ANNEX E

ROAD CONSTRUCTION

ANNEX E ROAD CONSTRUCTION

(1) Calculation of Work Quantities

1) Earth moving

The quantities of earth to be moved are calculated in Table A.E.1. In this table, the following abbreviations are used:

- Select 1 : Volume of selected soil for subgrade in a road section where only subgrade construction is required (low embankment height).
- Select 2 : Volume of selected soil for subgrade in a road section where embankment of the common soil under the subgrade is necessary (rather high embankment height).
- Com 1 : Required volume of common soil for embankment apart from the subgrade.
- Com 2 : Additional volume of embankment generated by site clearance. (see Table 7.1.5)
- Com 3 : Additional volume of embankment generated by displacement of natural ground possibly due to the consolidation of subsoil (at lowland on both sides of Rfo Tebicuary-mf). (see, Table 7.1.6)
- Side Borrow: Earth volume obtained from road side borrows.

Table A.E.1 Calculation of Quantity of Earthmoving

(1) 1st Section

Segument NO.	Type	Embankment				Cut				Side Borrow			Barnced Volume
		Section	Pavement	Length	volume	Section	Pavement	Length	volume	Section	Length	volume	
Paguan to Rio Tebicuarymi													
1	Select1	7.3	4.38	14200.0	41,464								
	Select2	14.8	4.38	7160.0	74,607								
	Total				116,071								116,071
	C0m1	9.8	0.00	7160.0	70,168								
	Com2				31,187								
	Total				101,355	5.6	4.38	1140.0	11,377	4.0	22500.0	90,000	-22
2	Select1	11.0	4.38	4605.0	30,485								
	Select2	18.1	4.38	2645.0	36,289								
	Total				66,775	21.0	4.38	3250.0	82,485				-15,711
	C0m1	11.4	0.00	2645.0	30,153								
	Com2				47,264								
	Total				77,417					7.4	10500.0	77,700	-283
3	Select1	15.5	4.38	7800.0	86,736								
	Select2	21.3	4.38	1200.0	20,304								
	Total				107,040								107,040
	C0m1	4.3	0.00	1200.0	5,160								
	Com2				0								
	Total				5,160					4.0	9000.0	36,000	-30,840
4	Select1	9.0	4.38	4900.0	22,638								
	Select2	21.0	4.38	5040.0	83,765								
	Total				106,403								106,403
	C0m1	14.2	0.00	5040.0	71,568								
	Com2				45,472								
	Total				117,040					11.7	10000.0	117,000	40
5	Select1	13.5	4.38	3200.0	29,184								
	Select2	17.4	4.38	2164.0	28,175								
	Total				57,359								57,359
	C0m1	17.8	0.00	2164.0	38,519								
	Com2				18,240								
	Com3				4,067								
	Total				60,826	11.4	4.38	1150.0	18,147	6.4	6514.0	41,690	990
Total	Select				453,648				82,485				371,163
	Com				361,798				29,524			362,390	-30,116

(2) 2nd Section

Segument NO.	Type	Embankment				Cut				Gutter Cut			Barnced Volume
		Section	Pavement	Length	volume	Section	Pavement	Length	volume	Section	Length	volume	
Rio Tebicuarymi to Villarica													
6	Select1	6.4	5.11	1140.0	1,471								
	Select2	19.8	5.11	2741.0	40,265								
	Total				41,736								41,736
	Com1	17.6	0.00	2741.0	48,242								
	Com2				23,026								
	Com3				5,636								
	Total				76,904					18.2	4271.0	77,818	-914
7	Select1	10.3	5.11	6550.0	33,995								
	Select2	19.4	5.11	1390.0	19,863								
	Total				53,858								53,858
	Com1	0.4	0.00	1390.0	556								
	Com2				11,040								
	Total				11,596					4.0	8000.0	32,000	-20,404
8	Select1	8.1	5.11	7060.0	21,109								
	Select2	24.2	5.11	4000.0	76,360								
	Total				97,469								97,469
	Com1	3.6	0.00	4000.0	14,400								
	Com2				33,800								
	Total				48,200	1.6	5.11	940.0	6,307	4.0	12000.0	48,000	200
Total	Select				193,063				0				193,063
	Com				136,700				6,307			157,818	-21,118

(3) 3rd Section (La Colmena - Tebicuary)

1	Select1	8.8	4.24	22595.0	103,033								103,033
	Com2				23,232					4.0	25300.0	101,200	-77,968
2	Select1	28.8	4.24	2400.0	58,944								58,944
	Com1	7.8	0.00	2400.0	18,720								
	Com2				464								
	Total				19,184					8.0	2400.0	19,200	-16
3	Select1	13.5	4.24	9560.0	88,526								88,526
	Com2				6,160	0.5	4.24	840.0	3,982	4.0	10400.0	41,600	-39,422
Total	Select				250,503				0				250,503
	Com				48,576				3,982			162,000	-117,406
Grand Total	Select				897,213				82,485				814,728
	Com				547,074				39,813			682,207	-168,639

2) Quantity of Site Clearance

Table A.E.2 Site Clearing (1) - Paraguarí to Tebicuary

Segment 1										
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	0 +	0 ~	S.	2 +	100	m	500.0		
S.	2 +	120 ~	S.	4 +	60	m		340.0	
S.	4 +	100 ~	S.	5 +	100	m	200.0		
S.	10 +	0 ~	S.	21 +	0	m	2,200.0		
S.	27 +	100 ~	S.	30 +	0	m	500.0		
S.	46 +	0 ~	S.	47 +	100	m	300.0		
S.	50 +	0 ~	S.	51 +	0	m	200.0		
S.	51 +	0 ~	S.	51 +	100	m	100.0		
S	55 +	0 ~	S.	57 +	0	m	400.0		
S.	58 +	0 ~	S.	60 +	0	m	400.0		
S.	63 +	0 ~	S.	64 +	0	m		200.0	
S.	64 +	0 ~	S.	65 +	0	m	200.0		
S.	71 +	0 ~	S.	73 +	100	m		500.0	
S.	73 +	100 ~	S.	75 +	0	m	500.0		
S.	76 +	0 ~	S.	79 +	0	m	600.0		
S.	84 +	0 ~	S.	86 +	0	m	400.0		
Sub Total						m	6,500.0	1,040.0	0.0
Segment 2									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	112 +	100 ~	S.	115 +	100	m	600.0		
S.	115 +	100 ~	S.	118 +	0	m		500.0	
S.	118 +	0 ~	S.	142 +	100	m	4,900.0		
S.	142 +	100 ~	S.	144 +	0	m		600.0	
S.	144 +	0 ~	S.	150 +	0	m	1,200.0		
S.	153 +	100 ~	S.	158 +	0	m	900.0		
S.	158 +	0 ~	S.	159 +	0	m		200.0	
S.	159 +	0 ~	S.	164 +	0	m	1,000.0		
Sub Total						m	8,600.0	1,300.0	0.0
Segment 3									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
Sub Total						m	0.0	0.0	0.0
Segment 4									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	210 +	0 ~	S.	216 +	100	m	1,300.0		
S.	216 +	100 ~	S.	218 +	0	m		300.0	
S.	218 +	0 ~	S.	260 +	0	m	8,400.0		
Sub Total						m	9,700.0	300.0	0.0
Segment 5									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	280 +	0 ~	S.	287 +	0	m	1,400.0		
S.	287 +	0 ~	S.	288 +	0	m		300.0	
S.	288 +	100 ~	S.	289 +	0	m	200.0		
S.	289 +	0 ~	S.	292 +	100	m			700.0
Sub Total						m	1,600.0	300.0	700.0
Total						m	26,400.0	2,940.0	700.0

Table A.E.2 Site Clearing (2) - Teblcuary to Villarrica

Segment 6									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	292 +	114 ~	S.	292 +	164	m			50.0
S.	292 +	164 ~	S.	314 +	0	m	4,236.0		
Sub Total						m	4,236.0	0.0	50.0
Segment 7									
STATION						UNIT	SITE CLEARING		
							NORMAL	MIDDLE	HEAVY
S.	315 +	0 ~	S.	317 +	0	m	300.0		
S.	319 +	0 ~	S.	322 +	0	m	600.0		
S.	325 +	150 ~	S.	328 +	0	m	450.0		
S.	330 +	0 ~	S.	331 +	100	m	300.0		
S.	344 +	0 ~	S.	348 +	50	m	850.0		
S.	351 +	0 ~	S.	353 +	100	m	500.0		
Sub Total						m	3,000.0	0.0	0.0
Segment 8									
STATION						UNIT	SITE CLEARING		
							NORMAL	WOODS	DENSE WOODS
S.	358 +	150 ~	NO.	360 +	150	m	400.0		
S.	364 +	50 ~	S.	370 +	150	m	1,300.0		
S.	370 +	150 ~	S.	373 +	100	m		550.0	
S.	373 +	100 ~	S.	391 +	100	m	3,600.0		
S.	395 +	0 ~	S.	405 +	0	m	2,000.0		
Sub Total						m	7,300.0	550.0	0.0
Total						m	14,536.0	550.0	50.0

Table A.E.2 Site Clearing (3) - La Colmena to Tcbicuary

Segument 1					
STATION	UNIT	SITE CLEARING		
		NORMAL	WOODS	DENSE WOODS
S. 2 + 100 ~ S. 3 + 50	m	150.0		
S. 3 + 50 ~ S. 3 + 150	m		100.0	
S. 3 + 150 ~ S. 11 + 0	m	1,450.0		
S. 25 + 0 ~ S. 27 + 100	m		500.0	
S. 30 + 0 ~ S. 37 + 0	m	400.0		
S. 50 + 100 ~ S. 55 + 0	m	900.0		
S. 65 + 0 ~ S. 66 + 100	m	300.0		
S. 72 + 100 ~ S. 76 + 100	m	800.0		
S. 79 + 0 ~ S. 80 + 0	m	200.0		
S. 83 + 0 ~ S. 84 + 50	m	250.0		
S. 117 + 0 ~ S. 118 + 0	m	200.0		
S. 120 + 0 ~ S. 121 + 100	m		300.0	
S. 123 + 100 ~ S. 126 + 100	m	600.0		
Sub Total	m	5,250.0	900.0	0.0
Segument 2				
STATION	UNIT	SITE CLEARING		
		NORMAL	WOODS	DENSE WOODS
S. 126 + 100 ~ S. 127 + 40.5	m	100.0		
Sub Total	m	100.0	0.0	0.0
Segument 3				
STATION	UNIT	SITE CLEARING		
		NORMAL	WOODS	DENSE WOODS
S. 139 + 50 ~ S. 140 + 40	m		310.0	
S. 142 + 70 ~ S. 146 + 20	m	400.0		
S. 148 + 80 ~ S. 155 + 40	m		350.0	
S. 176 + 50 ~ S. 177 + 70	m	240.0		
S. 180 + 0 ~ S. 180 + 60	m	120.0		
Sub Total	m	760.0	660.0	0.0
Total	m	6,110.0	1,560.0	0.0
Grand Total	m	47,046.0	5,050.0	750.0

3) Drainage Structure

Minor drainage structures other than bridges are standardized in this study as follows:

- Box culvert : 3.0×3.0
- Pipe culvert : Diameter = 1.2 m

The number of structures is listed in Table A.E.3.

Table A.E.3 List of Drainage Structures (1)

Section 1 : Paraguari to Rio Tebicuarymi		
Segment 1 Paraguari- Sapucai		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
3,193	1	
3,709	1	
3,888	1	
4,309	1	
4,527	1	
5,455	1	
5,688	1	
5,929	1	
6,779	1	
7,745	1	
8,186	1	
9,653	1	
10,195	1	
10,609	1	
10,875	1	
11,088	1	
11,470	1	
11,609	1	
11,754	1	
11,978	1	
12,212	1	
12,718	1	
12,984	1	
13,322	1	
13,456	1	
13,988	1	
15,507	1	
16,525	1	
16,762	1	
17,055	1	
17,609	1	
17,933	1	
18,137	1	
18,540	1	
19,180	1	
19,222	1	
19,720	1	
20,063	1	
20,432	1	
20,510	1	
20,735	1	
21,860	1	
Total	42	0

Segment 2 Sapucai - Caballero		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
27,734		1
28,016		1
28,139		1
29,228		1
29,600		1
Total	0	0
Segment 3 Caballero - Ybytimy		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
34,020		1
34,200		1
35,260		1
38,120	1	
40,530	1	
41,440		1
41,750		1
Total	2	5
Segment 4 Ybytimi - Punto Unido		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
Total	0	0
Segment 5 Punto Unido - Tebicuary		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
54,334	1	
54,675	1	
Total	2	0
Grand Tota	46	5

Table A.E.3 List of Drainage Structures (2)

Section2 : Rio Tebicuarymi to Villarrica		
Segment 6 Tebicuary - Cnel. Martinez		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
Total	0	0
Segment 7 Cnel. Martinez - Cardozo		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
64,542	1	
64,933	1	
65,810	1	
66,117	1	
70,620	1	
Total	5	0
Segment 8 Cardozo - Villarica		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
75,223		1
75,875		1
76,574		1
76,732	1	
77,174		1
77,352		1
77,735		1
78,112	1	
78,765		1
79,850	1	
80,049		1
80,849		1
81,249	1	
82,249		1
Total	4	10
Grand Total	9	10

Section 3 : Branch to La Colmena		
Segment 1 La Colmena - No 253+00		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
2,105	1	
4,484	1	
6,397	1	
6,449		1
6,597		1
7,428		1
11,462		1
12,972		1
13,330		1
15,968		1
17,422		1
17,635		1
18,089		1
18,535		1
18,707		1
19,742		1
20,031		1
20,300		1
22,352	1	1
Total	4	16
Segment 2 No 253+00 - No 277+00		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
Total	0	0
Segment 3 No 277+00 - Tebicuary		
	Structure Type	
Distance	Box Culvert(3.0x3.0)	Pipe Culvert(D1.2)
30,390	1	
32,352	1	
32,682	1	
33,967	1	
Total	4	0
Grand Total	8	16

4) Quantity of Pavement Materials

The quantities of pavement materials are shown in Table A.E.4, while more detailed data by segment are tabulated in Table A.E.5.

Table A.E.4 Summary of Quantity of Pavement Material

Description \ Segment		Unit	Paraguari to Rio Tbicuarymi						Rio Tebicuarymi to Villarrica			
			1	2	3	4	5	Total	6	7	8	Total
AC	Roadway	m3	22,050	10,290	8,820	9,800	6,370	57,330	4,410	7,840	11,760	24,010
	Shoulder	m3	4,500	2,100	1,800	2,000	1,300	11,700	900	1,600	2,400	4,900
	Total	m3	26,550	12,390	10,620	11,800	7,670	69,030	5,310	9,440	14,160	28,910
Base	Roadway	m3	23,963	11,183	9,585	10,650	6,923	62,303	4,793	8,520	12,780	26,093
Sub-base	Roadway	m3	24,638	11,498	9,855	10,950	7,118	64,058	8,213	14,600	21,900	44,713
	Shoulder	m3	23,400	10,920	9,360	10,400	6,760	60,840	4,680	8,320	12,480	25,480
	Total	m3	48,038	22,418	19,215	21,350	13,878	124,898	12,893	22,920	34,380	70,193
Prairn	Roadway	lt	239,625	111,825	95,850	106,500	69,225	623,025	47,925	85,200	127,800	260,925
Seal Coat	Shoulder	lt	175,500	81,900	70,200	78,000	50,700	456,300	35,100	62,400	93,600	191,100
	Total	lt	415,125	193,725	166,050	184,500	119,925	1,079,325	83,025	147,600	221,400	452,025

Description \ Segment		Unit	Brarch to La Colmena				Grand
			1	2	3	Total	Total
AC	Roadway	m3	21,252	2,016	8,736	32,004	113,344
	Shoulder	m3	5,060	480	2,080	7,620	24,220
	Total	m3	26,312	2,496	10,816	39,624	137,564
Base	Roadway	m3	26,945	2,556	11,076	40,577	128,972
Sub-base	Roadway	m3	27,704	2,628	11,388	41,720	150,490
	Shoulder	m3	26,312	2,496	10,816	39,624	125,944
	Total	m3	54,016	5,124	22,204	81,344	276,434
Prairn	Roadway	lt	269,445	25,560	110,760	405,765	1,289,715
Seal Coat	Shoulder	lt	197,340	18,720	81,120	297,180	944,580
	Total	lt	466,785	44,280	191,880	702,945	2,234,295

Table A.E.5 Quantity of Pavement Material by Segment

Paraguari to Villarrica

Segment1

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	22.5	7.0	0.14	22,050.0
	Shoulder	22.5	5.0	0.04	4,500.0
Base	Roadway	22.5	7.1	0.15	23,962.5
Sub-base	Roadway	22.5	7.3	0.15	24,637.5
	Shoulder	22.5	5.2	0.20	23,400.0
Prim	Roadway	22.5	7.1	0.0015	239,625.0
Seal Coat	Shoulder	22.5	5.2	0.0015	175,500.0

Segment2

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	10.5	7.0	0.14	10,290.0
	Shoulder	10.5	5.0	0.04	2,100.0
Base	Roadway	10.5	7.1	0.15	11,182.5
Sub-base	Roadway	10.5	7.3	0.15	11,497.5
	Shoulder	10.5	5.2	0.20	10,920.0
Prim	Roadway	10.5	7.1	0.0015	111,825.0
Seal Coat	Shoulder	10.5	5.2	0.0015	81,900.0

Segment3

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	9.0	7.0	0.14	8,820.0
	Shoulder	9.0	5.0	0.04	1,800.0
Base	Roadway	9.0	7.1	0.15	9,585.0
Sub-base	Roadway	9.0	7.3	0.15	9,855.0
	Shoulder	9.0	5.2	0.20	9,360.0
Prim	Roadway	9.0	7.1	0.0015	95,850.0
Seal Coat	Shoulder	9.0	5.2	0.0015	70,200.0

Segment4

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	10.0	7.0	0.14	9,800.0
	Shoulder	10.0	5.0	0.04	2,000.0
Base	Roadway	10.0	7.1	0.15	10,650.0
Sub-base	Roadway	10.0	7.3	0.15	10,950.0
	Shoulder	10.0	5.2	0.20	10,400.0
Prim	Roadway	10.0	7.1	0.0015	106,500.0
Seal Coat	Shoulder	10.0	5.2	0.0015	78,000.0

Segment5

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	6.5	7.0	0.14	6,370.0
	Shoulder	6.5	5.0	0.04	1,300.0
Base	Roadway	6.5	7.1	0.15	6,922.5
Sub-base	Roadway	6.5	7.3	0.15	7,117.5
	Shoulder	6.5	5.2	0.20	6,760.0
Prim	Roadway	6.5	7.1	0.0015	69,225.0
Seal Coat	Shoulder	6.5	5.2	0.0015	50,700.0

Segment6

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	4.5	7.0	0.14	4,410.0
	Shoulder	4.5	5.0	0.04	900.0
Base	Roadway	4.5	7.1	0.15	4,792.5
Sub-base	Roadway	4.5	7.3	0.25	8,212.5
	Shoulder	4.5	5.2	0.20	4,680.0
Prim	Roadway	4.5	7.1	0.0015	47,925.0
Seal Coat	Shoulder	4.5	5.2	0.0015	35,100.0

Segment7

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	8.0	7.0	0.14	7,840.0
	Shoulder	8.0	5.0	0.04	1,600.0
Base	Roadway	8.0	7.1	0.15	8,520.0
Sub-base	Roadway	8.0	7.3	0.25	14,600.0
	Shoulder	8.0	5.2	0.20	8,320.0
Prim	Roadway	8.0	7.1	0.0015	85,200.0
Seal Coat	Shoulder	8.0	5.2	0.0015	62,400.0

Segment8

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	12.0	7.0	0.14	11,760.0
	Shoulder	12.0	5.0	0.04	2,400.0
Base	Roadway	12.0	7.1	0.15	12,780.0
Sub-base	Roadway	12.0	7.3	0.25	21,900.0
	Shoulder	12.0	5.2	0.20	12,480.0
Prim	Roadway	12.0	7.1	0.0015	127,800.0
Seal Coat	Shoulder	12.0	5.2	0.0015	93,600.0

Itarch to La Colmera

Segment1

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	25.3	7.0	0.12	21,252.0
	Shoulder	25.3	5.0	0.04	5,060.0
Base	Roadway	25.3	7.1	0.15	26,944.5
Sub-base	Roadway	25.3	7.3	0.15	27,703.5
	Shoulder	25.3	5.2	0.20	26,312.0
Prim	Roadway	25.3	7.1	0.0015	269,445.0
Seal Coat	Shoulder	25.3	5.2	0.0015	197,340.0

Segment2

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	2.4	7.0	0.12	2,016.0
	Shoulder	2.4	5.0	0.04	480.0
Base	Roadway	2.4	7.1	0.15	2,556.0
Sub-base	Roadway	2.4	7.3	0.15	2,628.0
	Shoulder	2.4	5.2	0.20	2,496.0
Prim	Roadway	2.4	7.1	0.0015	25,560.0
Seal Coat	Shoulder	2.4	5.2	0.0015	18,720.0

Segment3

Description		Distance km	Width m	Thickness m	Volume m3,lt
A/C	Roadway	10.4	7.0	0.12	8,736.0
	Shoulder	10.4	5.0	0.04	2,080.0
Base	Roadway	10.4	7.1	0.15	11,076.0
Sub-base	Roadway	10.4	7.3	0.15	11,388.0
	Shoulder	10.4	5.2	0.20	10,816.0
Prim	Roadway	10.4	7.1	0.0015	110,760.0
Seal Coat	Shoulder	10.4	5.2	0.0015	81,120.0

5) Average distance of transport of selected soil

The average distance of transport of selected soil from the candidate borrow pits, which are described in Chapter 6, to the site was calculated according to the following Figure A.E.1 (1) and (2).

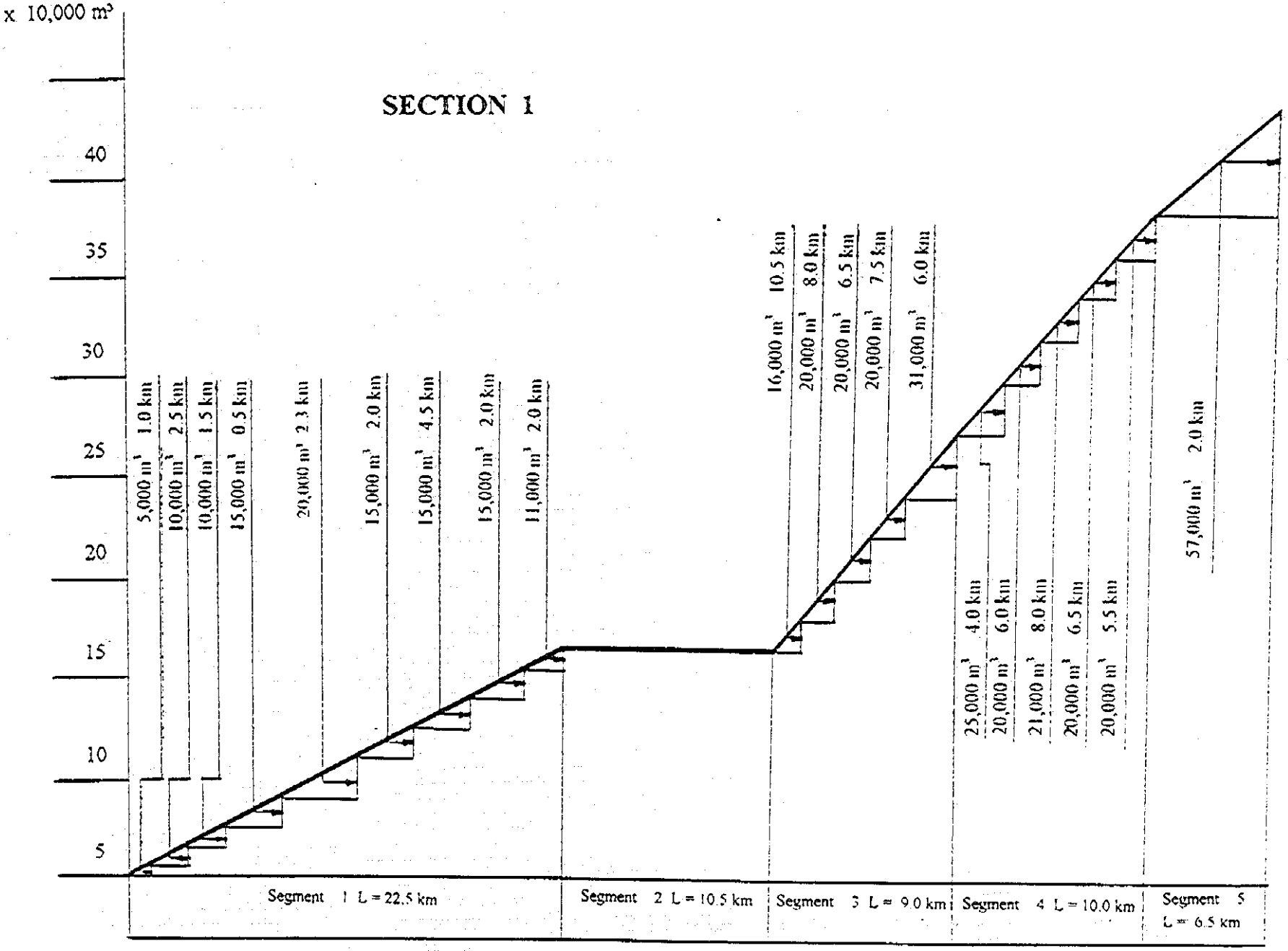
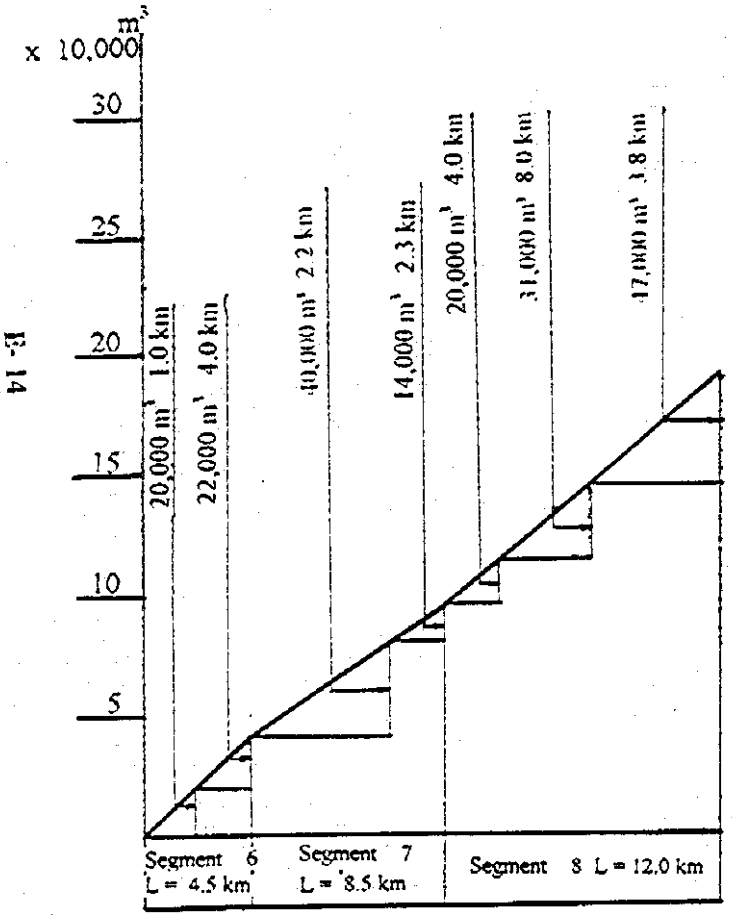

x 10,000 m³
SECTION 1
40
35
30
25
20
15
10
5
5,000 m³ 1.0 km
10,000 m³ 2.5 km
10,000 m³ 1.5 km
15,000 m³ 0.5 km
20,000 m³ 2.3 km
15,000 m³ 2.0 km
15,000 m³ 4.5 km
15,000 m³ 2.0 km
11,000 m³ 2.0 km
16,000 m³ 10.5 km
20,000 m³ 8.0 km
20,000 m³ 6.5 km
20,000 m³ 7.5 km
31,000 m³ 6.0 km
25,000 m³ 4.0 km
20,000 m³ 6.0 km
21,000 m³ 8.0 km
20,000 m³ 6.5 km
20,000 m³ 5.5 km
57,000 m³ 2.0 km
Segment 1 L = 22.5 km
Segment 2 L = 10.5 km
Segment 3 L = 9.0 km
Segment 4 L = 10.0 km
Segment 5
L = 6.5 km

Figure A.E.1 (1)

SECTION 2



SECTION 3

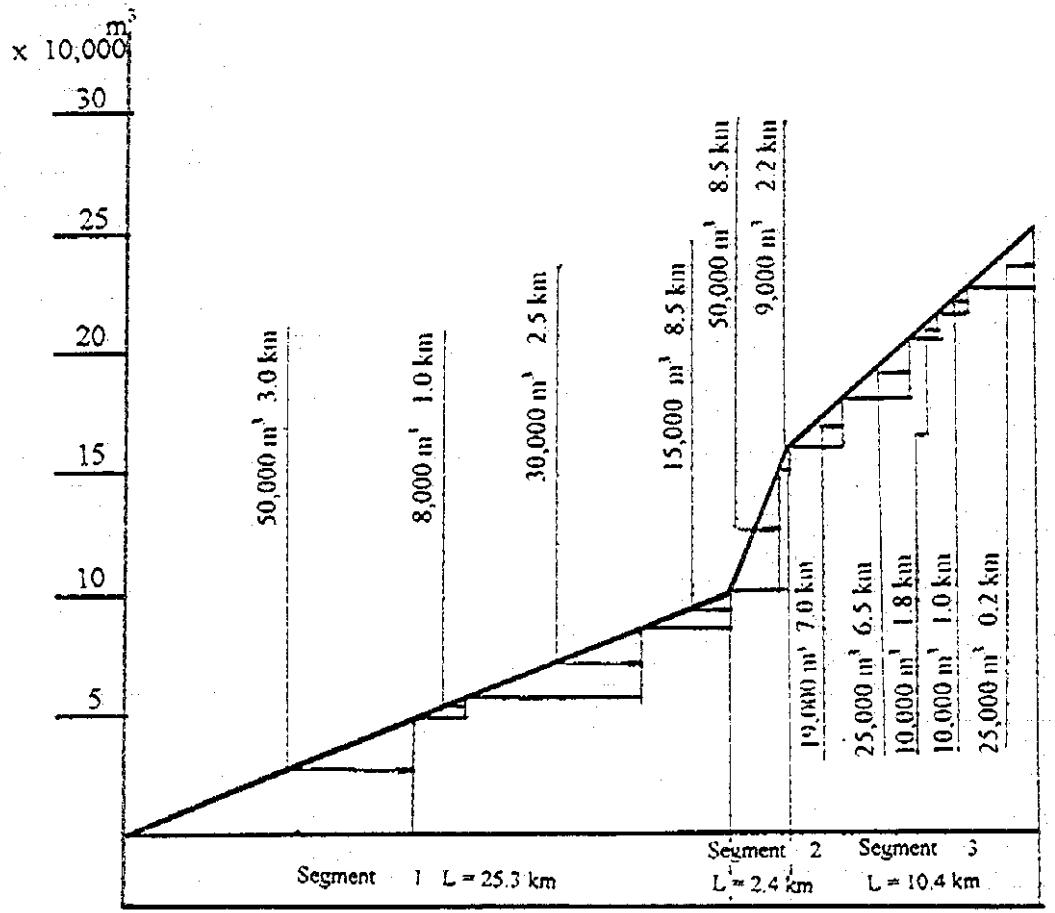


Figure A.E.1 (2)

(2) Cost Estimation

1) Modification of costs relative to pavement structure

Pavement structures were compared in 6-4-3, (3), 4). However, Table 6.4.10, which shows the cost comparison results of rigid pavement and flexible pavement, is based on unit prices tentatively set only for comparison purposes. More exact unit prices, however, have been set in Chapter 8. Table A.E.6 is the modification of Table 6.4.10 in that it uses exact unit prices. There is no change in the comparison results.

Table A.E.6 Cost Comparison of Rigid and Flexible Pavement

	Paraguari - Rio Teb. (58.5km)				Rio Teb. - Villarrica (24.5km)				La Colmena - Teb. (38.1km)				Total(121.1km)
Rigid Pavement	U.P.($/m3)	Thick(cm)	Vol. (m3)	1,000$	U.P.($/m3)	Thick(cm)	Vol. (m3)	1,000$	U.P.($/m3)	Thick(cm)	Vol. (m3)	1,000$	1,000 $
Cement Concrete	215.0	28	114,660	24,652	215.0	28	48,020	10,324	215.0	23	61,341	13,188	48,165
Subbase	39.6	16	65,520	2,593	38.1	16	27,440	1,044	49.9	16	42,672	2,128	5,765
Total ($)=R				27,245				11,369				15,316	53,930
Flexible Pavement													
Asphalt Concrete	119.1	14	57,330	6,825	117.5	14	24,010	2,822	129.4	12	32,004	4,140	13,787
Base	40.8	15	61,425	2,509	39.3	15	25,725	1,012	51.1	15	40,005	2,046	5,566
Subbase	39.6	15	61,425	2,431	38.1	25	42,875	1,632	49.9	15	40,005	1,995	6,057
Prime Coat	570.0	0.15	614	350	570.0	0.15	257	147	570.0	0.15	400	228	725
Sub-total ($/m^)=A				12,114				5,612				8,409	26,135
Overlay (A/C)=B	119.1	8	32,760	3,900	117.5	11	18,865	2,217	129.4	8	21,336	2,760	8,877
discounted B=C	8 % x 9years			1,951				1,109				1,380	4,440
Total ($)=F=A+C				14,065				6,721				9,789	30,576
R - F ($)				13,179				4,648				5,527	23,354

*Unit Price of Concrete = 215.0$ — The same price as for minor drainage structures was put. Of course, quality of concrete should be higher, but less formwork, less quantity of bar and etc. were taken into accou

2) Unit price of work item

Detailed data of unit price estimations are shown from the next page.

TRANSPORTATION OF SOIL	DMT (Km.) : 7
UNIT :G/m3/Km	
I EQUIPMENT	
Dump Truck 11 tn. (6m3)	35,700 G./hs.
TOTAL COST OF EQUIPMENT	35,700 G./hs.
II LABOR	
Of Equipment	4,530 G./hs.
Foreman and Guardman	453 G./hs.
Total Cost of Labor	4,983 G./hs.
Total Cost of Ejecution	40,683 G./hs.
III RENDIMIENTO	
Average Transportation Distance	7 km
Capacity of Equipment	7 m3
Average Speed of Equipment	20 km/hs.
Trip Duration (cycle)	
2 x DMT x 60/av.speed	42 min./v
Loading Time	4 min./v
Unloading Time	2 min./v
Wainting nad Handling Time	3 min./v
Total Trip Duration	51 min./v
Trips per hour	
60 (min/h.) /trip duration	1.176
Efficiency per hour	
(Capacity/trip) x trip per hour x AvTD	58 km.m3/hs.
IV UNIT PRICE	
(Total cost of Execution)/(Yield per hour)	701 G./m3/km.
V ADOPTED PRICE	701 G./m3/km.

0.35

TRANSPORTATION OF PAVIMENT	DMT (Km.) :11
UNIT :G/m3/Km	
I EQUIPMENT	
Dump Truck 17 tn. (8m3)	47,373 G./hs.
TOTAL COST OF EQUIPMENT	47,373 G./hs.
II LABOR	
Of Equipment	4,530 G./hs.
Foreman and Guardman	453 G./hs.
Total Cost of Labor	4,983 G./hs.
Total Cost of Ejecution	52,356 G./hs.
III RENDIMIENTO	
Average Transportation Distance	11 km
Capacity of Equipment	8 m3
Average Speed of Equipment	30 km/hs.
Trip Duration (cycle)	
2 x DMT x 60/av.speed	44 min./v
Loading Time	5 min./v
Unloading Time	3 min./v
Wainting nad Handling Time	3 min./v
Total Trip Duration	55 min./v
Trips per hour	
60 (min/h.) /trip duration	1.091
Efficiency per hour	
(Capacity/trip) x trip per hour x AvTD	96 km.m3/hs.
IV UNIT PRICE	
(Total cost of Execution)/(Yield per hour)	545 G./m3/km.
V ADOPTED PRICE	545 G./m3/km.

0.27

TRANSPORTATION OF STONE UNIT :G/m3/Km	DMT (Km.) : 40	
I EQUIPMENT		
Dump Truck 17 tn. (8m3)	47,373	G./hs.
TOTAL COST OF EQUIPMENT	47,373	G./hs.
II LABOR		
Of Equipment	4,530	G./hs.
Foreman and Guardman	453	G./hs.
Total Cost of Labor	4,983	G./hs.
Total Cost of Ejecution	52,356	G./hs.
III EFFICIENCY		
Average Transportation Distance	40	km
Capacity of Equipment	8	m3
Average Speed of Equipment	30	km/hs.
Trip Duration (cycle)		
2 x DMT x 60/av.speed	160	min./v
Loading Time	5	min./v
Unloading Time	3	min./v
Wainting nad Handling Time	3	min./v
Total Trip Duration	171	min./v
Trips per hour		
60 (min/h.) /trip duration	0.351	
Efficiency per hour		
(Capacity/trip) x trip per hour x AvTD	112	km.m3/hs.
IV UNIT PRICE		
(Total cost of Execution)/(Yield per hour)	467	G./m3/km.
V ADOPTED PRICE	467	G./m3/km.

0.23

Deforestation, Clearing (normal) - Section 1, Section 2 y Section 3					UNIT Km.
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Bulldozer 215HP		1	150,865	150,865	
				0	
				0	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPOS ..... (A)				150,865	
B- LABOR					
Of Equipment	h	1	21,518	21,518	
Assistants	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				2,472.7	
SUB-TOTAL LABOR ..... (B)				27,200	
C- UNITARY PRODUCCION		0.09	TOTAL ...(A+B)	178,065	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					1,978,497
E- MATERIALS					
				0	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					0
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					1,978,497
H- INDIRECT COST (Direct Cost x 0.40)					791,399
I- TOTAL UNITARY COST					2,769,895
ADOPTED					2,769,895

Deforestation and Clearing (forest) - Section 1, Section 2 y Section 3					UNIT. Km.
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Bulldozer 215HP		1	150,865	150,865	
Dragshovel 2,7m3		0.5	98,896	49,448	
Dump Truck 6m3		3	35,700	107,100	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				307,413	
B- LABOR					
Of Equipment	h	1	21,518	21,518	
Assistants	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				2,472.7	
SUB-TOTAL LABOR ..... (B)				27,200	
C- UNITARY PRODUCCION		0.045	TOTAL ...(A+B)	334,613	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					7,435,838
E- MATERIALS					
				0	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					0
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					7,435,838
H- INDIRECT COST (Direct Cost x 0.40)					2,974,335
I- TOTAL UNITARY COST					10,410,173
ADOPTED					10,410,173
OBSERVATIONES:					

Deforestation and Clearing (heavy forest) - Section 1 and Section 2					UNIDAD Km.
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Bulldozer 215HP		1	150,865	150,865	
Farm Tractor 2,7m3		0.5	98,896	49,448	
Dump Trauk 6m3		3	35,700	107,100	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				307,413	
B- LABOR					
Of Equipment	h	1	21,518	21,518	
Assistants	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				2,472.7	
SUB-TOTAL LABOR ..... (B)				27,200	
C- UNITARY PRODUCCION		0.018	TOTAL ...(A+B)	334,613	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					18,589,594
E- MATERIALS					
				0	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					0
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					18,589,594
H- INDIRECT COST (Direct Cost x 0.40)					7,435,838
I- TOTAL UNITARY COST					26,025,432
ADOPTED					26,025,432
OBSERVATIONES:					

Embankment(Com Soil)-Section1,Section2 y Section3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Bulldozer 215HP		2	150,865	301,730	
Motor grader 180HP		1	92,655	92,655	
Sheepsfoot roller		1	56,132	56,132	
Farm tractor		1	30,630	30,630	
Disk harrow		1	3,105	3,105	
Tank Truck		1	42,905	42,905	
Maintanance truck		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				540,540	
B- LABOR					
Equipment	h	1	64,598	64,598	
Assistants	h	2	2,309	4,618	
				0	
FOREMAN AND GURDMAN 10%				6,921.6	
SUB-TOTAL LABOR ..... (B)				76,138	
C- UNITARY PRODUCCION		110	TOTAL ...(A+B)	616,677	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					5,606
E- MATERIALS					
				0	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					0
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					5,606
H- INDIRECT COST (Direct Cost x 0.40)					2,242
I- TOTAL UNITARY COST					7,849
ADOPTED					7,849
OBSERVATIONES:					

3.89

Embankment (Selected Soil) - Section1,Section2 y Section3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Motor grader 180HP		2	92,655	185,310	
Sheepsfoot roller		1	56,132	56,132	
Farm tractor		1	30,630	30,630	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintanance truck		0.2	66,913	13,383	
Dragshovel 2.7 m3		1.5	98,896	148,344	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				479,809	
B- LABOR					
Equipment	h	1	69,982	69,982	
Assistants	h	4	2,309	9,236	
				0	
FOREMAN AND GURDMAN 10%				7,921.8	
SUB-TOTAL LABOR ..... (B)				87,140	
C- UNITARY PRODUCCION		74	TOTAL ...(A+B)	566,948	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					7,661
E- MATERIALS					
				0	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					0
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					7,661
H- INDIRECT COST (Direct Cost x 0.40)					3,065
I- TOTAL UNITARY COST					10,726
ADOPTED					10,726
OBSERVATIONES:					

5.31

Concrete tubular sewers. Diameter 1,20 - Section 1, Section 2 y Section3					UNIT. ml
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Truck crane		0.5	53,565	26,783	
				0	
				0	
				0	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				26,783	
B- LABOR					
Equipment	h	1	4,530	4,530	
Assistants	h	6	3,209	19,254	
				0	
FOREMAN AND GURDMAN 10%				2,378.4	
SUB-TOTAL LABOR ..... (B)				26,162	
C- UNITARY PRODUCCION		1.1	TOTAL ...(A+B)	52,945	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					48,132
E- MATERIALS					
Supply of tubo of 1,20	ml	1.00	264,925	264,925	
Supply of Concrete 110Kg/cm2	m3/ml	0.61	156,300	95,343	
Supply of Concrete 90Kg/cm2	m3/ml	0.80	154,000	123,200	
Mortar for Joint	m3/ml	0.03	153,000	4,590	
Structural excavation	m3/ml	0.8	10,000	8,000	
Timber for forms	pulg2/ml	48	380	18,240	
UNITARY COST MATERIALS ..... (E)					514,298
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					562,430
H- INDIRECT COST (Direct Cost x 0.40)					224,972
I- TOTAL UNITARY COST					787,402
AIXOPTED					787,402
OBSERVATIONES:					

389.80

Concrete tubular sewers (or culverts). 3,0 x 3,0 - Section 1,Section2 y Section3					UNIT. ml
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P.UNT GS.	TOTAL COST P.UNT GS.
A- EQUIPMENTS					
Hand tool (5% M.O.)				8,970	
				0	
				0	
				0	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				8,970	
B- LABOR					
Equipment	h	2	3,473	6,946	
Assistants	h	6	3,209	19,254	
				0	
FOREMAN AND GURDMAN 10%				2,620.0	
SUB-TOTAL LABOR ..... (B)				28,820	
C- UNITARY PRODUCCION		0.9	TOTAL ...(A+B)	37,790	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					41,989
E- MATERIALS					
Supply of Concret. 210Kg/cm2	m3/ml	6.10	270,150	1,647,915	
Supply of Concret de 90Kg/cm2	m3/ml	1.03	154,000	158,620	
Steel bars	kg/m	731.69	1,007	736,812	
Structural excavation	m3/ml	1.03	10,000	10,300	
Timber for forms	plg2/m	348.74	380	132,521	
				0	
UNITARY COST MATERIALS ..... (E)					2,686,168
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					2,728,157
H- INDIRECT COST (Direct Cost x 0.40)					1,091,263
I- TOTAL UNITARY COST					3,819,420
ADOPTED					3,819,420
OBSERVATIONES:					

Primer - Section1,Section2 y Section3					UNIT. Litros
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Sprinkler truck		1	74,495	74,495	
Tractor sweeper		1	17,243	17,243	
Tank truck		0.5	42,905	21,453	
Farm tractor		1	30,630	30,630	
Asphalt storage tank		0.2	9,620	1,924	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				145,745	
B- LABOR					
Equipment		1	17,535	17,535	
Complementary		0	0	0	
				0	
FOREMAN AND GURDMAN 10%				1,754	
SUB-TOTAL LABOR ..... (B)				19,289	
C- UNITARY PRODUCCION		1500	TOTAL ...(A+B)	165,033	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					110
E- MATERIALS					
Supply of asphalt in the project site		1	718	718	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					718
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					828
H- INDIRECT COST (Direct Cost x 0.40)					331
I- TOTAL UNITARY COST					1,159
ADOPTED					1,159
OBSERVATIONES:					

0.57

Sheet asphalt - Section1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Tamping finisher		1	102,316	102,316	
Tandem roller		1	51,332	51,332	
Neumatic compacton		1	43,488	43,488	
Maintennance truk (wrecking car)		0.2	66,913	13,383	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				210,519	
B- LABOR					
Equipment		1	44,583	44,583	
Complementary		0	0	0	
				0	
FOREMAN AND GURDMAN 10%				4,458	
SUB-TOTAL LABOR ..... (B)				49,041	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	259,560	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					7,416
E- MATERIALS					
Plant mix for sheet asphalt		1	160,029	160,029	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					160,029
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					167,445
H- INDIRECT COST (Direct Cost x 0.40)					66,978
I- TOTAL UNITARY COST					234,422
ADOPTED					234,422
OBSERVATIONES:					

116.05

Sheet asphalt - Section2					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Tamping finisher		1	102,316	102,316	
Tandem roller		1	51,332	51,332	
Neumatic compacton		1	43,488	43,488	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				210,519	
B- LABOR					
Equipment		1	44,583	44,583	
Complementary		0	0	0	
				0	
FOREMAN AND GURDMAN 10%				4,458	
SUB-TOTAL LABOR ..... (B)				49,041	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	259,560	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					7,416
E- MATERIALS					
Plant mix for sheet asphalt		1	160,963	160,963	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					160,963
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					168,379
H- INDIRECT COST (Direct Cost x 0.40)					67,351
I- TOTAL UNITARY COST					235,730
ADOPTED					235,730
OBSERVATIONES:					

116.70

Sheet asphalt - Section3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Tamping finisher		1	102,316	102,316	
Tandem roller		1	51,332	51,332	
Neumatic compacton		1	43,488	43,488	
Maintenance truk(wrecking car)		0.2	66,913	13,383	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				210,519	
B- LABOR					
Equipment		1	44,583	44,583	
Complementary		0	0	0	
				0	
FOREMAN AND GURDMAN 10%				4,458	
SUB-TOTAL LABOR ..... (B)				49,041	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	259,560	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					7,416
E- MATERIALS					
Plant mix for sheet asphelt		1	177,775	177,775	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					177,775
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					185,191
H- INDIRECT COST (Direct Cost x 0.40)					74,076
I- TOTAL UNITARY COST					259,267
ADOPTED					259,267
OBSERVATIONES:					

128.35

Production of asphalt mix for sheet asphalt - Section 1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Asphalt plant		1	267,046	267,046	
Dragshovel		1	98,896	98,896	
Surgace heater equipment		1	31,787	31,787	
Generating set		1	15,521	15,521	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				413,250	
B- LABOR					
Equipment	h	1	36,241	36,241	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				3,624	
SUB-TOTAL LABOR ..... (B)				39,865	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	453,115	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					12,946
E- MATERIALS					
Supply of crushed stone	t/m3	2.13	16,173	34,448	
Supply of sand	m3	0.2	32,325	6,465	
Asphalt cement	t	0.13	688,550	89,512	
Filler mineral	t	0.10	63,835	6,384	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					136,808
F- TRANSPORTS					
Dumptruck 8m3	t	22.0	467	10,274	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					10,274
G- TOTAL DIRECT COST					160,028
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					160,028
OBSERVATIONES:					

79.22

Production of asphalt mix for sheet asphalt - Section 2					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENT					
Asphalt plant		1	267,046	267,046	
Dragshovel		1	98,896	98,896	
Surgace heater equipment		1	31,787	31,787	
Generating set		1	15,521	15,521	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				413,250	
B- LABOR					
Equipment	h	1	36,241	36,241	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				3,624	
SUB-TOTAL LABOR ..... (B)				39,865	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	453,115	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					12,946
E- MATERIALS					
Supply of crushed stone	t/m3	2.13	16,173	34,448	
Supply of sand	m3	0.2	32,325	6,465	
Asphalt cement	t	0.13	688,550	89,512	
Filler mineral	t	0.10	63,835	6,384	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					136,808
F- TRANSPORTS					
Dumptruck 8m3	1	24.0	467	11,208	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					11,208
G- TOTAL DIRECT COST					160,962
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					160,962
OBSERVATIONES:					

79.68

Production of asphalt mix for sheet asphalt - Section 3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Asphalt plant		1	267,046	267,046	
Dragshovel		1	98,896	98,896	
Surgace heater equipment		1	31,787	31,787	
Generating set		1	15,521	15,521	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				413,250	
B- LABOR					
Equipment	h	1	36,241	36,241	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				3,624	
SUB-TOTAL LABOR ..... (B)				39,865	
C- UNITARY PRODUCCION		35	TOTAL ...(A+B)	453,115	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					12,946
E- MATERIALS					
Supply of crushed stone	t/m3	2.13	16,173	34,448	
Supply of sand	m3	0.2	32,325	6,465	
Asphalt cement	t	0.13	688,550	89,512	
Filler mineral	t	0.10	63,835	6,384	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					136,808
F- TRANSPORTS					
Dumptruck 8m3	1	60.0	467	28,020	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					28,020
G- TOTAL DIRECT COST					177,774
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					177,774
OBSERVATIONES:					

88.01

Base made of cruised stone - Section 1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Blade spresder		1	98,285	98,285	
Motor grader		1	92,655	92,655	
(Rubber tire)roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					4,858
E- MATERIALS					
Plant mix		1	49,546	49,546	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					49,546
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					54,404
H- INDIRECT COST (Direct Cost x 0.40)					21,761
I- TOTAL UNITARY COST					76,165
ADOPTED					76,165
OBSERVATIONES:					

37.71

Base made of crused stone - Section 2					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Blade spreader		1	98,285	98,285	
Motor grader		1	92,655	92,655	
Tandem roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					4,858
E- MATERIALS					
Plant mix		1	50,480	50,480	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					50,480
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					55,338
H- INDIRECT COST (Direct Cost x 0.40)					22,135
I- TOTAL UNITARY COST					77,473
ADOPTED					77,473
OBSERVATIONES:					

38.35

Base made of crused stone - Section 3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPOS					
Blade spreader		1	98,285	98,285	
Motor grader		1	92,655	92,655	
(Rubber tire)roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURIDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					4,858
E- MATERIALS					
Plant mix		1	67,292	67,292	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					67,292
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					72,150
H- INDIRECT COST (Direct Cost x 0.40)					28,860
I- TOTAL UNITARY COST					101,010
ADOPTED					101,010
OBSERVATIONES:					

50.00

Plant mix of base made of crused stone - Section 1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Plant for aggregates		1	142,153	142,153	
Dragshovel 2.7 m3		0.2	98,896	19,779	
Dump Truck		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				186,922	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	207,146	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					2,726
E- MATERIALS					
Supply of crushed stone	t	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					36,546
F- TRANSPORTS					
Dumptruck 8m3	1	22.0	467	10,274	
				0	
				0	
OBSERVATIONES:					10,274
G- COSTO DIRECTO TOTAL					49,546
H- COSTO INDIRECTO.....					
I- COSTO UNITARIO TOTAL					
ADOPTADO					49,546
OBSERVACIONES:					

24.53

Plant mix of base made of crused stone - Section 2					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST PUNT GS.	TOTAL COST PUNT GS.
A- EQUIPMENTS					
Planta de Arido		1	142,153	142,153	
Pala Cargadora 2.7 m3		0.2	98,896	19,779	
Camion Volquete		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				186,922	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	207,146	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					2,726
E- MATERIALS					
Supply of crushed stone	t	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					36,546
F- TRANSPORTS					
Dumptruck 8m3	1	24.0	467	11,208	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					11,208
G- TOTAL DIRECT COST					50,480
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					50,480
OBSERVATIONES:					

24.99

Plant mix of base made of crused stone - Section 3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Plant for aggregates		1	142,153	142,153	
Dragshovel 2.7 m3		0.2	98,896	19,779	
Dump Truck		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				186,922	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		76	TOTAL ...(A+B)	207,146	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					2,726
E- MATERIALS					
Supply of crushed stone	t	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					36,546
F- TRANSPORTS					
Dumptruck 8m3	1	60.0	467	28,020	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					28,020
G- TOTAL DIRECT COST					67,292
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					67,292
OBSERVATIONES:					

33.31

Subbase made of crushed stone - Section 1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST PUNT GS.	TOTAL COST PUNT GS.
A- EQUIPMENTS					
Blade spreader		1	98,285	98,285	
Motor grader		1	92,655	92,655	
(Rubber tire) roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					3,886
E- MATERIALS					
Plant mix		1	48,657	48,657	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					48,657
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					52,543
H- INDIRECT COST (Direct Cost x 0.40)					21,017
I- TOTAL UNITARY COST					73,560
ADOPTED					73,560
OBSERVATIONES:					

36.42

Subbase made of crushed stone - Section 2					UNIDAD m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Blade spreader		1	98,285	98,285	
Motor grader		1	92,655	92,655	
(Rubber tire) roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					3,886
E- MATERIALS					
Plant mix		1	49,591	49,591	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					49,591
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					53,477
H- INDIRECT COST (Direct Cost x 0.40)					21,391
I- TOTAL UNITARY COST					74,868
ADOPTED					74,868
OBSERVATIONES:					

37.06

Subbase made of crushed stone - Section 3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P.UNT GS.	TOTAL COST P.UNT GS.
A- EQUIPMENTS					
Blade spreader		1	98,285	98,285	
Motor grader		1	92,655	92,655	
(Rubber tire) roller		1	51,332	51,332	
Disk harrow		1	3,105	3,105	
Tank truck		1	42,905	42,905	
Maintenance truck(wrecking car)		0.2	66,913	13,383	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				301,665	
B- LABOR					
Equipment	h	1	61,382	61,382	
Complementary	h	0	0	0	
				0	
FOREMAN AND GURDMAN 10%				6,138	
SUB-TOTAL LABOR ..... (B)				67,520	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	369,185	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					3,886
E- MATERIALS					
Plant mix		1	66,403	66,403	
				0	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					66,403
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					70,289
H- INDIRECT COST (Direct Cost x 0.40)					28,116
I- TOTAL UNITARY COST					98,405
ADOPTED					98,405
OBSERVATIONES:					

48.72

Mix plant of subbase made of crushed plant - Section 1					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P.UNT GS.	TOTAL COST P.UNT GS.
A- EQUIPMENTS					
Plant for aggregates		1	109,481	109,481	
Dragshovel 2.7 m3		0.2	98,896	19,779	
Dump Truck		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				154,250	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	174,474	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					1,837
E- MATERIALS					
Supply of crushed stone	t/m3	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					36,546
F- TRANSPORTS					
Dumptruck 8m3	1	22.0	467	10,274	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					10,274
G- TOTAL DIRECT COST					48,657
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					48,657
ADOPTED					48,657
OBSERVATIONES:					

Mix plant of subbase made of crushed plant - Section 2					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P.UNT GS.	TOTAL COST P.UNT GS.
A- EQUIPMENTS					
Plant for aggregates		1	109,481	109,481	
Dragshovel 2.7 m3		0.2	98,896	19,779	
Dump Truck		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				154,250	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	174,474	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					1,837
E- MATERIALS					
Supply of crushed stone	t/m3	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					36,546
F- TRANSPORTS					
Dump Truck 8m3	t	24.0	467	11,208	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					11,208
G- TOTAL DIRECT COST					49,591
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					49,591
OBSERVATIONES:					

Mix plant of subbase made of crushed plant - Section 3					UNIT. m3
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Plant for aggregates		1	109,481	109,481	
Dragshovel		0.2	98,896	19,779	
Dump Truck		0.7	35,700	24,990	
				0	
				0	
				0	
				0	
				0	
SUB-TOTAL EQUIPMENTS ..... (A)				154,250	
B- LABOR					
Equipment	h	1	15,176	15,176	
Complementary	h	1	3,209	3,209	
				0	
FOREMAN AND GURDMAN 10%				1,839	
SUB-TOTAL LABOR ..... (B)				20,224	
C- UNITARY PRODUCCION		95	TOTAL ...(A+B)	174,474	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					1,837
E- MATERIALS					
Supply of crushed stone	t/m3	1.9	16,173	30,728	
Supply of sand	m3	0.18	32,325	5,819	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					36,546
F- TRANSPORTS					
Dump truck 8m3	1	60.0	467	28,020	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					28,020
G- TOTAL DIRECT COST					66,403
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					66,403
OBSERVATIONES:					

Production of crushed stone - Section 1 , Section 2 y Section 3					UNIT. tn
COMPONENTS	UNT.	QANT.	UNIT COST GS.	PARCIAL COST P/UNT GS.	TOTAL COST P/UNT GS.
A- EQUIPMENTS					
Wagon Drill	hs.	1	92,491	92,491	
Compresor	hs.	2	26,184	52,368	
Air hammer or jackhammer	hs.	4	1,400	5,600	
Dragshovel 2,7m3	hs.	2	98,896	197,792	
Bulldozer 215 HP	hs.	1	150,865	150,865	
Dump Truck	hs.	5	35,700	178,500	
Crushing Plant	hs.	1	417,734	417,734	
Generating set	hs.	1	15,521	15,521	
SUB-TOTAL EQUIPMENTS ..... (A)				1,110,871	
B- LABOR					
Complementary	h	2	3,209	6,418	
Equipment	h	1	99,850	99,850	
				0	
FOREMAN AND GURIDMAN 10%				10,627	
SUB-TOTAL LABOR ..... (B)				116,895	
C- UNITARY PRODUCCION		150	TOTAL ...(A+B)	1,227,766	
D- UNITARY COST OF EJECUTION ..... (A+B)/(C)=(D)					8,185
E- MATERIALS					
Explosives	kg.	0.6	11,575	6,945	
Highly explosive	ml.	0.3	3,475	1,043	
				0	
				0	
				0	
				0	
UNITARY COST MATERIALS ..... (E)					7,988
F- TRANSPORTS					
				0	
				0	
				0	
UNITARY COST TRANSPORT ..... (F)					0
G- TOTAL DIRECT COST					16,173
H- INDIRECT COST (Direct Cost x 0.40)					
I- TOTAL UNITARY COST					
ADOPTED					16,173
OBSERVATIONES:					

ANNEX F

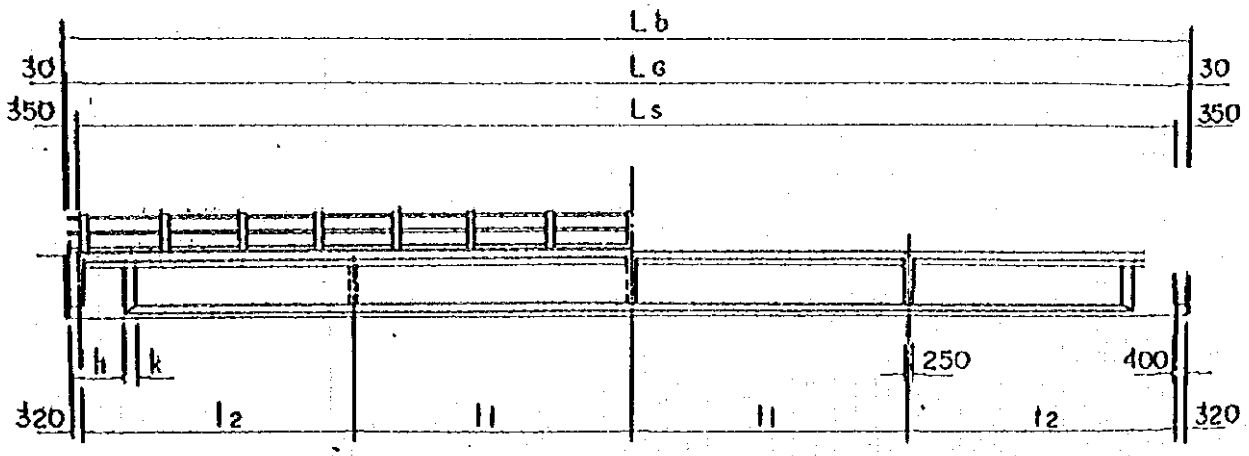
BRIDGE CONSTRUCTION

ANNEX F BRIDGE CONSTRUCTION

1. Quantity Calculation

1-1 Superstructure

(1) PC composite Girder



PC Composit Girder

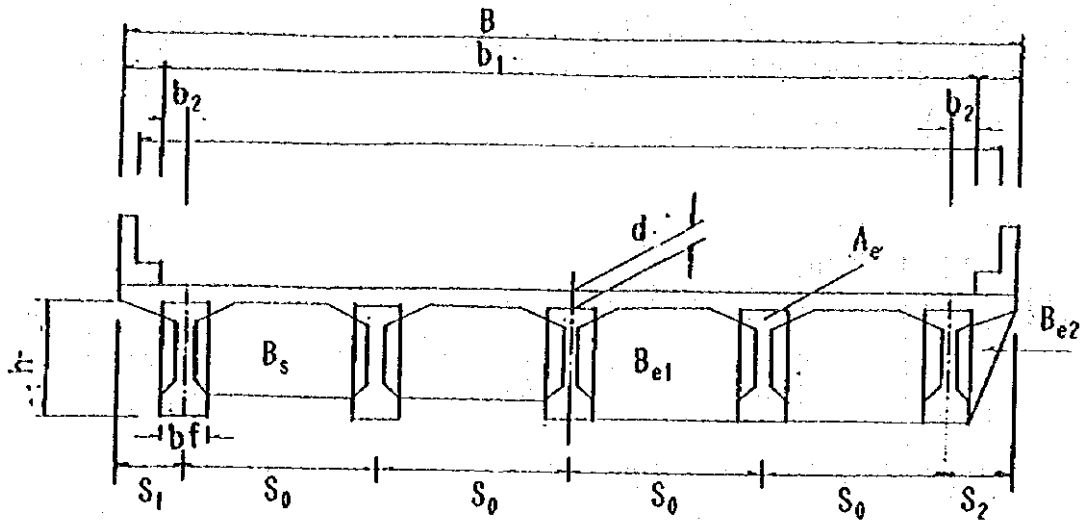
Name of Bridges	Lb(m)	Width				Spacing of Girder		Slab	Girder		
		B	b1	b2	S0	S1	S2	d	h	bf	n
Bailey	25.00	12.5	11.3	0.35	2.65	0.95	0.95	0.215	1.55	0.65	6
Tebicuary	26	12.5	11.3	0.35	2.65	0.95	0.95	0.215	1.55	0.65	6

PC Composit Girder Cross Section Area (Unit:m2)

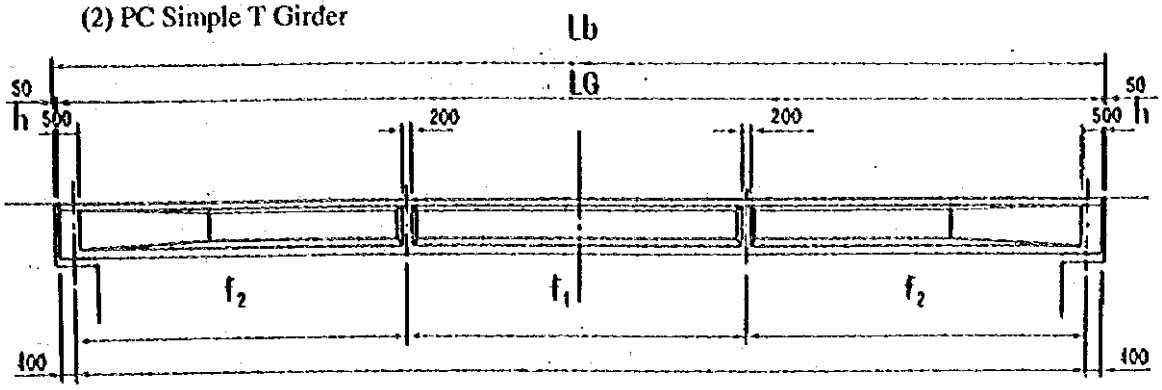
	Bailey	Tebicuary
End of Girder(Ae)	1.008	1.008
Center of Girder(As)	0.381	0.381
End Cross beam(Be1)	3.003	3.003
End Cross beam(Be2)	0.920	0.920
Inner Cross Beam(Bs)	2.939	2.939

PC Composit Girder Concrete Volume (Unit:m3)

	Bailey	Tebicuary
Girder(V0)	11.69	12.07
V0*n	58.45	60.35
Cross beam(Vc)	8.48	8.48
Slab(Vs)	67.03	69.71
Total	145.64	150.62


B
b1
b2
b2
d
Ae
Be2
h
Bs
Be1
bf
S1
S0
S0
S0
S0
S2

(2) PC Simple T Girder



Lb(m)	Width		Spacing of Girder			Slab	Girder			
	B	b1	S0	S1	S2	d	h	bu	bd	n
20.00	12.5	11.3	2.12	0.9	0.9	0.18	0.49	1.5	0.5	6
25.00	12.5	11.3	2.12	0.9	0.9	0.18	0.79	1.5	0.5	6
30.00	12.5	11.3	2.12	0.9	0.9	0.18	1.09	1.5	0.5	6

PC T Girder Cross Section Area (Unit:m2)

	Lb=20m	Lb=25m	Lb=30m
End of Girder(Ae)	0.850	1.000	1.150
Center of Girder(As)	0.542	0.602	0.662
End Cross beam(Be1)	1.453	1.939	2.425
End Cross beam(Be2)	0.583	0.778	0.973
Inner Cross Beam(Bs)	1.423	2.059	2.695

1) Concrete Volume(PC)

a) Girder

$V0=As\times(LG-2h)+2\times Ae\times h$

b) Cross Beam

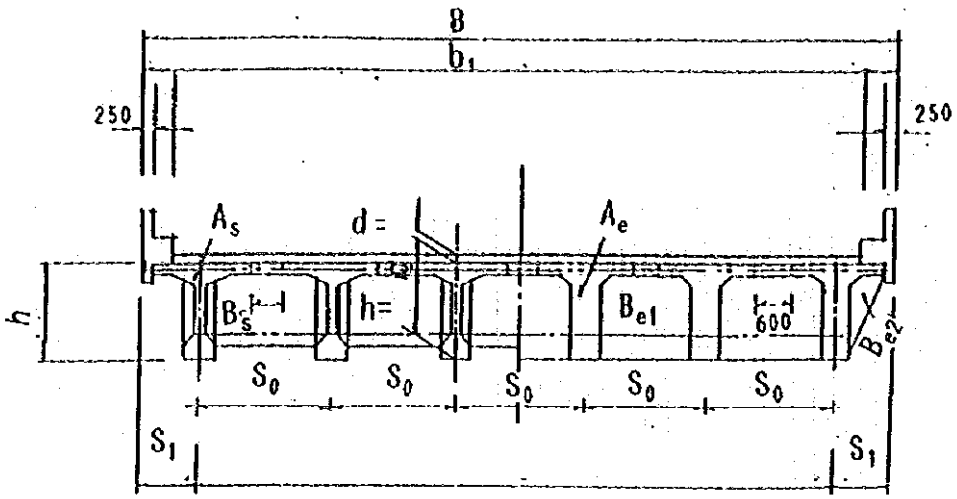
$Vc=N\times Bs\times 0.2+N\times Be1\times 0.4+2\times Be2\times 0.4$

c) Slab

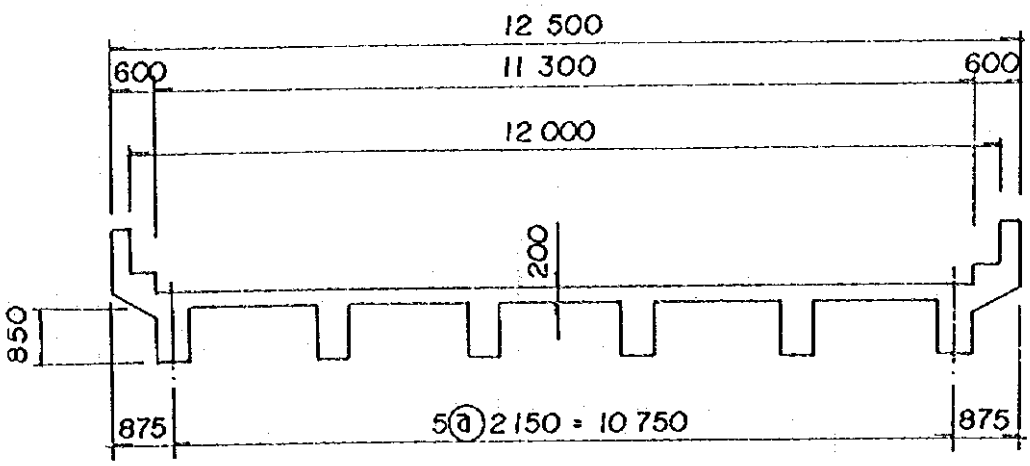
$Vs=B\times d\times LG$

PC T Girder Concrete Volume (Unit:m3)

	Lb=20m	Lb=25m	Lb=30m
Girder(V0)	11.93	16.38	21.42
V0*n	71.61	98.26	128.50
Cross beam(Vc)	4.79	6.56	8.32
Slab(Vs)	44.78	56.03	67.28
Total	133.11	177.21	225.52


B
b1
250
250
As
d =
Ae
h
Bs
h=
Be1
600
Be2
S0
S0
S0
S0
S0
S1
S1

(3) RC Bridge



RC Cross Sectional Area (Unit:m2)

L(m)	L=5	L=10	L=15
A1	0.225	0.270	0.383
A2	2.260	2.260	2.260
A3	0.098	0.098	0.098

Concrete VolumeRC (Unit:m3)

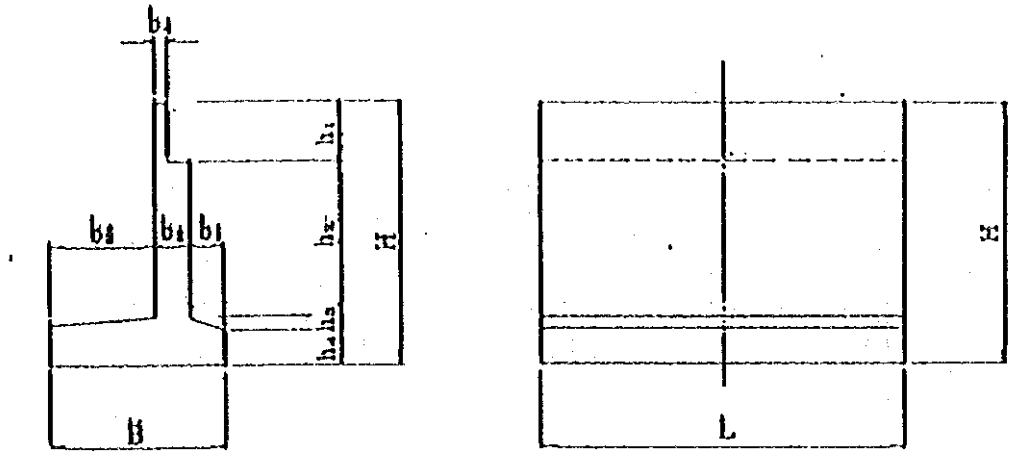
L(m)	L=5	L=10	L=15
V1	1.13	2.70	5.74
V1*n	6.75	16.2	34.43
V2	11.30	22.60	33.90
V3	0.49	0.98	1.46

RC h (Unit: m)

L(m)	L=5	L=10	L=15
h	0.500	0.600	0.850

1-2 Substructure

(1) Abutment



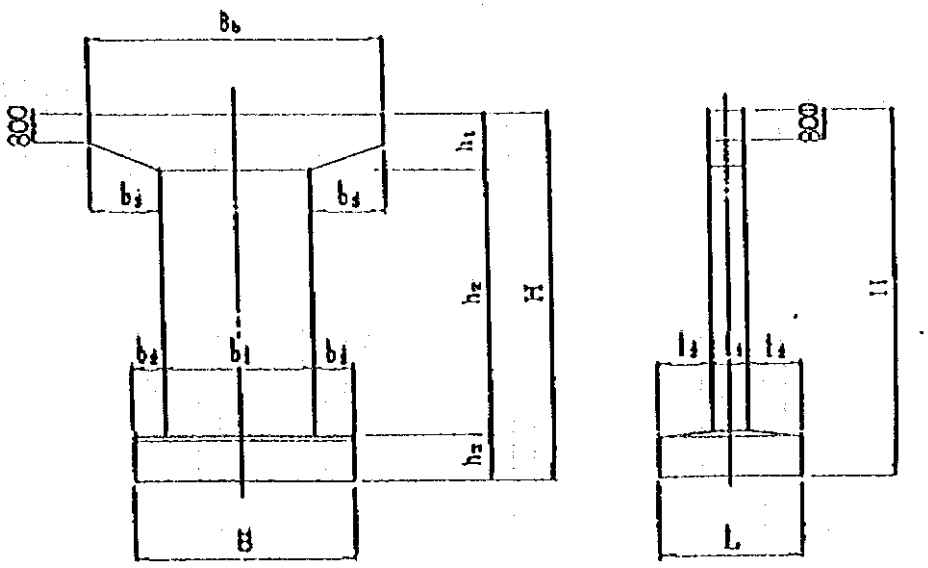
Abutment Concrete

Bridge No	G.L(m)	F.L(m)	H	h1	h2	h3	h4	B	b1	b2	b3	b4	L	V(m3)	V*2(m3)
1	121.791	123.350	7.30	0.80	5.30	0.20	1.00	4.00	1.00	1.00	2.00	0.40	12.50	126.50	253.00
2	138.450	140.830	9.60	1.58	6.82	0.20	1.00	5.00	1.30	1.20	2.50	0.40	12.50	180.45	360.90
3	139.437	140.830	7.80	1.28	5.32	0.20	1.00	4.50	1.20	1.00	2.30	0.40	12.50	136.03	272.05
4	141.510	142.397	7.00	1.05	4.75	0.20	1.00	3.50	0.70	1.00	1.80	0.30	12.50	112.69	225.38
5	142.658	144.830	5.20	1.88	2.12	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	76.05	152.10
6	128.177	129.430	5.00	0.80	3.00	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.00	166.00
7	127.032	128.407	5.00	0.80	3.00	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.00	166.00
8	119.266	119.626	5.00	0.70	3.10	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.88	167.75
9	119.152	120.600	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
10	120.040	120.600	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
11	120.671	121.462	5.00	0.80	3.00	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.00	166.00
12	116.480	119.013	7.00	0.80	5.00	0.20	1.00	3.50	0.70	1.00	1.80	0.30	12.50	114.88	229.75
13	117.950	119.219	5.00	0.70	3.10	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.88	167.75
14	120.635	122.148	5.00	0.70	3.10	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.88	167.75
15	104.612	107.500	5.00	1.88	1.92	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	73.55	147.10
16	104.700	107.500	5.00	1.88	1.92	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	73.55	147.10
17	104.740	107.500	5.00	1.88	1.92	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	73.55	147.10
18	151.077	151.600	5.00	1.88	1.92	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	73.55	147.10
19	147.721	148.509	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
20	117.740	118.246	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
21	115.924	116.431	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
22	106.547	108.200	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
23	106.738	108.200	5.00	0.80	3.00	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	83.00	166.00
24	106.621	108.200	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
25 A1	109.066	110.020	6.00	1.77	3.04	0.20	1.00	4.00	1.00	1.00	2.00	0.30	12.50	100.81	100.81
25 A2	109.066	110.020	6.00	1.77	3.04	0.20	1.00	4.00	1.00	1.00	2.00	0.30	12.50	100.81	100.81
26	108.789	109.290	5.00	1.05	2.75	0.20	1.00	3.00	0.50	1.00	1.50	0.30	12.50	80.81	161.63
TebicuryA1	104.369	107.500	8.00	1.77	5.04	0.20	1.00	4.50	0.70	1.50	2.30	0.40	13.70	183.01	183.01
TebicuryA2	104.300	107.500	8.00	1.77	5.04	0.20	1.00	4.50	0.70	1.50	2.30	0.40	12.50	166.98	166.98

Concrete Volume

$$V=(B\times h4+1/2\times b3\times h3+1/2\times b1\times h3+b2\times(h2+h3)+b4\times h1(m3)$$

(2) Pier



Pier Concrete

Pier	B	b1	b2	b3	L	l1	l2	H	h1	h2	h3	Bb	V(m3)	V*n(m3)
Bailey Bridge	7.00	5.00	1.00	3.00	5.00	1.20	1.90	8.50	1.50	5.80	1.20	11.00	156.68	156.68
Tebicury Mi P1	11.70	9.70	1.00	2.00	5.00	1.20	1.90	7.51	1.50	4.81	1.20	13.70	196.06	196.06
Tebicury Mi P2-P5	7.00	5.00	1.00	3.00	5.00	1.20	1.90	4.65	1.50	1.95	1.20	11.00	98.93	395.70

Concrete Volume

$$V=1/2(0.8+h1)\times b3\times h1+b1\times(h1\times h2)\times b3+B\times L\times h3$$

2. Cost Estimation

L=10m RC Bridge
No.1 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	775.04	7.10	5506.59	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	253.00	321.78	81410.89	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	131.67	32.13	4230.13	
Sub Total	-			119250.45	
Temporary Bridge	Set			0.00	
Total				119250	

L=25m PC T Gider Bridge
No.2 Bridge (L = 25.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	1169.64	7.10	8310.23	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Pier	m3		375.33	0.00	
Cross Beam	m3	6.56	375.33	2461.58	
Slab	m3	56.03	375.33	21027.68	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	360.90	375.33	135455.42	
Curb	m3	16.5	375.33	6192.89	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	98.26	482.42	47399.82	
Girder Erection	m	150.00	64.72	9707.52	
Handrail	m	50.00	133.86	6693.07	
Embankment Protection	m2	113.98	32.13	3661.84	
Sub Total	-			252955.11	
Temporary Bridge	Set			0.00	
Total				252955	

L=20m PC T Gider Bridge

No.3 Bridge (L = 20.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	951.44	7.10	6759.93	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Pier	m3		375.33	0.00	
Cross Beam	m3	4.79	375.33	1799.50	
Slab	m3	44.78	375.33	16805.25	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	272.05	375.33	102107.64	
Curb	m3	13.2	375.33	4954.31	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	71.61	482.42	34543.92	
Girder Erection	m	120.00	64.72	7766.02	
Handrail	m	40.00	133.86	5354.46	
Embankment Protection	m2	118.50	32.13	3807.11	
Sub Total	-			195943.20	
Temporary Bridge	Set			19594.32	10% of sub total
Total				215538	

L=15m RC Bridge

No.4 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	742.73	7.10	5277.06	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	225.38	321.78	72521.66	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	124.75	32.13	4007.94	
Sub Total	-			121967.48	
Temporary Bridge	Set			12196.75	10% of sub total
Total				134164	

L=30m PC T Gider Bridge
No.5 Bridge (L = 30.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	327.02	7.10	2323.49	1$US=G 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Pier	m3		375.33	0.00	
Cross Beam	m3	8.32	375.33	3123.66	
Slab	m3	67.28	375.33	25250.11	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	152.10	375.33	57087.20	
Curb	m3	19.8	375.33	7431.47	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	128.50	482.42	61992.41	
Girder Erection	m	180.00	64.72	11649.03	
Handrail	m	60.00	133.86	8031.68	
Embankment Protection	m2	173.03	32.13	5558.98	
Sub Total	-			194493.08	
Temporary Bridge	Set			0.00	
Total				194493	

L=10m RC Bridge
No.6 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	404.68	7.10	2875.20	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	166.00	321.78	53415.84	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	52.136	32.13	1674.96	
Sub Total	-			86068.85	
Temporary Bridge	Set			0.00	
Total				86069	

L=10m RC Bridge

No.7 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	391.50	7.10	2781.59	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	166.00	321.78	53415.84	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	57.19	32.13	1837.33	
Sub Total	-			86137.60	
Temporary Bridge	Set			0.00	
Total				86138	

L=5m RC Bridge

No.8 Bridge (L = 5.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	250.56	7.10	1780.22	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	11.79	321.78	3793.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	167.75	321.78	53978.96	
Curb	m3	3.3	321.78	1061.88	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	6.75	321.78	2172.03	
Handrail	m	10.00	133.86	1338.61	
Embankment Protection	m2	82.99	32.13	2666.26	
Sub Total	-			77293.94	
Temporary Bridge	Set			0.00	
Total				77294	

L=15m RC Bridge
No.9 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	383.62	7.10	2725.57	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	179	182.21	32630.86	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	60.17	32.13	1933.04	
Sub Total	-			129458.34	
Temporary Bridge	Set			0.00	
Total				129458	

L=15m RC Bridge
No.10 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	479.52	7.10	3406.97	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	179	182.21	32630.86	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	23.28	32.13	747.75	
Sub Total	-			128954.45	
Temporary Bridge	Set			0.00	
Total				128954	

L=10m RC Bridge
No.11 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	454.57	7.10	3229.71	1$US=Gs 2020
Concrete Piles(D=0.8m)	m	145	116.71	16883.54	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	166.00	321.78	53415.84	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	32.851	32.13	1055.40	
Sub Total	-			102687.34	
Temporary Bridge	Set			0.00	
Total				102687	

L=10m RC Bridge
No.12 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	542.74	7.10	3856.14	1$US=Gs 2020
Concrete Piles(D=0.8m)	m	0	116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	229.75	321.78	73929.46	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	105.26	32.13	3381.54	
Sub Total	-			109269.98	
Temporary Bridge	Set			10927.00	10% of sub total
Total				120197	

L=5m RC Bridge
No.13 Bridge (L = 5.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	250.56	7.10	1780.22	1$US=Gs 2020
Concrete Piles(D=0.8m)	m	0	116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	11.79	321.78	3793.81	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	167.75	321.78	53978.96	
Curb	m3	3.3	321.78	1061.88	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	6.75	321.78	2172.03	
Handrail	m	10.00	133.86	1338.61	
Embankment Protection	m2	52.72	32.13	1693.76	
Sub Total	-			76322.24	
Temporary Bridge	Set			7632.22	10% of sub total
Total				83954	

L=5m RC Bridge
No.14 Bridge (L = 5.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	250.56	7.10	1780.22	1$US=Gs 2020
Concrete Piles(D=0.8m)	m	0	116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	11.79	321.78	3793.81	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	167.75	321.78	53978.96	
Curb	m3	3.3	321.78	1061.88	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	6.75	321.78	2172.03	
Handrail	m	10.00	133.86	1338.61	
Embankment Protection	m2	62.86	32.13	2019.35	
Sub Total	-			76647.84	
Temporary Bridge	Set			7664.78	10% of sub total
Total				84313	

L=30m PC T Gider Bridge
No.15 Bridge (L = 30.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	228.10	7.10	1620.61	1$US=G 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	282	182.21	51349.22	
Pier	m3		375.33	0.00	
Cross Beam	m3	8.32	375.33	3123.66	
Slab	m3	67.28	375.33	25250.11	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	147.10	375.33	55210.56	
Curb	m3	19.8	375.33	7431.47	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	128.50	482.42	61992.41	
Girder Erection	m	180.00	64.72	11649.03	
Handrail	m	60.00	133.86	8031.68	
Embankment Protection	m2	39.90	32.13	1281.86	
Sub Total	-			238985.66	
Temporary Bridge	Set			0.00	
Total				238986	

L=30m PC T Gider Bridge
No.16 Bridge (L = 30.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	228.10	7.10	1620.61	1$US=G 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	282	182.21	51349.22	
Pier	m3		375.33	0.00	
Cross Beam	m3	8.32	375.33	3123.66	
Slab	m3	67.28	375.33	25250.11	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	147.10	375.33	55210.56	
Curb	m3	19.8	375.33	7431.47	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	128.50	482.42	61992.41	
Girder Erection	m	180.00	64.72	11649.03	
Handrail	m	60.00	133.86	8031.68	
Embankment Protection	m2	36.18	32.13	1162.22	
Sub Total	-			238866.02	
Temporary Bridge	Set			0.00	
Total				238866	

L=30m PC T Gider Bridge
No.17 Bridge (L = 30.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	228.10	7.10	1620.61	1$US=G 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	282	182.21	51349.22	
Pier	m3		375.33	0.00	
Cross Beam	m3	8.32	375.33	3123.66	
Slab	m3	67.28	375.33	25250.11	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	147.10	375.33	55210.56	
Curb	m3	19.8	375.33	7431.47	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	128.50	482.42	61992.41	
Girder Erection	m	180.00	64.72	11649.03	
Handrail	m	60.00	133.86	8031.68	
Embankment Protection	m2	34.58	32.13	1110.94	
Sub Total	-			238814.74	
Temporary Bridge	Set			0.00	
Total				238815	

L=30m PC T Gider Bridge
No.18 Bridge (L = 30.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	483.52	7.10	3435.36	1$US=G 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Pier	m3		375.33	0.00	
Cross Beam	m3	8.32	375.33	3123.66	
Slab	m3	67.28	375.33	25250.11	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	147.10	375.33	55210.56	
Curb	m3	19.8	375.33	7431.47	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	128.50	482.42	61992.41	
Girder Erection	m	180.00	64.72	11649.03	
Handrail	m	60.00	133.86	8031.68	
Embankment Protection	m2	41.50	32.13	1333.13	
Sub Total	-			189502.46	
Temporary Bridge	Set			0.00	
Total				189502	

L=15m RC Bridge
No.19 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	454.90	7.10	3232.01	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	32.74	32.13	1051.98	
Sub Total	-			96452.86	
Temporary Bridge	Set			0.00	
Total				96453	

L=15m RC Bridge
No.20 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	485.35	7.10	3448.40	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	21.04	32.13	675.97	
Sub Total	-			96293.24	
Temporary Bridge	Set			9629.32	10% of sub total
Total				105923	

L=20m PC T Gider Bridge
No.21 Bridge (L = 20.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	242.62	7.10	1723.82	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Pier	m3		375.33	0.00	
Cross Beam	m3	4.79	375.33	1799.50	
Slab	m3	44.78	375.33	16805.25	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	161.63	375.33	60662.18	
Curb	m3	13.2	375.33	4954.31	
Neoprene	unit	12	102.97	1235.64	
PC girder	m3	71.61	482.42	34543.92	
Girder Erection	m	120.00	64.72	7766.02	
Handrail	m	40.00	133.86	5354.46	
Embankment Protection	m2	82.99	32.13	2666.26	
Sub Total	-			148320.78	
Temporary Bridge	Set			14832.08	10% of sub total
Total				163153	

L=15m RC Bridge
No.22 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	178.52	7.10	1268.40	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	68.68	32.13	2206.50	
Sub Total	-			95643.78	
Temporary Bridge	Set			9564.38	10% of sub total
Total				105208	

L=10m RC Bridge

No.23 Bridge (L = 10.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	382.10	7.10	2714.83	1$US=Gs 2020
Concrete Piles(D=0.8m)	m	0	116.71	0.00	
Concrete Piles(D=1.0m)	m		182.21	0.00	
Slab	m3	23.58	321.78	7586.01	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	166.00	321.78	53415.84	
Curb	m3	6.6	321.78	2123.76	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	16.20	321.78	5212.87	
Handrail	m	20.00	133.86	2677.23	
Embankment Protection	m2	60.75	32.13	1951.84	
Sub Total	-			86185.36	
Temporary Bridge	Set			8618.54	10% of sub total
Total				94804	

L=15m RC Bridge

No.24 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	369.47	7.10	2625.05	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	65.62	32.13	2108.23	
Sub Total	-			96902.15	
Temporary Bridge	Set			9690.22	10% of sub total
Total				106592	

L=25m*2 PC Composit Gider Bridge
No.25 Bailey Bridge(L = 25.00 m*2)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	862.62	7.10	6128.87	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	467	182.21	85090.07	
Pier	m3	156.68	375.33	58804.32	
Cross Beam	m3	16.96	375.33	6365.47	
Slab	m3	134.05	375.33	50313.49	
Approach Cushion	m3	28.80	375.33	10809.41	
Abutment	m3	201.61	375.33	75670.56	
Curb	m3	33.00	375.33	12385.78	
Neoprene	unit	15	102.97	1544.55	
PC girder	m3	116.90	482.42	56392.14	
Girder Erection	m	250.00	64.72	16179.21	
Handrail	m	100.00	133.86	13386.14	
Embankment Protection	m2	188.33	32.13	6050.36	
Sub Total	-			399120.38	
Temporary Bridge	Set			39912.038	10% of sub total
Total				439032	

L=15m RC Bridge
No.26 Bridge (L = 15.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	485.89	7.10	3452.24	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	0	182.21	0.00	
Slab	m3	35.36	321.78	11379.02	
Approach Cushion	m3	28.80	321.78	9267.33	
Abutment	m3	161.63	321.78	52008.04	
Curb	m3	9.9	321.78	3185.64	
Neoprene	unit	12	102.97	1235.64	
Girder	m3	34.43	321.78	11077.35	
Handrail	m	30.00	133.86	4015.84	
Embankment Protection	m2	20.91	32.13	671.69	
Sub Total	-			96292.81	
Temporary Bridge	Set			9629.28	10% of sub total
Total				105922	

L=26m*5 PC Composit Gider Bridge

Tebicuary Bridge (L = 26.00 m*5)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	954.30	7.10	6780.25	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	888	182.21	161798.68	
Pier	m3	395.70	375.33	148516.79	
Cross Beam	m3	42.40	375.33	15913.67	
Slab	m3	348.57	375.33	130827.17	
Approach Cushion	m3	14.40	375.33	5404.70	
Abutment	m3	166.98	375.33	62672.53	
Curb	m3	85.8	375.33	32203.03	
Neoprene	unit	30	102.97	3089.11	
PC girder	m3	301.76	482.42	145572.36	
Girder Erection	m	650.00	64.72	42065.94	
Handrail	m	260.00	133.86	34803.96	
Embankment Protection	m2	47.75	32.13	1533.96	
Sub Total	-			791182.15	
Temporary Construction	Set			39559.107	5% of sub total
Total				830741	

L=85m Metal Truss Bridge

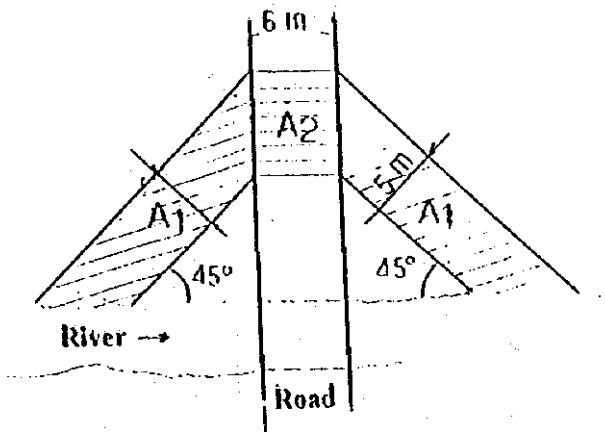
Tebicuary Bridge (L = 85.00 m)

Description	Unit	Quantity	Unit Cost	Cost	Remarks
Excavation	m3	504.45	7.10	3584.09	1$US=Gs 2020
Concrete Piles(D=0.8m)	m		116.71	0.00	
Concrete Piles(D=1.0m)	m	360	182.21	65594.06	
Pier	m3	196.06	375.33	73588.06	
Slab	m3	318.75	375.33	119635.40	
Approach Cushion	m3	14.40	375.33	5404.70	
Abutment	m3	183.01	375.33	68689.09	
Curb	m3	56.1	375.33	21055.83	
Shoe	unit	4	1540.00	6160.00	
Metal Fabri./Transport.	t	480.00	3500.00	1680000.00	
Erection	m	1020.00	156.87	160011.07	
Handrail	m	170.00	133.86	22756.44	
Embankment Protection	m2	65.17	32.13	2093.70	
Sub Total	-			2228572.44	
Temporary Construction	Set			111428.62	5% of sub total
Total				2340001.06	

Total Cost : Truss(85m)+PC Composit girder (5@26) = $US 3,170,742

3. Comparison of Culvert Box and Bridge (L=5m)

3-1 Culvert Box



(1) Detour of the River

1) Excavation

A1 = 75,00 m²

A2 = 42,43 m²

V = (2A1 + A2)×h

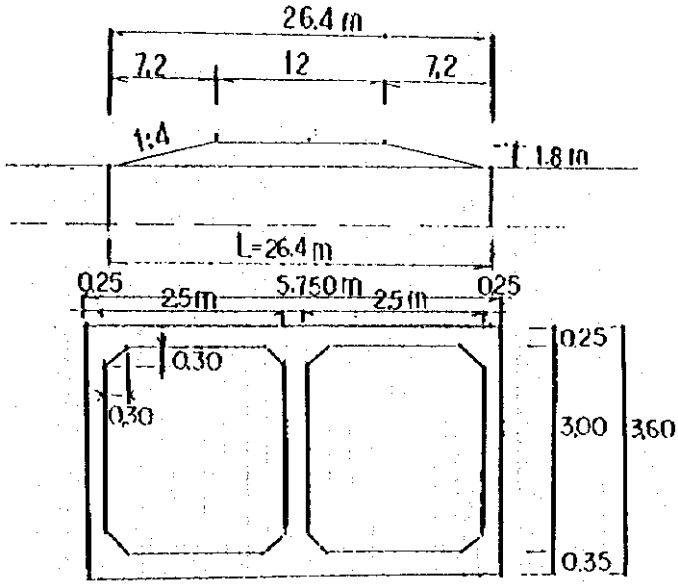
= 625,39 m³

2) Temporary bridge

Temporary bridge for L = 5 m shall be constructed.

3) Backfilling

V = 625,39 m³



(2) Box Culvert

1) Concrete volume

A = 6,24 m²

V = A×L m²

= 194,69 m³

2) Excavation volume

A1 = 17,085 m²

A2 = 1,750 m²

A3 = 1,785 m²

ΣA = 20,620 m²

V = ΣA×L = 544,368 m³

Box Culvert Construction Cost

Item		Volume	Unit Price (US$)	Cost (US$)
Detour	Excavation	625.39 m³	7.10	4,443.34
	Backfilling	625.39 m³	6.39	3,999.00
	Temporary Bridge	L = 5 m		7,729.39
Box Culvert	Concrete	194.688 m³	321.78	62,647.13
	Backfilling	384.73 m³	6.39	2,460.12
	Excavation	544.368 m³	7.10	3,867.71
Total				85,146.69

The construction cost of a 5-meter bridge shall be between:

US$ 77,294 and

US$ 83,954 (see Nos. 8, 13,14)

Therefore, a comparison with the construction cost of a 5-meter bridge shows that such a bridge is economical, and shall therefore be recommended.