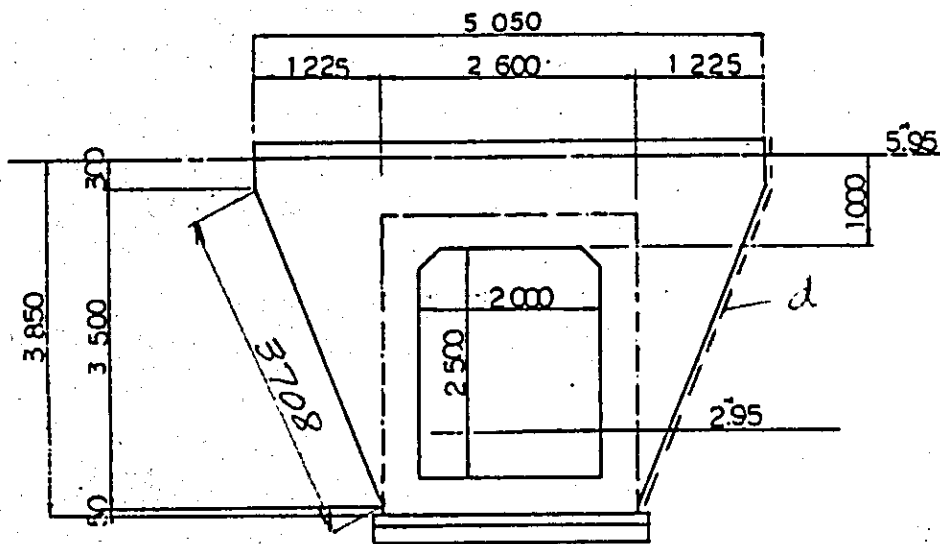
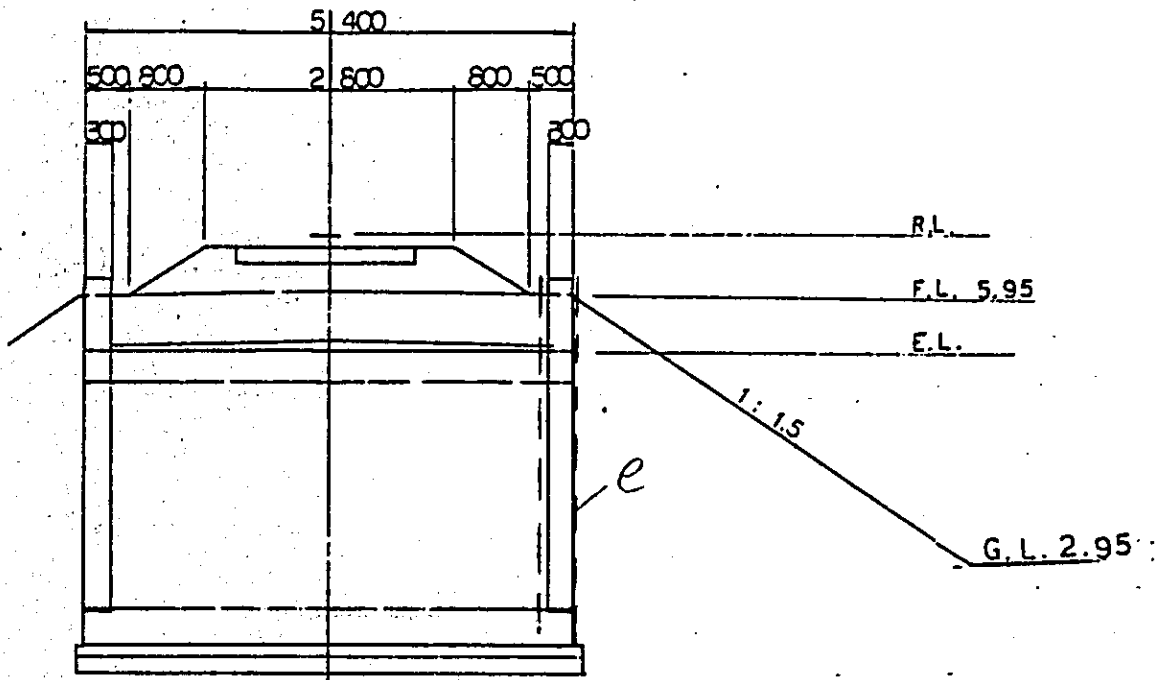
$$17,442 \text{ m}^3$$

2. WING

$$V_{e'} = (0,500 + 4,0) \times \frac{1}{2} \times 1,225 \\ \times 0,300 \times 2 = 1,653$$

$$V_{f'} = 2,600 \times 0,300 \times 0,900 = 0,702$$

$$V = (1,653 + 0,702) \times 2 = 4,71 \text{ m}^3$$



FORM AREA

1. BOX CULVERT

$$A_a = \{(2,300 + 0.283) \times 2 + 1,600\} \times 5,400 = 36,536 \text{ m}^2$$

$$A_b = 3,150 \times 4,800 \times 2 = 30,240 \text{ m}^2$$

$$A_c' = 2,600 \times 3,150 - 2,000 \times 2,500 \\ + 0.200 \times 0.200 \times \frac{1}{2} \times 2 = 3,23$$

$$A_c = 3,23 \times 2 = 6.46 \text{ m}^2$$

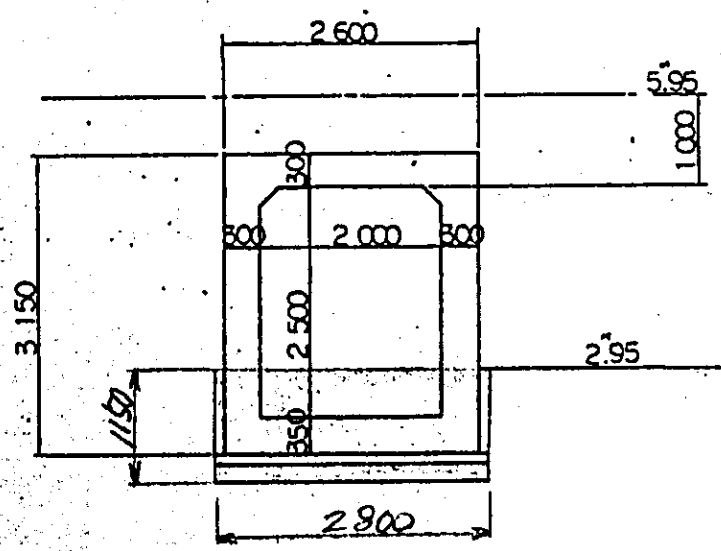
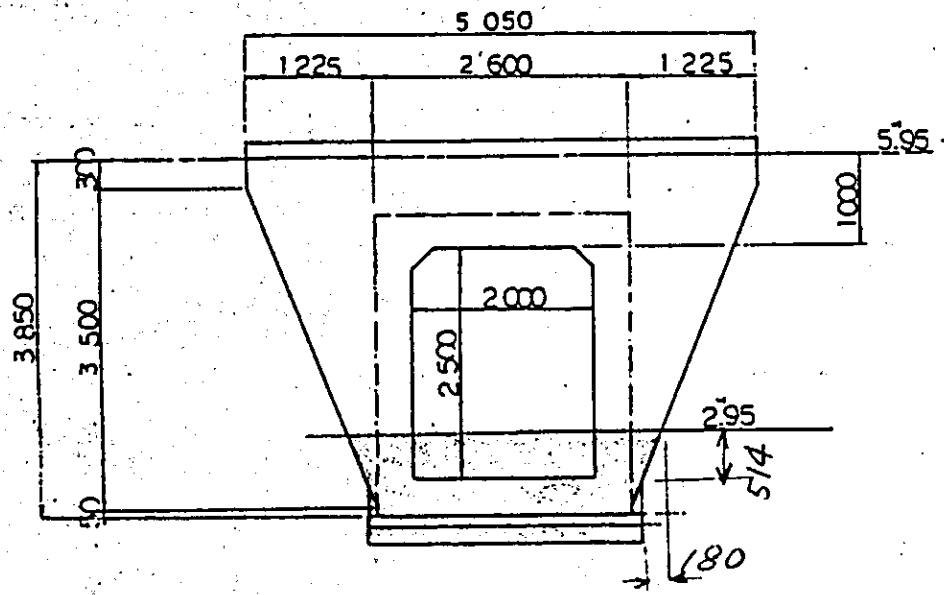
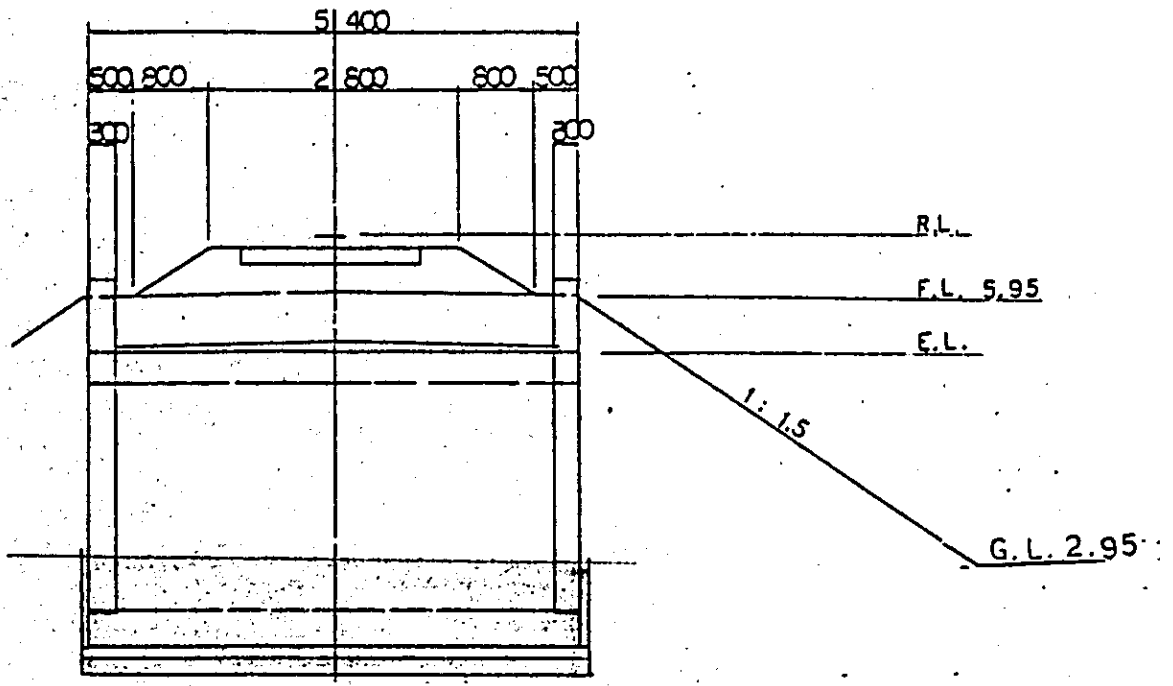
$$73,236 \text{ m}^2$$

2. WING

$$A_d' = (0.050 + 3,708 + 0.500) \\ \times 0.300 \times 2 = 2,555$$

$$A_e' = \{(0.500 + 4,000) \times \frac{1}{2} \times 1,225 \times 2 \\ + 2,600 \times 0.900\} \times 2 = 15,705$$

$$A = (2,555 + 15,705) \times 2 = 36.52 \text{ m}^2$$



GRADING CONCRETE

$$V = \frac{1}{2}(0.04 + 0.10) \times 4.800 \times 2.600 = 0.874 \text{ m}^3$$

LEVELING CONCRETE

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

AGGREGATE SUB BASE

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

EXCAVATION

$$V_a = 2.800 \times 1.150 \times 5.600 = 18.032 \text{ m}^3$$

$$V_b' = 0.180 \times 0.514 \times \frac{1}{2} \times 0.40 \times 2 = 0.037$$

$$V_b = 0.037 \times 2 = 0.074$$

$$18.106$$

31.

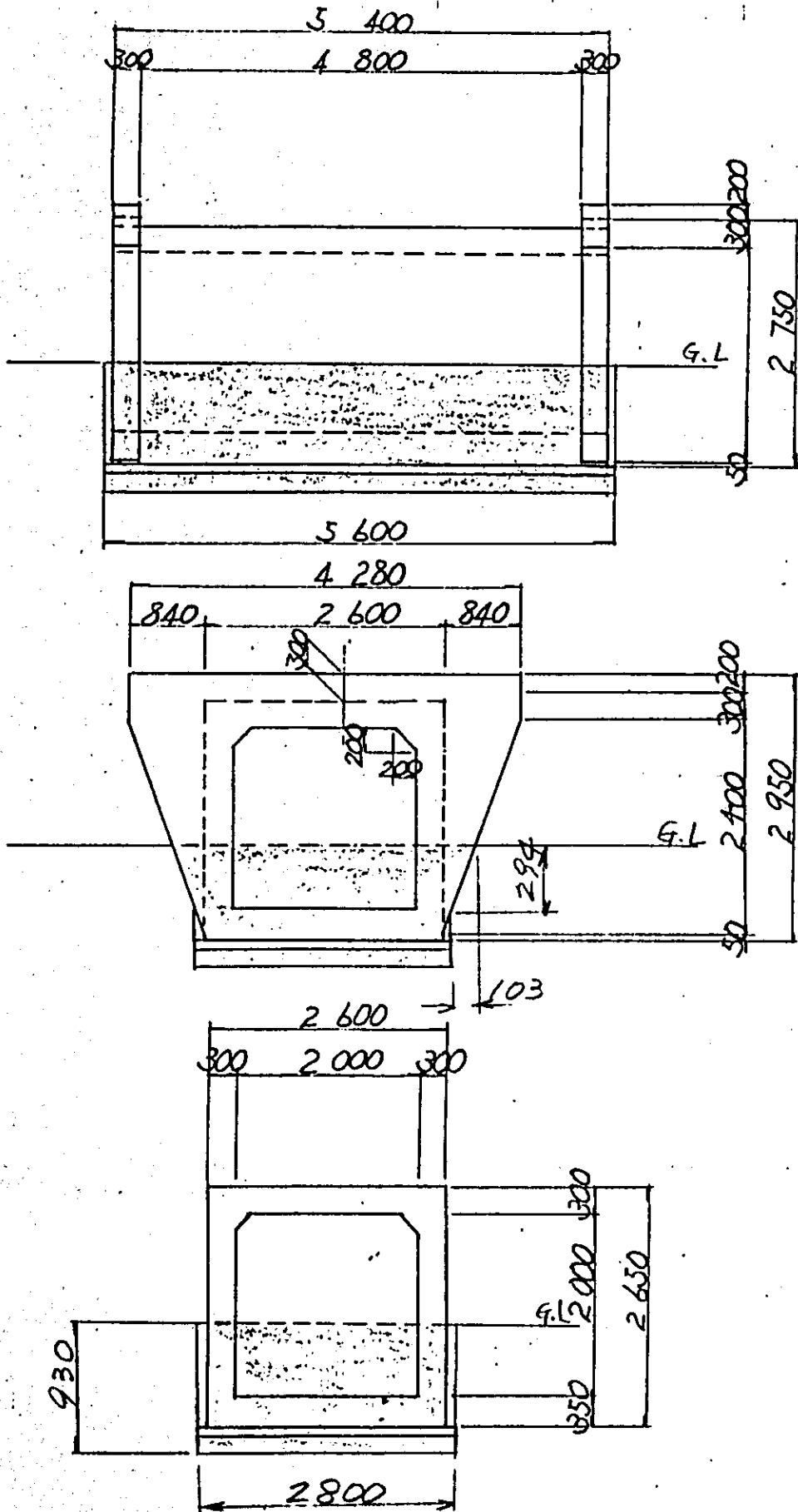
Cb28

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	14.6	



CONCRETE VOLUME

FORM AREA

REINFORCING BAR

GRADING CONCRETE

LEVELING CONCRETE

AGGREGATE SUB BASE

Refer to C06

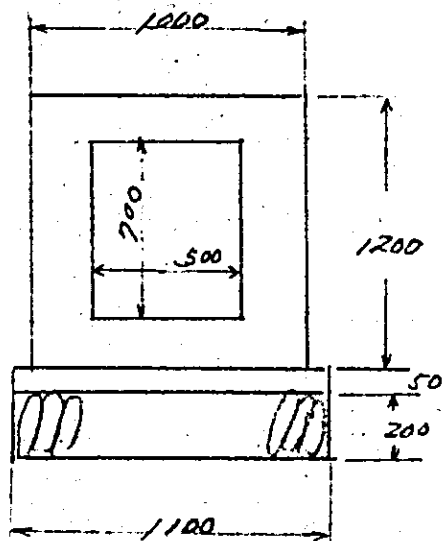
EXCAVATION

$$V_a = 2.800 \times 0.930 \times 5.600 = 14.582 \text{ m}^3$$

$$V_b = 0.103 \times 0.294 \times \frac{1}{2} \times 0.500 \times 2 = 0.015$$

$$V_b = 0.015 \times 2 = 0.030$$

$$14.612$$

32. BOX CULVERT - 0^K050^M

AREA

$$A = (1.0 \times 1.2) - (0.7 \times 0.5) \\ = 0.85 = 0.9 \text{ m}^2$$

BOX LENGTH

$$L = 22.0 + 24.8 = 46.8 \text{ m}$$

1) CONCRETE VOLUME (CLASS D)

$$V = 0.9 \text{ m}^2 \times 46.8 = 42.120 \text{ m}^3 \quad 42.1$$

2) CONCRETE VOLUME (CLASS F)

$$V = 0.05 \times 1.1 \times 46.8 = 2.574 \text{ m}^3 \quad 2.6$$

3) SUB BALLAST (ASB. - 3)

$$V = 0.2 \times 1.1 \times 46.8 = 10.296 \text{ m}^3 \quad 10.3$$

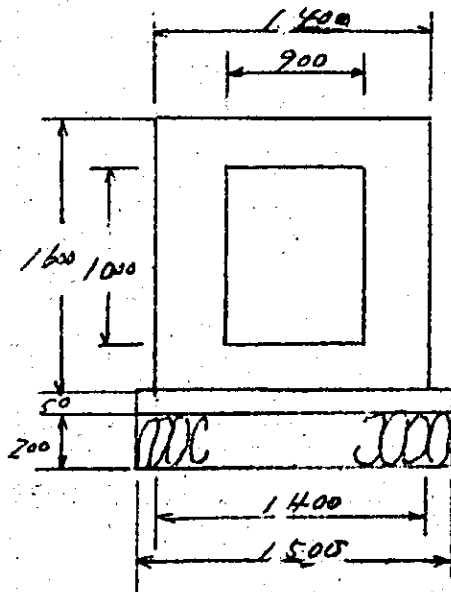
4) BAR WEIGHT

$$W = 70.6 \text{ kg} \times 46.8 = 3304.080 \text{ kg} \quad 3304.1$$

5) FORM AREA

$$(1.2 \times 2) + (0.7 \times 2) + (0.5 \times 2) \times 46.8 = 224.6 \text{ m}^2 \quad 224.6$$

33. BOX (OKM 170M)



SECTION AREA

$$A = (1.4 \times 1.6) - (1.0 \times 0.8)$$

$$= 1.44 = 1.44 \text{ m}^2$$

BOX LENGTH

$$L = 15.0 - 10.6 = 25.6 \text{ m}$$

1) CONCRETE VOLUME (CLASS D)

$$V = 1.4 \text{ m}^2 \times 25.6 = 35.84 \text{ m}^3$$

35.8^{m3}

2) CONCRETE VOLUME (CLASS. F)

$$V = (0.05 \times 1.5) \times 25.6 = 1.92$$

1.9^{m3}

3) SUB BALLAST (A.S.B.-3)

$$V = 0.2 \times 1.5 \times 25.6 = 7.68$$

7.7^{m3}

4) BAR WEIGHT

$$W = 97.6 \times 25.6 = 2498.56 \text{ kg}$$

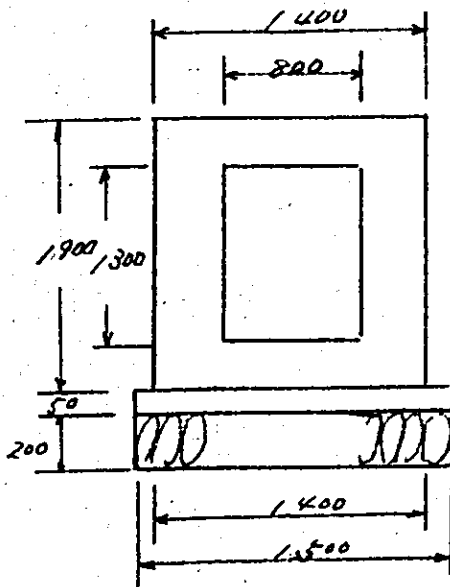
2498.6^{kg}

5) FORM AREA

$$[(1.6 \times 2) + (1.0 \times 2) + (0.9 \times 2)] \times 25.6$$

$$= 179.2 \text{ m}^2$$

179.2^{m2}

34. BOX CULVERT (1^{km} 574^m)

SECTION AREA

$$A = [(1.4 \times 1.9) - (1.3 \times 0.8)]$$

$$= 1.62 \text{ m}^2 = 1.64$$

BOX LENGTH

$$L = 87.0 \times 2 = 174.0 \text{ m}$$

1) CONCRETE VOLUME (CLASS D)

$$V = 1.6 \times 174.0 = 278.4 \text{ m}^3$$

278.4^{m³}

2) CONCRETE VOLUME (CLASS. F)

$$V = 0.05 \times 1.5 \times 174.0 = 13.05$$

13.1^{m³}

3) SUB BALLAST (AS. B-3)

$$V = (0.2 \times 1.5) \times 174.0 = 52.2 \text{ m}^3$$

52.2^{m³}

4) BAR WEIGHT

$$W = 113.9 \times 174.0 = 19818.6$$

19818.6^{kg}

5) FORM AREA

$$A = [(1.9 \times 2) + (1.3 \times 2) + (1.8 \times 2)] \times 174 = 1392.0 \text{ m}^2$$

1392.0^{m²}

§17 LEVEL CROSSING
AND
RELOCATION ROAD

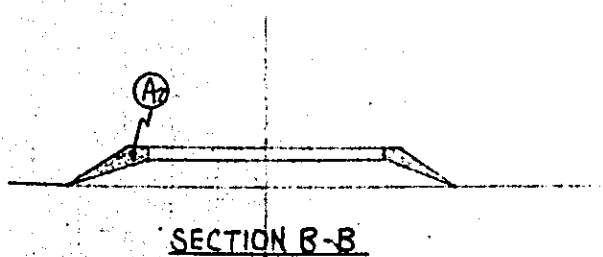
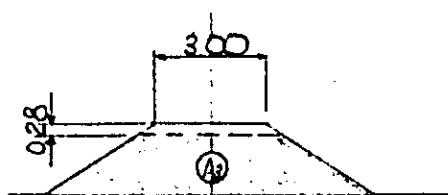
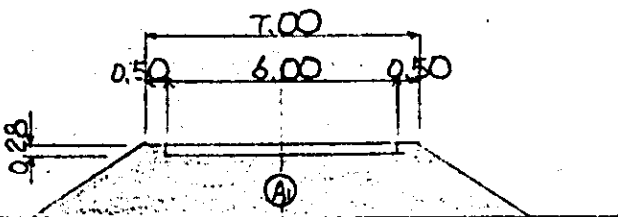
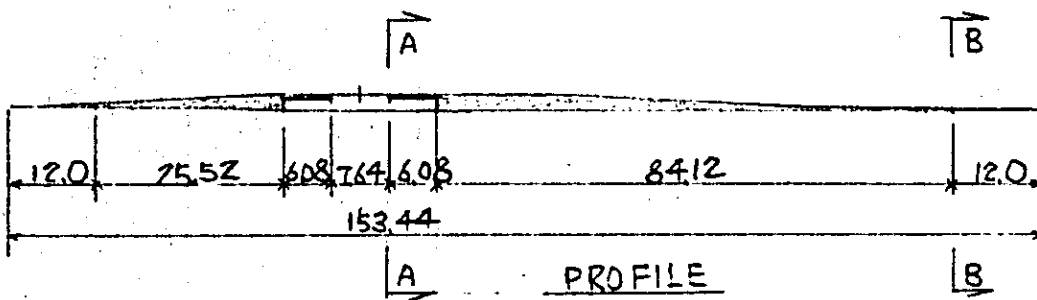
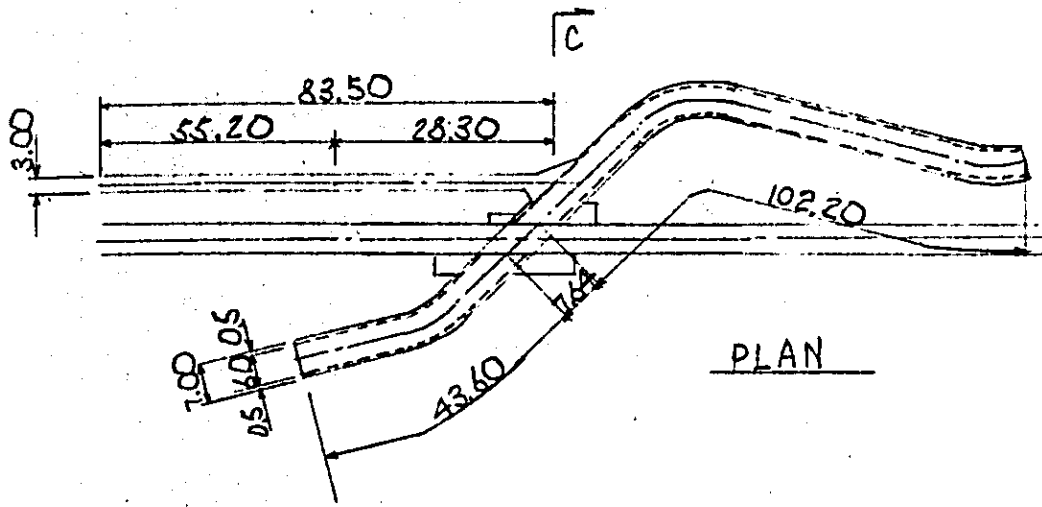
LEVEL CROSSING, RELOCATION OF ROAD

QUANTITY CALCULATION SHEET

	PAVEMENT (m ²) TYPE-C		EMBANKMENT (m ³)	DESIGN EXCAVATION (m ³)	SURPLUS SOILS (m ³)	BACK FILLING (m ³)	CONCRETE (CLASS D) (m ³)	SIDE DITCH				EXPANSION JOINTS (m ²)
	TRACK AT-GRADE	ELEVATED TRACK						FORM AREA (m ²)	AGGREGATE SUB-BASE-3 (m ³)	REINFORCING BAR SR-24 (FT)		
LC03	1136.3		1129									
04	438.5		334	24	18	6						
05	103.8		64									
06	142.1		170									
07	97.1		58									
08	365.9		149									
09	154.0		75									
10	548.6		1137	921	550	371						
11	599.9		1114	893	569	324						
12	871.6		987									
13	334.3		166									
14	437.3		668									
15	2385.4		342	453	405	48	178.8	853.3	69.8	3097	17.2	
RO 1	176.0											
2	238.8											
3	67.3											
4	42.0											
5	445.5											
6	385.0											
7	324.0											
8	550.7	1214.4										
9	450.0	144.4										
TOTAL	10294	1359	6393	2291	1542	749	179	853	70	3097	17	

	RETAINING WALL TYPE-1			RETAINING WALL TYPE-2					GUARDRAIL (M)	
	CONCRETE (CLASS E) (M ³)	FORM AREA (M ²)	AGGREGATE SUB-BASE -3 (M ³)	CONCRETE (CLASS E) (M ³)	FORM AREA (M ²)	AGGREGATE SUB-BASE -3 (M ³)	GRANULAR BACKFILL (M ³)	EXPANSION JOINTS (M ²)		U.P.V.C (EACH)
IC 03	13.4	65.7	2.2							80
04	9.3	45.7	1.5	21.0	49.1	4.0	2.6		5	80
05	7.7	37.6	1.3							69
06	9.5	46.3	1.5							80
07	7.7	37.6	1.3							65
08	9.5	46.3	1.5							80
09	8.0	39.1	1.3							80
10	21.6	102.1	3.4	484.7	782.3	56.6	72.9	35.3	117	80
11	21.3	100.8	3.3	477.1	776.0	55.8	71.7	40.4	117	80
12	14.0	68.5	2.3							80
13	11.6	56.7	1.9							80
14	10.7	52.6	1.8							80
15	10.2	49.8	1.7							76
TOTAL	155	749	25	983	1607	116	147	76	239	1010

LC 03



$$A_1 = 17.417 \text{ m}^2$$

$$A_2 = 0.549$$

$$A_3 = 10.420$$

$$\text{PAVEMENT } L_1 = 153.44 - 7.64 = 145.80^m$$

$$L_2 = 83.50^m$$

PAVEMENT AREA

$$A_1 = 6.00 \times 145.80 = 874.8^m^2$$

$$A_2 = 3.00 \times 83.50 + 0.50 \times 10.00 + 3.0 \times 2.0 \times \frac{1}{2} \times 2$$

$$= 261.5^m^2$$

TOTAL A

$$= 1136.3^m^2$$

EMBANKMENT

$$V_1 = (17.417 + 0.549) \times 109.64 \times \frac{1}{2} - 2.78 \times 1.31 \times \frac{1}{2} \times 9.90$$

$$\times 2 = 948.842$$

$$V_2 = (0.549 + 0) \times 24.0 \times \frac{1}{2} = 6.588$$

$$V_3 = (7.0 \times 0.62 - 6.0 \times 0.28) \times 12.16 = 32.346$$

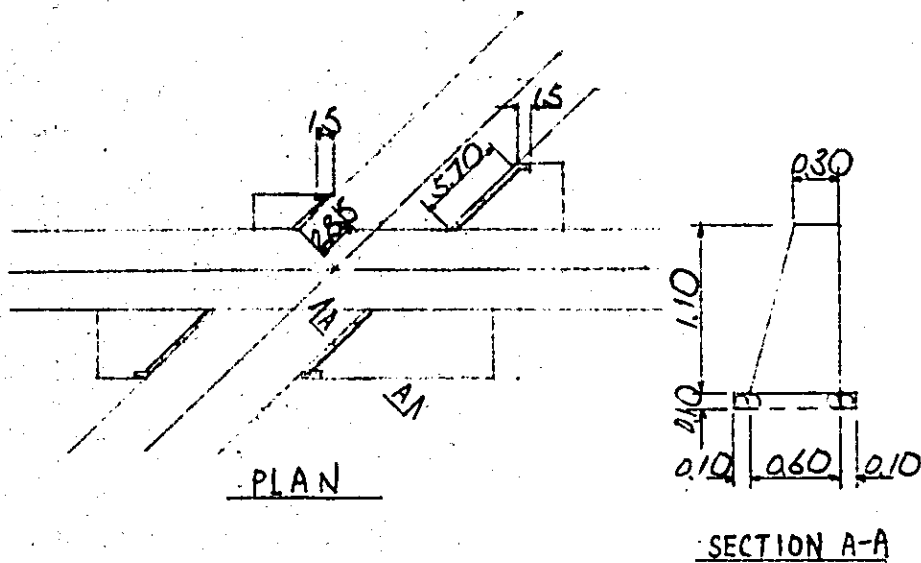
$$V_4 = (10.42 + 0) \times 28.30 \times \frac{1}{2} - 2.48 \times 1.65 \times \frac{1}{2} \times 3.0$$

$$= 141.305$$

TOTAL V

$$= 1129^m^3$$

RETAINING WALL TYPE 1.



$$L = (7.20 \times 3 + 4.35) = 25.95 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 25.95 + 0.30 \times 1.10 \times \frac{1}{2} \times 0.85 \times 4 = 13.4 \text{ m}^3$$

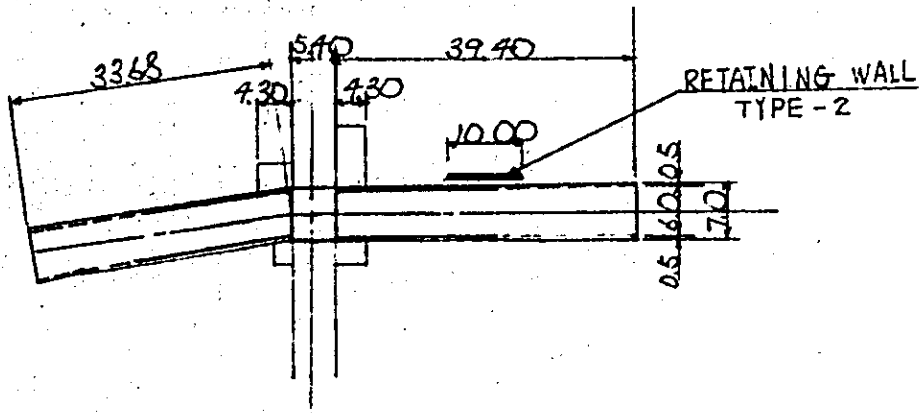
FORM AREA

$$A = (0.42 + 0.85) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{0.30^2 + 1.10^2}) \times 25.95 + (1.14 \times 0.85 - 0.42 \times 1.10) \times 4 = 65.7 \text{ m}^2$$

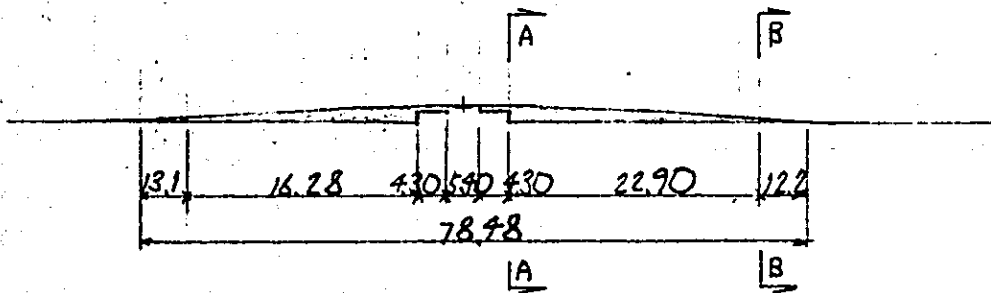
AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 25.95 + (0.90 \times 0.99 - 0.90 \times 0.14) \times 0.10 \times 4 = 2.2 \text{ m}^3$$

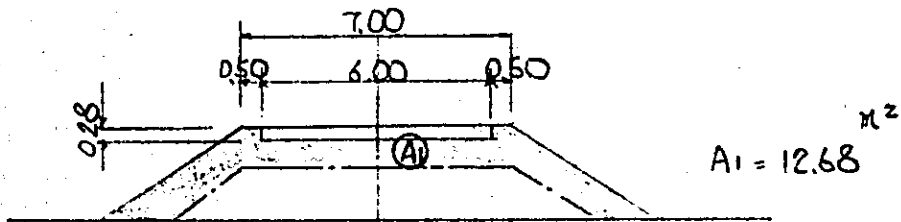
LC 04



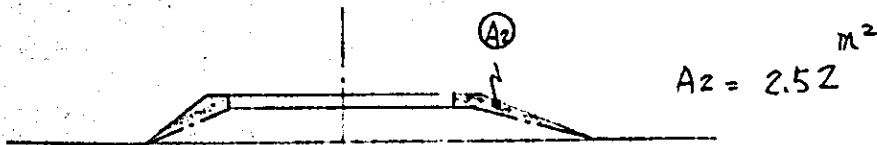
PLAN



PROFILE



SECTION A-A



SECTION B-B

PAVEMENT L = 78.48 - 5.40 = 73.08 m

PAVEMENT AREA

$$A = 6.00 \times 73.08 = 438.5 \text{ m}^2$$

EMBANKMENT

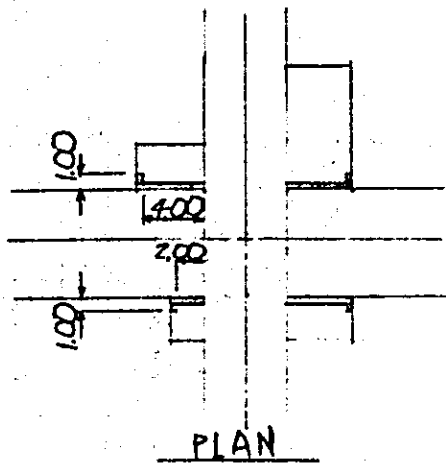
$$V_1 = (12.68 + 2.52) \times 39.18 \times \frac{1}{2} - \left\{ (2.58 \times 1.72 \times \frac{1}{2} - 1.50 \times 1.17 \times \frac{1}{2}) \right\} \\ \times 7.0 \times 2 = 278.994$$

$$V_2 = (2.52 + 0) \times \frac{1}{2} \times 25.3 = 31.878$$

$$V_3 = (7.0 \times 0.62 - 6.0 \times 0.28) \times 8.60 = 22.876$$

$$\text{TOTAL } V = 334 \text{ m}^3$$

RETAINING WALL TYPE-1



$$L = (5.00 \times 3 + 3.00) = 18.00 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 18.00 +$$

$$+ 0.30 \times 1.10 \times \frac{1}{2} \times 0.6 \times 4 = 9.3 \text{ m}^3$$

FORM AREA

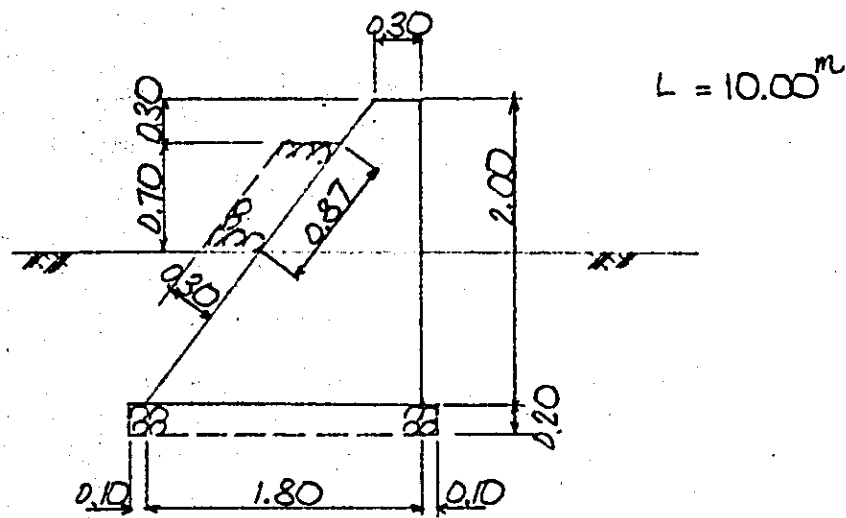
$$A = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{0.30^2 + 1.10^2})$$

$$\times 18.00 + (1.14 \times 0.60 - 0.30 \times 1.10) \times 4 = 45.7 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 18.00 + (0.4 \times 0.7 - 0.4 \times 0.1) \times 0.1 \times 4 = 1.5 \text{ m}^3$$

RETAINING WALL TYPE - 2



CONCRETE VOLUME

$$V = (0.30 + 1.80) \times 2.00 \times \frac{1}{2} \times 10.00 = 21.0 \text{ m}^3$$

FORM AREA

$$A = (0.30 + 1.80) \times 2.00 \times \frac{1}{2} \times 2 + (2.00 + \sqrt{1.50^2 + 2.00^2}) \times 10.00 = 49.1 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 2.00 \times 0.20 \times 10.00 = 4.0 \text{ m}^3$$

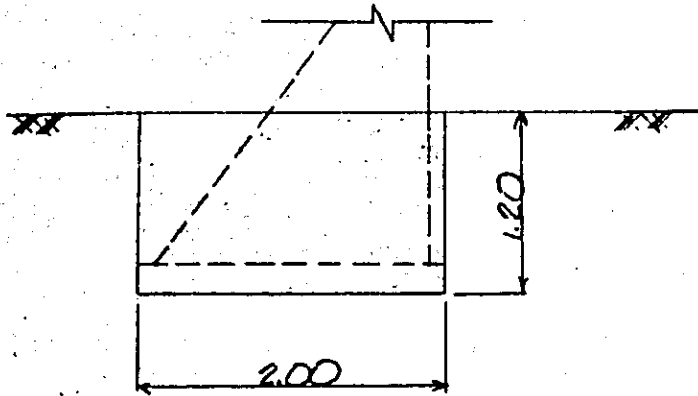
GRANULAR BACKFILL

$$V = 0.30 \times 0.87 \times 10.00 = 2.6 \text{ m}^3$$

U.P.V.C

$$= 5$$

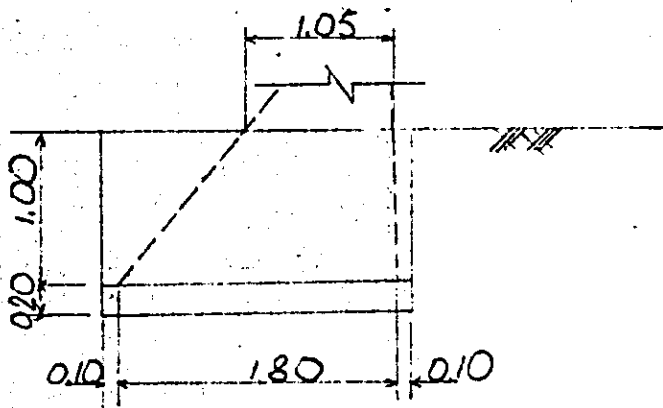
DESIGN EXCA



$$V = 2.00 \times 1.20 \times 10.00$$

$$= 24 \text{ m}^3$$

SURPLUSOILS



$$V = \left\{ 2.00 \times 0.20 + (1.05 + 1.80) \times 1.00 \times \frac{1}{2} \right\} \times 10.0 =$$

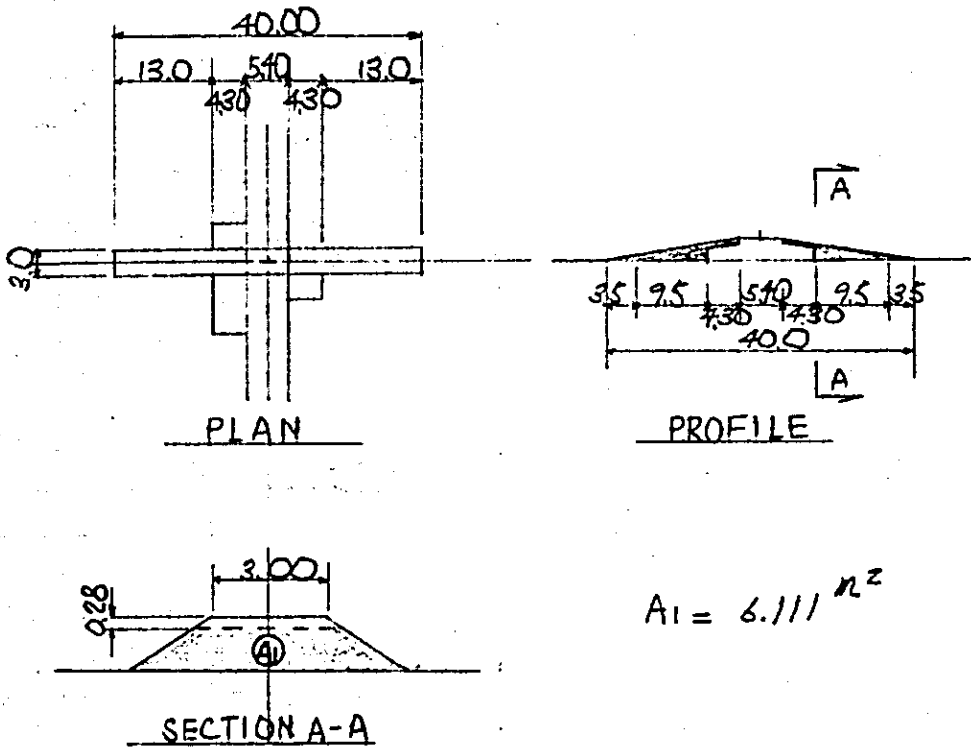
$$18 \text{ m}^3$$

BACK FILLING

$$V = 24 - 18$$

$$6 \text{ m}^3$$

LC 05



$$A_1 = 6.111 \text{ m}^2$$

PAVEMENT $L = 40.0 - 5.40 = 34.60 \text{ m}$

PAVEMENT AREA

$$A = 3.00 \times 34.60$$

$$= 103.8 \text{ m}^2$$

EMBANKMENT

$$V_1 = (6.111 + 0) \times 19.0 \times \frac{1}{2} - 0.77 \times 1.16 \times \frac{1}{2} \times 3.00 \times 2$$

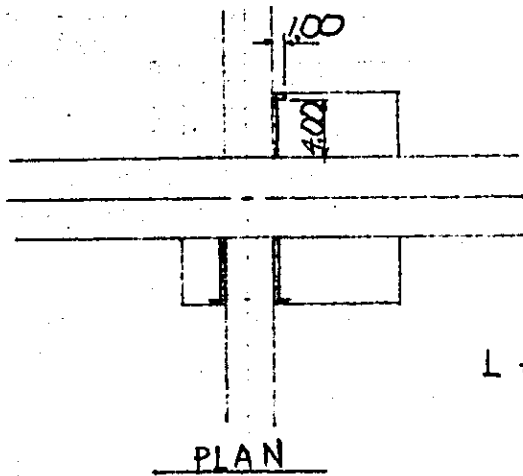
$$= 55.375$$

$$V_2 = (3.00 \times 0.62 - 3.00 \times 0.28) \times 8.60 = 8.772$$

TOTAL V

$$= 64 \text{ m}^3$$

RETAINING WALL TYPE-1



$$L = 5.00 \times 3 = 15.00 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 15.0 + 0.3 \times 1.10 \times \frac{1}{2} \times 0.6 \times 3 = 7.7 \text{ m}^3$$

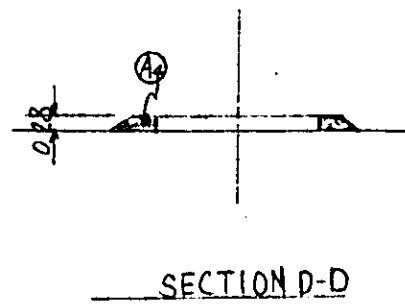
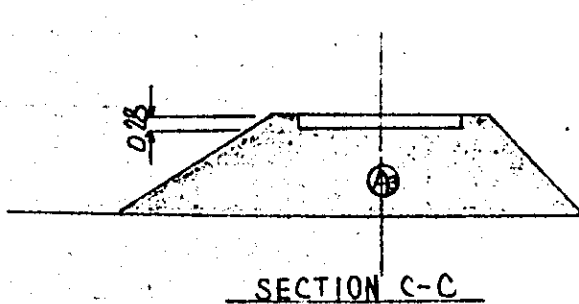
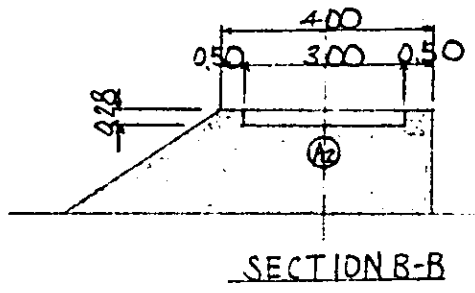
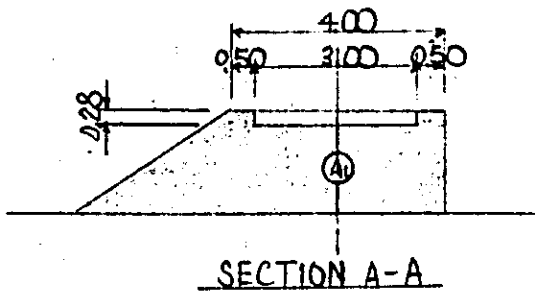
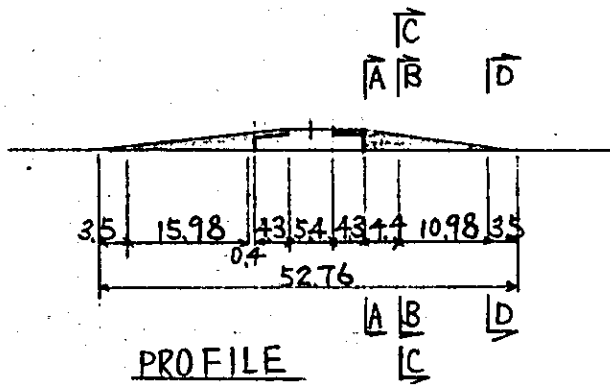
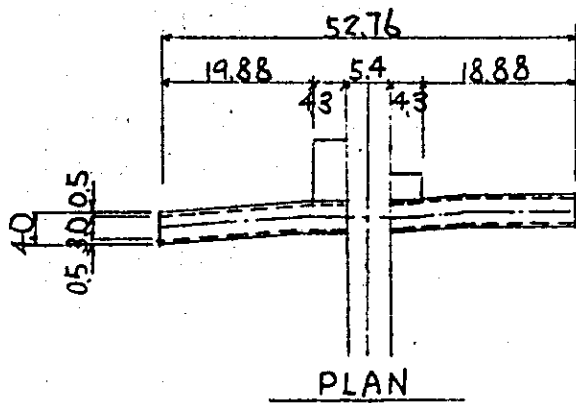
FORM AREA

$$A = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 6 + (1.10 + \sqrt{1.10^2 + 0.3^2}) \times 15.0 + (1.14 \times 0.60 - 0.30 \times 1.10) \times 3 = 37.6 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 15.0 + (0.7 \times 0.7 - 0.7 \times 0.1) \times 0.1 \times 3 = 1.3 \text{ m}^3$$

LC 06



$A_1 = 9.609 \text{ m}^2$

$A_2 = 7.48 \text{ m}^2$

$A_3 = 8.760 \text{ ''}$

$A_4 = 0.398 \text{ '}$

$$\text{PAVEMENT } L = 52.76 - 540 = 47.36^m$$

PAVEMENT AREA

$$A = 3.00 \times 47.36 = 142.1^m^2$$

EMBANKMENT

$$V_1 = (9.609 + 7.48) \times 4.80 \times \frac{1}{2} - 1.95 \times 1.30 \times \frac{1}{2} \times 4.00 \times 2$$

$$= 30.874$$

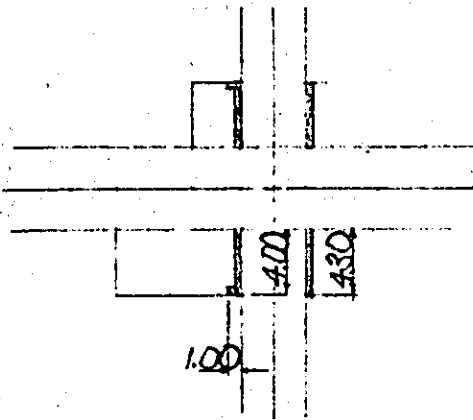
$$V_2 = (8.76 + 0.398) \times 26.96 \times \frac{1}{2} = 123.450$$

$$V_3 = (0.398 + 0) \times 7.00 \times \frac{1}{2} = 1.383$$

$$V_4 = (4.00 \times 0.62 - 3.00 \times 0.28) \times 8.60 = 14.104$$

$$\text{TOTAL } V = 170^m^3$$

RETAINING WALL TYPE-1

PLAN

$$L = (5.00 + 4.30) \times 2 \\ = 18.60 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 18.80 \\ + 0.30 \times 1.10 \times \frac{1}{2} \times 0.60 \times 2 = 9.5 \text{ m}^3$$

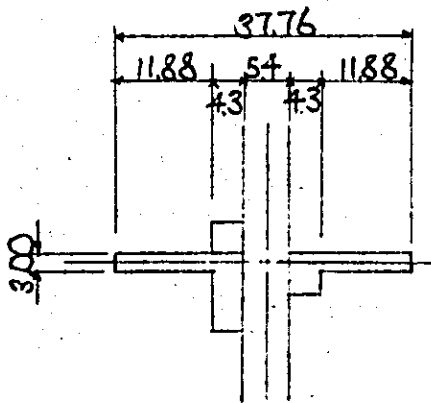
FORM AREA

$$A = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \\ \times 18.60 + (1.14 \times 0.60 - 0.30 \times 1.10) \times 2 = 46.3 \text{ m}^2$$

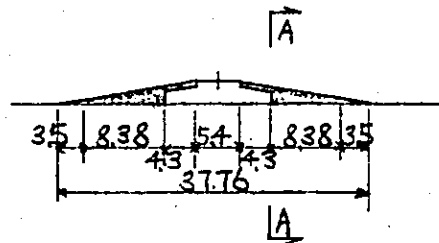
AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 18.60 + (0.7 \times 0.7 - 0.4 \times 0.1) \times 0.1 \times 2 = 1.5 \text{ m}^3$$

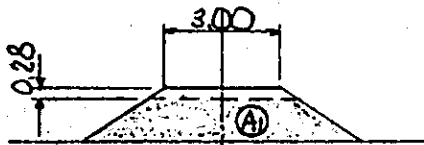
LC 07



PLAN



PROFILE



SECTION A-A

$$A_1 = 6.157 \text{ m}^2$$

$$\text{PAVEMENT } L = 37.76 - 5.40 = 32.36 \text{ m}$$

PAVEMENT AREA

$$A = 3.00 \times 32.36 = 97.1 \text{ m}^2$$

EMBANKMENT

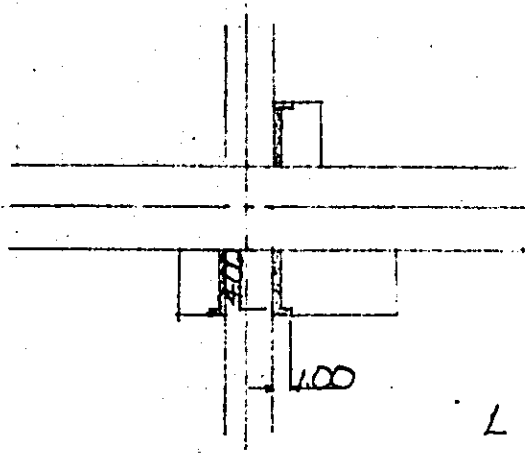
$$V_1 = (6.157 + 0) \times 16.76 \times \frac{1}{2} - 1.14 \times 0.76 \times \frac{1}{2} \times 3.00 \times 2 = 48.997$$

$$V_2 = (3.00 \times 0.62 - 3.00 \times 0.28) \times 8.60 = 8.772$$

TOTAL V

$$= 58 \text{ m}^3$$

RETAINING WALL TYPE 1



PLAN

$$L = 5.00 \times 3 = 15.00 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 15.00 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.6 \times 3 =$$

7.7 m^3

FORM AREA

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} + (1.10 + \sqrt{1.10^2 + 0.30^2}) \times 15.00 + (1.14 \times 0.40 - 0.30 \times 1.10) \times 3 =$$

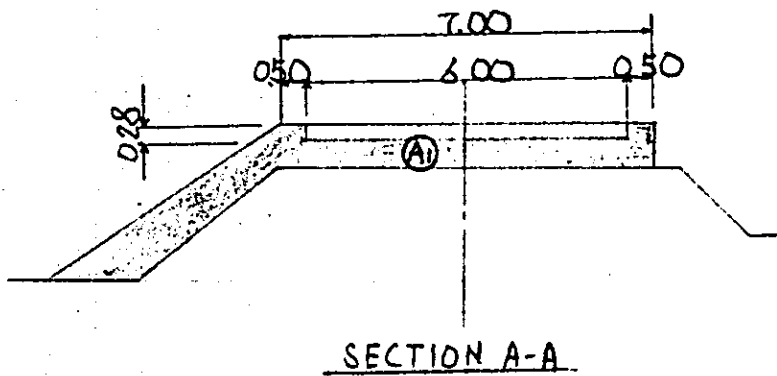
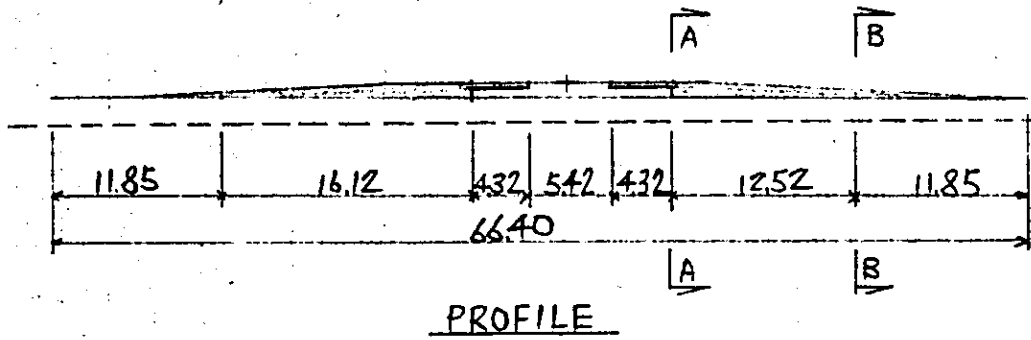
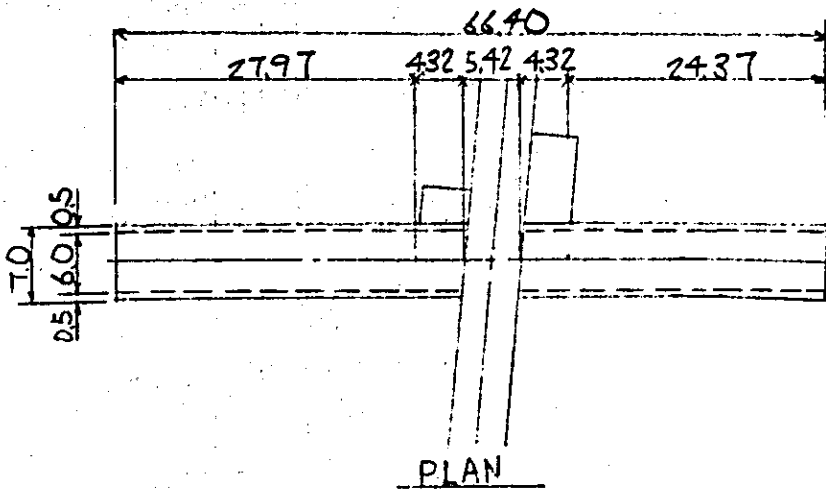
37.6 m^2

AGGREGATE SUB-BASE

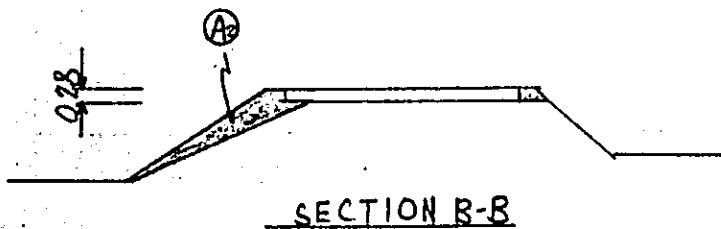
$$V = 0.80 \times 0.10 \times 15.00 + (0.90 \times 0.70 - 0.90 \times 0.10) \times 0.10 \times 3 =$$

1.3 m^3

LC 08



$$A_1 = 7.475 \text{ m}^2$$



$$A_2 = 2.148 \text{ m}^2$$

$$\text{PAVEMENT } L = 66.40 - 5.42 = 60.98^m$$

PAVEMENT AREA

$$A = 6.00 \times 60.98 = 365.9^m^2$$

EMBANKMENT

$$V_1 = (7.475 + 2.148) \times 28.64 \times \frac{1}{2} - 2.50 \times 2.13 \times \frac{1}{2} \times 7.03$$

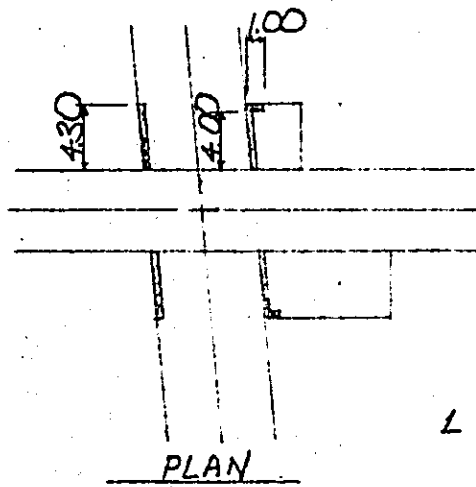
$$\times 2 = 100.367$$

$$V_2 = (2.148 + 0) \times 23.70 \times \frac{1}{2} = 25.454$$

$$V_3 = (7.00 \times 0.62 - 6.00 \times 0.28) \times 8.64 = 22.982$$

$$\text{TOTAL } V = 149^m^3$$

RETAINING WALL TYPE-1.



$$L = (5.00 + 4.30) \times 2 \\ = 18.60 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 18.60 \\ + 0.30 \times 1.10 \times \frac{1}{2} \times 0.60 \times 2 = 9.5 \text{ m}^3$$

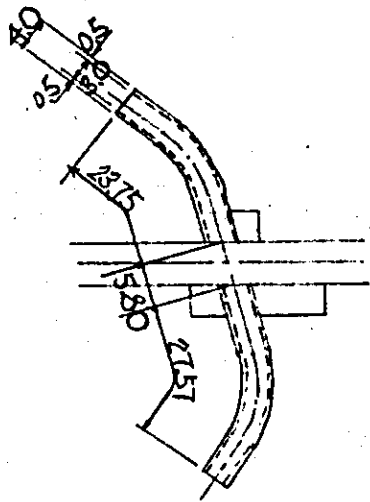
FORM AREA

$$A = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 8 + 1.10 + \sqrt{1.10^2 + 0.30^2} \\ \times 18.60 + (1.14 \times 0.60 - 0.30 \times 1.10) \times 2 = 46.3 \text{ m}^2$$

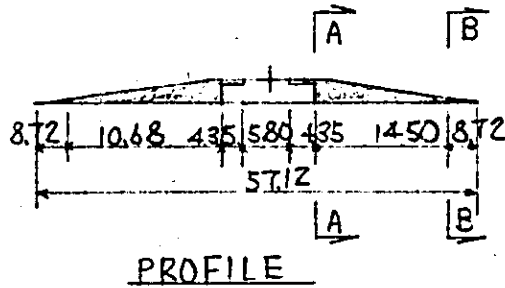
AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 18.60 + (0.40 \times 0.70 - 0.40 \times 0.10) \times 0.10 \times 2 = 1.5 \text{ m}^3$$

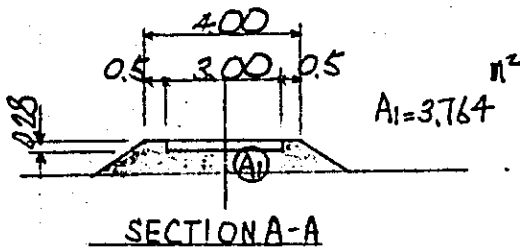
LC 09



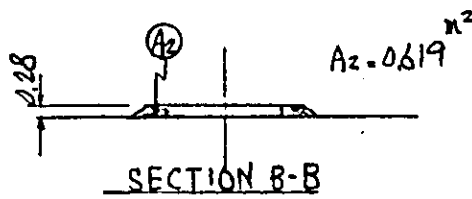
PLAN



PROFILE



SECTION A-A



SECTION B-B

PAVEMENT L = $57.12 - 5.80 = 51.32$ m

PAVEMENT AREA

$A = 3.00 \times 51.32 = 154.0$ m²

EMBANKMENT

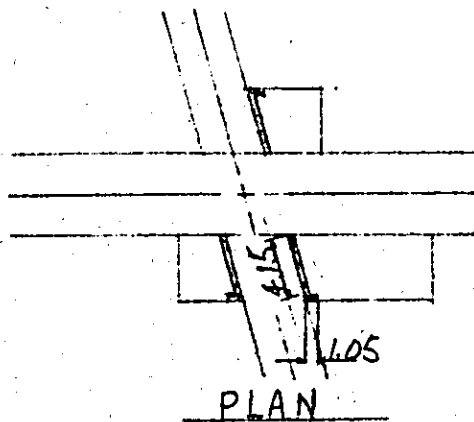
$V_1 = (3.764 + 0.619) \times 25.18 \times \frac{1}{2} = 55.182$

$V_2 = (0.619 + 0) \times 17.44 \times \frac{1}{2} = 5.398$

$V_3 = (4.00 \times 0.62 - 3.00 \times 0.28) \times 8.70 = 14.268$

TOTAL V = 75 m³

RETAINING WALL TYPE - 1



$$L = 5.20 \times 3 = 15.60 \text{ m.}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 15.60 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.62 \times 3 = 8.0 \text{ m}^3$$

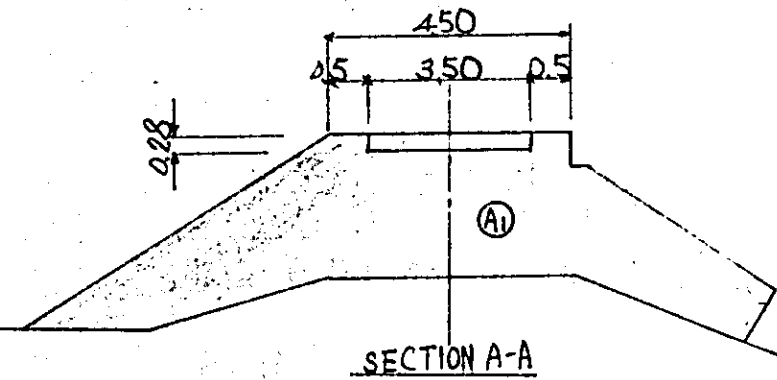
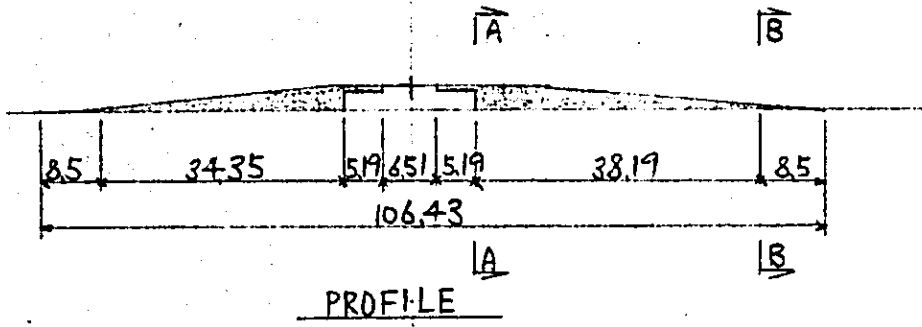
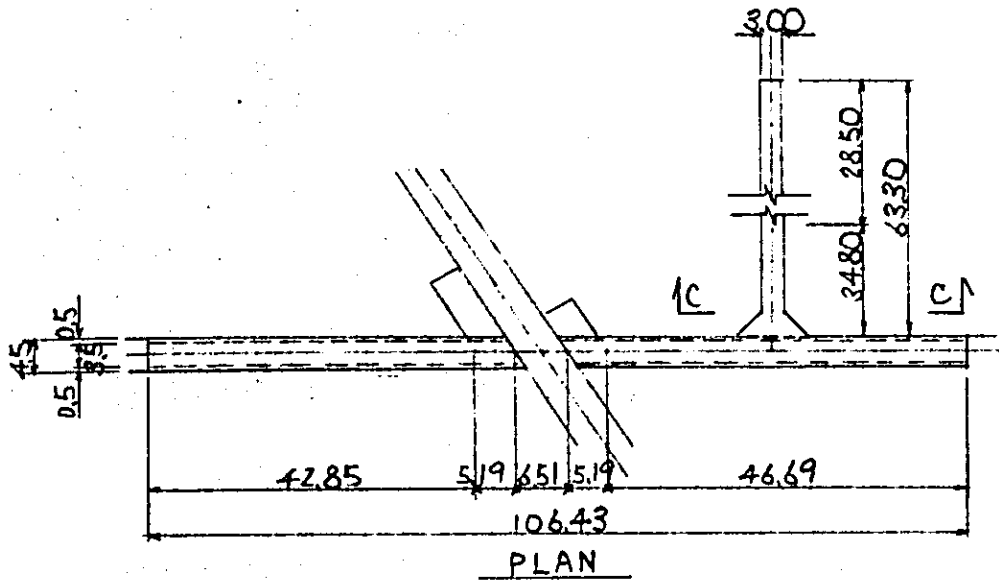
FORM AREA

$$A = (0.31 + 0.62) \times 1.10 \times \frac{1}{2} \times 6 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \times 15.60 + (1.14 \times 0.62 - 0.31 \times 1.10) \times 3 = 39.1 \text{ m}^2$$

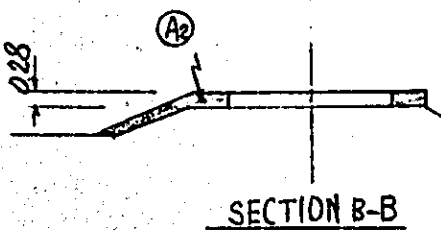
AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 15.60 + (0.40 \times 0.72 - 0.40 \times 0.10) \times 0.10 \times 3 = 1.3 \text{ m}^3$$

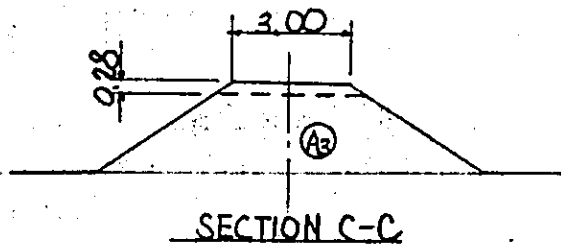
LC 10



$$A_1 = 24.708 \text{ m}^2$$



$$A_2 = 0.960 \text{ m}^2$$



$$A_3 = 14,882 \text{ m}^2$$

$$\text{PAVEMENT } L_1 = 106.43 - 6.51 = 99.92 \text{ m}$$

$$L_2 = 63.30$$

PAVEMENT AREA

$$A = 35 \times 99.92 + 3.0 \times 63.30 + 3.0 \times 3.0 \times \frac{1}{2} \times 2 = 548.6 \text{ m}^2$$

EMBANKMENT

$$V_1 = (24,708 + 0.960) \times 72.54 \times \frac{1}{2} - 4.44 \times 2.96 \times \frac{1}{2} \times 5.43 \\ \times 2 = 859,616$$

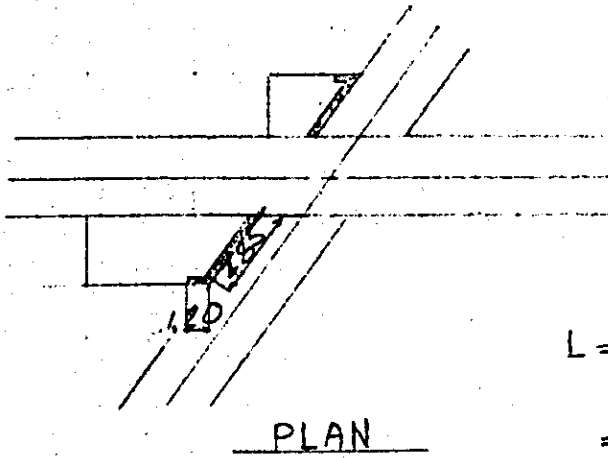
$$V_2 = (0.960 + 0) \times 17.0 \times \frac{1}{2} = 8,160$$

$$V_3 = (14,882 + 0) \times 34.80 \times \frac{1}{2} - 3.18 \times 2.12 \times \frac{1}{2} \times 3.0 \\ = 248,842$$

$$V_4 = (4.50 \times 0.62 - 3.00 \times 0.28) \times 10.38 = 20,241$$

$$\text{TOTAL } V = 1137 \text{ m}^3$$

RETAINING WALL TYPE 1



$$L = 6.05 \times 2 + 17.00 + 14.00 \\ = 43.10 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 43.1 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.72 \times 2 = 21.6 \text{ m}^3$$

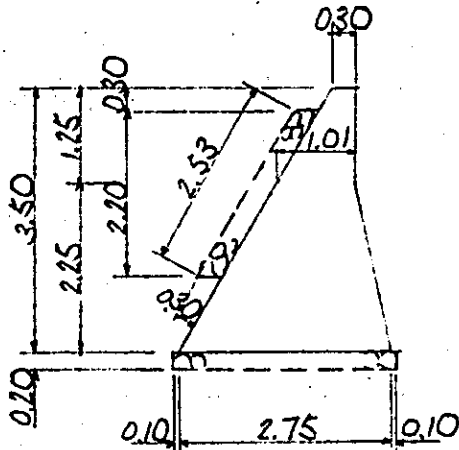
FORM AREA

$$A = (0.36 + 0.72) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \\ \times 43.10 + (1.14 \times 0.72 - 0.36 \times 1.10) \times 2 = 102.1 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 43.1 + (0.4 \times 0.84 - 0.4 \times 0.12) \times 0.1 \times 2 = 3.4 \text{ m}^3$$

RETAINING WALL TYPE - 2.



$$L = 53.0 + 43.0 = 96.0 \text{ m}$$

CONCRETE VOLUME

$$V = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\} \times 96.00 = 487.7 \text{ m}^3$$

FORM AREA

$$A = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\} \times 11 + (1.25 + \sqrt{2.25^2 + 0.45^2} + \sqrt{3.50^2 + 2.00^2}) \times 96.00 = 782.3 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 2.95 \times 0.20 \times 96.00 = 56.6 \text{ m}^3$$

GRANULAR BACK FILL

$$V = 0.30 \times 2.53 \times 96.00 = 72.9 \text{ m}^3$$

EXPANSION JOINTS

$$A = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\}$$

 $\times 7$

=

35.3 ^{m²}

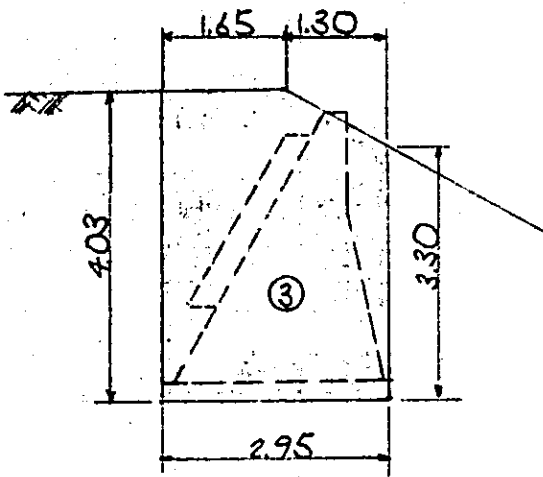
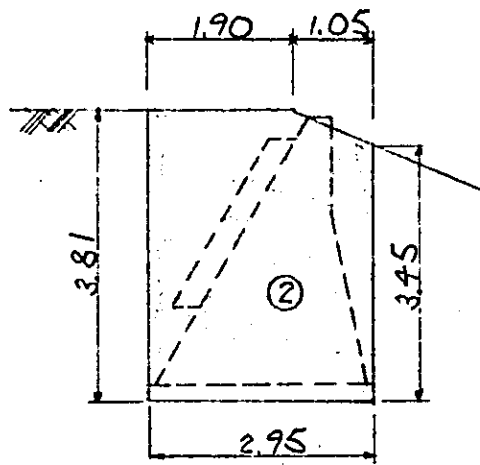
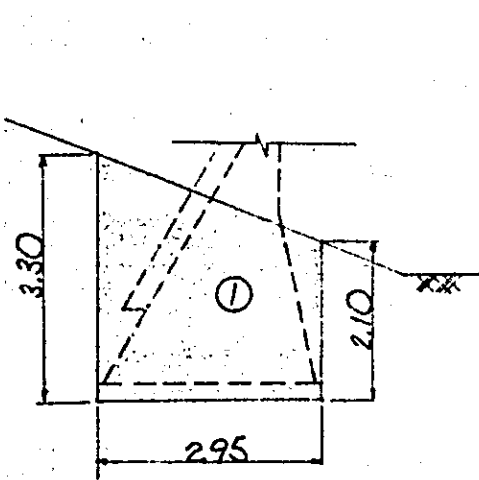
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DESIGN EXCA



$$L_1 = 53.0^m$$

$$L_2 = 43.0^m$$

$$A_1 = (2.10 + 2.95) \times 3.30 \times \frac{1}{2} = 7.965 \text{ m}^2$$

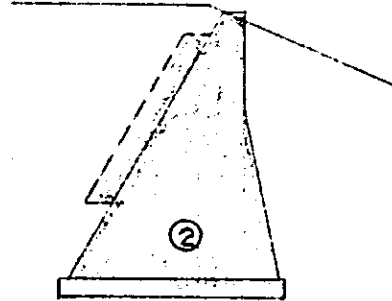
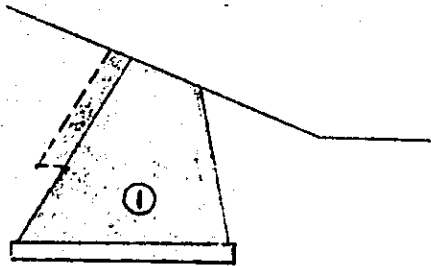
$$A_2 = (3.81 + 2.95) \times 1.05 \times \frac{1}{2} + 1.90 \times 3.81 = 11.051 \text{ m}^2$$

$$A_3 = (3.30 + 4.03) \times 1.30 \times \frac{1}{2} + 1.65 \times 4.03 = 11.415 \text{ m}^2$$

$$V = (7.965 + 11.051) \times 53.00 \times \frac{1}{2} + (7.965 + 11.415) \times 43.0 \times \frac{1}{2}$$

$$= 921 \text{ m}^3$$

SURPLUS SOILS



$$A_1 = 5.057 \text{ m}^2$$

$$A_2 = 6.398 \text{ m}^2$$

$$V = (5.057 + 6.398) \times 96.0 \times \frac{1}{2}$$

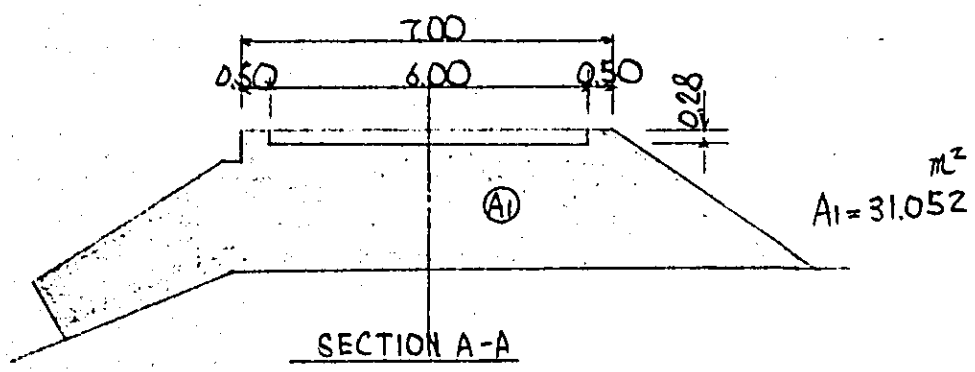
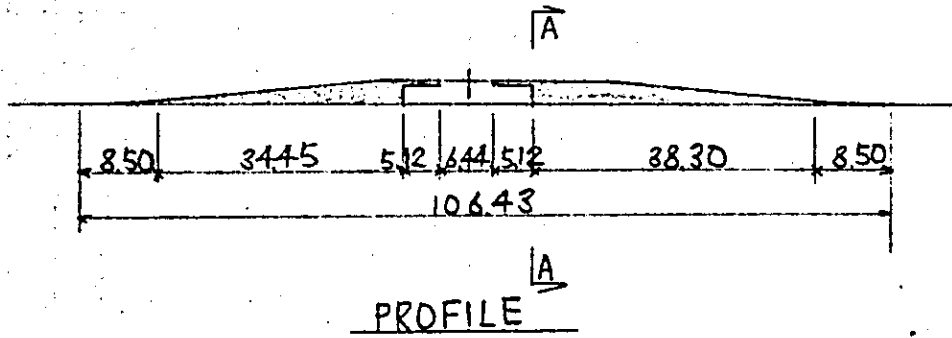
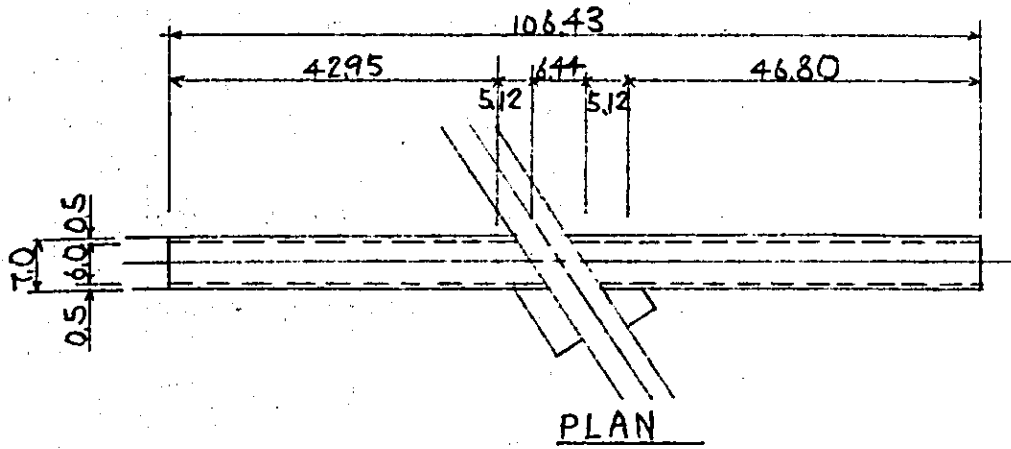
$$= 550 \text{ m}^3$$

BACK FILLING

$$V = 921 - 550$$

$$= 371 \text{ m}^3$$

LC 11



PAVEMENT L = $106.43 - 6.44 = 99.99 \text{ m}$

PAVEMENT AREA

$A = 6.00 \times 99.99 = 599.9 \text{ m}^2$

EMBANKMENT

$$V_1 = (31.052 + 0.339) \times 72.75 \times \frac{1}{2} - 3.23 \times 2.15 \times \frac{1}{2} \times 8.36$$

$$\times 2 = 1083.792$$

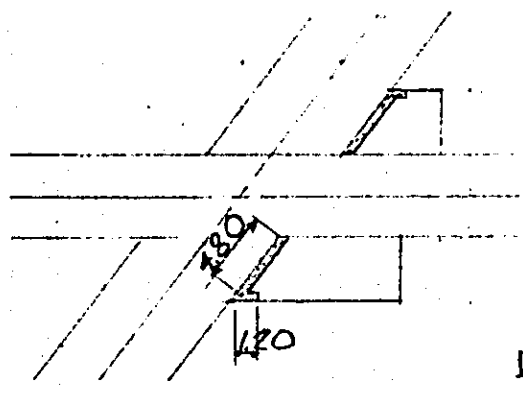
$$V_2 = (0.339 + 0) \times 17.0 \times \frac{1}{2} = 2.882$$

$$V_3 = (7.00 \times 0.62 - 7.00 \times 0.28) \times 10.24 = 27.238$$

TOTAL V

= 1114 m³

RETAINING WALL TYPE-1



PLAN

$$L = 6.00 \times 2 + 13.00 + 17.50 = 42.50 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 42.50 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.72 \times 2 = 21.3 \text{ m}^3$$

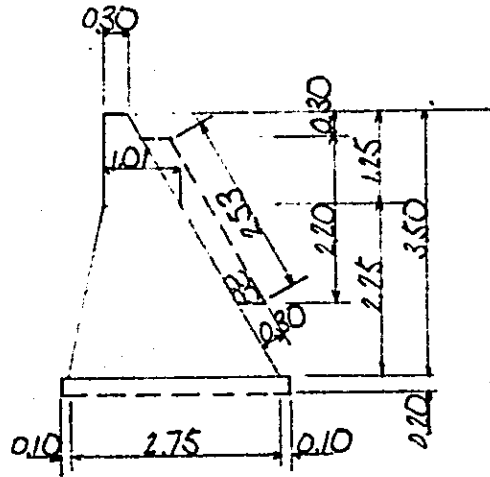
FORM AREA

$$A = (0.36 + 0.72) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \times 42.5 + (1.14 \times 0.72 - 0.36 \times 1.10) \times 2 = 100.8 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 42.5 + (0.4 \times 0.84 - 0.4 \times 0.12) \times 0.1 \times 2 = 3.3 \text{ m}^3$$

RETAINING WALL TYPE - 2



$$L = 44.5 + 50.0$$

$$= 94.5 \text{ m}$$

CONCRETE VOLUME

$$V = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\}$$

$$\times 94.5 = 477.1 \text{ m}^3$$

FORM AREA

$$A = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\} \times 12$$

$$+ (1.25 + \sqrt{2.25^2 + 0.45^2} + \sqrt{3.50^2 + 2.00^2}) \times 94.5 = 776.0 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 2.95 \times 0.20 \times 94.5 = 55.8 \text{ m}^3$$

GRANULAR BACKFILL

$$V = 0.30 \times 2.53 \times 94.5 = 71.7 \text{ m}^3$$

EXPANSION JOINTS

$$A = \left\{ (0.30 + 1.01) \times 1.25 \times \frac{1}{2} + (1.01 + 2.75) \times 2.25 \times \frac{1}{2} \right\}$$

 $\times 8$

=

40.4 ^{m²}

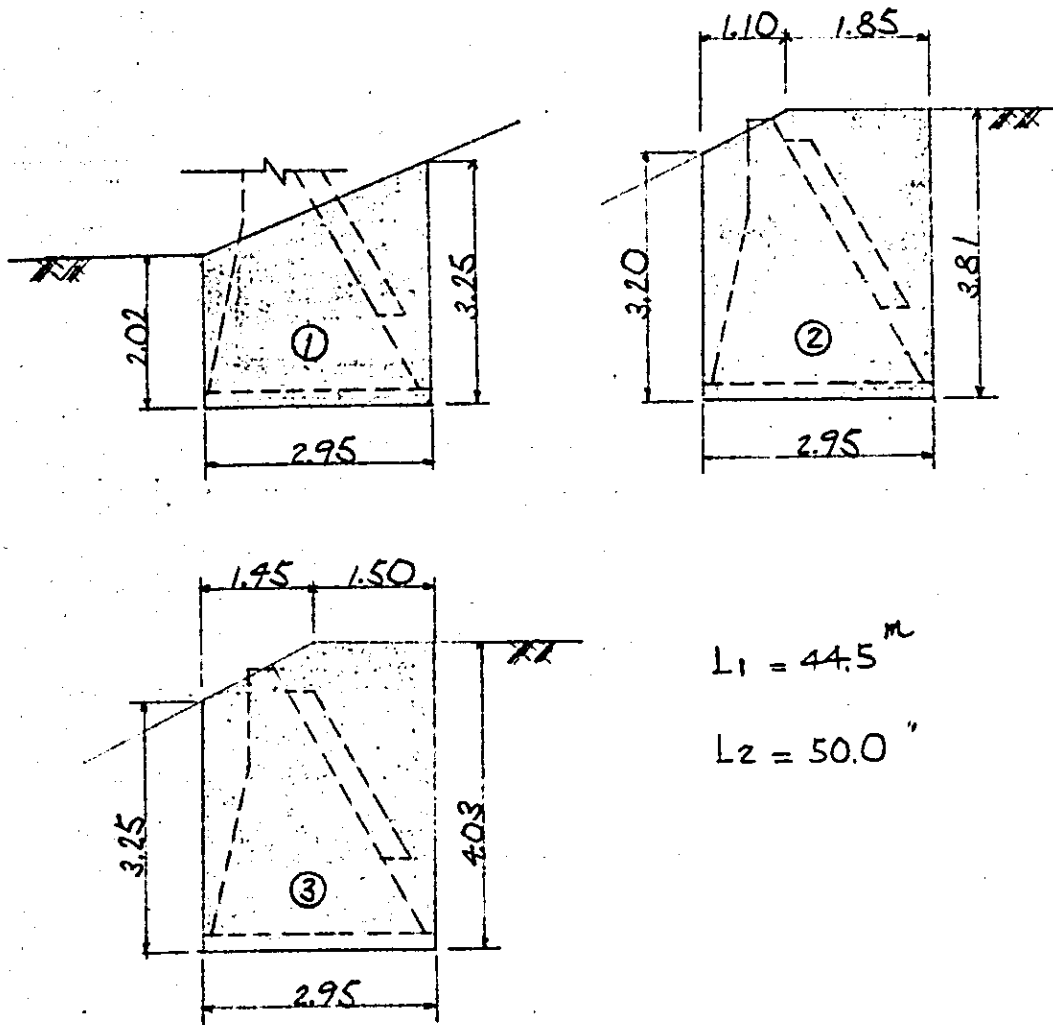
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DESIGN EXCA



$$L_1 = 44.5 \text{ m}$$

$$L_2 = 50.0 \text{ m}$$

$$A_1 = (2.02 + 2.95) \times 3.25 \times \frac{1}{2} = 7.773 \text{ m}^2$$

$$A_2 = (1.10 + 2.95) \times 3.81 \times \frac{1}{2} + 1.85 \times 3.81 = 10.905 \text{ m}^2$$

$$A_3 = (1.45 + 2.95) \times 4.03 \times \frac{1}{2} + 1.50 \times 4.03 = 11.323 \text{ m}^2$$

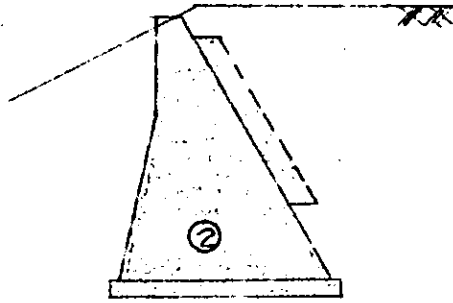
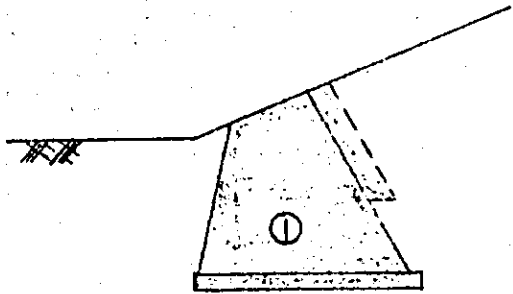
$$V = (7.773 + 10.905) \times 44.5 \times \frac{1}{2} + (7.773 + 11.323) \times 50.0 \times \frac{1}{2}$$

$$\times 50.0 \times \frac{1}{2}$$

=

$$893 \text{ m}^3$$

SURPLUSOILS



$$A_1 = 5.652 \text{ m}^2$$

$$A_2 = 6.398 \text{ m}^2$$

$$V = (5.652 + 6.398) \times 94.5 \times \frac{1}{2}$$

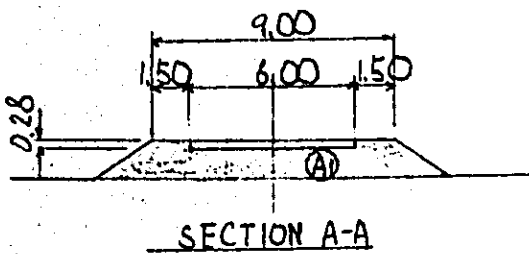
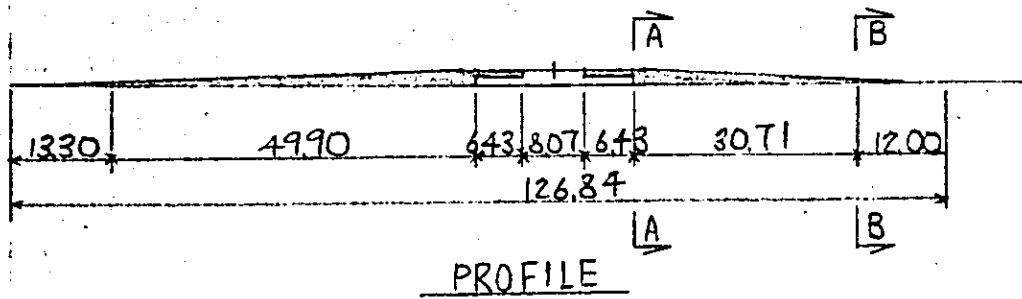
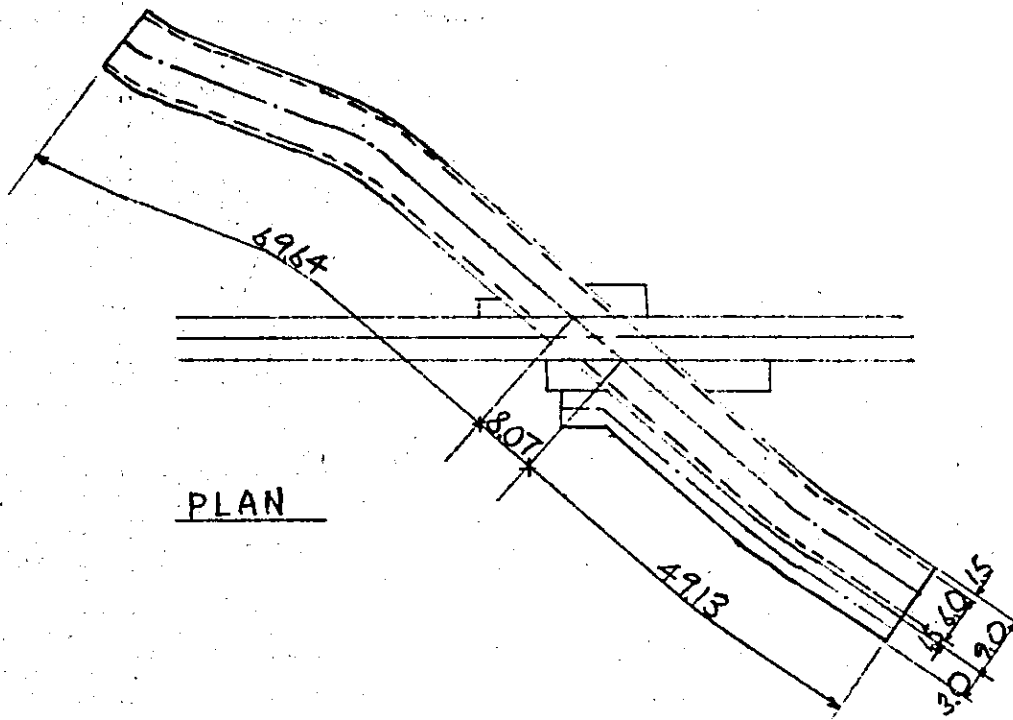
$$= 569 \text{ m}^3$$

BACK FILLING

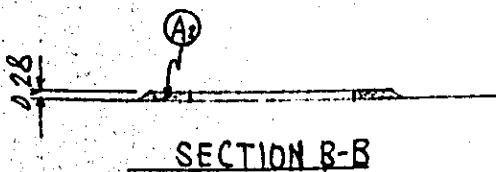
$$V = 893 - 569$$

$$= 324 \text{ m}^3$$

LC 12



$$A_1 = 22.320 \text{ m}^2$$



$$A_2 = 0.958 \text{ m}^2$$

$$\text{PAYEMENT } L_1 = 126.84 - 8.07 = 118.77^m$$

$$L_2 = 48.0^m$$

PAYEMENT AREA

$$A = 6.00 \times 118.77 + 3.00 \times 48.00 + 3.00 \times 10.00 \times \frac{1}{2} = 871.6 \text{ } m^2$$

EMBANKMENT

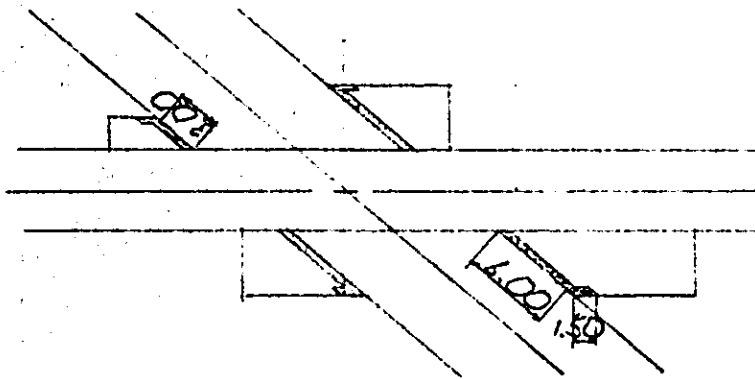
$$V_1 = (22.320 + 0.958) \times 80.60 \times \frac{1}{2} - 1.23 \times 0.82 \times \frac{1}{2} \\ \times 13.45 \times 2 = 924.654$$

$$V_2 = (0.958 + 0) \times 25.30 \times \frac{1}{2} = 12.119$$

$$V_3 = (9.00 \times 0.62 - 6.00 \times 0.28) \times 12.86 = 50.154$$

$$\text{TOTAL } V = 987 \text{ } m^3$$

RETAINING WALL TYPE-1.



PLAN

$$L = 7.50 \times 3 + 4.50 = 27.0 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 27.0 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.9 \times 4 =$$

$$14.0 \text{ m}^3$$

FORM AREA

$$A = (0.45 + 0.90) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2})$$

$$\times 27.0 + (1.14 \times 0.90 - 0.45 \times 1.10) \times 4 =$$

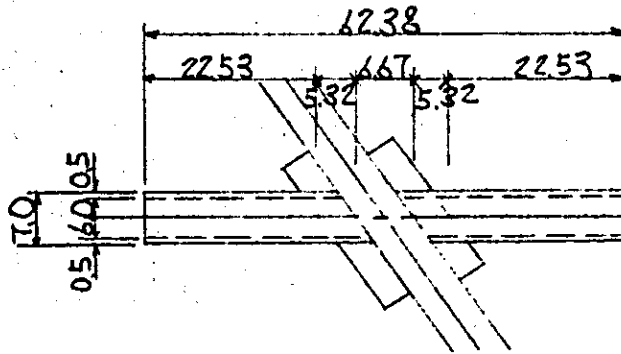
$$68.5 \text{ m}^2$$

AGGREGATE SUB-BASE

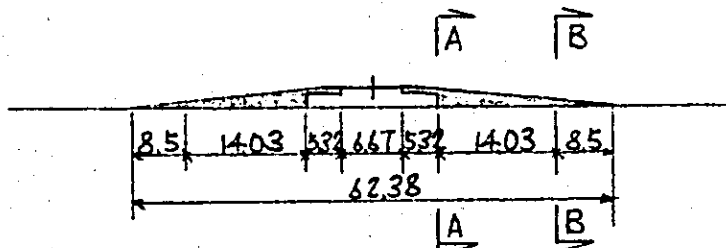
$$V = 0.80 \times 0.10 \times 27.0 + (0.4 \times 1.05 - 0.4 \times 0.15) \times 0.10 \times 4 =$$

$$2.3 \text{ m}^3$$

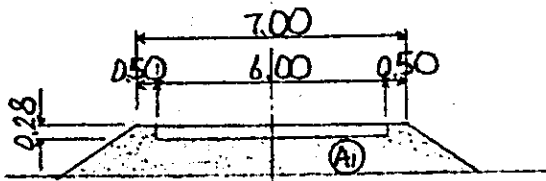
LC 13



PLAN

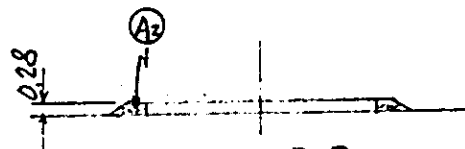


PROFILE



SECTION A-A

$$A_1 = 9.636 \text{ m}^2$$



SECTION B-B

$$A_2 = 0.358 \text{ m}^2$$

$$\text{PAVEMENT } L = 62.38 - 6.67 = 55.71 \text{ m}$$

PAVEMENT AREA

$$A = 6.00 \times 55.71$$

$$= 334.3 \text{ m}^2$$

EMBANKMENT

$$V_1 = (9.636 + 0.358) \times 28.07 \times \frac{1}{2} - 0.98 \times 0.65 \times \frac{1}{2}$$

$$\times 8.65 \times 2 = 134.756$$

$$V_2 = (0.358 + 0) \times 17.00 \times \frac{1}{2} = 3.043$$

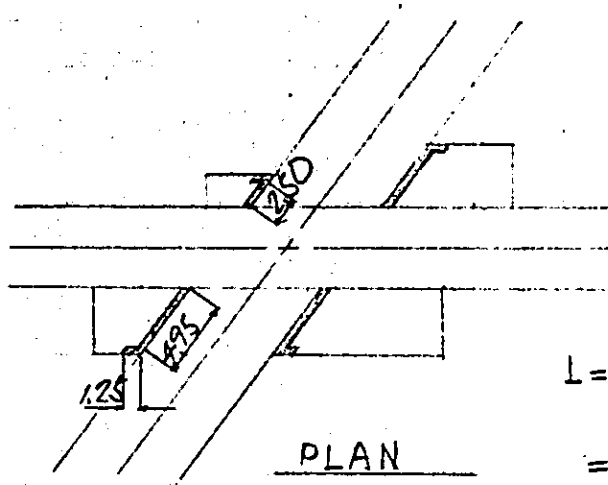
$$V_3 = (7.00 \times 0.62 - 6.00 \times 0.28) \times 10.64 = 28.302$$

TOTAL V

=

166 m³

RETAINING WALL TYPE-1



$$L = 6.20 \times 3 + 3.75 \\ = 22.35 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 22.35 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.74 \times 4 =$$

$$11.6 \text{ m}^3$$

FORM AREA

$$A = (0.37 + 0.74) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \\ \times 22.50 + (1.14 \times 0.74 - 0.37 \times 1.10) \times 4 =$$

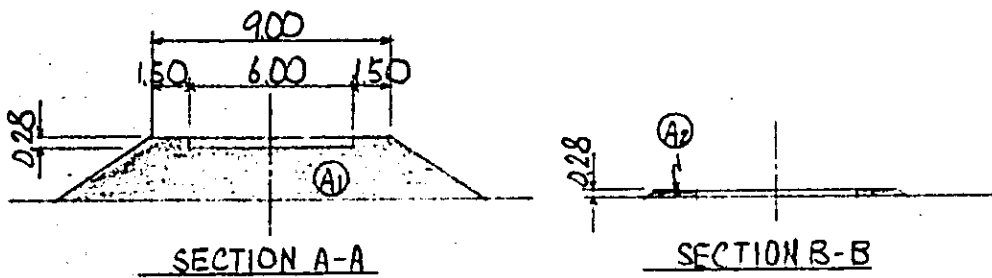
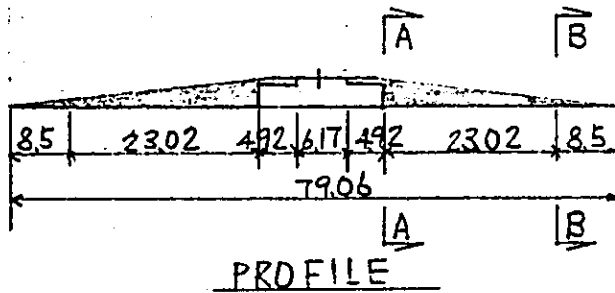
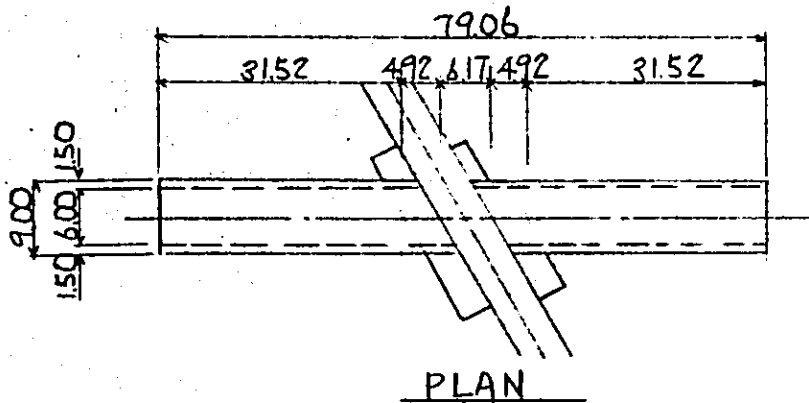
$$56.7 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 22.35 + (0.9 \times 0.86 - 0.4 \times 0.12) \times 0.1 \times 4 =$$

$$1.9 \text{ m}^3$$

LC 14



$$A_1 = 28.087 \text{ m}^2$$

$$A_2 = 0.958 \text{ m}^2$$

$$\text{PAVEMENT } L = 79.06 - 6.17 = 72.89 \text{ m}$$

PAVEMENT AREA

$$A = 6.00 \times 72.89$$

$$= 437.3 \text{ m}^2$$

EMBANKMENT

$$V_1 = (28.087 + 0.958) \times 46.05 \times \frac{1}{2} - 2.63 \times 1.75 \times \frac{1}{2}$$

$$\times 10.29 \times 2 = 621.401$$

$$V_2 = (0.958 + 0) \times 17.00 \times \frac{1}{2} = 8.143$$

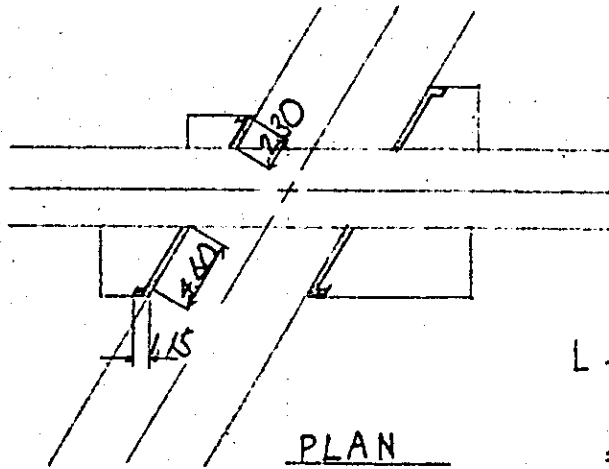
$$V_3 = (9.00 \times 0.62 - 6.00 \times 0.28) \times 9.84 = 38.376$$

TOTAL V

=

668 m³

RETAINING WALL TYPE-1



$$L = 5.75 \times 3 + 3.45 \\ = 20.70^m$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 20.7 + 0.3 \times 1.1 \times \frac{1}{2} \times 0.69 \times 4 =$$

$$10.7 \text{ m}^3$$

FORM AREA

$$A = (0.34 + 0.69) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2}) \\ \times 20.70 + (1.14 \times 0.69 - 0.34 \times 1.10) \times 4 =$$

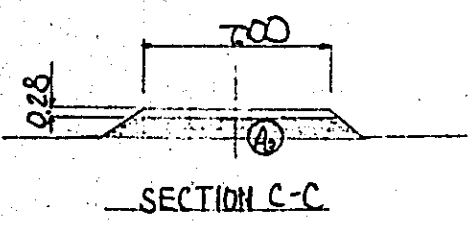
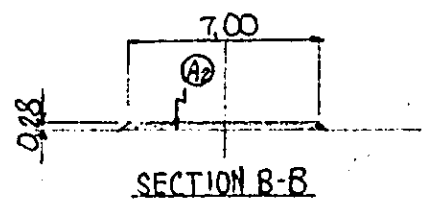
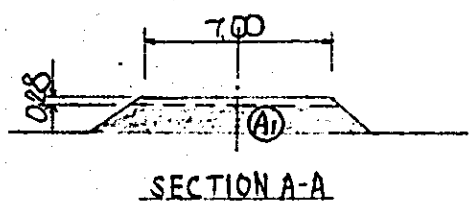
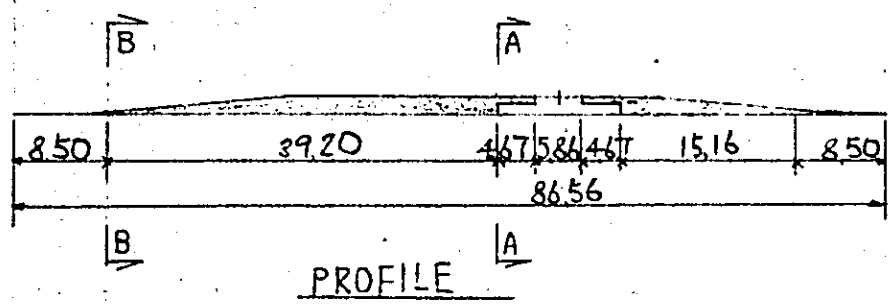
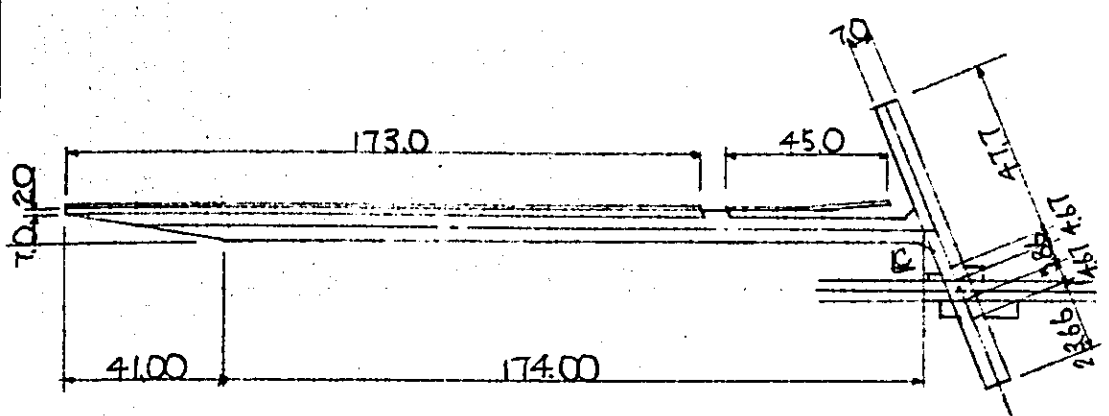
$$52.6 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 20.7 + (0.7 \times 0.8 - 0.4 \times 0.11) \times 0.1 \times 4 =$$

$$1.8 \text{ m}^3$$

LC 15



$A_1 = 10.001 \text{ m}^2$ $A_2 = 0$
 $A_3 = 7.437$

$$\text{PAVEMENT } L_1 = 86.56 - 5.86 = 80.70^m$$

$$L_2 = 215.00^m$$

PAVEMENT AREA

$$A = 7.00 \times (80.70 + 174.00) + 7.00 \times 41.00 \times \frac{1}{2} \\ + 2.00 \times 225.00 + 3.00 \times 3.00 \times \frac{1}{2} \times 2 = 2385.4^m^2$$

EMBANKMENT

$$V_1 = (10.001 + 0) \times 54.36 \times \frac{1}{2} - 1.08 \times 0.72 \times \frac{1}{2} \times 7.60 \\ \times 2 = 265.920$$

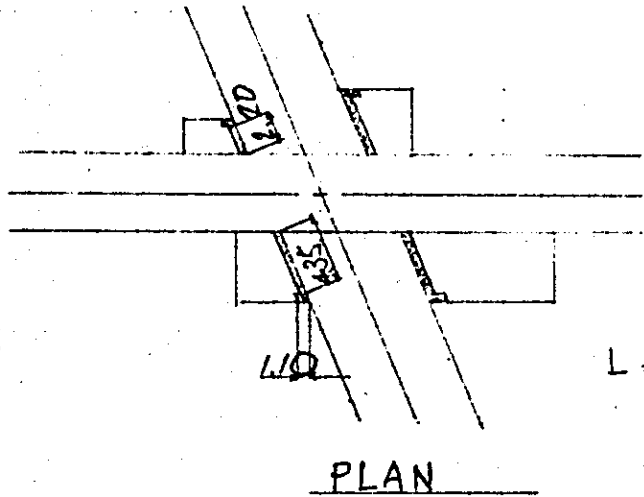
$$V_2 = (7.437 + 0) \times 15.30 \times \frac{1}{2} - 1.23 \times 0.82 \times \frac{1}{2} \times 7.00 \\ = 53.366$$

$$V_3 = 7.00 \times 0.34 \times 9.34 = 22.229$$

TOTAL V

$$= 342^m^2$$

RETAINING WALL TYPE-1



$$L = 5.45 \times 3 + 3.30$$

$$= 19.65 \text{ m}$$

CONCRETE VOLUME

$$V = (0.30 + 0.60) \times 1.10 \times \frac{1}{2} \times 19.65 + 2.3 \times 1.1 \times \frac{1}{2} \times 0.65 \times 4 =$$

$$10.2 \text{ m}^3$$

FORM AREA

$$A = (0.33 + 0.65) \times 1.10 \times \frac{1}{2} \times 8 + (1.10 + \sqrt{1.10^2 + 0.30^2})$$

$$\times 19.65 + (1.14 \times 0.65 - 0.33 \times 1.10) \times 4 =$$

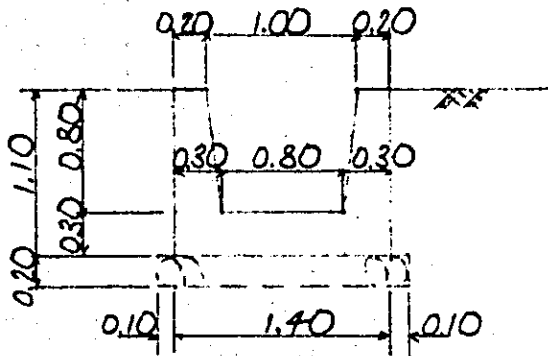
$$49.8 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 0.80 \times 0.10 \times 19.65 + (0.7 \times 0.76 - 0.4 \times 0.11) \times 0.1 \times 4 =$$

$$1.7 \text{ m}^3$$

SIDE DICH

TOTAL LENGTH $L = 218.0$ mCROSS SECTION

CONCRETE VOLUME

$$V = \{ 1.40 \times 1.10 - (0.80 + 1.00) \times 0.80 \times \frac{1}{2} \} \times 218.0 = 178.8 \text{ m}^3$$

FORM AREA

$$A = \{ 1.40 \times 1.10 - (0.80 + 1.00) \times 0.80 \times \frac{1}{2} \} \times 25 + (1.10 \times 2 + \sqrt{0.80^2 + 0.10^2}) \times 218 = 353.3 \text{ m}^2$$

AGGREGATE SUB-BASE

$$V = 1.60 \times 0.20 \times 218.0 = 69.8 \text{ m}^3$$

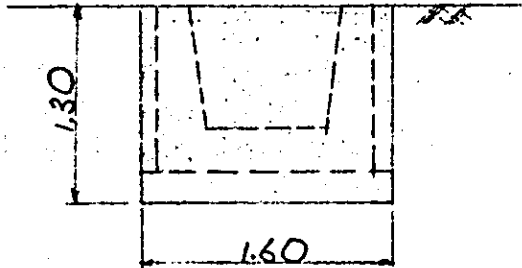
EXPANSION JOINTS

$$A = \{ 1.40 \times 1.10 - (0.80 + 1.00) \times 0.80 \times \frac{1}{2} \} \times 21 = 17.2 \text{ m}^2$$

REINFORCING BAR

$$= 3097 \text{ kg}$$

DESIGN EXCA



$$V = 1.60 \times 1.30 \times 218.0$$

$$= 453 \text{ m}^3$$

BACK FILLING

$$V = 0.10 \times 1.10 \times 218.0 \times 2$$

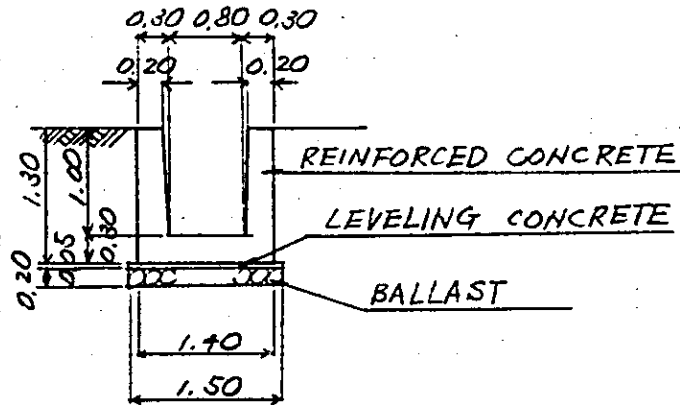
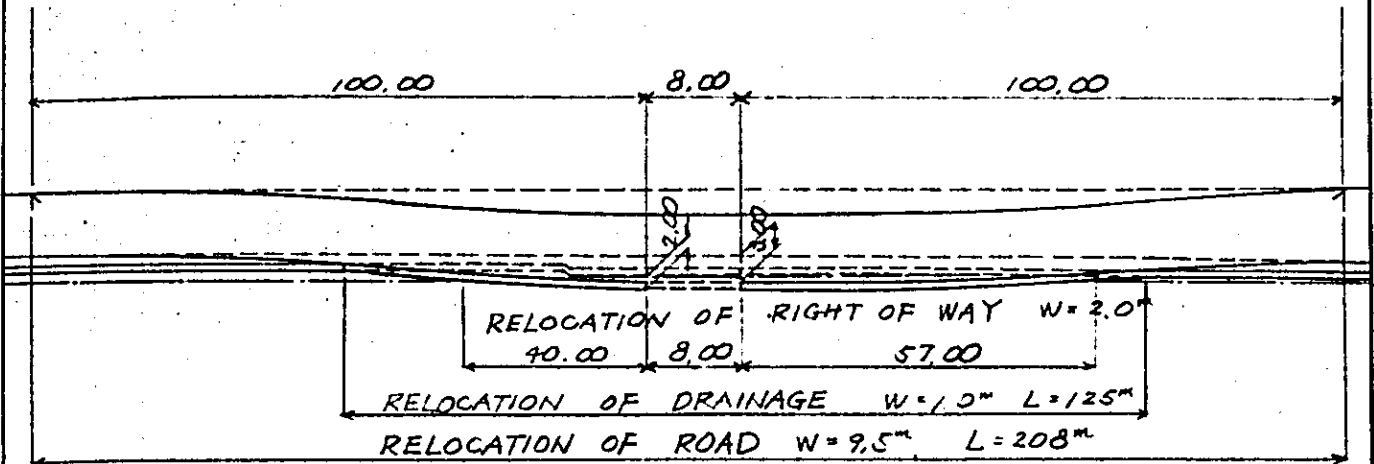
$$= 48 \text{ m}^3$$

SURPLUSOILS

$$V = 453 - 48$$

$$= 405 \text{ m}^3$$

RELOCATION OF JL. RAYA KAMPUNG



SECTION OF DRAINAGE

PAVING. $100.00 \times 3.00 \times \frac{1}{2} \times 2 + 3.00 \times 8.00 = 324 \text{ m}^2$

RIGHT OF WAY $2.00 \times (40.0 + 57.0) \times \frac{1}{2} + 2.00 \times 8.00 = 113 \text{ m}^2$

EXCUVATION OF DRAINAGE.

$1.50 \times 1.55 \times 125 = 291 \text{ m}^3$

REINFORCED CONCRETE

$[(0.20 \times 1.00) + (1.00 \times 0.10 \times \frac{1}{2}) \times 2 + 0.30 \times 1.7] \times 125 = 115 \text{ m}^3$

LEVELING CONCRETE.

$1.50 \times 0.05 \times 125 = 9.4 \text{ m}^3$

BALLAST

$1.50 \times 0.20 \times 125 = 37.5 \text{ m}^3$

BAR. $620.2 \times \frac{1}{20} \times 125 = 3876 \text{ kg}$

ASPHALT PAVING

TYPE A

T = 60 cm

A LINE	1724.8 m ²
C "	1615.2 m ²
D "	1608.1 m ²
<hr/>	
TOTAL	4948.1 m ²

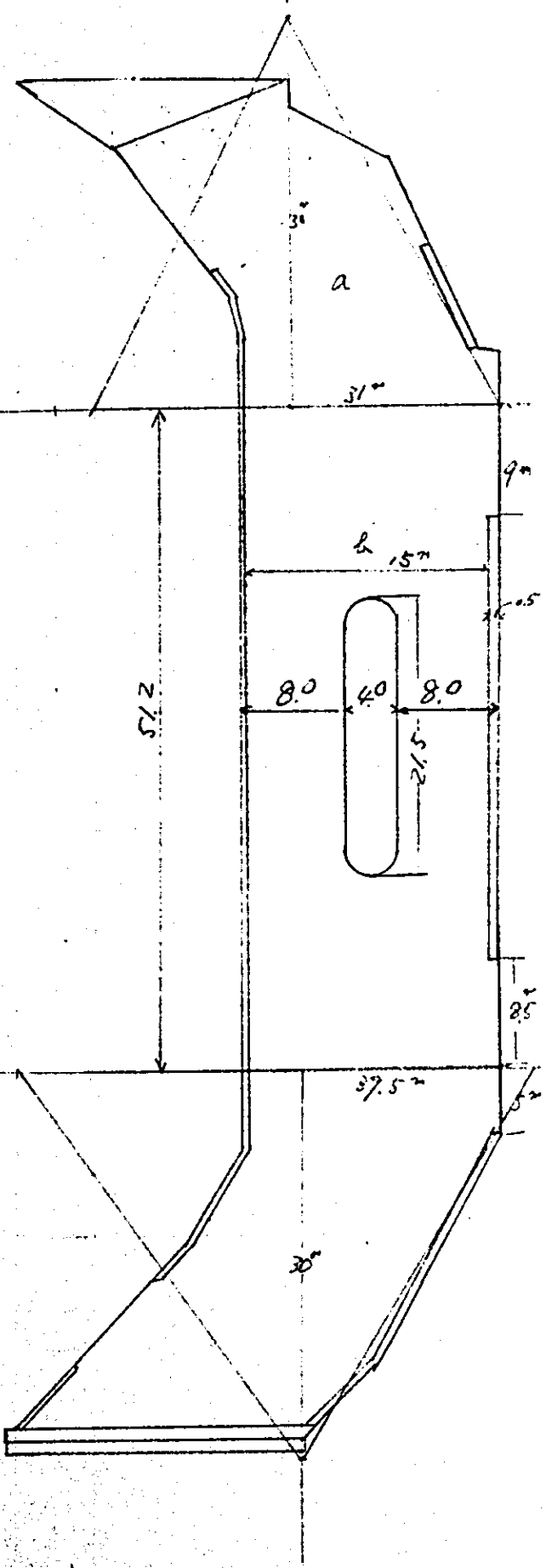
TYPE B

T = 40 cm

B LINE	666.5 m ²
E "	485.7 m ²
F "	183.0 m ²
G "	2986.1 m ²
<hr/>	
TOTAL	4321.3 m ²

A LINE

1/500



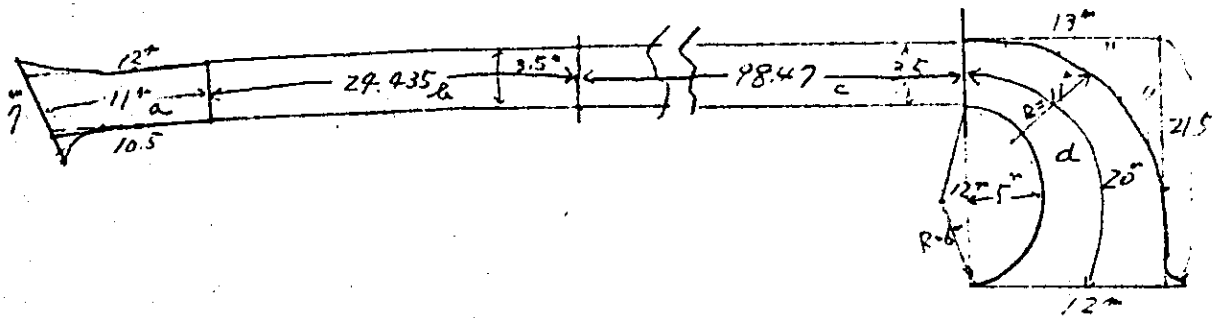
$$a = 31 \times 30 \times \frac{1}{2} = 465 \text{ m}^2$$

$$b = (51.2 \times 15) + [0.5 \times (9 + 8.5)] - (17.5 \times 4 + 2^2 \pi) = 667.272 \text{ m}^2$$

$$c = 37.5 \times 30 \times \frac{1}{2} = 562.5 \text{ m}$$

$$a + b + c = 465 + 667.27 + 562.5 = 1724.77 \approx 1724.8$$

B LINE



$$a = \frac{12 + 10.5}{2} \times 35 = 39.37$$

$$b = 35 \times 24.4 = 85.40$$

$$c = 35 \times 98.5 = 344.75$$

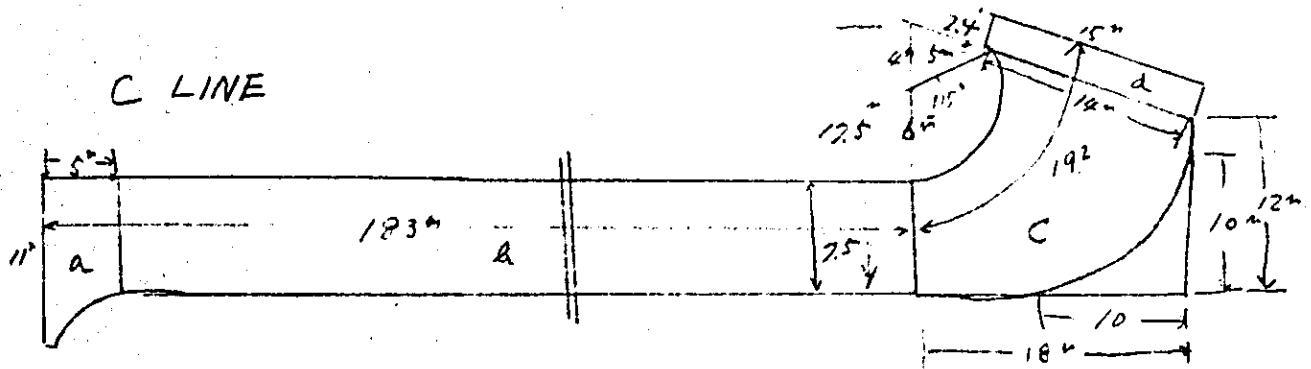
$$d = (13 \times 21.5) - \left(11^2 - \frac{11^2 \pi}{4}\right) - \left[\left(6^2 \pi \times \frac{161}{360}\right)\right]$$

$$- \left(1 \times \frac{1}{2} \times 12\right) = 279.5 - 25.97 - 50.58$$

$$= 196.95$$

$$a + b + c + d = 39.37 + 85.40 + 344.75 + 196.95$$

$$= 666.47 = 666.5 \text{ m}$$



$$a = \frac{11 + 2.5}{2} \times 5 = 46.25$$

$$b = 2.5 \times 172 = 430$$

$$C = \left(\frac{17.5 + 12}{2} \times 18 \right) - \left[10^2 - \left(10^2 \pi \times \frac{1}{4} \right) \right]$$

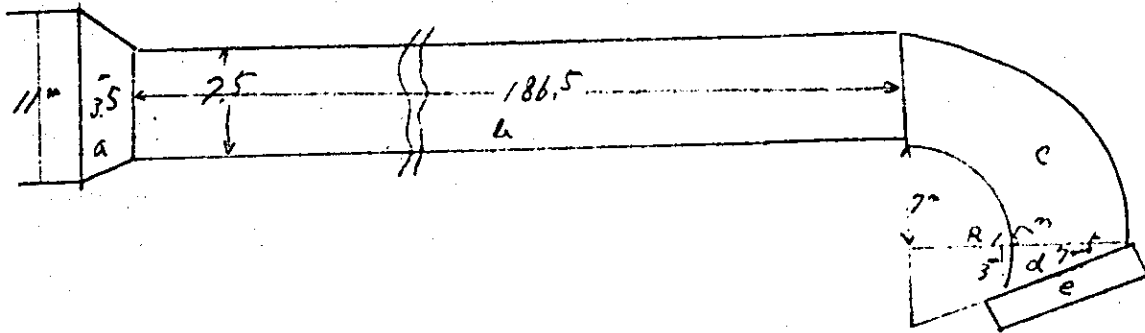
$$- \left(6^2 \pi \times \frac{115^\circ}{360} \right) - \left(4 \times 5 \times \frac{1}{2} \right)$$

$$= 265.5 - 21.46 - 361.3 - 10 = 197.91$$

$$d = 2.4 \times 15 = 36$$

$$\text{TOTAL} \quad 46.25 + 430 + 197.91 + 36 = 1109.16 \text{ in}^2$$

D LINE



$$a = \frac{11 + 7.5}{2} \times 3.5 = 32.375$$

$$b = 7.5 \times 186.5 = 1398.75$$

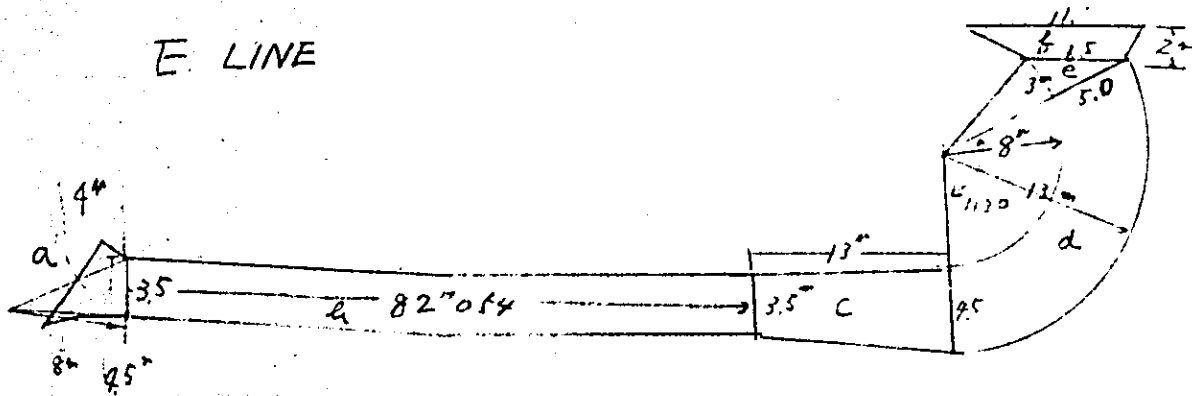
$$c = (15^2 \times \pi \times \frac{1}{4}) - (7^2 \times \pi \times \frac{1}{4}) = 138.2301$$

$$d = 3 \times 7.5 \times \frac{1}{2} = 11.25$$

$$e = 11 \times 2.5 = 27.5$$

$$\begin{aligned} \text{TOTAL} &= 32.37 + 1398.75 + 138.23 + 11.25 + 27.5 \\ &= 1608.1 \text{ m}^2 \end{aligned}$$

E LINE



$$a = 4.5 \times \frac{8}{2} = 18.0$$

$$b = 3.5 \times 82.054 = 287.189$$

$$c = \frac{3.5 - 4.5}{2} \times 13 = 52.00$$

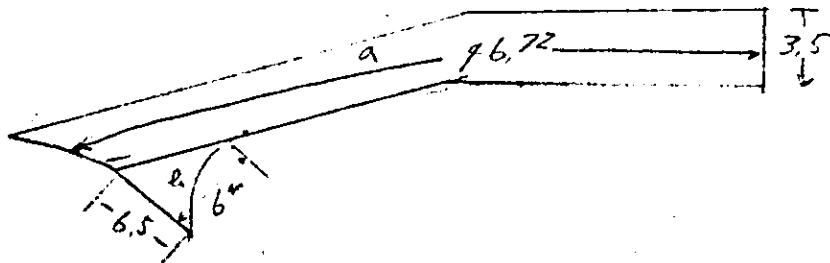
$$d = (13^2 \times \pi \times \frac{113}{360}) - (2^2 \times \pi \times \frac{113}{360}) = 103.5417$$

$$e = 3 \times 5 \times \frac{1}{2} = 7.5$$

$$f = \frac{11 + 6.5}{2} \times 2 = 17.5$$

$$\begin{aligned} \text{TOTAL} &= 18 + 287.189 + 52 + 103.54 + 7.5 + 17.5 \\ &= 425.73 \text{ m}^2 \end{aligned}$$

F LINE

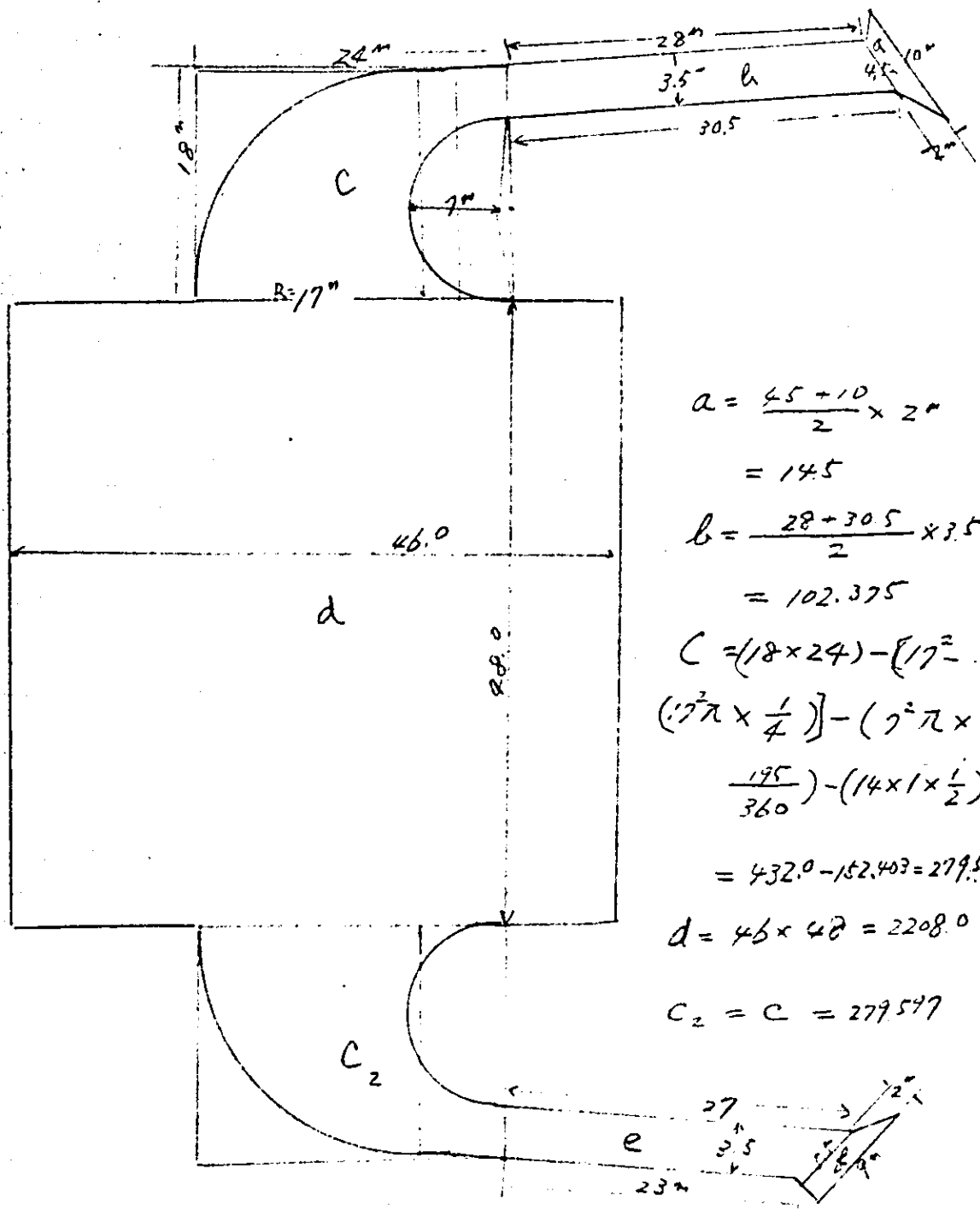


$$a = 3.5 \times 46.72 = 163.52$$

$$b = 6.5 \times 6 \times \frac{1}{2} = 19.50$$

$$\text{TOTAL} = 163.52 + 19.50 = 183.02 \text{ m}^2$$

G LINE



$$a = \frac{4.5 + 1.0}{2} \times 2.0$$

$$= 14.5$$

$$b = \frac{28 + 30.5}{2} \times 3.5$$

$$= 102.375$$

$$C = (18 \times 24) - \left[\left(17^2 \times \frac{\pi}{4} \right) - \left(7^2 \times \pi \times \frac{1}{4} \right) \right] - \left(\frac{17.5}{360} \right) - \left(14 \times 1 \times \frac{1}{2} \right)$$

$$= 432.0 - 152.403 = 279.597$$

$$d = 46 \times 48 = 2208.0$$

$$C_2 = C = 279.597$$

$$e = \frac{27 + 23}{2} \times 3.5 = 87.5$$

$$f = \frac{5.5 + 7}{2} \times 2 = 14.5$$

$$TOTAL = 14.5 + 102.4 + 279.6 + 2208.0 + 279.6 + 87.5 + 14.5$$

$$= 2986.1$$

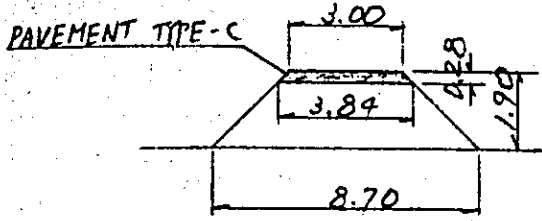
§ 18 ACCESS ROAD (FOR CABIN BOX)

ACCESS ROAD FOR CABIN BOX
QUANTITY CALCULATION SHEET

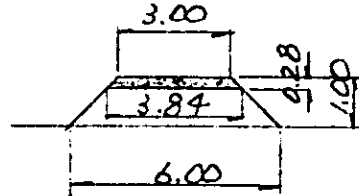
STATION	LENGTH (m)	EMBAKMENT (m ³)	PAVEMENT TYPE-C (m ²)
4Km563 ^m ~ 4Km930 ^m	390.0	1.531	1.170
12Km123 ^m ~ 12Km435 ^m 50	312.5	3.632	938
TOTAL		5.163	2,108

4K563^m ~ 4K930^m

L = 390.00



(4K563^m ~ 4K573^m)



(4K598^m ~)

EMBANKMENT

$$(3.84 + 8.7) \times 1.62 \times \frac{1}{2} \times 10.0 = 101.6^m$$

$$\left\{ (3.84 + 8.7) \times 1.62 + (3.84 + 6.0) \times 0.72 \right\} \times \frac{1}{2} \times 25.0 \times \frac{1}{2} = 171.2^m$$

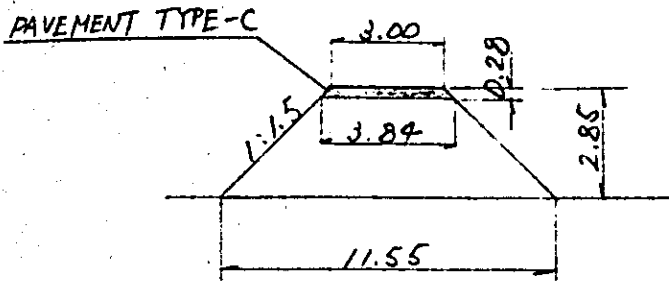
$$(3.84 + 6.0) \times 0.72 \times \frac{1}{2} \times 355.0 = 1,257.6^m$$

$$\Sigma = 1,530.4^m$$

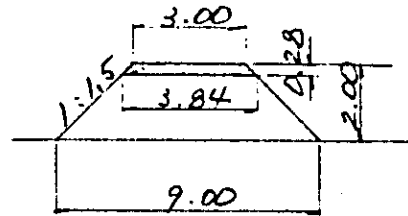
PAVEMENT TYPE-C

$$3.0 \times 390.0 = 1,170.0^m$$

12 Km 123^m ~ 12 Km 435^m 50 . L = 312^m 50



(12 Km 123^m ~ 12 Km 133^m)



(12 Km 154^m 50 ~ 12 Km 435^m 50)

EMBANKMENT

$$(3.84 + 11.55) \times 2.57 \times \frac{1}{2} \times 10.0 = 197.8 \text{ m}^3$$

$$\left\{ (3.84 + 11.55) \times 2.57 + (3.84 + 9.0) \times 1.72 \right\} \times \frac{1}{2} \times 21.5 \times \frac{1}{2} = 331.3$$

$$(3.84 + 9.0) \times 1.72 \times \frac{1}{2} \times 281.0 = 3,102.9$$

$$\Sigma = 3,632.0 \text{ m}^3$$

PAVEMENT TYPE-C

$$3.0 \times 312.5 = 937.5 \text{ m}^2$$

§ 19 TRAFFIC MARKING, TRAFFIC SIGN
AND TRAFFIC BLOCK

TRAFFIC MARKING

1. STOP LINE

$$l = 89^m \quad w = 0.2^m$$

$$A = 89^m \times 0.2^m = 17.8^m^2$$

2. CENTER LINE

$$l = 288^m \quad w = 0.12$$

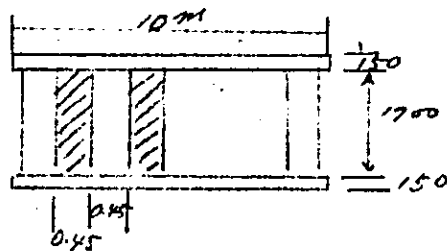
$$A = 288^m \times 0.12 = 34.56^m^2$$

3. WALKER LINE

$$l = 76^m$$

$l = 10^m$ about

$$\begin{aligned} A &= (10^m \times 0.15 \times 2) \\ &+ (0.45 \times 1.7 \times 11) \\ &= 11.415^m^2 \end{aligned}$$

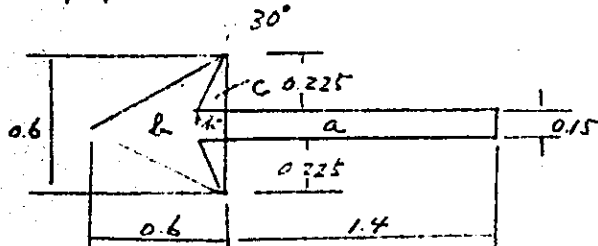


$$\begin{aligned} 10^m \div 0.45 &= 22.22 \\ \text{White paint } \frac{1}{2} \\ 22.2 \times \frac{1}{2} &= 11.1 \approx 11. \end{aligned}$$

$$\Sigma A = \frac{76}{10} \times 11.415^m^2 = 86.754 \approx 86.8^m^2$$

4. TRAFFIC ARROWS

T1 About NO 1.



$$\begin{aligned} A &= (0.15 \times 1.4) + (0.6 \times 0.6 \times \frac{1}{2}) \\ &- (0.13 \times 0.225 \times \frac{1}{2} \times 2) \\ &= 0.3608^m^2 \end{aligned}$$

$$h = 0.225 \times \tan 30^\circ = 0.130$$

$$T1 \quad 27 \text{ NO. } A = 0.361^m^2 \times 27 = 9.747^m^2$$

5. PARKING LINE

$$L = 746^m \quad W = 0.15$$

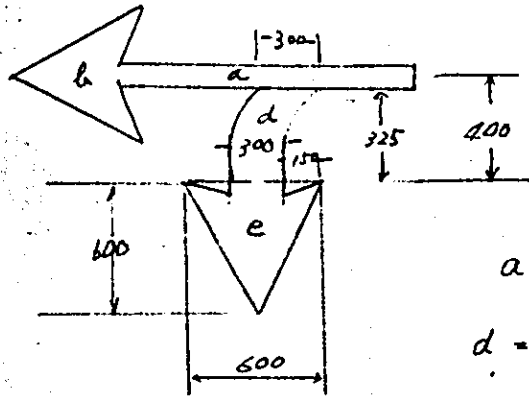
$$A = 0.15 \times 746 = 111.9^m^2$$

 Σ TOTAL

$$1 + 2 + 3 + 4 + 5 = 17.8 + 34.56 + 86.8 +$$

$$(9.75 + 6.29 + 7.22) + 111.9 = 274.32^m^2$$

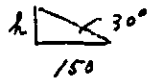
T₂



$$a + b = 0.364 \text{ m}^2$$

$$d = 0.3 \times 0.325 = 0.0975 \approx 0.098$$

$$e = (0.6 \times 0.6 \times \frac{1}{2}) - (0.15 \times 0.087 \times \frac{1}{2} \times 2) = 0.167$$



$$h = 150 \times \tan 30^\circ = 86.6$$

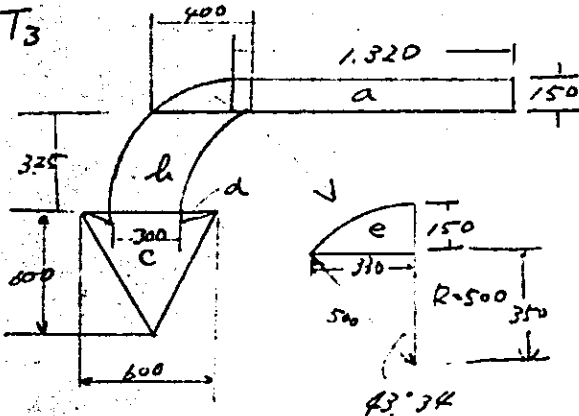
$$A = (a + b) + d + e =$$

$$0.364 + 0.098 + 0.167 = 0.629 \text{ m}^2$$

$$T_2 = 10 \text{ NO}$$

$$\Sigma A = 0.629 \times 10 = 6.29 \text{ m}^2$$

T₃



$$a = 0.15 \times 1.32 = 0.198$$

$$b = \frac{0.4 + 0.3}{2} \times 0.325 = 0.1138$$

$$c = 0.6 \times 0.6 \times \frac{1}{2} = 0.180$$

$$d = 0.15 \times (0.15 \times \tan 30^\circ) \times \frac{1}{2} \times 2 = 0.013$$

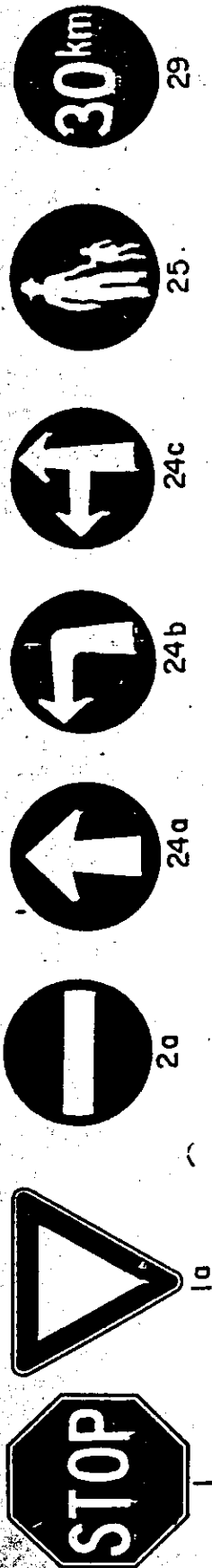
$$e = (0.5^2 \times \pi \times \frac{43.34}{360})$$

$$- (0.35 \times 0.33 \times \frac{1}{2})$$

$$= 0.0368 \approx 0.037$$

$$\text{TOTAL} = a + b + c - d + e = 0.198 + 0.1138 + 0.18 - 0.013 + 0.037 = 0.5158 = 0.516$$

$$T_3 = 14 \times 0.516 = 7.224 \text{ m}^2$$



STOP SIGNS ENTRY PROHIBITED DIRECTION TO BE FOLLOWED WALKING SIGN SPEED LIMIT SIGN

1a

2a

24a

24b

24c

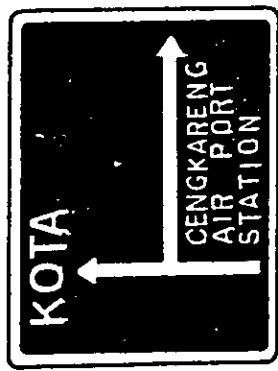
25

29

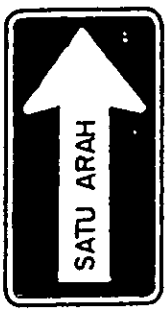
TABLE II SIGN LOCATION

SIGN TABULATION TABLE

DESCRIPTION	QUANTITY	REMARKS
TABLE II I	1	
1a	6	
2a	4	
24a	2	
24b	7	
24c	2	
25	12	
29	6	
TABLE III I	2	GUIDE SIGN
10a	7	
17	1	
TOTAL	50	



1
GUIDE SIGN



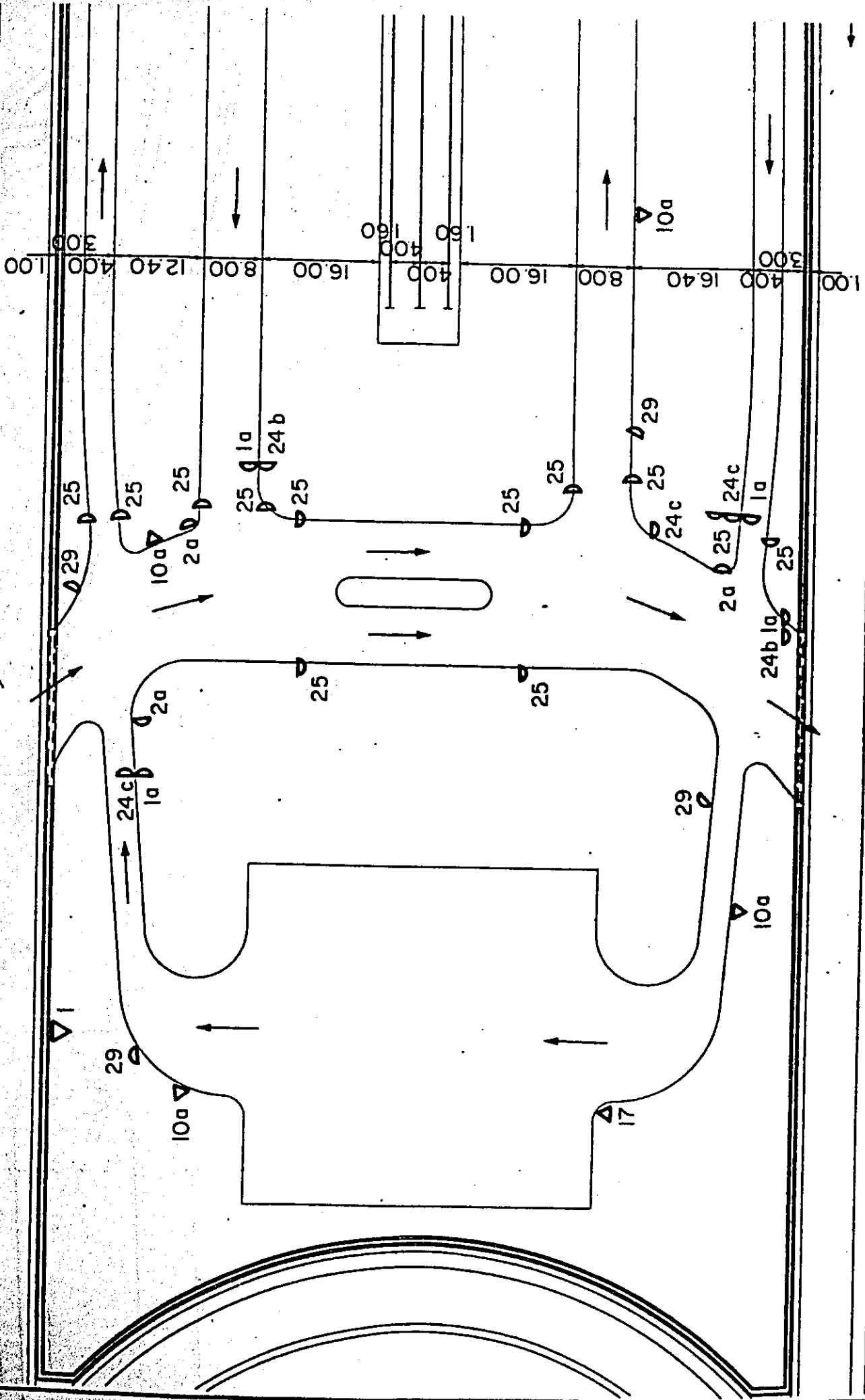
10a
ONE WAY SIGN



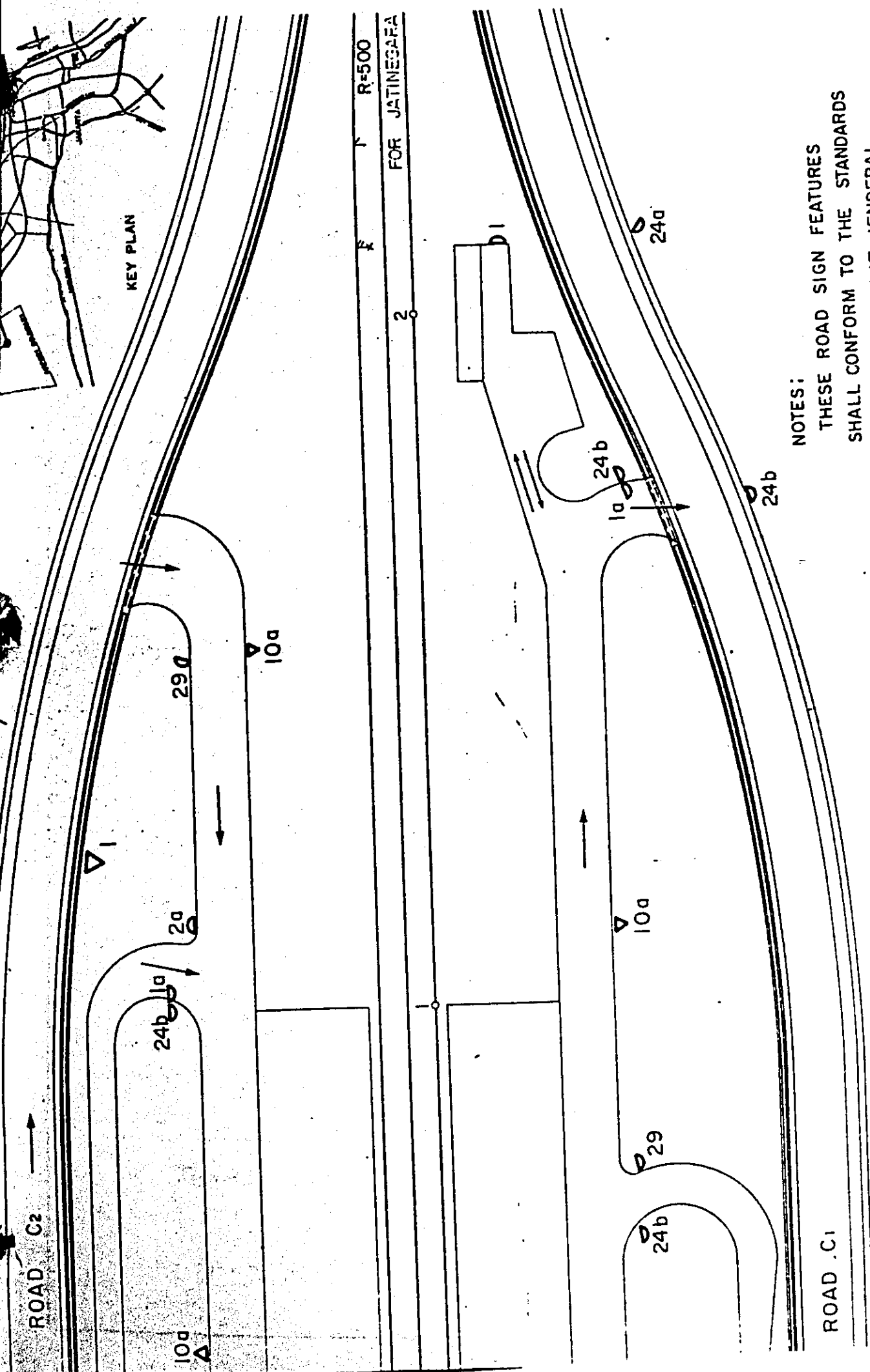
17
PARKING SIGN

TABLE III SIGN LOCATION

TRAFFIC SIGN



PLAN OF TRAFFIC SIGN (SHEET 1 OF 2)



NOTES:
 THESE ROAD SIGN FEATURES
 SHALL CONFORM TO THE STANDARDS
 OF THE DIREKTORAT JENDERAL
 PERHUBUNGAN DARAT.

▽ TABLE II SIGN

PLAN OF TRAFFIC SIGN (SHEET 2 OF 2)

GUIDE SIGN-BOARD.

TRAFFIC BLOCK

TYPE A

① $l = 48''$

② $l = 48''$

③ $(8.5'' \times 2 \times \pi \times \frac{96}{360}) + 60.7 + (7.5'' \times 2 \times \pi \times \frac{33^\circ + 67^\circ}{360}) + 5.7''$
 $= 93.2292 \approx 93.23$

④ $33.2 + (5'' \times 2 \times \pi \times \frac{1}{2}) = 48.908 \approx 48.91$

⑤ $(14.5'' \times 2 \times \pi \times \frac{93}{360}) + 35 + (2 \times 2 \times \pi \times \frac{116}{360}) + 6.2 = 68.7849$
 $= 68.78$

⑥ $20.8 + 24.5 + 98.5 + (13 \times 2 \times \pi \times \frac{97}{360}) + (2 \times 2 \times \pi \times \frac{1}{4})$
 $+ 41.2 + (6 \times 2 \times \pi \times \frac{112}{360}) = 221.8788 \approx 221.88$

⑦ $(2 \times 2 \times \pi \times \frac{113 + 70}{360}) + 7 + 126 + (6.2 \times 2 \times \pi \times \frac{1}{2}) = 158.5658 \approx 158.87$

⑧ $(2 \times 2 \times \pi \times \frac{117}{360}) + 9 + (6.0 \times 2 \times \pi \times \frac{70}{360}) + 87.7$
 $+ (8.2 \times 2 \times \pi \times \frac{1}{2}) = 133.2755 \approx 133.88$

⑨ $(14.5 \times 2 \times \pi \times \frac{1}{4}) + 32 + (2 \times 2 \times \pi \times \frac{137}{360}) + 5.5 = 65.0587$
 $= 65.06$

⑩ $3.4 + (7.5 \times 2 \times \pi \times \frac{55}{360}) + 10 + 24.4 + 49.5 + 12$
 $+ (15 \times 2 \times \pi \times \frac{113}{360}) + (2 \times 2 \times \pi \times \frac{113}{360}) + 82.8$
 $+ (7 \times 2 \times \pi \times \frac{115}{360}) = 226.2772 \approx 226.88$

⑪ $8.3 + (5 \times 2 \times \pi \times \frac{110}{360}) + 20 + 13 = 50.8773 \approx 50.90$

TOTAL $48 + 48 + 93.23 + 48.91 + 68.78 + 221.88 + 158.87$

$+ 133.88 + 65.06 + 226.88 + 50.90 = 1164.39$

$= 711.5 \text{ V} = @ 0.192 \times 1164.39 = 223.5629 \approx 223.6 \text{ m}^3$

TYPE B

$$1 \quad l = 12$$

$$2 \quad 9 + (7 \times 2 \times \pi \times \frac{1}{2}) + 28.4 = 59.3911 \approx 59.39$$

$$3 \quad (4 \times \pi) + (17 \times 2) = 46.5664 \approx 46.57$$

$$4 \quad l = 129.2$$

$$5 \quad 185.5 + (12 \times 2 \times \pi \times \frac{1}{4}) = 204.3496 \approx 204.35$$

$$6 \quad l = 12$$

$$7 \quad 9 + (14 \times \pi \times \frac{1}{2}) + 25.4 = 56.3911 \approx 56.39$$

$$8 \quad 185.5 + 31 + 20 + 4 = 240.50$$

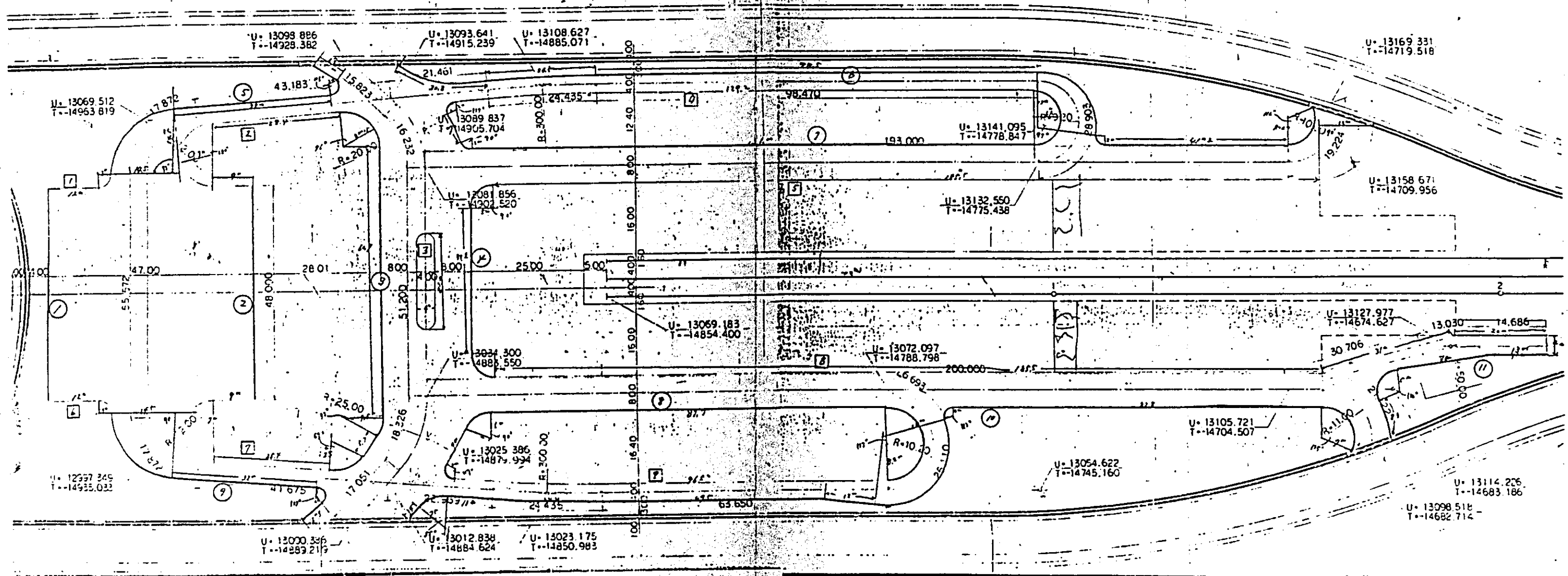
$$9 \quad l = 96.5$$

$$\begin{aligned} \text{TOTAL} \quad & 12 + 59.39 + 46.57 + 129.2 + 204.35 + 12 \\ & + 56.39 + 240.50 - 96.5 = 856.90 \end{aligned}$$

$$\text{CONV} \quad @ 0.072 \times 856.9 = 61.6768 = 61.7$$

$$\Sigma \text{ TOTAL} \quad 1164.39 + 61.7 = 2021.29$$

$$\Sigma V = 223.6 + 61.7 = 285.3 \text{ m}^3$$



PLAN OF TRAFFIC BLOCK

U. 13098 886
T. 14928.382

U. 13093.641
T. 14915.239

U. 13108.627
T. 14885.071

U. 13169 331
T. 14719.518

U. 13069.512
T. 14963.819

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