APPENDIX 6

PHASING OF PROPOSED BRIDGES

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
1	01.01	Ellet Bridge Benguet	151	24.40	Bailey . Fair Steel	10			. No topographic survey data	-
2	01.02	Bimmilog 8 Br. Ilocos Sur	133	30.00	Timber . Dilapidated timber trestle	5			. No topographic survey data	-
3	01.03	Malaya Br. Ilocos Sur	237	48.80	Steel Struss	5			. No picture . No topographic survey data	-
4	02.01	Sta. Cruz Bridge Cagayan	281	90.00	Timber . Dilapidated timber trestle	-	3 @ 30=90 m	. Continuous steel girder . Pile foundation	. Topographic and geological surveys are required. . Study on flood control is necessary. . Use of cofferdam for deep water (h=3.5 m) is required. . Long span bridge is advisable because of deep water	2
5	02.02	Dumadata Br. Quirino	261	30.00	Bailey . Dilapidated timber trestle.	5	17+17=34 m	. H-beam girder . Pile foundation	. Topographic and geological survey are required. . Use of cofferdam for deep water (h=2.0m) is required.	2
6	02.03	Baan Br. No. 2 Nueva Vizcaya	-	39.63	Bailey . Dilapidated timber trestle	3	23+23=46 m	. H-beam girder . Pile foundation	. No difficulty in construction because of ordinary types of abutments (2) and pier (1).	1
7	02.04	Diora Br. Cagayan	281	48.00	Timber . Seriously dilapidated	5	25+25=50 m	. H-beam girder . Pile foundation	. No special difficulty in construction . Use of cofferdam in water (h=1.0m) is required.	1

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
8	02.05	Diduyon Br. Quirino	261	30.00	Timber (Washed-Out)	-			. Study of flood area and control is required. . Bridge length should be studied	2
9	03.01	Segum Br. Nueva Ecija	-	34.00	Timber . Destroyed	-				-
10	03.02	Calabasa Br. Nueva Ecija	-	12.00	Timber . Dilapi-dated	3			. Topographic survey does not show the alignment of existing road and river	-
11	03.03	Malinao Br. Nueva Ecija	-	12.00	Timber . Destroyed	-				-
12	03.04	Asam Br. Nueva Ecija	-	36.00	Timber . Destroyed	-				-
13	04.01a	Binambang Bridge Batangas	-	80.00	Spillway . Over-flow meter	5	3 @ 25=75m	. H-Beam Girder . Spread Footing	. Flood water level shall be studied . Topographic and geological survey is required. . Alignment of road shall be studied in order to avoid demolision of existing houses.	2
14	04.02a	Mango Br. Rizal	-	-	R.C.D.G. . Defect-ive super-structure	15			. Proposed widening with concrete girder is recommended	-

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
15	04.03a	Leviste II Br. Batangas	520	40.00	Timber (washed-out)	-	20+20+20+20 +20 = 80 m	. H-Beam girder . Spread foundation	. Maximum high flood water level shall be reviewed	2
16	04.04b	Lumang Bayan Br. Mindoro Occ.	208	60.00	Bailey . Fair Steel . Dilapidated timber trestle	5	3 @30 = 30 m	. Continuous steel girder . Pile foundation	. Study on flood area and elevation is required	-
17	04.05b	Olangoan Br. Palawan	-	36.00	Bailey . Fair Steel . Timber Trestle	5	20+20 = 40 m	. H-Beam Girder . Pile foundation	. Geological survey is required . Use of cofferdam for water is required	2
18	04.06b	Bongabon Br. Oriental Mindoro	153	351.00	Bailey . Fair Steel . Permanent sub-structure	8	. Depend on existing span length	. Depend on existing pier	. Stability of existing substructure shall be checked	2
19	04.07b	Dipulao Br. Palawan	50	30.00	Bailey . Fair Steel . Dilapidated timber trestle	5	25 m	. Skewed H-Beam girder . Pile foundation	. No difficulty in construction	1
20	04.08b	Cogon Bridge Romblon	60	20.00	Bailey . Fair Steel . Dilapidated timber trestle	5	23 m	. H-Beam girder . Spread foundation	. No difficulty in construction	1
21	05.01	Duguit Br. Camarines Norte	1561	30.00	. Steel I-Beam . Fair	20			. Urgent replacement is not recommended . Coping of piers shall be remedied	-

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
22	05.02	Patitinan Br. Camarines Sur	624	20.00	Bailey	7	20-m	. H-Beam girder . Spread type foundation	. No difficulty in construction	1
23	05.03	Narangasan I Bridge Masbate	-	45.00	. Bailey . Dilapidated timber trestle	1	2 @ 35=70 m	. Continuous steel girder . File foundation	. Bridge length shall be examined considering river bank	2
24	06.01	Talus Bridge Negros Occ.	2420	40.00	Bailey . No bridge approach	10			. Steel of baily is fair and substructure is permanent . Construction of bridge approach is recommended	-
25	06.02	Cataan Br. Iloilo	390	39.00	Bailey . Fair Steel . Timber trestle	3	20+20 = 40 m	. H-Beam girder . Pile foundation	. No difficulty in construction	1
26	06.03	Iyang Br. Iloilo	526	25.00	Timber . Dilapidated	3.5	28 m	. Steel plate girder . Pile foundation	. Geological survey is required because of swampy and soft ground condition . Use of cofferdam for deep water (h=2.0m) is required	2
27	06.04	Guintas Br. Capiz	60	20.00	Bailey . Destroyed	-	21+21=42 m	. H-Beam girder . Pile foundation	. No difficulty in construction	1
28	06.05	Tumalalud Br. Capiz	92	30.00	Bailey . Fair Steel . Permanent subs structure	7			. Urgent replacement of superstructure might not be recommended . Stability of substructure shall be checked	-

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
29	07.01	Banban Br. Cebu	97	25.38	Timber . Dilapi- dated	5	30.m	. Steel plate girder . Pile foun- dation	. Geological survey is required . Study of flood area is required	2
30	07.02	Campacas Bridge Cebu	34	20.83	Bailey . Fair Steel . Dilapi- dated trestle timber	5	24 m	. H-beam girder . Pile foun- dation	. Geological survey is required . Maximum high flood water level shall be reviewed	2
31	07.03	Campanga Bridge Cebu	89	9.21	Bailey . Dilapi- dated timber trestle	3	12 m	. H-beam girder . Pile foun- dation	. No difficulty in construction	1
32	07.04	Camachiles Bridge Toledo City	207	35.00	. Timber . Fair	10	18+18 = 36 m	. H-beam girder . Pile foun- dation	. No difficulty in construction	1
33	07.05	Lagnason Br. Cebu	50	33.78	. Timber. . Bad condi- tion	5	19+19 = 38 m	. H-beam girder . Pile foun- dation	. No difficulty in construction	1
34	08.01	Poray Br. E. Samar	96	18.00	. Timber . Bad condition	5	22'm	. H-beam girder . Pile foun- dation	. No difficulty in construction	1
35	08.02	Iba Bridge Samar	-	21.65	Bailey . Unpass- able due to dila- pidated steel member	-	23.m	. H-beam girder . Pile foun- dation	. No difficulty in construction	1

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
36	08.03	Habay Br. S. Leyte	-	61.45	Bailey . Good . Timber trestle	7	22+22+22=66m	. H-beam girder . Pile foundation	. Geological survey is required . Study of flood area is required	2
37	08.04	Talisayan River Crossing Leyte	-	51.40	River Crossing . No existing bridge	-	27+27 = 54 m	. H-beam girder . Pile foundation	. Topographic and geological surveys are required . Study flood area and control is required	2
38	08.05	Pinucawan Br. Leyte	-	13.70	Timber . Bad condition	3	16 m	. H-beam girder . Pile foundation	. No difficulty in construction	1
39	09.01	Batungal Br. Basilan	340	15.40	Timber . Bad condition	3	23 m	. H-beam girder . Pile foundation	. No difficulty in construction	1
40	09.02	Mangop Br. Zamboanga del Norte	590	45.00	Timber . Deteriorated condition	3	17+17 = 34 m	. H-beam girder . Pile foundation	. No difficulty in construction	1
41	09.03	Canawan Br. Zamboanga del Norte	590	35.50	Bailey . Fair steel . Timber trestle	5	19+19 = 38 m	. H-beam girder . Pile foundation	. No difficulty in construction	1
42	09.04	Piangon Br. Zamboanga del Norte	677	25.00	Bailey . Fair steel . Timber trestle	7	20+20 = 40 m	. H-beam girder . Pile foundation	. No difficulty in construction	1

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
43	09.05	Patunan Br. Zamboanga del Norte	667	25.00	Bailey . Fair steel . Permanent pier . timber trestle	7	25 m	. H-beam girder	. Stability of existing permanent substructures shall be examined and incorporated in design	2
44	10.01	Hayangabon I Bridge Surigao del Norte	55	40.00	Timber . Dilapi-dated condition	5	21+21 = 42 m	. H-beam girder . Pile foun-dation	. Geological survey is required . Use of cofferdam for deep water is required	2
45	10.02	Maradugao Br. Bukidnon	1319	21.00	Bailey . Fair steel . Dilapi-dated timber trestle	5	25 m	. H-beam girder . Spread foundation	. No difficulty in construction	1
46	10.03	Maundo Br. Agusan del Sur	-	18.00	Bailey . Fair steel . Dilapi-dated timber trestle	5	22 m	. H-beam girder . Pile foun-dation	. No difficulty in construction	1
47	10.04	Sta. Irene Br. Agusan del Sur	-	20.00	Log Bridge . Unpass-able	-	22 m	. H-beam girder . Spread foun-dation	. No difficulty in construction	1
48	10.05	Malubog Br. Tangub City	362	25.00	Timber . Dilapi-dated condition	5	25 m	. H-beam girder . Pile foun-dation	. No difficulty in construction	1
49	11.01	Lambunao Br. Surigao del Sur	-	40.00	Bailey	-	19+19 = 38 m	. H-beam girder . Pile foun-dation	. No difficulty in construction	1

PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
50	11.02	Balibadon Br. Surigao del Sur	-	36.00	Timber	-			. No data	-
51	11.03	Calabanit Br. South Cotabato	270	36.80	Timber . Deteriora-tion steel and timber trestle	5	20+20 = 40 m	H-beam ringer pile foundation	. No difficulty in construction	1
52	11.04	Manay Bridge Davao Oriental	450	42.67	Bailey . Fair Steel . Permanent sub-structure	5	. Demand on existing span length	. Depend on existing pier condition	. Stability of permanent substructure shall be checked	2
53	11.05	Culaman I Br. Davao del Sur	-	72.00	Bailey	-			. No data	-
54	12.01	Pikinit Br. Lanao del Norte	76	20.00	Bailey	3	21 m	. H-beam girder . Pile foun-dation	. Maximum high water level shall be checked	2
55	12.02	Durugao Br. Maguindanao	-	40.00	Bailey . Fair steel . Permanent sub-structure	5	. Depend on existing span length	. Depend on existing pier condition	. Stability of permanent substructure shall be checked	2
56	12.03	Upian Bridge North Cota-bato	124	45.00	.Bailey . Dilapi-dated condition	5	25+25 = 50 m	. H-beam girder . Spread foundation	. No difficulty in construction	1

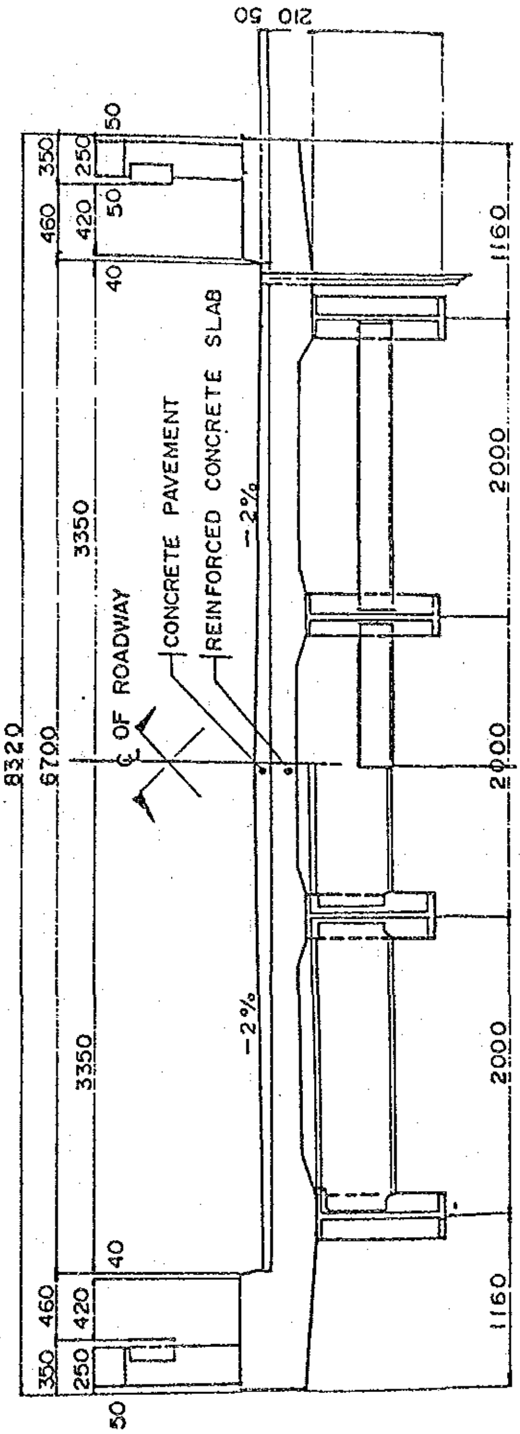
PHASING OF PROPOSED BRIDGES

NO.	BRIDGE NO.	NAME OF BRIDGE	TRAFFIC VOLUME (ADT)	EXISTING BRIDGE			PROPOSED BRIDGE		DESIGN AND CONSTRUCTION REQUIREMENTS	PHASING
				LENGTH (m)	LENGTH AND CONDITION	LOAD LIMIT (TONS)	LENGTH (m)	TYPE		
57'	12.04	Dangolaan Bridge Lanao del Norte	76	25.00	Timber	3	24 m	. H-beam girder . Pile foundation	. Direction of river stream was changed . Study of flood is required	2
58	12.05	Sapakan Br. Maguindanao	686	100.00	Bailey . Fair steel . Permanent substructure	10	. Depend on existing span length	. Depend on existing pier	. Stability of existing permanent substructure shall be checked.	2

APPENDIX 7

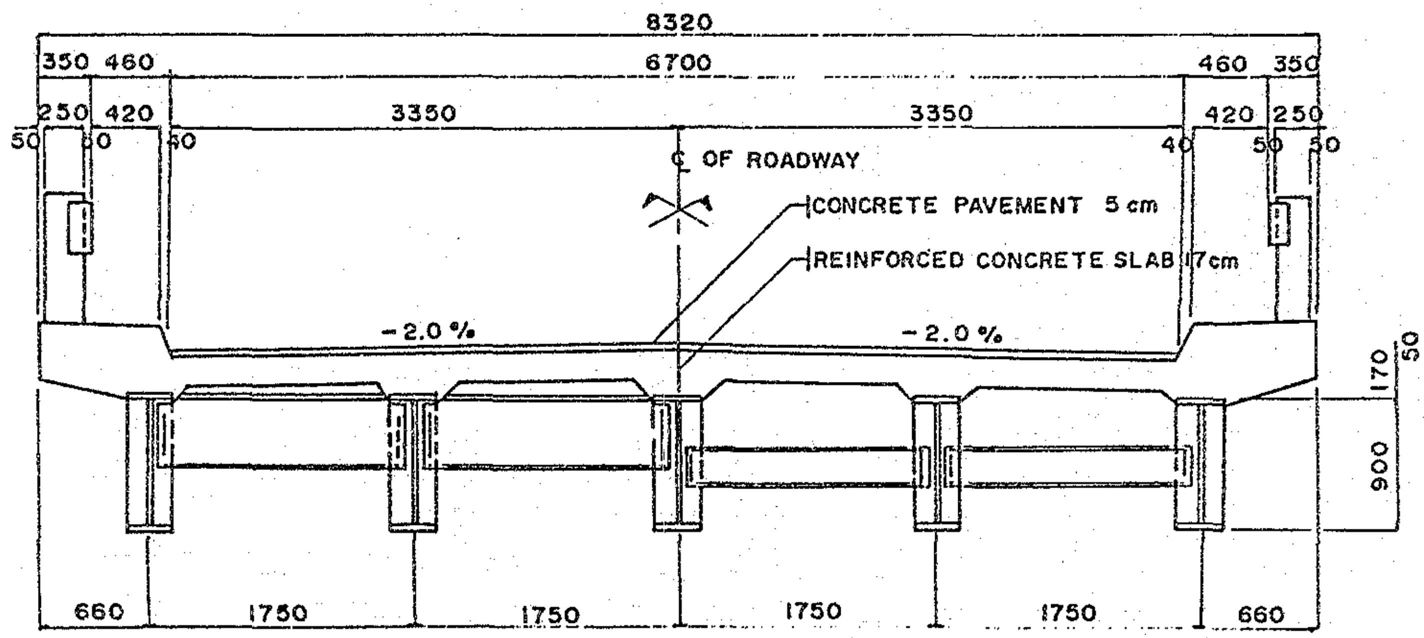
DESIGN ANALYSIS OF SUPERSTRUCTURES

1. View of Standard Cross Section



SUPERSTRUCTURE CROSS SECTION
SCALE: 1:50m
SPAN L = 12,16,17,18,19,20,21,22,23 M

FIGURE 1 SUPERSTRUCTURE CROSS SECTION (L=12 - 23)



SUPERSTRUCTURE CROSS SECTION

SPAN L = 25 m.

FIGURE 2 SUPERSTRUCTURE CROSS SECTION (L=25)

2. MAIN GIRDERS SECTION AND STRESS

Main girder sections are determined at G.1.

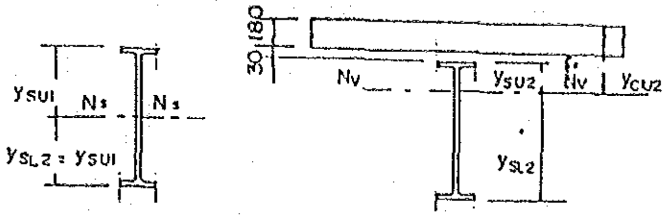


FIGURE 3

TABLE 1 STRESS OF GIRDER (L=12,16,17,18,19)

Span (L)		12	16	17	18	19
Girder Size		H790x300	H700x300	H700x300	H792x300	H800x300
Before Composite Sec.	Is	201.000	same to L = 12 m	same to L = 12 m	254.000	292.000
	As	235.500			243.400	267.400
	Ysu	35.000			39.600	40.000
	YsL	35.000			39.600	40.000
After Composite Sec.	Iv	580.100			717.700	793.400
	Av	785.500			791.100	816.700
	Yeuz	23.090			24.880	26.030
	Ysuz	2.090			3.880	5.030
	Ysez	67.910			75.320	74.970
Stress	σc	23.100	46.200	53.100	49.800	52.100
	σsu	425.000	749.000	843.000	872.000	870.000
	σse	1007.000	1689.000	1886.000	1875.000	1835.000

TABLE 2 STRESS OF GIRDER (L=20,21,22,23,25)

Span (L)		20	21	22	23	25
Girder Size		H890x299	H900x300	H900x300	H912x300	H900x300
Before Composite Sec.	Is	345.000	411.000	Same to L = 21 m	493.000	411.000
	As	270.900	309.800		364.000	309.800
	Ysu	44.500	45.000		45.600	45.000
	YsL	44.500	45.000		45.600	45.000
After Composite Sec.	Iv	939.500	1069.800		1239.700	957.500
	Av	821.200	860.100		914.000	678.900
	Yeuz	27.640	29.530		31.940	34.280
	Ysu	6.640	8.530		10.940	14.280
	Ysl	82.360	81.470		80.260	75.720
Stress	σc	49.800	50.200	53.200	54.300	67.500
	σsu	918.000	882.000	967.000	916.000	1025.000
	σse	1878.000	1758.000	1910.000	1744.000	1872.000

Notice : The bridges of which span lengthare from 12 m to 23 m consist of 4 main girders. The bridge L = 25 m have 5 main girders.

3. REACTION OF SUPERSTRUCTURE FOR ONE ABUTMENT

TABLE 3 REACTION OF SUPERSTRUCTURE R: ton

Span	Vertical Reaction			Earthquake			
				Longitudinal		Lateral	
	Dead Load	Live Load	Total	Vertical	Hori-zontal	Vertical	Hori-zontal
12	45.0	51.4	96.4	45.0	10.8	45.0	5.4
16	60.0	55.8	115.8	60.0	14.4	60.0	7.2
17	63.6	56.6	120.2	63.6	15.3	63.6	7.6
18	67.6	57.4	125.0	67.6	16.2	67.6	8.1
19	71.4	58.2	129.6	71.4	17.1	71.4	8.6
20	75.0	59.0	134.0	75.0	18.0	75.0	9.0
21	78.8	59.4	138.2	78.8	18.9	78.8	9.5
22	82.4	60.0	142.4	82.4	19.8	82.4	9.9
23	86.4	60.4	146.8	86.4	20.7	86.4	10.4
25	86.2	61.3	147.5	86.2	20.7	86.2	10.3

4. MOMENTS AND SHEARING FORCES OF MAIN GIRDER

(Span Length L = 12~23 m)

4.1 Loads

4.1-1 Dead Loads

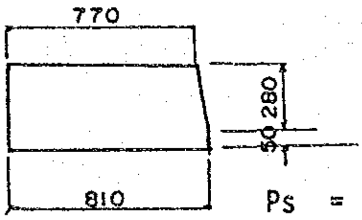
(1) Hand Rail

Post 0.250 x 0.250 x 0.8 x 2.4 = 0.120 t

Beam 0.150 x 0.300 x 1.85 x 2.4 = 0.200 t

P_H = (0.12 + 0.200)/1.85 = 0.175 t/m

(2) Side Walk



(0.770 + 0.810)/2 x 0.28 x 2.4 = 0.530 t/m

0.810 x 0.050 x 2.4 = 0.100 t/m

Ps = 0.530 + 0.100 = 0.630 t/m

(3) Concrete Pavement

0.05 x 2.4 = 0.120 t/m^2

(4) Concrete Slab

0.180 x 2.4 = 0.432 t/m^2

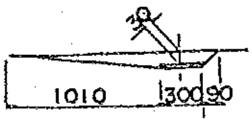
(5) Girder Weight

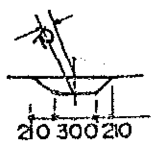
0.300 t/m

(6) Haunch

G.1 (1.4 + 0.3)/2 x 0.03 x 2.4 = 0.061 t/m

G.2 (0.72 + 0.3)/2 x 0.07 x 2.4 = 0.086 t/m





4.1-2 Live Loads

Truck Loads	HS 20-44 (MS 18)
Sidewalk Loads	0.293 t/m^2

4.1-3 Impact Fraction

$$I = \frac{50}{\frac{L}{0.305} + 125}$$

L = Length of Meter

I : Impact Fraction (But ≤ 0.3)

TABLE 4 IMPACT FRACTION

Span (L)	Impact (I)
12	0.300
16	0.282
17	0.277
18	0.272
19	0.267
20	0.262
21	0.258
22	0.254
23	0.249
25	0.242

4.2 Bending Moment

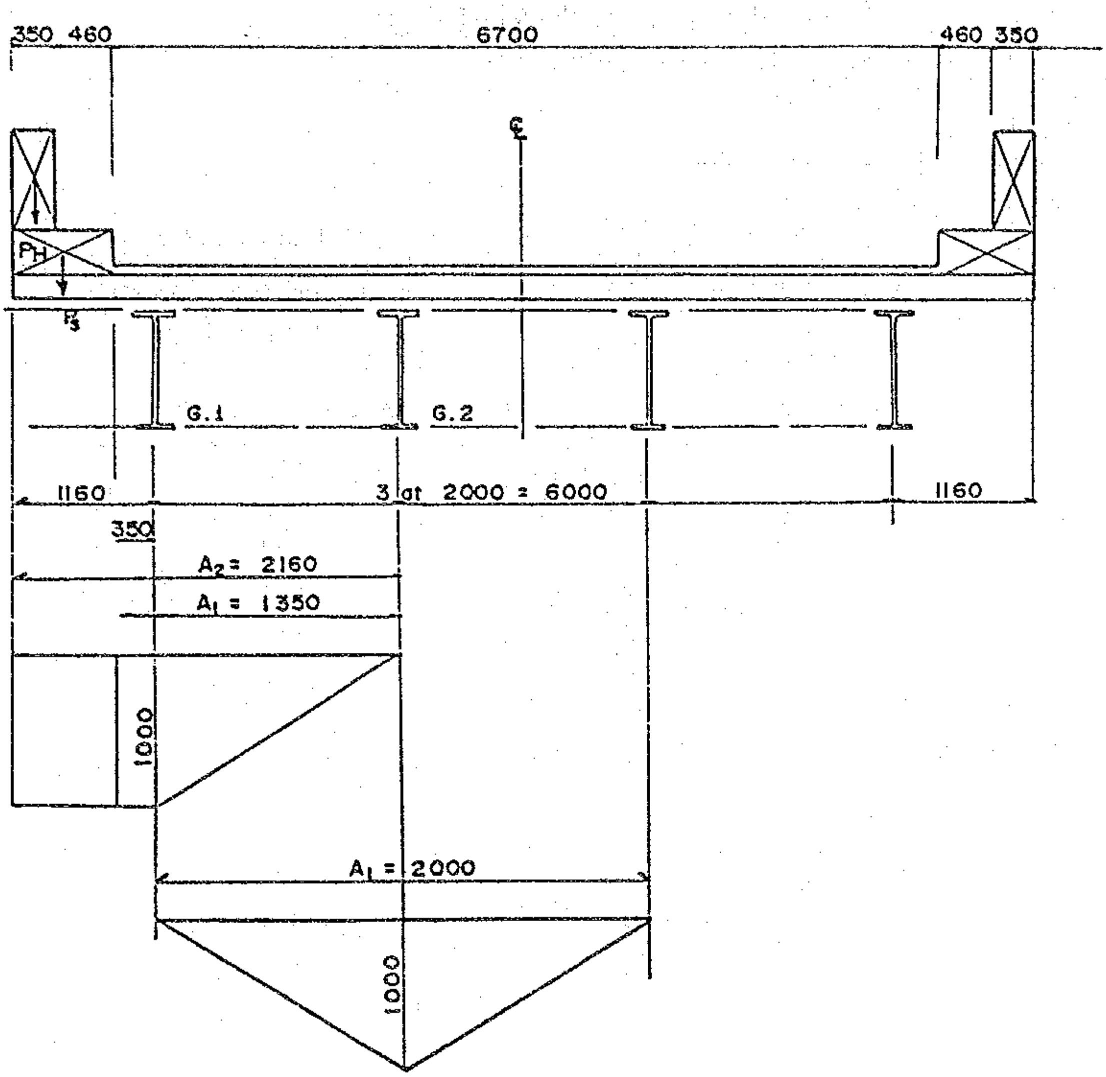


FIGURE 4 LOAD DISTRIBUTION DIAGRAM

4.2-1 Dead Load

G.1

Slab	0.432 x 2.160	= 0.933 t/m
Haunch		= 0.061 t/m
Girder		= 0.300 t/m
		Wd_1 = 1.294 t/m

Hand Rail	=	0.175 t/m
Sidewalk	=	0.630 t/m
Pavement 0.120 x 1.350	=	0.162 t/m
Wd2	=	0.967 t/m

Sidewalk Live Load Ww = 0.293 x 0.460 = 0.135 t/m
Amount of the dead load and the sidewalk load moments are determined by the formula:

$$Md = 1/8.Wd.L^2 \ (t \cdot m)$$

Amount of the live load moments are determined by AASHTO (Appendix A)

TABLE 5 BENDING MOMENT OF G1

M: t·m

Span (m)	Before Composition	After Composition			
		Dead Load	Live Load	Impact Load	Total
12	23.3	17.4	2.4 24.4	7.3	51.5
16	41.4	30.9	4.3 37.2	10.5	82.9
17	46.7	34.9	4.9 40.8	11.3	91.9
18	52.4	39.2	5.5 44.1	12.0	100.8
19	58.4	43.6	6.1 47.3	12.6	109.6
20	64.7	48.4	6.8 50.6	13.3	119.1
21	71.3	53.3	7.4 53.8	13.9	128.4
22	78.3	58.5	8.2 57.1	14.5	138.3
23	85.6	63.9	8.9 60.4	15.0	148.2
25	101.1	75.5	10.5 66.9	16.2	169.1

G.2

Slab 0.432 x 2.0 = 0.864 t/m
Haunch = 0.086 t/m
Girder = 0.300 t/m
Wd1 = 1.250 t/m

Pavement 0.120 x 2.0 = 0.240 t/m
Wd2 = 0.240 t/m

TABLE 6 BENDING MOMENT OF G2

M; t·m

Span (m)	Before Composition	After Composition			
		Dead Load	Live Load	Impact Load	Total
12	22.5	4.3	36.1	10.8	51.2
16	40.0	7.7	55.1	15.5	78.3
17	45.2	8.7	60.4	16.7	85.8
18	50.6	9.7	65.3	17.8	92.8
19	56.4	10.8	70.0	18.7	99.5
20	62.5	12.0	74.9	19.6	106.5
21	68.9	13.2	79.8	20.6	113.6
22	75.6	14.5	84.7	21.5	120.7
23	82.7	15.9	89.6	22.3	127.8
25	97.7	18.8	99.2	24.0	142.0

4.2-3 Shearing Force

TABLE 7 SHEARING OF G1,G2

S: ton

Girder	Span (m)	Before Composition	After Composition			
			Dead Load	Live Load	Impact Load	Total
G.1	12	7.8	5.8	0.8 10.0	3.0	19.6
	16	10.4	7.7	1.1 10.8	3.0	22.6
	17	11.0	8.2	1.1 11.0	3.0	23.3
	18	11.6	8.7	1.2 11.1	3.0	24.0
	19	12.3	9.2	1.3 11.2	3.0	24.7
	20	12.9	9.7	1.4 11.3	3.0	25.4
	21	13.6	10.2	1.4 11.4	2.9	25.9
	22	14.2	10.6	1.5 11.5	2.9	26.5
	23	14.9	11.1	1.6 11.5	2.9	27.1
G.2	12	7.5	1.4	14.9	4.5	20.8
	16	10.0	1.9	16.0	4.5	22.4
	17	10.6	2.0	16.2	4.5	22.7
	18	11.3	2.2	16.4	4.5	23.1
	19	11.9	2.3	16.6	4.4	23.3
	20	12.5	2.4	16.8	4.4	23.6
	21	13.1	2.5	16.9	4.4	23.8
	22	13.8	2.6	17.0	4.3	23.9
	23	14.4	2.8	17.1	4.3	24.2

5. MOMENT AND SHEARING FORCE OF MAIN GIRDER

5.1 Loads Span Length L = 25 m

5.1-1 Dead Loads

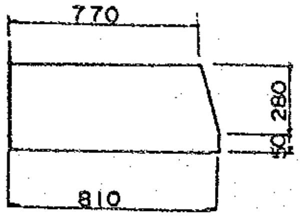
(1) Hand Rail

Post 0.250 x 0.250 x 0.8 x 2.4 = 0.120 t

Beam 0.150 x 0.300 x 1.85 x 2.4 = 0.200 t

P_H = (0.12 + 0.200)/1.85 = 0.175 t/m

(2) Sidewalk



(0.770 + 0.810)/2 x 0.28 x 2.4 = 0.530 t/m

0.810 x 0.050 x 2.4 = 0.100

Ps = 0.530 + 0.100 = 0.630 t/m

(3) Concrete Pavement

0.05 x 2.4 = 0.120 t/m^2

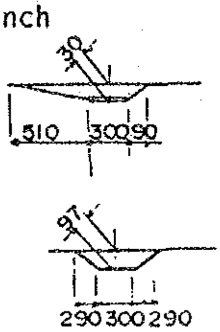
(4) Concrete Slab

0.170 x 2.4 = 0.408 t/m^2

(5) Girder Weight

0.300 t/m

(6) Haunch



G-1 (0.9+0.3)/2 x 0.03 x 2.4 = 0.043 t/m

G-2 (0.67+0.3)/2 x 0.062 x 2.4 = 0.072 t/m

G-3 (0.88+0.3)/2 x 0.097 x 2.4 = 0.137 t/m

5.1-2 Bending Moment

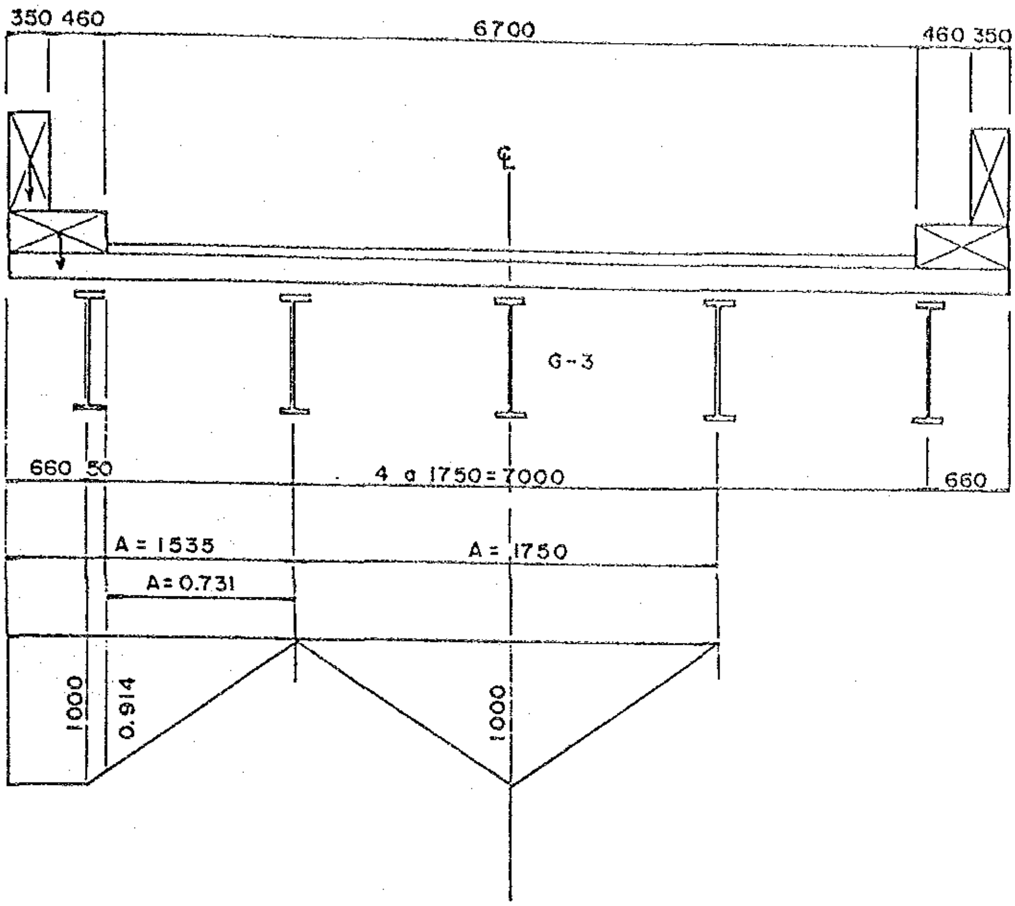


FIGURE 5 LOAD DISTRIBUTION DIAGRAMN

(1) Dead Load

G-1

Slab	0.408 x 1.535	=	0.626 t/m
Haunch		=	0.043 t/m
Girder		=	0.300 t/m
	Wdl	=	0.969 t/m

Hand Rail		=	0.175 t/m
Side Walk		=	0.630 t/m
Pavement	0.12 x 0.731	=	0.088 t/m
	Wd2	=	0.893 t/m

Sidewalk Live Load Ww = 0.293 x 0.46 = 0.135 t/m
Amount of the dead load and the sidewalk load moments are determined by the formula:

$$Md = 1/8 \cdot Wd \cdot L^2 \ (t \cdot m)$$

Amount of the live load moments are determined by AASHTO (Appendix A)

TABLE 8 BENDING MOMENT OF G1 (M: t·m)

Span (m)	Before Composition	After Composition			
		Dead Load	Live Load	Impact Load	Total
25	75.7	69.8	10.5 41.6	10.1	132.0

Note:

Before Composition

$$M = 1/8 \times 0.969 \times 25.0^2 = 75.7 \ t \cdot m$$

After Composition

$$M\ (D.L.) = 1/8 \times 0.893 \times 25.0^2 = 69.8 \ t \cdot m$$
$$M\ (L.L.) = (166.2 \times 2)/7.0 \times 0.875 = 41.6 \ t \cdot m$$
$$M\ (L.W.) = 1/8 \times 0.135 \times 25.0^2 = 10.5 \ t \cdot m$$
$$M\ (L.I.) = 41.6 \times 0.242 = 10.1 \ t \cdot m$$

G.3

Slab		=	0.408 t/m
Haunch		=	0.137 t/m
Girder		=	0.300 t/m
	Wd1	=	0.845 t/m
Pavement	0.120 x 1.75	=	0.210 t/m
	Wd2	=	0.210 t/m

TABLE 9 BENDING MOMENT OF G2

Span (m)	Before Composition	After Composition			
		Dead Load	Live Load	Impact Load	Total
25	66.0	16.4	83.1	20.1	119.6

5.2 SHEARING FORCE

G.1

Before Composition

$$S_{d1} = 1/2 \times 0.969 \times 25.0 = 12.1\ t$$

After Composition

S_{d2}	=	$1/2 \times 0.893 \times 25.0$	=	11.1
S_w	=	$1/2 \times 0.135 \times 25.0$	=	1.7
S_L	=	$(28.96 \times 2)/\ 7 \times 0.875$	=	7.2
S_i	=	7.2×0.242	=	1.8
		S_2	=	21.9 t

G.3

Before Composition

$$S_{d1} = 1/2 \times 0.845 \times 25.0 = 10.6\ t$$

After Composition

S_{d2}	=	$1/2 \times 0.210 \times 25.0$	=	2.6 t
S_L	=	$(28.96 \times 2)/\ 7 \times 1.75$	=	14.5 t
S_i	=	14.5×0.242	=	3.5 t
		S_2	=	20.6 t

NOTE: Table of Maximum M.S.R., Loading HS 20-44 (MS18)

from AASHTO APPENDIX A

TABLE OF MAXIMUM MOMENTS, SHEARS AND
REACTIONS-SIMPLE SPANS, ONE LANE

Impact not included

Span (m)	Moment (kNm)	(t·m)	Reaction (kN)	(t)
12	593.1	(60.52)	244.3	(24.93)
16	904.3	(92.28)	263.4	(26.88)
17	991.8	(101.20)	266.7	(27.21)
18	1071.7	(109.40)	269.6	(27.51)
19	1149.4	(117.30)	272.4	(27.80)
20	1229.5	(125.50)	275.0	(28.06)
21	1309.5	(133.60)	276.8	(28.24)
22	1389.7	(141.80)	278.9	(28.46)
23	1469.8	(150.00)	280.9	(28.66)
25	1628.6	(166.20)	283.8	(28.96)

APPENDIX 8

GUIDELINE FOR DESIGN OF SUBSTRUCTURES

1. Earth Pressure

As Rankine's formula specified by AASHTO specification does not take into account effect due to seismic horizontal force, Coulomb's formula which is modified to include the effects is adoptable.

1.1 Active Earth Pressure of Sandy Soil

Coulomb's formula for active earth pressure of sandy soil, is expressed as follows:

$$pa = (q + r\,x)\ KA$$

where:

pa: active earth pressure at x

KA: Coulomb's active earth pressure coefficient

$$KA = \frac{\cos^2 (\emptyset - 0 - 0)}{\cos 0o \cos^2 \cos (0+)o+8)\ 1 + \frac{\sin(\emptyset +)\sin(\emptyset \ -0o}{\cos(0+)o+)\cos(0-d)}^2}$$

when Ø-a-0z 0, adopt Ø- -0o = 0

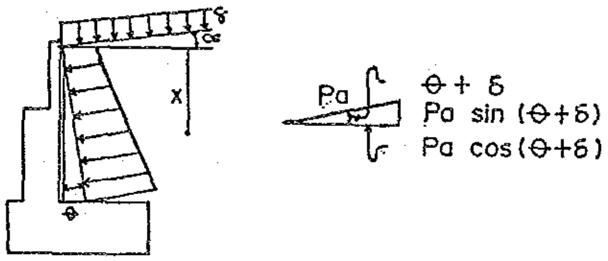


FIGURE 1 EARTH PRESSURE

Ø: angle of backfill

θo: $\theta o = \tan^{-1} k$

k: seismic horizontal coefficient

θ: angle between back of wall and vertical plane

α: angle between ground surface and horizontal plane

δ: friction angle along wall boundary

: surcharge

r: unit weight of backfill

x: depth of point under construction

1.2 Ø and r

It is recommended to use the following angle of repose Ø and unit weight of backfill r, unless selected backfill is used.

Ø = 30°
r = 1.8 $^{t}/m^{3}$

1.3 δ

There are two types of failure wedge, for stability of a structure and for design of a wall member.

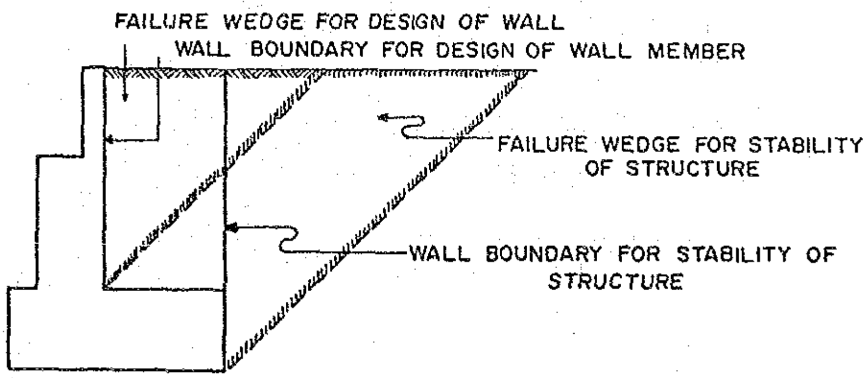


FIGURE 2 FAILURE WEDGE AND WALL BOUNDARY

The friction along the wall boundary is different for each wedge.

It is recommended to use the following table of friction angle.

TABLE I FRICTION ANGLE

	Friction Between	Group I L.	Group VII L.
Stability	Fill and fill	ϕ	$\phi/2$
Design of Members	Fill and concrete wall	$\phi/3$	0

ϕ: angle of repose of backfill

1.4 Earth Pressure Coefficient KA

The earth pressure coefficient KA is tabulated in Table 2 varying ϕ from 25° to 40°, k from 1.0 to 0.25 and k = 0 (group I loading) with combinatin of δ

1.5 Surcharge q

Live load surcharge q for HS-20 on backfill is obtained as follows:

Weight of a rear axle load	w	=	32000 lbs.
		=	14.5 tons
Distance of rear axles	L	=	14 ft.
		=	4.267 m
Width of truck	B	=	10 ft.
		=	3.048 m

$$q = \frac{w}{L.B.} = 1.17^{t/m^2}$$

1.6 Earth Pressure for Design Footing

A footing shall be designed taking account of vertical component of earth pressure. The component is assumed to be distributed as an equivalent triangle on the footing, as shown in Figure 3.

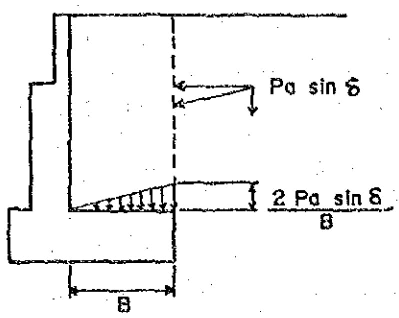


FIGURE 3 VERTICAL COMPONENT OF EARTH PRESSURE FOR DESIGN OF FOOTING

2. Horizontal Seismic Force due to Superstructure

Substructures shall be designed taking account of horizontal seismic force due to superstructures as follows: (refer Figure 4).

(1) AL (Expansion Bearing)

Horizontal seismic force at AL, HAL

HAL = smallest of RaL x fal or 1/2 k WA

(2) P_1 (Fixed and Expansion Bearing)

HaR + HbL = largest of k WA or 1/2 KWA + RoL fbL

(3) AR (Fixed Bearing)

HbR = kWb

Where:

fal: friction coefficient of expansion bearing AL

An equivalent friction coefficient of an elastomeric bearing is obtained as follows:

Using relation of shearing force and strain of an elastomeric bearing due to horizontal force H.

$H = G r A$

G: Modulus of shearing elasticity ($6.2\ kg/cm^2$)

r: shearing strain (maximum $r = 0.5$)

A: area of elastomeric bearing

Assuming the normal stress of bearing of $30\ kg/cm^2$ under dead load

$N/A = 30\ kg/cm^2$

then:

$H = GrN/30$

$H/N = Gr/30$

$= 6.2 \times 0.5/30 = 0.10 = f$

fbL: friction coefficient of expansion bearing BL

HaL: horizontal seismic force on AL due to span A

HaR: horizontal seismic force on P1 due to span A

HbL: horizontal seismic force on P1 due to span B

HbR: horizontal seismic force on AR due to span B

ks : horizontal seismic coefficient

RaL: reaction on AL due to WA

RaR: reaction on P1 due to WA

RbL: reaction on P1 due to WB

WA : dead weight of span A

WB : dead weight of span B

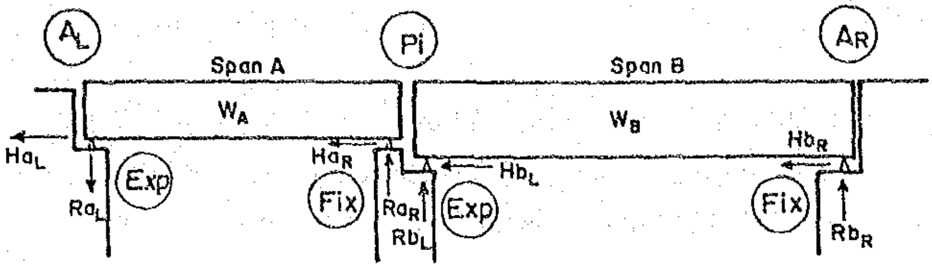


FIGURE 4 HORIZONTAL SEISMIC FORCE

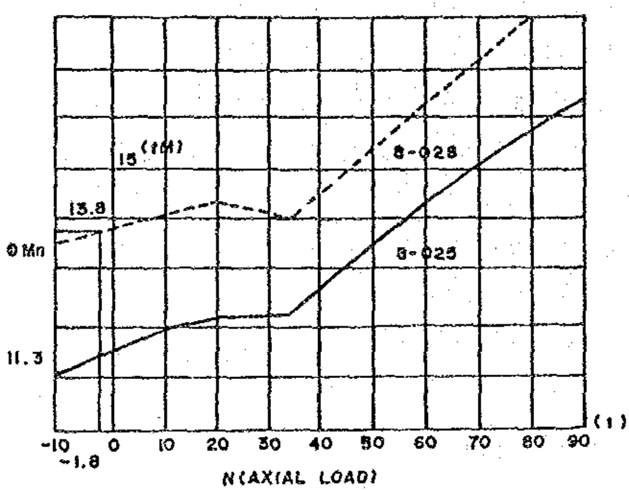
3. Pile

3.1 Ultimate Strength of Precast RC Pile

Required number and arrangement of piles is governed not only by capacity of the ground to support the load delivered by the pile, but also by the strength of the pile itself subjected combinations of bending moment and axial load.

It is recommended to use Load Factor Design for design of a pile under Group Loading VII.

Figure 5 gives the interaction diagram of standard RC pile



$f'c = 210\ kg/cm^2$ (3000 psi)
$fsy = 2800\ kg/cm^2$ (Grade)

FIGURE 5 INTERACTION DIAGRAM OF STANDARD RC PILE ($0.^m4 \times 0.^m4$)

Example

Select type of a pile subjected

M = 10.1 tm/pile and N = -1.8 t/pile

Try pile provided 8-ø25

$\phi M = 11.3^{tm}$

$1.3M = 1.3 \times 10.1 = 13.1 \qquad \phi M = 11.3$ No

Try pile (8-ø28)

$\phi Mn = 13.8^{t.m}$

1.3M øMN

Adopt pile with 8-ø28

3.2 Spacing, clearance and Embedment

It is recommended to use following minimum spacing, clearance and embedment of piles considering accuracy of pile driving on the position, firm connection with a footing and reduction of load carrying capacity as group pile, though AASHTO specifies otherwise.

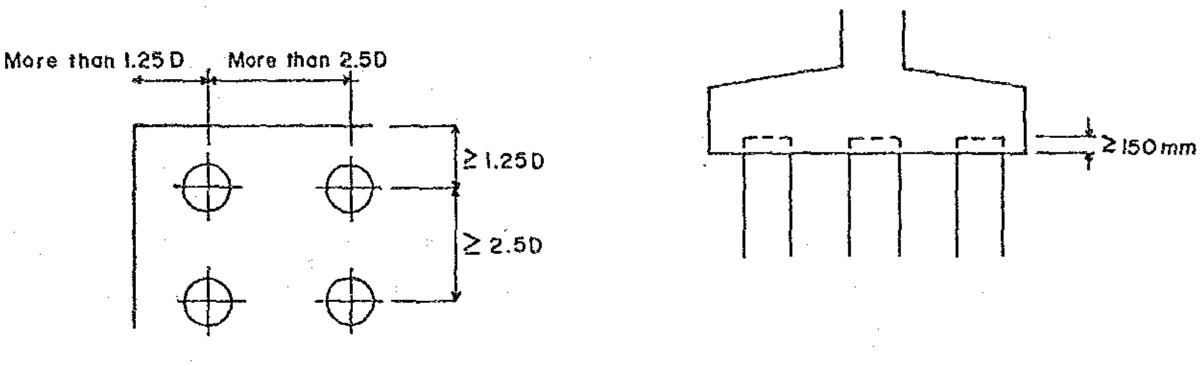


FIGURE 6 SPACING, CLEARANCE AND EMBEDMENT OF PILE

3.3 Design of Pile Embedment in Embankment

Piles in an open type of abutment are often used being extended from original ground, a-d embedded in embankment adjacent to a slope.

In this case, it is very difficult to expect subgrade lateral reaction to the piles as well as in original ground, even though the embankment is well compacted. And also, the embankment has a tendency to move toward the slope.

Taking these facts into consideration, it is recommended to analyze the pile assuming that one is extended from the original ground and no lateral resistance to the pile is expected in the embankment.

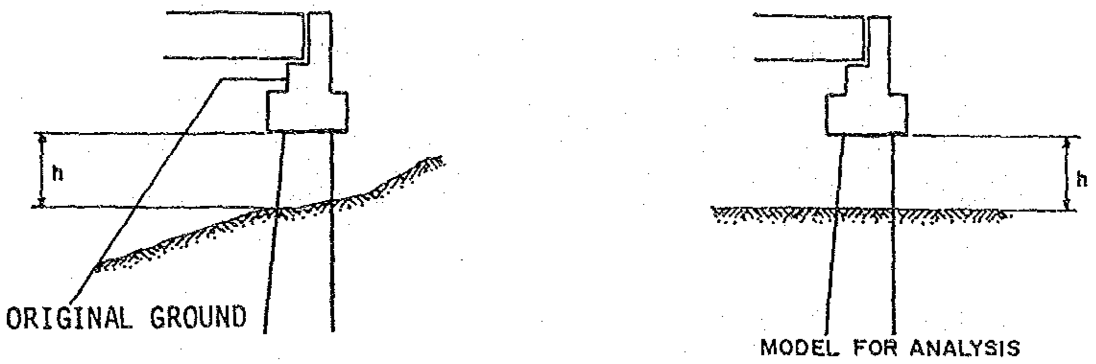


FIGURE 7 PILE EMBEDDED IN EMBANKMENT

4. Design of Backwall

A backwall is greatly affected by wheel loads as surcharge. Assuming that a wheel load is distributed depending on the depth from the load surcharged.

$$Px = \frac{T}{(a+x)}$$

$$Py = \frac{T}{(a+x)}$$

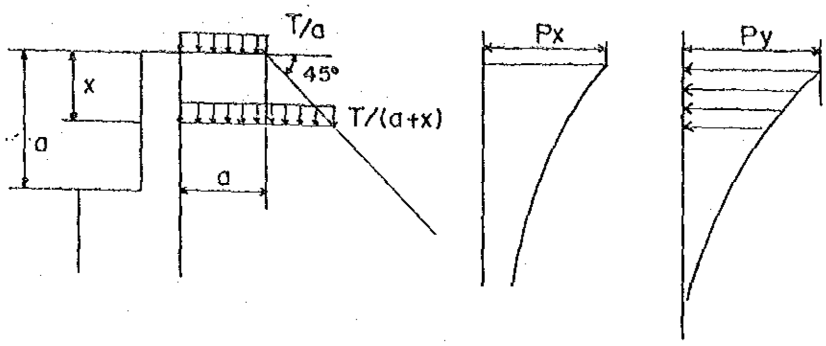


FIGURE 8 EARTH PRESSURE ON BACKWALL

where:

T = distributed axle load (t/m)
a = longitudinal distribution of wheel load (m)
x = depth (m)
Ka = earth pressure coefficient

integrating PY from 0 to h

$$MW = \int_o^h PY \ . \ x\,dx - Kat\ 1\text{-}h + (hla)\ \log\ (\frac{a+h}{a})^1$$

$$SW = \int_o^h py\,dx = KaT\ \log\ (\frac{a+b}{a})$$

then, bending moment and shearing force of backwall can be obtained by the following equation in the case of h 1^m, substituting

$a = 0.2^m$, $T = 14.5\ t/3.05^m$
$= 4.75\ t/m\ (9.81)$
$Mw = 8.5\ Ka\ x\ (h-0.24)$ (tm/m)
$Sw = 8.5\ Ka$ (t/m)

5. Wing Wall

5.1 Dimensions

Dimensions of a wing wall are determined by slope of backfill and retaining height of an abutment, as shown in Figure 9.

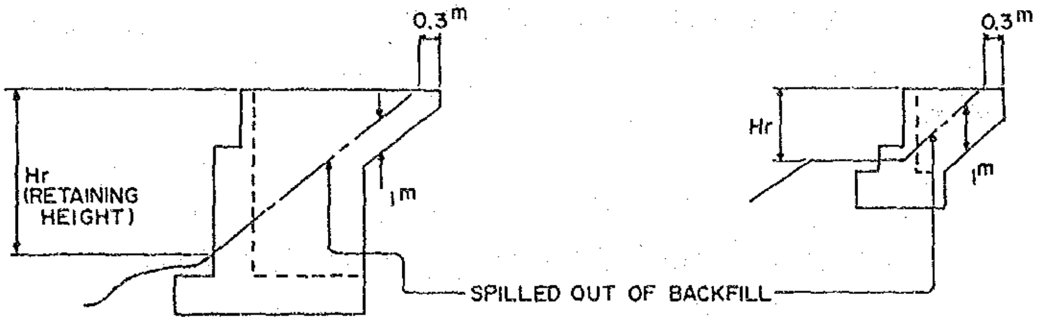


FIGURE 9 DIMENSIONS OF WING WALL

5.2 Design of Wing Wall

A wing wall is analytically a two-way slab subjected earth pressure. However, it is recommended to use the following simplified concepts for the design:

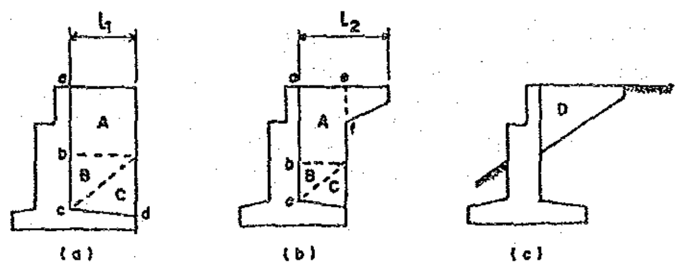


FIGURE 10 TYPE OF WING WALL

1. Part A and D are supported along ab and ef respectively, as a cantilever beam, and it is assumed that bending moment and shearing force caused by the earth pressure on part A and D, is equivalently distributed along ab and ef.

2. Part B and C are supported along bc and cd respectively, as a cantilever beam, as shown in Figure 11.

Bending moment can be obtained as follows.

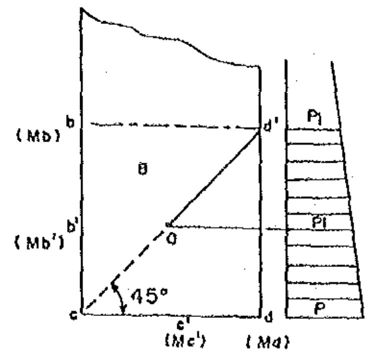


FIGURE 11 DESIGN OF WING WALL

for b-b'	M_b	$= 1/2 \times pi \times \overline{bd'}^{\,2}$
b-C	M'_b	$= 1/2 \times pi \times \overline{b'O}^{\,2}$
d-C'	Md	$= 1/6 \times (2pi + pk) \times \overline{dd'}^{\,2}$
C'-C	M'c	$= 1/6 \times (2pi + pk) \times \overline{C'O}^{\,2}$

5.3 Connection of Wing Wall With Backwall

A backwall has to sustain a part of horizontal bending moment transmitted from part A and D.

It is recommended to provide a haunch and increase thickness of backwall in order to secure frim connection with backwall, when it is relatively thin comparing thickness of wingwall as shown below:

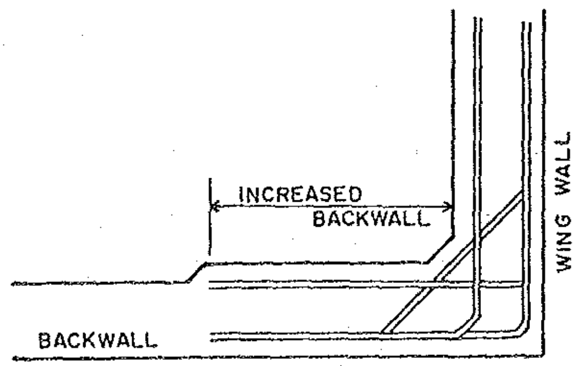


FIGURE 12 CONNECTION OF WING WALL WITH BACK WALL

APPENDIX 9
BENEFIT CALCULATION

BENEFIT CALCULATION

1. General

The quantified traffic benefits are savings in road traffic costs, maintenance costs, restoration cost and salvage value. These direct benefits were studied as follows:

2. Traffic Benefits

1) Savings in Road Traffic Costs.

Basic vehicle operating cost (BVOC) of owning and operating road vehicles is composed of the following cost.

Running Cost: That portion of the vehicle operating cost which is calculated in units of distance (Kilometers) travelled.

Basic Fixed Cost: That portion of the vehicle operating cost which is calculated in units of time travelled.

Passenger Time Cost: Passenger time value including the time of the car driver.

Accidents Cost: The implementation of this Project will reduce the number of traffic accident caused by detouring or bridge failures.

The above mentioned basic costs, which are used as a basis for this study, were updated by the Planning Service of the Department of Public Works and Highways (DPWH) to 1988 prices in accordance with the procedure outlined in DPWH's Highway Planning Manual. Such costs were assumed to be incurred by vehicles operating under the basic ideal Philippines condition:

2) Savings in Maintenance/Restoration Costs

Without the project, maintenance restoration expenditures will be required. With the project, such expenditures will become unnecessary and they can be added as project benefit. Basic conditions considered are as follows:

The costs of Maintenance/restoration were assumed by applying EMIC (Equivalent Maintenance Kilometer) method being used by DPWH.

3) Salvage Value

The allowance in the economic analysis of a net salvage value at the end of the economic life of the project is beset with uncertainties. Whether road construction consisting of land molded to road geometrics would have a positive salvage value at some Far-distant year is uncertainly. Practically none of the road construction would be beneficial to any alternatives use without considerable cost expanded to make it suitable. Likewise, most bridges have no value except as a part of a road. Therefore, this benefit was considered negligible.

3. Saving in Road Traffic Costs

Road Condition and Future Traffic Volume

The road conditions of the road section including the subject bridge and the alternative routes are estimated as follows:

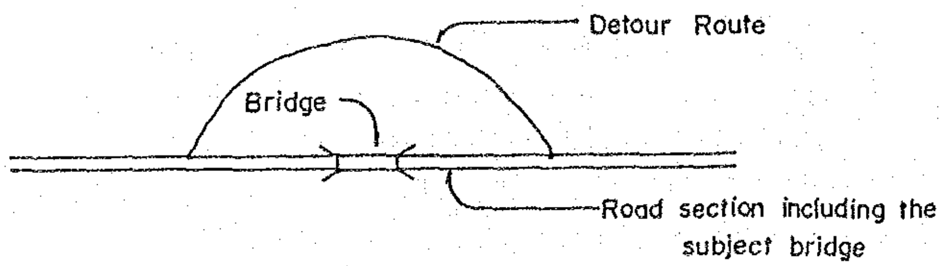


TABLE 1 Road Condition (Average)

	Road including Subject Bridge	Alternative Route
Length of Section	10 Km	35 Km
Surface Type	Gravel	Gravel
Surface Condition	Bad	Bad
Traffic Volume	See Table 10-2	

TABLE 2 Future Traffic Volume (AADT)

Vehicle Type	1988	1990	2000	2010
Car/Van	2,544	2,658	4,128	6,411
Jeepney	2,459	2,570	3,990	6,192
Bus	863	902	1,400	2,175
Truck	2,368	2,474	3,843	5,968
T o t a l	8,234	8,604	13,361	20,751

Traffic Growth Rate

Growth in Traffic is calculated on the basis of population growth, growth in per capita income and transport demand-income elasticities, possibly by income group. The formula for the Traffic growth rates (TGR) is as follows:

$$\text{TGR (in percent)} = \left[\left(\frac{I \times E}{100} + 1\right)^{CP} - 1\right] - 100,$$

Where: TGR is the traffic growth rate per annum;

E is the transport demand-income elasticity for the respective vehicle type;

I is the growth rate (in percent) for per capita income in constant prices; and

CP is the compound population growth rate per annum (e.g. 3 percent population growth becomes 1.03 compounded).

Given Data:

E = 1.0 (corresponding to the per capita income)
I = 2.0 percent
CP = 1.025

$$TGR = \left[\left(\frac{2.0 \times 1.0}{100} + 1\right) 1.025 - 1\right] \times 100$$
$$= 4.5\ \%$$

TABLE 3 TRAFFIC VOLUME (AADT), 1987

Bridge No. (Location)	Car/Van	Jeepney	Bus	Truck	Total
02.03	100	90	23	37	250
02.04	112	101	25	43	281
04.07	20	18	4	8	50
04.08	24	22	5	9	60
05.02	250	225	56	93	624
06.02	156	140	35	59	390
06.04	24	22	5	9	60
07.03	36	32	8	13	89
07.04	107	96	24	40	267
07.05	20	18	4	6	50
08.01	38	35	9	14	96
08.02	46	35	9	17	107
08.05	52	47	12	19	130
09.01	68	200	-	72	340
09.02	169	127	116	178	590
09.03	169	127	116	176	590
09.04	179	182	128	178	667
10.02	165	224	-	930	1,319
10.03	252	227	57	94	630
10.04	232	209	52	87	580
10.05	78	51	123	110	362
11.01	90	89	17	112	308
11.03	108	97	24	41	270
12.03	49	45	11	19	124
	2,544	2,459	863	2,368	8,234

TABLE 4 (₱/KM., EXCLUDING TAXES, DECEMBER 1986 PRICES)

ECONOMIC BASIC VEHICLE OPERATING COST AND PASSENGER TIME COST

Surface Type	Surface Condition	Vehicle Type	Running Costs (₱/Km)	Fixed Costs (₱/Km)	Time Costs (₱/Km)	Total Costs (₱/Km)
	Very Bad	Car/Van	1.711	.096	.377	2.184
		Jeepney	1.266	.729	.457	2.452
		Bus	4.199	1.015	2.193	7.407
		Truck	4.495	1.087	0	5.582
	Bad	Car/Van	1.497	.072	.283	1.852
		Jeepney	1.108	.547	.342	1.997
		Bus	3.536	.761	1.645	5.942
		Truck	3.785	.815	0	4.600
Paved	Fair	Car/Van	1.283	.048	.188	1.519
		Jeepney	.949	.364	.228	1.541
		Bus	2.873	.609	1.316	4.798
		Truck	3.075	.652	0	3.727
	Good	Car/Van	1.069	.041	.161	1.271
		Jeepney	.791	.312	.195	1.298
		Bus	2.210	.507	1.096	3.813
		Truck	2.366	.543	0	2.909
	Very Bad	Car/Van	2.032	.096	.377	2.505
		Jeepney	1.503	.729	.457	2.689
		Bus	5.083	1.015	2.193	8.291
		Truck	5.441	1.087	0	6.528
	Bad	Car/Van	1.711	.072	.283	2.066
		Jeepney	1.266	.547	.342	2.155
		Bus	4.199	1.015	2.193	7.407
		Truck	4.495	1.087	0	5.582
Gravel	Fair	Car/Van	1.390	.057	.226	1.673
		Jeepney	1.029	.437	.274	1.740
		Bus	3.315	.761	1.645	5.721
		Truck	3.548	.815	0	4.363
	Good	Car/Van	1.230	.048	.168	1.466
		Jeepney	.910	.364	.228	1.502
		Bus	2.763	.609	1.316	4.688
		Truck	2.957	.652	0	3.609

TABLE 5 SAVING IN TRAFFIC COSTS

	Vehicle Type	Traffic Volume (Veh. Day)	Add. Cost (₱/Veh.)	No. of Days	Saving in Detour (M₱)
1988	Car	2,544	58.78	20	2.99
	Jeepney	2,459	56.00	20	2.75
	Bus	863	153.60	20	2.65
	Truck	2,368	139.75	20	6.61
	Total	8,234			15.00
1990	Car	2,658	58.78	20	3.12
	Jeepney	2,570	56.00	20	2.88
	Bus	902	153.60	20	2.77
	Truck	2,474	139.75	20	6.92
	Total	8,604			15.69
2000	Car	4,128	58.78	20	4.85
	Jeepney	3,990	56.00	20	4.46
	Bus	1,400	153.60	20	4.29
	Truck	3,848	139.75	20	10.75
	Total	13,361			24.35
2010	Car	6,411	58.78	20	7.53
	Jeepney	6,197	56.00	20	6.95
	Bus	2,175	153.60	20	6.68
	Truck	5,968	139.75	20	16.68
	Total	20,751			37.73

4. Calculation of Economic Cost-Benefit Streams

TABLE 6 ADDITIONAL TRAFFIC COST

		Car	Jeepney	Bus	Truck
Add. Length	Km	25	25	25	25
Add. Time	hour	0.34	0.43	0.55	0.89
B. R. C.	₱/km	1.71	1.26	4.20	4.50
B. F. C.	₱/hour	0.07	0.55	1.02	1.09
P. T. C.	₱/hour	42.00	25.00	42.00	-
Running Cost	₱/Veh.	42.75	31.50	105.00	112.50
Fixed Cost	₱/Veh.	1.75	13.75	25.50	27.25
Time Cost	₱/Veh.	14.28	10.75	23.10	-
Total	₱/Veh.	58.78	56.00	153.60	139.75

TABLE 7 ECONOMIC COST-BENEFIT STREAMS

(Unit: M₱ at 1988 Prices)

Year	Cost	Before Discount			After Discount (15%)	
		Saving in Traffic Cost	Saving in Maintenance Cost	Total	Cost	Benefit
1988	93.60	-	-	-	93.60	-
1989	10.40	3.93	0.02	3.95	9.04	3.43
1990	-	15.69	0.08	15.77	-	11.92
1991	-	16.47	0.08	16.55	-	10.88
1992	-	17.33	0.08	17.41	-	9.95
1993	-	18.20	0.08	18.28	-	9.09
1994	-	19.07	0.08	19.15	-	8.28
1995	-	19.93	0.08	20.01	-	7.52
1996	-	20.80	0.08	20.88	-	6.83
1997	-	21.67	0.08	21.75	-	6.18
1998	-	22.53	0.08	22.61	-	5.59
1999	-	23.40	0.08	23.48	-	5.05
2000	-	24.35	0.08	24.43	-	4.57
2001	-	25.71	0.08	25.79	-	4.21
2002	-	27.05	0.08	27.13	-	3.83
2003	-	28.40	0.08	28.48	-	3.50
2004	-	29.75	0.08	29.83	-	3.14
2005	-	31.09	0.08	31.17	-	2.90
2006	-	32.44	0.08	32.52	-	2.63
2007	-	33.80	0.08	33.88	-	2.37
2008	-	35.15	0.08	35.23	-	2.15
2009	-	27.36	0.06	27.42	-	1.45
Total	104.0				102.60	114.94

NPV = 12.34 M₱

B/C = 1.12

IRR = 17.0%

APPENDIX 10

COUNTRY DATA

I. Land and Population

(1) Land

The Philippines consist of 7,100 islands that were formed by repeated orogenic movements and volcanic activities. The islands are divided into the three (3) main groups of Luzon, Visayas and Mindanao. Luzon is the largest island and is located furthest north. Visayas, composed of Samar, Leyte and other islands, is situated between the other two, and Mindanao, the second largest island, is located furthest south.

The area of the major islands is as follows:

Island	Area (km2)
Luzon	104,687
Mindanao	94,630
Samar	13,079
Negros	12,704
Palawan	11,784
Others	43,541
Total	280,415

(2) Climate

The Philippines is located in the tropics. The climate in the Philippines is due to its grographical location and the different winds system that prevails over the locality. The condition of the climate has been described in term of the characteristics of the distribution of rainfall received in a locality during the different month of the year. There are four climate types in the Philippines.

Over 50% of the rainfall is associated with tropical cyclones. The frequency of tropical cyclones in the Philippine Area of Responsibility (PAR) has an average of 20 times a year, while the frequency crossing in the Philippines has an average of 8.8 times a year.

The average annual rainfall in the Philippines is 2416.3 mm The largest average annual rainfall are 4316 mm and 4360 mm at Borongan in Samar and Hinatuan in Surigao del Sur, respectively, both of which face the Pacific Ocean and belong to the 2nd type of climate. The highest daily rainfall was 979.4 mm recorded in Baguio City on October 17,1967. In Samar and Leyet islands, the highest daily rainfall of 387.9 mm was recorded in Catbalogan City, whereas in Mindanao Island, 564.7 mm in Surigao City.

(3) Population

The National Capital Region, an integrated community composed of 4 cities and 13 municipalities, holds a populaiton density of 9,317.4 persons per each square kilometer, as compared to 160.3 for the whole country. Its population has being growing at a much higher rate.

Table 1 shows comparative figures of the population, and density of each region.

II. Economy

(1) National Economy

The decade of the 1970's witnessed substantial growth in the Philippine economy. Real Gross National Product (GNP) increased at an average yearly rate of 6.2 percent from 1972 to 1980. However, the early 1980's was a period of relatively slower growth in the Philippine economy as an effect of the worldwide economic recession precipitated by the oil crisis.

This moreover, continued to pose difficulties for the Philippine economy until the early part of 1983. As a result of this tight financial situation, the maturities of Philippine borrowings became shorter while interest rates became higher. The declining pace of the economy continued until it reached the lowest fall in GNP in 1984 which gave a negative growth of 5.3%. The negative growth of 2.5% in 1985 showed a gradual recovery of the economy, which was actually the start of the Philippine economic recovery, from a negative growth to a positive growth of 1.2% in 1986 to a rapid growth until the early part of 1987 which was estimated at 5.4%.

The relatively higher growth the country is currently experiencing is expected to continue as the necessary structual reforms within the economy are currently being instituted under the new leadership.

(2) Regional Economy

A review of past regional economic performance reveals that different regions of the country showed wide variations in growth and development as exhibited in Table 2 Overall, more than half of the country's domestic output was contributed by only 3 regions: Metro Manila (NCR), Southern Tagalog (R-III) and Western Visayas (R-VI). The depressed regions are Regions II, VIII, IX and XII.

Poverty has been identified as a critical problem in all of the country's regions. Despite various government assistance and programs directed toward low-income groups, the situation has worsened in recent years.

Larger number of poor families and higher poverty incidences have been observed in both developed and poorer regions, pointing to the uneven distribution of incomes within the regions.

As shown in Table 3 regional poverty incidence in 1985 ranged from 44.1 percent in the National Capital Region to a high 73.2 percent in Region V. Nine of the country's thirteen regions had poverty incidences higher than the national average. The Visayas area, covering three regions, had a generally higher proportion of poor families in the Philippines. Poverty in the rural sector is more severe than in the urban areas. Rural poverty incidence were highest in Regions V, VI, VII and VIII, with more than 70 percent of families falling below the poverty line.

In urban areas, the proportion of poor families was highest in Eastern (R-VIII) and Western (R-VII) Visayas and Northern Mindanao (R-IX).

(3) Industrial Structure

By industrial sector, the service sector consistently dominated the country's economy throughout the years from 1970 to 1985, contributing 38% to 42% to the national economy. Industry was next with contributions from 30% to 37%. Agriculture had the least contribution, ranging from 25% to 29% during the same period.

The economy of the country is basically agricultural and its total land area is predominantly rural. The total arable land of the Philippines is 1,333,258 hectares. In 1986, total agricultural crop production of the country reached to 28.5 million metric tons planted to 12.2 million hectars and valued at 77.9 million. Of total production about 80% was contributed by food crops made up of palay, corn and fruits, and only 20% by commercial crops with coconuts and sugarcane as the leading commerical crops.

The largest crop producing region of the country is Region XI (Southern Mindanao) contributing about 18 percent of the country's total crop production. The next largest crop producing region are Central Mindanao (R-XII) and Western Visays (R-VI) contributing 12 percent, respectively.

These different regions of the country consists of different soil types suitable to different types of crops, thus different regions each advantages to different types of crops. The major producers of palay are Regions X, XI and XII, all in Mindanao while the major producers of coconuts are Southern Tagalog (R-IV) and Southern Mindanao (R-XI). Sugaarcane is predominantly grown in Western Visayas (R-VI) while abaca is the major crop of Bicol Region (R-V).

Table 4 shows crop production and the value of production by region.

III. National Development Plan

The Medium-Term Philippine Development Plan for 1987 to 1992 was formulated to guide development efforts in both the public and private sector as follows:

The plan address the fundamental problems of the people: persistence of poverty and income inequality, high unemployment and underemployment, and urban/rural and regional disparities. These have been brought about by continued structural inefficiencies in the economy. Moreover, the external debt crisis experienced in 1983 has set back whatever gains had been attained in the past.

The Philippines experienced the worst economic and financial crisis in its postwar history starting in late 1983. The roots of these problems can be traced to structural weaknesses in the foundation of the economy, errors in economic management, and abuse of power by the previous regime.

Philippines devedlopment efforts in 1987-92 shall be principally directed towards the following goals: (a) alleviation of poverty, (b) generation of more productive employment, (c) promotion of equity and social justice, and (d) the attainment of sustainaable economic growth.

Table 2.1-2 shows the gross national product and per capita GNP, for 1986-92.

TABLE 1 POPULATION DENSITY BY REGION AND RANK
1980, 1975, 1970

	Land Area (Sq. Km.)	1980			1975			1970		
		Population (In Thousand)	Density	Rank	Population (In Thousand)	Density	Rank	Population (In Thousand)	Density	Rank
Philippines	300000	48099	160.3		42071	140.2		36685	122.3	
National Capital Region	636	5926	9317.4	1	4971	7814.5	1	3967	6236.9	1
Region III-Central Luzon	18230.8	4803	263.4	2	4210	230.9	2	3616	198.3	3
Region VII-Central Visayas	14951.4	3787	253.3	3	3387	226.6	3	3033	202.8	2
Region VI-Western Visayas	20223.1	4526	223.8	4	4146	205.0	4	3618	178.9	4
Region V-Bicol	17632.5	3477	197.2	5	3194	181.1	5	2967	168.3	5
Region I-Ilocos	21568.4	3541	164.2	6	3269	151.6	6	2991	138.7	6
Region IX-Western Mindanao	18685.1	2529	135.3	7	2048	109.6	9	1869	100.0	8
Region VIII-Eastern Visayas	21431.7	2800	130.6	8	2600	121.3	7	2381	111.1	7
Region IV-Southern Tagalog	46924.2	6119	130.4	9	5214	111.1	8	4456	95.0	9
Region XI-Southern Mindanao	31692.8	3347	105.6	10	2715	85.6	11	2201	69.4	11
Region XII-Central Mindanao	23293.2	2271	97.5	11	2070	88.9	10	1942	83.3	10
Region X-Northern Mindanao	28327.7	2759	97.4	12	2314	81.7	12	1953	68.9	12
Region II-Cagayan Valley	36403.0	2216	60.9	13	1933	53.1	13	1692	46.5	13

TABLE 2 GROSS DOMESTIC PRODUCT AND GROWTH RATE BY REGION: 1971 TO 1985
(AT CONSTANT 1972 PRICES)

Region/Year		GRDP in Million Pesos				Growth Rate			
		1971	1975	1980	1985	1971-1975	1975-1980	1980-1985	1971-1985
	Philippines	53528	67455	92706	90469	6.0	6.6	9.5	3.8
	N C R	16182	20976	29959	27026	6.7	7.4	8.0	3.7
I.	Ilocos Region	2691	3144	3315	3859	4.0	1.1	3.1	2.6
II.	Cagayan Valley	1421	1809	2437	2472	6.2	6.1	0.3	4.0
III.	Central Luzon	4664	5556	7500	7996	4.5	6.2	1.3	3.9
IV.	Southern Tagalog	6434	9617	12935	12905	0.6	6.1	-0.05	5.1
V.	Bicol Region	2032	2554	3277	3069	5.9	5.1	8.7	3.0
VI.	Western Visayas	5988	5837	7331	7241	9.4	4.7	9.8	1.4
VII.	Central Visayas	3137	4754	6794	6332	1.0	7.4	8.6	5.1
VIII.	Eastern Visayas	1766	2094	2272	2205	4.4	1.6	9.4	1.6
IX.	Western Mindanao	1589	1834	3248	3235	3.6	2.1	9.9	5.2
X.	Northern Mindanao	2304	2731	4267	4349	4.3	9.3	0.4	4.6
XI.	Southern Mindanao	3552	4587	6292	6157	6.6	6.5	9.6	4.0
XII.	Central Mindanao	1768	1962	3079	3623	2.6	9.4	3.3	5.3

TABLE 3 REGIONAL POVERTY INDICATORS: 1985

Region	Total			Urban			Rural		
	Total Poverty Threshold (In ₱)	Magnitude of Poverty (000 Families)**	Incidence of Poverty (In %) ***	Total Poverty Threshold (In ₱)*	Magnitude of Poverty (000 Families)**	Incidence of Poverty (In %)***	Total Poverty Threshold (In ₱)*	Magnitude of Poverty (000 Families)**	Incidence of Poverty (In%) ***
Philippines	2,382	5,676.6	59.3	3,021	1,875.9	52.1	2,066	3,800.7	63.7
N C R	3,282	550.5	44.1	3,282	550.5	44.1			
Outs, NCR	2,285	5,126.1	61.6	2,912	1,325.4	56.3	2,066	3,800.7	63.7
I	2,374	364.9	52.3	3,093	89.7	56.2	2,139	275.2	51.1
II	2,194	246.3	54.6	2,897	31.3	48.6	2,092	215.0	55.6
III	2,550	420.0	44.4	3,153	178.5	45.2	2,104	241.5	43.8
IV	2,471	712.2	55.9	3,048	241.7	50.6	2,174	470.5	59.1
V	2,148	464.0	73.2	2,625	81.2	62.3	2,047	382.7	76.0
VI	2,449	632.4	73.1	3,069	154.1	65.0	2,249	478.3	76.2
VII	1,982	530.6	68.8	2,426	142.7	58.9	1,819	387.9	73.4
VIII	2,016	385.4	70.4	2,733	81.9	70.1	1,822	303.5	70.5
IX	2,118	316.5	65.3	2,650	47.2	61.6	2,025	269.3	66.0
X	2,262	355.4	66.2	2,952	91.7	65.7	2,022	263.7	66.3
XI	2,388	426.0	61.7	2,998	143.1	59.6	2,079	282.9	62.8
XII	2,233	272.4	65.2	2,624	42.2	56.8	2,161	230.2	67.0

* The monthly income required to satisfy 100 percent of nutritional requirements and other needs of a family of 6.
** The total number of families below the poverty line or threshold in 1985.
*** Out of the total number of families, the proportion of families that fall below the povertyline in 1985.

SOURCE: Inter-agency Working Group on Poverty Determination - NEDA, FNRI, NCSO.

TABLE 4(1) CROP PRODUCTION BY REGION, 1986

(IN METRIC TONS)

	Ilocos	Cagayan Valley	Central Luzon	Southern Tagalog	Bicol	Western Visayas	Central Visayas	Eastern Visayas	Western Mindanao
All Crops	1,713,726	1,760,242	2,001,026	2,753,156	1,741,385	3,038,775	1,157,011	1,594,719	1,511,66
Food Crops	1,582,284	1,710,079	1,789,876	1,824,165	1,485,439	1,769,198	815,986	1,266,609	1,122,54
Palay (Rough Rice)	871,740	1,172,110	1,525,355	985,765	683,090	1,121,920	148,180	469,440	353,37
Corn (Shelled)	64,530	374,835	8,370	242,305	133,975	43,740	243,645	273,020	216,70
Fruit and nuts except Citrus	265,868	73,754	101,881	330,135	118,420	430,622	137,106	254,842	191,75
Others	241,280	67,985	121,495	262,570	83,810	392,469	119,110	247,207	185,54
Commercial Crops	131,442	50,163	211,150	928,991	255,946	1,269,577	341,025	328,110	389,12
Coconut (Products)	84,961	23,393	10,913	624,397	212,533	116,617	133,123	245,035	295,67
Sugarcane	7,576	16,615	197,127	303,218	13,536	1,149,153	205,072	61,519	[illegible]
Abaca	-	-	-	594	29,860	1,185	930	21,462	9,09
Tobacco	35,855	10,122	3,105	695	13	412	583	39	6
Coffee	1,846	4,969	230	32,971	1,215	4,793	1,445	390	17,261
Cacao	114	60	11	133	113	186	2,174	99	30
Peanut	11,117	17,394	1,954	3,051	1,118	979	19,119	844	1,661
Rootcrops	85,378	22,590	38,364	95,247	466,930	82,291	242,079	285,208	301,211
Vegetables	147,067	9,433	35,130	54,954	17,484	25,658	10,482	5,184	3,07
Others	102,446	100,790	79,251	310,751	50,347	57,425	23,089	10,702	142,96

TABLE 4(2) CROP PRODUCTION BY REGION, 1986
(IN METRIC TONS)

Crops	Northern Mindanao	Southern Mindanao	Central Mindanao	Philippines
All Crops	2,673,185	5,040,157	3,544,782	28,529,828
Food Crops	2,351,905	3,995,652	3,207,726	22,921,461
Palay (Rough Rice)	342,095	653,195	770,720	9,096,980
Corn (Shelled)	252,850	1,203,315	900,735	3,922,020
Fruits and Nuts Except Citrus	1,469,021	1,927,076	729,846	6,030,326
Others	550,159	1,320,388	725,915	4,286,367
Commercial Crops	321,280	1,044,505	337,056	5,608,367
Coconut Product	177,555	983,362	254,827	3,162,389
Sugarcane	122,711	34,690	24,091	2,135,316
Abaca	5,474	9,653	4,409	82,665
Tobacco	652	56	4,405	56,002
Coffee	40,457	26,058	4,880	136,515
Cacao	846	3,070	246	6,235
Peanut	563	889	2,163	43,907
Rootcrops	184,054	101,547	763,577	2,668,476
Vegetables	20,603	18,845	9,246	357,060
Others	49,017	50,927	288,812	729,768

TABLE 5 CHARACTARISTIC OF THE PHILIPPINES ECONOMY

	1970	1975	1980	1982	1983	1984	1985
Population (thousands)	36,850	42,070	48,320	50,740	51,960	53,170	54,380
GNP (billion pesos)	42	114	265	335	379	539	607
GDP (billion pesos)	143	195	265	279	282	268	257
GNP Growth rate (%)					1.1	-6.8	-3.8
GNP Per Capital (Pesos)		375		769	635	660	
Consumer Price Increase Rate (%)		-		10.2	10.0	50.4	23.1
Exchange Rate on US$ (Pesos)	59,044	72,479	75,114	85,400	111,127	166,987	186,073
External Accounts (US$ mil.)							
Current Account	-48	-923	-1,917	-3,212	-2,751	-1,268	8
Trade Account	-26	-1,196	-1,939	-2,646	-2,485	-679	-482
Exports	1,064	2,263	5,788	5,021	5,005	5,391	4,629
Imports	1,090	3,459	7,727	7,667	7,490	6,070	-5,111
Invisible trade Account	-141	-46	-412	-1,040	-738	-975	111
Capital Account	271	1,094	2,684	2,846	-394	750	301
Total External Account	75	-11	891	-730	-3,501	-403	952
Gold, Foreign Currency Reserves	251	1,359	3,140	1,711	864	890	1,116
Commercial Banking (mil.Rupiah)							
Total Asset	12	47	123	164	201	224	206
Deposit liabilities	7	15	45	66	76	88	100
Public Finance (mil.Pesos)							
Revenues	4,849	16,838	34,373	37,993	45,606	56,851	68,961
Expenditures	4,790	18,198	37,758	52,407	53,074	66,689	80,102
Accounts	59	-1,360	-3,385	-14,414	-7,468	-9,828	-11,141
External Debt(US$mil.)	1,562	2,043	17,390	24,166	23,871	24,381	26,700
External Debt/GNP(%)	22.1	12.9	49.4	61.5	69.9	75.8	83.7
Debt Service (US$mil.)	258	404	1,576	2,930	2,659	2,802	2,774
Debt Service/Exports(%)		12.7	19.7	36.6	32.7	35.0	35.0

Source: IMF, International Monetary Statistics yearbook, 1986
Philippines Central Bank Data

TABLE 6 FUNCTIONAL CLASSIFICATION OF NATIONAL GOVERNMENT EXPENDITURES, 1987-1992
(Percentage Distribution)

	Actual Annual average 1976-85	Estimate 1986	Projections 1987	1988	1989	1990	1991	1992	Annual Average 1987-92
Economic Services	33.8	17.3	19.9	21.6	23.9	26.3	28.4	30.3	25.1
Agriculture	7.3	3.2	3.9	5.7	6.5	7.4	8.2	9.1	6.8
Industry, trade and tourism	3.1	0.7	1.4	1.9	2.4	2.8	3.0	3.3	2.5
Utilities and Infrastructure	23.5	13.4	14.6	14.0	15.0	16.1	17.2	17.9	15.8
Social Services	20.2	18.3	21.5	24.5	28.4	31.4	35.7	39.2	30.1
Education	12.3	10.2	11.5	13.2	14.1	14.9	17.1	18.7	15.0
Health	3.9	3.0	3.4	4.2	5.9	6.6	8.2	9.6	6.3
Social security and welfare	2.1	4.7	6.2	6.2	6.2	6.3	6.4	6.4	6.2
Housing and community development	1.9	0.4	0.4	0.9	2.2	3.6	4.0	4.5	2.7
Defense	14.0	6.9	7.3	7.4	8.0	8.4	8.5	8.9	8.1
General Public Services	20.0	10.0	11.3	15.7	14.7	13.7	12.3	9.6	12.9
Debt Service Fund and Net Lending[a]	11.9	47.5	40.0	30.8	25.0	20.2	15.1	12.0	23.9
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

a. For 1987 onwards, this item includes a portion of the external liabilities of government financial institutions to be assumed by the national government. Excludes debt service on liabilities of the Philippine Nuclear Power Plant.

Sources of Basic Data: MBM and NEDA.

TABLE 7(1) EXISTING ROAD LENGTH, 1985

	National					City			
	Concrete	Asphalt	Gravel	Earth	Total	Concrete	Asphalt	Gravel	Total
Philippines	6132.90	5714.75	13601.18	810.29	26259.12	637.44	2016.48	1166.85	3820.77
N C R	440.47	421.64	14.04	-	876.15	281.87	832.78	159.09	1273.74
I	447.90	943.16	904.49	98.19	2393.74	8.25	183.42	118.05	309.72
II	607.02	107.95	1530.31	61.95	2307.23	-	-	-	-
III	810.59	501.19	378.08	-	1689.86	56.52	115.83	40.95	213.30
IV-A	507.04	973.72	854.66	16.30	10351.72	37.28	120.17	47.26	204.71
IV-B	23.47	265.89	1343.49	73.10	1705.95	0.64	7.46	54.91	63.01
V	624.42	401.32	961.39	47.45	2034.58	20.34	81.14	125.77	227.25
VI	314.73	590.39	1637.44	52.80	2595.36	79.80	163.05	51.31	294.16
VII	159.48	648.51	859.77	9.40	1677.16	32.43	236.68	24.10	293.21
VIII	664.81	58.84	1161.16	100.30	1985.11	39.09	2.81	20.02	61.92
IX	50.99	338.17	651.03	-	1040.19	8.22	76.89	36.31	121.42
X	639.07	311.62	1251.06	5.70	2207.45	36.10	71.20	98.91	206.21
XI	458.22	123.64	1234.97	142.95	1959.78	15.10	92.45	319.06	426.61
XII	384.69	28.72	819.31	202.14	1434.86	21.71	32.61	71.11	125.43

TABLE 7(2) EXISTING ROAD LENGTH, 1985

Region	Municipal					Provincial				
	Concrete	Asphalt	Gravel	Earth	Total	Concrete	Asphalt	Gravel	Earth	Total
Philippines	11706.25	1579.03	6318.79	3220.75	12990.63	711.57	2739.52	19443.45	5524.74	28419.28
N C R	351.18	162.02	29.36	11.78	554.34	-	-	-	-	-
I	40.44	286.70	667.64	409.74	1404.52	48.84	483.32	1678.66	659.69	2870.51
II	21.09	56.45	827.99	236.41	1141.94	8.44	159.04	1416.70	388.23	1972.41
III	202.22	213.60	465.88	155.21	1082.09	302.75	360.87	1534.95	185.66	2384.23
IV-A	279.98	217.12	252.22	114.97	885.65	132.36	498.75	954.66	308.24	1894.01
IV-B	50.03	22.16	342.84	103.87	472.55	11.47	50.30	1667.75	351.90	2081.42
V	107.07	192.40	360.93	121.16	799.68	35.02	318.15	1089.53	361.05	1803.75
VI	197.95	87.52	345.14	59.01	695.28	61.92	94.29	1966.89	106.20	2229.30
VII	97.56	137.24	445.53	228.19	930.47	13.69	169.93	1906.53	266.51	2356.66
VIII	246.93	18.12	305.44	137.95	717.13	65.39	327.39	865.55	185.12	1443.45
IX	3.31	25.58	518.10	253.71	800.80	1.68	184.36	1563.86	278.35	2028.25
X	38.25	91.72	556.34	523.88	1221.26	14.09	87.97	1907.97	663.34	2673.37
XI	39.57	33.56	753.77	429.50	1283.37	10.74	4.50	2018.59	783.61	2817.44
XII	30.58	34.84	447.61	435.37	951.50	5.17	0.67	876.83	986.85	1869.52

TABLE 7(3) EXISTING ROAD LENGTH, 1985

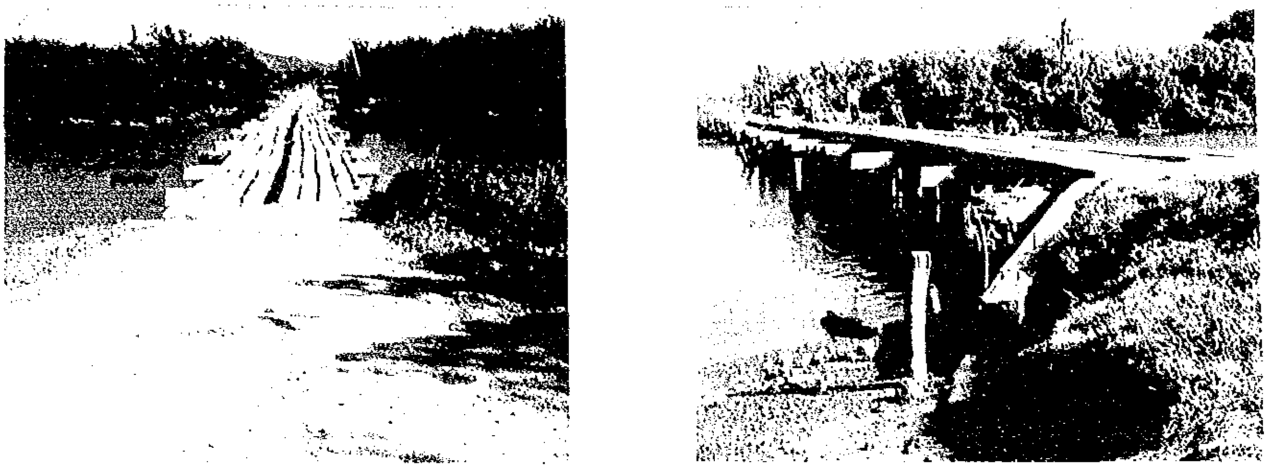
(単位：km)

Region	Barangay					Total				
	Concrete	Asphalt	Gravel	Earth	Total	Concrete	Asphalt	Gravel	Earth	Total
Philippines	-	-	90213.83	-	90213.83	9188.15	12049.78	130749.11	9721.59	161708.63
N C R	-	-	234.71	-	234.71	1073.52	1416.43	437.20	11.78	2938.93
I	-	-	11011.23	-	11011.23	545.44	1896.59	14380.08	1167.62	17989.73
II	-	-	7745.80	-	7745.80	636.55	323.44	11520.80	686.59	13167.38
III	-	-	7943.06	-	7943.06	1372.08	1191.48	10362.91	386.05	13312.52
IV-A	-	-	5428.89	-	5428.89	956.66	1809.76	7537.69	460.87	10764.98
IV-B	-	-	3782.27	-	3728.27	85.61	345.82	7191.26	532.56	8155.25
V	-	-	4012.86	-	4012.86	786.85	993.01	6550.47	547.78	8878.11
VI	-	-	7486.82	-	7486.82	654.41	935.25	11487.60	223.67	13300.93
VII	-	-	5854.05	-	5854.05	303.66	1192.36	9089.97	526.04	11112.03
VIII	-	-	5113.86	-	5113.86	1016.22	407.12	7466.02	432.05	9321.44
IX	-	-	5210.93	-	5210.93	64.20	625.00	7980.22	532.16	9201.58
X	-	-	9675.19	-	9675.19	727.60	562.51	13489.47	1204.00	15983.58
XI	-	-	9306.09	-	9306.09	523.72	254.15	13631.48	1382.98	15792.33
XII	-	-	7408.08	-	7408.08	442.14	96.84	9623.94	1627.46	11790.38

APPENDIX II

PHOTOGRAPHS OF BRIDGES

CANDIDATE BRIDGE FOR PHASE 2



BRIDGE NO. 02.01
NAME OF BRIDGE: STA. CRUZ BRIDGE

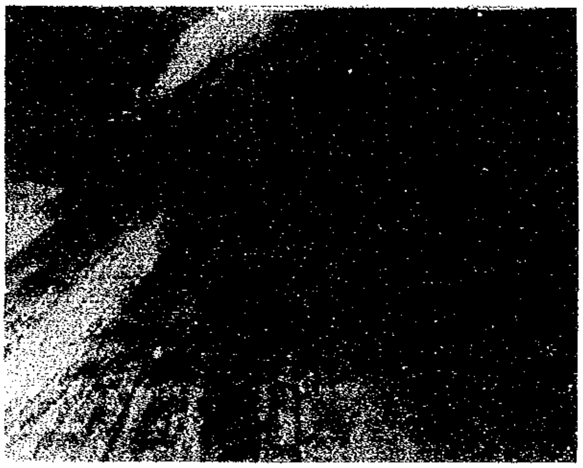
BRIDGE NO. 02.02
NAME OF BRIDGE: DUMADATA BRIDGE

BRIDGE NO. 02.05
NAME OF BRIDGE: DIDUYON BRIDGE

CANDIDATE BRIDGE FOR PHASE 2

BRIDGE NO. 04.01a

NAME OF BRIDGE: BINAMBANG BRIDGE



BRIDGE NO. 04.03a

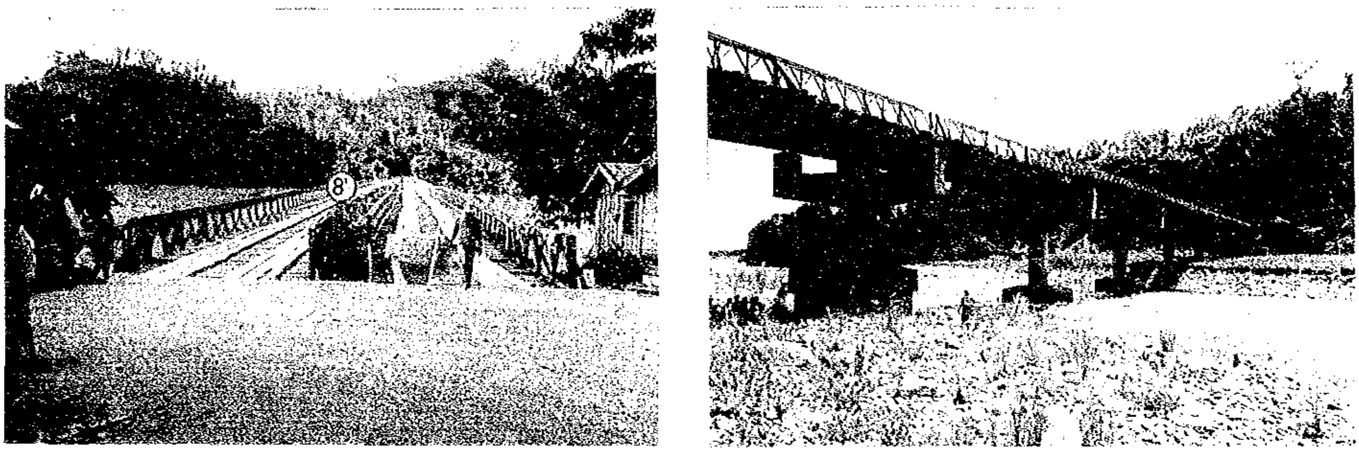
NAME OF BRIDGE: LEVISTE II BRIDGE

BRIDGE NO. 04.04b

NAME OF BRIDGE: LUMANG BAYAN BRIDGE

CANDIDATE BRIDGE FOR PHASE 2

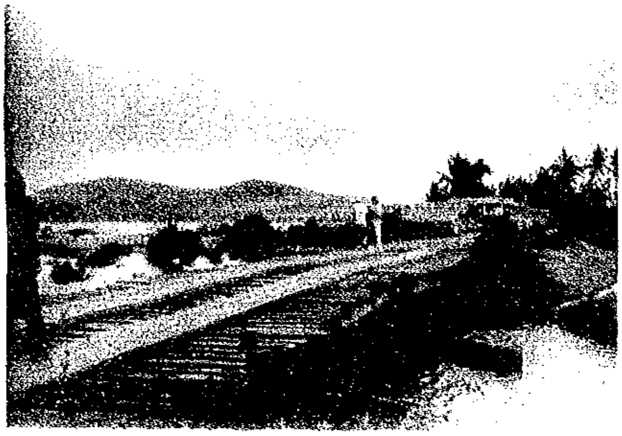
BRIDGE NO. 04.05b
NAME OF BRIDGE : OLANGOAN BRIDGE

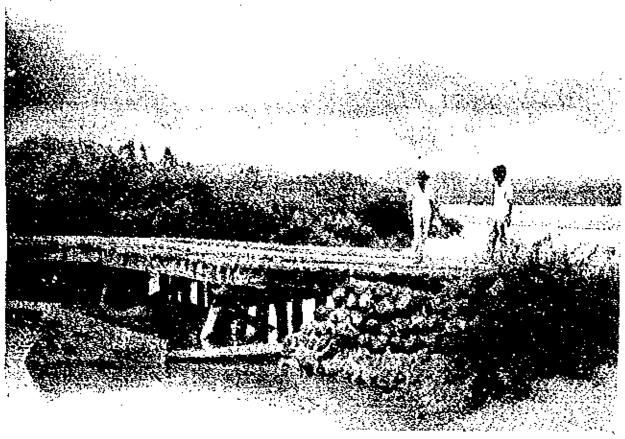


BRIDGE NO. 04.06b
NAME OF BRIDGE : BONGABON BRIDGE

BRIDGE NO. 05.03
NAME OF BRIDGE : NARANGASAN I BRIDGE

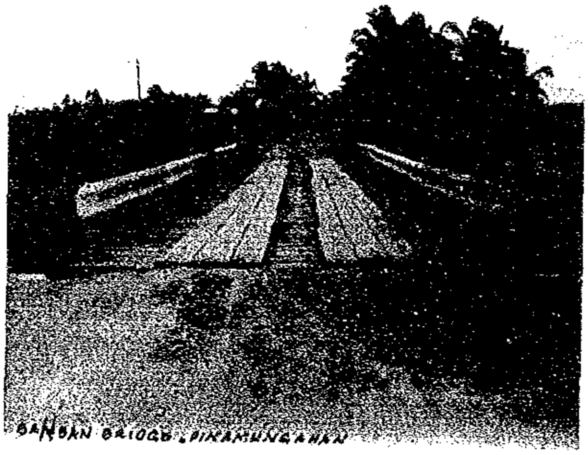
CANDIDATE BRIDGE FOR PHASE 2





BRIDGE NO. 06.03

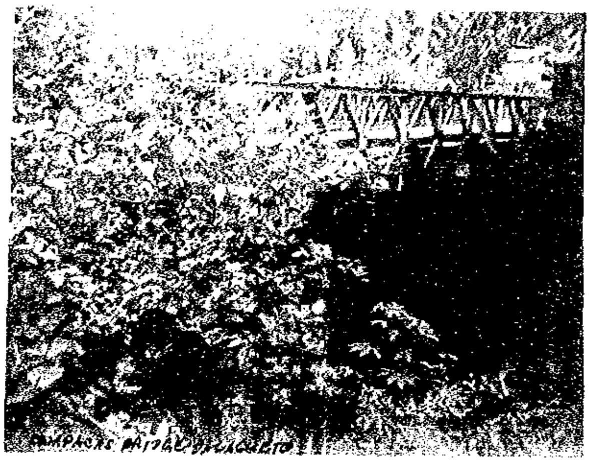
NAME OF BRIDGE: IYANG BRIDGE



BRIDGE NO. 07.01

NAME OF BRIDGE: BANBAN BRIDGE

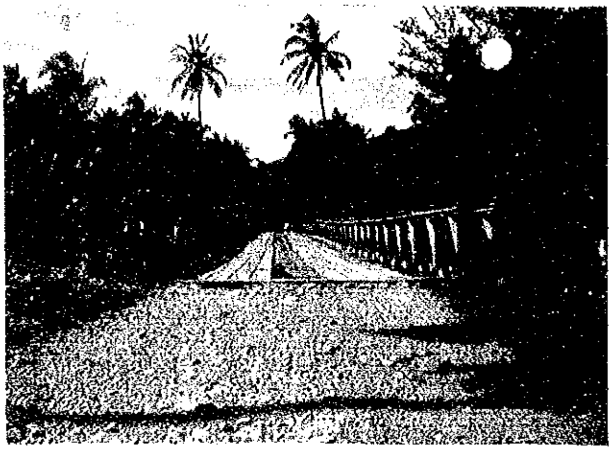
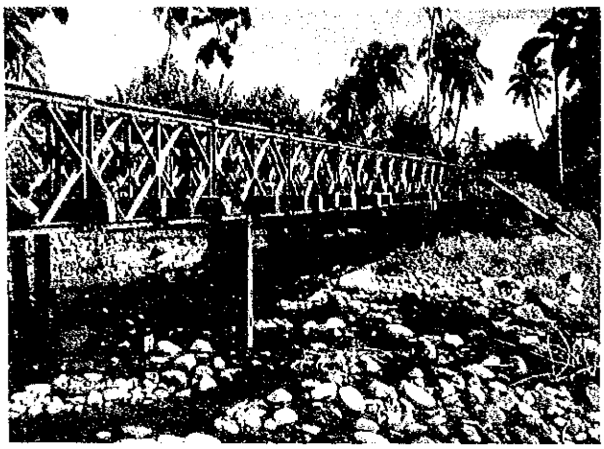
CAMPACAS BRIDGE, DALAGUETE



BRIDGE NO. 07.02

NAME OF BRIDGE: CAMPACAS BRIDGE

CANDIDATE BRIDGE FOR PHASE 2

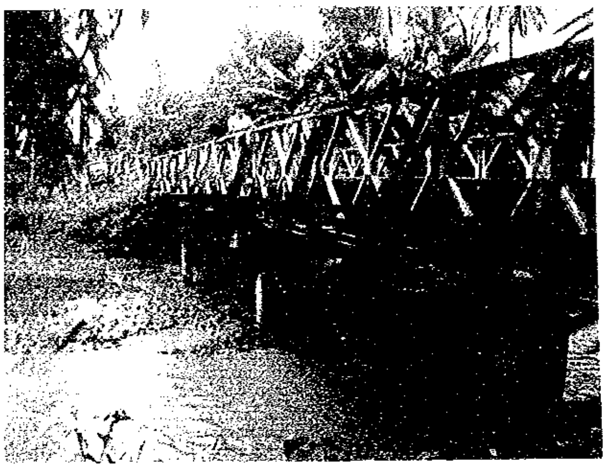



BRIDGE NO. 08.03

NAME OF BRIDGE: HABAY BRIDGE


BRIDGE NO. 08.04

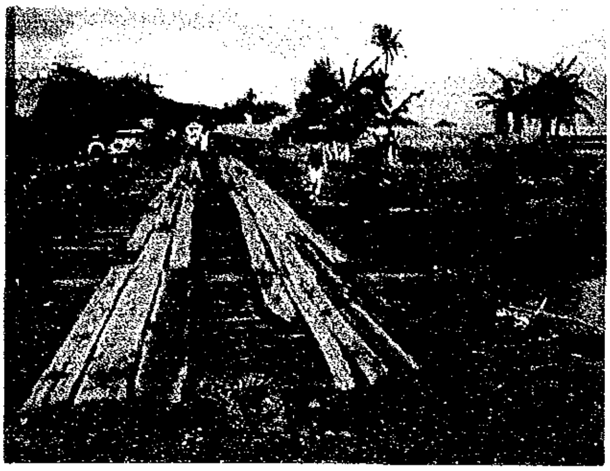
NAME OF BRIDGE: TALISAYAN RIVER CROSSING

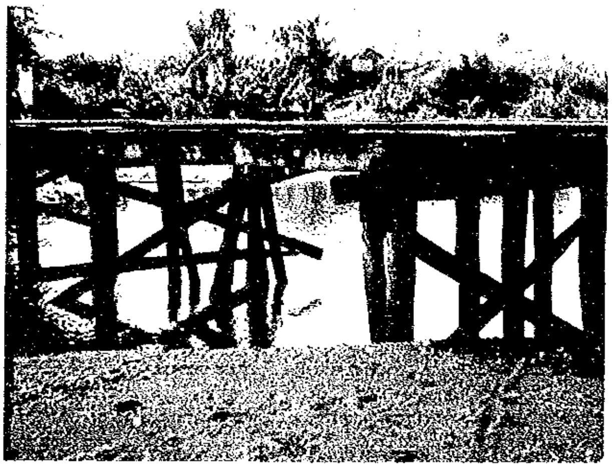



BRIDGE NO. 09.05

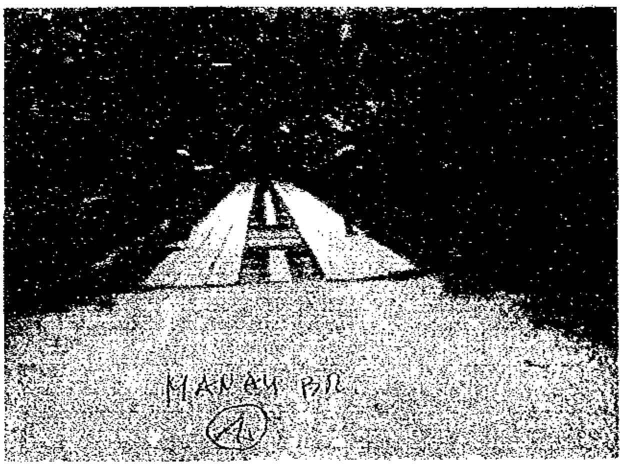
NAME OF BRIDGE: PATUNAN BRIDGE

CANDIDATE BRIDGE FOR PHASE 2

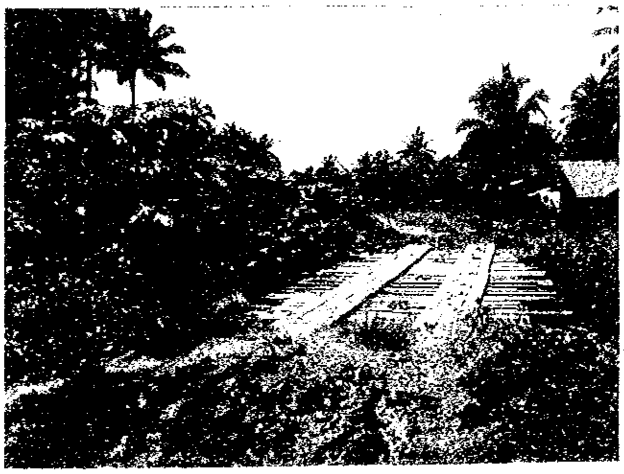




BRIDGE NO. 10.01
NAME OF BRIDGE: HAYANGABON BRIDGE

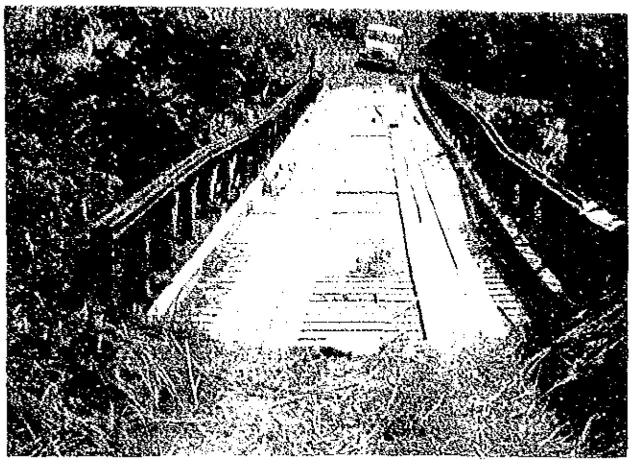


BRIDGE NO. 11.04
NAME OF BRIDGE: MANAY BRIDGE

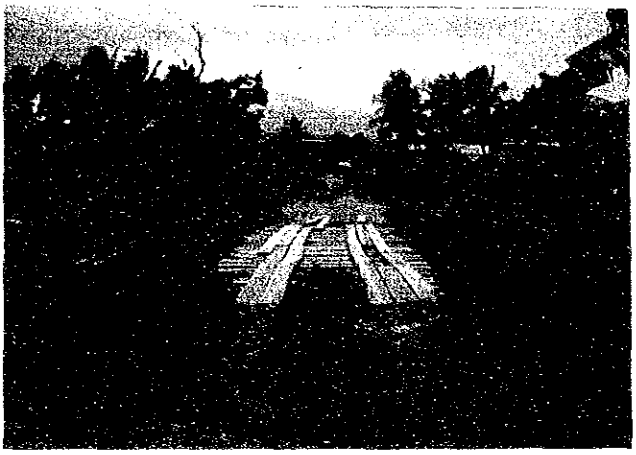


BRIDGE NO. 12.01
NAME OF BRIDGE: PIKINIT BRIDGE

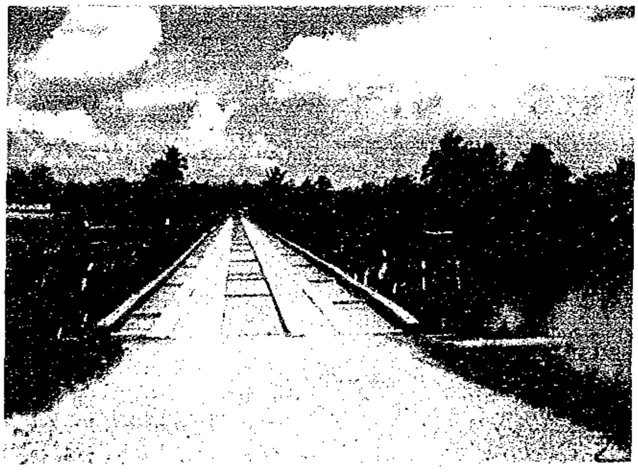
CANDIDATE BRIDGE FOR PHASE 2

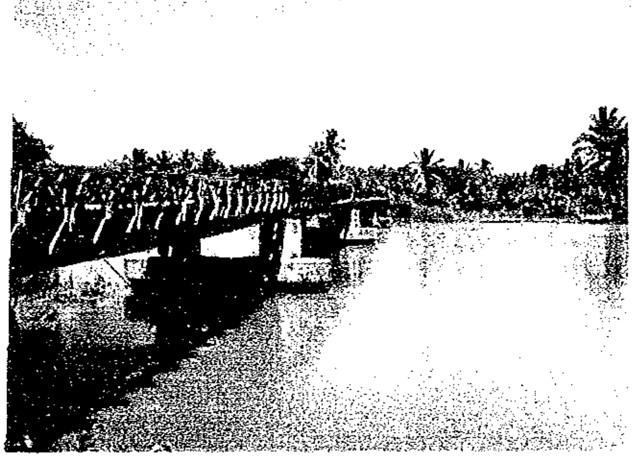


BRIDGE NO. 12.02
NAME OF BRIDGE : DURUGAO BRIDGE



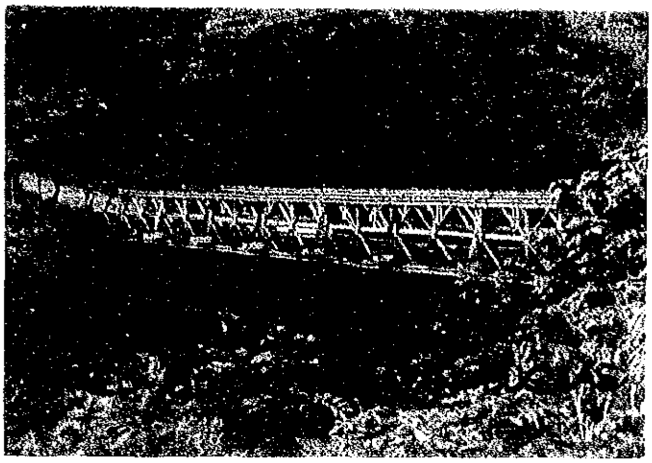
BRIDGE NO. 12.04
NAME OF BRIDGE : DANGOLAAN BRIDGE





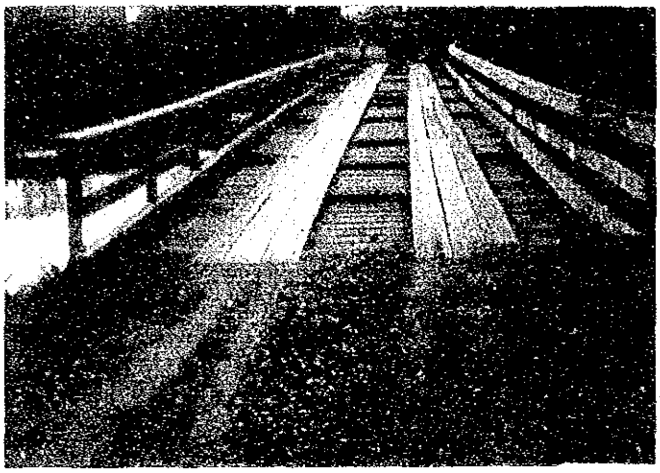
BRIDGE NO. 12.05
NAME OF BRIDGE : SAPAKAN BRIDGE

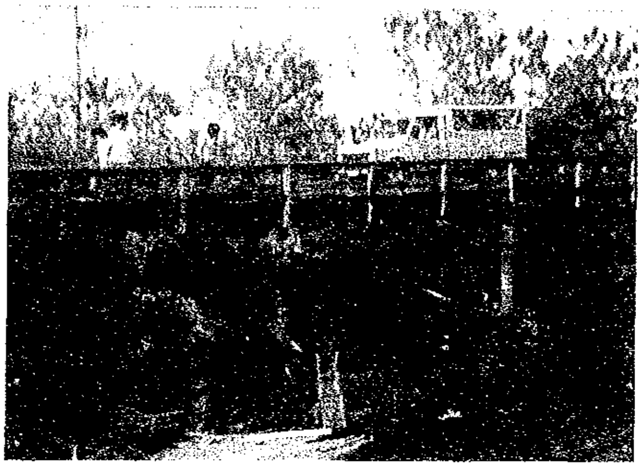
NO DATA/NO URGENT REPLACEMENT



BRIDGE NO. 01.01

NAME OF BRIDGE: ELLET BRIDGE





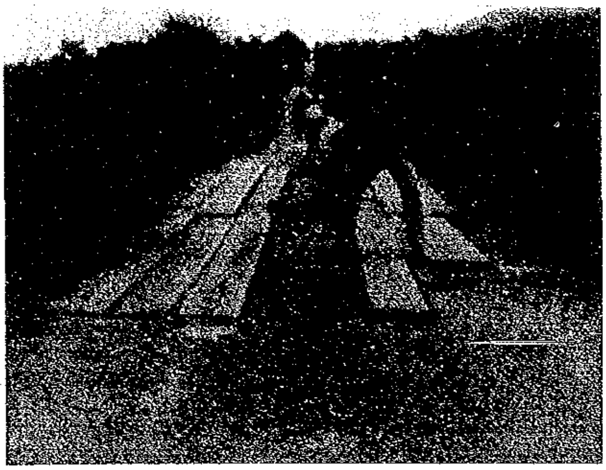
BRIDGE NO. 01.02

NAME OF BRIDGE: BIMMILOG BRIDGE

BRIDGE NO. 03.01

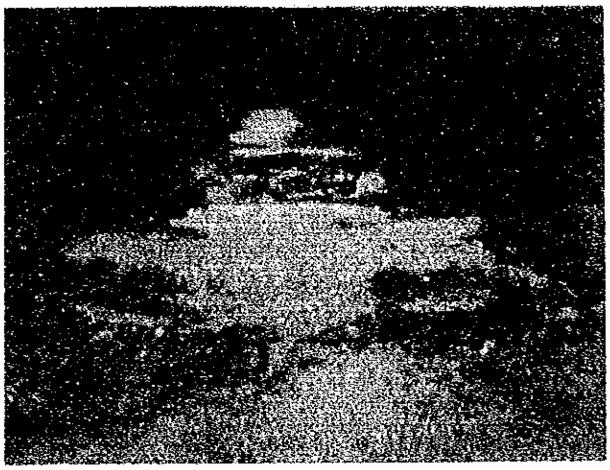
NAME OF BRIDGE: SEGUM BRIDGE

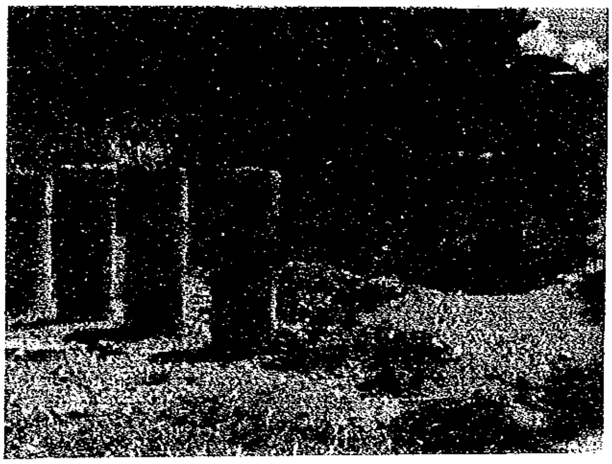
NO DATA/NO URGENT REPLACEMENT



BRIDGE NO. 03.02

NAME OF BRIDGE: CALABASA BRIDGE





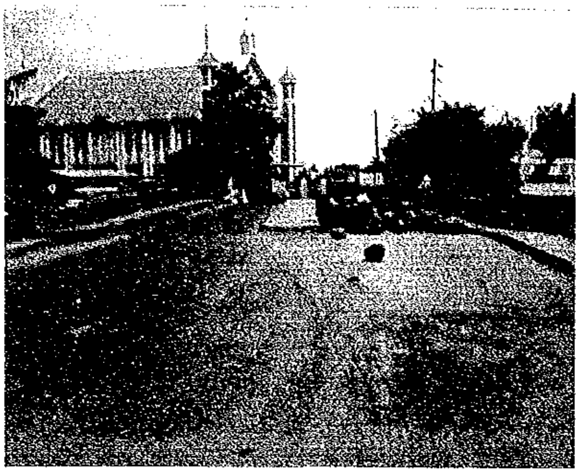
BRIDGE NO. 03.03

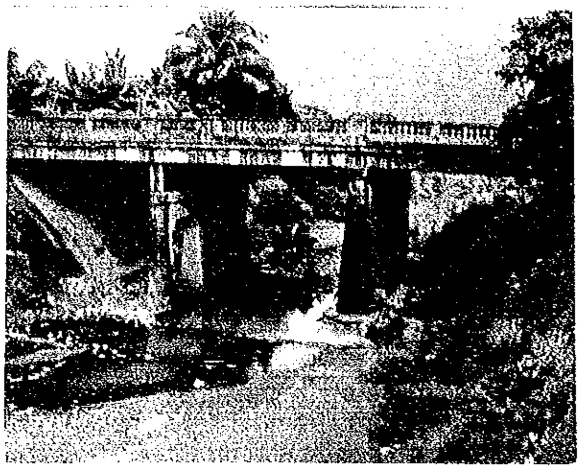
NAME OF BRIDGE: MALINAO BRIDGE

BRIDGE NO. 03.04

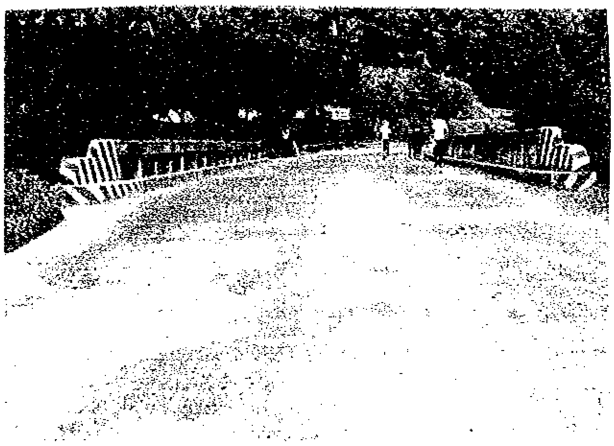
NAME OF BRIDGE: ASAM BRIDGE

NO DATA/NO URGENT REPLACEMENT

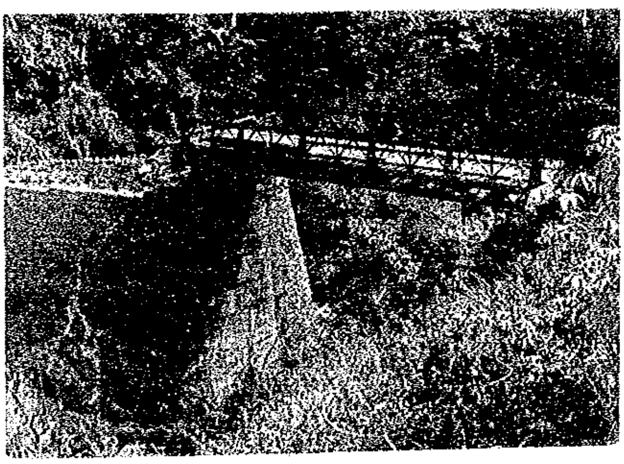


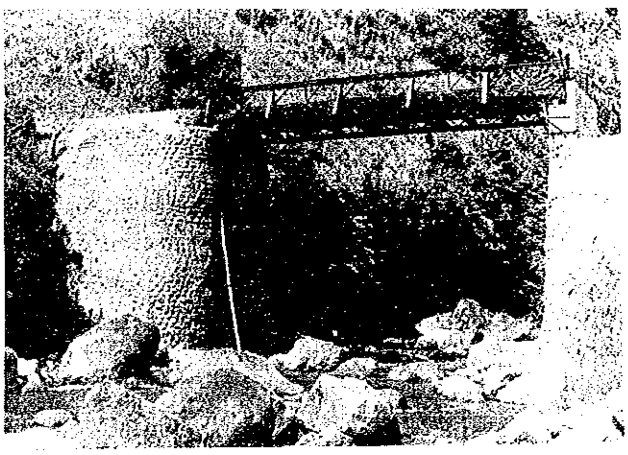


BRIDGE NO. 04.02a
NAME OF BRIDGE: MANGO BRIDGE



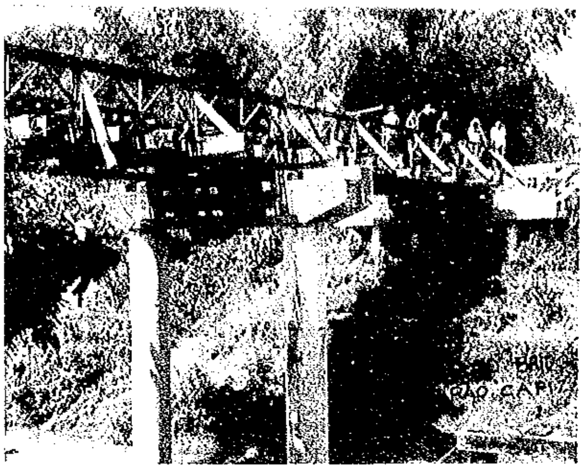
BRIDGE NO. 05.01
NAME OF BRIDGE: DAGUIT BRIDGE





BRIDGE NO. 06.01
NAME OF BRIDGE: TALUS BRIDGE

NO DATA/NO URGENT REPLACEMENT



BRIDGE NO. 06.05

NAME OF BRIDGE : TUMALALUD BRIDGE

JICA