8. SABO

Approximate Cost Estimation of Erosion/Sediment Control Works

SEGMENT	DESCRIPTION		'000 CONSTRUCTION COST
1	-		
2	No. 1 SABO DAM (To Control the Sediment)		
	No. 2 SABO DAM (To Control the Sediment and the erosion		
3	No.3 SABO DAM (To check the further erosion)		
	No. 4 SABO DAM (-do-)		
	No. 5 SABO DAM (- do -)		
		Total	12,685
4	SABO DAM		
	Rivetment Works		
		Sub Total	10,160.0
	DROPPED CHEACK SHUTE (KM 20? + 365)		120.0
		Total	10,289.0
		Total	22,974.0

SEGMENT 2

1) On the Southern side of Dalton Pass (Dig-dig River)

Four Sabo dams shall be delineated at the proper sites in the extreme upper reaches of Digdig River for the following reasons:

a) To support the foundation of the newly planned road, especially for the parcel of land where the land slide is feared to occur (KM 204 - 205)

b) To support the foundation of existing road, especially at the site where a fierce land slide and gully erosion is prevailing (KM 206 - 207)

c) To treat the muck of Tunnel Construction properly at the site adjacent to the Tunnel Entrance.

d) To maintain the natural environment of the rivers and mountain slopes or its vegetation that might be deteriorated totally by the construction works of the Project.

The main purpose for each dam is as follows:

CAPINTALAN No. 1: To control the sediment,
No. 2: To control the sediment and the erosion
No. 3: To check the further erosion
No. 4: To check the further erosion
No. 5: To check the further erosion
(See Drawing)

Seg. 2 on the South Side of Dalton pass

CONSTRUCTION COST (STA. Dig Dig River)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	23,055	1,406,355
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M			
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR (H=)	L.M			
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733	15,388	11,278,804
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M.	384		
FENCE FOR FALLING ROCK	L.M.	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
				12,685 ...p

QUANTITY OF SABO DAM FOR DIGDIG RIVER

1. SABO DAM NO. 1

H = 20 m

L = 66 m

1) Concrete Volume

(12 + 2.5) x ½ x 15.0 x 57.0 = 6,200

(2.5 + 2.0) x ½ x 3.5 x 30.0 = 300

6,500 m^3

2) Excavation Volume

6,500 x 1.5 = 9,750 m^3

2. SABO DAM NO. 2

H = 17.0 m

L = 4.0 m

1) Concrete Volume

(11.6 + 2.5) x ½ x 13.0 x 30.0 = 2,750

(2.5 + 2.0) x ½ x 4.0 x 22.0 = 200

2,950 m^3

2) Excavation Volume

2,950 x 1.5 = 4,425 m^3

3. SABO DAM NO. 3

H = 13.0 m

L = 46.0 m

1) Concrete Volume

(7.0 + 2.5) x ½ x 13.0 x 27.0 = 1,670

(2.5 + 2.0) x ½ x 4.0 x 28.0 = 250

1,920 m^3

2) Excavation Volume

1,920 x 1.5 = 2,880 m^3

4. SABO DAM NO. 4

H = 13.0 m

L = 40.0 m

1) Concrete Volume

$(7.0 + 2.5) \times \frac{1}{2} \times 13.0 \times 28.0 = 1,730$

$(2.5 + 2.0) \times \frac{1}{2} \times 4.0 \times 31.0 = 270$

$2,000\ m^3$

2) Excavation Volume

$2,000 \times 1.5 = 3,000\ m^3$

5. SABO DAM NO. 5

Same with No. 4

1) Concrete Volume $= 2,000\ m^3$

2) Excavation Volume $= 3,000\ m^3$

SEGMENT 4

2) On the northern side of Dalton Pass (Santa Fe River Channel Works)

One Sabo dam, three consolidation works, and three ground sills shall be delineated in the rivercourse adjacent to the Santa Fe Bridge. The length of channel works which is related to the above mentioned works is to extend one thousand meters. The purpose of these works consists in the following matters.

a) To support and stabilize the parcel of land where the newly planned road is passing by.

b) To protect the existing Santa Fe Bridge from the sediment flow.

c) To lend support to the treatment of muck of Tunnel Construction.

d) To maintain the natural environment of the center of Municipality Santa Fe.

SEC 4 (on the North side of Kalton Pass)

CONSTRUCTION COST (STA. SANTAFE River CHANNEL WORK)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.09		
STRUCTURE EXCAVATION	Cu.M	61	7,296	445,056
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M			
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATER WAY (H= 5.5)	L.M	2100	400	840,000
-do- (H= 7.0)	L.M	2700	1800	4860,000
-do- (H=)	L.M.			
CONCRETE PIPE ø	L.M			
-do- ø	L.M			
CONCRETE FOR SABO	Cu.M	733	4870	3569,710
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	2550	453,900
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
				10169

QUANTITY OF SANTA FE CHANNEL WORK

1. SABO DAM

1. Concrete Volume (H= 8m L = 75m)

$(8 + 2) \times \frac{1}{2} \times 8 \times 60 = 2,400m^3$

$2 \times 8 \times 70 = \underline{1,120m^3}$

$3,520m^3$

2. Excavation Volume

$3,520 \times 1.5 = 5,280m^3$

2. CONSOLIDATION Nos. 3 (H = 7m L = 38m)

1. Concrete Volume

$(2 + 4) \times \frac{1}{2} \times 3.0 \times 31m = 279m^3$

$(2.0 + 1.5) \times \frac{1}{2} \times 4.0 \times 8 = \underline{56m^3}$

$325m^3 \times 3 = 1,005m^3$

2. Excavation Volume

$335 \times 1.5 = 500m^3 \times 3 = 1,500$

3. GROUND SILL No.3 (H = 5.5m L = 34m)

1. Concrete Volume

$1.5 \times 1.5 \times 29.0 = 65$

$1.5 \times 5.5 \times 6.0 = \underline{50}$

$115m^3 \times 3 = 345m^3$

2. Excavation Volume

$115 \times 1.5 = 172m^3 \times 3 = 516$

4. Rivetment Works L = 1,100m x 2

H = 5.5m 2 x 200

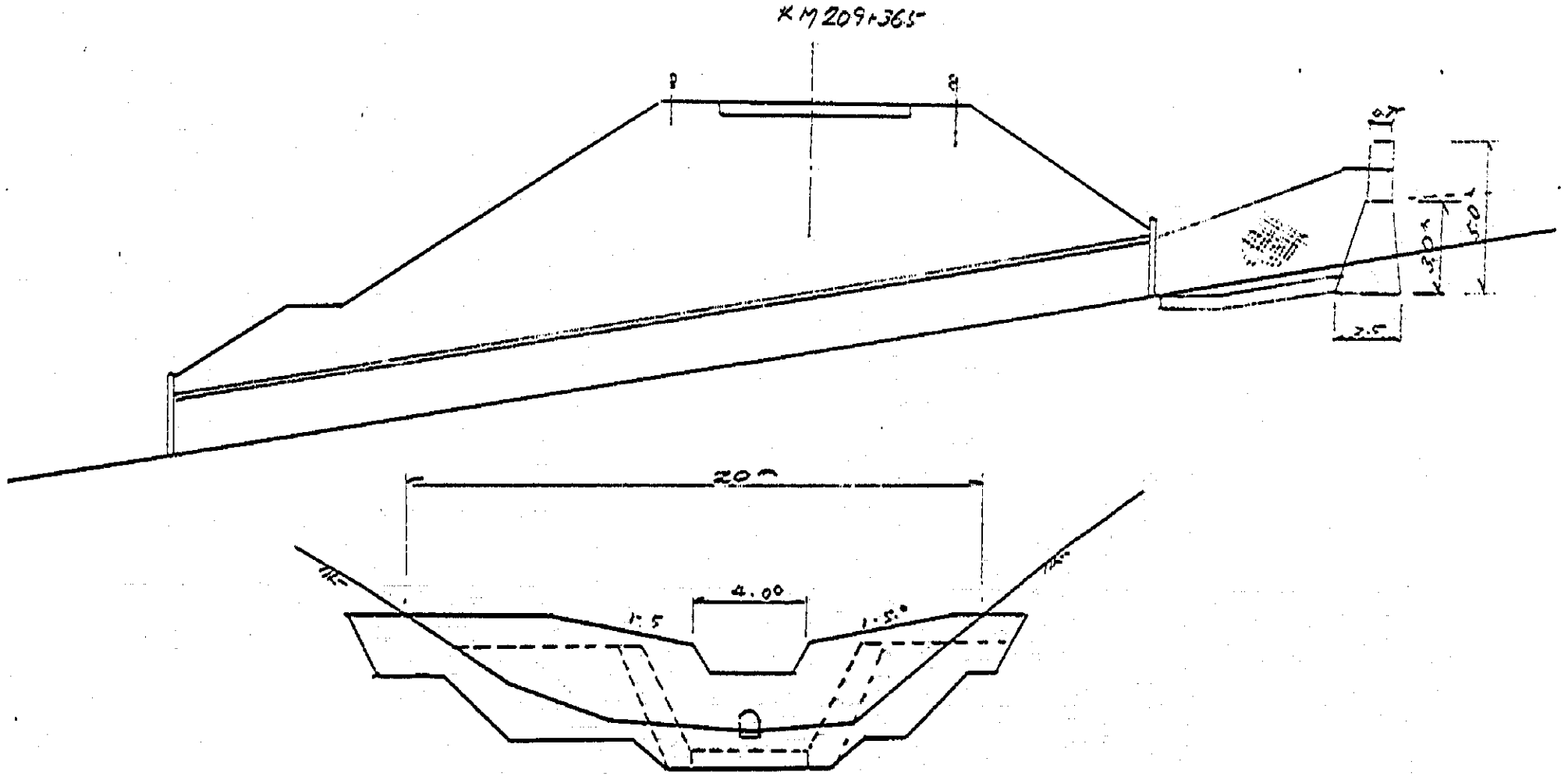
H = 7m 2 x 90 Stone Masonry

5. GABION

$3 \times 31 \times 9m = 837m^2$

$3 \times 24 \times 12m = \underline{864m^2}$

$1,701m^2 \times 1.5m = 2,550m^3$



DROPPED CHECK SHOOT AT KM 209+365

CONSTRUCTION COST (SEGMENT 4. STA. KM 209+365)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR Walk Way (H= 3.0)	L.M	1100	7.0×2	15,400
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO (Dropped Check Dike)	Cu.M	233	130.0	95,290
CONCRETE FOR RIVER BED	Cu.M	645	9.0	5,805
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
				116,495 P

9. IMPROVEMENT

SEGMENT	DESCRIPTION	CONSTRUCTION COST ('000P)
1	Location: Km 202 + 000 To Km 202 + 500	
	Over lay (L = 500m)	375.0
	Inprovement of Drainage facility	132.0
	Sub-Total	507.0
2	-	
3	-	
4	Location: Km 216 + 800	
	(For shoulder scorded)	475.0
	Location: Km 217 + 250	
	(For Land Slided)	869.0
	Location: Km 216 + 580 To Km 218 + 000	
	(For Drainage Facility)	285.0
	Sub-Total	1,629.0
	Total	2,136.0

IMPROVEMENT
SEGMENT 1.

(a) KM. 202 + 000 To KM. 202 + 500

L = 500m

		'000 ₱
(1) OVER LAY	m ₱ 750.0	
500m X 750.0		(375.0)
(2) Drainage		(132.0)
Concrete side Ditch	L = 300m	
300m x 433.18 ₱		130.0
Clean and repair Existing Culvert		
3 Boxes x 14.0m x 62.38 ₱		2.0
		507

(3) Total

'000 ₱

SEGMENT 4.

3) KM 217 + 250 Land slided L = 70m (1090) '000

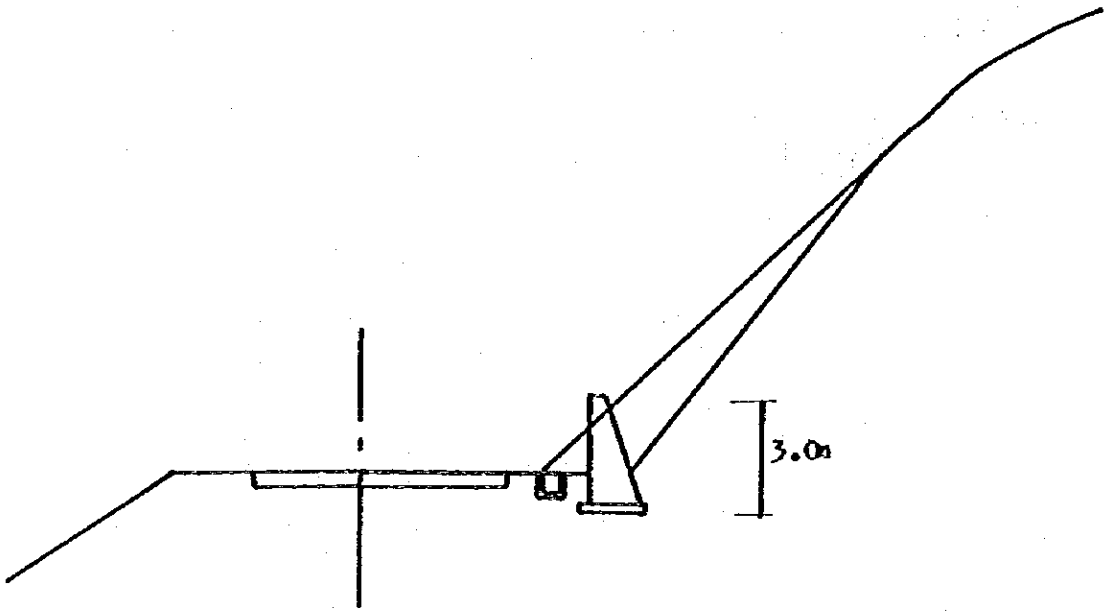
(<100m)

Recutting 70m x 70m^2 = 4,900 (common)

49,000m^3 x 0.5 x 13.05^P = 320 '000

Retaining Wall H = 3m

70m x 1100^P = 77.0



4) Total 869.0 '000P

SEGMENT 4

(C) KM 216 + 580 To KM. 218 + 000 L = 1,420m

1) Drainage (285.0 '000₱)

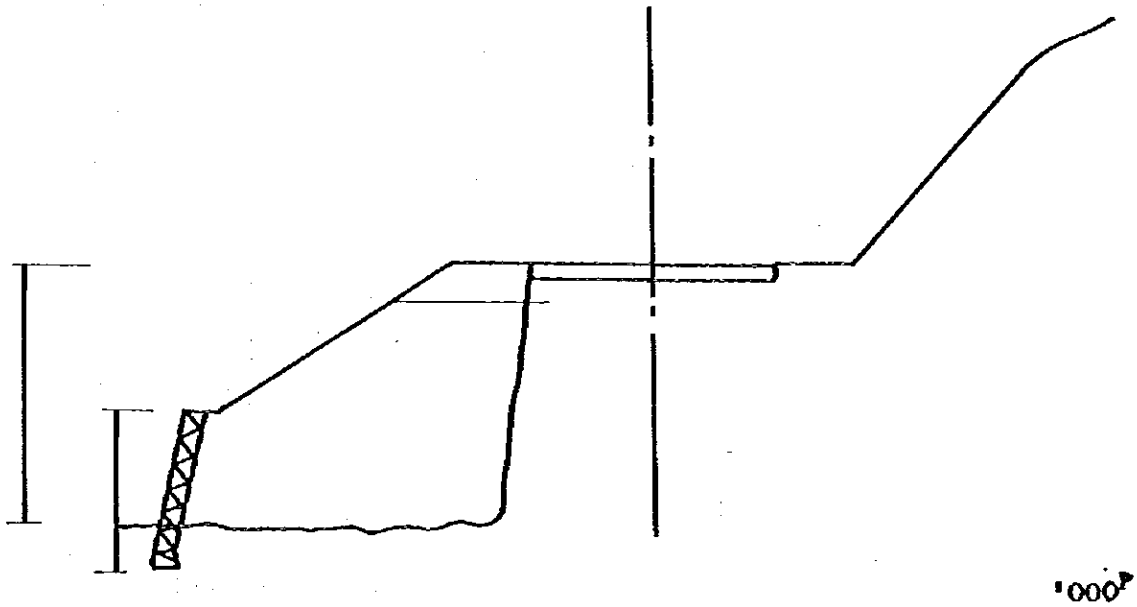
Side Ditch 650m x 433.18₱ 282.0 '000₱

Clean and repair Existing Culvert

4 pipes x 13.0m x 62.38₱ 3.0

2) KM. 216 + 800 Shoulder Scorded (475.0)

L = 160 m



		'000₱
Earth Work	36 m^2/m x 160 m x 34.1₱	196.0
Crushed Gravel Base Course	3 m^2/m x 160 m x 115.43₱	55.0
Stone Masonry H = 4 m	160 m x 14000₱	224.0

Santa Fe Intersection SBD. 4

KK. 216 + 420 - 216 + 515 Fill L = 95m Ave. height = 1.5m
216 + 515 - 216 + 545 SANTA FE CRIDGE L = 30m
216 + 545 - 216 + 605 Fill L = 60m Ave. height = 1.5m
(210 + 165)

1) Embankment $20 \times 95.0 = 1,900.0\ m^3$
$23 \times 60.0 = 1,380.0\ m^3$
$3,280.0\ m^3$

2) Topsoil and Seeding $6.0 \times 95 = 570\ m^2$
$3.0 \times 20 = 60$
$630\ m^2$

3) Pavement 155 m

4) Retaining Wall H = 3.0 m L = 80 m

5) Side Walk See : Page

6) Concrete Curb on Island 20 m

7) Bridge Santa Fe Bridge See Page

No.	UNIT COST	QUANTITY	COST	REMARK
1	34.1	3,280.0	111,848.0	
2	7.15	630.0	4,504.5	
3	1,428.0	155.0	221,340.0	
4	1,100.0	80.0	88,000.0	
5	52.18	20.0	1,043.6	
TOTAL			426,736.1	

NO. RIGHT - OF - WAY W = 40.0 m as January 1981

SEG.	STA. KILO - POST	Length	LAND				BUILDINGS
			Uncultivated	Cultivated	Forest	Crops	Nipa
			2.5 P/m^2	6 P/m^2	7.5 P/m^2	33 P/hill	44 P/m^2
	202 + 500						
	- 202 + 950	450.0		108,000			1 (44.0)
	203 + 170						
1	- 203 + 657.5	487.5		117,000			1 (44.0)
	203 + 747.5						
	- 204 + 135	387.5		93,000			1 (44.0)
	Sub Total		(0)	(318,000)	(0)	(0)	3 (132.0)
	204 + 225						
	- 204 + 500	275.0	27,500				
	- 205 + 037.5	537.5			161,250		
2	205 + 152.5						
	- 205 + 830	677.5		162,600			
	Sub Total		(27,500)	(162,600)	(161,250)		
	207 + 700						
	- 207 + 877.5	177.5	17,750				
3	207 + 922.5						
	- 208 + 450	527.5	52,750				
	Sub Total		(70,500)				
	208 + 498						
	- 208 + 845	347.0	34,700				
	208 + 890						
4	- 209 + 130	231.0	23,100				
	209 + 170						
	- 209 + 481	231.0	23,100				
	209 + 636						
	- 209 + 845	173.0	17,300				
	209 + 845	320.0	32,000				
	- 210 + 165	Sub SEG. 4	136,800				
		TOTAL	234,800	480,600	161,250		3 (132.0)

ROAD RIGHT -OF- WAY
1978 Price Level

RURAL	TYPE	UNIT	COST
Land	a) Uncultivated	P/hectare	P20,000.00
	b) Cultivated	P/hectare	P50,000.00
	c) Forest	P/hectare	P60,000.00
	d) Crops and improvement	P/hectare	P30/tree - coconut P10/hill - banana P60/grove - bamboo P30/tree - mango P10/tree - star apple
Buildings	a) Residential	P/m^2	P35/sq. m/ - Nipa/mix mat P1,000-P1,500 - conc. P500-700 - semi-conc.

APPENDIX E

UNIT COSTS OF STRUCTURES

TABLE OF CONTENTS

I. BRIDGE CONSTRUCTION COST:

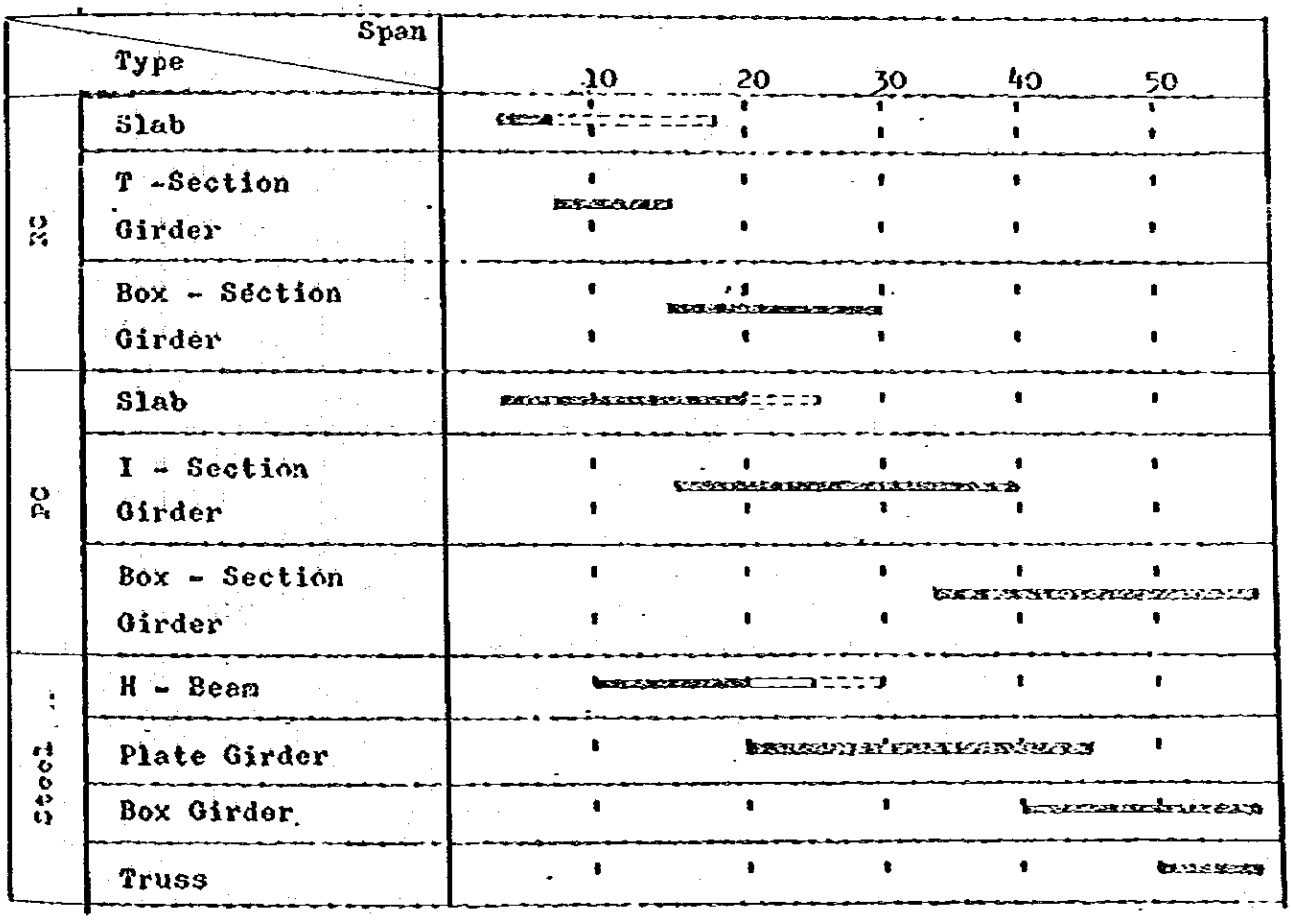
1. SUPERSTRUCTURE:

1.1 Bridge type and Span Length

Generally, the type of Superstructure of the bridge is determined by its proper span length.

Figure 1.1 shows the mutual relation between each bridge type and span length based on the analysis of a number of bridge data and economic studies of the construction cost.

Figure 1.1 RELATION BETWEEN TYPE OF BRIDGE AND SPAN:



NOTE: RC - - - Reinforced Concrete Bridge

PC - - - Prestressed Concrete Bridge

The types of bridge were determined based on span length as follows :

(a) In case of span length $L \leq 15^{m}$
Bridge Type ----- Reinforced Concrete T-Section Girder (RCDG)

(b) In case of span length $15 < L \leq 35$
Bridge Type ----- Prestressed Concrete I-Section Girder (PCG)

(c) In case of span length $L > 35$
Continous Bridge Type ----- Prestressed Concrete Segental Box-Girder (PCSG) or
Steel Truss (ST)

1.2 Typical Cross Section
(A) RCDG ($L \leq 15^{m}$)

Figure 1-2 RCDG

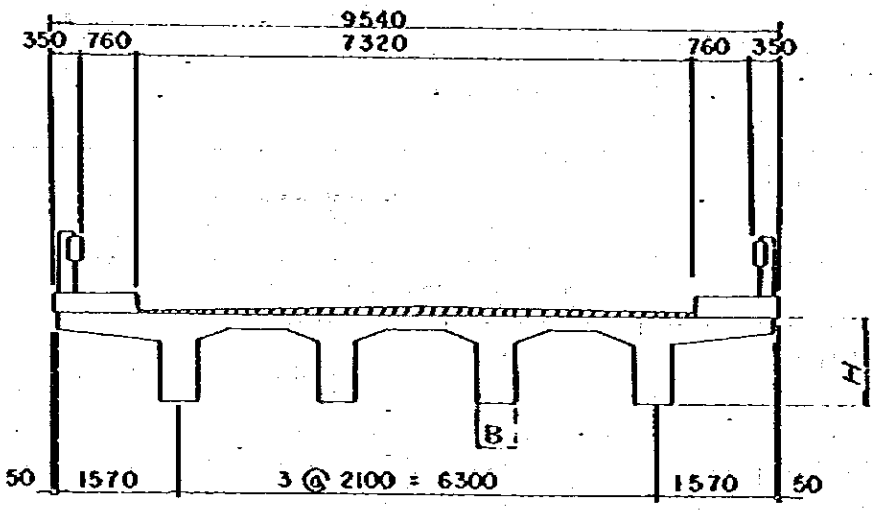


TABLE 1-1 Dimension of B & H

B & H / SPAN	(B cm)	(H cm.)
10 m.	40	90
15 m.	50	120

(B) PCG ($15 < L \leq 35$)

Figure 1.3 PCG

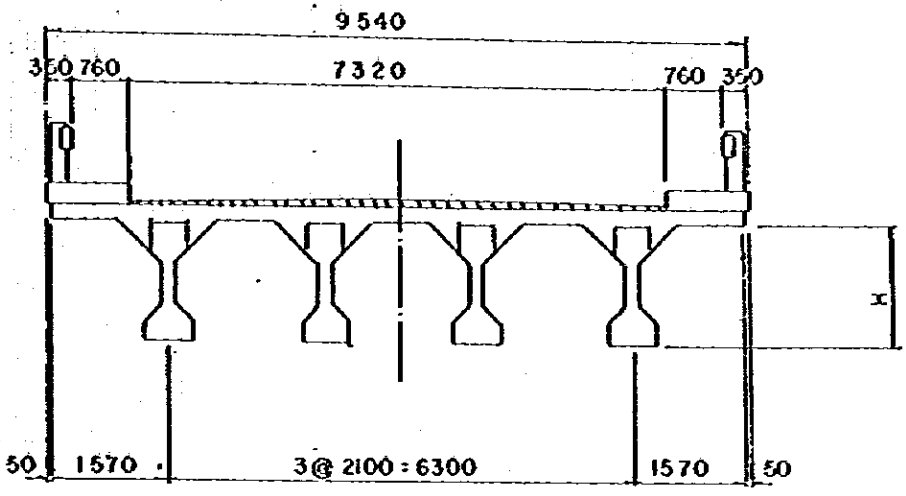


Table 1.2 GIRDER TYPE

SPAN (m)	STANDARD AASHTO	H (m)	REMARKS
20	TYPE-IV	1.371	
25	TYPE-IV	1.371	
30	TYPE-VI	1.829	
35	TYPE-VI	1.829	

There are STANDARD AASHTO & PCI SECTIONS for prestressed concrete girder in the Philippines.

(C) PCSG

Figure 1.4 PCSG

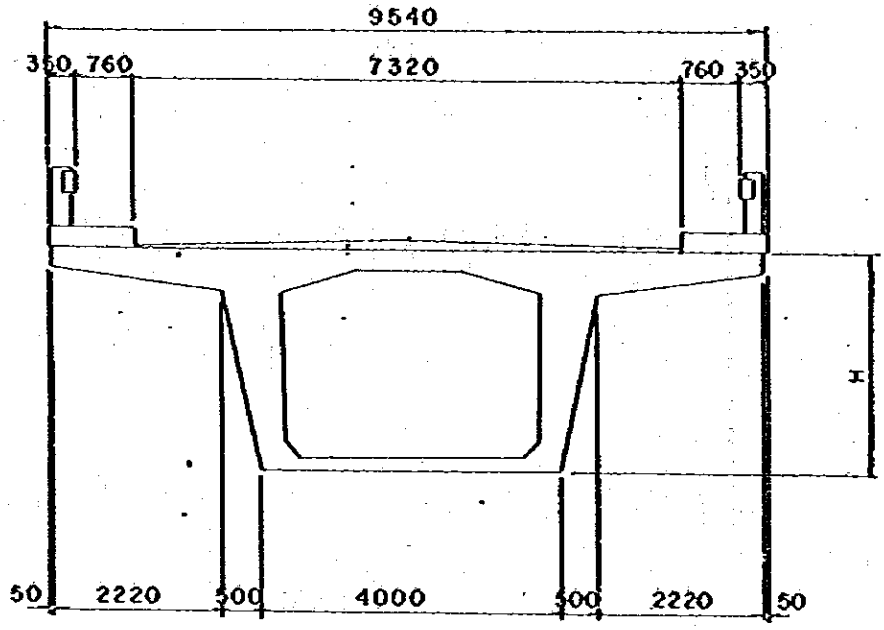


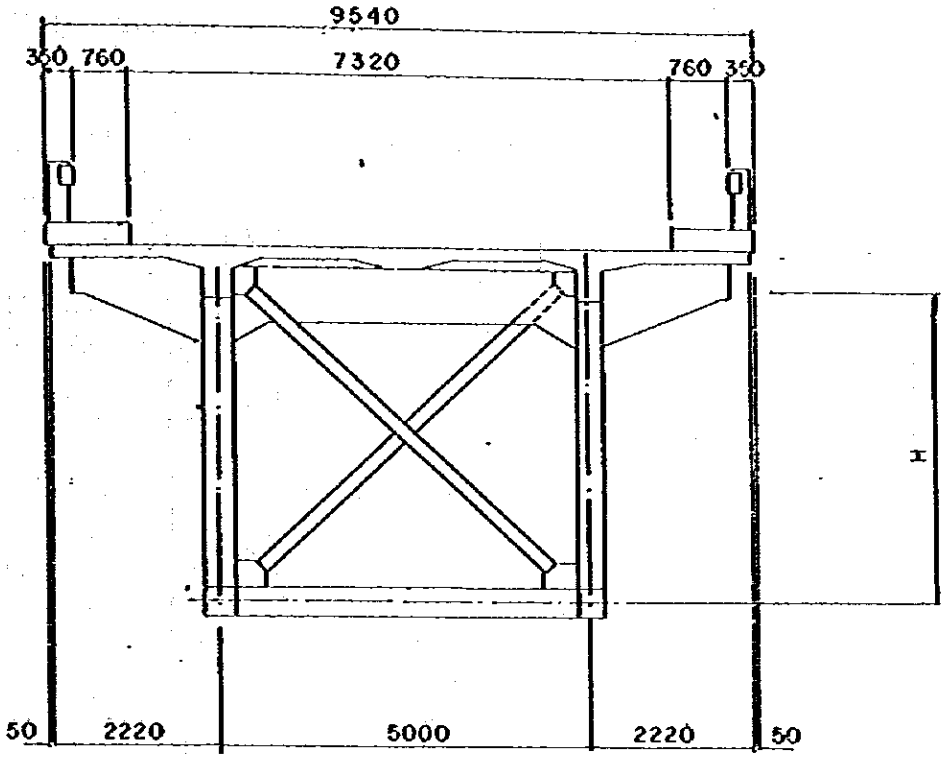
Table 1-3 GIRDER DEPTH FOR CONTINOUS BRIDGE

Depth	On Support	At Center
H (m)	L/20 ~ L/16	L/45 ~ L/60

Where L; Span length

(d) STEEL TRUSS ($L > 35^{m}$)

Figure 1.5 S.T



Where: H = L/10 to L/8 (m)

L = Span length (m)

1.3 ESTIMATE OF QUANTITIES

The estimate of quantity of RCDG and PCG is adopted from detailed design of each bridges in "LAOAG-ALLACAPAN ROAD PROJECT PHASE II".

(A) RCDG

TABLE 1.4 ESTIMATE OF QUANTITY FOR RCDG

DESCRIPTION	UNIT	QUANTITIES	
		SPAN 10m	SPAN 15m
CONCRETE RAILING	L.M.	20.0	30
CONCRETE FOR SUPER-STRUCTURE	Cu.M	44.5	78.5
REINFORCING STEEL	Kg.	5030	1214.0
STEEL BEARING DEVICES	Kg.	348	343

(B) PCG

TABLE 1.5 ESTIMATE OF QUANTITY FOR PCG

DESCRIPTION	UNIT	QUANTITIES			
		SPAN		SPAN	
		20M	25M	30M	35M
CONCRETE RAILING	L.M.	40	50	60	70
CONCRETE FOR SUPER-STRUCTURE	Cu.M	68	79	95	112
PRESTRESSED CONCRETE GIRDER	EACH	4	4	4	4
REINFORCING STEEL	Kg.	5680	1320	8800	10280

(c) RCSG

The estimate of quantity for RCSG is calculated by continuous beam in accordance with the following Figure 1-6 (a)~(d).

Fig. 1-b (a) Average Span length 40 M

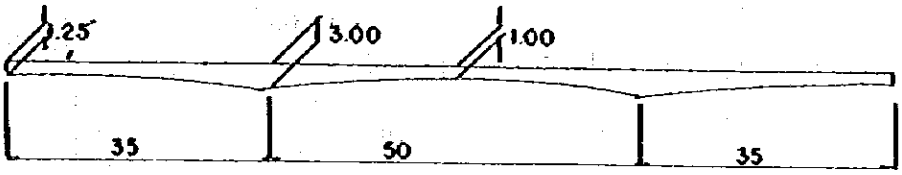


Fig. 1.b (b) Average Span length 50 M

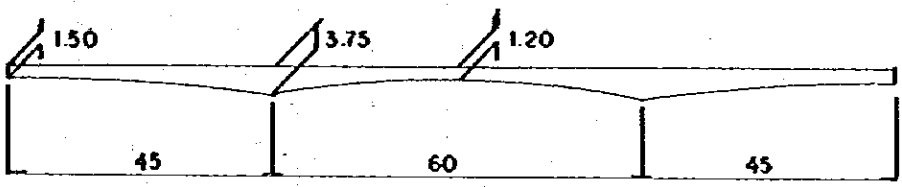


Fig. 1.b (c) Average Span length 60 M

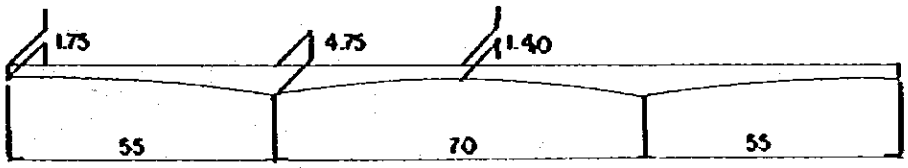


Fig. 1.b (d) Average Span length 70 M

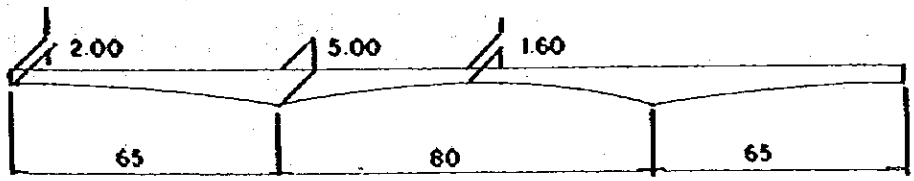


TABLE 1.6 ESTIMATE OF QUANTITY FOR PCSG

DESCRIPTION	UNIT	QUANTITY			
		A.S. 50M	A.S. 55M	A.S. 60M	A.S. 70M
CONCRETE RAILING	L.M.	240	300	360	420
CONCRETE FOR SEGMENTAL CONSTRUCTION	Cu.M	868	1144	1490	1880
REINFORCING STEEL	Kg.	86800	114400	149000	188000
PRESTRESSING STEEL	Kg.	39000	57200	82000	112800
METAL BEARING	Kg.	15440	19000	22700	26280

Where A.S. = Average Span Length

(d) S.T

The estimate of quantity for S.T is calculated by continous beam in accordance with the following Figure 1.7

Figure 1.7 CONTINOUS STEEL TRUSS

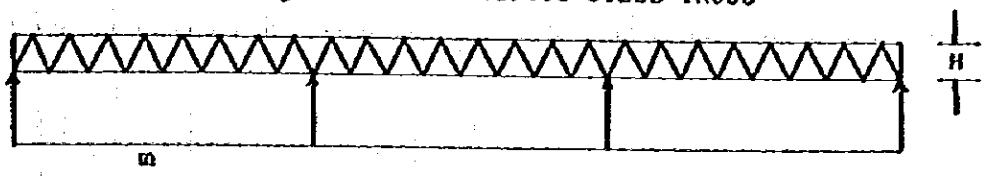


Table for Depth of Main Truss

SPAN	DEPTH OF MAIN TRUSS	REMARKS
40	4.0m	L/H = 10
50	5.5m	L/H = 9.1
60	6.5m	L/H = 9.2
70	7.5m	L/H = 9.3

Where, L-length of Span & H-length of Girder

TABLE 1.8 ESTIMATE OF QUANTITY FOR S.T.

DESCRIPTION	UNIT	QUANTITIES			
		SPAN 40m	50m	SPAN 60m	70m
CONCRETE RAILING	L.M	240	300	360	420
CONCRETE FOR SUPER-STRUCTURE	Cu.M	366	458	550	641
REINFORCING STEEL	Kg.	80520	100760	121000	141020
STRUCTURAL STEEL	Kg.	271000	364000	465000	577000
METAL BEARING DEVICES	Kg.	6300	7500	8700	9900

1.4 Unit Price for each Item

Table 1.9 is the direct cost for bridge construction using as reference the Laoag-Allacapan Road Project Phase II in the Philippines of which the detailed designs were completed on February 1981.

TABLE 1.9 SUMMARY OF UNIT PRICE DIRECT COST:

ITEM NO.	DESCRIPTION	UNIT	FINANCIAL COST P	REMARKS
403	Concrete Railing	L.M.	296.62	
405 (1)	Class A-1 Concrete (Superstructure)	Cu.M	977.0	
405 (4)	Class D-1 Concrete (Segmental Concstruction)	Cu.M	2228.0	
405.6(1)-1	Prestressed Concrete Structural Members (L=20.0M)	Each	44721.97	
-2	Prestressed Concrete Structural Members (L=25.0M)	Each	62235.08	
-3	Prestressed Concrete Structural Members (L=30.0M)	Each	34208.09	
-4	Prestressed Concrete Structural Members (L=35.0M)	Each	106181.10	
405 A(2)	Prestressing Steel (Strand 12-Ø12.4mm.)	Kg.	61.20	
406	Reinforcing Steel	Kg.	6.43	
407	Structural Steel	Kg.	36.38	
SPL-1	Metal Bearing Shoe	Kg.	52.29	

1.5 CONSTRUCTION COST

(A) RCDG

TABLE 1.10 CONSTRUCTION COST FOR RCDG

DESCRIPTION	UNIT	UNIT PRICE ₱	SPAN 10^m		SPAN 15^m	
			QUANTITIES	AMOUNT x 1000 ₱	QUANTITIES	AMOUNT x 1000 ₱
Concrete Railing	L.M.	296.62	20	5.93	30	8.90
Concrete for Super-structure	Cu.M.	977.0	44.5	43.48	78.5	76.69
Reinforcing Steel	Kg.	6.43	5030	32.34	12140	78.06
Steel Bearing Devices	Kg.	52.59	348	18.20	348	18.20
Total (1)				99.95		181.85
Bridge Surface Area (BSA) (2)			10.5 x (7.32 + .76) =84.84 m^2		15.5 x (7.32 + .76) =125.24 m^2	
Construction Cost per (BSA) (1)/(2)			1180 ₱/M^2		1450 ₱/M^2	

(B) PCG

TABLE 1.11 (a) CONSTRUCTION COST FOR PCG

DESCRIPTION	UNIT	UNIT PRICE ₱	SPAN 20m		SPAN 25m	
			QUANTITIES	AMOUNT x 1000 ₱	QUANTITIES	AMOUNT x 1000 ₱
Concrete Railing	L.M.	296.62	40	11.86	50	14.83
Concrete for Superstructure	Cu.M	977.0	68	66.44	79	77.18
Prestressed Concrete Girder	Each	44721.97	4	178.89	4	248.94
Reinforcing Steel	Kg.	6.43	5680	36.52	7320	47.07
Total (1)				293.71		388.02
Bridge Surface Area (BSA) (2)			20.5 x (7.32 + .76) = 165.64 m^2		25.5 x (7.32 + .76) = 206.04	
Construction Cost per (BSA) (1) (2)			1770 ₱/M^2		1880 ₱/M^2	

TABLE 1.11 (b) CONSTRUCTION COSTS FOR PCG

DESCRIPTION	UNIT	UNIT PRICE ₱	SPAN 30m		SPAN 35m	
			QUANTITIES	AMOUNT x 1000 ₱	QUANTITIES	AMOUNT x 1000 ₱
Concrete Railing	L.M.	296.62	60	17.80	70	20.76
Concrete for Superstructure	Cu.M	977.0	95	92.82	112	109.42
Prestressed Concrete Girder	Each	84208.09	4	336.83	4	424.72
Reinforcing Steel	Kg.	6.43	8800	56.58	10280	66.10
Total (1)			504.03		621.00	
Bridge Surface Area (BSA) (2)			246.44 m^2		286.84 m^2	
Construction Cost per (BSA) (1) (2)			2050 ₱/m^2		2160 ₱/m^2	

(C) PCSG

TABLE 1.12 (a) CONSTRUCTION COST FOR PCSG

DESCRIPTION	UNIT	UNIT PRICE ₱	SPAN 40m		SPAN 50m	
			QUANTITIES	AMOUNT x 1000 ₱	QUANTITIES	AMOUNT x 1000 ₱
Concrete Railing	L.M.	296.62	240	71.19	300	88.99
Concrete for Segmental Construction	Cu.M	2228.0	868	1933.90	1164	2548.83
Reinforcing Steel	Kg.	6.43	86800	558.12	114400	735.59
Prestressing Steel	Kg.	61.20	39000	2386.80	51200	3500.64
Metal Bearing Shoe	Kg.	52.29	15440	807.36	19000	993.51
Total (1)			5757.37		7867.56	
Bridge Surface Area (BSA) (2)			969.60 m^2		1212.0 m^2	
Concstruction Cost per (BSA) (1) (2)			5938 ₱/m^2		6490 ₱/m^2	

TABLE 1.12 (b) CONSTRUCTION COST FOR PCSG

DESCRIPTION	UNIT	UNIT PRICE P	SPAN 60m		SPAN 70m	
			QUANTITIES	AMOUNT x 1000 P	QUANTITIES	AMOUNT x 1000 P
Concrete Railing	L.M.	296.62	360	106.78	420	124.58
Concrete for Segmental Construction	Cu.M	2228.0	1490	3319.72	1880	4188.64
Reinforcing Steel	Kg.	6.43	169000	958.07	188000	1208.84
Prestressing Steel	Kg.	61.20	82000	5018.60	112800	6903.36
Metal Bearing Shoe	Kg.	52.29	22700	1186.98	26280	1374.18
Total (1)			10589.95		13799.60	
Bridge Surface Area			1454.4 m^2		1696.8 m^2	
Construction Cost per (BSA) (1) (2)			7280 P/m^2		8130 P/m^2	

(b) S.T.

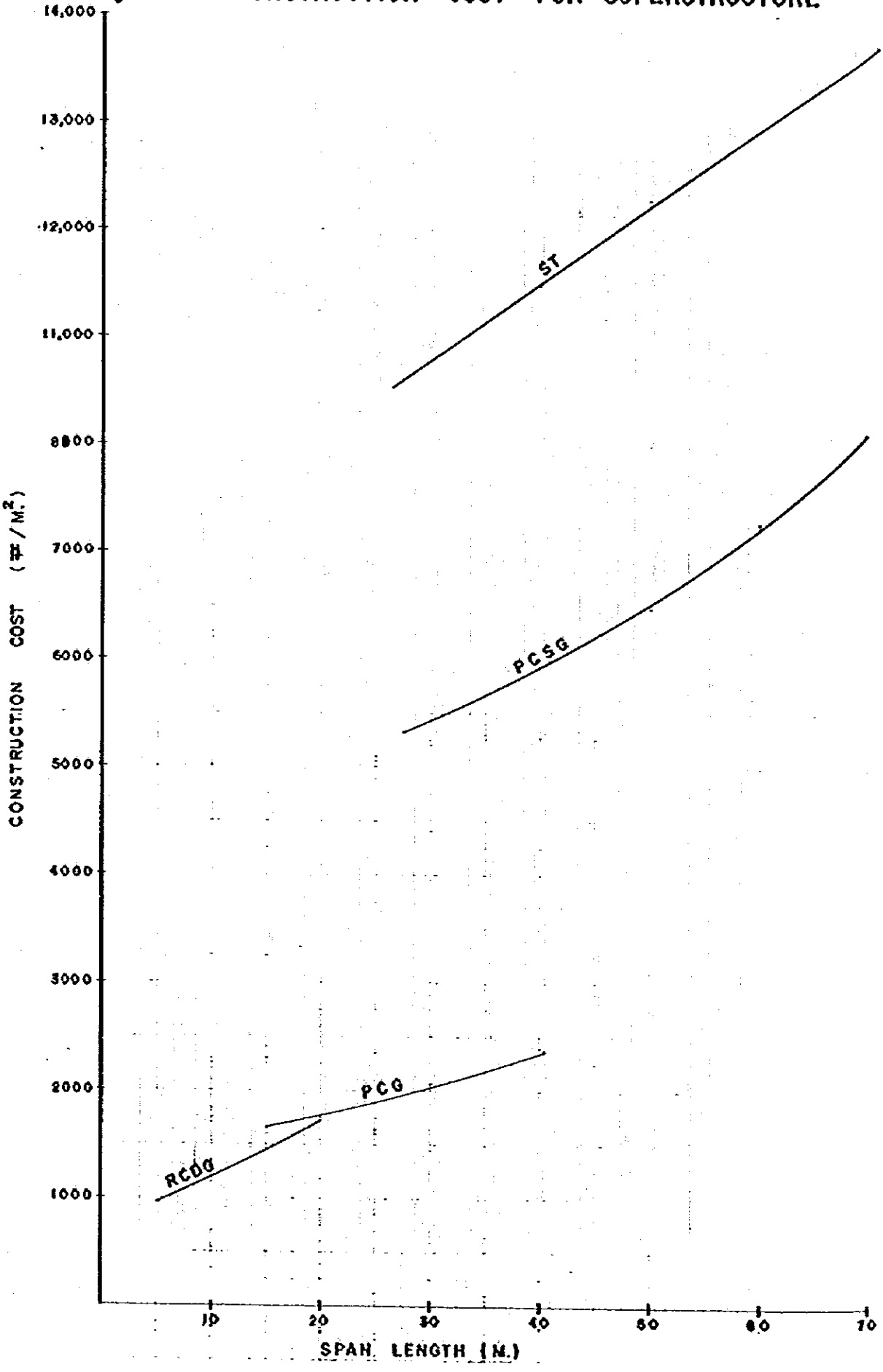
TABLE 1.13 (a) CONSTRUCTION COST FOR S.T.

DESCRIPTION	UNIT	UNIT PRICE ₱	SPAN 40m		SPAN 50m	
			QUANTITIES	AMOUNT x 1000 ₱	QUANTITIES	AMOUNT x 1000 ₱
Concrete Railing	L.M.	296.62	240	71.19	300	88.99
Concrete for Superstructure	Cu.M	977.0	366	357.58	458	447.47
Reinforcing Steel	Kg.	6.43	80520	517.76	100760	647.89
Structural Steel	Kg.	36.38	271000	9858.98	364000	13242.32
Metal Bearing Shoe	Kg.	52.29	6300	329.43	7500	392.18
Total (1)			11134.92		14818.85	
Bridge Surface Area (BSA) (2)			969.60 m^2		1212.0 m^2	
Construction Cost per BSA (1) (2)			11480. ₱/m^2		12270 ₱/m^2	

TABLE 1.13 (b) CONSTRUCTION COST FOR S.T.

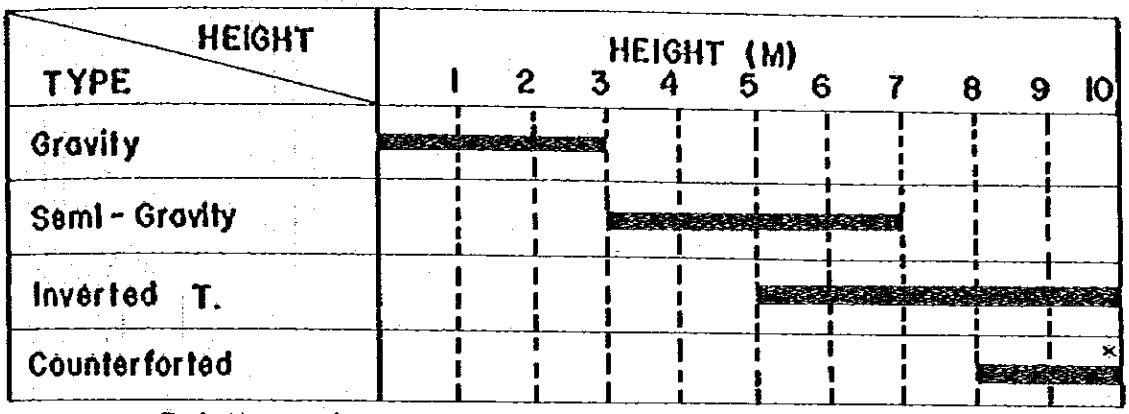
DESCRIPTION	UNIT	UNIT PRICE P	SPAN 60m		SPAN 70m	
			QUANTITES	AMOUNT x 1000 P	QUANTITIES	AMOUNT x 1000 P
Concrete Railing	L.M.	296.62	360	106.78	420	125.58
Concrete for Superstructure	Cu.M	977.00	550	537.35	661	626.26
Reinforcing Steel	Kg.	6.43	121000	778.03	141020	906.76
Structural Steel	Kg.	36.38	465000	16911.70	577000	20991.26
Metal Bearing Shoe	Kg.	52.29	8700	454.92	9900	517.67
Total (1)			18793.78		23167.53	
Bridge Surface Area (BSA) (2)			1454.4 m^2		1696.8 m^2	
Construction Cost per (BSA) (1) (2)			12930 P/m^2		13650 P/m^2	

Figure 1.8 CONSTRUCTION COST FOR SUPERSTRUCTURE



2. SUB STRUCTURE

FIGURE 2.1



Relation between Type and Height of Abutment

Note: × Maximum height is about 15 meters.

FIGURE 22 ABUTMENT TYPE

Fig.-1 Gravity type

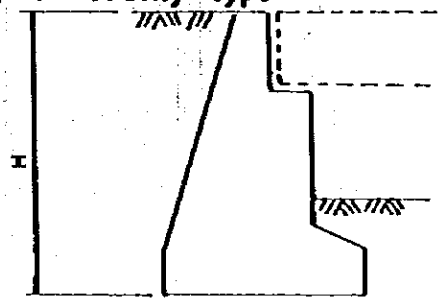


Fig. 2 Semi - Gravity Type

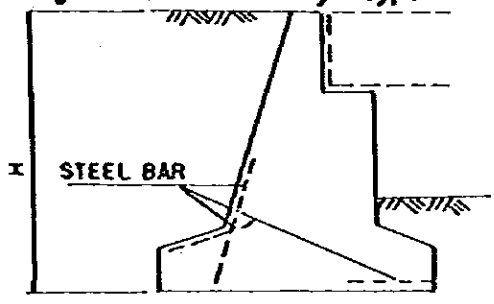


Fig.-3 Inverted-T Type

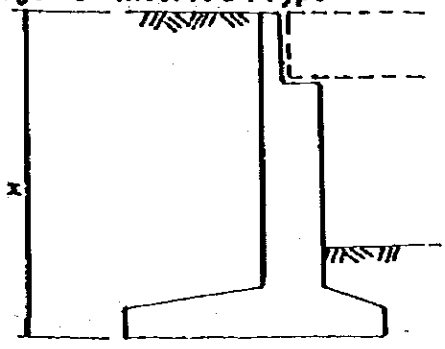


Fig-4 Counterforted Type

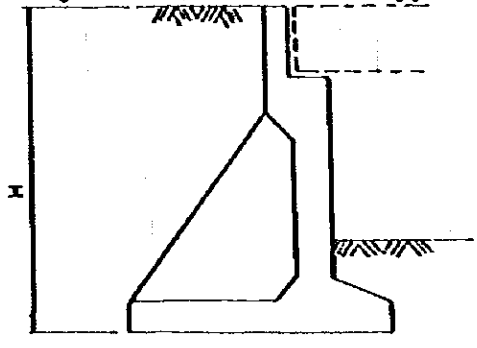
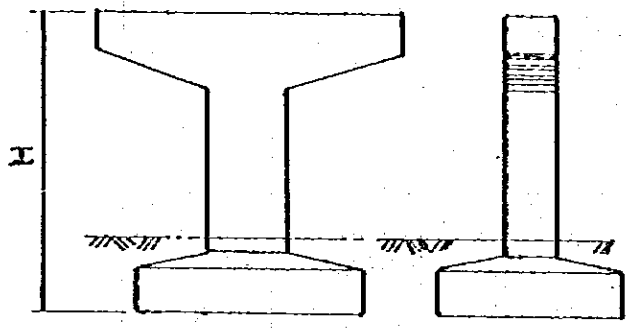


FIGURE 2.3 PIER TYPE

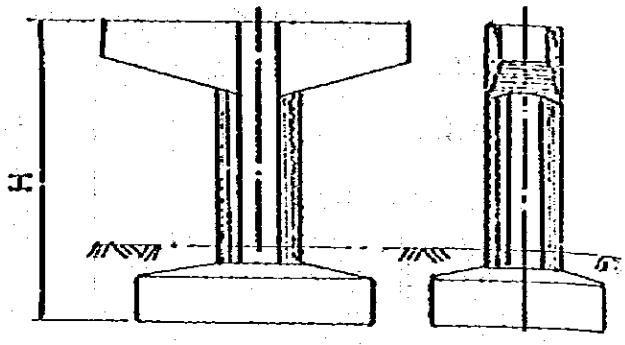
ON THE LAND

IN THE RIVER

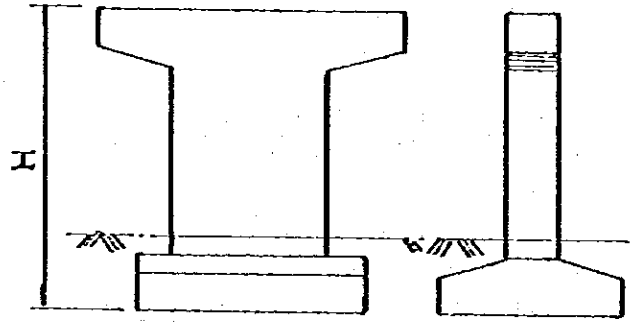
RECTANGULAR (I) TYPE



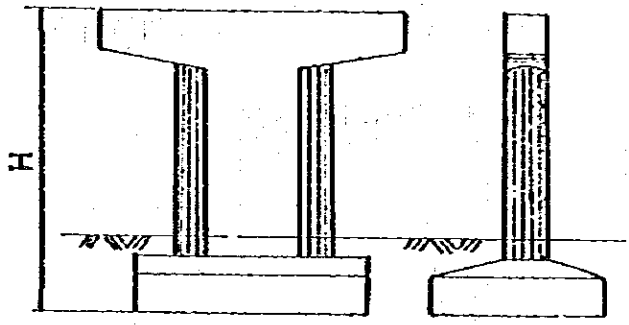
CIRCULAR TYPE



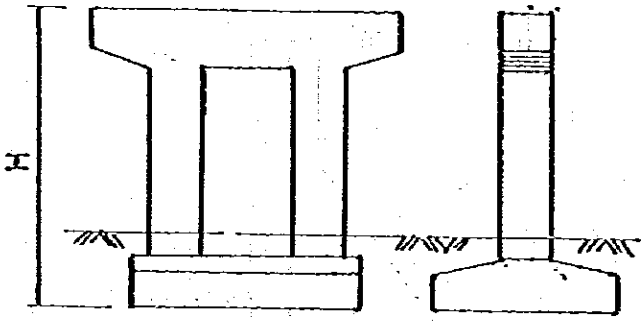
RECTANGULAR (II) TYPE



OVAL TYPE



RIGID - frame TYPE



Abutments and piers were determined based on the following:

A. Abutment

Type	----------	Inverted Type
Height	----------	5, 7, 9, 11 meters
Span	----------	15, 30, 50, 70 meters

B. Pier

Type	----------	Rectangular (I) Type
Height	----------	10, 15, 20, 25, 30, 35 m
Span	----------	15, 30, 50, 70 meters

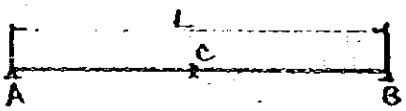
2.2 STABILITY CALCULATION FOR SUBSTRUCTURE:

2.2.1 REACTION

Maximum Moment And Reaction due to Line, Load

For simple Beam

Fig. 2.4 Simple Span



Where L: Span Length (m)

MC: Maximum Moment at point c (tm)

SA: Maximum Reaction at end of Girder (t)

Span length

Moment

Reaction

The results on the computed sheet at the right was programmed using AASHTO standards

```
MAX-MOS--AASHTO
(HS20-44)
L>MC>SA
        10.
  89.16597806
  46.7369218
L>MC>SA
        15.
  169.7328239
  52.93061452
L>MC>SA
        20.
  250.625997
  56.0274609
L>MC>SA
        25.
  332.1473603
  57.88556872
L>MC>SA
        30.
  413.5746536
  59.12430726
L>MC>SA
        35.
  495.0549336
  60.0091205
L>MC>SA
        40.
  576.5945062
    61.696
L>MC>SA
        50.
    739.4375
    71.211
L>MC>SA
        60.
    1102.2
    80.736
L>MC>SA
        70.
   1452.5875
    90.261
```

(B) Maximum Reaction due to Dead Load for Simple Beam

The following table shows the maximum reaction at the end of the beam.

TABLE 2.1 Maximum Reaction

SPAN (m)	TYPE	WEIGHT (t/m)	Rd (t)
10	RCDG	11.28	56.4
15	RCDG	13.68	102.6
20	RCG	13.57	135.7
25	RCG	13.39	167.4
30	RCG	15.94	239.1
35	RCG	15.29	267.6
40	RCSG	17.96	359.2
50	RCSG	18.90	472.5
60	RCSG	20.47	614.1
70	RCSG	22.09	773.2
40	ST	10.18	203.6
50	ST	10.35	258.8
60	ST	10.52	315.6
70	ST	10.67	323.5

(c) TOTAL REACTION (L.L + DL)

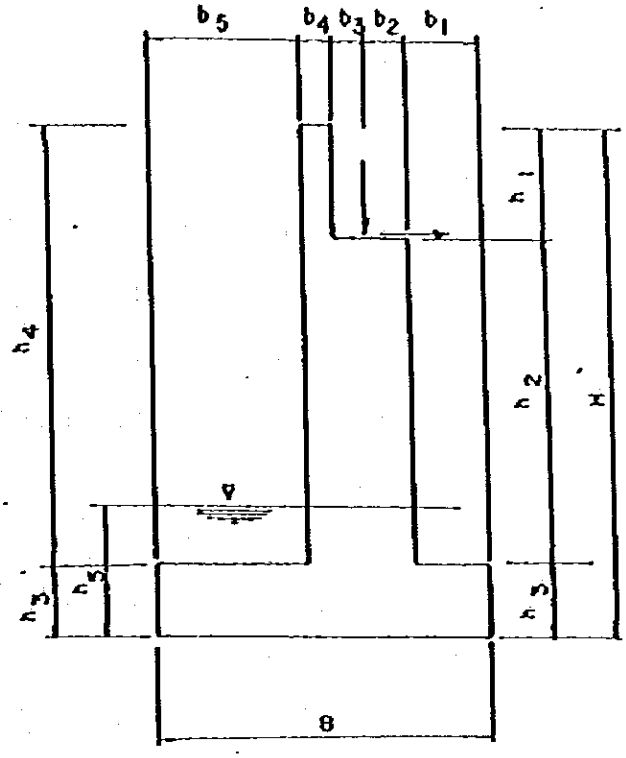
Table 2.2 Total Reaction

SPAN (m)	TYPE	LL	DL	LL + DL
10	RCDG	46.7	56.4	103.1
15	RCDG	52.9	102.6	155.5
20	RCG	56.0	135.7	191.7
25	RCG	57.9	169.4	225.3
30	RCG	59.1	239.1	298.2
35	RCG	60.0	269.6	327.6
40	RCSG	61.7	359.2	420.9
50	RCSG	71.2	492.5	563.7
60	RCSG	80.7	614.1	694.8
70	RCSG	90.3	773.2	863.5
60	ST	61.7	203.6	265.3
50	ST	71.2	258.8	330.0
60	ST	80.7	315.6	396.3
70	ST	70.3	373.5	463.8

FIGURE 2.5

2.2.2. Stability

2.2.2.1 Abutment



(1) Design Manner

The following design criteria was used in calculating stability for abutment :

(1) Unit Weight

Concrete	2.4 t/m^3
Compacted sand	1.9 t/m^3

(2) Earthpressure

Coulomb formula and Mononobe-Okabe's formula gives the structure in which retail fill should be proportioned to withstand pressure. The coeeficient of active pressure is shown as :

Ordinary Time	0.297
Earthquake Time	0.433

(3) Earthquake

The coefficient of seismic intensity for horizontal direction was assumed as :

$$Kh = 0.15$$

(4) Live Load

HS 20 - 44

(5) Bearing Capacity of Soil:

The bearing capacity of soil will be assumed as follows:

For Group I - - - - - - - - - - - 30 t/m^2

For Group III - - - - - - - - - - 35 t/m^2

For Group VII - - - - - - - - - - 45 to 50 t/m^2

(6) Safety factor for sliding:

For Group I, III - - - - - - - - 1.5

For Group VII - - - - - - - - - 1.2

(B) Calculation of the Center of Gravity

Table 2.3 Dimension of Abutment

SPAN	15.0		30.0		50.0		70.0	
T.O.S.	RCDG	RCDG	PCG	PCG	PCSG	ST	PCSG	ST
B	3.00	4.00	4.50	6.50	7.50	6.50	8.00	7.50
b1	.20	.20	1.00	1.25	2.00	1.50	2.00	2.00
b2	.55	.55	.65	.65	.65	.70	.70	.70
b3	.25	.25	.35	.35	.45	.50	.50	.50
b4	.40	.40	.40	.40	.40	.70	.50	.70
b5	1.10	2.10	2.10	3.85	4.00	3.10	4.30	3.60
H2	5.00	7.00	7.00	9.00	9.00	11.00	9.00	11.00
N1	1.40	1.40	2.00	2.00	1.80	5.80	2.30	7.80
N2	2.40	4.40	3.70	3.70	5.70	3.70	5.00	1.50
N3	1.20	1.20	1.30	1.30	1.50	1.50	1.70	1.70
N4	3.80	5.80	5.70	5.70	7.50	9.50	7.30	9.30
N5	0	0	0	0	0	0	0	0
C	9.54	9.54	9.54	9.54	9.54	9.54	9.54	9.54
Xh	.15	.15	.15	.15	.15	.15	.15	.15

ST-50-11 PCSG-70-9 ST-70-11

ARUT--1	ARUT--1	ARUT--1
IN	IN	IN
6.5	8.	7.5
1.5	2.	2.
0.7	0.7	0.7
0.5	0.5	0.5
0.7	0.5	0.7
3.1	4.3	3.6
11.	9.	11.
5.8	2.3	7.8
3.7	5.	1.5
1.5	1.7	1.7
9.5	7.3	9.3
0.	0.	0.
9.54	9.54	9.54
0.15	0.15	0.15
OUT	OUT	OUT
K+MD+H+X+Y	K+MD+H+X+Y	K+MD+H+X+Y
1010.96334	1101.30714	1069.04924
1010.96334	1101.30714	1069.04924
151.644501	165.196071	163.357216
4.001876456	4.739406109	4.765720532
4.743904335	5.934211949	4.728114159
CONCRETE-VLU.	CONCRETE-VLU.	CONCRETE-VLU.
159.8136	221.805	200.9124

PCG-15-5 PCG-15-7 PCG-30-7 PCG-30-9 PCG-50-9

ABUT--1	ABUT--1	ABUT--1	ABUT--1	ABUT--1
IN	IN	IN	IN	IN
3.	4.	4.5	6.5	7.5
0.7	0.7	1.	1.25	2.
0.55	0.55	0.65	0.65	0.65
0.25	0.25	0.35	0.35	0.45
0.4	0.4	0.4	0.4	0.6
1.1	2.1	2.1	3.85	4.
5.	7.	7.	9.	9.
1.4	1.4	2.	2.	1.8
2.4	4.4	3.7	3.7	5.7
1.2	1.2	1.3	1.3	1.5
3.8	5.8	5.7	5.7	7.5
0.	0.	0.	0.	0.
9.54	9.54	9.54	9.54	9.54
0.15	0.15	0.15	0.15	0.15
OUT	OUT	OUT	OUT	OUT
W+WB+Hb+Ht+Y	W+WB+Hb+Ht+Y	W+WB+Hb+Ht+Y	W+WB+Hb+Ht+Y	W+WB+Hb+Ht+Y
236.95452	464.38812	497.9279	728.16435	1013.60592
236.59152	464.38812	497.9279	728.16435	1013.60592
35.543178	69.658218	75.174185	109.2246525	152.040888
1.758979865	2.261130284	2.648122616	3.741945071	4.455359428
2.100199235	3.150215705	3.015356408	3.154028691	3.973581251
CONCRETE-VLU.	CONCRETE-VLU.	CONCRETE-VLU.	CONCRETE-VLU.	CONCRETE-VLU.
62.1616	101.5056	112.8582	157.6622	195.7608

Where W: Weight of body including soil.

Wb: Weight of body including soil with bouyancy.

H: Horizontal Faces at Earthquake time.

X: Horizontal distance from toe to the center of gravity.

Y: Height of the center of gravity from botton of footing.

(g) Stability Calculation

Table 2.4 INPUT DATA

SPAN (m)	15.0		30.0		50.0		70.0	
T.O.S.	RCDG	RCDG	PCG	PCG	PCSG	ST	PCSG	ST
Y (+)	236.95	464.39	487.83	728.16	1013.61	1010.96	1101.31	1089.05
YB (+)	236.95	464.39	487.83	728.16	1013.61	1010.96	1101.31	1089.05
H (+)	35.54	69.66	73.17	109.22	152.04	151.64	165.20	163.36
X (m)	1.76	2.26	2.65	3.74	4.49	4.00	4.74	4.77
Y (m)	2.10	3.15	3.02	3.15	3.98	4.74	3.93	4.73
D (+)	102.6	102.6	239.1	239.1	472.5	258.8	723.2	323.5
L (+)	52.9	52.9	59.1	59.1	71.2	71.2	90.3	90.3
DH (+)	30.8	30.8	71.7	71.7	141.75	38.82	115.98	56.03
IF (+)	2.65	2.65	2.96	2.96	3.56	3.56	4.52	4.52
KA	0.297	0.297	0.297	0.297	0.297	0.297	0.297	0.297
KEA	0.433	0.433	0.433	0.433	0.433	0.433	0.433	0.433
Ho (m)	5.00	7.00	7.00	9.00	9.00	11.00	9.00	11.00
H1 (m)	3.60	5.60	5.00	5.00	7.20	5.20	6.70	3.20
a (m)	1.25	1.25	1.65	1.90	2.65	2.20	2.70	2.70
b (m)	3.00	4.00	4.50	6.50	7.50	6.50	8.00	7.50
Tan ØB	.55	.55	.55	.55	.55	.55	.55	.55
C (m)	9.54	9.54	9.54	9.54	9.54	9.54	9.54	9.54
Ø Degree	30°	30°	30°	30°	30°	30°	30°	30°
Concrete Volume (m^3)	67.16	101.51	112.86	137.66	195.76	198.81	221.81	200.91
Bearing Condition	Fix.	Fix.	Fix.	Fix.	Exp.	Exp.	Exp.	Exp.

RCDq-15-5	RCDq-15-7	PCq-30-7	PCq-30-9	PCSq-50-9
APUT=2 ... 7	ABUT=2 ... 7	APUT=2 [illegible]	APUT=2 [illegible]	APUT=2 [illegible]
IN	IN	IN	IN	IN
236.95	464.39	487.83	728.16	1013.61
236.95	464.39	487.83	728.16	1013.61
35.54	69.66	73.17	109.22	152.04
1.76	2.26	2.65	3.74	4.49
2.1	3.15	3.02	3.15	3.99
102.6	102.6	239.1	239.1	472.5
52.9	52.9	59.1	59.1	71.2
30.8	30.8	71.7	71.7	141.75
2.65	2.65	2.96	2.96	3.56
0.297	0.297	0.296	0.297	0.297
0.433	0.433	0.433	0.433	0.433
5.	7.	7.	9.	9.
3.6	5.6	5.	5.	7.2
1.25	1.25	1.65	1.9	2.65
3.	4.	4.5	6.5	7.5
0.55	0.55	0.55	0.55	0.55
9.54	9.54	9.54	9.54	9.54
30.	30.	30.	30.	30.
OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS
0.102369419	0.242227225	0.15557655	0.2703929	0.032065314
18.19452846	24.74558493	24.25462821	23.03892705	23.5972024
11.95034921	11.55520874	15.74403526	15.91901511	22.79201598
3.484294753	3.02191558	3.758313723	3.116991653	4.565184712
OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS
0.133654744	0.269057455	0.183712064	0.291504465	0.051278181
19.12045439	25.47775158	24.89815641	23.43545939	24.35114137
11.65442328	10.82604203	15.10050705	13.42245176	22.4337764
3.353399158	2.5597021	3.671811735	3.071958678	4.45596601
OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS	OUT-E,QT,GH,FS
7.235835406-01	1.081836244	1.075206041	1.232158692	1.263227204
32.72649344	46.74194624	46.04514692	36.19701289	43.55161849
1.260586131	1.221959507	1.326938216	1.218450908	1.421314654

ST-50 – 11 PCSG – 70 – 9 ST- 70-11

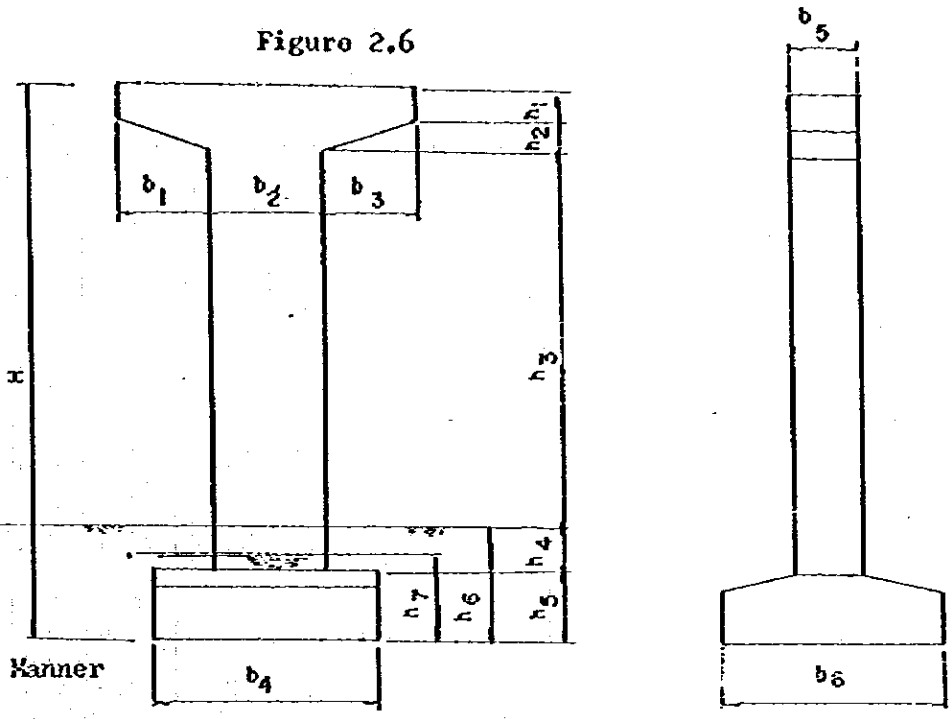
ABOT-2 IN		
	1010.96	
	1010.96	
	151.64	
	4.	
	4.74	
	258.8	
	71.2	
	38.82	
	3.56	
	0.237	
	0.433	
	11.	
	5.2	
	2.2	
	6.5	
	0.55	
	9.54	
	30.	
OUT-EIQI-GN-FS		
	0.113937454	
	26.91337222	
	21.8276261	
	2.818372574	
OUT-EIQI-GN-FS		
	0.138950365	
	27.43630554	
	21.24469281	
	2.784951774	
OUT-EIQI-GN-FS		
	1.18559869	
	47.01422102	
	1.219889762	

ABOT-2 IN		
	1101.31	
	1101.31	
	165.2	
	4.74	
	3.93	
	773.2	
	90.3	
	115.38	
	4.52	
	0.297	
	0.433	
	9.	
	6.7	
	2.7	
	8.	
	0.55	
	9.54	
	30.	
OUT-EIQI-GN-FS		
	0.232640773	
	32.02783968	
	22.51174183	
	5.676661644	
OUT-EIQI-GN-FS		
	0.252186903	
	32.42760365	
	22.11197773	
	5.552206123	
OUT-EIQI-GN-FS		
	1.115193692	
	46.97943019	
	4.165400329	
	1.287117261	

ABOT-2 IN		
	1069.05	
	1089.05	
	163.36	
	4.77	
	4.73	
	373.5	
	90.3	
	56.03	
	4.52	
	0.297	
	0.433	
	11.	
	5.2	
	2.2	
	7.5	
	0.55	
	9.54	
	30.	
OUT-EIQI-GN-FS		
	-0.073370163	
	22.66897384	
	25.48607568	
	3.213769472	
OUT-EIQI-GN-FS		
	-0.044515271	
	23.22489272	
	24.91015694	
	3.165253217	
OUT-EIQI-GN-FS		
	0.680289268	
	31.60929773	
	6.527076491	
	1.328013345	

2.2.2.2 Pier

Figure 2.6



(A) Design Manner

The stability calculation for pier will be provided the following design criteria:

(1) Unit Weight

concrete	2.4 t/m^3
sand	1.8

(2) Earthquake

The coefficient of seismic intensity for horizontal direction will be assumed as follow:

Kh = 0.15

(3) Line Load

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(4) Bearing Capacity of soil will be assumed as follow:

For Group I	30 t/m^2	40 t/m^2
For Group II	35 "	46 t/m^2
For Group III	45 to 50 t/m^2	60 t/m^2

(5) Safety factor for sliding

For Group I, III - - - - - - - - - - - - - - - 1.5

For Group VII - - - - - - - - - - - - - - - - 1.2

(B) CALCULATION OF THE CENTER OF GRAVITY

TABLE 2.5 (A) DIMENSION OF PIER

SPAN (M)	15		30				50			70		
T.O.S	RCDG	RCDG	PCG	PCG	PCG	PCG	PCSG	PCG	PCSG	PCSG	PCSG	PCSG
H	10	15	10	15	20	25	25	30	35	25	30	35
b1	3.00	3.00	2.75	2.75	2.75	2.75	2.25	2.25	2.25	2.00	2.00	2.00
b2	2.00	2.00	2.50	2.50	2.50	2.50	3.50	3.50	3.50	4.00	4.00	4.00
b3	3.00	3.00	2.75	2.75	2.75	2.75	2.25	2.25	2.25	2.00	2.00	2.00
b4	4.50	5.50	6.00	7.0	7.75	8.50	9.50	11.00	11.75	11.75	13.00	14.00
b5	1.40	1.40	1.50	1.50	1.50	1.50	1.80	1.80	1.80	2.50	2.50	2.50
b6	5.50	6.00	7.00	8.00	8.75	9.50	9.25	9.50	10.25	10.75	11.25	11.75
h1	0.80	0.80	0.80	0.80	0.80	0.80	1.00	1.00	1.00	1.00	1.00	1.00
h2	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70	0.70
h3	7.10	2.10	7.00	12.00	11.00	22.00	20.80	25.80	30.80	20.30	25.30	30.30
h4	.40	.40	.50	.50	.50	.50	.50	.50	.50	.50	.50	.50
h5	1.00	1.00	1.00	1.00	1.00	1.00	2.00	2.00	2.00	2.50	2.50	2.50
h6	2.40	2.40	2.50	2.50	2.50	2.50	3.50	3.50	3.50	4.00	4.00	4.00
h7	-	-	-	-	-	-	-	-	-	-	-	-
Kh	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15	.15

TABLE 2.5 (B) DIMENSION OF PIER (cont.)

SPAN (m)	50			70		
T.O.S.	S.T	S.T	S.T	S.T	S.T	S.T
H (M)	25	30	35	25	30	35
b1	2.25	2.25	2.25	2.25	2.25	2.25
b2	3.80	3.50	3.50	4.00	4.00	4.00
b3	2.25	2.25	2.25	2.25	2.25	2.25
b4	8.75	9.50	10.00	9.75	10.50	11.00
b5	1.70	1.70	1.70	1.90	1.90	1.90
b6	7.75	8.25	9.00	8.75	9.25	10.00
h1	1.00	1.00	1.00	1.00	1.00	1.00
h2	.70	.70	.70	.70	.70	.70
h3	21.30	26.30	31.30	20.80	25.80	30.80
h4	.50	.50	.50	.50	.50	.50
h5	1.50	1.50	1.50	2.00	2.00	2.00
h6	3.00	3.00	3.00	3.50	3.50	3.50
h7	-	-	-	-	-	-
Kh	.15	.15	.15	.15	.15	.15

RCD(E-15-10 | RCD(E-15-15 | PCG-30-10 | PCG-30-15 | PCG-30-20

PIER--1 IN	PIER--1 IN	PIER--1 IN	PIER--1 IN	PIER--1 IN
3.	3.	2.75	2.75	2.75
2.	2.	2.5	2.5	2.5
3.	3.	2.75	2.75	2.75
3.	4.5	5.	6.	7.5
4.	1.4	1.5	1.5	1.5
1.4	4.5	6.	7.	9.5
4.	0.8	0.8	0.8	0.8
0.8	0.7	0.7	0.7	0.7
0.7	12.1	7.	12.	17.
7.1	0.4	0.5	0.5	0.5
0.4	1.	1.	1.	1.
1.	2.4	2.5	2.5	2.5
2.4	0.	0.	0.	0.
0.	0.15	0.15	0.15	0.15
0.15	OUTPUT	OUTPUT	OUTPUT	OUTPUT
OUTPUT				
4.5	5.5	6.	7.	7.75
5.5	6.	7.	8.	8.75
OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT
208.074	265.888	329.22	453.57	565.56875
208.074	265.888	329.22	453.57	565.56875
31.2111	42.8832	49.383	68.0355	84.8345625
3.28835028	4.449315972	2.785551134	3.721422773	4.717569359
CONCRETE-VOL.	CONCRETE-VOL.	CONCRETE-VOL.	CONCRETE-VOL.	CONCRETE-VOL.
64.7	88.83	96.1125	132.7375	166.534375

PCG--20-25

PIER--1
IN
2.75
2.5
2.75
6.5
1.5
7.5
0.3
0.7
22.
0.5
1.
2.5
0.
0.15
OUT>X>X2>X3>Y
8.5
9.5
OUT>X>X2>X3>Y
693.97
693.97
102.5955
5.675571937
CONCRETE-VOL.
201.7375

PCSG-50-25

PIER--1
IN
2.25
3.5
2.25
6.
1.8
8.
1.
0.7
20.8
0.5
2.
3.5
0.
0.15
OUT>X>X2>X3>Y
9.5
9.25
OUT>X>X2>X3>Y
1061.7615
1061.7615
159.264225
6.088755269
CONCRETE-VOL.
354.67875

PCSG-50-30

PIER--1
IN
2.25
3.5
2.25
9.5
1.8
8.
1.
0.7
25.8
0.5
2.
3.5
0.
0.15
OUT>X>X2>X3>Y
11.
9.5
OUT>X>X2>X3>Y
1271.214
1271.214
190.6821
7.000613899
CONCRETE-VOL.
424.26

PCSG-50-35

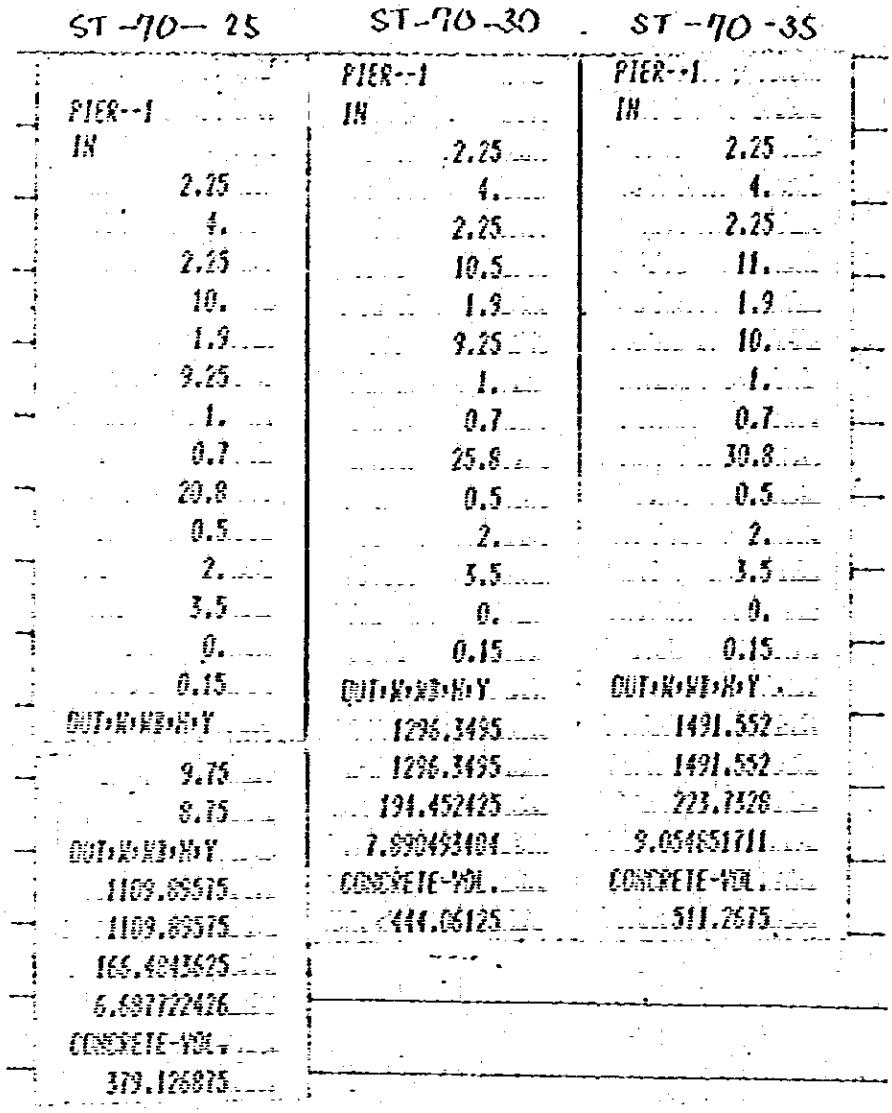
PIER--1
IN
2.25
3.5
2.25
12.
1.8
10.
1.
0.7
30.8
0.5
2.
3.5
0.
0.15
OUT>X>X2>X3>Y
11.75
10.25
OUT>X>X2>X3>Y
1475.50275
1475.50275
221.3254125
7.931735456
CONCRETE-VOL.
491.556875

PCSG-70-25

PIER--1
IN
2.
4.
2.
11.75
2.5
10.75
1.
0.7
20.3
0.5
2.5
4.
0.
0.15
OUT>X>X2>X3>Y
1709.29375
1709.29375
256.2440625
6.063324033
CONCRETE-VOL.
569.765625

PCSG-70-30 PCSG-70-35 ST-50-25 ST-50-30 ST-60-35

PIER--1	PIER--1	PIER--1	PIER--1	PIER--1
IN	IN	IN	IN	IN
2.	2.	2.25	2.25	2.25
4.	4.	3.5	3.5	3.5
2.	2.	2.25	2.25	2.25
13.	13.75	8.5	9.5	10.
2.5	2.5	1.7	1.7	1.7
11.25	11.75	8.	8.25	9.
1.	1.	1.	1.	1.
0.7	0.7	0.7	0.7	0.7
25.3	30.3	21.3	26.3	31.3
0.5	0.5	0.5	0.5	0.5
2.5	2.5	1.5	1.5	1.5
4.	4.	3.	3.	3.
0.	0.	0.	0.	0.
0.15	0.15	0.15	0.15	0.15
OUTPUT	OUTPUT	OUTPUT	OUTPUT	OUTPUT
2012.775	14.	6.75	949.9585	1101.216
2012.775	11.75	7.75	949.8565	1101.216
501.91625	OUTPUT	OUTPUT	142.479775	165.1824
7.043113353	2301.75	805.55375	8.275160827	9.461104433
CONCRETE-VOL.	2301.75	805.55375	CONCRETE-VOL.	CONCRETE-VOL.
693.9125	345.2625	120.6939625	318.12125	359.4225
	8.065022256	7.034447405		
	CONCRETE-VOL.	CONCRETE-VOL.		
	794.625	269.568125		


ST -70- 25
PIER--1
IN
2.25
4.
2.25
10.
1.9
9.25
1.
0.7
20.8
0.5
2.
3.5
0.
0.15
OUT>NO>NO>NOY
9.75
8.75
OUT>NO>NO>NOY
1109.69575
1109.69575
166.4843625
6.691722426
CONCRETE-VOL
379.126875
ST-70-30
PIER--1
IN
2.25
4.
2.25
10.5
1.9
9.25
1.
0.7
25.8
0.5
2.
3.5
0.
0.15
OUT>NO>NO>NOY
1296.3495
1296.3495
194.452425
7.990493404
CONCRETE-VOL
444.06125
ST -70 -35
PIER--1
IN
2.25
4.
2.25
11.
1.9
10.
1.
0.7
30.8
0.5
2.
3.5
0.
0.15
OUT>NO>NO>NOY
1491.552
1491.552
223.7328
9.054651711
CONCRETE-VOL
511.2675

(C) Stability Calculation

Tabje 2-6(A) INPUT DATA

SPAN	15		30				50			70		
T.O.S.	RCDG	RCDG	PCD	PCG	PCG	PCG	PCSG	PCSG	PCSG	PCSG	PCSC	PCSG
H	10	15	10	15	20	25	25	30	35	25	30	35
b1	4.50	5.50	6.00	7.00	7.75	8.50	9.50	11.00	11.75	17.75	13.00	14.00
b2	5.50	6.00	7.00	8.00	8.75	9.50	9.25	9.50	10.25	10.75	11.25	11.75
h1	10.00	15.00	10.00	15.00	20.00	25.00	25.00	30.00	35.00	25.00	30.00	35.00
h2	1.00	1.00	1.00	1.30	1.30	1.30	1.30	2.00	2.00	2.00	3.00	3.00
D	205.20	205.20	478.20	478.20	478.20	478.20	945.00	945.00	945.00	1546.40	1546.40	1546.40
L	105.80	105.80	118.20	118.20	118.20	118.20	142.40	142.40	142.40	180.60	180.60	180.60
IF	5.29	5.29	5.91	5.91	5.91	5.91	7.12	7.12	7.12	9.03	9.03	9.03
H1	46.17	46.17	107.60	107.60	107.60	107.60	141.75	141.75	141.75	231.96	231.96	231.96
H2	30.78	30.78	71.73	71.73	71.73	71.73	141.75	141.75	141.75	231.96	231.96	231.96
W	208.07	285.89	329.22	453.57	565.56	683.97	1061.76	1271.21	1475.50	1708.29	2021.78	2301.75

T. O. S.	RCDG	RCDG	PCG	PCG	PCG	PCG	PCSG	PCSG	PCSG	PCSG	PCSG	PCSG
WB	708.07	285.89	329.22	453.57	565.56	683.97	1061.76	1271.21	1475.50	1708.29	2012.78	2301.75
H	31.21	42.88	49.38	68.04	84.83	102.60	159.60	190.62	221.33	256.24	301.92	345.26
Y	3.30	4.45	2.79	3.72	4.71	5.67	6.09	7.00	7.93	6.06	7.04	8.07
Tan ϕB	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55	0.55
Concrete Volume	64.7	88.8	96.11	132.74	166.53	201.74	354.68	424.26	491.96	588.20	613.81	794.63
Bearing	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.	Exp.
Condition	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.

Table 2-6 (B) INPUT DATA

SPAN	50			70		
T.O.S.	S.T.	S.T.	S.T.	S.T.	S.T.	S.T.
H	25	30	35	25	30	35
b1	8.75	9.59	10.00	9.75	10.00	11.00
b2	7.75	8.25	9.00	8.75	9.25	10.00
h1	25.00	30.00	35.00	25.00	30.00	35.00
h2	3.50	3.50	3.50	4.50	4.50	4.50
D	517.60	517.60	517.60	747.00	747.00	747.00
L	142.40	142.40	142.40	180.60	180.60	180.60
LF	7.12	7.12	7.12	9.03	9.03	9.03
H1	77.64	77.64	77.64	112.05	112.05	112.05
H2	77.64	77.64	77.64	112.05	112.05	112.05
W	805.96	949.86	1101.22	1109.90	1296.35	1491.55
WB	805.96	949.86	1101.22	1109.90	1296.35	1491.55
H	120.89	142.48	165.18	166.48	194.45	223.73
Y	7.03	8.28	9.46	6.69	7.89	9.05
Tan ØB	.55	.55	.55	.55	.55	.55
Concrete Volume (m^3)	269.52	318.12	368.43	379.13	444.06	511.27
Bearing Condition	Fix.	Fix.	Fix.	Fix.	Fix.	Fix.

RCDG-15-10	RCDG-15-15	PCG-30-10	PCG-30-15	PCG-30-30	PCG-30-45
PIER--2	PIER--2	PIER--2	[illegible]-2	PIER--2	PIER--2
IN	IN	IN		IN	IN
4.5	5.5	6.	7.	7.75	8.5
5.5	6.	7.	8.	8.75	9.5
10.	15.	10.	15.	20.	25.
1.	1.	1.3	1.3	1.3	1.3
265.2	265.2	478.2	478.2	478.2	478.2
105.8	105.8	118.2	118.2	118.2	118.2
5.29	5.29	5.91	5.91	5.91	5.91
45.17	45.17	107.6	107.6	107.6	157.5
30.78	30.78	71.73	71.73	71.93	71.73
208.07	265.89	329.22	453.57	565.56	693.97
208.07	265.89	329.22	453.57	565.56	693.97
31.21	42.83	49.38	68.04	84.83	102.6
3.3	4.45	2.79	3.72	4.72	5.67
0.55	0.55	0.55	0.55	0.55	0.55

GROUP-1,LONGI.
OUT,Y,YB,HB,HT,E
Q1,Q2,FS

RCDG-15-10	RCDG-15-15	PCG-30-10	PCG-30-15	PCG-30-30	PCG-30-45
519.07	596.89	925.62	1049.97	1161.95	1280.37
519.07	596.89	925.62	1049.97	1161.95	1280.37
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
0.	0.	0.	0.	0.	0.
20.97252525	18.08757575	22.03657142	[illegible]45427	17.134934	15.65597523
20.97252525	18.08757575	22.03657142	[illegible]45427	17.134934	15.65597523
1000.	1000.	1000.	1000.	1000.	1000.

GROUP-7,LONGI.
OUT,Y,YB,HB,HT,E
Q1,Q2,FS

RCDG-15-10	RCDG-15-15	PCG-30-10	PCG-30-15	PCG-30-30	PCG-30-45
413.27	491.03	807.42	931.77	1043.76	1162.17
413.27	491.03	807.42	931.77	1043.76	1162.17
77.58	89.65	155.38	175.64	192.43	210.2
564.693	883.366	1213.7702	1861.1088	2552.3976	3271.742
1.35540211	1.759766373	1.503269321	2.003950129	2.445387445	2.815200374
44.25070724	49.55453282	44.93012554	44.45513444	45.53345417	47.11113779
0.	0.	0.	0.	0.	0.
2.937432153	3.033121241	2.92859177	2.917749373	2.583256245	3.040592492

GROUP-3,LONGI.
OUT,Y,YB,HB,HT,E
Q1,Q2,FS

RCDG-15-10	RCDG-15-15	PCG-30-10	PCG-30-15	PCG-30-30	PCG-30-45
519.07	596.89	925.62	1049.97	1161.96	1280.37
519.07	596.89	925.62	1049.97	1161.96	1280.37
5.29	5.29	5.91	5.91	5.91	5.91
52.9	79.35	59.1	88.65	118.2	147.75
1.019130567-01	1.373390674-01	6.324909574-02	[illegible]4490374-02	1.017245721-01	1.153863307-01
2[illegible]	20.49212119	23.24459286	[illegible]53741 03	18.33012242	17.01158872
1 [illegible]	15.63303029	20.83244597	[illegible]5013743	15.93955556	14.20036173
53.96750034	62.55550561	55.14363913	[illegible]71254415	108.1359253	119.1545555

GROUP-7,TRANS.
OUT,Y,YB,HB,HT,E
Q1,Q2,FS

RCDG-15-10	RCDG-15-15	PCG-30-10	PCG-30-15	PCG-30-30	PCG-30-45
413.27	491.03	807.42	931.77	1043.76	1162.17
413.27	491.03	807.42	931.77	1043.76	1162.17
61.99	73.66	121.11	139.77	156.76	174.33
441.573	635.236	543.3152	1472.3078	1932.5066	2469.241
1.068465493	1.391396507	1.174565451	1.526458031	1.85145559	2.125925555
42.39756564	40.16761743	42.12430555	39.3442355	39.3002249	38.35731235
0.	0.	0.	0.	0.	0.
3.666666241	3.66664089	3.666757453	3.666548515	3.662282163	3.666572018

PCSG-50-25

ER-2

9.5
9.25
25.
2.
945.
142.4
7.12
141.75
141.75
1051.76
051.76
159.25
6.05
0.55

[illegible]P-1,LONGI.	GROUP-7,LONGI.
[illegible]Y[illegible]HT,E	OUT,Y1,Y2,H,HT,E
[illegible]92 S	Q1,Q2,FS
2149.16	2036.76
149.16	2036.76
0.	301.01
0.	4513.5434
0.	2.249219358
24.4570128	59.27536392
24 4570128	0.
1000.	3.666715391

[illegible]P-3 LONGI.	GROUP-7,TRANS.
[illegible]Y2 H,HT,E	OUT,Y1,Y2,H,HT,E
[illegible]92,FS	Q1,Q2,FS
149.16	2036.76
149.16	2036.76
7.12	301.91
178.	4197.1434
.267205644-02	2.350491837
5.2[illegible]91843	61.23724557
3.1 [illegible]10714	0.
165.016573	3.666715391

PCSG-50-30

PIER--2
IN

11.
9.5
30.
2.
945.
142.4
7.12
141.75
141.75
1271.21
1271.21
190.69
7.
0.55

GROUP-1,LONGI.	GROUP-7,LONGI.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
2358.61	2216.21
2358.61	2216.21
0.	332.43
0.	5597.26
0.	2.521087803
22.57043652	60.26057673
22.57043652	0.
1000.	3.666583211

GROUP-3,LONGI.	GROUP-7,TRANS.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
2358.61	2216.21
2358.61	2216.21
7.12	332.43
213.6	5879.76
9.056181394-02	2.649309893
23.86139007	51.5506818
21.27347116	0.
182.1959911	3.666583211

PCSG-50-35

PIER--2
IN

11.75
10.25
35.
2.
945.
142.4
7.12
141.75
141.75
1475.5
1475.5
221.33
7.93
0.55

GROUP-1,LONGI.	GROUP-7,LONGI.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
2562.9	2420.5
2562.9	2420.5
0.	363.08
0.	6716.3393
0.	2.774797314
21.27591695	58.4346753
21.27551656	0.
1000.	3.666516172

GROUP-3,LONGI.	GROUP-7,TRANS.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
2562.9	2420.5
2562.9	2420.5
7.12	363.08
249.2	6959.8953
9.723350255-02	2.891921875
22.49111033	52.77454572
20.05972301	0.
197.9758258	3.666516172

PCSG-70-25

11.75
10.75
25.
3.
1545.4
120.5
5.03
231.55
231.55
1705.29
1705.29
255.24
6.65
0.55

[illegible]LONGI.	GROUP-7,LONGI.
[illegible]H,HT,E	OUT,Y1,Y2,H,HT,E
[illegible]FS	Q1,Q2,FS
3395.29	3254.69
3395.29	3254.69
0.	459.2
0.	7351.8144
0.	2.258837362
[illegible]525407	59.2558224
[illegible]525407	0.
1000.	3.666592553

[illegible]LONGI.	GROUP-7,TRANS.
[illegible]H,HT,E	OUT,Y1,Y2,H,HT,E
[illegible]S	Q1,Q2,FS
3395.29	3254.69
3395.29	3254.69
9.03	483.2
225.75	8047.6944
[illegible]357532-02	2.472645443
[illegible]425024	59.32359779
[illegible]3722059	0.
[illegible]255324	3.666592553

PCSG-70-30

PIER--2
IN

13.
11.25
30.
3.
1545.4
180.6
9.03
231.56
231.56
2012.78
2012.78
301.92
7.04
0.55

GROUP-1,LONGI.	GROUP-7,LONGI.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
3739.78	3559.18
3739.78	3559.18
0.	533.88
0.	9084.3158
0.	2.552347285
25.57114523	59.40239089
25.57114523	0.
1000.	3.666545062

GROUP-3,LONGI.	GROUP-7,TRANS.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
3739.78	3559.18
3739.78	3559.18
9.03	533.88
270.9	9780.1968
7.24374161-02	2.74787923
26.55924271	56.21204193
24.58324765	0.
227.7828349	3.666545062

PCSG-70-35

PIER--2
IN

14.
11.75
35.
3.
1545.4
180.6
9.03
231.95
231.95
2301.75
2301.75
345.26
8.07
0.55

GROUP-1,LONGI.	GROUP-7,LONGI.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
4028.75	3548.15
4028.75	3548.15
0.	577.22
0.	10934.8452
0.	2.833759735
24.49088145	60.25405205
24.49088145	0.
1000.	3.666492547

GROUP-3,LONGI.	GROUP-7,TRANS.
OUT,Y1,Y2,H,HT,E	OUT,Y1,Y2,H,HT,E
Q1,Q2,FS	Q1,Q2,FS
4028.75	3548.15
4028.75	3548.15
9.03	577.22
316.05	11603.7282
7.944655052-02	3.014524741
25.47155865	54.78593833
23.50980493	0.
245.383444	3.666492547

ST-50-25

PIER-2
IN
8.75
7.75
25.
3.5
317.6
142.4
7.12
77.64
77.64
805.96
805.96
120.89
7.03
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
1265.96	1123.56
1265.96	1123.56
0.	198.53
0.	2790.6567
0.	2.403945655
18.6653455	61.53913575
18.6653455	0.
1000.	3.11266911

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
1265.96	1123.56
1265.96	1123.56
7.12	198.53
178.	3262.5967
1.406047584-01	2.725797193
[illegible].7007034	58.60426774
16.63636558	0.
97.79165393	3.11266911

ST-50-30

PIER--2
IN
9.5
8.25
30.
3.5
517.6
142.4
7.12
77.64
77.64
949.86
949.86
142.48
8.28
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
1609.86	1467.46
1609.86	1467.46
0.	220.12
0.	3509.9344
0.	2.391161971
20.54047846	59.39103879
20.54047846	0.
1000.	3.66665093

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
1609.86	1467.46
1609.86	1467.46
7.12	220.12
213.6	3720.6744
0.132692345	2.57633898
22.5225576	54.55435257
18.55833923	0.
124.3511673	3.66665093

ST-50-35

PIER--2
IN
10.
9.
35.
3.5
517.6
142.4
7.12
77.64
77.64
1101.22
1101.22
165.18
9.45
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
1761.22	1619.92
1761.22	1619.92
0.	242.92
0.	4260.0078
0.	2.54580234
19.56911111	58.14422539
19.56911111	0.
1000.	3.66671157

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
1761.22	1619.92
1761.22	1619.92
7.12	242.92
249.2	4551.7425
1.414928288-01	2.51176555
21.41503702	54.79970414
17.72318518	0.
135.6492977	3.66671157

ST-70-25

-2
IN
9.75
8.75
25.
4.5
747.
180.6
9.03
112.05
112.05
1109.9
1109.9
166.48
6.59
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
2037.5	1656.9
2037.5	1656.9
0.	278.53
0.	3915.0012
0.	2.168353276
[illegible]22278387	56.01557576
[illegible]22278387	0.
1000.	3.666732433

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
2037.5	1656.9
2037.5	1656.9
9.03	278.53
225.75	4419.2262
[illegible]10727545	2.373591555
[illegible]19706335	56.10725099
[illegible]22227837	0.
[illegible].1002214	3.666732459

ST-70-30

PIER--2
IN
10.5
9.25
30.
4.5
747.
180.6
9.03
112.05
112.05
1296.35
1296.35
194.45
7.83
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
2223.55	2043.35
2223.55	2043.35
0.	306.5
0.	4555.7105
0.	2.395923605
22.89781209	58.20151187
22.89781209	0.
1000.	3.666656574

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
2223.55	2043.35
2223.55	2043.35
9.03	306.5
270.9	5359.9355
1.218102324-01	2.642687499
24.70701587	55.48266052
21.05860929	0.
135.4565337	3.666656574

ST-70-35

PIER--2
IN
11.
10.
35.
4.5
747.
180.6
9.03
112.05
112.05
1491.55
1491.55
223.73
9.05
0.55

GROUP-1,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS
2419.15	2238.55
2419.15	2238.55
0.	335.73
0.	5345.5085
0.	2.656409952
21.93227272	57.68566093
21.93227272	0.
1000.	3.666693566

GROUP-3,LONGI. OUT,Y,Y3,H,HT,E 01,02,FS	GROUP-7,TRANS. OUT,Y,Y3,H,HT,E 01,02,FS
2419.15	2238.55
2419.15	2238.55
9.03	335.73
316.05	6450.7315
1.306450612-01	2.881656206
23.71618179	56.55656557
20.26835362	0.
147.3451918	3.666693566

Table 2.9 shows the direct cost for substructure of bridge construction, referring to Laoag-Allacapan Road Project (Phase II). The detailed design of this project was completed on February 1981.

Table 2-9 SUMMARY OF UNIT PRICE : DIRECT COST

ITEM NO.	DESCRIPTION	UNIT	FINANCIAL COST ₱	REMARKS
106	Excavation	Cu.M	61.0	
405 (2)	Class A-1 Concrete (Abutment)	Cu.M	733.0	
405 (3)	Class A-1 Concrete (Pier)	Cu.M	845.0	
406	Reinforcing Steel	Kg.	6.43	

2.3.2 Estimate of Quantities

2.3.2.1 Abutment

Table 2-7 ESTIMATE OF QUANTITIES

DESCRIPTION	15.0		30.0		50.0		70.0	
	RCDG	RCDG	PCG	PCG	PCSG	ST	PCSG	ST
	5.00	7.00	7.00	9.00	9.00	11.00	9.00	11.00
Concrete (Cu.M)	67.2	101.5	112.9	137.6	195.8	198.8	221.8	200.9
Reinforcing Steel (Kg.)	5400	8100	9000	11000	15700	15900	17700	16100
Excavation (Cu.M)	63	103	118	162	200	176	229	216

The weight of reinforcing steel was assumed as 80 kg. per cubic meter of concrete volume. Excavation volume was assumed to be footing area plus 0.45 meters on each in width and length of base multiplied by depth of footing plus one meter.

Table 2.8 Estimate of Quantities

SPAN (M) / T.O.S / H (M) / DESCRIPTION	15.0		30				50		
	RCDG	RCDG	PCG	PCG	PCG	PCG	PCSG	PCSG	PCSG
	10	15	10	15	20	25	25	30	35
Concrete (Cu.M)	64.7	88.9	96.1	132.7	166.5	201.7	354.7	424.3	492.0
Reinforcing Steel (Kg.)	5800	8000	8600	11900	15000	18200	31900	38200	44300
Excavation (Cu.M)	83	106	136	176	209	244	369	433	494
SPAN (M) / T.O.S / H (m) / DESCRIPTION	70			50			70		
	PCSG	PCSG	PCSG	ST	ST	ST	ST	ST	ST
	25	30	35	25	30	35	25	30	35
Concrete (Cu.M)	588.2	693.8	794.6	269.6	318.1	368.4	379.7	444.1	511.3
Reinforcing Steel (Kg.)	52900	62400	71500	24300	28700	33200	34100	40000	46000
Excavation (Cu.M)	589	676	756	250	285	324	360	405	454

The weight of reinforcing steel was assumed as 90 kg. per cubic meter of concrete volume. Excavation volume was assumed to be footing area plus .45 meters on each in width and length of base multiplied by the depth of footing plus one meter.

2.3.3 Construction Cost

2.3.3 Abutment

Table 2.9 (A) Construction Cost for Abutment

DESCRIPTION	UNIT	UNIT PRICE P	RCDG-15-5		RCDG-15-7	
			QUANTITIES	AMOUNT x 1000 P	QUANTITIES	AMOUNT x 1000 P
Excavation	Cu.M	61.0	63	3.84	103	6.28
Concrete for Abutment	Cu.M	733.0	67	49.11	102	74.77
Reinforcing Steel	Kg.	6.43	5400	34.72	8100	52.08
T O T A L				87.67		133.13

Table 2.9 (B) Construction Cost for Abutment

DESCRIPTION	UNIT	UNIT PRICE P	PCG-30-7		RCDG-30-9	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	118	7.20	162	9.88
Concrete for Abutment	Cu.M	733.0	113	82.83	138	101.15
Reinforcing Steel	Kg.	6.43	9000	57.97	11000	70.73
TOTAL				147.90		181.76

Table 2.9 (C) Construction Cost for Abutment

DESCRIPTION	UNIT	UNIT PRICE P	PCSG-50-9		ST-50-11	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	200	12.20	176	10.74
Concrete for Abutment	Cu.M	733.0	196	143.67	199	145.87
Reinforcing Steel	Kg.	6.43	15700	100.95	15900	102.24
TOTAL				256.82		258.85

Table 2.9 (D) Construction Cost for Abutment

DISCRIPTION	UNIT	UNIT PRICE (P	PCSC - 70-9		ST-70-11	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	229	13.97	216	13.18
Concrete for Abutment	Cu.M	733.0	222	162.73	201	147.33
Reinforcing Steal	Kg.	6.43	17700	113.81	16100	103.52
TOTAL				290.51		264.03

2.3.2 Pier

Table 2.10 (A) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	RCDG-15-10		RCDG-15-15	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M.	61.0	83	5.06	106	6.47
Concrete for Pier	Cu.M.	845.0	65	54.93	89	75.21
Reinforcing Steel	Kg.	6.43	5800	37.29	8000	51.44
				97.28		133.12

Table 2.10 (B) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	PCG-30-10		PCG-30-15	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	136	8.30	176	10.74
Concrete for Pier	Cu.M	845.0	96	81.12	133	112.39
Reinforcing Steel	Kg.	6.43	8600	55.30	11900	76.52
TOTAL				144.72		199.65

Table 2.10 (C) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	PCG-30-20		PCG-30-25	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	209	12.75	244	14.88
Concrete for Pier	Cu.M	845.0	167	141.12	202	170.69
Reinforcing Steel	Kg.	6.43	15000	96.45	18200	117.03
TOTAL				250.32		302.60

Table 2.10 (D) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	RCSG-50-25		RCSG-50-30	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	369	22.50	433	26.41
Concrete for Pier	Cu.M	845.0	355	299.98	424	358.28
Reinforcing Steel	Kg.	6.43	31900	205.12	38230	245.63
TOTAL				527.60		630.32

Table 2.10 (E) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	RCSG-50-35		RCSG-70-25	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	494	30.13	589	35.93
Concrete for Pier	Cu.M	845.0	492	415.74	588	496.86
Reinforcing Steel	Kg.	6.43	44300	284.85	52900	340.15
TOTAL				730.72		872.94

Table 2.10 (F) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	RCSG-70-30		RCSG-70-35	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	676	41.24	754	44.99
Concrete for Pier	Cu.M	845.0	694	586.43	795	671.78
Reinforcing Steel	Kg.	6.43	62400	401.23	71500	459.75
TOTAL				1028.90		1177.52

Table 2.10 (G) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P)	ST-50-25		ST-50-30	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	250	15.25	285	17.39
Concrete for Pier	Cu.M	845.0	270	228.15	318	268.71
Reinforcing Steel	Kg.	6.43	24300	156.25	28700	184.54
TOTAL				399.65		470.64

Table 2.10 (H) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P	ST-50-35		ST-70-25	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	324	19.76	360	21.96
Concrete for Pier	Cu.M	845.0	368	310.96	379	320.26
Reinforcing Steel	Kg.	6.43	33200	213.48	34100	219.26
TOTAL				544.20		561.68

Table 2.10 (I) Construction Cost for Pier

DISCRIPTION	UNIT	UNIT PRICE (P	ST-70-30		ST-70-35	
			QUANTITIES	AMOUNT X 1000 P	QUANTITIES	AMOUNT X 1000 P
Excavation	Cu.M	61.0	405	24.71	654	27.69
Concrete for Pier	Cu.M	845.0	444	375.18	511	431.89
Reinforcing Steel	Kg.	6.43	40000	257.20	46000	295.78
TOTAL				657.09		755.2

Figure 27 CONSTRUCTION COST FOR ABUTMENT

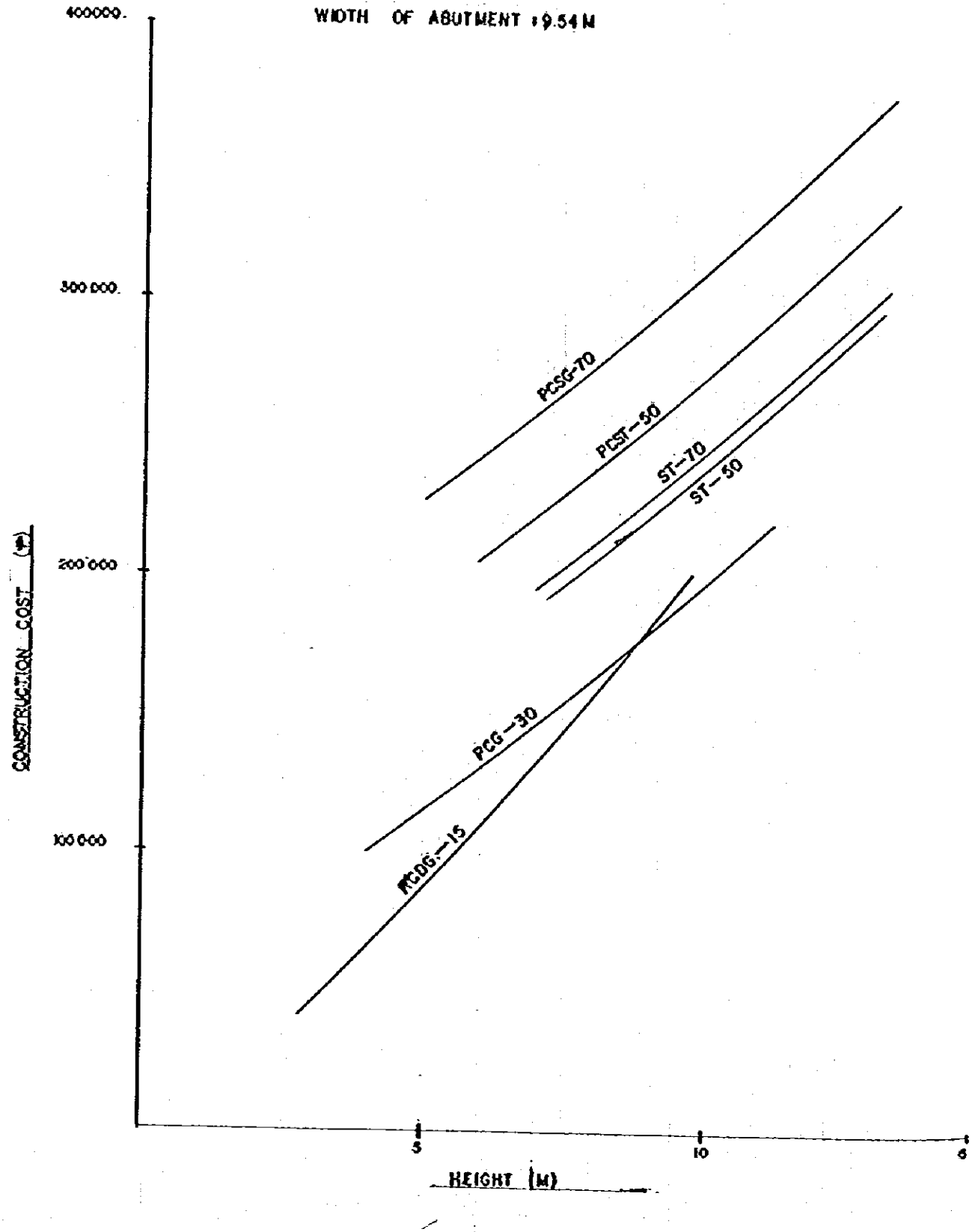
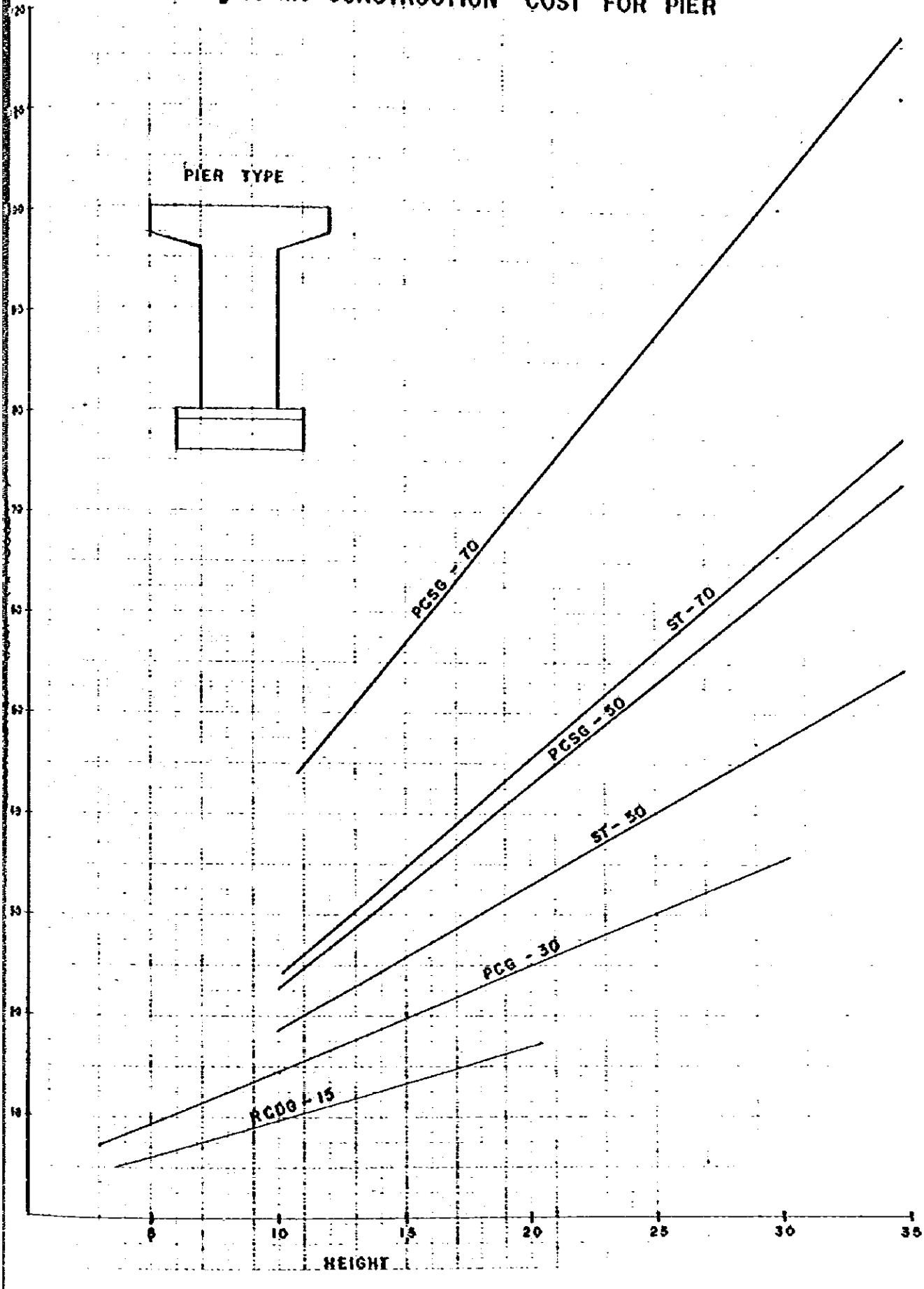
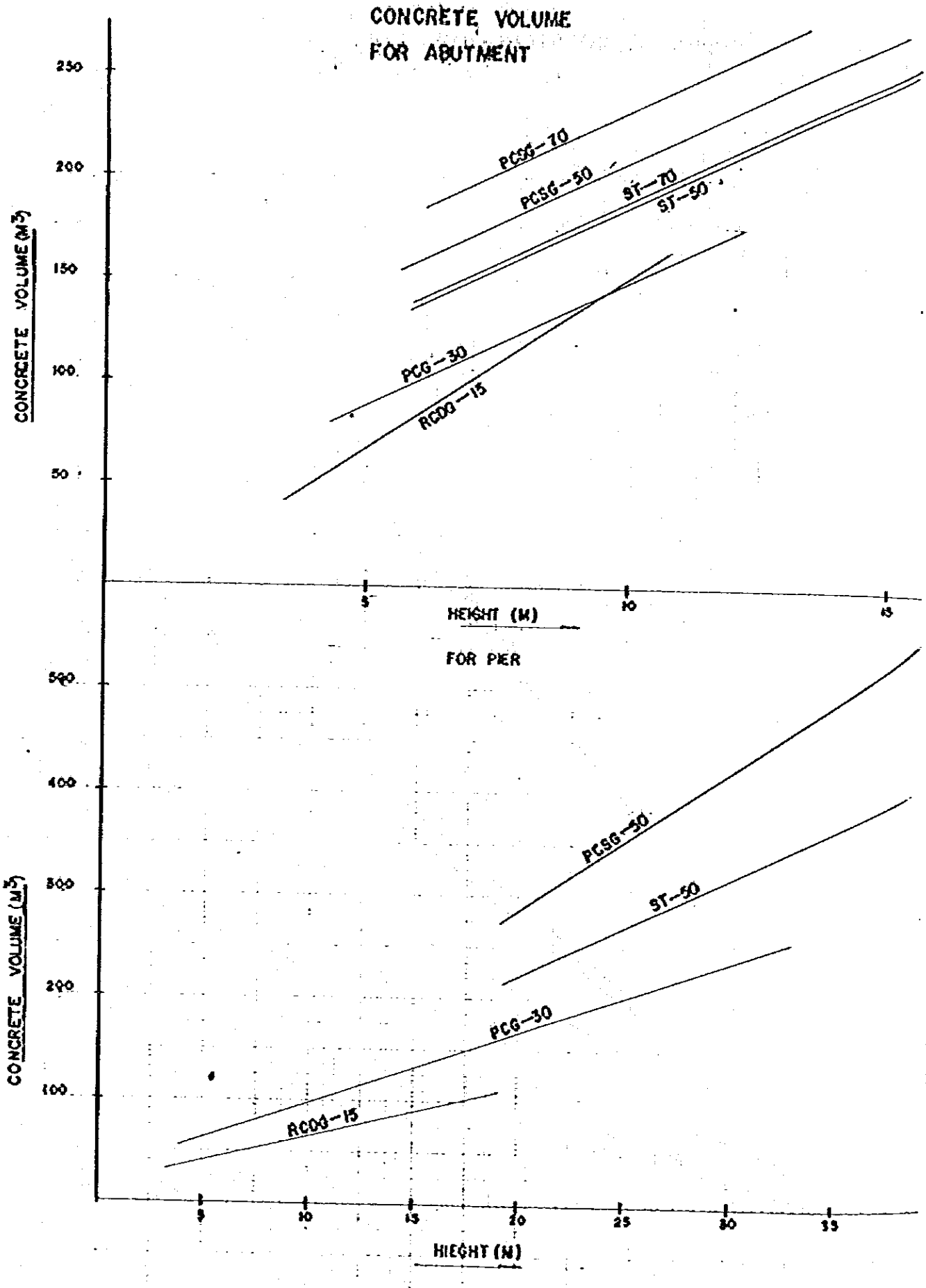


Figure 2.8 CONSTRUCTION COST FOR PIER




CONCRETE VOLUME
FOR ABUTMENT
CONCRETE VOLUME (M³)
250
200
150
100
50
PCSG-70
PCSG-50
ST-70
ST-50
PCG-30
RCDG-15
5
10
15
HEIGHT (M)
FOR PIER
CONCRETE VOLUME (M³)
500
400
300
200
100
PCSG-50
ST-50
PCG-30
RCDG-15
5
10
15
20
25
30
35
HIEGHT (M)

CONSTRUCTION COST FOR THE PIER WITH SHISHO & SHISHO PILE

1. PIER WITH SHIMSO

2. DIMENSION OF PIER

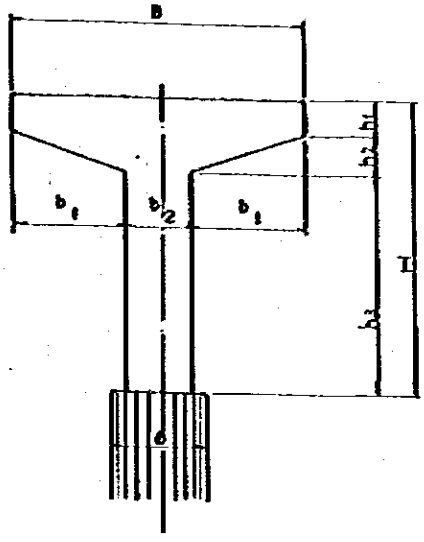


Table DIMENSION OF PIER

	H = 5.0	H = 10.0	H = 15.0	H = 20.0	H = 10.0	H = 15.0	H = 20.0	H = 25.0
B (M.)	8.0	8.0	8.0	8.0	8.0	8.0	8.0	8.0
b_1 (M.)	3.0	3.0	3.0	3.0	2.75	2.75	2.75	2.75
b_2 (M.)	2.0	2.0	2.0	2.0	2.5	2.5	2.5	2.5
H (M.)	5.0	10.0	15.0	20.0	10.0	15.0	20.0	25.0
h_1 (M.)	1.0	1.0	1.0	1.0	1.25	1.25	1.25	1.25
h_2 (M.)	1.25	1.25	1.25	1.25	1.25	1.25	1.25	1.25
h_3 (M.)	2.75	7.75	12.75	17.75	7.50	12.50	17.50	22.50
C.V (M.)	39.50	59.50	79.50	99.50	88.28	119.53	150.78	182.03

2. SHINSO PILE

The following table shows the construction cost of shinso pile for a diameter of 2 meters and a length of 37 meters.

DESCRIPTION	UNIT	CONSTRUCTION COST
CONCRETE	CuM	114541.86
REINFORCING STEEL	Kg	48557.43
STRUCTURAL STEEL	Kg	361000.00
EXCAVATION (COMMON)	CuM	2492.94
EXCAVATION (ROCK)	CuM	7200.86
TOTAL	P	533793.09

CONSTRUCTION COST PER ONE CUBIC METERS

$$\frac{533\,793.09}{37 \times \frac{\pi \times 2.0^2}{4}} = 4592 \text{ P/M}^3$$

CONSTRUCTION COST PER EACH DIAMETER

FOR 3.0 DIAMETERS = $4592 \times \frac{\pi \times 3.0^2}{4} = 32500$ P/M

FOR 3.6 DIAMETERS = $4592 \frac{\pi \times 3.6^2}{4} = 46700$ P/M

1.2 ESTIMATE OF QUANTITIES

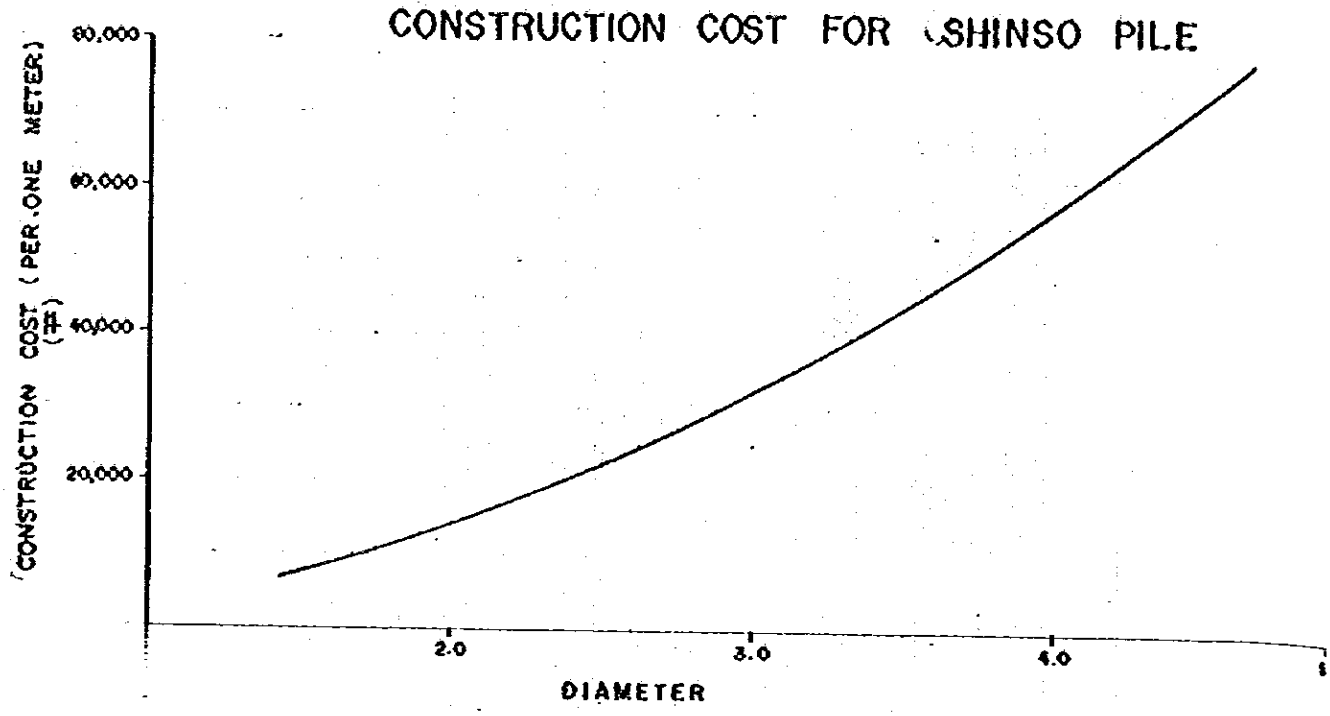
DESCRIPTION	UNIT	H = 5.0	H = 10.0	H = 15.0	H = 20.0	H = 10.0	H = 15.0	H = 20.0	H = 25.0
CONCRETE	Cu. M.	39.50	59.50	79.50	99.50	88.28	119.53	150.78	182.03
REINFORCING STEEL . BAR	Kg.	4150	6580	9140	11960	10150	14340	18850	23660

1.3 CONSTRUCTION COST

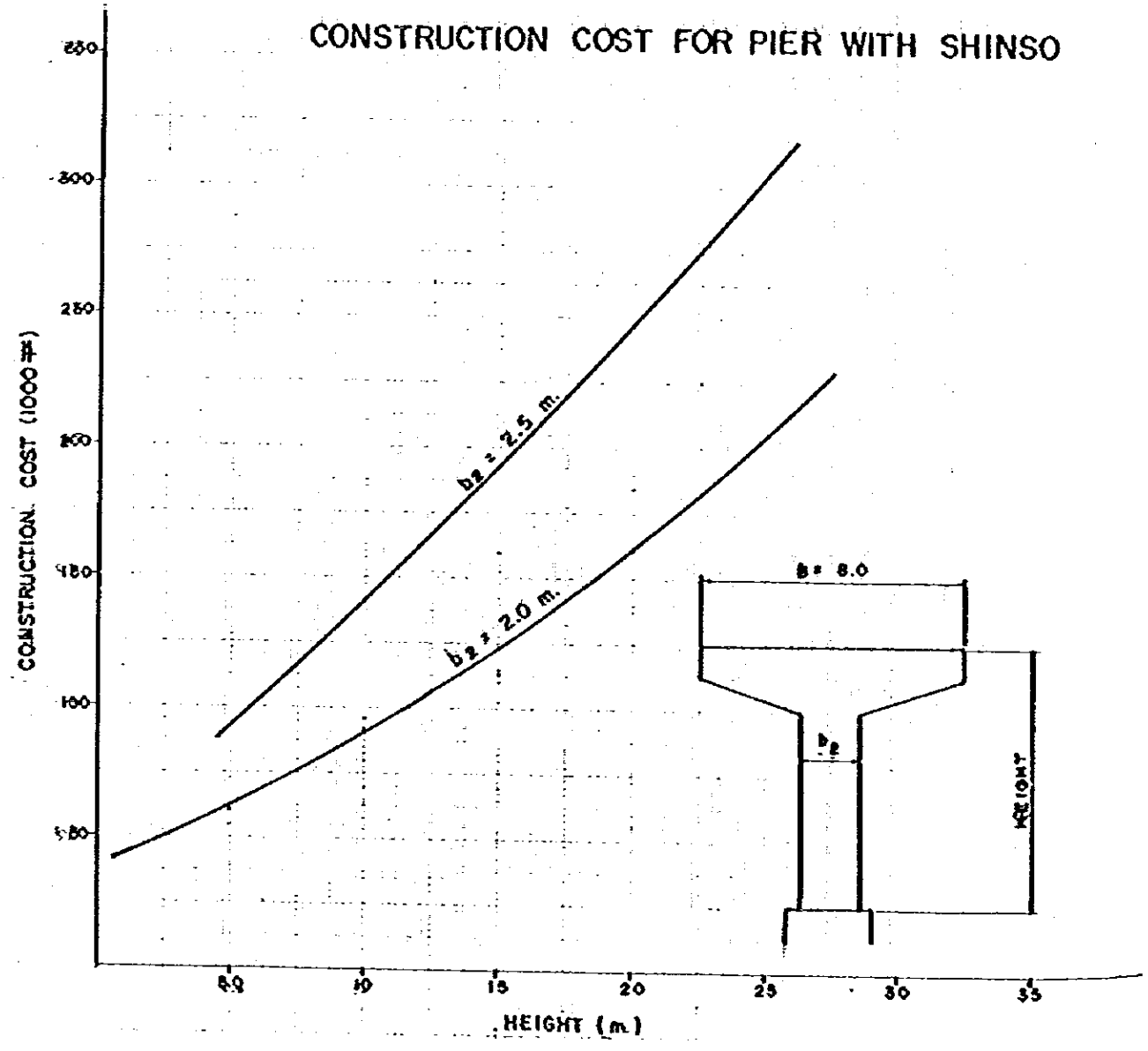
(UNIT 1000 ₱)

DESCRIPTION	UNIT COST	H = 5.0	H = 10.0	H = 15.0	H = 20.0	H = 10.0	H = 15.0	H = 20.0	H = 25.0
CONCRETE	845 ₱/m^3	33.4	50.3	67.1	84.1	74.6	101.0	127.4	153.8
REINFORCING STEEL BAR	6.43 ₱/Kg	26.7	42.1	58.8	76.8	65.3	92.2	121.2	152.1
TOTAL		60.1	92.4	125.9	160.9	139.9	193.2	248.6	305.9

CONSTRUCTION COST FOR SHINSO PILE



CONSTRUCTION COST FOR PIER WITH SHINSO



CONSTRUCTION COST

FOR

RETAINING WALL

[Inverted-T Type
Gravity Type
Stone Masonry]

Inverted Type

Stability Calculation

The dimension of each height of the Retaining Walls are assumed as follows:

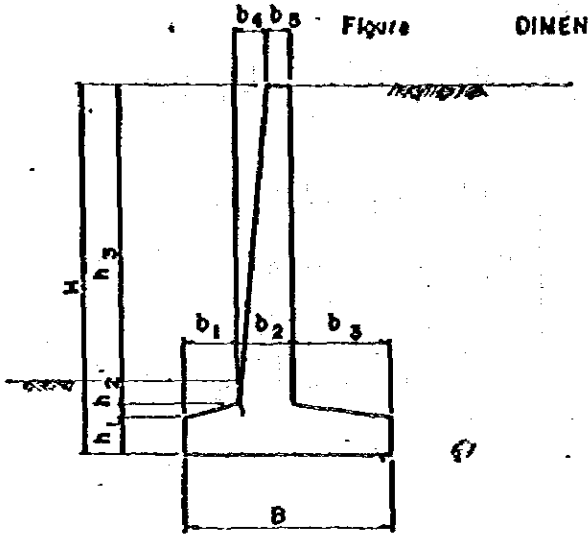


Figure DIMENSION OF RETAINING WALL

Table ASSUMED DIMENSION OF THE RETAINING WALL

TYPE	I_M - 3.0	I_M - 4.0	I_M - 5.0	I_M - 6.0	I_M - 7.0
H	3.000	4.000	5.000	6.000	7.000
h_1	0.400	0.450	0.500	0.500	0.550
h_2	0.150	0.150	0.150	0.200	0.200
h_3	2.450	3.400	4.350	5.300	6.250
B	2.000	2.700	3.500	4.250	5.000
b_1	0.400	0.550	0.700	0.850	1.000
b_2	0.550	0.600	0.650	0.700	0.750
b_3	1.050	1.550	2.150	2.700	3.250
b_4	0.245	0.340	0.435	0.530	0.625
b_5	0.350	0.350	0.350	0.350	0.350

Calculation of the Center of Gravity

The following table shows the computerized calculation of the height of retaining walls.

Stability Calculation

Table INPUT DATA

TYPE	H - 3.00	H - 4.00	H - 5.00	H - 6.00	H - 7.00
W (t)	9.85	17.04	27.13	38.86	52.77
X_0 (M)	1.18	1.63	2.12	2.60	3.08
Y_0 (M)	1.20	1.69	2.22	2.73	3.24
H (M)	3.00	4.00	5.00	6.00	7.00
ΔH (M)	0	0	0	0	0
B (M)	2.00	2.70	3.50	4.25	5.00
K_4	0.297	0.297	0.297	0.297	0.297
K_{EA}	0.403	0.403	0.403	0.403	0.403
ϕ	30	30	30	30	30
Tan ϕ_3	0.55	0.55	0.55	0.55	0.55
K_h	0.15	0.15	0.15	0.15	0.15
Concrete Volume (m^3)	2.09	3.08	4.24	5.40	6.76

The allowable value will be assumed as fdllows:

Bearing capacity of Soil

For Group I - - - - - - - - 20 t/m^2

For Group VII - - - - - - - 30 t/m^2

Safety factor Against Sliding

For Group I - - - - - - - - 1.5

For Group VII - - - - - - - 1.2

OUT PUT DATA

RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)
9.85	17.04	27.13	38.86	52.72
1.18	1.63	2.12	2.66	3.08
1.2	1.69	2.22	2.73	3.24
3.	4.	5.	6.	7.
0.	0.	0.	0.	0.
2.	2.2	3.5	4.25	5.
0.297	0.297	0.297	0.297	0.297
0.403	0.403	0.403	0.403	0.403
30.	30.	30.	30.	30.
0.55	0.55	0.55	0.55	0.55
0.15	0.15	0.15	0.15	0.15
GROUP-1	GROUP-1	GROUP-1	GROUP-1	GROUP-1
Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²
11.119675	19.2972	30.656935	43.9587	59.6926625
2.199141609	3.909585092	6.108726692	8.796566456	11.97310431
14.16235	33.66984	69.65966625	124.9560075	197.0749375
2.199141609	5.212780108	10.18121114	17.59313267	27.93724338
E+01+02+FS	E+01+02+FS	E+01+02+FS	E+01+02+FS	E+01+02+FS
-0.075859536	-0.135026837	-0.196558012	-0.318560029	-0.334263353
4.234537421	5.00255154	5.806166689	5.691584533	7.14928442
6.925137578	9.291670676	11.71204258	14.98548064	16.72470557
2.781003835	2.714727526	2.760159716	2.747240662	2.741600202
GROUP-2	GROUP-2	GROUP-2	GROUP-2	GROUP-2
Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²	Y=A+BX+CX²
10.74179984	18.62542194	29.60722178	42.42719953	57.62535459
4.605742323	8.472815241	13.31461756	19.14196923	26.03593842
13.40659968	32.05883924	66.16597624	118.5291973	196.9083734
5.101242323	12.20880498	24.44781926	42.55910658	67.9272243
E+01+02+FS	E+01+02+FS	E+01+02+FS	E+01+02+FS	E+01+02+FS
2.268168311-01	0.284411671	0.340105574	0.333953458	0.436999765
5.925563643	11.25821172	13.39124596	14.69943152	17.56680796
1.716236196	2.538397116	3.527166472	5.276309351	5.491333899
1.229360525	1.209032561	1.223014622	1.215046969	1.213115631

CONSTRUCTION COST

ESTIMATE OF QUANTITIES (per one meter)

DESCRIPTION	UNIT	R_w- 3.0	R_w- 4.0	R_w- 5.0	R_w- 6.0	R_w- 7.0
CONCRETE	Cu.M	2.09	3.08	6.24	5.40	6.76
REINFORCING STEEL	Kg	1.70	2.50	3.40	4.30	5.40
EXCAVATION	Cu.M	4.50	5.76	7.26	8.76	10.33

The reinforcing steel bar is assumed at 80 kg. per unit in a concrete volume.

CONSTRUCTION COST

DESCRIPTION	UNIT COST	R_w- 3.0	R_w- 4.0	R_w- 5.0	R_w- 6.0	R_w- 7.0
CONCRETE	733P/M^3	1532	2258	3108	3958	4955
REINFORCING STEEL	6.43P/Kg	1093	1608	2186	2765	3472
EXCAVATION	61.0P/M^3	275	351	443	534	630
TOTAL	----	2900	4217	5737	7257	9057

Gravity Type

Stability Calculation

The dimension of the gravity type each height are assumed as follows

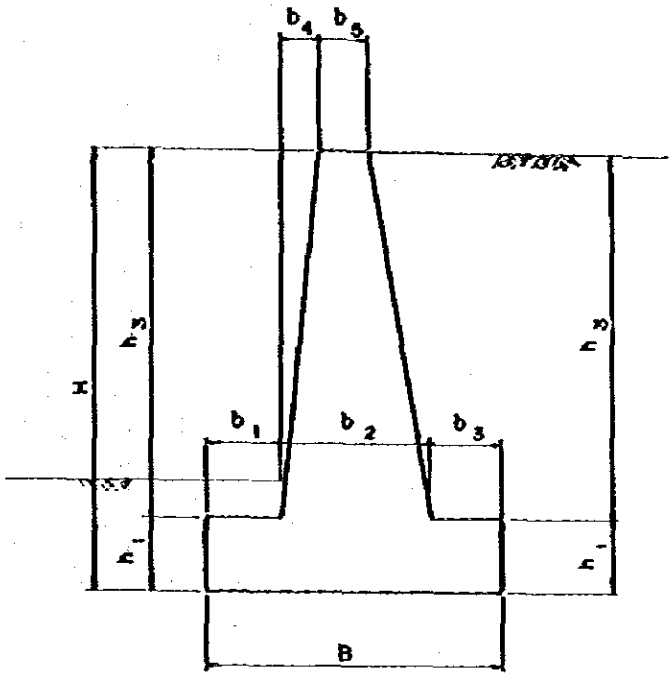


Table ASSUMED DIMENSION OF THE GRAVITY TYPE

T Y P E	G_H = 1.0	G_H = 2.0	G_H = 3.0	G_H = 4.0	G_H = 5.0
H	1.00	2.00	3.00	4.00	5.00
h_1	0.30	0.35	0.40	0.45	0.50
h_2	0	0	0	0	0
h_3	0.70	1.65	2.60	3.55	4.50
B	0.55	0.95	1.65	2.30	3.00
b_1	0.05	0.05	0.25	0.40	0.50
b_2	0.50	0.850	1.15	1.45	1.700
b_3	.0	0.05	0.25	0.45	0.60
b_4	0.07	0.165	0.26	0.355	0.45
b_5	0.35	0.35	0.35	0.35	0.35

Calculation of the Center of Gravity

The following table shows the computerized calculation of the height of gravity wall.

Stability Calculation

Table INPUT DATA

TYPE	G_H - 1.00	G_H - 2.00	G_H - 3.00	G_H - 4.00	G_H - 5.00
W (t)	1.22	4.38	10.17	18.21	29.21
X_o (M)	0.29	0.45	0.83	1.16	1.55
Y_o (M)	0.18	0.17	0.46	0.70	1.07
H (M)	1.00	2.00	3.00	4.00	5.00
$_sH$ (M)	0	0	0	0	0
B (M)	0.55	0.95	1.65	2.30	3.00
K_A	0.297	0.297	0.297	0.297	0.297
K_{EA}	0.403	0.403	0.403	0.403	0.403
ϕ	30°	30°	30°	30°	30°
Tan ϕ_3	0.55	0.55	0.55	0.55	0.55
K_h	0.15	0.15	0.15	0.15	0.15
CONCRETE VOL.	0.46	1.32	2.61	4.23	6.11

The allowable value will be assumed as follows:

Bearing Capacity of Soil

For Group I - - - - - - 20 t/m^2

For Group VII - - - - - 30 t/m^2

Safety Factor Against Sliding

For Group I - - - - - - - 1.5

For Group VII - - - - - 1.2

RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)	RETAINING -WALL(2)
1.22	4.38	10.17	18.21	29.21
0.29	0.45	0.83	1.16	1.55
0.18	0.17	0.46	0.7	1.07
1.	2.	3.	4.	5.
0.	0.	0.	0.	0.
0.55	0.55	1.65	2.3	3.
0.297	0.297	0.297	0.297	0.297
0.403	0.403	0.403	0.403	0.403
30.	30.	30.	30.	30.
0.55	0.55	0.55	0.55	0.55
0.15	0.15	0.15	0.15	0.15
GROUP-1	GROUP-1	GROUP-1	GROUP-1	GROUP-1
V>H>WX>WY	V>H>WX>WY	V>H>WX>WY	V>H>WX>WY	V>H>WX>WY
1.361075	4.9443	11.439575	20.4672	32.736975
2.443490676-01	9.773962707-01	2.199141609	3.906555082	6.108726592
0.43139125	2.507065	10.53606375	26.31516	55.856125
8.144968919-02	6.515975132-01	2.199141609	5.212760108	10.18121114
E>01>02>FS	E>01>02>FS	E>01>02>FS	E>01>02>FS	E>01>02>FS
1.76932566-02	9.97219048-02	9.622735083-02	0.118965561	-0.104786992
2.957737635	8.402454386	9.359163326	11.66043406	15.19922409
1.991623998	1.926598242	4.507109393	6.137081152	8.625359222
3.063614104	2.702254323	2.861035062	2.879123448	2.947468786
GROUP-7	GROUP-7	GROUP-7	GROUP-7	GROUP-7
V>H>WX>WY	V>H>WX>WY	V>H>WX>WY	V>H>WX>WY	V>H>WX>WY
1.319088971	4.776355485	11.06179984	19.73542134	31.69722178
5.528047025-01	2.13621881	4.853742323	8.648375241	13.62661756
4.002989792-01	2.347537711	9.91256924	24.77081046	52.70716535
1.562092341-01	1.097835873	4.029972323	9.801215986	20.09673426
E>01>02>FS	E>01>02>FS	E>01>02>FS	E>01>02>FS	E>01>02>FS
8.38503253-02	2.133566101-01	2.952061236-01	3.939224598-01	0.476564934
4.593226579	3.16421693	7.374533226	13.19694796	20.50934165
0.2034562222	1.2[illegible]0241	1.25346372	1.2[illegible]491	6.154726652-01
1.312396358				1.2[illegible]531

CONSTRUCTION COST

ESTIMATE OF QUANTITIES (per one meter)

DESCRIPTION	UNIT	G_H= 1.0	G_H= 2.0	G_H= 3.0	G_H= 4.0	G_H= 5.0
CONCRETE	Cu.M	0.46	1.32	2.61	4.23	6.11
EXCAVATION	Cu.M	0.51	1.57	2.30	3.04	3.90

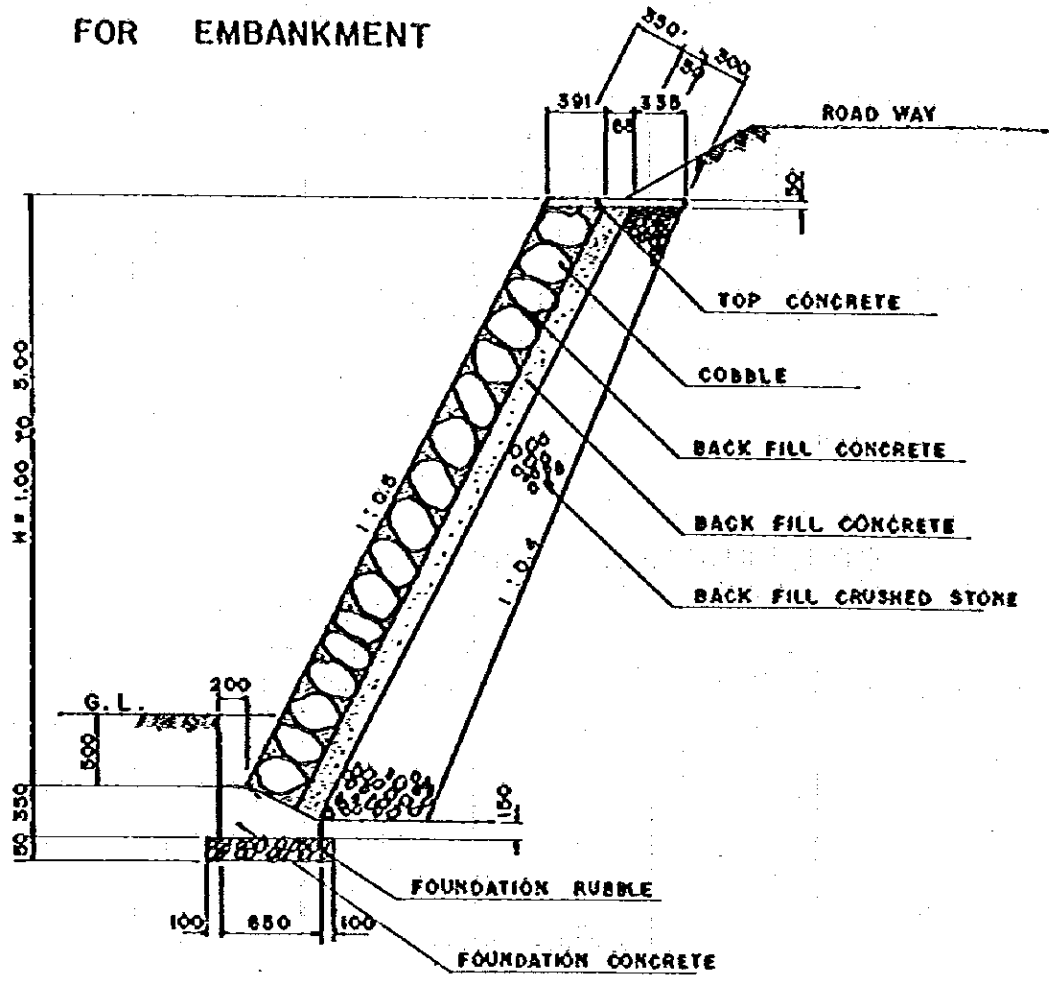
CONSTRUCTION COST

DESCRIPTION	UNIT COST	G_H= 1.0	G_H= 2.0	G_H= 3.0	G_H = 4.0	G_H= 5.0
CONCRETE	733 P/M^3	337	768	1913	3101	4479
EXCAVATION	61 P/M^3	31	96	140	185	238
TOTAL (₱)		368	864	2053	3241	4717

STONE MASONRY

TYPICAL CROSS SECTION

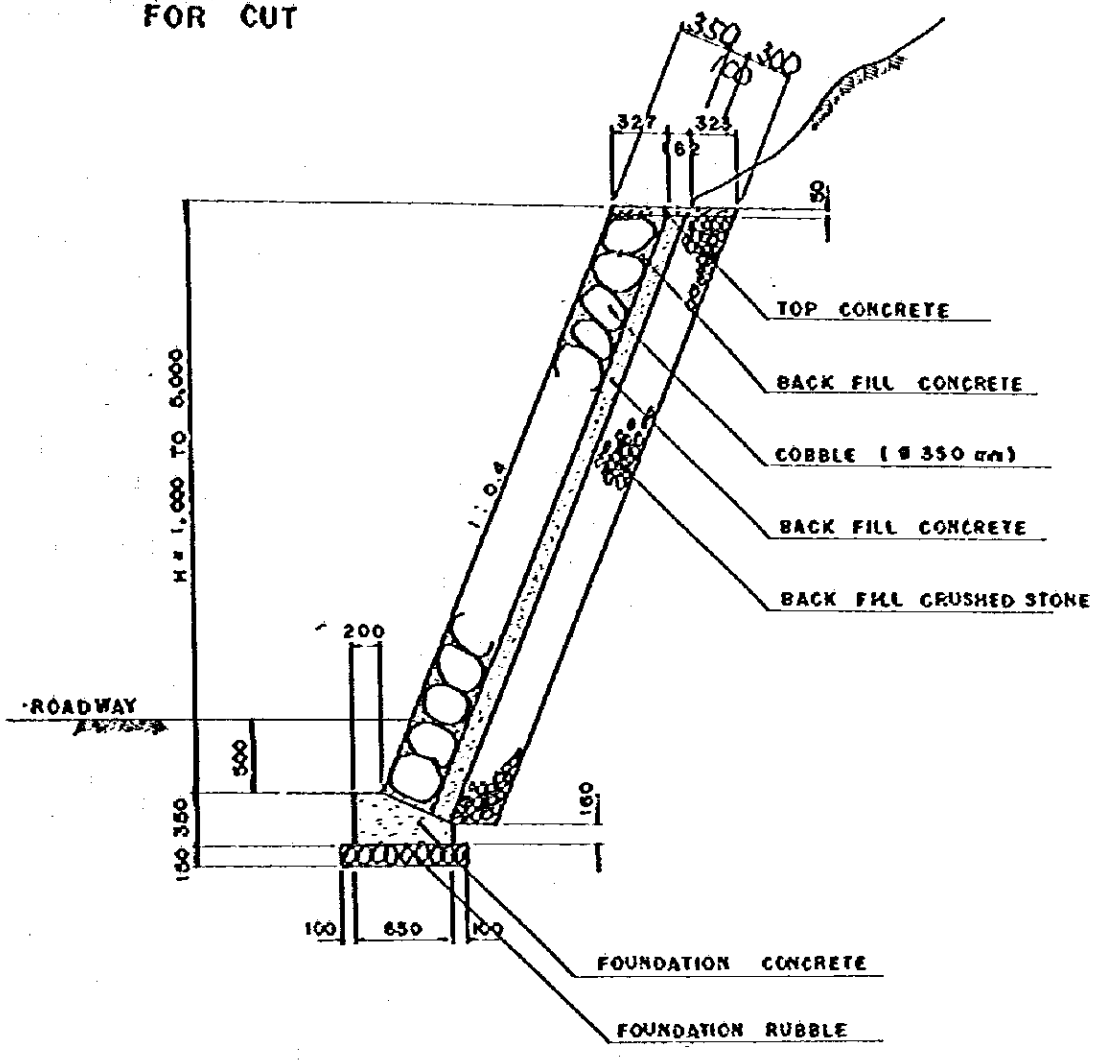
FOR EMBANKMENT



ESTIMATES OF QUANTITIES

DESCRIPTION	UNIT	H = 1.0	H = 2.0	H = 3.0	H = 4.0	H = 5.0
COBBLE (ø 350 mm)	Sq.M	10.62	21.80	32.98	44.16	55.34
BACK FILL CONCRETE	Cu.M	4.32	7.96	11.60	15.24	18.87
FOUNDATION CONCRETE	Cu.M	1.83	1.83	1.83	1.83	1.83
BACK FILL CRUSHED STONE	Cu.M	4.50	9.55	15.59	22.62	30.64
FOUNDATION RUBBLE	Cu.M	1.28	1.28	1.28	1.28	1.28

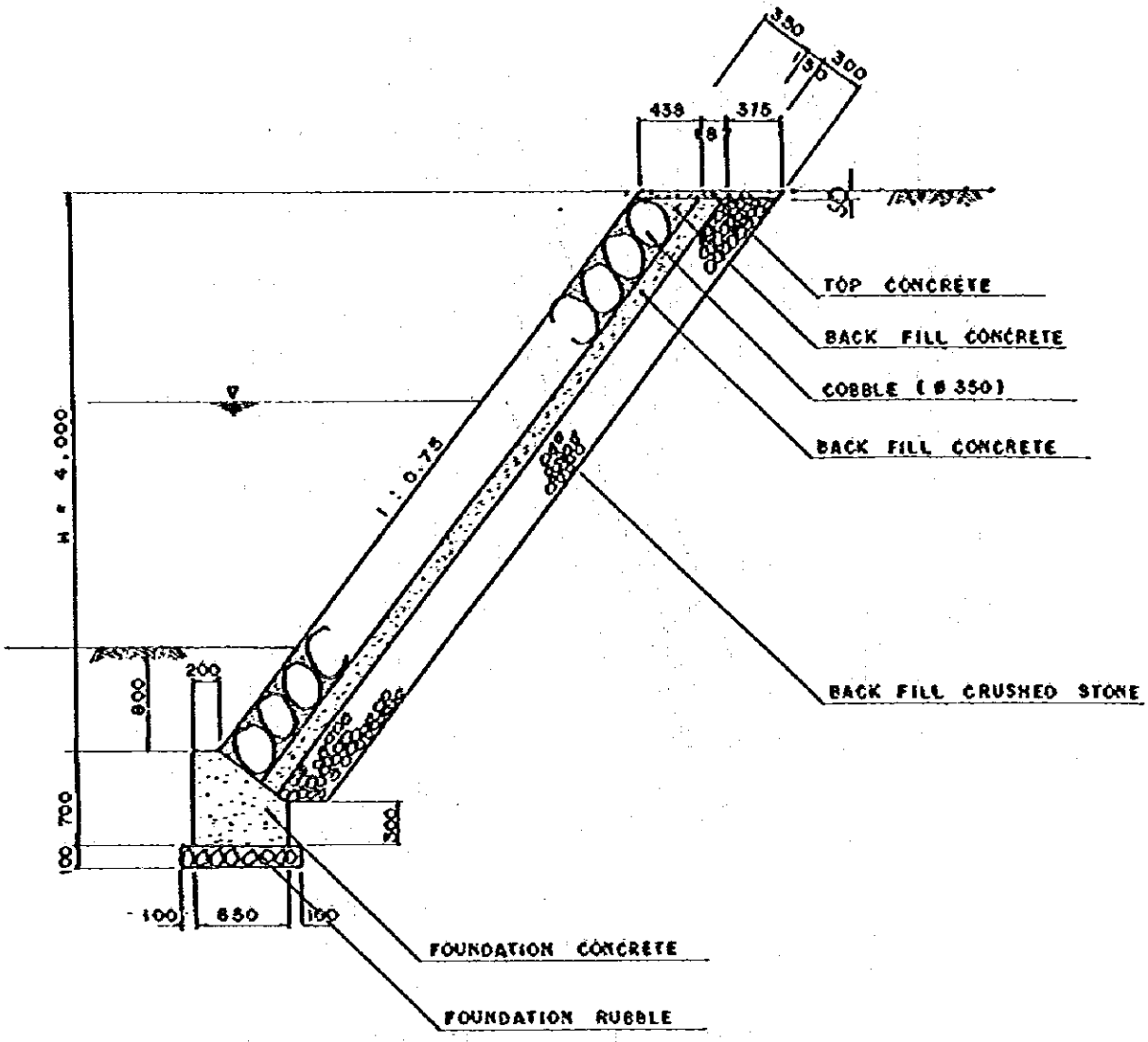
FOR CUT



ESTIMATE OF QUANTITIES

DESCRIPTION	UNIT	H = 1.0	H = 2.0	H = 3.0	H = 4.0	H = 5.0
COBBLE (ø 350 mm)	Sq.M	10.23	21.00	31.77	42.54	53.31
BACK FILL CONCRETE	Cu.M	4.00	7.51	11.02	14.53	18.03
FOUNDATION CONCRETE	Cu.M	1.81	1.81	1.81	1.81	1.81
BACK FILL CRUSHED STONE	Cu.M	3.68	6.91	10.14	13.37	16.60
FOUNDATION RUBBLE	Cu.M	0.85	0.85	0.85	0.85	0.85

FOR WATER WAY



. ESTIMATE QUANTITIES (per 10 m.)

DESCRIPTION	UNIT	H = 4.0
COBBLE (ϕ 350 mm)	Sq.M	49.38
BACK FILL CONCRETE	Cu.M	16.86
FOUNDATION CONCRETE	Cu.M	3.90
. BACK FILL CRUSHED STONE	Cu.M	15.52
FOUNDATION RUBBLE	Cu.M	0.85

CONSTRUCTION COST

FOR EMBANKMENT

CONSTRUCTION COST

DESCRIPTION	UNIT COST	H = 1.0	H = 2.0	H = 3.0	H = 6.0	H = 5.0
COBBLE (ϕ 350 mm)	41P/M^2	435	894	1352	1811	2269
BACK FILL CONCRETE	645.0P/M^3	2786	5134	7482	9830	12171
FOUNDATION CONCRETE	645.0P/M^3	1180	1180	1180	1180	1180
BACK FILL CRUSHED STONE	60.0P/M^3	270	573	935	1357	1838
FOUNDATION RUBBLE	60.0P/M^3	77	77	77	77	77
TOTAL (Per 10 m.)	P	4748	7858	11026	14255	17535
PER ONE SQ.M.	P/M^2	447	360	334	322	317

FOR CUT

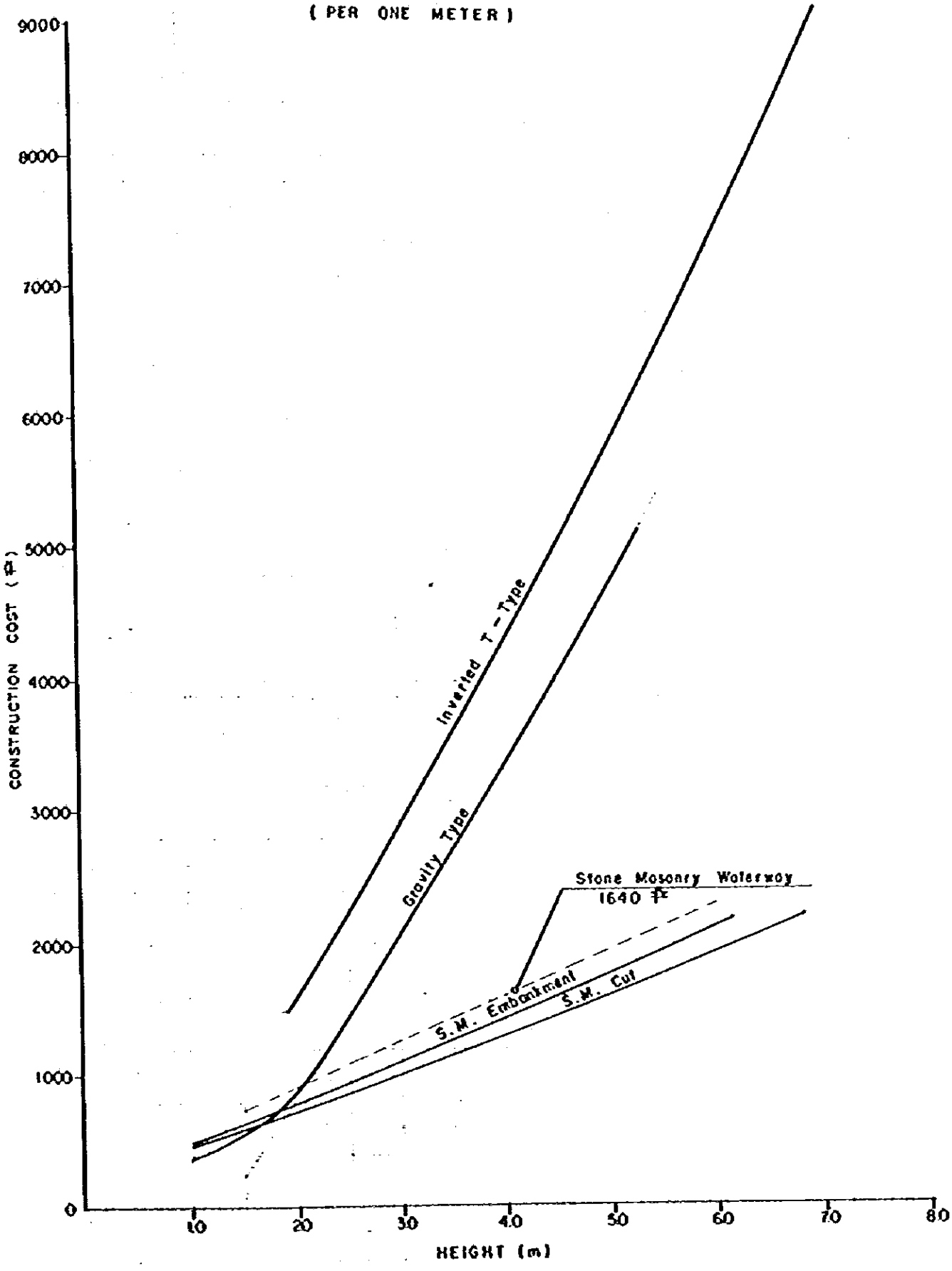
CONSTRUCTION COST

DESCRIPTION	UNIT COST	H = 1.0	H = 2.0	H = 3.0	H = 4.0	H = 5.0
COBBLE (ϕ 350 mm)	41	419	861	1303	1744	2186
BACK FILL CONCRETE	645	2580	4844	7108	9372	11629
FOUNDATION CONCRETE	645	1167	1167	1167	1167	1167
BACK FILL CRUSHED STONE	60	221	415	608	802	996
FOUNDATION RUBBLE	60	51	51	51	51	51
TOTAL (Per 10 m.)	P	4438	7338	10237	13136	16029
PER ONE SQ. M.	P/M^2	434	349	322	309	301

FOR WATERWAY

CONSTRUCTION COST

DESCRIPTION	UNIT COST	H = 4.0
COBBLE (ø 350 mm)	41P/M^2	2025
BACK FILL CONCRETE	645P/M^3	10875
FOUNDATION CONCRETE	645P/M^3	2516
BACK FILL CRUSHED STONE	60P/M^3	931
FOUNDATION RUBBLE	60P/M^3	57
TOTAL (Per 10 m)	P	16398
PER ONE SQ. M.	P/M^2	332

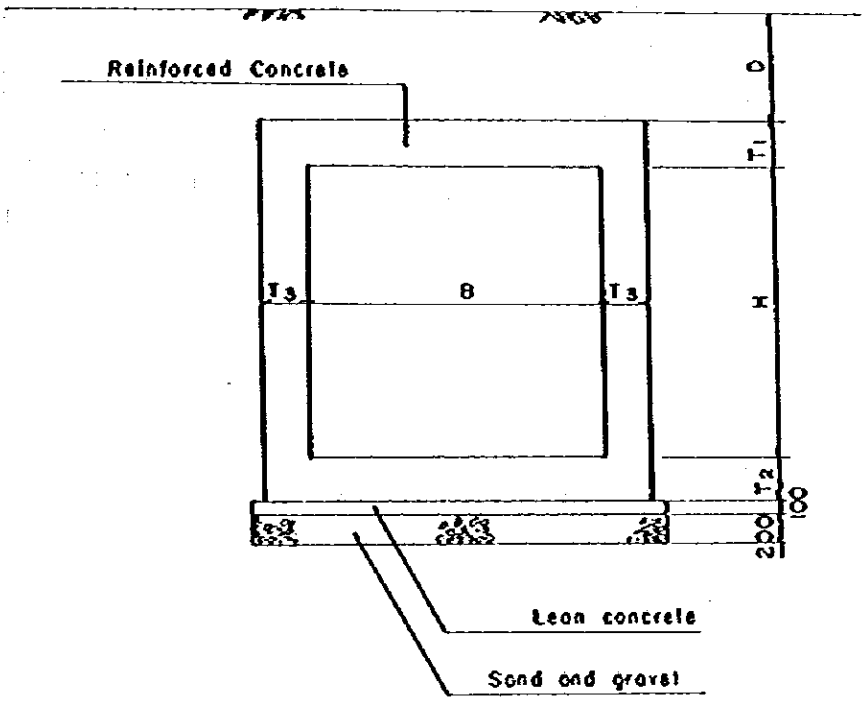

CONSTRUCTION COST FOR RETAINING WALL
(PER ONE METER)
CONSTRUCTION COST (₱)
9000
8000
7000
6000
5000
4000
3000
2000
1000
0
10
20
30
40
50
60
70
80
HEIGHT (m)
Inverted T - Type
Gravity Type
Stone Masonry Waterway
1640 ₱
S.M. Embankment
S.M. Cut

CONSTRUCTION COST
FOR
BOX CULVERT
AND
PIPE CULVERT

Dimension of Box Culverts

The standard design of Japan Highway Public Corp. was adopted for structures of box culverts :

Figure



where , D= Earth Covering (0.15 m to 2.0 m)

LIST OF DIMENSION (UNIT: M)

B X H	T_1	T_2	T_3	Area (m^2)
2.0 X 2.0	.30	.30	.30	4.00
2.0 X 2.5	.30	.30	.30	5.00
2.5 X 2.5	.30	.30	.30	6.25
2.5 X 3.0	.30	.30	.30	7.50
3.0 X 3.0	.35	.35	.35	9.00
3.0 X 4.0	.35	.40	.40	12.00
3.5 X 3.5	.35	.40	.40	12.25
3.5 X 4.0	.40	.45	.45	14.00
4.0 X 4.0	.45	.45	.45	16.00
4.0 X 5.0	.45	.50	.50	20.00
4.5 X 4.5	.45	.50	.50	20.25
4.5 X 5.0	.50	.55	.55	22.50
5.0 X 5.0	.50	.55	.55	25.00

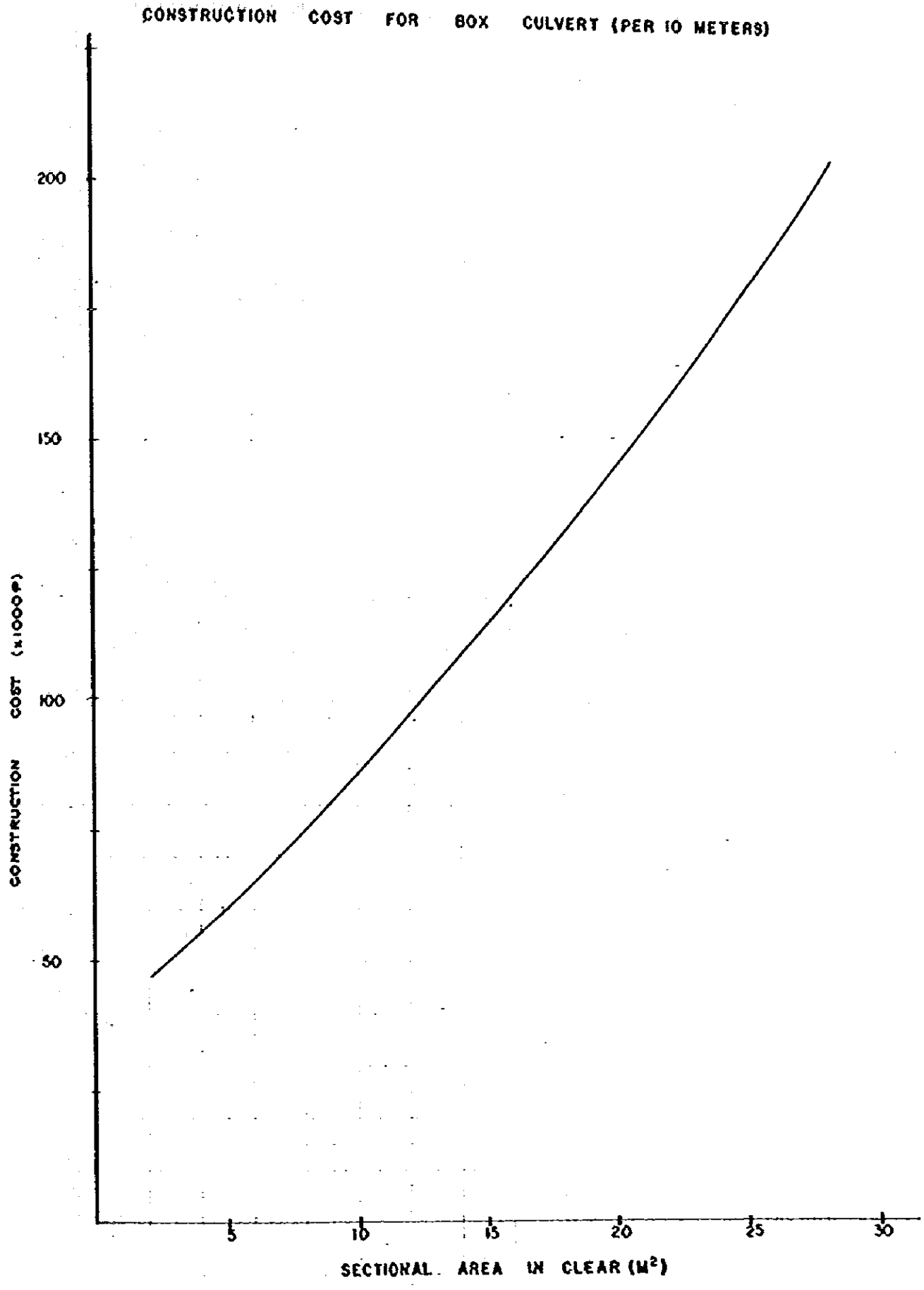
ESTIMATE OF QUANTITIES

ESTIMATE OF QUANTITIES (PER 10 METERS)

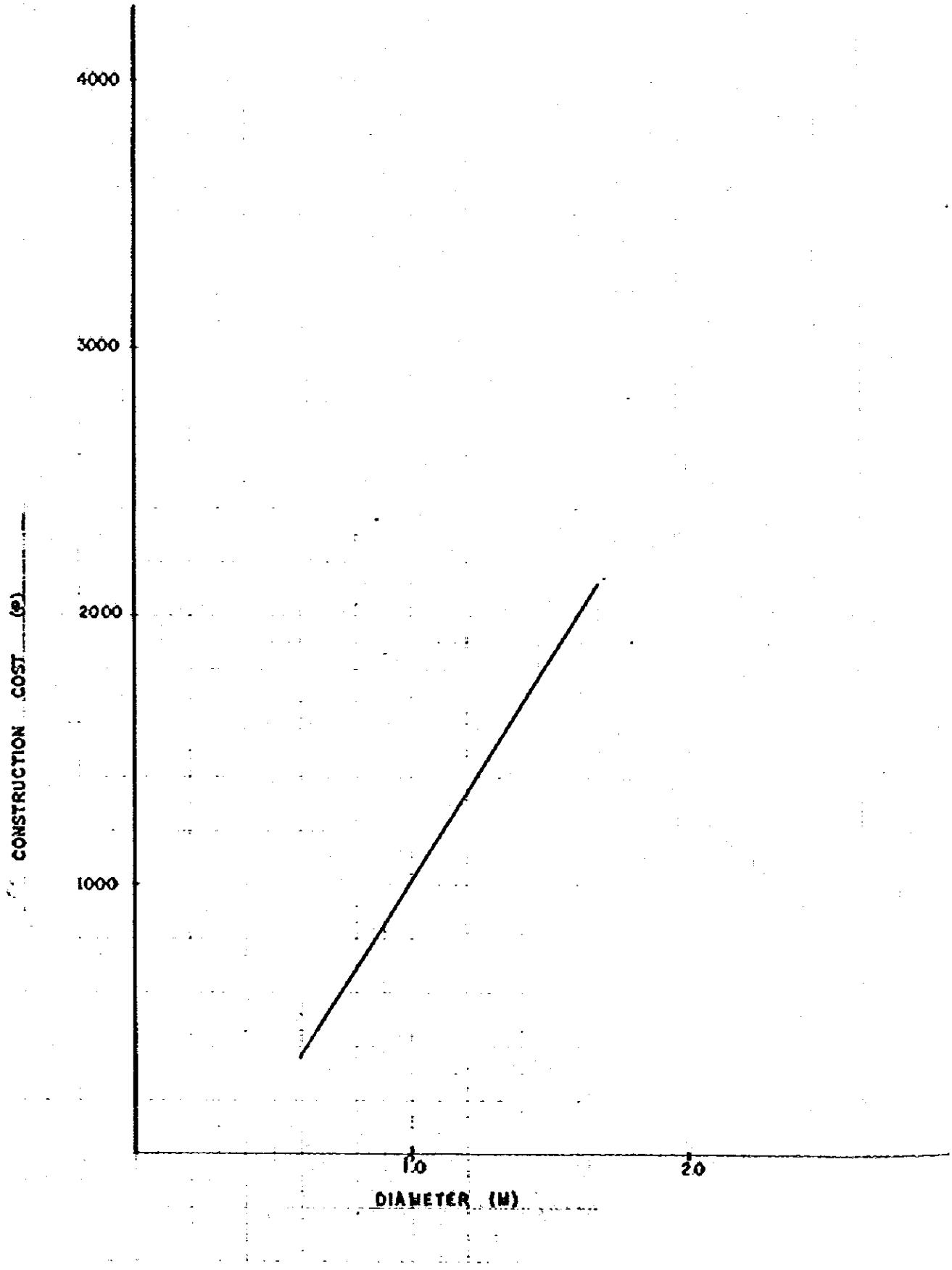
BXH	CONCRETE (M^3)	LEAN CONCRETE(M^3)	SAND & GRAVEL (M^3)	EXCAVATION (M^3)	REINFORCING STEEL (M^3)	REMARKS
2.0X2.0	27.6	2.8	5.6	580	4700	
2.0X2.5	30.6	2.8	5.6	68.0	4930	
2.5X2.5	33.6	3.3	6.6	76.5	5234	
2.5X3.0	36.6	3.3	6.6	87.8	5571	
3.0X3.0	46.9	3.9	7.8	97.5	5782	
3.0X4.0	60.5	4.0	8.0	122.5	6391	
3.5X3.5	60.3	4.5	9.0	121.0	6447	
3.5X4.0	73.4	4.6	9.2	134.8	6785	
4.0X4.0	80.1	5.1	10.2	147.0	7351	
4.0 X5.0	97.5	5.2	10.4	177.0	10099	
4.5X4.5	97.3	5.7	11.4	175.5	9831	
4.5X5.0	113.8	5.8	11.6	191.8	10252	
5.0X5.0	119.1	6.3	12.6	206.5	11647	

CONSTRUCTION COST

DESCRIPTION / UNIT COST / TYPE	CONCRETE	LEAN CONCRETE	SAND AND GRAVEL	EXCAVATION	REINFORCING STEEL	TOTAL (₱)
	733 P/M³	645 P/M³	60.0 P/M³	61.0 P/M³	6.43 P/Kg	
20X20	20230	1810	340	3540	30220	56140
20X25	22430	1810	340	4150	31700	60430
25X25	24630	2130	400	4670	33650	65480
25X30	26830	2130	400	5360	35820	70540
30X30	34380	2520	470	5950	37180	80500
30X40	44350	2560	480	7470	41090	95970
35X35	44200	2900	540	7380	41450	96470
35X40	53800	2970	550	8220	43630	109170
40X40	58710	3090	610	8970	47270	118850
40X50	71470	3350	620	10800	64940	151180
45X45	71320	3680	680	10710	63210	149600
45X50	83415	3740	700	11700	65920	163475
50X50	87300	4060	760	12600	74890	179610


CONSTRUCTION COST FOR BOX CULVERT (PER 10 METERS)
CONSTRUCTION COST (x10000₱)
200
150
100
50
5
10
15
20
25
30
SECTIONAL AREA IN CLEAR (M²)

CONSTRUCTION COST FOR PIPE CULVERT (PER ONE METER)



APPENDIX F

CONSTRUCTION COST ESTIMATES OF STRUCTURES

TABLE OF CONTENTS

LIST OF BRIDGE CONSTRUCTION COST

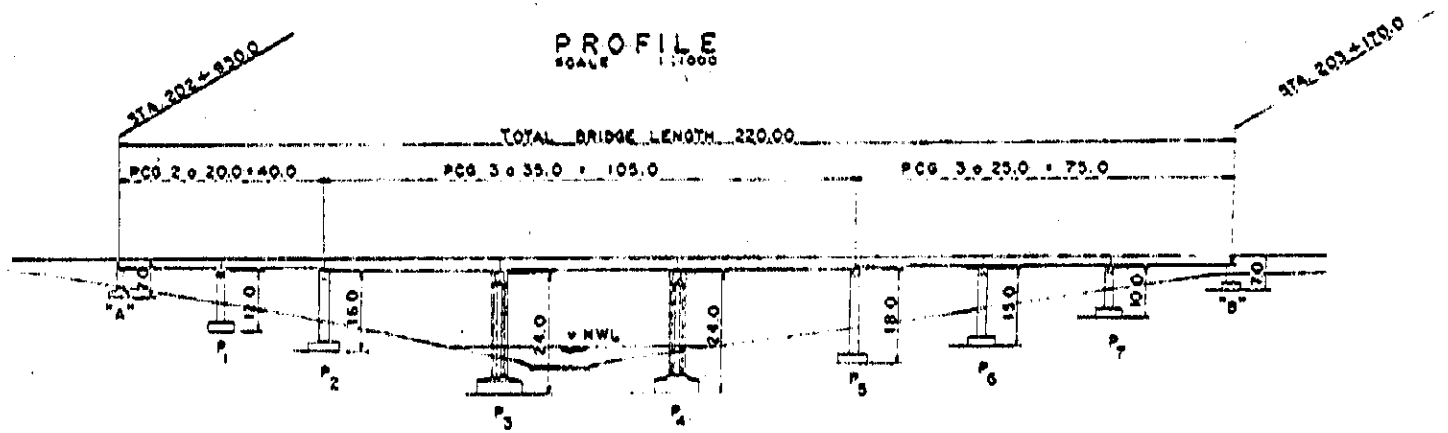
STA. (Km.)	BRIDGE NAME	TYPE	LENGTH (m)	DIRECT COST (₱)	₱/M.^{2}
202+560.0	S.D.P NO.1	PCG	220	5355500	3010
203+702.5	S.D.P NO.2	PCG	90	2130800	2930
204+180.0	S.D.P NO.3	PCG	90	2140800	2940
205+95.0	S.D.P NO.4	RCDG PCG	115	2984500	2670
		SUB-TOTAL	515	12111600	
207+900.0	N.D.P NO.1	RCDG	45	963200	2650
208+474.0	N.D.P NO.2	PCG	48	1035300	2670
208+872.0	N.D.P NO.3	RCDG PCG	55	1695700	3820
209+160.0	N.D.P NO.4	PCG	60	1811400	3740
209+558.5	N.D.P NO.5	PCG	155	3570900	2850
209+830.0	N.D.P NO.6	RCDG	30	596900	2460
216+400.0	SANTA FE	PCG	30	814800	3360
		SUB-TOTAL	423	10488200	
		GRAND TOTAL	938	22599800	

1. Schemes of proposed bridges along the Most Likely Route (Section A)

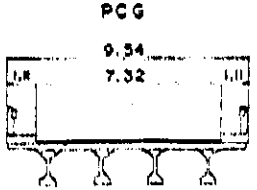
PROPOSED BRIDGE

(1) STATION	202 + 560	(10)	AREA OF BRIDGE		17777.6				ABUT."A"	PIER	PIER	ABUT."B"	TOTAL
(2) BRIDGE NAME	S.D.P. NO. 1	(11)	PCG	LENGTH	20.0, 35.0, 25.0	(19)	SUBSTRUCTURE	CONCRETE	125	625	190	125	1265
(3) BRIDGE LENGTH	220.00 M	(12)		EACH	32	(20)		REIN. BAR	10000	56000	35000	10000	111000
(4) ROADWAY WIDTH	7.32	(13)		CONCRETE	558	(21)		PILE	–	–	–	–	–
(5) BRIDGE TYPE	P.C.G	(14)	SUPERSTRUCTURE	CONCRETE	708	(22)		EXCAVATION	165	1250	1600	165	3180
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	64200	(23)		CONSTRUCTION COST			1772000		
(7) PIER TYPE	RECTANGULAR, CIRCULAR	(16)		RAILING	440	(24)		(23) ÷ (10)			1000 ₱/M²		
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	3383500 ₱	(25)	TOTAL CONSTRUCTION COST				5355500 ₱		
(9) HEIGHT WATER LEVEL	556.0	(18)		(17) ÷ (10)	2020 ₱	(26)	(25) ÷ (10)				3010 ₱/M²		

PROFILE
SCALE 1:1000



TYPICAL CROSS SECTION
SCALE 1:200

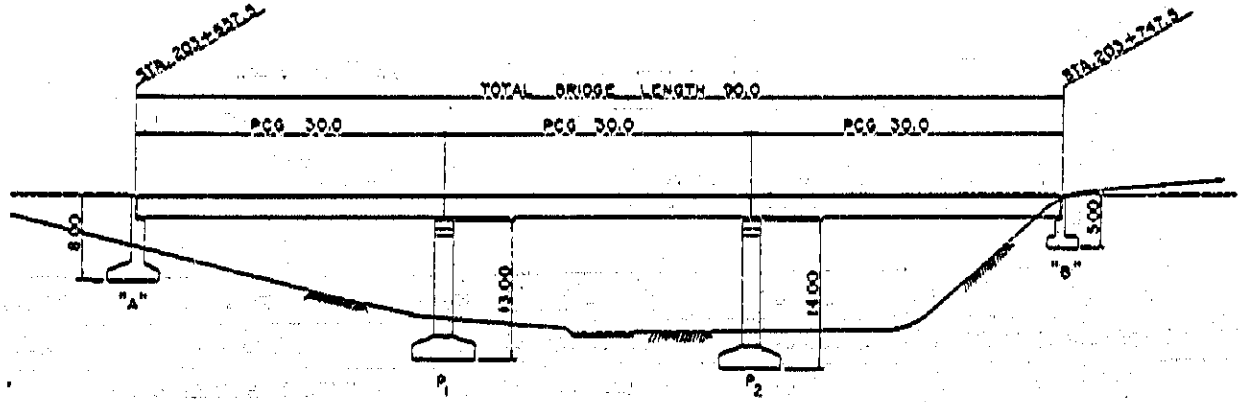


PROPOSED BRIDGE

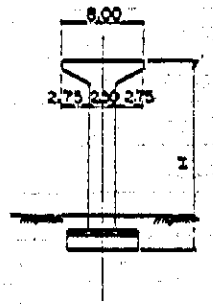
(1) STATION	203+702.5	(10)	AREA OF BRIDGE		727.2				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
(2) BRIDGE NAME	S.D.P NO.2	(11)	PCG	LENGTH	30	(19)	SUBSTRUCTURE	CONCRETE	140	120	125	105	490
(3) BRIDGE LENGTH	90.0	(12)		EACH	12	(20)		REIN. BAR	11200	10800	11300	8400	41700
(4) ROADWAY WIDTH	7.32	(13)		CONCRETE	263	(21)		PILE	–	–	–	–	–
(5) BRIDGE TYPE	PCG	(14)	SUPERSTRUCTURE	CONCRETE	290	(22)		EXCAVATION	230	250	250	200	930
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	27600	(23)		CONSTRUCTION COST	165000 + 175000 + 185000 + 115000 = 640,000 ₱				
(7) PIER TYPE	RECTANGULAR	(16)		RAILING	180	(24)		(23) ÷ (10)	880 ₱/M.²				
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	149 0800 ₱	(25)		TOTAL CONSTRUCTION COST	2130800 ₱				
(9) HEIGHT WATER LEVEL	–	(18)		(17) ÷ (10)	2050 ₱/M.²	(26)		(25) ÷ (10)	2930 ₱/M.²				

PROFILE

SCALE 1:500



PIER TYPE



TYPICAL CROSS SECTION

SCALE 1:200

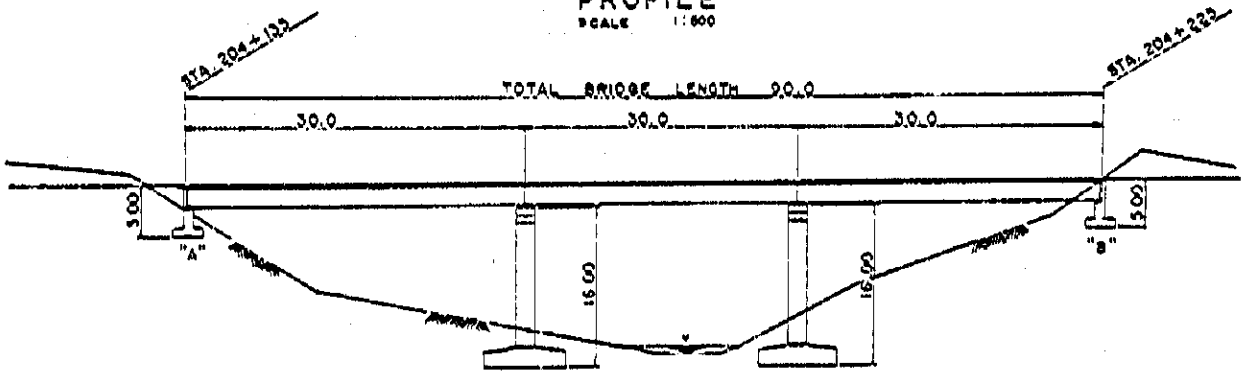
PCG

PROPOSED BRIDGE

(1) STATION	204+180	(10)	AREA OF BRIDGE		727.2				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
(2) BRIDGE NAME	S.D.P NO.3	(11)	PCG	LENGTH	30	(19)	SUBSTRUCTURE	CONCRETE	105	140	140	105	490
(3) BRIDGE LENGTH	90.0	(12)		EACH	12	(20)		REIN. BAR	8400	12600	12600	6400	42000
(4) ROADWAY WIDTH	7.32	(13)		CONCRETE	263	(21)		PILE	--	--	--	--	--
(5) BRIDGE TYPE	PCG	(14)	SUPERSTRUCTURE	CONCRETE	290	(22)		EXCAVATION	200	310	450	200	1160
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	27600	(23)		CONSTRUCTION COST	(115000+210000)X2 = 650000 ₱				
(7) PIER TYPE	RECTANGULAR	(16)		RAILING	180	(24)		(23) ÷ (10)	890 ₱/M.²				
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	1490800 ₱	(25)		TOTAL CONSTRUCTION COST	2140800 ₱				
(9) HEIGHT WATER LEVEL	--	(18)		(17) ÷ (10)	2050 ₱/M.²	(26)		(25) ÷ (10)	2940 ₱/M.²				

PROFILE

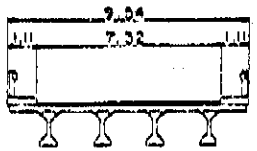
SCALE 1:600



TYPICAL CROSS SECTION

SCALE 1:200

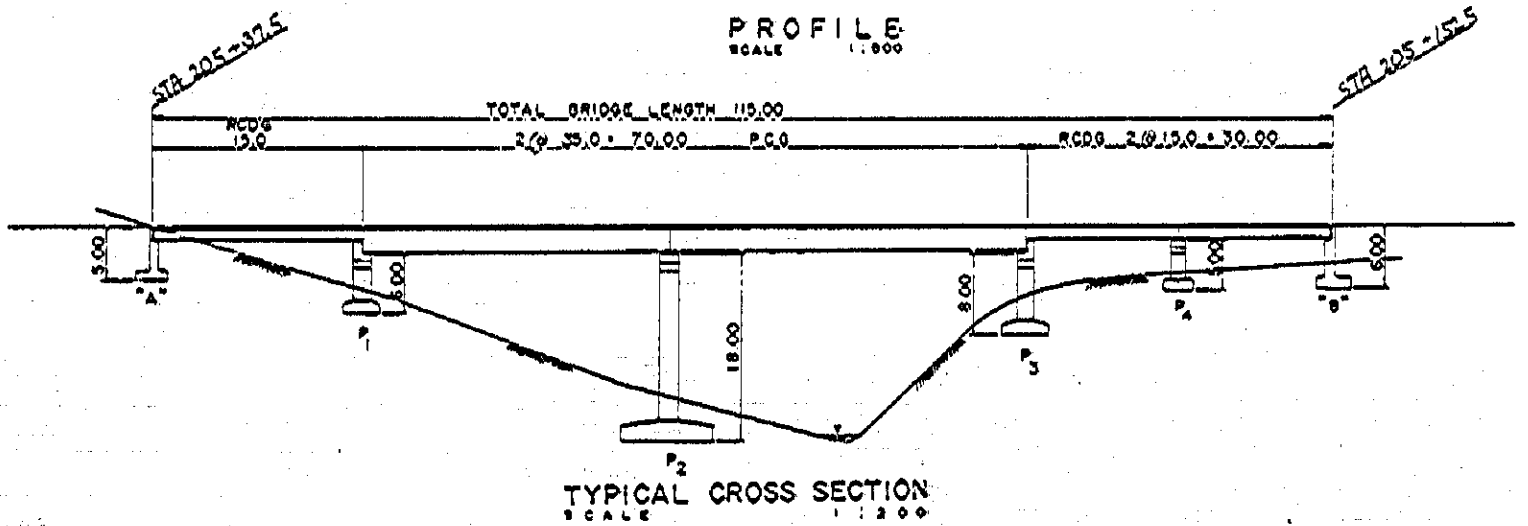
PCG



S - 4

PROPOSED BRIDGE

(1) STATION	205+95	(10)	AREA OF BRIDGE		929.2				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
(2) BRIDGE NAME	S.D.P NO.4	(11)	PCG	LENGTH	35.0	(19)	SUBSTRUCTURE	CONCRETE	78	190	155	95	518
(3) BRIDGE LENGTH	115.0	(12)		EACH	8	(20)		REIN. BAR	6200	17000	14000	7600	46800
(4) ROADWAY WIDTH	7.32	(13)		CONCRETE	205	(21)		PILE	–	–	–	–	–
(5) BRIDGE TYPE	RCDG , PCG	(14)	SUPERSTRUCTURE	CONCRETE	462	(22)		EXCAVATION	200	300	405	120	1025
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	32700	(23)		CONSTRUCTION COST			713000 ₱		
(7) PIER TYPE	RECTANGULAR	(16)		RAILING	230.0	(24)		(23) ÷ (10)			770 ₱/M.²		
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	177500 ₱	(25)		TOTAL CONSTRUCTION COST			2484500 ₱		
(9) HEIGHT WATER LEVEL	–	(18)		(17) ÷ (10)	1910 ₱/M.²	(26)		(25) ÷ (10)			2670 ₱/M.²		

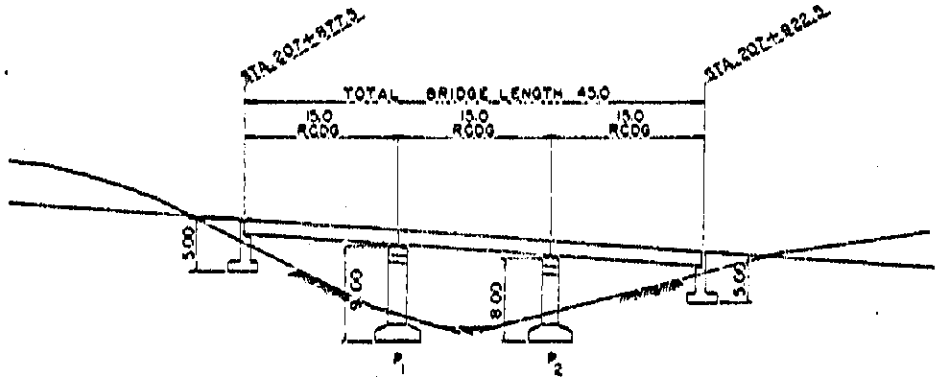


PROPOSED BRIDGE

① STATION	207+900	⑩	AREA OF BRIDGE		363.6				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
② BRIDGE NAME	N.O.P NO.1	⑪	PCG	LENGTH	—	⑲	SUBSTRUCTURE	CONCRETE	78	60	55	78	271
③ BRIDGE LENGTH	45.0	⑫		EACH	—	⑳		REIN. BAR	6200	5400	5000	6200	22800
④ ROADWAY WIDTH	7.32	⑬		CONCRETE	—	㉑		PILE	—	—	—	—	—
⑤ BRIDGE TYPE	RC DG	⑭	SUPERSTRUCTURE	CONCRETE	236	㉒		EXCAVATION	200	115	105	200	620
⑥ ABUTMENT TYPE	INVERTED-T	⑮		REINFORCING BAR	36400	㉓		CONSTRUCTION COST			2X88000+135000+125000=436000 ₹		
⑦ PIER TYPE	RECTANGULAR	⑯		RAILING	900	㉔		㉓ ÷ ⑩			1200 ₹/M.²		
⑧ FOUNDATION TYPE	SPREAD	⑰		CONST. COST	527200 ₹	㉕		TOTAL CONSTRUCTION COST			963200 ₹		
⑨ HEIGHT WATER LEVEL	—	⑱		⑰ ÷ ⑩	1450 ₹/M.²	㉖		㉕ ÷ ⑩			2650 ₹/M.²		

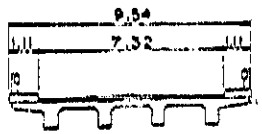
PROFILE

SCALE 1:500



TYPICAL CROSS SECTION

SCALE 1:200

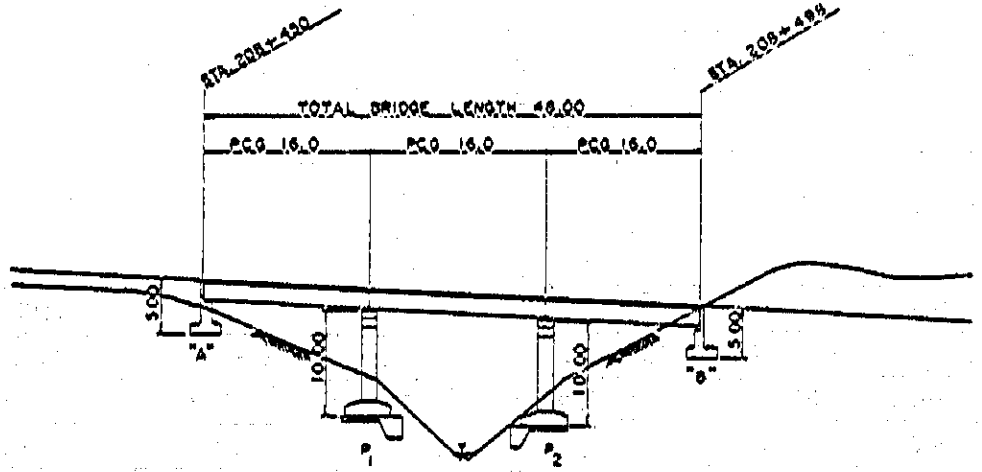


PROPOSED BRIDGE

(1) STATION	208+474	(10)	AREA OF BRIDGE		387.64				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
(2) BRIDGE NAME	N.D.P NO.2	(11)	PCG	LENGTH	16.00	(19)	SUBSTRUCTURE	CONCRETE	78	65	65	78	286
(3) BRIDGE LENGTH	48.0	(12)		EACH	12.00	(20)		REIN. BAR	6200	5900	5900	6200	24000
(4) ROADWAY WIDTH	7.32 M	(13)		CONCRETE	106.00	(21)		PILE	—	—	—	—	—
(5) BRIDGE TYPE	P.C.G.	(14)	SUPERSTRUCTURE	CONCRETE	161.	(22)		EXCAVATION	200	135	135	200	670
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	137.00	(23)		CONSTRUCTION COST			2X(88000+100000)= 376000 ₱		
(7) PIER TYPE	RECTANGULAR	(16)		RAILING	96.00	(24)		(23) ÷ (10)			970 ₱/M.²		
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	659 300 ₱	(25)		TOTAL CONSTRUCTION COST			1038 300 ₱		
(9) HEIGHT WATER LEVEL	—	(18)		(17) ÷ (10)	1 700 ₱/M	(26)		(25) ÷ (10)			26.70 ₱/M²		

PROFILE

SCALE 1:500



TYPICAL CROSS SECTION

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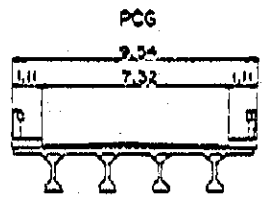
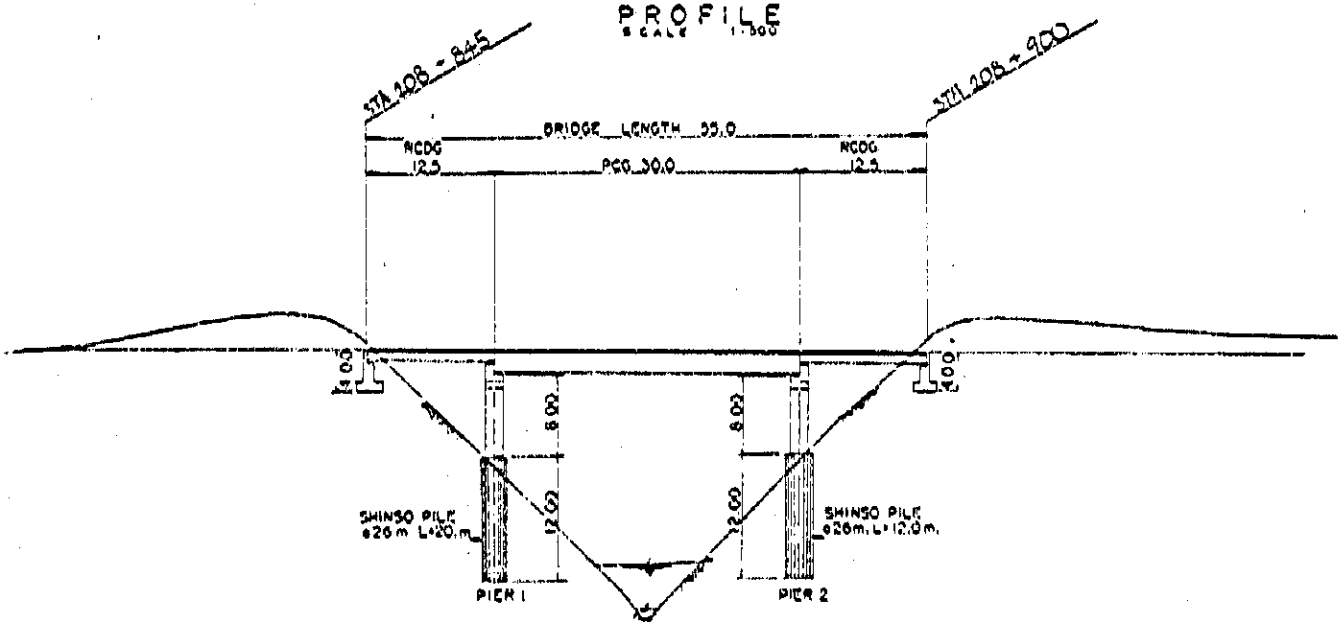


PROPOSED BRIDGE

(1) STATION	208 + 872.5	(10)	AREA OF BRIDGE	666.4 M²				ABUT."A"	PIER 1	PIER 2	ABUT."B"	TOTAL
(2) BRIDGE NAME	N.D.P. NO.3	(11)	PCG	LENGTH 30 M.	(19)	SUBSTRUCTURE	CONCRETE	.60	55	55	60	230
(3) BRIDGE LENGTH	55.0	(12)	PCG	EACH 4	(20)	SUBSTRUCTURE	REIN. BAR	4800	4500		4800	18600
(4) ROADWAY WIDTH	7.32	(13)	PCG	CONCRETE 85 M³	(21)	SUBSTRUCTURE	PILE		12	12		26
(5) BRIDGE TYPE	R.C.D., P.C.G	(14)	SUPERSTRUCTURE	CONCRETE 211 M³	(22)	SUBSTRUCTURE	EXCAVATION	120			120	140
(6) ABUTMENT TYPE	INVERTED- T	(15)	SUPERSTRUCTURE	REINFORCING BAR 22400 Kg	(23)	SUBSTRUCTURE	CONSTRUCTION COST				920000	
(7) PIER TYPE	RECTANGULAR	(16)	SUPERSTRUCTURE	RAILING 110	(24)	SUBSTRUCTURE	(23) ÷ (10)				2070 P/M²	
(8) FOUNDATION TYPE	SPREAD PILE	(17)	SUPERSTRUCTURE	CONST. COST 7,756.80 ₱	(25)		TOTAL CONSTRUCTION COST				1695680 ₱	
(9) HEIGHT WATER LEVEL		(18)	SUPERSTRUCTURE	(17) ÷ (10) 1750 ₱/M²	(26)		(25) ÷ (10)				3820 ₱/M²	

PROFILE
SCALE 1:500



TYPICAL CROSS SECTION
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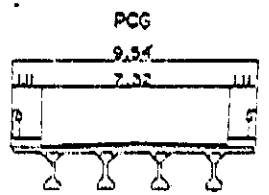
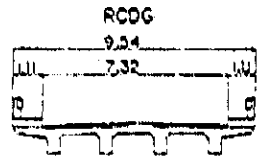




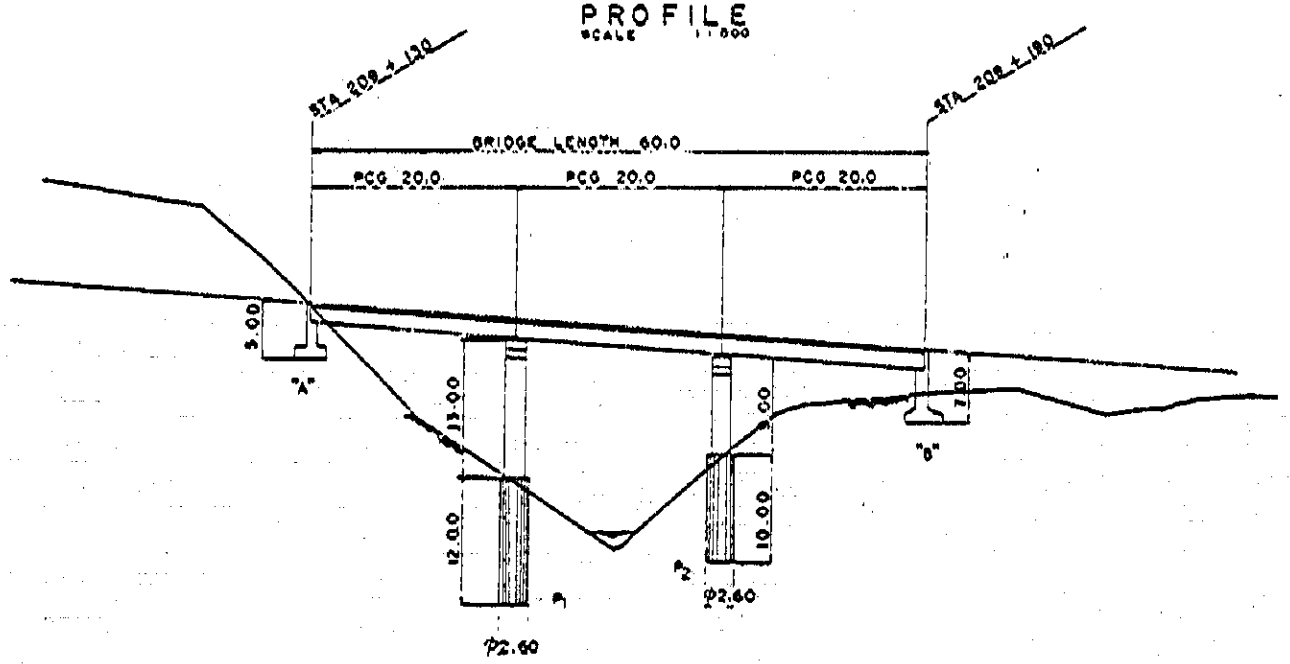
6 - 4

PROPOSED BRIDGE

① STATION	209 + 160	⑩	AREA OF BRIDGE		684.80				ABUT "A"	PIER 1	PIER 2	ABUT "B"	TOTAL
② BRIDGE NAME	N. D. P.NO 4	⑪	PCG	LENGTH	20.0	⑲	SUBSTRUCTURE	CONCRETE	105	104	104	125	411
③ BRIDGE LENGTH	60.0	⑫		EACH	12	⑳		REIN. BAR	8400	9400	6900	10000	34700
④ ROADWAY WIDTH	7.32	⑬		CONCRETE	132	㉑		PILE	—	12.0	10.0	—	22.0
⑤ BRIDGE TYPE	P.C.G	⑭	SUPERSTRUCTURE	CONCRETE	201	㉒		EXCAVATION	215	64	53	160	492
⑥ ABUTMENT TYPE	INVERTED-T	⑮		REINFORCING BAR	17100	㉓		CONSTRUCTION COST			963000 ₱		
⑦ PIER TYPE	RECTANGULAR	⑯		RAILING	120	㉔		㉓ ÷ ⑩			1990 ₱/M		
⑧ FOUNDATION TYPE	SHINSO PILE	⑰		CONST. COST	868400 ₱	㉕		TOTAL CONSTRUCTION COST			1811.400 ₱		
⑨ HEIGHT WATER LEVEL	—	⑱		⑰ ÷ ⑩	1750 ₱/M²	㉖		㉕ ÷ ⑩			3740 ₱/M²		

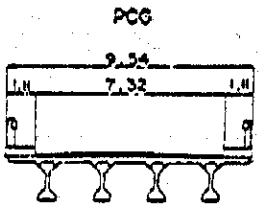
PROFILE

SCALE 1:600



TYPICAL CROSS SECTION

SCALE 1:100

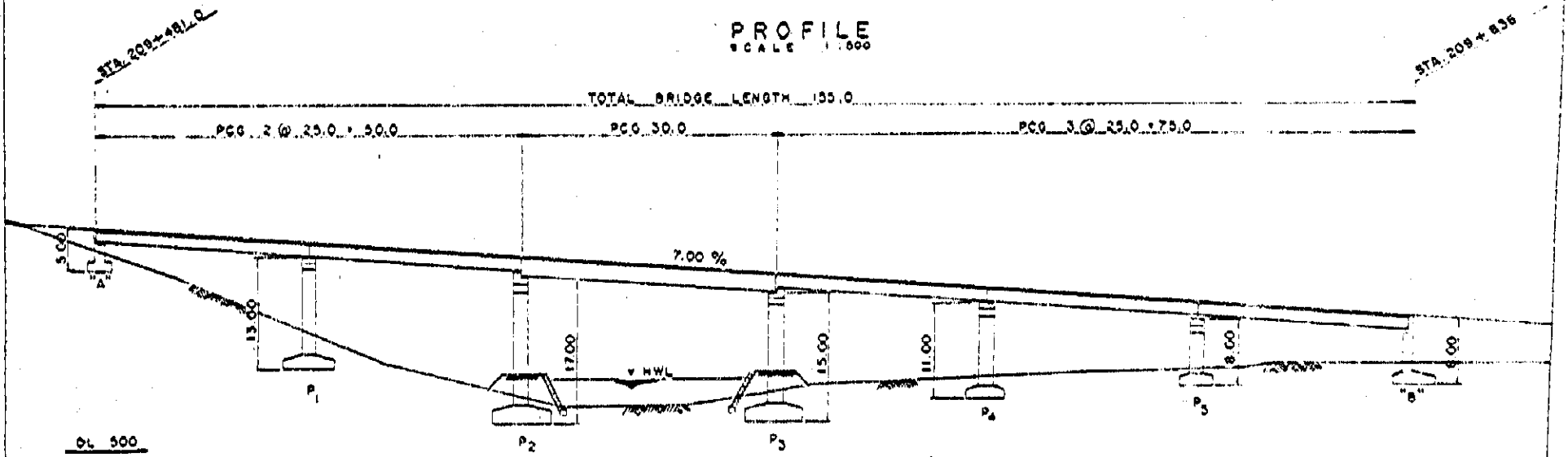


F - 10

PROPOSED BRIDGE

(1) STATION	209+558.5	(10)	AREA OF BRIDGE		1252.4				ABUT."A"	PIER	PIER	ABUT."B"	TOTAL
(2) BRIDGE NAME	N.D.P NO.5	(11)	PCG	LENGTH	250.70.0	(19)	SUBSTRUCTURE	CONCRETE	105	305	280	140	830
(3) BRIDGE LENGTH	155.0	(12)		EACH	20 , 4	(20)		REIN. BAR	8400	27500	25200	11200	72300
(4) ROADWAY WIDTH	73.2	(13)		CONCRETE	360	(21)		PILE	–	–	–	–	–
(5) BRIDGE TYPE	PCG	(14)	SUPERSTRUCTURE	CONCRETE	491	(22)		EXCAVATION	200	390	480	230	1300
(6) ABUTMENT TYPE	INVERTED-T	(15)		REINFORCING BAR	45800	(23)		CONSTRUCTION COST			1155000 ₹		
(7) PIER TYPE	RECTANGULAR	(16)		RAILING	310.0	(24)		(23) ÷ (10)			920 ₹/M.²		
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	2415900 ₹	(25)		TOTAL CONSTRUCTION COST			3570900 ₹		
(9) HEIGHT WATER LEVEL	568.0	(18)		(17) ÷ (10)	1430 ₹/M.²	(26)		(25) ÷ (10)			2850 ₹/M.²		

PROFILE
SCALE 1:1000



TYPICAL CROSS SECTION
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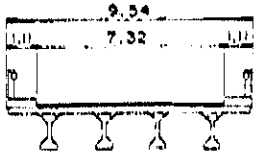
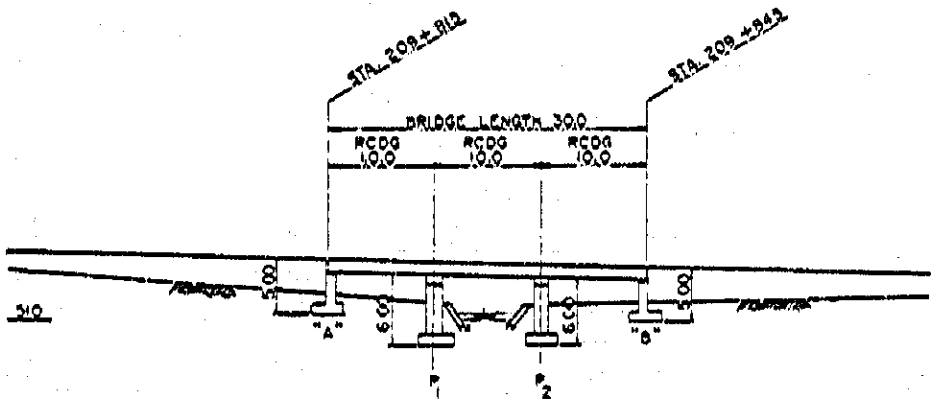


F - 11

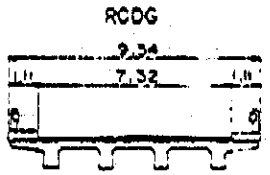
PROPOSED BRIDGE

① STATION	209+830	⑩ AREA OF BRIDGE		242.4				ABUT."A"	PIER	PIER	ABUT."B"	TOTAL
② BRIDGE NAME	N.D.P NO.6	⑪	PCG	LENGTH	-	⑲	SUBSTRUCTURE	CONCRETE	78	45	45	78	246
③ BRIDGE LENGTH	30.0	⑫		EACH	-	⑳		REIN. BAR	6200	4100	4100	6200	20600
④ ROADWAY WIDTH	7.32	⑬		CONCRETE	-	㉑		PILE	-	-	-	-	-
⑤ BRIDGE TYPE	RCDG	⑭	SUPERSTRUCTURE	CONCRETE	134	㉒		EXCAVATION	200	100	100	200	600
⑥ ABUTMENT TYPE	INVERTED-T	⑮		REINFORCING BAR	15100	㉓		CONSTRUCTION COST			2X(88,000+6500) = 306,000 ₱		
⑦ PIER TYPE	RECTANGULAR	⑯		RAILING	60	㉔		㉓ ÷ ⑩			1260 ₱/M.²		
⑧ FOUNDATION TYPE	SPREAD	⑰		CONST. COST	290900 ₱	㉕		TOTAL CONSTRUCTION COST			596,900 ₱		
⑨ HEIGHT WATER LEVEL	-	⑱		⑰ ÷ ⑩	1200 ₱/M.²	㉖		㉕ ÷ ⑩			2460 ₱/M.²		

PROFILE
SCALE 1:600



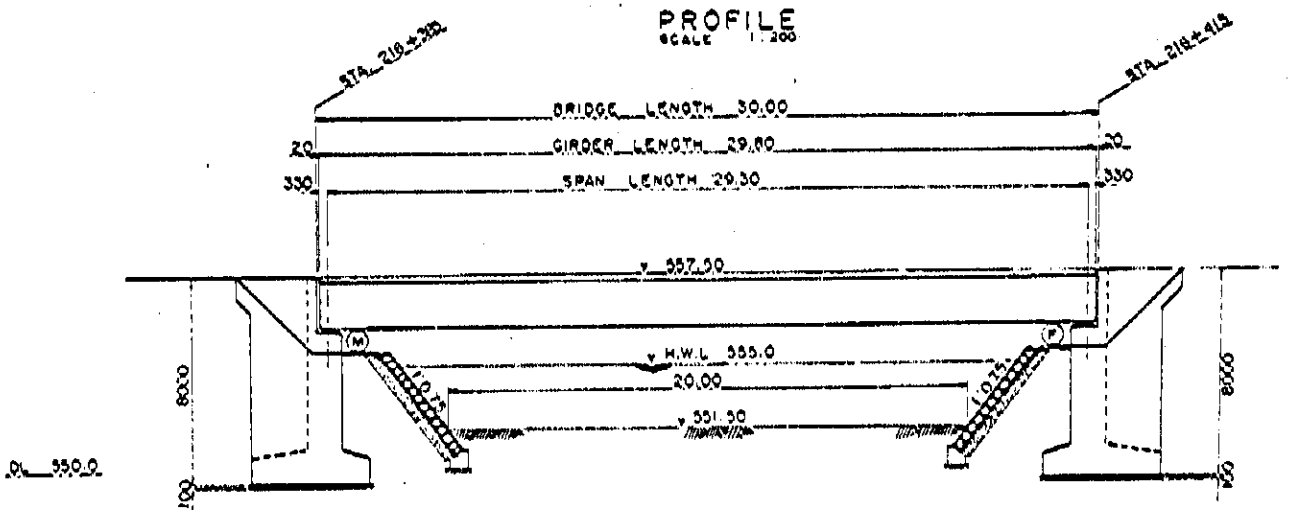
TYPICAL CROSS SECTION
SCALE 1 : 200



PROPOSED BRIDGE

(1) STATION	216+400	(10)	AREA OF BRIDGE		242.4 M.^{2}				ABUT."A"	PIER	PIER	ABUT."B"	TOTAL
(2) BRIDGE NAME	SANTA FE	(11)	PCG	LENGTH	29.80 M.	(19)	SUBSTRUCTURE	CONCRETE	140	–	–	140	280
(3) BRIDGE LENGTH	30.00 M.	(12)		EACH	4	(20)		REIN. BAR	11200	–	–	11200	22400
(4) ROADWAY WIDTH	7.32	(13)		CONCRETE	85 M.^{3}	(21)		PILE	–	–	–	–	–
(5) BRIDGE TYPE	PCG	(14)	SUPERSTRUCTURE	CONCRETE	95 M.^{3}	(22)		EXCAVATION	335			335	670
(6) ABUTMENT TYPE	INVERTED – T	(15)		REINFORCING BAR	9000 Kg.	(23)		CONSTRUCTION COST		2 X 165,000= 330,000			
(7) PIER TYPE	–	(16)		RAILING	60.0 M.	(24)		(23) ÷ (10)		1360 ₱/M.^{2}			
(8) FOUNDATION TYPE	SPREAD	(17)		CONST. COST	484,800 ₱	(25)		TOTAL CONSTRUCTION COST		814,800 ₱			
(9) HEIGHT WATER LEVEL	555.5 M.	(18)		(17) ÷ (10)	2,000 ₱/M.^{2}	(26)		(25) ÷ (10)		3360. ₱/M.^{2}			

PROFILE
SCALE 1:200



TYPICAL CROSS SECTION
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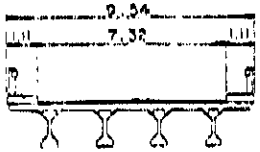
PCG



F - 13

2. Countermeasure Works for Section A and Section B

CONSTRUCTION COSTS OF COUNTERMEASURE WORKS

NO.	STATION	I T E M S	DIRECT COST (¥)
1	167+050 ~ 100	SLOPE PROTECTION, DRAINAGE AND OTHERS	521000
2	167+400	DRAINAGE	56000
3	171+100 ~ 800	SPUR DIKE AND OTHERS	18014000
4	172+478 ~ 546	SABO SLOPE PROTECTION DRAINAGE AND OTHERS	809000
5	173+110 ~ 173+180	SLOPE PROTECTION, DRAINAGE	97000
6	177+100 ~ 750	NEW ALIGNMENT, BRIDGE AND OTHERS	3128000
7	181+100 ~ 500	BRIDGE AND OTHERS	1881000
8	182+047 ~ 200	SLOPE PROTECTION AND OTHERS	481000
9, 10 11	185+660 ~ 186+240	SLOPE PROTECTION, DRAINAGE	1483000
12	187+700 ~ 800	SABO	1288000
13	188+085 ~ 335	SLOPE PROTECTION	942000
14	196+105 ~ 265	SLOPE PROTECTION	275000
16	198+880 ~ 199+060	BRIDGE, ALIGNMENT AND OTHERS	1810000
17	201+937 ~ 202+060	SABO AND OTHERS	1531000
18	203+787.3	SABO, CHANNEL WORK AND OTHERS	338000
19	204+950 ~ 205+150	NEW ALIGNMENT	1469000
20	205+900 ~ 207+500	SLOPE PROTECTION, CHECK DAM AND OTHERS	14510000
21	210+700	SABO, DRAINAGE AND OTHERS	442000
22	213+400 ~ 550	SLOPE PROTECTION	751000
23	216+000 ~ 550	BRIDGE	815000
24	216+720 ~ 880	SABO, AND OTHERS	418000
25	217+250 ~ 275	SLOPE PROTECTION AND OTHERS	913000
26	219+400	SLOPE PROTECTION AND OTHERS	1723000
27	220+550 ~ 900	SABO, SLOPE PROTECTION	1888000

CONSTRUCTION COST - 1 (STA. 167 + 50 ~ 167 + 100)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	1100	14355
STRUCTURE EXCAVATION	Cu.M	61	110	6710
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 5.0 m)	L.M	1950	200	390000
-do- (H= 2.0 m)	L.M	920	50	46000
-do- (H= 4.0)	L.M	1640	20	32800
CONCRETE PIPE Ø 1.20	L.M	1350	12	16200
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250	1	1250
OUTLET	EACH	1250		
GABION	Cu.m	178	5	890
DRAINAGE	L.M	368	35	12880
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₱ 521,025

CONSTRUCTION COST - 2 (STA. 167 + 400)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	2500	32625
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR (H=)	L.M			
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø 1.00	L.M	1020	11.5	11730
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368	32	11776
REINFORCING STEEL BAR	Kg.	6.43		
TOTAL				56131

CONSTRUCTION COST - 3 (STA. 171 + 100 - 800)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	17800	1085800
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	25	15600	390000
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 7.5 m)	L.M	8600	460	3956000
-do- (H= 4.0 m)	L.M	3200	300	960000
STONE MASONRY FOR WATERWAY (H= 4.0 m)	L.M	1640	690	1131600
-do- FOR EMBANKMENT (H= 2.0)	L.M	790	1650	1303500
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO or SPUR DIKE	Cu.M	233	11800	3949400
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.m	178	900	160200
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
RETAINING WALL INVERTED-T TYPE (H=3.0m)	LM	2900	130	377000
T O T A L				≥ 18,013,500

CONSTRUCTION COST - 4 (STA. 172 + 478 - 546)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	650	8483
STRUCTURE EXCAVATION	Cu.M	61	360	21960
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433	150	64950
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0)	L.M	4700	60	282000
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 5.0)	L.M	1750	25	43750
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150	60	369000
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	108	19224
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₱ 800,357

CONSTRUCTION COST - 5 (STA. 173 + 110 - 173 + 180)				
DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	40	522
STRUCTURE EXCAVATION	Cu.M	61	180	10980
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 2.0 m)	L.M	790	45	35550
-do- FOR WATERWAY (H= 5.0 m)	L.M	1950	12	23400
-do- (H=)	L.M.			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368	72	26496
REINFORCING STEEL BAR	Kg.	6.43		
TOTAL				¥ 96,048

CONSTRUCTION COST - 6 (STA. 177 + 100 - 177 + 750)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	4650	60683
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428	310	442680
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 3.0 m)	L.M	1100	100	110000
-do- WATERWAY (H= 4.0)	L.M	1640	40	65600
-do- (H=)	L.M			
CONCRETE PIPE ø	L.M			
-do- ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE (L = 75 m)	L.S		1	2435000
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	80	14240
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
				₱ 3,123,203

CONSTRUCTION COST - 7 (STA. 181 + 100 - 500)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	4300	56115
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428	390	556920
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540	280	151200.
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 4.02)	L.M	1610	170	278800
-do- (H= 3.0 m)	L.M	1280	10	12800
-do- (H=)	L.M			
CONCRETE PIPE ø	L.M			
-do- ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S	714600	1	714600
CONCRETE BOX CULVERT 2.0 x 2.0	L.M	5100	1.6	81600
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	160	28480
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₱ 1,880,515

CONSTRUCTION COST - 8 (STA. 182 + 47 - 200)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	2100	43680
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433	153	66249
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 3.0)	L.M	2050	153	313650
-do- (H=)	L.M			
STONE MASONRY FOR (H=)	L.M			
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE ø	L.M			
-do- ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250	1	1250
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368	153	56304
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				≥ 481,133

CONSTRUCTION COST - 9 (STA.185 + 660 - 186 + 240)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	11880	155034
STRUCTURE EXCAVATION	Cu.M	61	1760	107360
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 5.0 m)	L.M	1950	500	975000
-do- (H= 4.0 m)	L.M	1640	150	246000
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				1,438,394

CONSTRUCTION COST - 10 (STA. 187 + 700 - 187 + 800)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	920	561120
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433	100	43300
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0 m)	L.M	4700	100	470000
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 5.0 m)	L.M	1950	69	134550
-do- (H= 4.0 m)	L.M	1040	28	45920
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733	611	447863
CONCRETE FOR RIVER BED	Cu.M	645	140	90300
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
TOTAL				₱ 1,268,053

CONSTRUCTION COST - 11 (STA. 188 + 85 - 183 + 335)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	2400	31320
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	181	330	59730
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 6.0)	L.M	1950	400	780000
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	2331		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	400	71200
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				2 942,250

CONSTRUCTION COST - 12 (STA. 196 + 15 - 196 + 265)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	6500	84825
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433	260	112580
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR (H=)	L.M			
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	1000	178000
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₹ 275405

CONSTRUCTION COST - 13 (STA. 198 + 880 - 199 + 60)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	1950	25448
STRUCTURE EXCAVATION	Cu.M	61	510	31110
CONCRETE PAVEMENT (t=230 m)	L.M	1428	160	228480
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 2.0)	L.M	790	320	252800
-do- WATERWAY (H= 3.5)	L.M	1440	270	388800
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733	370	271210
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M.	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE L = 20.m	L.S	594800	1	594800
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	100	17800
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
TOTAL				≥ 1,810,448

CONSTRUCTION COST - 14 (STA. 201+937 - 202+60)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	540	32940
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433	170	73610
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0 m)	L.M	4700	145	681500
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 4.0 m)	L.M	1610	280	450200
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233	360	263880
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	110	19580
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
TOTAL				P 1,530,710

CONSTRUCTION COST -15 (STA. 203 + 782.3)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	375	22875
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 3.5 m)	L.M	1440	83	119520
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733	230	168590
CONCRETE FOR RIVER BED	Cu.M	645	42	27090
GROUTED RIPRAP	Cu.M.	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				P 338,075

CONSTRUCTION COST - 16 (STA. 201 + 950 - 205 + 150)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	32500	676000
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428	250	357000
SIDE DITCH	L.M.	433	250	108250
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR CUT (H= 4.0 m)	L.M	1310	180	235800
-do- EMBANKMENT (H= 5.0)	L.M	1750	40	70000
-do- (H=)	L.M			
CONCRETE PIPE Ø 1.20	L.M	1350	15	20250
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250	1	1250
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				P 1,468,550

CONSTRUCTION COST - 17 (STA. 205 + 000 - 207 + 500)				
DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	28100	590720
EMBANKMENT	Cu.M	13.05	33600	438480
STRUCTURE EXCAVATION	Cu.M	61	13300	811300
CONCRETE PAVEMENT (t=230 m)	L.M	1428	700	999600
SIDE DITCH	L.M.	433	700	303100
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	25	13500	337500
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0m)	L.M	4700	510	2397000
-do- (H= 7.0m)	L.M	2050	630	1291500
STONE MASONRY FOR EMBANKMENT (H= 5.0 m)	L.M	1750	50	87500
-do- (H= 4.0m)	L.M	1430	300	429000
-do- (H= 3.0 m)	L.M	1100	240	264000
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO or CHECK DAM	Cu.M	733	8850	6487050
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368	200	73600
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				P 14,510,350

CONSTRUCTION COST - 18 (STA. 210 + 200)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	350	4568
STRUCTURE EXCAVATION	Cu.M	61	800	48800
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M		600	600
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 3.0 m)	L.M	1280	225	288000
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø .90	L.M	850	17	14450
-do- Ø .60	L.M	350	12	4200
CONCRETE FOR SABO or GROUND SILL	Cu.M	233	20	14660
CONCRETE FOR RIVER BED	Cu.M	645	95	61275
GROUTED RIPRAP	Cu.M.	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250	2	2500
OUTLET	EACH	1250	2	2500
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₱ 441,553

CONSTRUCTION COST - 19 (STA. 213 + 400 - 550)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	3700	76960
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428	160	228480
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 3.0 m)	L.M	1100	150	165000
-do- FOR CUT (H= 5.0 m)	L.M	1600	110	126000
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO AND GROUND SILL	Cu.M	233	110	80630
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368	66	24288
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₱ 751358

CONSTRUCTION COST - 20 (STA. 216 + 720 - 880)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	1800	37440
EMBANKMENT	Cu.M	13.05	3400	44370
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 4.0)	L.M	1640	170	278800
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	324	57672
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				≥ 416,282

CONSTRUCTION COST - 21 (STA. 217 + 250 ~ + 275)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61	870	53070
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	25	3400	85000
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0 m)	L.M	4700	105	493500
-do- (H= 3.0 m)	L.M	2050	60	123000
STONE MASONRY FOR EMBANKMENT (H= 2.0m)	L.M	700	200	158000
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	233		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				P 912,520

CONSTRUCTION COST - 22 (STA. 219 + 400)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8	1700	35360
EMBANKMENT	Cu.M	13.05		
STRUCTURE EXCAVATION	Cu.M	61		
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	29	6200	170000
SODDING	Sq.M			
RETAINING WALL GRAVITY TYPE (H= 5.0 m)	L.M	4700	120	846000
-do- (H=)	L.M			
STONE MASONRY FOR EMBANKMENT (H= 9.0 m)	L.M	1430	470	672100
-do- (H=)	L.M			
-do- (H=)	L.M			
CONCRETE PIPE ø	L.M			
-do- ø	L.M			
CONCRETE FOR SABO	Cu.M	733		
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178		
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				₹ 1,723,460

CONSTRUCTION COST - 23 (STA. 220 + 550 - 220 + 900)

DESCRIPTION	UNIT	UNIT PRICE	QUANTITIES	DIRECT COST
CUT	Cu.M	20.8		
EMBANKMENT	Cu.M	13.05	1250	16313
STRUCTURE EXCAVATION	Cu.M	61	8800	536800
CONCRETE PAVEMENT (t=230 m)	L.M	1428		
SIDE DITCH	L.M.	433		
GUARD RAIL	L.M	540		
PLANTATION WORK	L.M	1		
VEGETATION WORK	Sq.M	1		
SODDING	Sq.M	1		
RETAINING WALL GRAVITY TYPE (H=)	L.M			
-do- (H=)	L.M			
STONE MASONRY FOR WATERWAY (H= 4.0 m)	L.M	1640	240	393600
-do- (H= 2.0 m)	L.M	920	70	64400
-do- (H=)	L.M			
CONCRETE PIPE Ø	L.M			
-do- Ø	L.M			
CONCRETE FOR SABO	Cu.M	733	980	718340
CONCRETE FOR RIVER BED	Cu.M	645		
GROUTED RIPRAP	Cu.M	384		
FENCE FOR FALLING ROCK	L.M	6150		
BRIDGE	L.S			
CONCRETE BOX CULVERT	L.M			
DROP INLET	EACH	1250		
OUTLET	EACH	1250		
GABION	Cu.M	178	1450	258100
DRAINAGE	L.M	368		
REINFORCING STEEL BAR	Kg.	6.43		
T O T A L				P 1,987,553