

Appendix- 8

A8. APPENDIX TO CHAPTER 8

There is no established theory for arriving at the load carrying capacity of a bridge. Although it is the responsibility of the MOP to establish load restrictions on structures, the Study Team is including the following notes as backup data to assist the MOP in its decision.

An evaluation of the capacity of the bridge can only be obtained after taking into consideration the level of stresses, the design conditions, the actual traffic and the physical condition of the bridge.

The approach takes into consideration the following:

(1) Safety Factor for the Bridge.

This is computed as the ratio of the stress due to live load to the yield stress minus the dead load stress. Thus:

$$r = (f_y - f_d) / f_l$$

where, f_y = yield stress of the steel girder
 f_d = stress due to dead load
 f_l = stress due to live load

Refer to Fig. A8-1

(2) Stress for Evaluation of Stability of Bridge.

To evaluate the stability of the bridge, the stress to be examined is calculated using the formula below.

$$f = f_o \times K_1 \times K_2 \times K_3 \times K_4$$

Where: f = stress to be examined for the stability of bridge,
 f_o = calculated stress due to using design live load for non-composite action,
 K_1 = See derivation below,
 K_2 = coefficient for traffic condition
 K_3 = coefficient for conditions of road surface
 K_4 = coefficient for other conditions to be considered

(3) Assumptions for derivation of coefficients

K_1 is developed on the basis of stress obtained by loading test of the bridge, and by the following formula:

$$K1 = \frac{\text{strains obtained from loading test}}{\text{calculated strains using design load}}$$

Since there are no data regarding an actual loading test on the existing bridge, K1 is taken as 0.4 on the assumption that there are no cracks between the steel girder and the concrete deck slab as visually noted.

The stability study of 17 steel girders in Japan, shown in Fig. A8-2 indicates that statistically, the girder will function as composite section of steel girder and concrete slab to some extent.

K2 can be obtained taking into account the actual traffic conditions on the bridge. For the existing bridge, both lanes are congested because a one-way system is applied in the morning peak hours as verified by the survey results obtained in the course of the study.

The design live load is applied on the basis of a sequence of vehicles as in Fig A8-3.

It is therefore assumed that the load intensity under actual traffic conditions is more severe than those of design load. Based on the above context and on the short span lengths of the bridge, a value of 1.1 is used for K2.

K3 is applied taking into account the condition of the road surface on the bridge. Based on the findings shown in Table 8-2 of the report, and considering the substantial presence of type 2 and type 3 cracks, a value of 1.1 is used for K3.

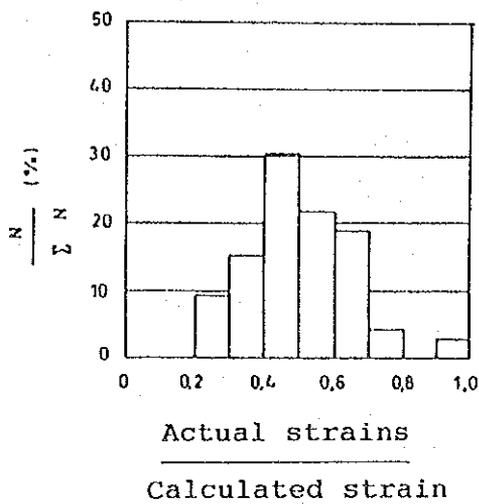
K4 is applied when the physical conditions on the bridge are judged to be severe. Major vibrations were felt at the bridge during the field survey. Steel structures deteriorate with age. The existing bridge has been in use for about 60 years, even though rebuilt in the fifties. Considerations should be given to fatigue stresses in the steel girders. Due to these considerations, a value of 1.05 is used for K4.

(4) Evaluation of Stability

The product obtained by the multiplication of the K factors, is thus, $0.4 \times 1.1 \times 1.1 \times 1.05 = 0.51$.

Using the value of -754 as the live load stress under the 8 ton loading for non-composite action, $-754 \times 0.51 = -385$ kg/cm². (see Table 8-8)

Under the dead load of the slab alone, the unit stress in the top flange of the girder is -1,240 kg/cm², while the unit stress under the full dead load is -1,885 kg/cm² (see Table 8-8). Thus the difference is -645. Therefore $-645 \times 0.51 = -329$.



Legend:
 N : Measurement point
 ΣN : Total number of measurement point
 (57 points for 17 bridges)

Figura A.8-2 Deformación en la Viga de Acero

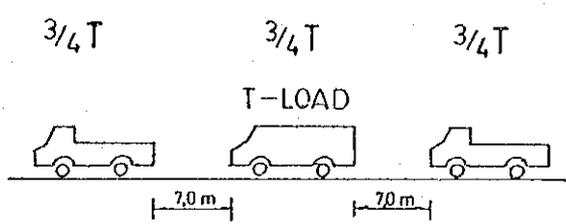
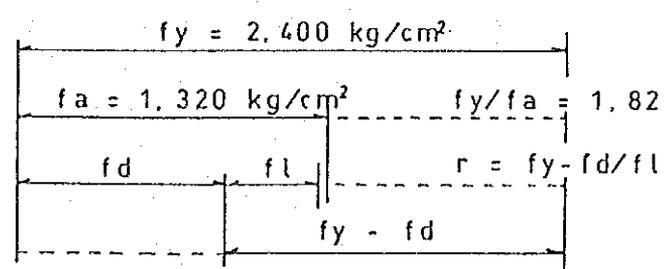


Figura A.8-3 Carga Util Aplicado para Puento Existente



Legend:
 fy : yield strength
 fa : allowable stress
 fd : stress due to dead load
 fl : stress due to live load

Figura A.8-1 Relación Entre Tensiones

The total dead load based on the above derivation is $-1,240 - 329 = 1,569$. The total dead and live load based on the above derivation is:
 $- 1,569 - 385 = - 1,954$ kg/cm². This value is substantially higher than the allowable value of $- 1,320$.

The safety factor for the evaluation of stability is calculated:
 $r = (f_y - f_d) / f_l$ or $(2400 - 1569) / 385 = 831 / 385 = 2.16$. This is considered reasonable for the 8 ton load. However, the stress due to dead load alone, $- 1,569$ exceeds the allowable stress of $1,320$ kg/cm².

The safety factor, ratio, of the yield stress to the combined stress, namely $2,400 / 1,954 = 1.22$. This is considerably smaller than the specified ratio of 1.8, and is considered unacceptable.

Tabla A.8-1 Pruebas de Resistencia del Hormigón (1)

NOMBRE DEL PUENTE : BIOBIO FECHA : 01-05-94
 INSPECTOR : H.LEIVA
 UBICACION : P20 ENSAYO Nº : 1
 ANGULO DE APLICACION : 0° CORRECCION : 0

Nº	VALORES MEDIDOS (Dm1)	CORRECCION	VALOR CORREGIDO (D1)	VALOR APLICABLE (Dad1)
1	38	0	38	38
2	36	0	46	46
3	43	0	43	43
4	44	0	44	44
5	44	0	44	44
6	37	0	37	37
7	37	0	37	37
8	42	0	42	42
9	40	0	40	40
10	41	0	41	41
11	40	0	40	40
12	44	0	44	44
13	41	0	41	41
14	42	0	42	42
15	38	0	38	38
16	40	0	40	40
17	42	0	42	42
18	40	0	40	40
19	44	0	44	44
20	40	0	40	40
VALOR PROMEDIO			40.65	40.65

Promedio de valores corregidos: $\bar{A}_v = (1/20) \text{SUM}(D1) = 40.65$
 Intervalo de confianza : $0.9A_v \leq (D1) \leq 1.2A_v$: $32.51 \leq (D1) \leq 48.77$
 Resistencia básica : $D_o = 40.65$
 Resistencia estimada (Kg/cm²) : $F = 13 D_o - 104 = 344$ kg/cm²
 Tiempo de vida : 30 años
 Factor de corrección por vida : $\alpha = 0.60$
 Resistencia estimada considerando el factor de vida :
 $F_n = \alpha \times F = 207$ kg/cm²

Appendix- 9

A9. APPENDIX TO CHAPTER 9

A.9-1 Construction Methods

(1) Manufacture of Prestressed Concrete Girders

Two units of portal cranes shall be provided to carry out the manufacture and handling of the prestressed concrete girders. The prestressed concrete girders will be manufactured at the site and moved onto the bridge to be handled by the launching system.

(2) Prestressed Concrete Girder Erection

One set of launching system will be provided at each end of the bridge to be used for the erection of the prestressed concrete girders. The launching system will move position as the erection proceeds. See Fig. A.9-5 for Girder Launching System.

(3) Temporary Bridge(s)

The construction of the bridge foundation will be carried out by rechanneling the river water and the creation of a dry area to be used for foundation construction. Rechanneling the river would create constriction in the channel which would divert the water to the other side. Short temporary bridge(s) are anticipated to be needed over the deep water, or in case of urgency to accomplish foundation work to progress the work. These bridge lengths will be provided for in the estimates and will depend on water conditions, and construction stages.

Depending on the alternative selected, provisions for short lengths of temporary bridge(s) will be made in the estimates.

See Fig. A.9-6 for General Details of Temporary Bridge.

(4) Structure Excavation

In general it is anticipated that the structural excavation will be carried out in dry areas created where the river is diverted. Most of the structural excavations will be done by open cut method using backhoe. Braced cofferdams may be used to create a working environment for the construction of the foundations particularly where the water is deep.

(5) Foundations

In the construction of the temporary bridge(s), particularly where the water is deep, braced cofferdams may be used to create a working environment for the construction of the foundations, including the placement of the piles and the pile cap. Steel pipe piles, cast-in-place concrete piles and open caissons will be considered and compared for use in the foundations of this bridge.

A.9-2 Construction Schedule

ACTIVITY	DURATION
1. Mobilization	Two months
2. Pile Driving for Temporary Bridges	42 minutes per pile including welding
3. Sheet Piling	19 minutes per section including extraction
4. Cast-in-Place Pile	320 minutes per pile for excavation Time for placement of reinforcement and concreting is absorbed in this activity.
5. Substructures	45 days per pier, however, 6 piers can be constructed simultaneously using assembly line techniques.
6. Manufacture of PC Girders	One team working for 23 days per one girder. (two teams needed).
7. Launching Girder	Two sets of launching girders. Each launching girder can handle 54 ton per day. (One prestressed concrete girder weighs up to 78 tons.
8. Deck Slab and Cross beam	Four teams can construct 20 m ² per day per team.
9. Bridge Surface & Accessories	Two teams can complete 2.5 m of bridge per day per team.
10. Retaining Wall	20 m ³ concrete placement per day
11. Concrete Pavement	1,250 m ² per month
12. Rechanneling of River	Approximately one month for four bulldozers.

For tentative Construction Schedule for the four alternatives, see Table A.9-1.

A.9-3 Construction Costs of the Four Alternatives

The total construction costs for the various alternatives developed during the preparation of the Interim Report were:

	L.C. Ch.\$ Millions	F.C. US \$ X1,000	Total Ch.\$ Millions	Total US \$ X1,000
Alternative 1	20,515	13,928	26,518	61,527
Alternative 2	20,396	13,611	26,262	60,934
Alternative 3	19,831	13,522	25,659	59,534
Alternative 4	22,508	15,268	29,089	67,491

L.C. means Local Costs expressed in Millions of Ch \$.
 F.C. means Foreign Costs expressed in Thousands of US \$
 Total cost is the sum of the L.C. and F.C. and is expressed in Millions of Ch \$ or Thousands of US \$, at the rate of Ch \$ 431 = US \$ 1.00

Refer to the following for related data.

- Table A.9-2 Construction Costs for Alternative Routes.
- Table A.9-3 Direct Construction Costs.
- Table A.9-4 Summary of Quantities.
- Table 12-4 List of Unit Prices for Work Items.

Tabla A.9-1 Programa Provisional de Construcción para Cuatro Alternativas (Alternativa.1 para Ruta Punte Existente)

YEARS MONTHS	1ST YEAR			2ND YEAR			3RD YEAR			4TH YEAR		
	1	2	3	4	5	6	7	8	9	10	11	12
I. ECUBIO BRIDGE												
Preparations												
Temporary bldgs												
Rechannel of river												
Sheet piling												
Preloaded cap												
Substructure												
River bank												
Manufacturing girder												
Launching girder												
Dock slab												
Accessories												
II. ACCESS TO CONCEPCION												
Substructure												
Superstructure												
Retaining wall												
Access road												
III. ACCESS TO SA PEDRO												
Substructure												
Superstructure												
Retaining wall												
Accessories												
IV. CLEAR AWAY												
TOTAL												

Tabla A.9-1 Programa Provisional de Construcción para Cuatro Alternativas (Alternativa.2 para Ruta CHACABUCO)

YEARS MONTHS	1ST YEAR		2ND YEAR		3RD YEAR		4TH YEAR	
	1	2	1	2	1	2	1	2
I. EGOEIO BRIDGE								
Permittees								
Temporary bridge								
Rechannel of river								
Shovel piling								
Foundations								
Substructure								
River bank								
Manufacturing girder								
Laying girder								
Deck slab								
Asphalt								
II. ACCESS TO CONCEPCION								
Substructure								
Superstructure								
Retaining wall								
Access road								
III. ACCESS TO SAN PEDRO								
Substructure								
Superstructure								
Retaining wall								
Access road								
IV. CLEAR AWAY								
TOTAL								

Tabla A.9-1 Programa Provisional de Construcción para Cuatro Alternativas (Alternativa.3 para Ruta Los Carrera (B))

YEARS	1ST YEAR			2ND YEAR			3RD YEAR			4TH YEAR		
	MONDIS	1	2	1	2	3	1	2	3	1	2	3
I. BUENOS AIRES BRIDGE												
Preparations												
Temporary bridge												
Rechannel of river												
Sheet piling												
Foundations												
Substructure												
River bank												
Manufacturing girder												
Launching girder												
Deck slab												
Accessories												
II. ACCESS TO CONCEPCION												
Substructure												
Superstructure												
Raising wall												
Access road												
III. ACCESS TO SAN PEDRO												
Substructure												
Superstructure												
Raising wall												
Accessories												
IV. CLEAR AWAY												
TOTAL												

3.5 Months

Tabla A.9-2 Costos de Construcción de las Rutas Alternativas(1)

(1) ALTERNATIVE 1 - EXISTING BRIDGE ROUTE

DESCRIPTION	UNIT	QUANTITY	AMOUNT		REMARKS
			\$ Mill	US \$1000	
1. DIRECT COST					
Road construction	m2	25690	1581	1426	Carriageway
Retaining wall	m3	13940	1264	696	
Substructure	pier	52	3593	3229	
Superstructure	m2	27382	4321	2986	
Sub-total			10759	8336	
2. GENERAL EXPENSES					
	%	20	2152	1667	0.20x1
3. CONSTRUCTION COST					
			12911	10003	1+2
4. ENGINEERING COST					
	%	8	1033	800	0.08x3
5. CONTINGENCY					
	%	10	1291	1000	0.10x3
6. IVA					
	%	18	2742	2125	(3+4+5)x0.18
7. LAND AQUISITION					
			2537	0	
TOTAL CONSTRUCTION COST					
			20515	13928	3+4+5+6+7

(2) ALTERNATIVE 2 - CHACABUCO ROUTE

DESCRIPTION	UNIT	QUANTITY	AMOUNT		REMARKS
			\$ Mill	US \$1000	
1. DIRECT COST					
Road construction	m2	19630	1476	1171	Carriageway
Retaining wall	m3	10650	927	508	
Substructure	pier	54	3776	3352	
Superstructure	m2	28612	4510	3114	
Sub-total			10689	8146	
2. GENERAL EXPENSES					
	%	20	2138	1629	0.20x1
3. CONSTRUCTION COST					
			12827	9775	1+2
4. ENGINEERING COST					
	%	8	1026	782	0.08x3
5. CONTINGENCY					
	%	10	1283	978	0.10x3
6. IVA					
	%	18	2724	2076	(3+4+5)x0.18
7. LAND AQUISITION					
			2535	0	
TOTAL CONSTRUCTION COST					
			20396	13611	3+4+5+6+7

Tabla A.9-2 Costos de Construcción de las Rutas Alternativas(2)

(3) ALTERNATIVE 3 - LOS CARRERA B ROUTE

DESCRIPTION	UNIT	QUANTITY	AMOUNT		REMARKS
			\$ Mill	US \$1000	
1. DIRECT COST					
Road construction	m2	18810	1430	1180	
Retaining wall	m3	4490	410	246	
Substructure	pier	58	4056	3306	
Superstructure	m2	30744	4869	3362	Carriageway
Sub-total			10766	8093	
2. GENERAL EXPENSES	%	20	2153	1619	0.20x1
3. CONSTRUCTION COST			12919	9712	1+2
4. ENGINEERING COST	%	8	1034	777	0.08x3
5. CONTINGENCY	%	10	1292	971	0.10x3
6. IVA	%	18	2744	2063	(3+4+5)x0.18
7. LAND AQUISITION			1842	0	
TOTAL CONSTRUCTION COST			19831	13522	3+4+5+6+7

(4) ALTERNATIVE 4 - LOS CARRERA A ROUTE

DESCRIPTION	UNIT	QUANTITY	AMOUNT		REMARKS
			\$ Mill	US \$1000	
1. DIRECT COST					
Road construction	m2	10400	975	774	
Retaining wall	m3	3190	855	476	
Substructure	pier	71	5248	3880	
Superstructure	m2	37042	5818	4008	Carriageway
Sub-total			12897	9138	
2. GENERAL EXPENSES	%	20	2579	1828	0.20x1
3. CONSTRUCTION COST			15476	10966	1+2
4. ENGINEERING COST	%	8	1238	877	0.08x3
5. CONTINGENCY	%	10	1548	1097	0.10x3
6. IVA	%	18	3287	2329	(3+4+5)x0.18
7. LAND AQUISITION			959	0	
TOTAL CONSTRUCTION COST			22508	15268	3+4+5+6+7

Tabla A.9-3 Costos Directos de Construcción (1)

ALTERNATIVE 1 - EXISTING BRIDGE ROUTE

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS	
			Pesos (\$)	US (\$)	\$ Mill	US \$1000		
1. ROAD CONSTRUCTION								
Cutting	m3	110440	213,64	2,68	23,59	295,98	102	
Filling	m3	54300	1136,36	3,91	61,70	212,31	104	
Drainage ditch	m	5980	32600,00	12,50	194,95	74,75	301	
Drainage pipe	m	100	60181,82	34,55	6,02	3,46	302	
Subbase	m3	20095	3400,00	3,31	68,32	66,51	402+401	
Concrete pavement	m2	25690	13348,54	2,97	342,92	76,30	406	
Curb	m	21810	3181,82	1,82	69,40	39,69	500	
Median	m	4800	3181,82	1,82	15,27	8,74	500	
Guard rail	m	3550	10000,00	3,27	35,50	11,61	501	
Marginal strip	m	27410	14,55	0,41	0,40	11,24	503	
Interlocking	m2	27005	6800,00	7,40	183,63	199,84	504	
Illumination	each	211	331000,00	160,00	69,84	33,76	506	
Signal	set	2	12350000,00	1500,00	24,70	3,00	507	
Demolition of concrete	m3	7020	15600,00	24,10	109,51	169,18	204	
Sewerage work	m	2165	80000,00	46,40	173,20	100,46		
Electrical work, Tel	m	2165	5160,00	4,00	11,17	8,66		
Utilition, Gas & Water	m	2165	80000,00	51,00	190,52	110,42		
S U B T O T A L						1500,66	1425,90	
2. RETAINING WALL								
Structure excavation	m3	24140	5490,91	4,97	132,55	119,98	601+605	
Cast in-situ pile 800	m	3020	56100,00	67,00	169,42	202,34	707	
Formwork for footing	m2	5300	5454,55	1,36	28,91	7,21	803	
Formwork for stem	m2	19380	7090,91	2,73	137,42	52,91	804	
Re-bar for footing	t	255	435455,55	54,55	111,04	13,91	805	
Re-bar for stem	t	457	513636,36	62,73	234,73	28,67	806	
Concrete for footing	m3	5130	30415,10	12,64	156,03	64,84	809+811	
Concrete for stem	m3	8810	33415,10	23,35	294,39	205,71	810+812	
S U B T O T A L						1264,49	695,57	
3. SUBSTRUCTURE								
Structure excavation	m3	38985	8800,00	7,22	343,07	281,47	603+605	
Sheet piling	m2	3660	886,67	169,97	3,25	622,09	607	
Temporary bridge	m	210	143225,31	2024,95	30,08	425,24	609	
Cast in-situ pile	m	12240	70117,00	83,01	858,23	1016,04	706	
Formwork for footing	m2	3610	5454,55	1,36	19,69	4,91	803	
Formwork for stem	m2	19255	7090,91	2,73	136,54	52,57	804	
Re-bar for footing	t	837	435455,55	54,55	364,48	45,66	805	
Re-bar for stem	t	1737	513636,36	62,73	892,19	108,96	806	
Concrete for footing	m3	11924	30415,10	12,64	362,67	150,72	809+811	
Concrete for stem	m3	17407	33415,00	23,35	581,65	406,45	810+812	
Rechannel of river	m	3000	0,00	36,00	0,00	108,00	105	
River bank	m2	500	1745,45	12,82	0,87	6,41		
S U B T O T A L						3592,71	3228,52	
4. SUPERSTRUCTURE								
PC girder	each	437	5104976,58	4063,16	2230,87	1775,60	900	
Cross beam	each	196	1797010,61	668,32	352,21	130,99	1100	
Launching work	each	437	261433,49	673,15	114,25	294,17	1000	
Dock slab	m2	40680	31783,01	12,58	1292,93	511,75	1200	
Expansion joint	m	1250	2909,09	62,73	3,64	78,41	1302	
Bearing	each	811	254545,45	104,55	206,44	84,79	1304	
Bridge railing	m	6580	11090,91	13,82	72,98	90,94	1306	
Illumination	each	111	331000,00	160,00	36,74	17,76	506	
Road signs	L.S.	1	11400000,00	1400,00	11,40	1,40		
S U B T O T A L						4321,46	2985,81	
T O T A L						10759,32	8335,80	

Tabla A.9-3 Costos Directos de Construcción (2)

ALTERNATIVE 2 - CHACABUCO

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			Pesos (\$)	US (\$)	\$ Mill	US \$1000	
1. ROAD CONSTRUCTION							
Cutting	m3	42890	213,64	2,68	9,16	114,95	102
Filling	m3	44900	1136,36	3,91	51,02	175,56	104
Drainage ditch	m	5080	32600,00	12,50	191,69	73,50	301
Drainage pipe	m	95	60181,82	34,55	5,72	3,28	302
Subbase	m3	19925	3400,00	3,31	67,75	65,95	402+401
Concrete pavement	m2	19630	13348,54	2,97	262,03	50,30	406
Curb	m	18580	3181,82	1,82	59,12	33,82	500
Median	m	4810	3181,82	1,82	15,30	8,75	500
Guard rail	m	3110	10000,00	3,27	31,10	10,17	501
Marginal strip	m	27440	14,55	0,41	0,40	11,25	503
Interlocking	m2	27250	6800,00	7,40	185,30	201,65	504
Illumination	each	332	331000,00	160,00	109,89	53,12	506
Signal	set	2	12350000,00	1500,00	24,70	3,00	507
Demolition of concrete	m3	5800	15600,00	24,10	90,48	139,78	204
Sewerage work	m	2120	80000,00	46,40	169,60	98,37	
Electrical work, Tel.	m	2380	5160,00	4,00	12,28	9,52	
Utilities, Gas & Water	m	2165	88000,00	51,00	190,52	110,42	
S U B T O T A L					1476,06	1171,38	
2. RETAINING WALL							
Structure excavation	m3	19780	5490,91	4,97	108,61	98,31	601+605
Cast in-situ pile 800	m	1870	56100,00	67,00	104,91	125,29	707
Formwork for footing	m2	3820	5454,55	1,36	20,84	5,20	803
Formwork for stem	m2	15040	7090,91	2,73	106,65	41,06	804
Re-bar for footing	t	171	435455,55	54,55	74,46	9,33	805
Re-bar for stem	t	324	513636,36	62,73	166,42	20,32	806
Concrete for footing	m3	3720	30415,10	12,64	113,14	47,02	809+811
Concrete for stem	m3	6930	33415,10	23,35	231,57	161,82	810+812
S U B T O T A L					926,59	508,34	
3. SUBSTRUCTURE							
Structure excavation	m3	40385	8800,00	7,22	355,39	291,58	603+605
Sheet piling	m2	3660	886,67	169,97	3,25	622,09	607
Temporary bridge	m	210	143225,31	2024,95	30,08	425,24	609
Cast in-situ pile	m	13200	70117,00	83,01	925,54	1095,73	706
Formwork for footing	m2	3760	5454,55	1,36	20,51	5,11	803
Formwork for stem	m2	20105	7090,91	2,73	142,56	54,89	804
Re-bar for footing	t	872	435455,55	54,55	379,72	47,57	805
Re-bar for stem	t	1817	513636,36	62,73	933,28	113,98	806
Concrete for footing	m3	12404	30415,10	12,64	377,27	156,79	809+811
Concrete for stem	m3	18187	33415,00	23,35	607,72	424,67	810+812
Rechannel of river	m	3000	0,00	36,00	0,00	108,00	105
River bank	m2	500	1745,45	12,82	0,87	6,41	
S U B T O T A L					3776,18	3352,05	
4. SUPERSTRUCTURE							
PC girder	each	455	5104976,58	4063,16	2322,76	1848,74	900
Cross beam	each	204	1797010,61	668,32	366,59	136,34	1100
Launching work	each	455	261433,49	673,15	118,95	306,28	1000
Deck slab	m2	42150	31783,01	12,58	1339,65	530,25	1200
Expansion joint	m	1300	2909,09	62,73	3,78	81,55	1302
Bearing	each	910	254545,45	104,55	231,64	95,14	1304
Bridge railing	m	6940	11090,91	13,82	76,97	95,91	1306
Illumination	each	117	331000,00	160,00	38,73	18,72	506
Road signs	L.S.	1	11400000,00	1400,00	11,40	1,40	
S U B T O T A L					4510,48	3114,33	
T O T A L					10689,31	8146,10	

Tabla A.9-3 Costos Directos de Construcción (3)

ALTERNATIVE 3 - LOS CARRERA B

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS	
			Pesos (\$)	US (\$)	\$ Mill	US \$1000		
1. ROAD CONSTRUCTION								
Cutting	m3	65220	213,64	2,68	13,93	174,79	102	
Filling	m3	44400	1136,36	3,91	50,45	173,60	104	
Drainage ditch	m	5790	32600,00	12,50	188,75	72,38	301	
Drainage pipe	m	75	60181,82	34,55	4,51	2,59	302	
Subbase	m3	19125	3400,00	3,31	65,03	63,30	402+401	
Concrete pavement	m2	18810	13348,54	2,97	251,09	55,87	406	
Curb	m	18840	3181,82	1,82	59,95	34,29	500	
Median	m	4980	3181,82	1,82	15,05	9,06	500	
Guard rail	m	6210	10000,00	3,27	62,10	20,31	501	
Marginal strip	m	27480	14,55	0,41	0,40	11,27	503	
Interlocking	m2	27580	6800,00	7,40	187,54	204,09	504	
Illumination	each	318	331000,00	160,00	105,26	50,88	506	
Signal	set	2	12350000,00	1500,00	24,70	3,00	507	
Demolition of concrete	m3	4630	15600,00	24,10	72,23	111,58	204	
Sewerage work	m	1890	80000,00	46,40	151,20	87,70		
Electrical work, Tel.	m	2140	5160,00	4,00	11,04	8,56		
Utilities, Gas & Water	m	1890	88000,00	51,00	166,32	96,39		
S U B T O T A L						1430,35	1179,66	
2. RETAINING WALL								
Structure excavation	m3	8080	5490,91	4,97	44,37	40,16	601+605	
Cast in-situ pile 800	m	1280	56100,00	67,00	71,81	85,76	707	
Formwork for footing	m2	1560	5454,55	1,36	8,51	2,12	803	
Formwork for stem	m2	6390	7090,91	2,73	45,31	17,44	804	
Re-bar for footing	t	66	435455,55	54,55	28,74	3,60	805	
Re-bar for stem	t	129	513636,36	62,73	66,26	8,09	806	
Concrete for footing	m3	1530	30415,10	12,64	46,54	19,34	809+811	
Concrete for stem	m3	2960	33415,10	23,35	98,91	69,12	810+812	
S U B T O T A L						410,44	245,63	
3. SUBSTRUCTURE								
Structure excavation	m3	43165	8800,00	7,22	379,85	311,65	603+605	
Sheet piling	m2	3665	886,67	169,97	3,25	622,94	607	
Temporary bridge	m	105	143225,31	2024,95	15,04	212,62	609	
Cast in-situ pile	m	14160	70117,00	83,01	992,86	1175,42	706	
Formwork for footing	m2	4040	5454,55	1,36	22,04	5,49	803	
Formwork for stem	m2	21735	7090,91	2,73	154,12	59,34	804	
Re-bar for footing	t	937	435455,55	54,55	408,02	51,11	805	
Re-bar for stem	t	1977	513636,36	62,73	1015,46	124,02	806	
Concrete for footing	m3	13334	30415,10	12,64	405,55	168,54	809+811	
Concrete for stem	m3	19717	33415,00	23,35	658,84	460,39	810+812	
Rechannel of river	m	3000	0,00	36,00	0,00	108,00	105	
River bank	m2	500	1745,45	12,82	0,87	6,41		
S U B T O T A L						4055,91	3305,94	
4. SUPERSTRUCTURE								
PC girder	each	491	5104976,58	4063,16	2506,54	1995,01	900	
Cross beam	each	220	1797010,61	668,32	395,34	147,03	1100	
Launching work	each	491	261433,49	673,15	128,36	330,52	1000	
Deck slab	m2	45570	31783,01	12,58	1448,35	573,27	1200	
Expansion joint	m	1400	2909,09	62,73	4,07	87,82	1302	
Bearing	each	902	254545,45	104,55	249,96	102,67	1304	
Bridge railing	m	7500	11090,91	13,82	83,18	103,65	1306	
Illumination	each	127	331000,00	160,00	42,04	20,32	506	
Road signs	L.S.	1	11400000,00	1400,00	11,40	1,40		
S U B T O T A L						4869,26	3361,69	
T O T A L						10765,95	8092,92	

Tabla A.9-3 Costos Directos de Construcción (4)

ALTERNATIVE 4 - LOS CARRERA

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS	
			Pesos (\$)	US (\$)	\$ Mill	US \$1000		
1. ROAD CONSTRUCTION								
Cutting	m3	2190	213,64	2,68	0,47	5,87	102	
Filling	m3	55440	1136,36	3,91	63,00	216,77	104	
Drainage ditch	m	4310	32600,00	12,50	140,51	53,88	301	
Drainage pipe	m	25	60181,82	34,55	1,50	0,86	302	
Subbase	m3	10395	3400,00	3,31	35,34	34,41	402+401	
Concrete pavement	m2	10400	13348,54	2,97	130,82	30,89	406	
Curb	m	15420	3181,82	1,82	49,06	28,06	500	
Median	m	3700	3181,82	1,82	11,77	6,73	500	
Guard rail	m	4450	10000,00	3,27	44,50	14,55	501	
Marginal strip	m	22200	14,55	0,41	0,32	9,10	503	
Interlocking	m2	22200	6800,00	7,40	150,96	164,28	504	
Illumination	each	222	331000,00	160,00	73,40	35,52	506	
Signal	post	2	1235000,00	1500,00	24,70	3,00	507	
Demolition of concrete	m3	1950	15600,00	24,10	30,42	47,00	204	
Sewerage work	m	1215	80000,00	46,40	97,20	56,38		
Electrical work, Tel.	m	1215	5160,00	4,00	6,27	4,86		
Utilities, Gas & Water	m	1215	88000,00	51,00	106,92	61,97		
S U B T O T A L						975,26	774,12	
2. RETAINING WALL								
Structure excavation	m3	15780	5490,91	4,97	86,65	78,43	601+605	
Cast in-situ pile, 800	m	2120	56100,00	67,00	118,93	142,04	707	
Formwork for footing	m2	3140	5454,55	1,36	17,13	4,27	803	
Formwork for stem	m2	11460	7090,91	2,73	81,26	31,29	804	
Re-bar for footing	t	156	435455,55	54,55	67,93	8,51	805	
Re-bar for stem	t	335	513636,36	62,73	172,07	21,01	806	
Concrete for footing	m3	3190	30415,10	12,64	97,02	40,32	809+811	
Concrete for stem	m3	6410	33415,10	23,35	214,19	149,67	810+812	
S U B T O T A L						855,18	475,54	
3. SUBSTRUCTURE								
Structure excavation	m3	54310	8800,00	7,22	477,93	392,12	603+605	
Sheet piling	m2	3660	886,67	169,97	3,25	622,09	607	
Temporary bridge	m	105	143225,31	2024,85	15,04	212,61	609	
Cast in-situ pile 1000	m	17565	70117,00	83,01	1231,61	1458,07	706	
Formwork for footing	m2	4960	5454,55	1,36	27,05	6,75	803	
Formwork for stem	m2	26120	7090,91	2,73	185,71	71,31	804	
Re-bar for footing	t	1150	435455,55	54,55	500,77	62,73	805	
Re-bar for stem	t	2970	513636,36	62,73	1525,50	186,31	806	
Concrete for footing	m3	16380	30415,10	12,64	498,20	207,04	809+811	
Concrete for stem	m3	23410	33415,00	23,35	782,25	546,62	810+812	
Rechannel of river	m	3000	0,00	36,00	0,00	108,00	105	
River bank	m2	500	1745,45	12,82	0,87	6,41		
S U B T O T A L						5247,68	3880,06	
4. SUPERSTRUCTURE								
PC girder	each	584	5104976,58	4063,16	2981,31	2372,89	900	
Cross beam	each	272	1797010,61	668,32	488,79	181,78	1100	
Launching work	each	584	261433,49	673,15	152,68	393,12	1000	
Deck slab	m2	54520	31783,01	12,58	1732,81	685,86	1200	
Expansion joint	m	1660	2909,09	62,73	4,83	104,13	1302	
Bearing	each	1168	254545,45	104,55	297,31	122,11	1304	
Bridge railing	m	8840	11090,91	13,82	98,04	122,17	1306	
Illumination	each	155	331000,00	160,00	51,31	24,80	506	
Road signs	L.S.	1	11400000,00	1400,00	11,40	1,40		
S U B T O T A L						5818,47	4008,26	
T O T A L						12896,58	9137,99	

Tabla A.9-4 Sumario de la Cantidades(1)

ALTERNATIVE 1 - EXISTING BRIDGE ROUTE

DESCRIPTION	UNIT	WIDENING at CONCEP.	GRAVITY WALL SECTION at CONCEP.	FRYONER SECTION at CONCEP.	RETAINING WALL SECTION at CONCEP.	FILLING SECTION at CONCEP.	BIOBIO BRIDGE	FILLING SECTION at Sn PEDRO	INTERSECTION at Sn PEDRO	WIDENING at Sn PEDRO	TOTAL
1. ROAD CONSTRUCTION											
Cutting	m3	1800							84800	23840	110440
Filling	m3		2000		18750	22670		680	10200		54300
Drainage ditch	m	260	160		300	450		470	1240	3100	5980
Drainage pipe	m	25								75	100
Subbase	m3	840	600		1125	1685		1250	2970	11625	20095
Concrete pavement	m2	2400	2000		3750	1690		1250	2970	11630	25690
Curb	m	520	320	1530	600	900	8400	860	2480	6200	21810
Median	m	130	80	255	150	225	1400	390	620	1550	4800
Guard rail	m		320		900	1350		40	940		3550
Marginal strip	m	780	480	1530	900	900	8400	1400	3720	9300	27410
Interlocking	m2	715	480	1530	900	1350	8400	1210	3120	9300	27005
Illumination	each	9	5		10	15			26	42	211
Signal	set	2									2
Demolition of concrete	m3	580	360						1040	5040	7020
Sewerage work	m	130	80		150	255				1550	2165
Electrical work	m	130	80	255	150	255				1550	2420
Utilities, Gas & Water	m	130	80		150	255				1550	2165
S U B T O T A L											
2. RETAINING WALL											
Structure excavation	m3		960		6070				8820	9600	25450
Well point	m								1650		3020
Cast in-situ pile 800	m				1370				6150	8320	19380
Formwork for footing	m2		830		4080				2040	1600	5300
Formwork for stem	m2		160		1500				185	120	457
Re-bar for footing	t		12		140				110	50	255
Re-bar for stem	t		5		90				2680	4000	8810
Concrete for footing	m3		400		1730				1950	1600	5130
Concrete for stem	m3		160		1420						
S U B T O T A L											
3. SUBSTRUCTURE											
Structure excavation	m3			9400			28540		1045		38985
Sheet piling	m2						3660				3660
Temporary bridge	m						210				210
Cast in-situ pile	m			2160			9840		240		12240
Formwork for footing	m2			2300			16700		255		19255
Formwork for stem	m2			640			2900		70		3610
Re-bar for footing	t			150			1570		17		1737
Re-bar for stem	t			150			670		17		837
Concrete for footing	m3			1500			15740		167		17407
Concrete for stem	m3			2100			9590		234		11924
Rechannel of river	m						3000				3000
River bank	m2						500				500
S U B T O T A L											
4. SUPERSTRUCTURE											
PC girder	each			72			360		5		437
Cross beam	each			32			160		4		196
Launching work	each			72			360		5		437
Deck slab	m2			6220			34160		300		40680
Expansion joint	m			220			1000		30		1250
Bearing	each			81			720		10		811
Bridge railing	m			900			5600		80		6580
Illumination	each			15			94		2		111
S U B T O T A L											

Tabla A.9-4 Sumario de la Cantidades(2)

ALTERNATIVE 2 - CHACABUCO

DESCRIPTION	UNIT	WIDENING at CONCEP.	GRAVITY CONCEP.	FRYONER CONCEP.	RETAINING WALL CONCEP.	DI OBIO BRIDGE	FILLING Sn PEDRO	INTER - SECTION at Sn PEDRO	WIDENING at Sn PEDRO	TOTAL
1. ROAD CONSTRUCTION										
Cutting	m3	2250						20150	20490	42890
Filling	m3		2250		30750		1700	10200		44900
Drainage ditch	m	400	180		900		400	1160	2760	5680
Drainage pipe	m	25							70	95
Subbase	m3	1500	680		3380		1245	2765	10355	19925
Concrete pavement	m2	1500	680		3380		1250	2470	10350	19630
Curb	m	800	360	1040	1800	5880	860	2320	5520	18580
Median	m	200	90	260	450	1470	380	580	1380	4010
Guard rail	m		360		1800		50	900		3110
Marginal strip	m	1200	540	1560	2700	8820	860	3480	8280	27440
Interlocking	m2	1200	540	1560	2700	8820	1190	2960	8280	27250
Illumination	each	14	6		30	124	26	40	92	332
Signal	set	2								2
Demolition of concrete	m3	900	410						4490	5800
Sewerage work	m	200	90		450				1380	2120
Electrical work	m	200	90	260	450				1380	2380
Utilities, Gas & Water	m	200	90		450				1380	2120
S U B T O T A L										
2. RETAINING WALL										
Structure excavation	m3		1080		11260				7440	19780
Well point	m									1780
Cast in-situ pile 800	m				1780					1780
Formwork for footing	m2		940		7650				6450	15040
Formwork for stem	m2		180		2400				1240	3820
Re-bar for footing	t		14		215				95	324
Re-bar for stem	t		6		125				40	171
Concrete for footing	m3		450		3380				3100	6930
Concrete for stem	m3		180		2300				1240	3720
S U B T O T A L										
3. SUBSTRUCTURE										
Structure excavation	m3			9410		29930		1045		40385
Sheet piling	m2					3660				3660
Temporary bridge	m					210				210
Cast in-situ pile 1000	m			2590		10320		290		13200
Formwork for footing	m2			2300		17550		255		20105
Formwork for stem	m2			640		3050		70		3760
Re-bar for footing	t			150		1650		17		1017
Re-bar for stem	t			150		705		17		872
Concrete for footing	m3			1500		16520		167		18187
Concrete for stem	m3			2100		10070		234		12404
Rechannel of river	m					3000				3000
River bank	m2					500				500
S U B T O T A L										
4. SUPERSTRUCTURE										
PC girder	each			72		378		5		455
Cross beam	each			32		160		4		204
Launching work	each			72		376		5		455
Deck slab	m2			5980		35870		300		42150
Expansion joint	m			220		1050		30		1300
Bearing	each			144		756		10		910
Bridge railing	m			980		5880		80		6940
Illumination	each			17		98		2		117
S U B T O T A L										

Tabla A.9-4 Sumario de la Cantidades(3)

ALTERNATIVE 3 - LOS CARRERA B

DESCRIPTION	UNIT	WIDENING at CONCEP.	GRAVITY WALL SECTION at CONCEP.	FRYONER SECTION at CONCEP.	RETAINING WALL SECTION at CONCEP.	FILLING SECTION at CONCEP.	BIOBIO BRIDGE	FILLING SECTION at SnPEDRO	INTERSECTION at Sn PEDRO	WIDENING at Sn PEDRO	TOTAL
1. ROAD CONSTRUCTION											
Cutting	m3	2370							49100	13750	65220
Filling	m3		2000		10500	19400		2300	10200		44400
Drainage ditch	m	420	160		280	880		770	1240	2040	5790
Drainage pipe	m	25								50	75
Subbase	m3	1580	600		1055	3300		1960	2975	7655	19125
Concrete pavement	m2	1580	600		1050	3300		1960	2670	7650	18810
Curb	m	840	320	1000	560	1760	6440	1360	2480	4080	18840
Median	m	210	80	250	140	440	1610	590	640	1020	4980
Guard rail	m		320		560	1760		90	3480		6210
Marginal strip	m	1260	480	1500	840	2640	9660	1360	3720	6120	27580
Interlocking	m2	1260	480	1500	840	2640	9660	1060	3120	6120	27480
Illumination	each	14	6		10	30	108	40	42	68	318
Signal	set	2									2
Demolition of concrete	m3	950	365							3315	4630
Sewerage work	m	210	80		140	440				1020	1890
Electrical work	m	210	80	250	140	440				1020	2140
Utilities, Gas & Water	m	210	80		140	440				1020	1890
S U B T O T A L											
2. RETAINING WALL											
Structure excavation	m3		960		3760					3360	8080
Well point	m										0
Cast in-situ pile 800	m				1280						1280
Formwork for footing	m2		840		2640					2910	6390
Formwork for stem	m2		160		840					560	1560
Re-bar for footing	t		12		75					42	129
Re-bar for stem	t		5		44					17	66
Concrete for footing	m3		400		1160					1400	2960
Concrete for stem	m3		160		810					560	1530
S U B T O T A L											
3. SUBSTRUCTURE											
Structure excavation	m3			9410			32710		1045		43165
Sheet piling	m2						3660				3660
Temporary bridge	m						105				105
Cast in-situ pile 1000	m						11280		290		14160
Formwork for footing	m2		2590		2300		19180		255		21735
Formwork for stem	m2		640				3330		70		4040
Re-bar for footing	t		150		150		1810		17		1977
Re-bar for stem	t		150		150		770		17		937
Concrete for footing	m3		1500		1500		18050		167		19717
Concrete for stem	m3			2100			11000		234		13334
Rechannel of river	m						3000				3000
River bank	m2						500				500
S U B T O T A L											
4. SUPERSTRUCTURE											
PC girder	each			72			414		5		491
Cross beam	each			32			184		4		220
Launching work	each			72			414		5		491
Deck slab	m2			5980			39290		300		45570
Expansion joint	m			220			1150		30		1400
Bearing	each			144			828		10		982
Bridge railing	m			980			6440		80		7500
Illumination	each			17			108		2		127
S U B T O T A L											

Tabla A.9-4 Sumario de la Cantidades(4)

ALTERNATIVE 4 - LOS CARRERA A

DESCRIPTION	UNIT	WIDENING at CONCEP.	GRAVITY WALL SECTION at CONCEP.	FRYONER SECTION at CONCEP.	RETAINING WALL SECTION at CONCEP.	FILLING SECTION at CONCEP.	BIOBIO BRIDGE	RETAI - NING WALL SECTION at SnPEDRO	INTERSECTION BRIDGE	RETAI - NING WALL SECTION at Sn PEDRO	TOTAL
1. ROAD CONSTRUCTION											
Cutting	m3	2190									2190
Filling	m3		2500		10750	23150		8330		10710	55440
Drainage ditch	m	390	200		300	1840		340		1240	4310
Drainage pipe	m	25									25
Subbase	m3	1460	755		1125	3455		1275		2325	10395
Concrete pavement	m2	1460	750		1130	3450		1280		2330	10400
Curb	m	780	400	900	600	1840	7440	680	840	1860	15420
Median	m	195	100	245	150	460	1060	170	210	310	3700
Guard rail	m		400		600	1840		680		930	4450
Marginal strip	m	1170	600	1470	900	2760	11160	1020	1260	1060	22200
Interlocking	m2	1170	600	1470	900	2760	11160	1020	1260	1060	22200
Illumination	each	13	7		15	31	124	11		21	222
Signal	set	2									2
Demolition of concrete	m3	875	450							625	1950
Sewerage work	m	195	100		150	460				310	1215
Electrical work	m	195	100	245	150	460				310	1460
Utilities, Gas & Water	m	195	100		150	460				310	1215
S U B T O T A L											
2. RETAINING WALL											
Structure excavation	m3		1200		3890			4420		6270	15780
Wall point	m										0
Cast in-situ pile 800	m				640			740		740	2120
Formwork for footing	m2		1040		2740			3110		4570	11460
Formwork for stem	m2		200		860			820		1260	3140
Re-bar for footing	t		15		80			90		150	335
Re-bar for stem	t		6		40			50		60	156
Concrete for footing	m3		500		1210			1380		3320	6410
Concrete for stem	m3		200		830			940		1220	3190
S U B T O T A L											
3. SUBSTRUCTURE											
Structure excavation	m3			9410			37580		7320		54310
Sheet piling	m2						3660				3660
Temporary bridge	m						105				105
Cast in-situ pile	m		2590				12960		2015		17565
Formwork for footing	m2		2300				22030		1790		26120
Formwork for stem	m2		640				3820		500		4960
Re-bar for footing	t		150				2700		120		2970
Re-bar for stem	t		150				880		120		1150
Concrete for footing	m3		1500				20740		1170		23410
Concrete for stem	m3		2100				12640		1640		16380
Rechannel of river	m						3000				3000
River bank	m2						500				500
S U B T O T A L											
4. SUPERSTRUCTURE											
PC girder	each			72			477		35		584
Cross beam	each			32			212		28		272
Launching work	each			72			477		35		584
Deck slab	m2		5980				45390		3150		54520
Expansion joint	m		220				1320		120		1660
Bearing	each		144				954		70		1168
Bridge railing	m		980				7440		420		8840
Illumination	each			17			124		14		155
S U B T O T A L											

NUEVO PUENTE BIO BIO

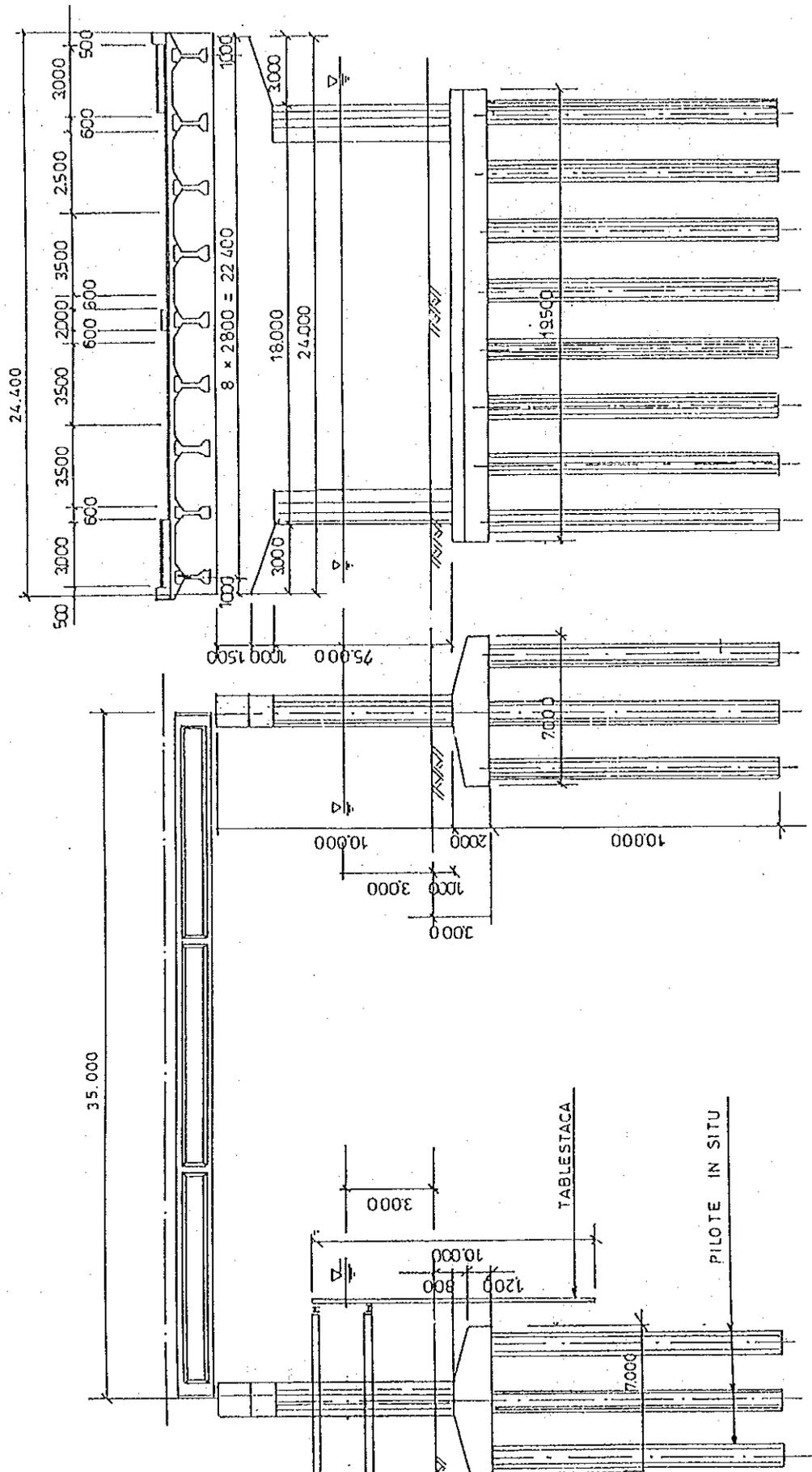


Figura A.9-1 Dibujo de la Estructura del Nuevo Puente Bio Bio

CEPAS PARA PASOS FERROVIARIOS

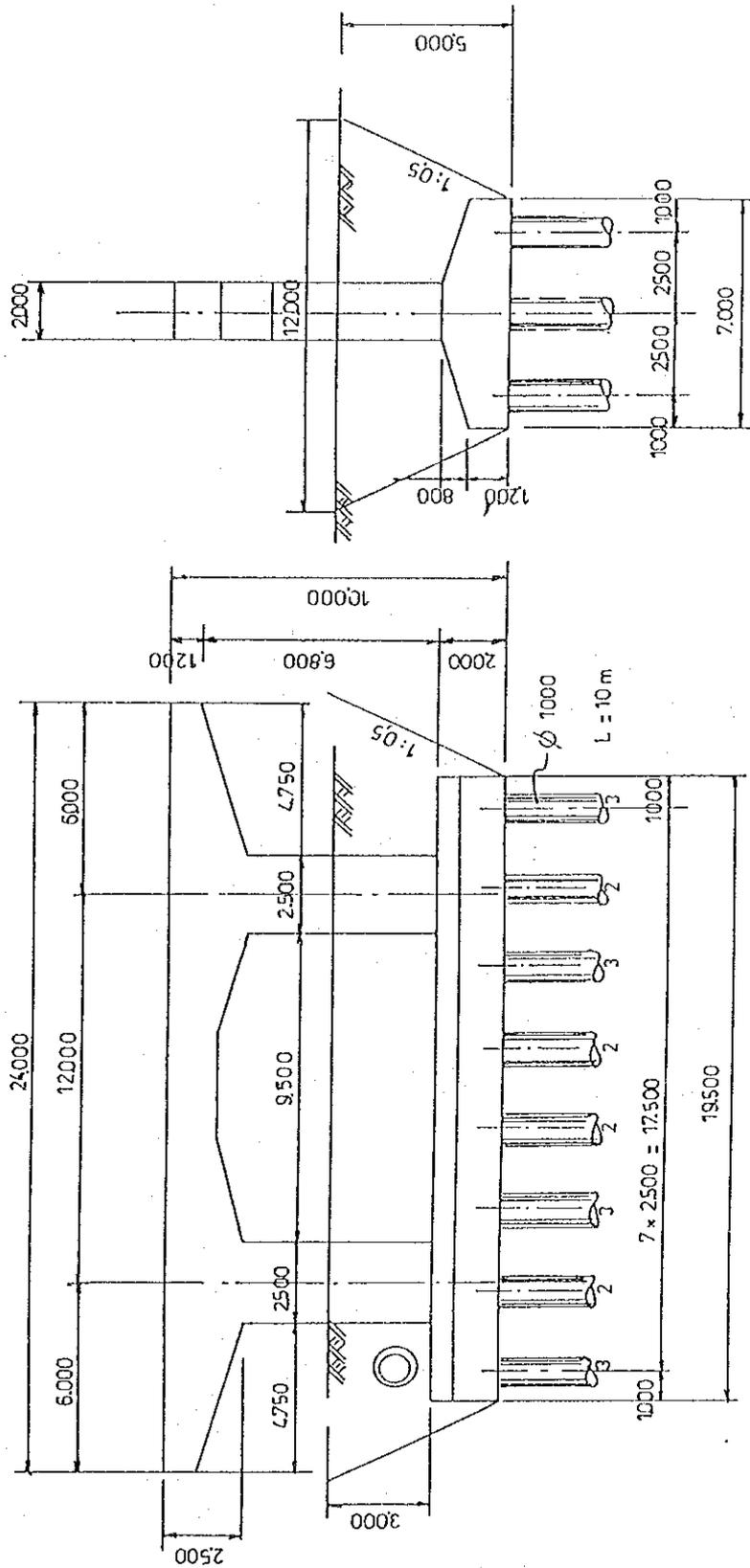


Figura A.9-2 Cepa del Paso Superior

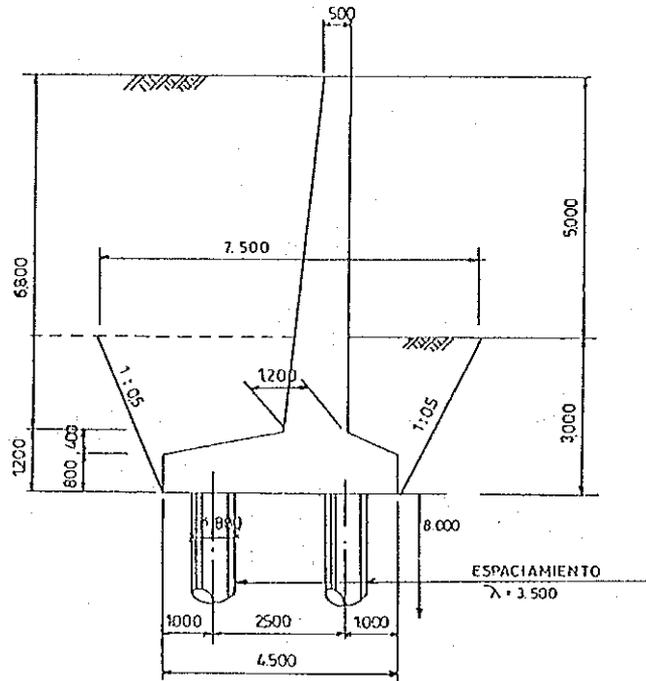


Figura A.9-3 Muro de Retención del Tipo Cantilever

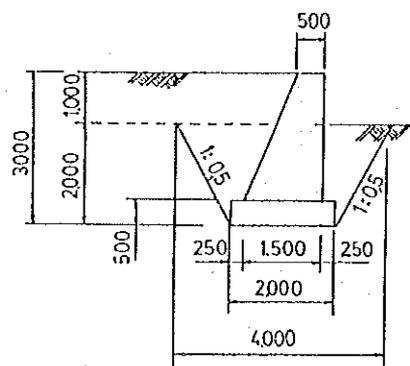


Figura A.9-4 Muro de Retención del Tipo Gravedad

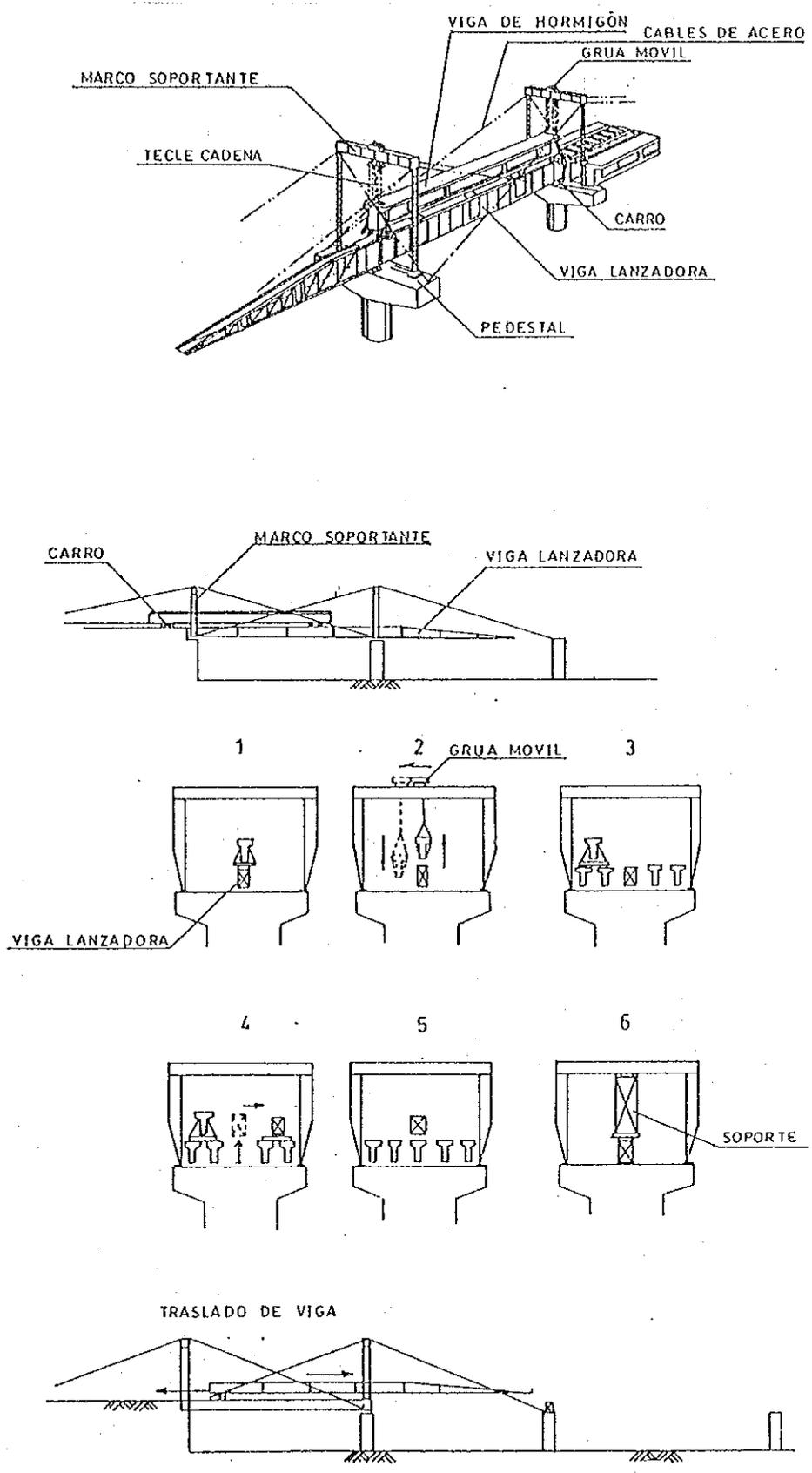


Figura A.9-5 Sistema de Lanzamiento de Vigas

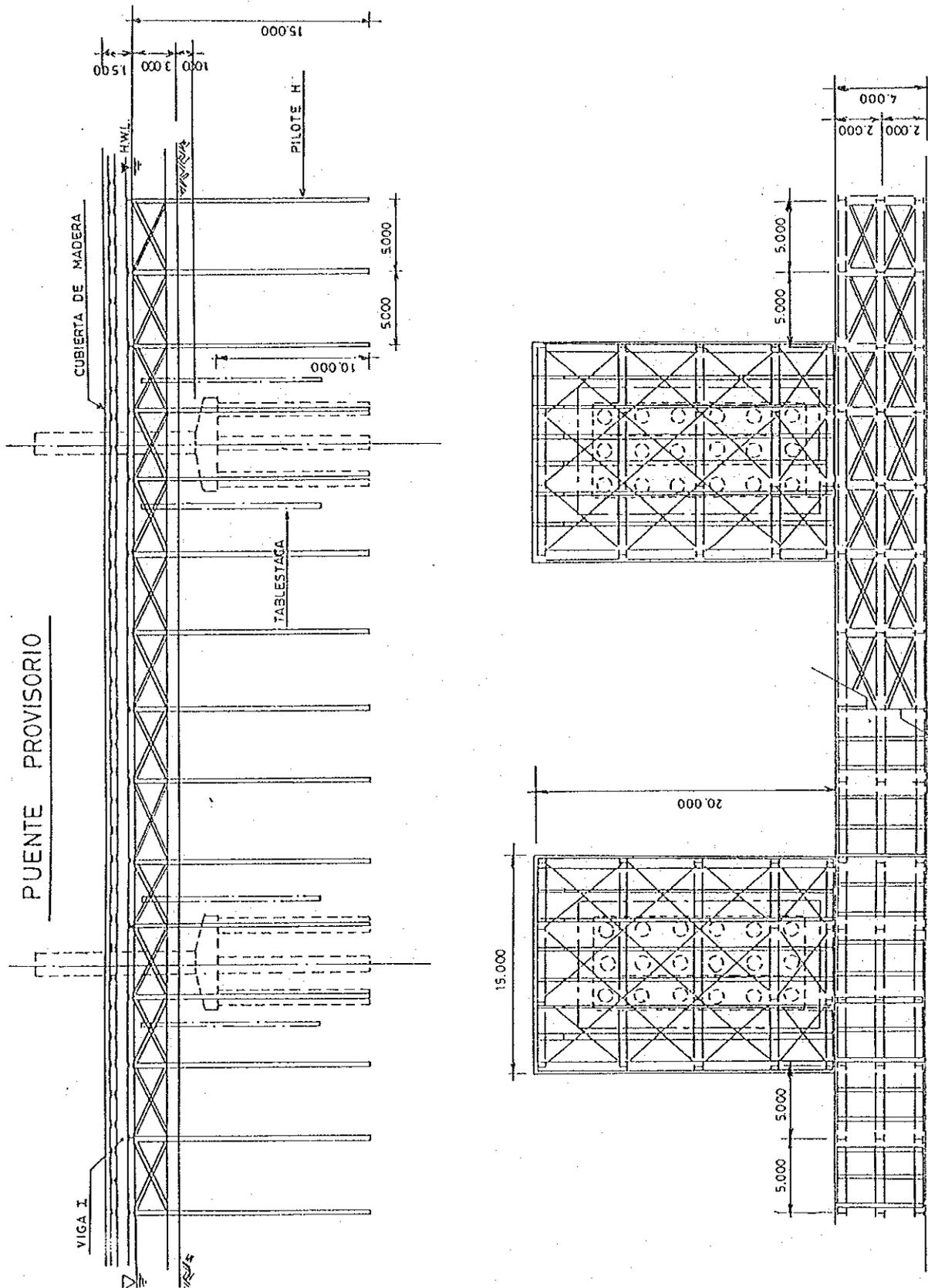


Figura A.9-6 Detalles Generales del Puente Temporal

Appendix- 10

Tabla A.10-1 Costo Directo de Construcción de las Fundaciones de las Alternativas

(1) Open Excavation Method

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	PESOS(\$)	US(\$)	
Structural Excavation	m3	2560	2091	1.5	5352960	3840	601
Waterproofing material	m2	440	0	3.9	0	1716	35/9
Water pump	L.S	1	491400	3290	491400	3290	610
Backfilling	m3	2300	0	1.29	0	2967	605-1
Surplus Soil	m3	260	2455	1.82	638300	473.2	606
					0	0	
Formwork for Footing	m2	90	5455	1.36	490950	122.4	803
Formwork for Stem	m2	260	7091	2.73	1843660	709.8	804
Re-bar for Footing	t	17	435455	54.6	7402735	928.2	805
Re-bar for Stem	t	20	513636	62.7	10272720	1254	806
Concrete for Footing	m3	240	33415	12.6	8019600	3024	810+811
Concrete for Stem	m3	440	33415	23.4	14702600	10296	810+812
Scaffolding	m2	580	4346	3.68	2520680	2134.4	807
Staging	m3	100	3633	4.95	363300	495	808
TOTAL					52098905	31250	

Tabla A.10-1 Costo Directo de Construcción de las Fundaciones de las Alternativas

(2) Sheet Piling Method

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	PESOS(\$)	US(\$)	
Sheet pile 1=12m	m2	576	2667	59.7	1536192	34387.2	607.1
Structural Excavation	m3	950	5545	4	5267750	3800	603
Backfilling	m3	590	0	1.29	0	761.1	605.1
Surplus Soil	m3	280	2455	1.82	687400	509.6	606
Water pump	L.S	1	491400	3290	491400	3290	610
Seal Concrete	m3	86	42500	17.4	3655000	1496.4	608
Formwork for Footing	m2	90	5455	1.36	490950	122.4	803
Formwork for Stem	m2	260	7091	2.73	1843660	709.8	710
Re-bar for Footing	t	17	435455	54.6	7402735	928.2	805
Re-bar for Stem	t	20	513636	62.7	10272720	1254	806
Concrete for Footing	m3	240	33415	12.6	8019600	3024	810+811
Concrete for Stem	m3	440	33415	23.4	14702600	10296	810+812
Scaffolding	m2	460	4346	3.68	1999160	1692.8	807
Staging	m3	100	3633	4.95	363300	495	808
TOTAL					56732467	62766.5	

Tabla A.10-1 Costo Directo de Construcción de las Fundaciones de las Alternativas

(3) COST OPEN CAISSON

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	PESOS(\$)	US(\$)	
1. Open caisson							
Excavation with Sinking	m3	600	1570	12.93	942000	7758	709-2
Caisson edge	each	1	5804	1364	5804	1364	709-1
Scaffolding	m2	145	4346	3.68	630170	533.6	807
Re-bar	t	23	435455	54.55	10015465	1254.65	805
Formwork	m2	380	7091	2.73	2694580	1037.4	803
Concrete 240 kg/cm2	m2	500	33415	12.6	16707500	6300	810+811
Sub total					30995519	18247.6	
2. Stem							
Formwork of Stem	m2	250	7091	2.73	1772750	682.5	804
Re-bar of Stem	t	18	513636	62.7	9245448	1128.6	806
Concrete of Stem	m3	425	33415	23.4	14201375	9945	810+812
Scaffolding	m2	460	4346	3.68	1999160	1692.8	807
Staging	m3	100	3633	4.95	363300	495	808
Sub total					27582033	13943.9	
TOTAL					58577552	32191.5	

Tabla A.10-2 Sumario de los Costos Directos de Construcción de los Proyectos Comparativos

			L. C.	F. C.	TOTAL	
			CH. \$MILL	US \$1000	CH. \$MILL	US \$1000
TYPE-1 PC-I-GIRDER	25 m span	SUPERSTRUCTURE	4112	4013	5842	13554
		SUBSTRUCTURE	3346	2128	4263	9891
		TOTAL	7458	6141	10105	23445
	35 m span	SUPERSTRUCTURE	4520	4392	6413	14879
		SUBSTRUCTURE	2920	1843	3714	8618
		TOTAL	7440	6235	10127	23497
	45 m span	SUPERSTRUCTURE	4979	4827	7059	16379
		SUBSTRUCTURE	2668	1666	3386	7856
		TOTAL	7647	6493	10445	24235
TYPE-2 STEEL-I-GIRDER	25 m span	SUPERSTRUCTURE	2351	11839	7454	17294
		SUBSTRUCTURE	3346	2128	4263	9891
		TOTAL	5697	13967	11717	27185
	35 m span	SUPERSTRUCTURE	2355	15771	9152	21235
		SUBSTRUCTURE	2774	1766	3535	8202
		TOTAL	5129	17537	12687	29437
	45 m span	SUPERSTRUCTURE	2394	20686	11310	26241
		SUBSTRUCTURE	2440	1545	3106	7206
		TOTAL	4834	22231	14416	33447
TYPE-3 PC-HOLLOW-SLAB	25 m span	SUPERSTRUCTURE	3510	4808	5582	12952
		SUBSTRUCTURE	3528	2231	4490	10417
		TOTAL	7038	7039	10072	23368
	30 m span	SUPERSTRUCTURE	3716	5326	6012	13948
		SUBSTRUCTURE	3316	2082	4213	9776
		TOTAL	7032	7408	10225	23724
	35 m span	SUPERSTRUCTURE	3946	5960	6515	15115
		SUBSTRUCTURE	3065	1920	3893	9031
		TOTAL	7011	7880	10407	24147
TYPE-4 PC-BOX-GIRDER	35 m span	SUPERSTRUCTURE	7319	6101	9949	23082
		SUBSTRUCTURE	3502	2611	4627	10736
		TOTAL	10821	8712	14576	33819
	50 m span	SUPERSTRUCTURE	7121	7674	10428	24196
		SUBSTRUCTURE	2958	1812	3739	8675
		TOTAL	10079	9486	14167	32871
	65 m span	SUPERSTRUCTURE	8034	8544	11716	27184
		SUBSTRUCTURE	2764	1690	3492	8103
		TOTAL	10798	10234	15209	35287

1.0 US\$= 431 CH. PESOS

Tabla A.10-3 Costo Directo de Construcción del Puente
Tipo 1, de Viga de Hormigón Postensado I

(1) 25m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manu facture of PC Girder	each	666	2169559	1918	1445	1277	900-1
Deck slab	m2	45384	33203	13	1507	595	1200-1
Cross Beam	each	296	1281026	823	379	244	1100-1
Support Type Staging	span	74	4078998	20529	302	1519	1008-1
Expansion Joint	m	1830	2909	63	5	115	1302
Bearing	each	1332	254545	105	339	140	1304
Railing and Guardrail	m	7440	11091	14	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					4112	4013	
2. Substructure							
Rechannel of River	m	4000	47999	46	192	183	105-1
Temporary Road	m	1860	3264	3	6	6	106
Pier	each	75	41951586	25681	3146	1926	1700-1
River bank	m2	1000	1745	13	2	13	210
Sub total					3346	2128	
TOTAL					7458	6141	

Tabla A.10-3 Costo Directo de Construcción del Puente
Tipo 1, de Viga de Hormigón Postensado I

(2) 35m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Girder	each	486	4042170	3478	1964	1690	900-2
Deck Slab	m2	45384	33203	13.1	1507	595	1200-1
Cross Beam	each	216	1563675	926	338	200	1100-2
Support type Staging	span	54	6018878	29569	325	1597	1008-2
Expansion Joint	m	1340	2909	62.7	4	84	1302
Bearing	each	972	254545	105	247	102	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					4520	4392	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	55	49455939	29845	2720	1641	1700-2
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2920	1843	
TOTAL					7440	6235	

Tabla A.10-3 Costo Directo de Construcción del Puente
 Tipo 1, de Viga de Hormigón Postensado I

(3) 45m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Girder	each	378	6618628	5768	2502	2180	900-3
Deck Slab	m2	45384	33203	13.1	1507	595	1200-1
Cross Beam	each	168	1966376	1073	330	180	1100-3
Support Type Staging	span	42	7360228	38163	309	1603	1008-3
Expansion Joint	m	1049	2909	62.7	3	66	1302
Bearing	each	756	254545	105	192	79	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L. S	1	11400000	1400	11	1	508
Sub total					4979	4827	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	43	57390292	34064	2468	1465	1700-3
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2668	1666	
TOTAL					7646	6493	

Tabla A.10-4 Costo Directo de Construcción del Puentes
Tipo 2, de Vigas de Placas de Acero

(1) 25m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of Girder	t	5180	0	1740	0	9013	
Transportation	t	5180	143	53.8	1	279	1507
Girder Launching	t	5180	21892	208	113	1077	1501
Paints	m2	98420	308	6	30	591	1508
Deck Slab	m2	45384	41832	14.5	1899	658	1200-2
Expansion Joint	m	415	2909	62.7	1	26	1303
Bearing	each	675	254545	105	172	71	1304
Railing and guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					2351	11839	
2. Substructure							
Rechannel of river	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	75	41951586	25681	3146	1926	1700-1
River bank	m2	1000	1745	12.8	2	13	210
Sub total					3346	2128	
TOTAL					5697	13966	

Tabla A.10-4 Costo Directo de Construcción del Puentes
Tipo 2, de Vigas de Placas de Acero

(2) 35m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of Girder	t	7050	0	1740	0	12267	
Transportation	t	7050	143	53.8	1	379	1507
Girder Launching	t	7050	21892	208	154	1466	1501
Paints	m2	133950	308	6	41	804	1508
Deck Slab	m2	45384	41832	14.5	1899	658	1200-2
Expansion Joint	m	342	2909	62.7	1	21	1303
Bearing	each	486	254545	105	124	51	1304
Railing and guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					2355	15771	
2. Substructure							
Rechannel of river	m	4000	47999	45.68	192	183	105
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	55	46807518	28446	2574	1565	1700-4
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2774	1766	
TOTAL					5129	17537	

Tabla A.10-4 Costo Directo de Construcción del Puente
Tipo 2, de Vigas de Placas de Acero

(3) 45m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of Girder	t	9380	0	1740	0	16321	
Transportation	t	9380	143	53.8	1	505	1507
Girder Launching	t	9380	21892	208	205	1951	1501
Paints	m2	178220	308	6	55	1069	1508
Deck Slab	m2	45384	41832	14.5	1899	658	1200-2
Expansion Joint	m	269	2909	62.7	1	17	1303
Bearing	each	387	254545	105	99	41	1304
Railing and guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L. S	1	11400000	1400	11	1	508
Sub total					2394	20686	
2. Substructure							
Rechannel of river	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	43	52098905	31249	2240	1344	1700-5
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2440	1545	
TOTAL					4834	22231	

Tabla A.10-5 Costo Directo de Construcción del Puente
 Tipo 3, de Losa Alivianada de Hormigón
 Postensado

(1) 25m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Slab	Span	74	43376390	34236	3210	2533	1618-1
Movable Staging	Span	74	1076008	28384	80	2100	1619-1
Expansion Joint	m	244	2909	62.7	1	15	1303
Bearing	each	332	254545	105	85	35	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L. S	1	11400000	1400	11	1	508
Sub total					3510	4808	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	75	44379553	27059	3328	2029	1700-9
River bank	m2	1000	1745	12.8	2	13	210
Sub total					3528	2231	
TOTAL					7038	7039	

Tabla A.10-5 Costo Directo de Construcción del Puente
 Tipo 3, de Losa Alivianada de Hormigón
 Postensado

(2) 30m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Slab	Span	62	55437290	43262	3437	2682	1618-2
Movable Staging	Span	62	1161166	39945	72	2477	1619-2
Expansion Joint	m	220	2909	62.7	1	14	1303
Bearing	each	280	254545	105	71	29	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L. S	1	11400000	1400	11	1	508
Sub total					3716	5326	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	63	49455939	29845	3116	1880	1700-2
River bank	m2	1000	1745	12.8	2	13	210
Sub total					3316	2082	
TOTAL					7032	7408	

Tabla A.10-5 Costo Directo de Construcción del Puente
 Tipo 3, de Losa Alivianada de Hormigón a
 Postensado

(3) 35m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Slab	Span	54	68155865	55309	3680	2987	1618-3
Movable Staging	Span	54	1242404	52058	67	2811	1619-3
Expansion Joint	m	195	2909	62.7	1	12	1303
Bearing	each	248	254545	105	63	26	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					3946	5960	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	55	52098905	31249	2865	1719	1700-5
River bank	m2	1000	1745	12.8	2	13	210
Sub total					3065	1920	
TOTAL					7011	7880	

Tabla A.10-6 Costo Directo de Construcción del Puente
Tipo 4, de Cajón de Hormigón Postensado

(1) 35m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC Box	Span	54	125256299	80161	6764	4329	1400-1
Movable Staging	Span	54	6018878	29569	325	1597	1405-1
Expansion Joint	m	195	2909	62.7	1	12	1303
Bearing	each	248	381818	158	95	39	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					7319	6101	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	55	60035986	43811	3302	2410	1700-6
River bank	m2	1000	1745	12.8	2	13	210
Sub total					3502	2611	
TOTAL					10821	8712	

Tabla A.10-6 Costo Directo de Construcción del Puente
Tipo 4, de Cajón de Hormigón Postensado

(2) 50m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC	Span	37	178727145	160410	6613	5935	1400-2
Movable Staging	Span	37	8330168	42695	308	1580	1405-2
Expansion Joint	m	146	2909	62.7	0	9	1303
Bearing	each	168	381818	158	64	27	1304
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L.S	1	11400000	1400	11	1	508
Sub total					7121	7674	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	38	72583498	42391	2758	1611	1700-7
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2958	1812	
TOTAL					10079	9487	

Tabla A.10-6 Costo Directo de Construcción del Puente
Tipo 4, de Cajón de Hormigón Postensado

(3) 65m Span

DESCRIPTION	UNIT	QUANTITY	UNIT COST		AMOUNT		REMARKS
			PESOS(\$)	US(\$)	\$Mill	US\$1000	
1. Superstructure							
Manufacture of PC	Span	30	250914214	223894	7527	6717	1400
Movable Staging	Span	30	10641458	55820	319	1675	1405-3
Expansion Joint	m	122	2909	62.7	0	8	1303
Bearing	each	136	381818	158	52	21	1304x1.5
Railing and Guardrail	m	7440	11091	13.8	83	103	1306
Illumination	each	124	331000	160	41	20	506
Road Sign	L. S	1	11400000	1400	11	1	508
Sub total					8034	8544	
2. Substructure							
Rechannel of River	m	4000	47999	45.68	192	183	105-1
Temporary Road	m	1860	3264	3.25	6	6	106
Pier	each	31	82706319	48015	2564	1488	1700-8
River bank	m2	1000	1745	12.8	2	13	210
Sub total					2764	1690	
TOTAL					10798	10234	

Figura A.10-1 Programación de Construcción para Los Proyectos Comparativos

Type of Bridge	Span (m)	Works	1st Year		2nd Year		3rd Year		4th Year		Remarks
			6	12 1	6	12 1	6	12 1	6	12 1	
Steel I Girder (Continuous Span)	25	Superstructure									4 Teams
		Substructure									2 Teams
	35	Superstructure									6 Teams
		Substructure									2 Teams
	45	Superstructure									6 Teams
		Substructure									2 Teams
Post-Tension I Girder (Simple Span)	25	Superstructure									2 Teams
		Substructure									2 Teams
	35	Superstructure									2 Teams
		Substructure									2 Teams
	45	Superstructure									2 Factories & 2 Teams
		Substructure									2 Teams
Post-Tension I Hollow Slab (Continuous Span)	25	Superstructure									2 Teams
		Substructure									2 Teams
	30	Superstructure									2 Teams
		Substructure									2 Teams
	35	Superstructure									2 Teams
		Substructure									2 Teams
Post-Tension Box Girder (Continuous Span)	35	Superstructure									6 Teams
		Substructure									2 Teams
	50	Superstructure									6 Teams
		Substructure									2 Teams
	65	Superstructure									6 Teams
		Substructure									1 Team

Appendix- 11

BP 0+ 0.000 0.000 914.606 5922758.8 673358.4

	Station	Cumulative	Intermed.	Northing	Easting
BC. 1	9+ 14.606	914.606	172.789	5922352.117	672539.186
EC. 1	10+ 87.395	1087.395	2123.853	5922276.626	672383.762

R= 10000.000 IA= 0.5924 IP= 5922313.7 672461.8
 Right Curve Circle Center= 5931309.139 668092.642

	Station	Cumulative	Intermed.	Northing	Easting
KA. 2	32+ 11.248	3211.248	100.000	5921365.255	670465.389
BC. 2	33+ 11.248	3311.248	109.001	5921326.17	670373.419
EC. 2	34+ 20.250	3420.250	100.000	5921306.475	670266.554
KE. 2	35+ 20.250	3520.250	167.214	5921310.205	670166.693

A= 200.000 τ = 7.0943 IP= 5921336.624 670405.123
 R= 400.000 IA= 15.3648 IP= 5921308.997 670321.336
 A= 200.000 τ = 7.0943 IP= 5921304.94 670233.206
 Right Curve Circle Center= 5921706.052 670248.158
 (By Straight IA= 29.5614 IP= 5921297.8 670323.400)

EP 36+ 87.464 3687.464 5921323.4 670000

Tabla A.11-1 Alineamiento Horizontal(1)

Name	Station	Cumulat.	Inter	Northing	Easting	Direction	Dist.	
BP	0+	0.00	0.00	100.00	5922758.800	673358.400	243.3556	100.00
No 1	1+	0.00	100.00	100.00	5922714.335	673268.830	243.3556	100.00
No 2	2+	0.00	200.00	100.00	5922669.869	673179.260	243.3556	100.00
No 3	3+	0.00	300.00	100.00	5922625.404	673089.689	243.3556	100.00
No 4	4+	0.00	400.00	100.00	5922580.938	673000.119	243.3556	100.00
No 5	5+	0.00	500.00	100.00	5922536.473	672910.549	243.3556	100.00
No 6	6+	0.00	600.00	100.00	5922492.007	672820.979	243.3556	100.00
No 7	7+	0.00	700.00	100.00	5922447.542	672731.408	243.3556	100.00
No 8	8+	0.00	800.00	100.00	5922403.077	672641.838	243.3556	100.00
No 9	9+	0.00	900.00	14.61	5922358.611	672552.268	243.3556	14.61
BC 1	9+	14.61	914.61	85.39	5922352.117	672539.186	243.5036	85.39
No 10	10+	0.00	1000.00	87.39	5922314.473	672462.537	244.2018	87.39
EC 1	10+	87.40	1087.39	12.61	5922276.626	672383.762	244.3520	12.61
No 11	11+	0.00	1100.00	100.00	5922271.217	672372.376	244.3520	100.00
No 12	12+	0.00	1200.00	100.00	5922228.306	672282.051	244.3520	100.00
No 13	13+	0.00	1300.00	100.00	5922185.395	672191.726	244.3520	100.00
No 14	14+	0.00	1400.00	100.00	5922142.483	672101.401	244.3520	100.00
No 15	15+	0.00	1500.00	100.00	5922099.572	672011.076	244.3520	100.00
No 16	16+	0.00	1600.00	100.00	5922056.661	671920.751	244.3520	100.00
No 17	17+	0.00	1700.00	100.00	5922013.750	671830.426	244.3520	100.00
No 18	18+	0.00	1800.00	100.00	5921970.839	671740.100	244.3520	100.00
No 19	19+	0.00	1900.00	100.00	5921927.927	671649.775	244.3520	100.00
No 20	20+	0.00	2000.00	100.00	5921885.016	671559.450	244.3520	100.00
No 21	21+	0.00	2100.00	100.00	5921842.105	671469.125	244.3520	100.00
No 22	22+	0.00	2200.00	100.00	5921799.194	671378.800	244.3520	100.00
No 23	23+	0.00	2300.00	100.00	5921756.283	671288.475	244.3520	100.00
No 24	24+	0.00	2400.00	100.00	5921713.372	671198.150	244.3520	100.00
No 25	25+	0.00	2500.00	100.00	5921670.460	671107.824	244.3520	100.00
No 26	26+	0.00	2600.00	100.00	5921627.549	671017.499	244.3520	100.00
No 27	27+	0.00	2700.00	100.00	5921584.638	670927.174	244.3520	100.00
No 28	28+	0.00	2800.00	100.00	5921541.727	670836.849	244.3520	100.00
No 29	29+	0.00	2900.00	100.00	5921498.816	670746.524	244.3520	100.00
No 30	30+	0.00	3000.00	100.00	5921455.904	670656.199	244.3520	100.00
No 31	31+	0.00	3100.00	100.00	5921412.993	670565.874	244.3520	100.00
No 32	32+	0.00	3200.00	11.25	5921370.082	670475.549	244.3520	11.25
KA 2	32+	11.25	3211.25	88.75	5921365.255	670465.389	246.2809	88.71
No 33	33+	0.00	3300.00	11.25	5921329.837	670384.052	250.5831	11.25
BC 2	33+	11.25	3311.25	88.75	5921326.170	670373.419	258.0626	88.57
No 34	34+	0.00	3400.00	20.25	5921307.918	670286.750	265.5450	20.25
EC 2	34+	20.25	3420.25	79.75	5921306.475	670266.554	271.3327	79.70
No 35	35+	0.00	3500.00	20.25	5921308.641	670186.882	274.2541	20.25
KE 2	35+	20.25	3520.25	79.75	5921310.205	670166.693	274.3134	79.75
No 36	36+	0.00	3600.00	87.46	5921316.498	670087.191	274.3134	87.46
EP	36+	87.46	3687.46		5921323.400	670000.000		

Tabla A.11-1 Alineamiento Horizontal(2)

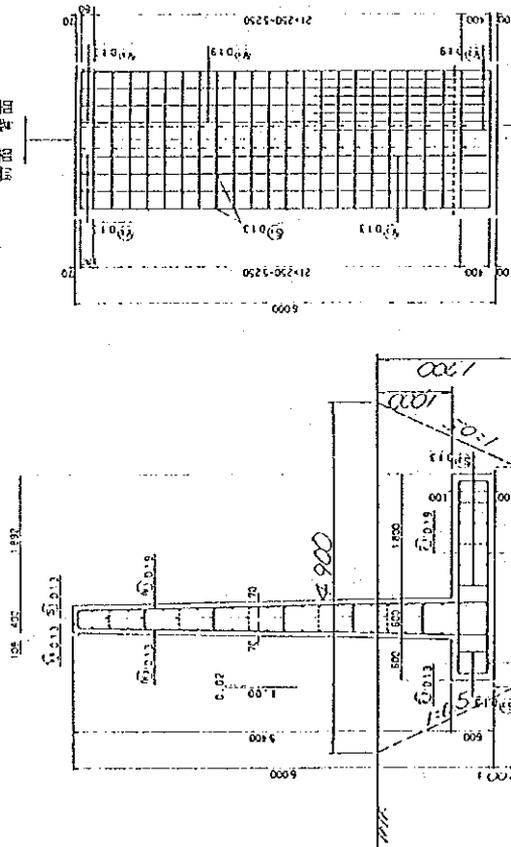
VERTICAL ALIGNMENT									
NO.	STATION	DIS.	FL	GRADE	VCL	ΔI	$\Delta I/2xVCL$	Xmax	Ymax
1	0.000	0	12.375		0				
2	0.250	250	11.500	-0.00350	100	-0.06600	-0.000330	50	-0.825
3	0.370	370	19.000	0.06250	100	0.04250	0.000213	50	0.531
4	0.470	470	21.000	0.02000	100	0.08053	0.000403	50	1.007
5	0.660	660	9.500	-0.06053	100	-0.06403	-0.000320	50	-0.800
6	0.830	830	10.095	0.00350	100	0.00700	0.000035	50	0.088
7	1.000	1000	9.500	-0.00350	100	-0.04140	-0.000207	50	-0.518
8	1.100	1100	13.290	0.03790	100	0.03440	0.000172	50	0.430
9	2.120	2120	16.860	0.00350	200	0.00700	0.000018	100	0.175
10	3.080	3080	13.500	-0.00350	100	-0.06550	-0.000328	50	-0.819
11	3.210	3210	21.560	0.06200	100	0.06550	0.000328	50	0.819
12	3.370	3370	21.000	-0.00350	100	0.06150	0.000308	50	0.769
13	3.500	3500	12.550	-0.06500	100	-0.06850	-0.000343	50	-0.856
14	3.700	3700	13.250	0.00350	100	0.00350	0.000018	50	0.044

VERTICAL ALIGNMENT DETAIL								
STATION	DIS.	Ho	Y1	Y2	FL	GL		
0.000	0	12.375	0.000	0.000	12.375	12.18	-0.20	0
0.100	100	12.025	0.000	0.000	12.025	11.85	-0.18	250
0.120	120	11.955	0.000	0.000	11.955	11.78	-0.18	250
0.200	200	11.675	0.000	0.000	11.675	11.50	-0.18	250
0.250	250	11.500	-0.825	0.000	10.675	11.38	0.71	250
0.300	300	14.625	0.000	0.000	14.625	11.11	-3.52	370
0.385	385	19.300	0.000	0.260	19.560	10.76	-8.80	470
0.450	450	20.600	0.362	0.000	20.962	10.38	-10.58	470
0.500	500	19.184	0.000	0.161	19.345	9.85	-9.50	660
0.600	600	13.132	0.000	0.000	13.132	9.06	-4.07	660
0.700	700	9.640	0.000	-0.032	9.608	9.10	-0.51	830
0.800	800	9.990	0.014	0.000	10.004	7.92	-2.08	830
0.900	900	9.850	0.000	0.000	9.850	8.34	-1.51	1000
1.000	1000	9.500	-0.518	0.000	8.983	7.90	-1.08	1000
1.100	1100	13.290	0.430	0.000	13.720	7.80	-5.92	1000
3.100	3100	14.740	0.000	0.000	14.740	12.00	-2.74	3210
3.300	3300	21.245	0.000	0.000	21.245	12.52	-8.73	3370
3.400	3400	19.050	0.000	0.000	19.050	12.45	-6.60	3500
3.500	3500	12.550	-0.856	0.000	11.694	12.50	0.81	3500
3.600	3600	12.900	0.000	0.000	12.900	12.75	-0.15	3700
3.700	3700	13.250	0.044	0.000	13.294	13.10	-0.19	3700

Tabla A.11-2 Alineamiento Vertical

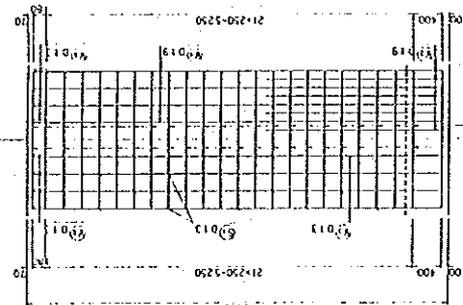
03-RCT-051 (H6000-B3000-C()-N()-S62)
 (高さ) (総高) (壁の厚) (壁の長さ) (制約高さ)
 擁壁一辺T型擁壁

断面図 縮尺 1:90

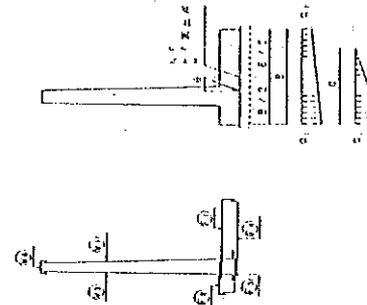


材料 1/2 x (900-320) x 170 = 6.9 m²

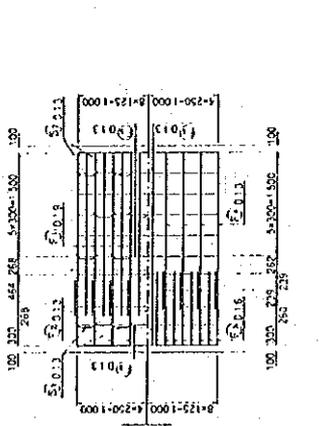
たて壁
前面背面



鉄筋組立図 外力図



底版
下面上面



鉄筋加工・継手寸法表

No.	長さ	幅	高さ	重量
1	1000	1000	100	0.31
2	1000	1000	100	0.31
3	1000	1000	100	0.31
4	1000	1000	100	0.31
5	1000	1000	100	0.31
6	1000	1000	100	0.31
7	1000	1000	100	0.31
8	1000	1000	100	0.31
9	1000	1000	100	0.31
10	1000	1000	100	0.31

鉄筋加工表 (1m当たり)

品名	長さ	幅	高さ	重量
1	1000	1000	100	0.31
2	1000	1000	100	0.31
3	1000	1000	100	0.31
4	1000	1000	100	0.31
5	1000	1000	100	0.31
6	1000	1000	100	0.31
7	1000	1000	100	0.31
8	1000	1000	100	0.31
9	1000	1000	100	0.31
10	1000	1000	100	0.31

外力表 (1m当たり)

品名	長さ	幅	高さ	重量
1	1000	1000	100	0.31
2	1000	1000	100	0.31
3	1000	1000	100	0.31
4	1000	1000	100	0.31
5	1000	1000	100	0.31
6	1000	1000	100	0.31
7	1000	1000	100	0.31
8	1000	1000	100	0.31
9	1000	1000	100	0.31
10	1000	1000	100	0.31

材料表 (1m当たり)

品名	長さ	幅	高さ	重量
1	1000	1000	100	0.31
2	1000	1000	100	0.31
3	1000	1000	100	0.31
4	1000	1000	100	0.31
5	1000	1000	100	0.31
6	1000	1000	100	0.31
7	1000	1000	100	0.31
8	1000	1000	100	0.31
9	1000	1000	100	0.31
10	1000	1000	100	0.31

設計条件

項目	条件
1	土質
2	土圧係数
3	土圧分布
4	土圧計算高さ
5	土圧計算土量
6	土圧計算土重
7	土圧計算土圧
8	土圧計算土圧率
9	土圧計算土圧率率
10	土圧計算土圧率率率

注意事項

1. 設計条件に示す土質は、地質調査結果に基づき、設計に用いた。
2. 土圧係数は、地質調査結果に基づき、設計に用いた。
3. 土圧分布は、地質調査結果に基づき、設計に用いた。
4. 土圧計算高さは、地質調査結果に基づき、設計に用いた。
5. 土圧計算土量は、地質調査結果に基づき、設計に用いた。

Figura A.11-1 Muro de Retención del Tipo Cantilever

Appendix- 12

Tabla A.12-1 Gastos Generales, Costo del Puente Existente (1)

PROJECT	MAULE	LIGUAY	EUAQUI & RARINCO	BUENCERILLAMI	I. YARAWBIO	COLINA
Construction company	Navarrete, Diaz & Cumsille Ltda.	Bründtl y Cia.	Navarrete, Diaz & Cumsille Ltda.	Pawyc Ltda.	Pawyc Ltda.	Pawyc Ltda.
Guideline of bridge	New construction 20.8	New construction 11	New construction 12	New construction 8	Repair 6	New construction 8
Construction period (months)	16;14;36;504.39	10;4;30;120	10;2;30;60	6.1;4;33;132	7;14;23;324	10;2;30;60
Width, N° span, Span length, Total length (m)			10;2;25;50			
Telephones	69-90620	23-57401	69-90620	68-16530	68-16530	68-16530
A. Total construction cost	3.255.095.944	506.867.340	638.672.352	302.000.037	360.991.203	375.560.595
Unit prices (\$/m ²)	433.350	422.400	581.500	375.100	159.200	626.000
B. Direct construction cost	1.647.363.670	303.997.670	411.789.208	247.341.590	211.856.687	267.927.954
C. General expenses	476.088.101	125.338.157	108.955.140	59.398.000	56.650.000	51.830.000
Percentage of General exp. to Direct cost (%)	28.9	41.23	25.5	39	39.4	28.19
1. Cost for indirect works						
(1) General cost for temporary facilities						
1). Transport	5.000.000	1.800.000		1.000.000	1.000.000	400.000
2). Preliminary cost				3.000.000		
3). Temporary facilities						
eg 1. Concrete plants	4.000.000					
eg 2. Equipment and machinery	25.800.000	11.864.000	2.700.000		650.000	
eg 3. Water supplies, Electric						
4). Compensation	123.466.000	28.355.557	33.000.000	25.000.000	25.000.000	20.000.000
5). Safety and sanitary control			500.000		420.000	150.000
6). Engineering fee, Quality control						
7). Maintenance cost						

Tabla A.12-1 Gastos Generales, Costo del Puente Existente (2)

\$ Peso

PROJECT	MAULE	LIGUAY	HUASQUI	HUENCHILLAMI	I. MARAMBIO	COLINA
(2) Site office expenses						
1). Administration cost for labours	33.330.000	4.033.000	6.640.000	3.188.000		1.900.000
2). Taxes and public dues						
3). Insurance and guarantee		6.130.000	4.200.000	4.000.000	4.000.000	3.760.000
4). Staff salary & Allowance	110.360.000	38.325.000	35.400.000	23.440.000	14.400.000	15.600.000
5). Office supplies and expenses						
6). Water, Electric, Gas at office	1.440.000	550.000	960.000		300.000	
7). Communication expenses	2.700.000	2.750.000			480.000	400.000
8). Social expenses	19.010.000	9.900.000	5.640.000	640.000	1.200.000	240.000
9). Compensation						
10). Subcontract price						
11). Miscellaneous expenses		2.500.000			50.000	100.000
12). Vehicle and gasoline	31.100.000		9.240.000	3.350.000	3.150.000	1.680.000
2. Head office expenses	52.000.000	11.000.000	14.000.000		6.000.000	6.400.000
D. Contingency	749.422.854	251.298	25.890.224	22.199.611	49.771.706	31.266.837
Contingency to direct cost	45 %	0.1 %	6.3 %	9 %	23.5 %	11.7 %
Remarks	Finish	Under Const.	Under const. With access 708 m	Under const.	Under const.	Under const. With access 620 m

I. MUNICIPALIDAD DE CONCEPCION



TASACIONES COMERCIALES

Con el objeto de hacer más fácil el análisis de los datos de valores por M2. se ha considerado un rango en el que se incluye todos los valores por destino del terreno.

La utilización y el destino está dado por el Plan Regulador que normaliza la construcción en el casco urbano de la comuna.

CUADRO RESUMEN

<u>SECTOR</u>	<u>VALOR UF/M2 (1)</u>	
<u>SAN PEDRO</u>		
- VILLA SAN PEDRO	3.0	- 4.0
- CANDELARIA	0.2	- 0.3
- HUERTOS FAMILIARES	1.0	- 2.0
- SPRING HILL	1.5	- 2.0
- PUENTE VIEJO - PAPELERA	3.0	- 4.5
<u>CONCEPCION</u>		
- COSTANERA - PTE. VIEJO	0.5	- 0.8
- PTE. VIEJO - CERRO CHEPE	0.3	- 0.5
- CENTRO CI (Plaza - Chacabuco - Prat - Carrera)	13.0	- 18.0
- CENTRO NORTE (Carreras - Paicavi - C.Henríquez)	5.0	- 10.0
- CHILLANCITO	1.5	- 1.5
- BARRIO NORTE	1.0	- 1.5
- PUCHACAY	3.0	- 6.0
- PEDRO DE VALDIVIA	6.0	- 10.0
- VALLE NONGUEN Y PALOMARES	0.4	- 0.6

(1) Recopilación en la comuna de acuerdo a valores entregados por Corredores de Propiedades.

Tabla A.12-2 Precios Unitarios para la Adquisición de Terrenos

TYPE A	TYPE B	TYPE C	AREA 2	AREA 4
30 x 30 = 900 m ²	7 x 180 = 1260 m ²	3883	5220	1100 m ²
		442	442	
		5220	3883	
		9545 x 07 = 6680 m ²	1071	
			10616 m ²	

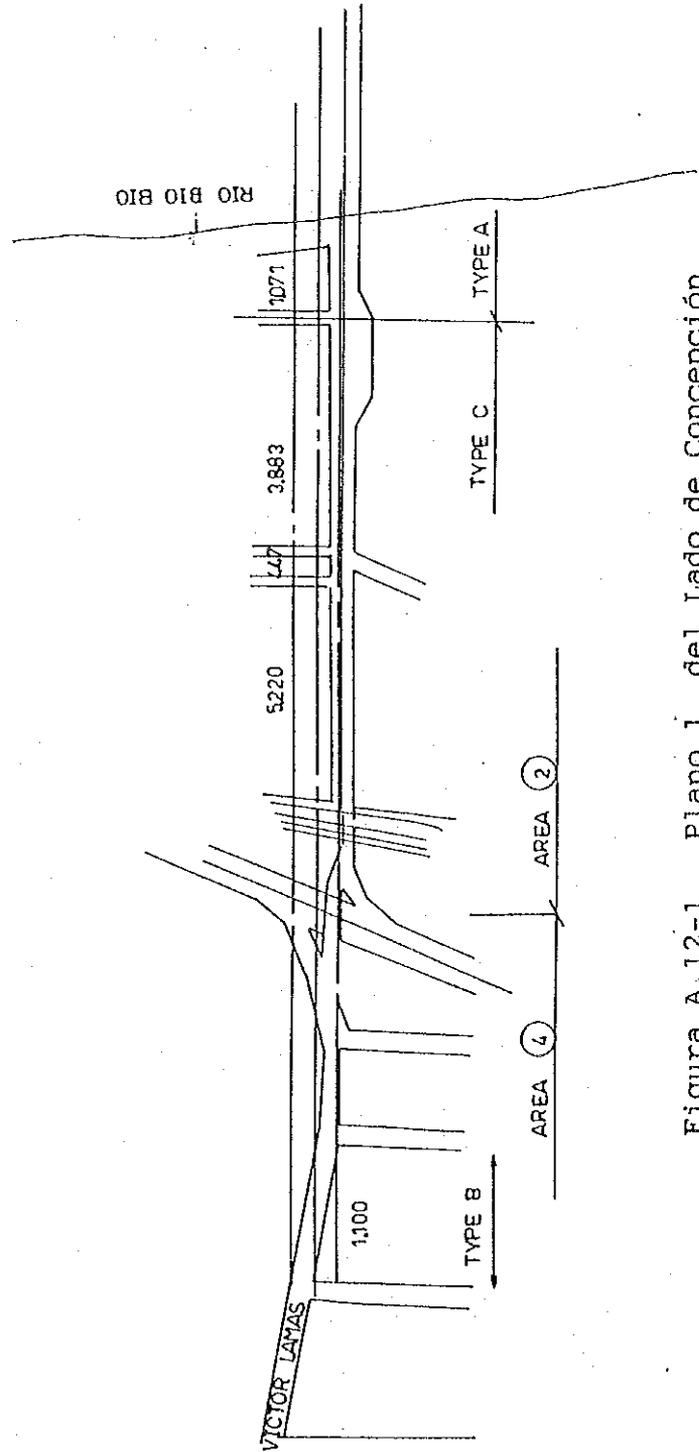


Figura A.12-1 Plano I, del Lado de Concepción

TYPE A	TYPE B	TYPE C	AREA 3	AREA 4
1700	14 x 180	420	440	550
1120	= 2520m ²	470	1700	550
310		1305	420	550
330		530	470	440
<u>3460</u>		378	1305	330
<u>x 2</u>		500	806	255
6920 m ²		693	310	<u>2676m²</u>
		186	1120	
		<u>4482m²</u>	530	
			378	
			500	
			693	
			<u>186</u>	
			<u>8858m²</u>	

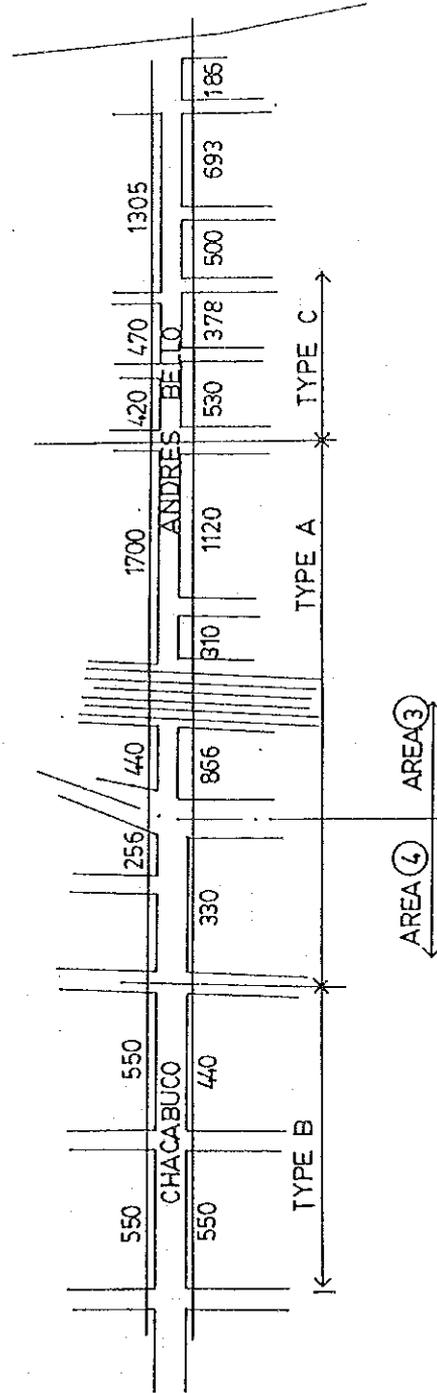


Figura A.12-2 Plano 2, del Lado de Concepción

TYPE A	AREA 2	TYPE C
700	8050	770
333	450	828
<u>1033</u>	175	450
x 2	631	175
= 2066 m ²	324	<u>2223 m²</u>
	729	
	333	
	<u>700</u>	
	11392 m ²	

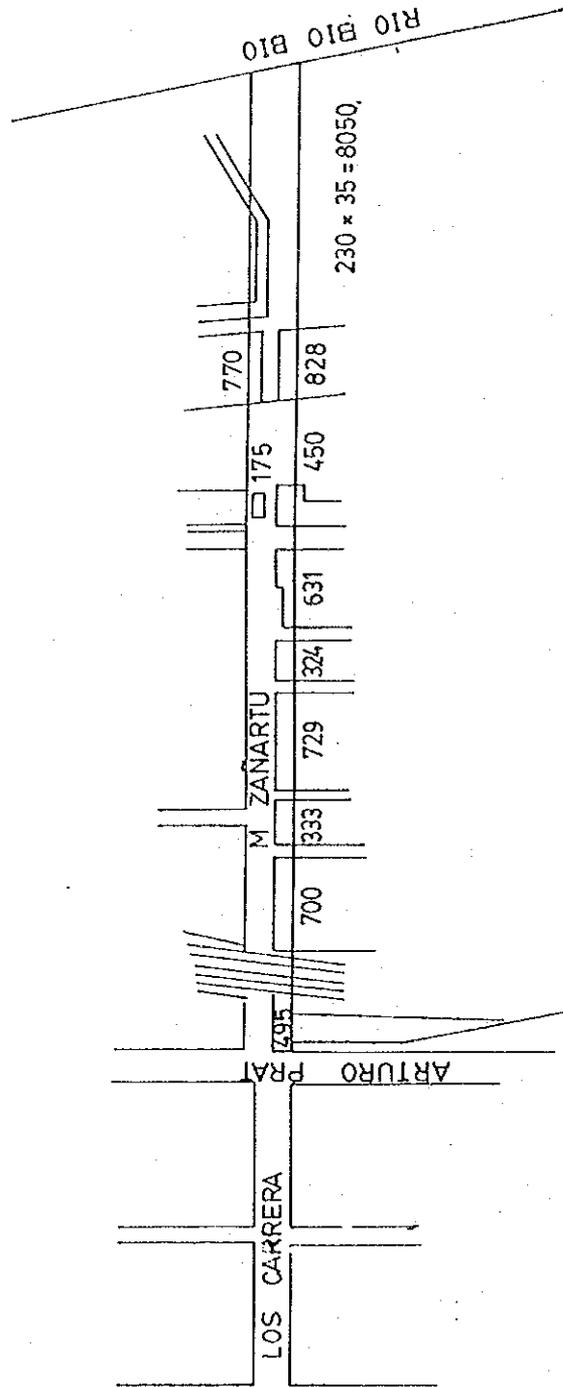


Figura A.12-3 Plano 3 y Plano 4, del lado de Concepción

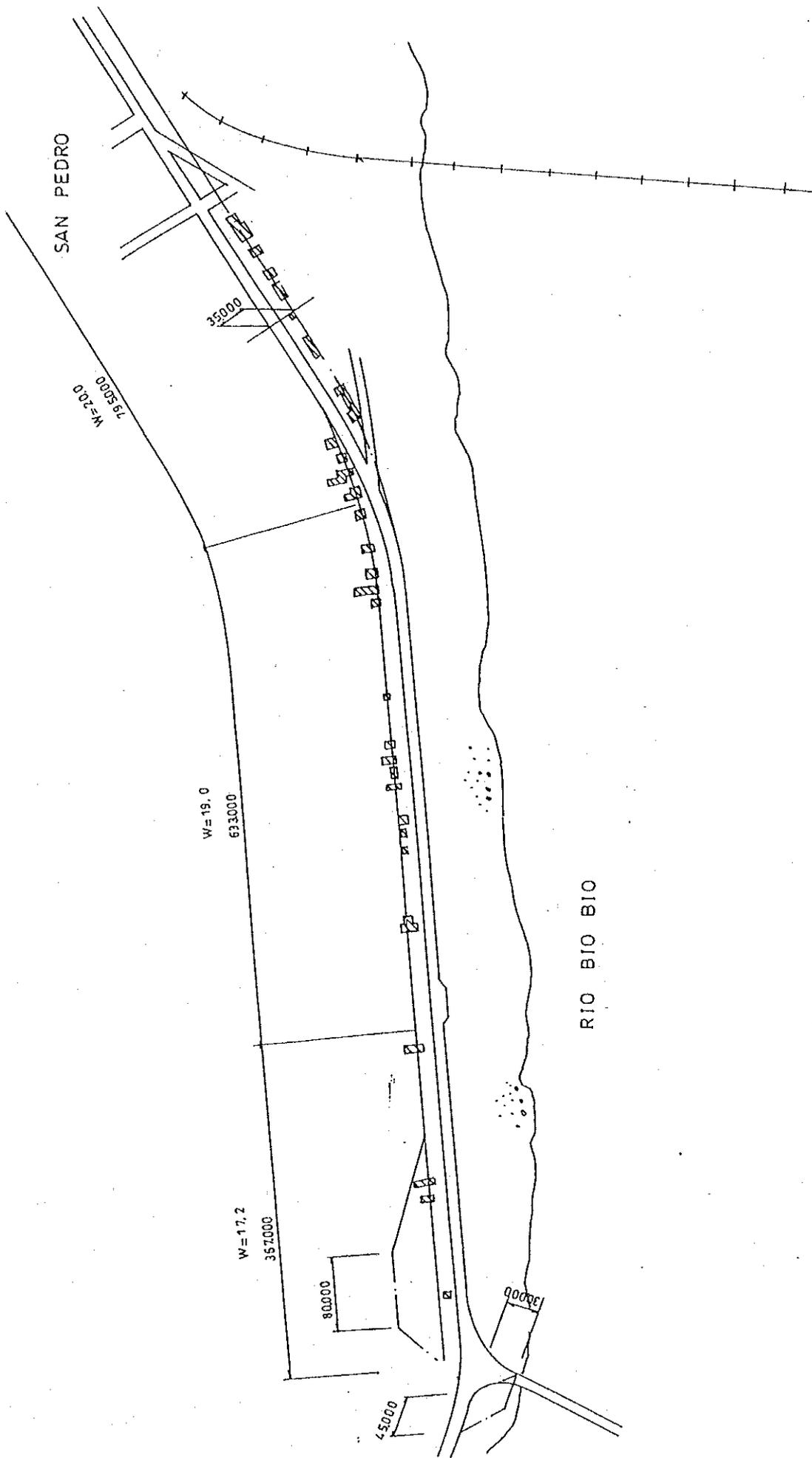


Figura A.12-4 Plano 1, del Lado de San Pedro

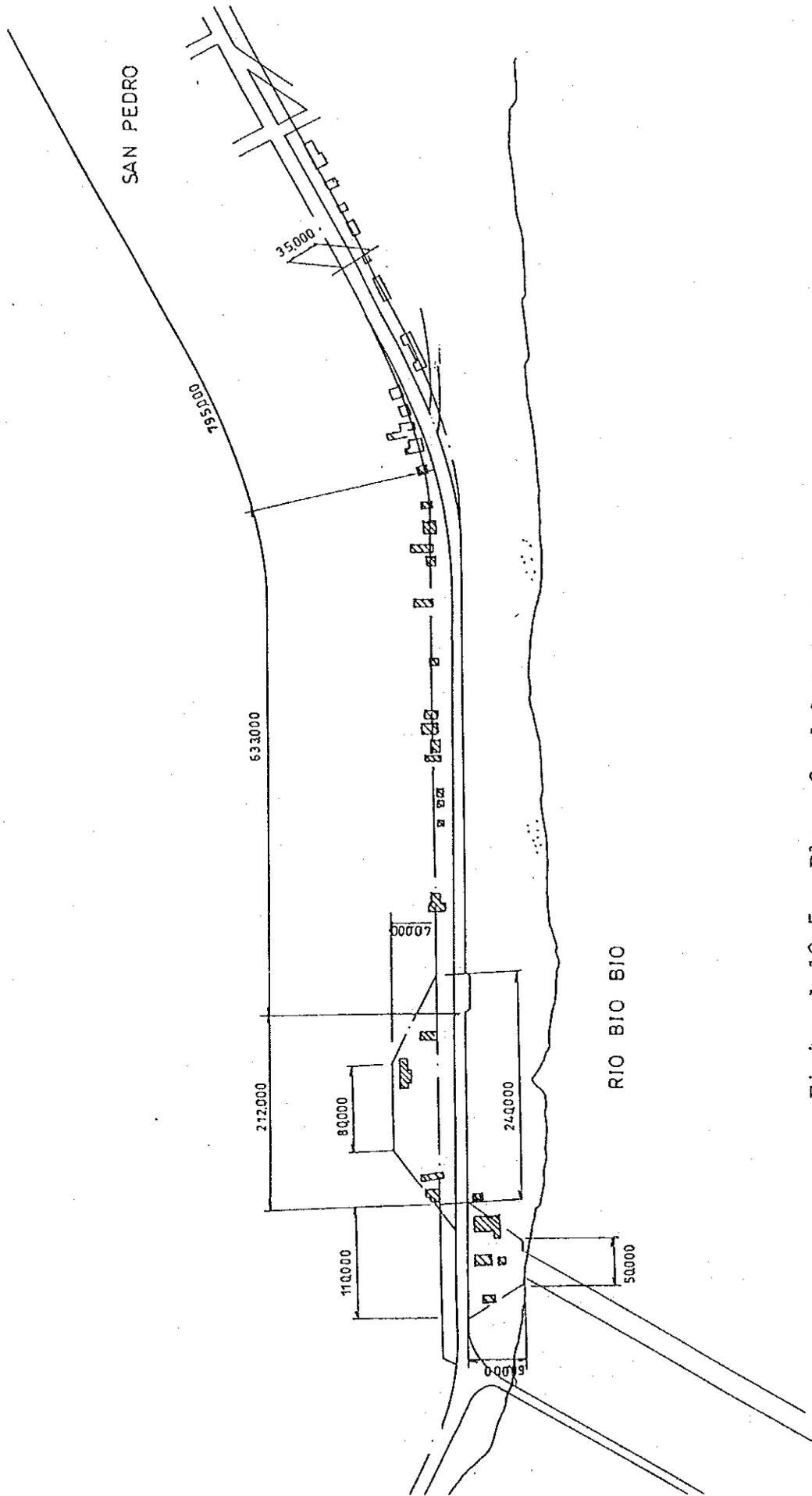


Figura A.12-5 Plano 2, del Lado de San Pedro

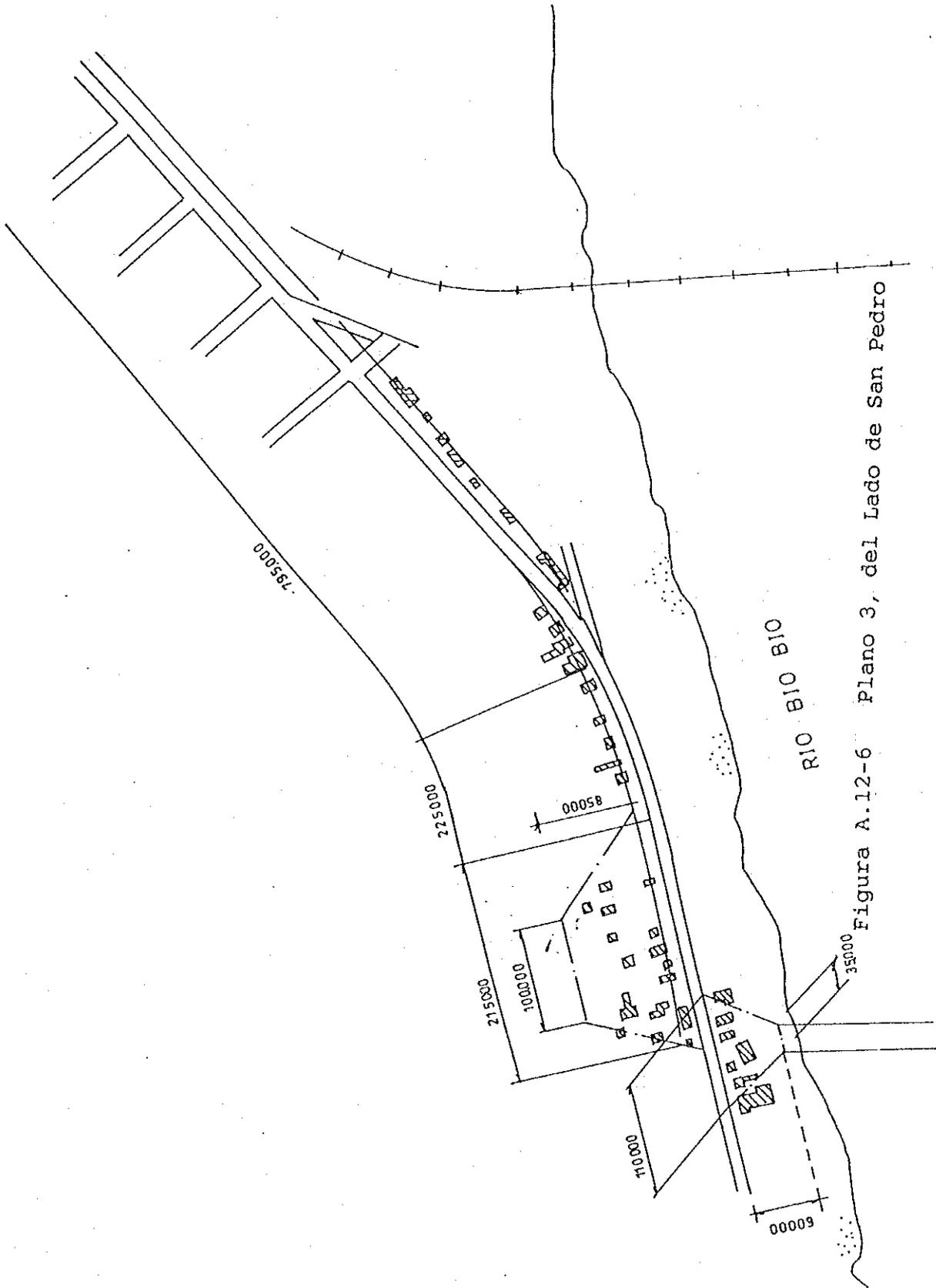


Figura A.12-6 Plano 3, del Lado de San Pedro

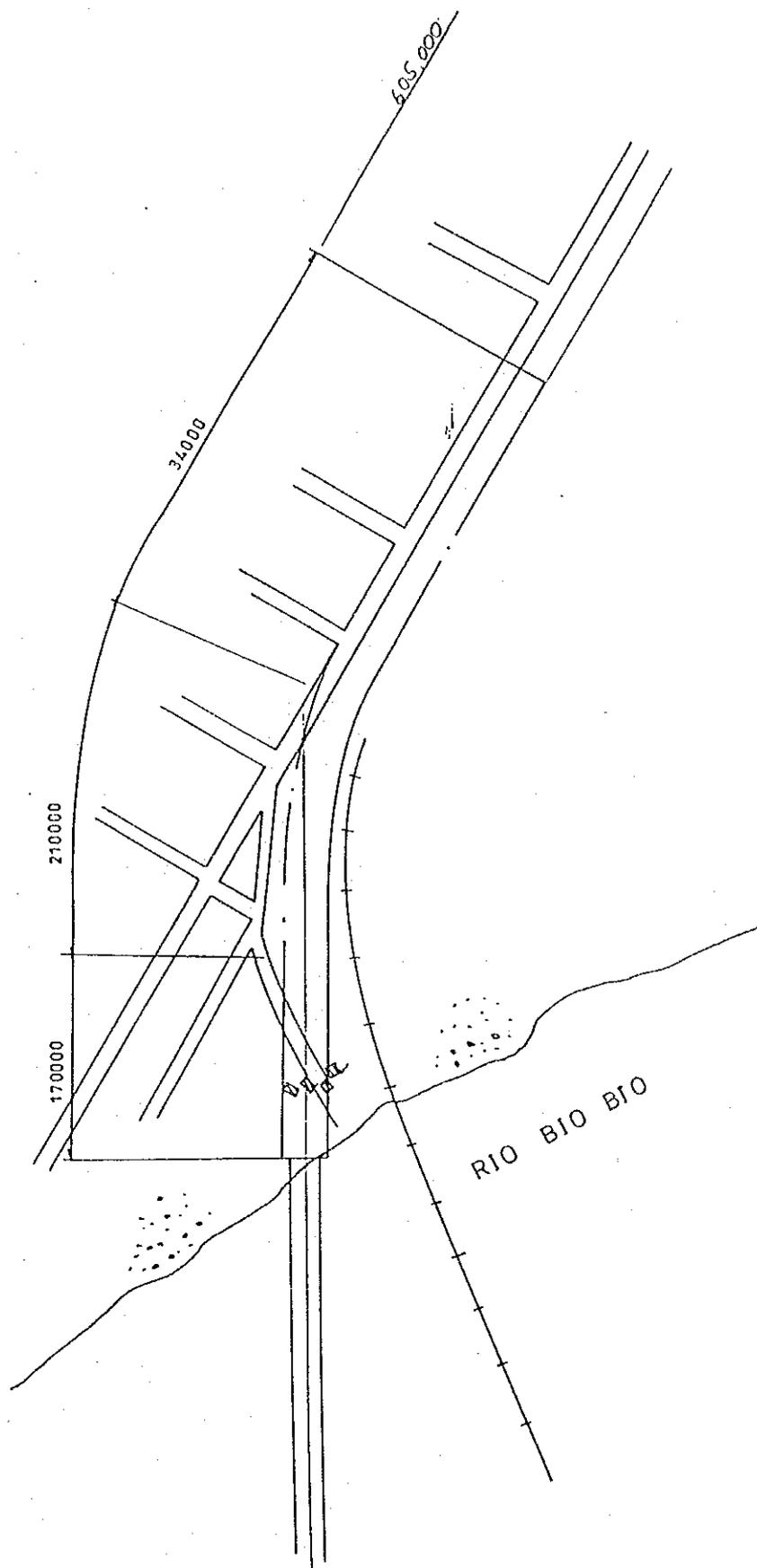


Figura A.12-7 Plano 4, del Lado de San Pedro

