REPUBLIC OF INDONESIA
MINISTRY OF PUBLIC WORKS
DIRECTORATE GENERAL OF HIGHWAYS

THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA

KABUPATEN REPORT 6

KABUPATEN BANGKA

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

This is the Kabupaten Report of the Feasibility Study of the Local Road Development in the Republic of Indonesia for Kabupaten Bangka in Sumatra Selatan Province. The report has been prepared by the Study Team of the Japan International Cooperation Agency (hereinafter called JICA).

Based upon a request from the Government of Indonesia, the Government of Japan arranged for JICA to conduct the Study and JICA accordingly organized a Study Team. The study was carried out using data which were generally prepared by the Kabupaten, routed through the province, under the instructions of Bina Marga of the Ministry of Public Works and Bangda of the Ministry of Home Affairs.

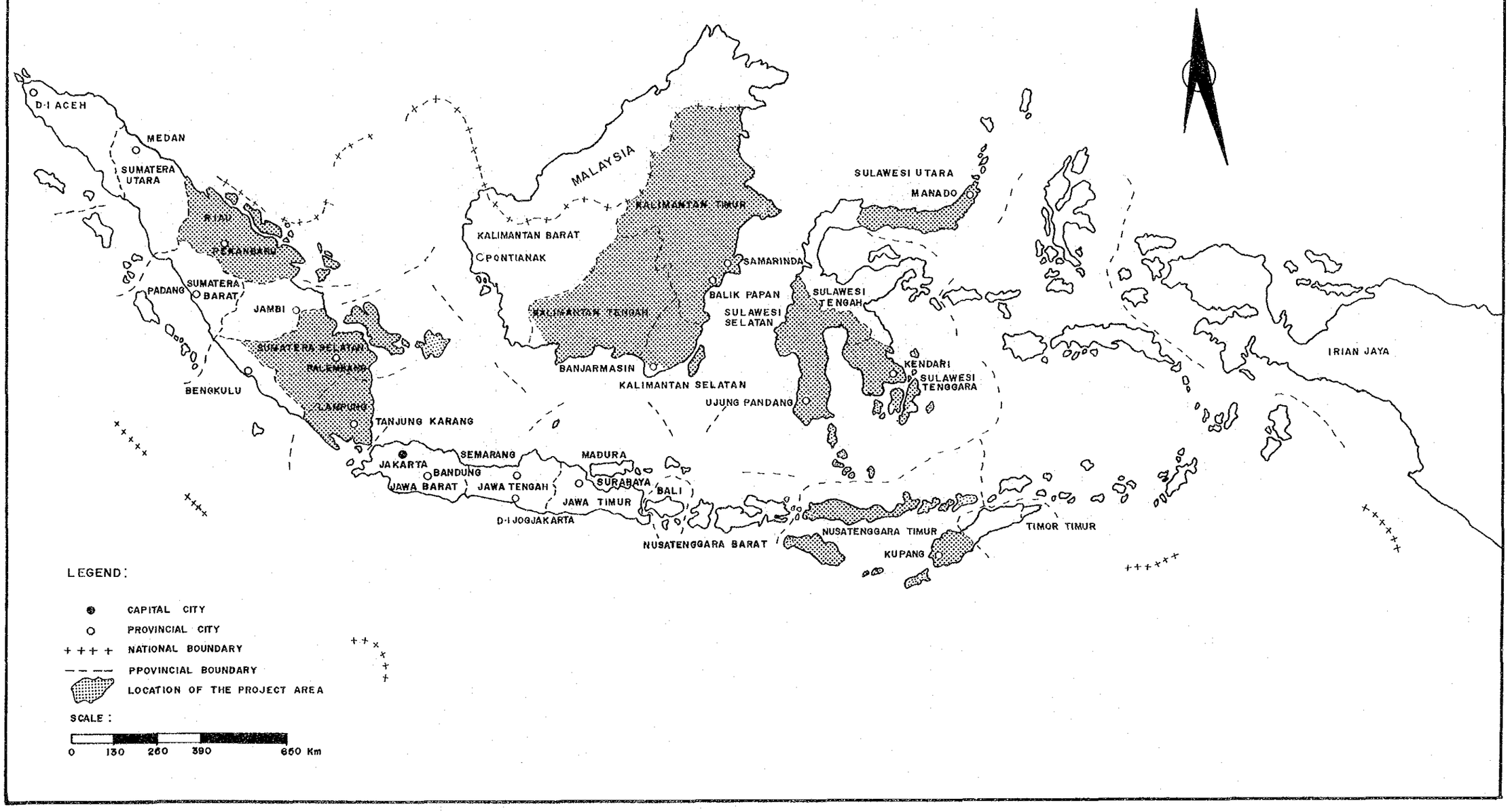
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

The report consists of the results of the feasibility study and proposed implementation programme of the local road development in the Kabupaten.

The simplified economic feasibility evaluation methodology utilized for the study was established by the Study Team in Phase I Study through a pilot study of seven (7) model Kabupatens, and is described in the Main Report.

The purpose of the study for the Kabupaten is mainly to estimate the total Project Cost for the local road development but only limited data is available for study base. Therefore a detailed survey and design for the improvement of the Kabupaten roads should be carried out before commencing the Project together with a review of this report.

LOCATION MAP OF THE PROJECT AREAS



I · PROPINSI RIAU

01· KAB · INDRAGIRI HULU
02· KAB · INDRAGIRI HILIR
03· KAB · BENGKALIS

II · PROPINSI SUMATERA SELATAN

04· KAB · MUSI RAWAS
05· KAB · MUSI BANYUASIN
06· KAB · BANGKA
07· KAB · BELITUG

III PROPINSI LAMPUNG

08· KAB : LAMPUNG TENGAH

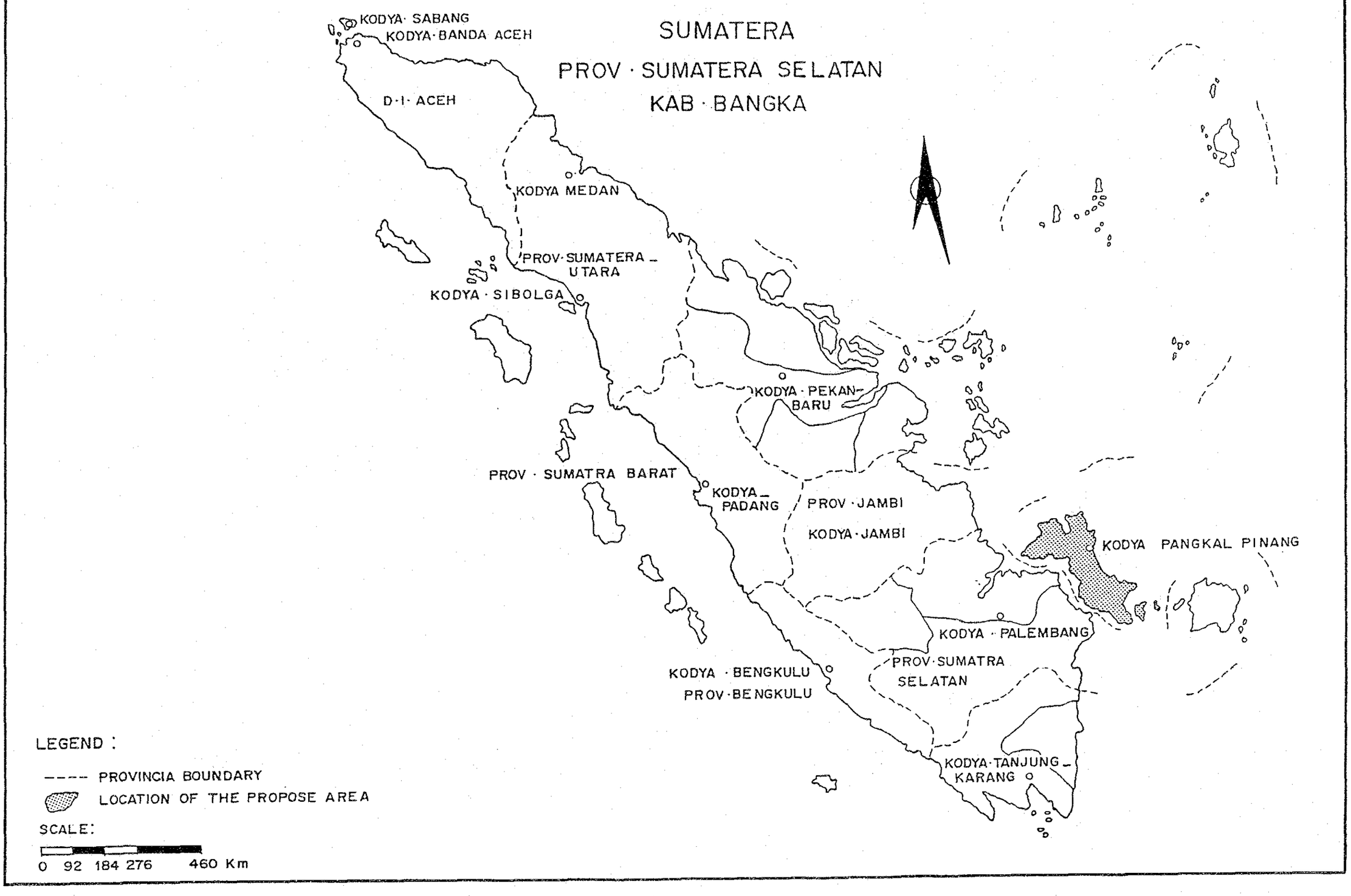
LEGEND :

----- PROVINCIAL BOUNDARY

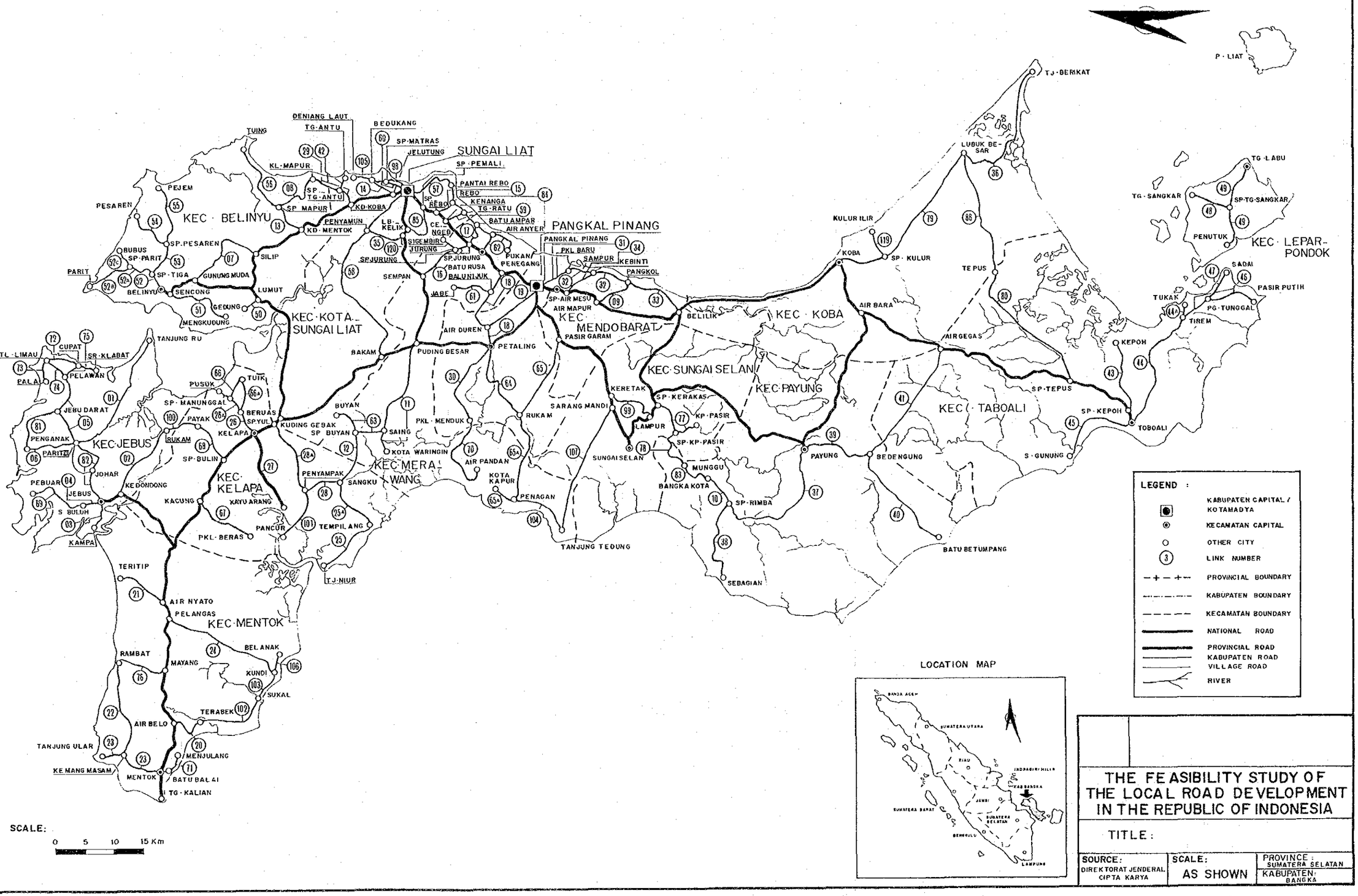
LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km


SUMATERA
PROV · SUMATERA SELATAN
KAB · BANGKA
KODYA · SABANG
KODYA · BANDA ACEH
D · I · ACEH
KODYA MEDAN
PROV · SUMATERA UTARA
KODYA · SIBOLGA
KODYA · PEKAN-BARU
PROV · SUMATRA BARAT
KODYA PADANG
PROV · JAMBI
KODYA · JAMBI
KODYA PANGKAL PINANG
KODYA · PALEMBANG
PROV · SUMATRA SELATAN
KODYA · BENGKULU
PROV · BENGKULU
KODYA · TANJUNG KARANG
LEGEND :
---- PROVINCIA BOUNDARY
LOCATION OF THE PROPOSE AREA
SCALE:
0 92 184 276 460 Km

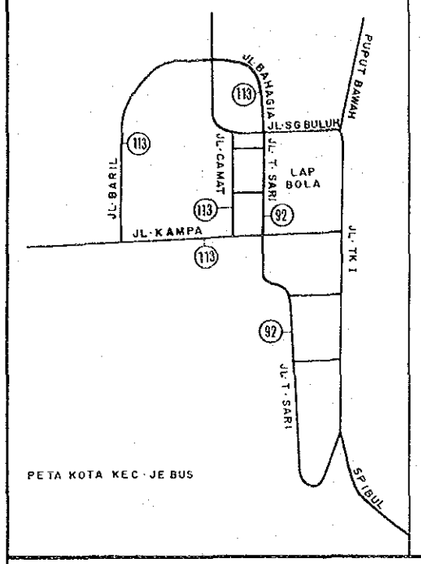
KAB · BANGKA



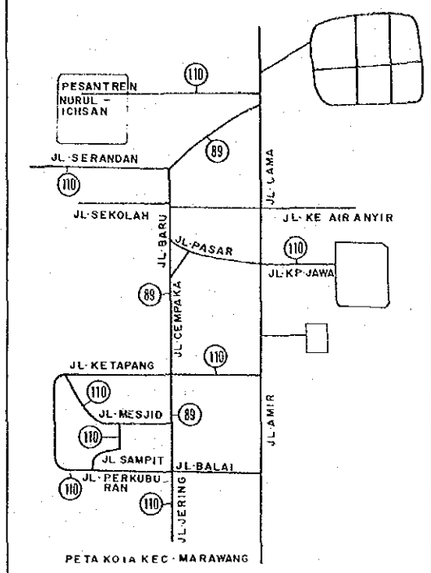
THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA

TITLE :

SOURCE:	SCALE:	PROVINCE: SUMATERA SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN: BANGKA



PETA KOTA KEC JE BUS



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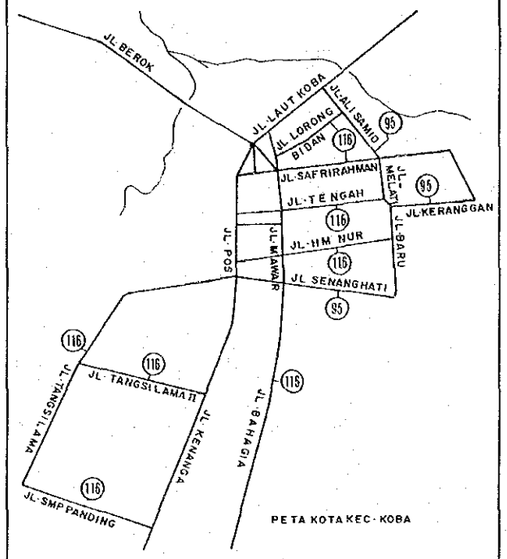

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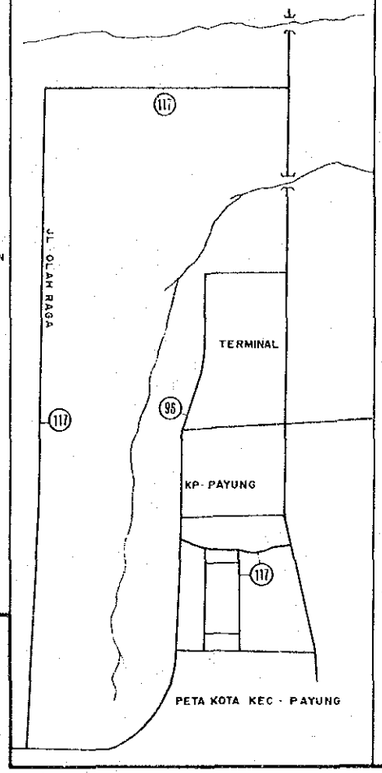

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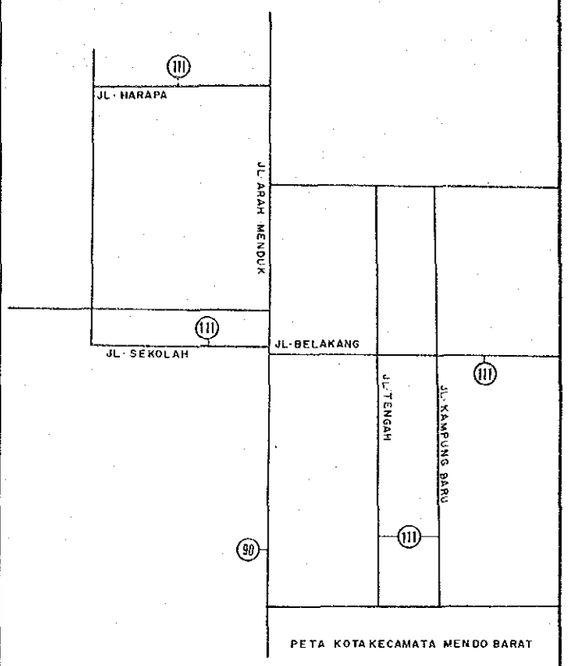

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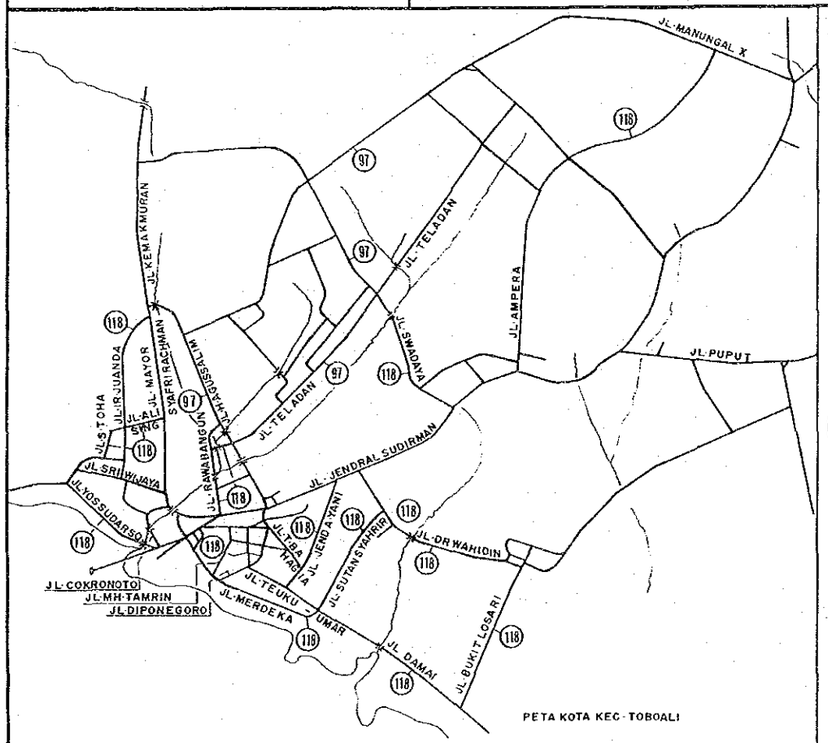
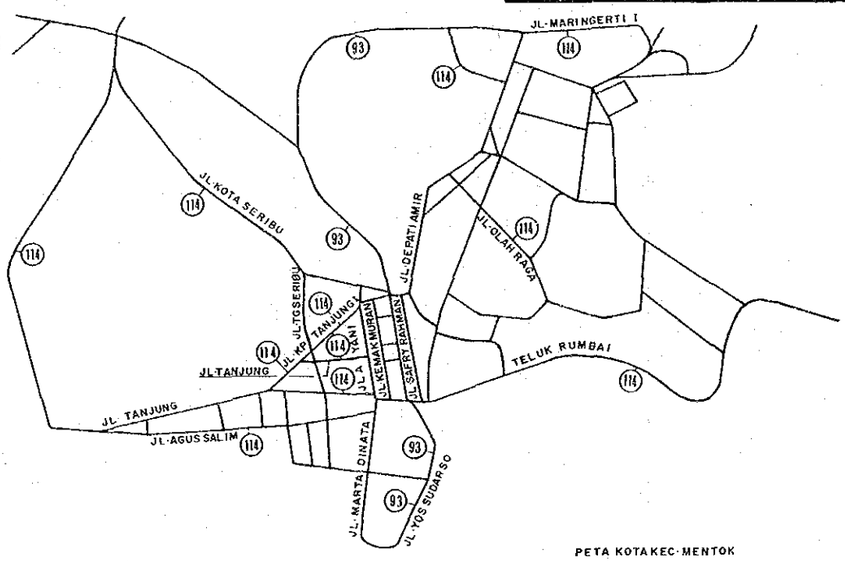


PETA KOTA KEC TOBOALI



PETA KOTA KEC MENTOK

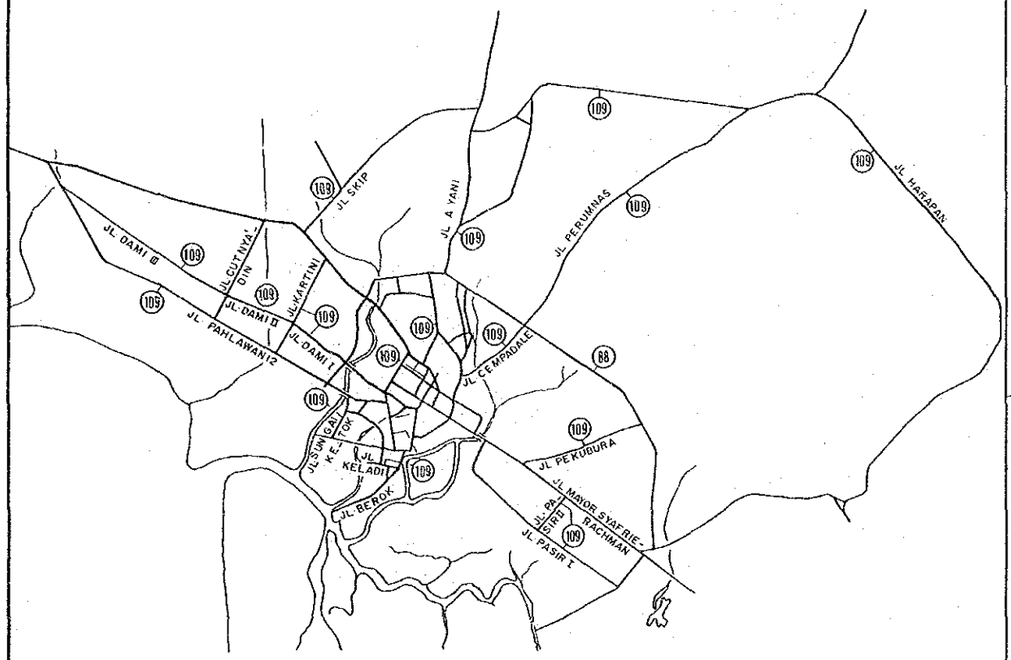
LEGEND :
- KABUPATEN ROAD
- RIVER
- BRIDGE

THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA

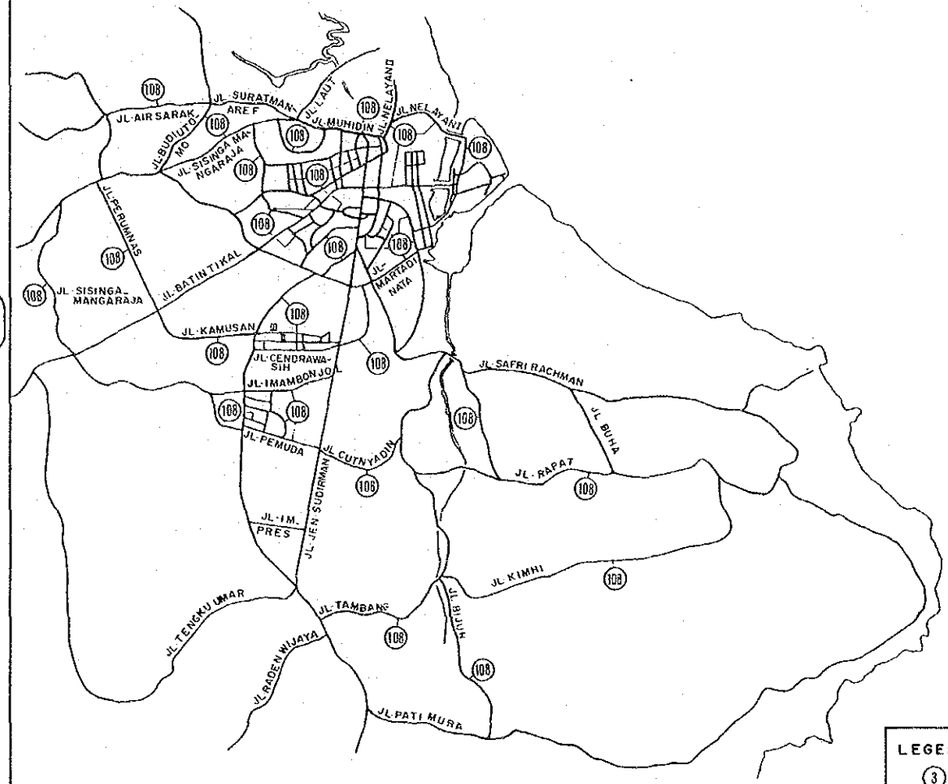
TITLE :

SOURCE:	SCALE:	PROVINCE : SUMATERA SELATAN
KABUPATEN		KABUPATEN: BANGKA

KOTA KEC. BELINYU



KOTA KEC. SUNGAI LIAT



LEGEND:

- (3) LINK NUMBER
- KABUPATEN ROAD
- RIVER
- BRIDGE

THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA

TITLE:

SOURCE	SCALE :	PROVINCE : SUMATERA SELATAN
KABUPATEN		KABUPATEN : BANGKA

C O N T E N T S

Chapter 1 BACKGRAOUND OF THE KABUPATEN

1.1 Topographic and Meteorological Conditions

1.1.1 location and Topography

Kabupaten Bangka is an island facing the Bangka Strait, 15 kilometers offshore at the nearest point and 40 kilometers at the furthest point from the main island of Sumatera. The south coast of the island faces the Jawa Sea.

The island is formed by tablelands rising gradually towards the east from the west lowlands. Development of the island has a long history since the time of Dutch rule and pepper plantations and tin mining have continued since that time. Pangkalpinang City, the capital of the Kabupaten is administered as a Kotamadya. A beautiful shoreline ranges all along the east coast facing the Jawa Sea and presents fine views of the island.

The area of the Kabupaten is about 11,590 square kilometers, including Lepar Island which lies towards the south, and is approximately 11 percent of the total of Sumatera Selatan Province. It administers 13 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Bangka are 120 days and 2,315 mm respectively.

One year in the Kabupaten consists of a rainy season and a dry season. The dry season is from June through October in general. However this is variable as Table 1-1-1 shows.

The number of working days which is necessary for planning the construction schedule in chapter 6, is estimated at 240 days using the following formula based upon the data shown in the table referred to above.

$$\text{Working Days} = 365 - \text{Holidays} - \text{Rainy Days} + \left(\text{Rainy Days} \times \frac{\text{Holiday}}{365}\right) + (0.10 \times \text{Rainy Days})$$

Where :

- Holidays consist of 52 Sundays and 13 national holidays; and
- 10% of rainy days are assumed to be workable days.

Table 1-1-1

METEOROLOGICAL CONDITIONS

PROVINCE : Sumatera Selatan
KABUPATEN : Bangka STATION : --

MONTH	1980		1981		1982		1983		1984	
	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)
January	10	105	8	170	10	346	20	443	18	125
February	7	110	8	190	8	164	3	56	15	570
March	8	165	8	210	16	380	3	54	12	487
April	7	180	11	317	10	256	4	91	12	198
May	12	62	14	30	13	274	15	329	-	-
June	7	214	6	60	6	50	12	165	14	106
July	10	190	7	285	4	30	13	202	14	211
August	16	283	-	-	-	-	3	61	6	146
September	7	105	12	297	-	-	6	83	9	229
October	7	222	8	25	8	82	13	210	8	114
November	15	328	10	110	7	53	20	315	16	236
December	14	313	23	678	13	414	22	215	15	232
Total	120	2,277	115	2,372	95	2,049	134	2,224	139	2,654

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Bangka in 1984 was 436,687 which was approximately 8.3% of the 5,259,200 total population of Sumatera Selatan Province as shown in Table 1-2-1.

The population density was 0.38 persons per ha which was lower than the provincial density of 0.49.

The recent annual average growth rate of population of the Kabupaten is 2.7% which is lower than the provincial rate of 3.3% and higher than the national rate of 2.2%. This may be a result of the transmigration programme which has just started in the Kabupaten.

The population of each Kecamatan and its proportion to the Kabupaten population is shown in Table 1-2-2.

Table 1-2-1 POPULATION BY KABUPATEN

DESCRIPTION	POPULATION	AAGR (%)	AREA (ha)	POPULATION DENSITY (persons/ha)	SURVEY YEAR
KABUPATEN:					
MUSI RAWAS	397,143	3.1	1,520,000	0.26	1982
MUSI BANYUASIN	860,597	4.5	2,619,125	0.33	1984
BANGKA	436,687	2.7	1,159,184	0.38	1984
BELITUNG	173,379	1.8	462,305	0.38	1984
PROVINCE:					
SUMATRA SELATAN	4,944,300		10,368,800		1982
	5,099,700	3.3	10,368,800	0.49	1983
	5,259,200		10,368,800		1984
Jawa IS.(Excluding DKI JAKARTA)	91,126,900	1.7	13,159,700	6.92	-
INDONESIA	161,579,500	2.2	191,944,300	0.84	-

Notes :

1. Sources:
   Kabupaten: Kabupaten concerned with the study.
   Province : Jawa sand Indonesia;
   Statistical yearbook of Indonesia 1984, published by the Central Statistics Bureau.
2. AAGR : Average Annual Growth Rate.

Table 1-2-2 POPULATION BY KECAMATAN

Year : 1984

PROVINCE : SUMATERA SELATAN

KABUPATEN : BANGKA

KECAMATAN	POPULATION	PROPORTION (%)
MENTOK	44,997	10.3
JEBUS	27,780	6.4
KELAPA	28,324	6.5
BELINYU	46,973	10.8
KOTA SUNGAI LIAT	74,896	17.1
MERAWANG	28,871	6.6
MENDO BARAT	22,327	5.1
PANGKAL PINANG	42,579	9.8
SUNGAI SELATAN	24,917	5.7
PAYUNG	19,814	4.5
KOBA	25,284	5.8
TABOALI	41,688	9.5
LEPAR PONDOK	8,237	1.9
TOTAL	436,687	100

1.2.2 Land Use

In Kabupaten Bangka, 565,312 ha of the current available land use area, which is approximately 48.8% of the 1,159,184 ha total area of the Kabupaten, is used for living purposes and for industrial activity of the inhabitants of the Kabupaten. It is the total value of columns (1) through (6) in Table 1-2-3.

The current available land use area consists of 552,811 ha of agricultural harvest area, 5,631 ha of residential area and 6,870 ha of usable open space which are 97.8%, 1.0% and 1.2% of the current available land use area respectively.

The agricultural harvest area consists of 8,006 ha of paddy field, 77,553 ha of plantation and 467,252 ha of other cultivated area which are 1.4%, 14.0% and 84.6% of the agricultural harvest area respectively.

It can be realized from the land use that the main agricultural production in the Kabupaten is plantation.

Table 1-2-3

LAND USE

PROVINCE : SUMATRA SELATAN

(ha)

KABUPATEN	WET PADDY FIELD	UPLAND PADDY FIELD	OTHER CULTIVATED AREA	PLANTATION AREA	RESIDENTIAL AREA	USABLE OPEN SPACE	RIVER & LAKE	FORESTRY AREA	OTHERS	TOTAL AREA	SURVEY YEAR
MUSI RAWAS	32,554 (2.1)	-	6,639 (0.4)	112,803 (7.4)	21,000 (1.4)	-	10,264 (0.7)	1,203,055 (79.1)	134,685 (8.9)	1,520,000 (100)	1982
MUSI BANYUASIN	131,486 (5.0)	78,455 (3.0)	-	249,271 (9.5)	60,667 (2.3)	-	77,121 (2.9)	265,181 (10.1)	1,756,944 (67.1)	2,619,125 (100)	1983
BANGKA	68 (0.01)	7,938 (0.7)	467,252 (40.3)	77,553 (6.7)	5,631 (0.5)	6,870 (0.6)	16,611 (1.4)	347,741 (30.0)	229,520 (19.8)	1,59 ,184 (100)	1984
BELITUNG	488 (0.1)	1,889 (0.4)	-	20,142 (4.4)	5,336 (1.2)	-	-	404,352 (87.5)	30,098 (6.5)	462,305 (100)	1984

Notes :

1. The value in ( ) denotes the proportion
2. Source : Kabupaten concerned with the study

1.2.3 Agriculture

The cultivated area and food crop production in Kabupaten Bangka in 1984 was 15,836 ha and 54,266 ton respectively as shown in Table 1-2-4. Of food crops, the area and production of paddy which consists of wet paddy and upland paddy were 10,256 ha and 12,047 ton respectively which are 64.8% and 22.2% of the total food crops. The yield rate of paddy production is only 1.17 ton per ha. Thus, paddy is the most predominant agricultural crop of the Kabupaten.

As the table shows, average annual growth rates of area and production of paddy in 1981 through 1984 were 16.1% and 11.2% respectively which show a low development of paddy production. The production volume of paddy in the Kabupaten shows a volume far less than the approximately 57,000 tons of yearly consumption of the Kabupaten because the area of upland paddy forms approximately 95% of the total cultivated area in the Kabupaten. Thus the productivity is quite low. A fundamental consolidation programme of developing water facilities relating to the agricultural sector will be needed to promote more intensive productivity of the paddy.

The commodity crops, of which palm, clove (cengke) and rubber are major, are produced by the plantations. The area and production of plantation crops in 1983 were 77,636 ha and 28,227 ton respectively with current growth rates being 3.4% and 5.7% respectively. Thus the plantation crop which is an export product is important agriculturally. Some changes are expected considering the international balance of supply and demand.

The population of the agricultural sector which is assumed from the employment in the Kabupaten is 51.3% of the total population as shown in Table 1-2-6. Thus the Kabupaten is an agricultural Kabupaten.

It is desirable that processing industries which can produce commodities suitable for future demand should be established in order to cope with the fluctuation of the international balance of supply and demand.

Table 1-2-4 AREA AND PRODUCTION OF FOOD CROPS

KABUPATEN : BANGKA

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	12,331	5,785	7,349	8,006	8,736	10,256	11.2
OTHERS	7,455	6,197	5,203	5,862	5,416	5,580	2.4
TOTAL	19,786	11,982	12,552	13,868	14,152	15,836	8.1

PRODUCTION

(ton)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	7,636	4,536	7,693	9,654	13,269	12,047	16.1
OTHERS	48,602	46,110	36,230	41,775	52,829	42,219	5.2
TOTAL	56,238	50,646	43,923	51,429	66,098	54,266	7.3

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	0.62	0.78	1.05	1.21	1.52	1.17	3.7

Notes :

1. AAGR : Average annual growth rate
2. Source : Kabupaten concerned with the study

Table 1-2-5 AREA AND PRODUCTION OF PLANTATION CROPS
Year : 1983

PROVINCE : SUMATRA SELATAN

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AAGR (%) AREA	AAGR (%) PRODUCTION
MUSI RAWAS	112,803	35,421	1.2	14.4
MUSI BANYUASIN	140,989	40,076	5.1	3.5
BANGKA	77,636	28,227	3.4	5.7
BELITUNG	9,105	3,187	6.8	11.8

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : SUMATRA SELATAN

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
MUSI RAWAS	346,000	397,143	87.1	3.5	1982
MUSI BANYUASIN	466,000	860,597	54.2	4.6	1984
BANGKA	224,100	436,687	51.3	2.1	1984
BELITUNG	-	173,379	-	-	1984

Notes :

1. AAGR : Average annual growth rate
2. Source : Kabupaten concerned with the Study

1.2.4 Other Economic Activities

Notable economic activities in Kabupaten Bangka are the industries related to tin. However, these industries are based on foreign investment capital, therefore, due to lack of data it is impossible to make further analysis of the impact on the whole industrial activities in the Kabupaten.

As can be seen from the following figures the production is rapidly declining due to the recent stagnation of the international market.

	1980	1984	AAGR (%)
Production (ton)	240,047	50,769	- 32.2

Notes : 1. AAGR : Average annual growth rate
2. Source : Kabupaten data

The fishery sector has a production volume which is more than the Kabupaten consumption. Judging from the present conditions it is expected to export yearly approximately 15,000 tons from the Kabupaten. The following figures show the current growth of fishery.

	1980	1984	AAGR (%)
Catch (ton)	19,084	19,453	0.5

Notes : 1. AAGR : Average annual growth rate
2. Source : Kabupaten data

Besides the above mentioned sectors there is a tile industry which uses the clay remaining after mining tin, however it is still a less advanced industry.

It should be noted that this Kabupaten appears to be an exception as the economic structure relies upon the non-agricultural sector. It has become a market-directed structure instead of the monoculture structure of the other Kabupatens.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

The provincial road networks of Kabupaten Bangka are consolidated by the regional trunk roads covering most of the Kabupaten. One provincial road runs across the Kabupaten from south to northwest and the other provincial roads link with this provincial road to form networks as follows :

1. Main trunk road : From Toboali to Tg.Kalian via Air Bara, Belilik, Pangkal Pinang (municipality), Sungai Liat (Kabupaten Capital), Puding Besar and Kuding Gebak.

2. Link road : From Puding Besar to Air Bara via Sungai Selatan and Payung as a link to the above main road.

3. Four service roads : 3.1 From Sungai Liat to Kuding Gebak via Silip
   3.2 From Pangkal Pinang to the link road
   3.3 From Belilik to SP.Kerakas
   3.4 From Payung to Air Bara

4. Other road : From its junction with the service road between Sungai Liat and Kuding Gebak to Belinju.

To provide transportation services required for the whole regional development the Kabupaten roads north of the provincial road between Sungai Selatan and Belilik, located at centre of the Kabupaten, consolidate their networks linking with the regional provincial roads. In the sourthern regions which are available for agricultural development the road networks have not yet been developed and it is judged that the road networks in the region should have a relatively high priority for development.

1.3.2 Road Inventory

From the road inventory data prepared by the Kabupaten, the number and total length of Kabupaten roads to be studied in Kabupaten Bangka are confirmed as 143 links and 1,462 Km respectively. These figures exclude Kabupaten roads with no data.

According to the data the present status of the Kabupaten roads is as follows:

(1) Density of Kabupaten Roads

The density of the Kabupaten roads is 1.26 m per ha. This is higher than the national density of 0.48 m per ha but lower than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table. Thus, the Kabupaten is presently progressing road development.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Bangka	1,462	1,159,184	1.26
Province : Sumatera Selatan	2,905	5,760,614	0.50
Jawa Is.(Excluding DKI Jakarta)	27,715	13,159,700	2.11
Indonesia	92,038	191,944,300	0.48

Notes : 1. The value for the province is the total value for the Kabupatens included in with the study.

2. The sources of data are as follows:
Kabupaten and Province : Bina Marga Inventory
Jawa and Indonesia : Statistical Yearbook of Indonesia 1984, published by the Central Statistics Bureau

(2) Kabupaten Road Surface Type

The type of surface on the Kabupaten roads in the Kabupaten is shown in Table 1-3-1.

The legend used in the table is as follows:

ASP : Asphalt

Table 1-3-1(1) EXISTING ROAD LENGTH BY SURFACE TYPE

PROV : SUMATERA SELATAN KAB : BANGKA

(Km)

I02	I)	L.L	ASP	TNH	KRK	TOTAL
LINK	1	27				27
LINK	2	15				15
LINK	3	5				5
LINK	4	4				4
LINK	5		16			16
LINK	6	10	1			11
LINK	7	16				16
LINK	8	4				4
LINK	9	7				7
LINK	10	6				6
LINK	11	25				25
LINK	12	9	1			10
LINK	13	6	2			8
LINK	14	4	2			6
LINK	15		8			8
LINK	16	12				12
LINK	17	4				4
LINK	18	8	3			11
LINK	19	8				8
LINK	20	9				9
LINK	21	16	1			17
LINK	22	18				18
LINK	23	10	3			13
LINK	24	19	5			24
LINK	25	13	2			15
LINK	26	6				6
LINK	27		19			19
LINK	28	7				7
LINK	29	15				15
LINK	30	18				18
LINK	31		4			4
LINK	32	9				9
LINK	33	15				15
LINK	34	6				6
LINK	35	6	2			8
LINK	36	32				32
LINK	37	23	5			28
LINK	38	12	7			19
LINK	39	11	5			16
LINK	40	22	1			23
LINK	41	21	3			24
LINK	42	3				3
LINK	43	13				13
LINK	44	23	1			24
LINK	45	10		6		16
LINK	46	14				14
LINK	47	6				6
LINK	48	10				10
LINK	49	9				9
LINK	50	2				2
LINK	51	11				11
LINK	52	5				5
LINK	53	7				7
LINK	54	9				9
LINK	55	13				13
LINK	56	14				14
LINK	57		15			15
LINK	58	34	5			39
LINK	59	5				5
LINK	60		8			8
LINK	61	7				7
LINK	62	6				6
LINK	63	5				5
LINK	64	14				14
LINK	65	15				15
LINK	66	5				5
LINK	67	12				12
LINK	68	9				9
LINK	69	9				9
LINK	70	17				17
LINK	71			3		3
LINK	72	5				5
LINK	73	4				4
LINK	74	6				6
LINK	75	5				5
LINK	76	11	1			12
LINK	77	9				9
LINK	78	4				4
LINK	79	33				33
LINK	80	27				27
LINK	81	14				14
LINK	82	8				8
LINK	83	9				9
LINK	84	13				13
LINK	85	8				8
LINK	86	23				23
LINK	87		14			14
LINK	88		3			3
LINK	89			2		2
LINK	90		1			1
LINK	91		2			2
LINK	92				1	1
LINK	93		3	1		4
LINK	94		2			2
LINK	95		1	1		2
LINK	96		1			1
LINK	97			2	4	6
LINK	98	5				5
LINK	99	6	3			9
LINK	100	7				7

Table 1-3-1 (2) EXISTING ROAD LENGTH BY SURFACE TYPE

PROV : SUMATERA SELATAN KAB : BANGKA

(Km)

102 (7)	L.L	ASP	TNH	KRK	TOTAL
LINK 101	12				12
LINK 102	8		5		13
LINK 103	7				7
LINK 104			10		10
LINK 105			8		8
LINK 106	2	1			3
LINK 107			20		20
LINK 108		51	28	5	84
LINK 109	1	11	9		21
LINK 110			1		1
LINK 111					
LINK 112			3		3
LINK 113		1			1
LINK 114		17			17
LINK 115		2	3		5
LINK 116		9	6		15
LINK 117			4		4
LINK 118		5	8		13
LINK 119	7				7
LINK 120	4				4
LINK 121	4	5			9

(Km)

102 (7)	L.L	ASP	TNH	KRK	TOTAL
LINK 122	5	1			6
LINK 123	2				2
LINK 124	5				5
LINK 125	11				11
LINK 126	5				5
LINK 127	8				8
LINK 128	23				23
LINK 129	6				6
LINK 130	14				14
LINK 131					
LINK 132					
LINK 133					
LINK 134					
LINK 135					
LINK 136					
LINK 137					
LINK 138					
LINK 139					
LINK 140					
LINK 141					
LINK 142					
LINK 143					
TOTAL	1066	256	130	10	1462
RATIO	73	18	9	1	(2)

KRK : Gravel/Stone/Telford/Water Bound Macadam

TNH : Earth

LL : Others

Comparison of the proportion of surface type in the Kabupaten with other regions is as follows:

	ASP	KRK	TNH/LL
Kabupaten : Bangka	17.5	0.7	91.8
Province : Sumatera Selatan	13.7	10.7	75.6
Jawa Is.(Excluding DKI Jakarta)	56.2	25.0	18.8
Indonesia	26.0	26.6	47.4

Thus, in the Kabupaten the proportion of Kabupaten roads with asphalt surface is lower than either that of Indonesia or of Jawa Island. The proportion of low grade roads such as earth roads and others is distinctly high. This means that the road classification in the Kabupaten is low.

(3) Surface Condition of Kabupaten Roads

The surface condition of the Kabupaten roads classified as good, fair, poor and bad which are shown as BA, SD, RU and RB respectively, are summarized in Table 1-3-2.

Comparison of the proportions of the various surface conditions of the Kabupaten roads in the Kabupaten with other regions is as follows:

	Good	Fair	Poor	Bad
Kabupaten : Bangka	42.5	35.1	16.1	6.1
Province : Sumatera Selatan	43.3	31.7	17.3	7.7
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

Table 1-3-2 (1) EXISTING ROAD CONDITION BY SURFACE TYPE

PROVINCE : SUMATERA SELATAN

KABUPATEN : BANGKA

(1)

102	71		L.L				ASP				BRI				KRK			
102		BA	SB	RU	RB	BA	SB	RU	RB	BA	SB	RU	RB	BA	SB	RU	RB
LINK	1	31	28	25	16												
LINK	2	40	28	21	11												
LINK	3	34	49	18													
LINK	4	5	30	25	40												
LINK	5					29	31	26	14								
LINK	6	17	48	21	14	80		20									
LINK	7	64	36														
LINK	8	63	38														
LINK	9	18	44	27	10												
LINK	10	92	90	10													
LINK	11	17	27	31	25												
LINK	12	49	44	8		40	45	15									
LINK	13	54	46			65	35										
LINK	14	85	15			75	25										
LINK	15					81	13	6									
LINK	16	45	40	13	2												
LINK	17	60	25	15													
LINK	18	23	29	36	13	53	27	20									
LINK	19	49	51														
LINK	20		42	58													
LINK	21	18	53	29		80	20										
LINK	22	13	27	60													
LINK	23	19	57	24		90	10										
LINK	24	41	48	11		80	18	2									
LINK	25	55	40	5		78	23										
LINK	26	70	30														
LINK	27					95	5										
LINK	28	61	39														
LINK	29	4	58	38													
LINK	30	64	36														
LINK	31					70	28	3									
LINK	32	43	23	26	8												
LINK	33	5	36	29	31												
LINK	34	31	33	23	13												
LINK	35		39	60	2	90	10										
LINK	36	11	30	50	10												
LINK	37	3	52	44		90	10										
LINK	38	11	58	31		91	9										
LINK	39	58	41			61	39										
LINK	40	37	45			60	40										
LINK	41	45	46	8	2	47	53										
LINK	42	70	30														
LINK	43	38	61	1													
LINK	44	37	37	23	3	55	30	15									
LINK	45	69	32										9	91			
LINK	46	26	41	22	10												
LINK	47	60	40														
LINK	48	22	38	40													
LINK	49	61	39	0													
LINK	50	45	55														
LINK	51	66	34														
LINK	52	58	40	2													
LINK	53	66	34														
LINK	54	60	40														
LINK	55	68	32														
LINK	56	53	45	2													
LINK	57					89	10	2									
LINK	58	28	69	16	7	82	18										
LINK	59		32	68													
LINK	60					99	1										
LINK	61	21	39	33	7												
LINK	62	39	28	30	3												
LINK	63	70	30														
LINK	64	63	37														
LINK	65	58	42														
LINK	66	56	44														
LINK	67	73	28														
LINK	68	70	24	6													
LINK	69	29	32	28	11												
LINK	70	63	37														
LINK	71									10	57	27	7				
LINK	72		26	12	62												
LINK	73	5	35	78	33												
LINK	74	48	26	14	12												
LINK	75	44	32	24													

Table 1-3-2 (2) EXISTING ROAD CONDITION BY SURFACE TYPE

PROVINCE : SUMATERA SELATAN

KABUPATEN : BANGKA

(1)

NO	LINK	L.L				ASP				INI				KRK			
NO		BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
	LINK 76	20	51	29		20	30										
	LINK 77	51	49														
	LINK 78		5	48	48												
	LINK 79	56	33	11													
	LINK 80	11	82	43	6												
	LINK 81		45	33	21												
	LINK 82		59	29	83												
	LINK 83	87	9	4													
	LINK 84	13	62	45													
	LINK 85	90	10														
	LINK 86	8	19	42	38												
	LINK 87					85	10	5									
	LINK 88					57	28	15									
	LINK 89									88	13						
	LINK 90					10	80	10									
	LINK 91					50	50										
	LINK 92													90	10		
	LINK 93					25	43	17	15	5	30	50	15				
	LINK 94					8	45	48									
	LINK 95						65	35			65	35					
	LINK 96					26	3	71									
	LINK 97									53	48	5		66	24	10	
	LINK 98	42	43	15													
	LINK 99	12	28			77	15	8									
	LINK 100	25	33	42													
	LINK 101	95	5														
	LINK 102	7	37	52						26	54	20					
	LINK 103	3	61	36													
	LINK 104											5	95				
	LINK 105									59	13	29					
	LINK 106		80	20		40	60										
	LINK 107											8	92				
	LINK 108		5			85	19	12	5	67	8	11	34		88	12	
	LINK 109	40	60	50		45	12	20	22	6	28	43	22				
	LINK 110										90	10					
	LINK 111																
	LINK 112											1	99				
	LINK 113					50	50										
	LINK 114					57	13	30									
	LINK 115					10	20	70			15	2	83				
	LINK 116					39	41	21		8	30	62					
	LINK 117									30	19	51	5				
	LINK 118					78	14	8		8	26	50	16				
	LINK 119	6	24	47	24												
	LINK 120	10	18	33													
	LINK 121	58	43			64	30	6									
	LINK 122	70	30			80	20										
	LINK 123		72	28													
	LINK 124	74	26														
	LINK 125	69	31														
	LINK 126	66	34	2													
	LINK 127	60	33	8													
	LINK 128	60	40														
	LINK 129	68	32														
	LINK 130	68	32														
	LINK 131										80	20					
	LINK 132										80	20					
	LINK 133									80	20						
	LINK 134									95	15						
	LINK 135									90	10						
	LINK 136										80	20					
	LINK 137									80	20						
	LINK 138						99	1									
	LINK 139										99	1					
	LINK 140					85	15										
	LINK 141					25	50	25									
	LINK 142											10	90				
	LINK 143										5	25	70				
	AVERAGE	41	37	17	5	51	29	14	1	23	32	20	26	52	41	7	0
	LENGTH		1066 Ka				256 Ka				130 Ka				10 Ka		
	(Ka)	437	394	181	53	131	73	28	3	30	42	26	34	5	4	1	0

The surface condition level of the Kabupaten roads in the Kabupaten is similar to that of Indonesia and of Jawa Island. The proportion in good or fair condition is relatively high. Therefore, it seems that road maintenance is carried out diligently in the Kabupaten.

(4) Terrain Conditions of Kabupaten Roads

The difficulty of road improvement is mainly dependent upon the terrain conditions.

The terrain conditions of the Kabupaten roads, classified as flat, hilly, mountainous and swampy which are shown as DT, BK, GN and RW, are summarized in Table 1-3-3.

The proportions of terrain conditions in the Kabupaten are 72.0% flat, 20.0% hilly, and 8.0% swampy. There is no mountainous area in the Kabupaten are road construction is anticipated to be not so difficult because of the small proportion of swamp.

1.3.3 Bridge Inventory

A bridge inventory showing the existing condition of bridges on the Kabupaten roads in Kabupaten Bangka was prepared by the Kabupaten.

The bridges types are classfied as timber, concrete, steel and others which are shown in the inventory as KY, BT, BJ and LL respectively.

The inventory shown in Table 1-3-5 indicates a total of 571 bridges with a total length of 4,594 m of which 346 or 60.6% are timber, 146 or 25.6% are concrete and 67 or 11.7% are others. Steel bridges account for 12 or 0.4% of the total. On the other hand, 23 bridges with a total length of 206 m are required to be newly constructed.

Table 1-3-3 (1) EXISTING ROAD LENGTH BY TERRAIN CONDITION

PROV : SUMATERA SELATAN KAB : BANGKA

(Km)

I02	3	BK	DT	RW	TOTAL
LINK	1	12	15		27
LINK	2		15		15
LINK	3		5		5
LINK	4		4		4
LINK	5	9	7		16
LINK	6		11		11
LINK	7	6	10		16
LINK	8	3	1		4
LINK	9	6	1		7
LINK	10		6		6
LINK	11	3	22		25
LINK	12	2	8		10
LINK	13	5	3		8
LINK	14		6		6
LINK	15		8		8
LINK	16	1	11		12
LINK	17		4		4
LINK	18		11		11
LINK	19		8		8
LINK	20	1		8	9
LINK	21		6	11	17
LINK	22	6	12		18
LINK	23	3	5	5	13
LINK	24		20	4	24
LINK	25	1	13	1	15
LINK	26	1	5		6
LINK	27	19			19
LINK	28	4	3		7
LINK	29	1	13	1	15
LINK	30		18		18
LINK	31		4		4
LINK	32	5	4		9
LINK	33	8	7		15
LINK	34	2	4		6
LINK	35		6	2	8
LINK	36		32		32
LINK	37		28		28
LINK	38		19		19
LINK	39	6	9	1	16
LINK	40	3	19	1	23
LINK	41	10	14		24
LINK	42		3		3
LINK	43	4	8	1	13
LINK	44	6	18		24
LINK	45	4	6	6	16
LINK	46	11	3		14
LINK	47		6		6
LINK	48	1	7	2	10
LINK	49	9			9
LINK	50	1	1		2
LINK	51	11			11
LINK	52		5		5
LINK	53	2	5		7
LINK	54	2	7		9
LINK	55	3	10		13
LINK	56	4	10		14
LINK	57	4	10	1	15
LINK	58	2	26	11	39
LINK	59		5		5
LINK	60	3	5		8
LINK	61	5	2		7
LINK	62		6		6
LINK	63		5		5
LINK	64		14		14
LINK	65		15		15
LINK	66	2	3		5
LINK	67	6	6		12
LINK	68	4	5		9
LINK	69	1	8		9
LINK	70		17		17
LINK	71		3		3
LINK	72	1	4		5
LINK	73	2	2		4
LINK	74		6		6
LINK	75	1	4		5
LINK	76		4	8	12
LINK	77		4	5	9
LINK	78		2	2	4
LINK	79	3	30		33
LINK	80		10	17	27
LINK	81	11	3		14
LINK	82		8		8
LINK	83		6	3	9
LINK	84		12	1	13
LINK	85	2	5	1	8
LINK	86		22	1	23
LINK	87	2	12		14
LINK	88		3		3
LINK	89		2		2
LINK	90		1		1
LINK	91		2		2
LINK	92		1		1
LINK	93	1	3		4
LINK	94		2		2
LINK	95		2		2
LINK	96		1		1
LINK	97	1	5		6
LINK	98	2	3		5
LINK	99		9		9
LINK	100	6	1		7

Table 1-3-3(2) EXISTING ROAD LENGTH BY TERRAIN CONDITION

PROV : SUMATERA SELATAN KAB : BANGKA

(Km)

NO (3)	BK	DT	RN	TOTAL
LINK 101	7	5		12
LINK 102		5	8	13
LINK 103	3	1	3	7
LINK 104	1	7	2	10
LINK 105		8		8
LINK 106		3		3
LINK 107	1	13	6	20
LINK 108	4	76	4	84
LINK 109	1	20		21
LINK 110		1		1
LINK 111				
LINK 112		3		3
LINK 113		1		1
LINK 114	12	5		17
LINK 115		5		5
LINK 116		15		15
LINK 117	1	3		4
LINK 118	3	10		13
LINK 119		7		7
LINK 120		4		4
LINK 121	5	4		9
LINK 122	1	5		6
LINK 123		2		2
LINK 124		5		5
LINK 125		11		11
LINK 126	1		4	5
LINK 127	3	5		8
LINK 128		23		23
LINK 129	2	4		6
LINK 130	10	4		14
LINK 131		1		1
LINK 132		1		1
LINK 133		1		1
LINK 134		1		1
LINK 135		1		1
LINK 136		1		1
LINK 137		1		1
LINK 138		1		1
LINK 139		1		1
LINK 140		1		1
LINK 141	1			1
LINK 142		1		1
LINK 143		1		1
TOTAL	290	1052	120	1462
RATIO	20	72	8	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : LAMPUNG KAB : LAMPUNG TENGAH

LINK NO	<<<< BRIDGE >>>> EXISTING NO.	EXISTING LENGTH	NOT EXIST NO.	NOT EXIST LENGTH	TOTAL NO.	TOTAL LENGTH	UNIT: m
1	4	34.00			4	34.00	
2	1	6.00			1	6.00	
3	1	4.00	1	35.00	2	39.00	
4	2	12.00			2	12.00	
5	2	39.00	1	30.00	3	69.00	
7	3	24.00			3	24.00	
13	1	6.50			1	6.50	
15	1	10.00			1	10.00	
16	1	6.00			1	6.00	
17	2	37.00			2	37.00	
18	6	66.80			6	66.80	
19	4	32.50			4	32.50	
20	2	23.00			2	23.00	
21	2	24.00	1	60.00	3	84.00	
22	2	20.00			2	20.00	
23	2	18.00			2	18.00	
25	1	12.00			1	12.00	
26	1	10.00			1	10.00	
27	3	56.00			3	56.00	
29	1	8.00			1	8.00	
30	1	12.00			1	12.00	
31	1	19.00			1	19.00	
32	1	9.00			1	9.00	
33	1	10.00			1	10.00	
34	1	6.00			1	6.00	
36	3	30.00			3	30.00	
38	4	38.00			4	38.00	
40	2	26.00			2	26.00	
41	3	21.50			3	21.50	
43	1	4.00	1	10.00	2	14.00	
46	2	14.00			2	14.00	
47	1	11.00			1	11.00	
48	2	14.00			2	14.00	
49	1	6.00			1	6.00	
51	1	7.00			1	7.00	
54	1	8.00			1	8.00	
55	3	29.00			3	29.00	
56	1	7.00			1	7.00	
57			1	12.00	1	12.00	
58	4	38.00			4	38.00	
59	2	25.00			2	25.00	
60	2	14.00			2	14.00	
61	2	14.00			2	14.00	
62			1	15.00	1	15.00	
63	1	30.00			1	30.00	
64	3	17.00			3	17.00	
65	1	8.00	1	6.00	2	14.00	
66	1	10.00			1	10.00	
67							
69	1	8.00			1	8.00	
70			1	25.00	1	25.00	
72	1	5.00			1	5.00	
74	2	20.00			2	20.00	
76	1	7.00			1	7.00	
77	1	7.00			1	7.00	
78	1	7.00			1	7.00	
79	1	9.00			1	9.00	
80	1	12.00	1	5.00	2	17.00	
84	3	51.00			3	51.00	
88	3	26.00			3	26.00	
96	3	24.00			3	24.00	
100	4	31.00			4	31.00	
102	1	7.00			1	7.00	
103	5	50.00			5	50.00	
107	2	21.00			2	21.00	
111	1	7.00			1	7.00	
112	1	12.00			1	12.00	
113	2	22.00			2	22.00	
115			1	6.00	1	6.00	
116	2	16.00			2	16.00	
119	1	8.00			1	8.00	
120	2	24.00			2	24.00	
123	1	7.00			1	7.00	
125			1	7.00	1	7.00	
130	1	7.00			1	7.00	
133			2	14.00	2	14.00	
134	1	7.00			1	7.00	
144	1	8.00			1	8.00	
149	2	16.00			2	16.00	
156	3	26.00			3	26.00	
157	2	22.00			2	22.00	
164	3	24.00			3	24.00	
165	3	42.00			3	42.00	
167	1	8.00			1	8.00	
168	1	12.00			1	12.00	
172	1	6.00	1	6.00	2	12.00	
175	1	20.00			1	20.00	
TOTAL	148	1455.30	14	231.00	162	1686.30	

Table 1-3-5 NUMBER OF EXISTING BRIDGES BY BRIDGE TYPE

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(No)

103 (18)	BT	KY	LL	BJ	TOTAL	103 (18)	BT	KY	LL	BJ	TOTAL
LINK 1	4				4	LINK 62					
LINK 2		1			1	LINK 63			1		1
LINK 3	1				1	LINK 64		2	1		3
LINK 4		2			2	LINK 65			1		1
LINK 5			2		2	LINK 66			1		1
LINK 7			3		3	LINK 67					
LINK 13	1				1	LINK 69			1		1
LINK 15	1				1	LINK 70					
LINK 16			1		1	LINK 72	1				1
LINK 17			2		2	LINK 74			2		2
LINK 18	6				6	LINK 76	1				1
LINK 19	3		1		4	LINK 77			1		1
LINK 20	1		1		2	LINK 78	1				1
LINK 21			2		2	LINK 79				1	1
LINK 22	2				2	LINK 80			1		1
LINK 23	2				2	LINK 84			3		3
LINK 25	1				1	LINK 88			3		3
LINK 26			1		1	LINK 96		3			3
LINK 27			3		3	LINK 100	4				4
LINK 29	1				1	LINK 102			1		1
LINK 30	1				1	LINK 103			5		5
LINK 31	1				1	LINK 107			2		2
LINK 32		1			1	LINK 111	1				1
LINK 33	1				1	LINK 112	1				1
LINK 34	1				1	LINK 113			2		2
LINK 36	3				3	LINK 115					
LINK 38	4				4	LINK 116			2		2
LINK 40	2				2	LINK 119			1		1
LINK 41	3				3	LINK 120			2		2
LINK 43	1				1	LINK 123	1				1
LINK 46			2		2	LINK 125					
LINK 47	1				1	LINK 130	1				1
LINK 48	2				2	LINK 133					
LINK 49	1				1	LINK 134			1		1
LINK 51			1		1	LINK 144			1		1
LINK 54			1		1	LINK 149	2				2
LINK 55	2	1			3	LINK 156	3				3
LINK 56			1		1	LINK 157			2		2
LINK 57						LINK 164			3		3
LINK 58	2	1		1	4	LINK 165			3		3
LINK 59	2				2	LINK 167	1				1
LINK 60			2		2	LINK 168			1		1
LINK 61	2				2	LINK 172	1				1
						LINK 175	1				1
						TOTAL	71	11	64	2	148
						RATIO	48	7	43	1	(2)

The number of existing bridges by span length is as follows:

Bridges Type	Span Length (m)										
	〈3	〈5	〈8	〈10	〈12	〈14	〈16	〈18	〈20	〈99	Total
Timber	107	148	83	4	3	-	-	-	-	1	346
Concrete	76	38	21	4	4	1	-	-	1	-	145
Steel	1	2	4	2	-	1	-	-	1	-	11
Others	34	20	10	1	-	1	-	1	-	-	67
Total	218	208	118	11	7	3	-	1	2	1	569

Thus, most of the existing bridges on the Kabupaten roads are timber and concrete and the majority of spanlengths is within the range of 3 m to 5 m.

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Lampung Tengah were prepared by the Kabupaten and are shown in Chapter 2.

From the inventories, total value of average daily trips by vehicle type and their proportions in the Kabupaten in 1985 are summarized as follows:

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Total Trips	1,967	45	989	14,585	10,301
Proportion (%)	11.19	0.26	5.62	82.93	100.00

Source : Bina Marga Inventory

The proportions of registered vehicles by vehicle type are as follows:

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	0.00	0.91	12.89	86.20	100.00

Source : Kabupaten.

Thus, the proportion of motorcyles in the Kabupaten is by far the highest.

From the above tables the following can be observed:

- Number of total trips might be underestimated
- Proportions are probably reasonable.

Essentially, for estimation of future traffic volumes past and present traffic data together with the trend in the number of registered vehicles are important basic data. However the data obtained for the study was traffic count data for each road link in 1985 and of low reliability.

Therefore the future traffic volumes are estimated by the calculation process recommended in chapter 3 of the Main Report.

Chapter 2 ESTIMATIONS OF FUTURE TRAFFIC VOLUME AND BENEFIT

2.1 Future Traffic Volume

2.1.1 Traffic Growth Rate

The traffic growth rate used for estimation of the future traffic volume on the Kabupaten roads was estimated by the following calculation process.

Growth of Production Basis "A":

$$\sqrt{\text{Annual Population Growth of the Kabupaten} \times \text{Growth of the Total Cultivated Area}}$$

Growth of Productivity "B" :

$$\sqrt{\text{Growth of the Total Paddy Field Area} \times \text{Growth of the Paddy Production per ha}}$$

Traffic Growth Rate: Initial estimated figure:

$$\overline{GR'} = \sqrt{A \times B}$$

Traffic Growth Rate GR =Final adjusted figure:

$$\sqrt{GR' \times \text{Trend of GDP/Capita of the Province Concerned}}$$

Results of the estimation are shown in Table 2-1-1.

Table 2-1-1 TRAFFIC GROWTH RATE ESTIMATION

PROV : SUMATERA SELATAN KAB : BANGKA

A)	Growth Rate of Population	:	2.70 (%)
B)	Growth Rate of Cultivated Area	:	3.60 (%)
C)	Growth Rate of Rice field	:	2.30 (%)
D)	Growth Rate of Rice yield rate	:	2.20 (%)
E)	Growth Rate of GDP / capita	:	6.70 (%)
a)	Geometrical Mean (A x B)	:	3.15 (%)
b)	Geometrical Mean (C x D)	:	2.25 (%)
c)	Geometrical Mean (a x b)	:	2.70 (%)
d)	Geometrical Mean (c x E)	:	4.68 (%)
	TRAFFIC GROWTH RATE	:	4.68 (%)

2.1.2 Present and Future Traffic Volume

The future traffic volumes on the Kabupaten roads in 1998 for the Project life time of ten years were estimated by the following formula :

$$Tn = Te\ (1 + r)^n$$

Where :

Tn : Future traffic volume n years later
Te : Traffic volume in 1985
r : Traffic growth rate

The results are shown in Table 2-1-2 together with the traffic volume in 1985.

Table 2-1-2 (1) EXISTING AND FUTURE TRAFFIC VOLUME

PROV : SUMATERA SELATAN KAB : BANGKA

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	19	23	29	82	112	4.7%	34	42	53	149	203	IIIB-1
2	28	18	32	74	115	4.7%	51	33	58	134	208	IIIB-1
3	4	6	5	38	34	4.7%	7	11	9	69	62	IIIB-2
4	6	3	6	40	35	4.7%	11	5	11	72	63	IIIB-2
5	8	4	12	52	50	4.7%	14	7	22	94	91	IIIB-2
6	4	6	4	45	37	4.7%	7	11	7	82	67	IIIB-2
7	4	0	6	40	30	4.7%	7	0	11	72	54	IIIB-2
8	26	17	34	76	115	4.7%	47	31	62	138	208	IIIB-1
9	31	28	17	84	118	4.7%	56	51	31	152	214	IIIB-1
10	19	24	28	80	111	4.7%	34	43	51	145	201	IIIB-1
11	26	16	32	78	113	4.7%	47	29	58	141	205	IIIB-1
12	29	26	34	88	133	4.7%	53	47	62	159	241	IIIB-1
13	21	19	38	94	125	4.7%	38	34	69	170	227	IIIB-1
14	64	78	61	148	277	4.7%	116	141	111	268	502	IIIA
15	76	68	63	149	282	4.7%	138	123	114	270	511	IIIA
16	71	79	64	162	295	4.7%	129	143	116	294	535	IIIA
17	4	6	6	50	41	4.7%	7	11	11	91	74	IIIB-2
18	27	19	33	76	117	4.7%	49	34	60	138	212	IIIB-1
19	15	0	10	30	40	4.7%	27	0	18	54	72	IIIB-2
20	4	4	8	39	36	4.7%	7	7	14	71	65	IIIB-2
21	2	0	4	8	10	4.7%	4	0	7	14	18	IIIC
22	4	3	2	12	15	4.7%	7	5	4	22	27	IIIC
23	6	0	12	28	32	4.7%	11	0	22	51	58	IIIB-2
24	25	16	36	74	114	4.7%	45	29	65	134	207	IIIB-1
25	32	27	21	86	123	4.7%	58	49	38	156	223	IIIB-1
26	4	2	8	60	44	4.7%	7	4	14	109	80	IIIB-2
27	18	16	10	50	69	4.7%	33	29	18	91	125	IIIB-2
28	31	26	38	94	142	4.7%	56	47	69	170	257	IIIB-1
29	10	6	8	60	54	4.7%	18	11	14	109	98	IIIB-2
30	34	28	41	78	142	4.7%	62	51	74	141	257	IIIB-1
31	29	36	38	84	145	4.7%	53	65	69	152	263	IIIB-1
32	27	39	41	72	143	4.7%	49	71	74	130	259	IIIB-1
33	10	0	4	60	44	4.7%	18	0	7	109	80	IIIB-2
34	21	3	2	42	47	4.7%	38	5	4	76	85	IIIB-2
35	6	4	8	50	43	4.7%	11	7	14	91	78	IIIB-2
36	18	24	30	84	114	4.7%	33	43	54	152	207	IIIB-1
37	21	26	27	88	118	4.7%	38	47	49	159	214	IIIB-1
38	38	24	31	74	130	4.7%	69	43	56	134	236	IIIB-1
39	31	19	38	78	127	4.7%	56	34	69	141	230	IIIB-1
40	19	26	31	86	119	4.7%	34	47	56	156	216	IIIB-1
41	26	21	29	94	123	4.7%	47	38	53	170	223	IIIB-1
42	6	2	6	45	37	4.7%	11	4	11	82	67	IIIB-2
43	4	6	6	50	41	4.7%	7	11	11	91	74	IIIB-2
44	20	21	37	88	122	4.7%	36	38	67	159	221	IIIB-1
45	19	22	38	92	125	4.7%	34	40	69	167	227	IIIB-1
46	32	29	17	98	127	4.7%	58	53	31	178	230	IIIB-1
47	28	34	19	86	124	4.7%	51	62	34	156	225	IIIB-1
48	2	0	2	8	8	4.7%	4	0	4	14	14	IIIC
49	3	0	0	30	18	4.7%	5	0	0	54	33	IIIC
50	18	17	10	56	73	4.7%	33	31	18	101	132	IIIB-2

Table 2-1-2 (2) EXISTING AND FUTURE TRAFFIC VOLUME

PROV : SUMATERA SELATAN KAB : BANGKA

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	9	3	4	12	22	4.7%	16	5	7	22	40	IIIC
52	19	23	33	82	116	4.7%	34	42	60	149	210	IIIB-1
53	21	30	38	88	133	4.7%	38	54	69	159	241	IIIB-1
54	24	28	36	92	134	4.7%	43	51	65	167	243	IIIB-1
55	6	2	2	40	30	4.7%	11	4	4	72	54	IIIB-2
56	22	34	24	78	119	4.7%	40	62	43	141	216	IIIB-1
57	41	19	39	110	154	4.7%	74	34	71	199	279	IIIB-1
58	26	18	34	68	112	4.7%	47	33	62	123	203	IIIB-1
59	21	27	19	94	114	4.7%	38	49	34	170	207	IIIB-1
60	68	81	68	164	299	4.7%	123	147	123	297	542	IIIA
61	2	3	4	18	18	4.7%	4	5	7	33	33	IIIC
62	26	31	16	34	90	4.7%	47	56	29	62	163	IIIB-2
63	4	4	6	50	39	4.7%	7	7	11	91	71	IIIB-2
64	25	19	31	78	114	4.7%	45	34	56	141	207	IIIB-1
65	23	21	26	84	112	4.7%	42	38	47	152	203	IIIB-1
66	4	4	6	30	29	4.7%	7	7	11	54	53	IIIB-2
67	2	2	6	20	20	4.7%	4	4	11	36	36	IIIC
68	26	21	34	68	115	4.7%	47	38	62	123	208	IIIB-1
69	2	0	4	13	13	4.7%	4	0	7	24	24	IIIC
70	2	2	4	50	33	4.7%	4	4	7	91	60	IIIB-2
71	2	0	4	4	8	4.7%	4	0	7	7	14	IIIC
72	19	2	6	32	43	4.7%	34	4	11	58	78	IIIB-2
73	19	24	27	90	115	4.7%	34	43	49	163	208	IIIB-1
74	20	28	31	98	128	4.7%	36	51	56	178	232	IIIB-1
75	2	6	2	14	17	4.7%	4	11	4	25	31	IIIC
76	4	2	4	11	16	4.7%	7	4	7	20	29	IIIC
77	18	26	15	56	87	4.7%	33	47	27	101	158	IIIB-2
78	20	31	16	32	83	4.7%	36	56	29	58	150	IIIB-2
79	32	19	28	94	126	4.7%	58	34	51	170	228	IIIB-1
80	2	0	2	16	12	4.7%	4	0	4	29	22	IIIC
81	4	2	4	14	17	4.7%	7	4	7	25	31	IIIC
82	6	0	12	28	32	4.7%	11	0	22	51	58	IIIB-2
83	2	1	2	4	7	4.7%	4	2	4	7	13	IIIC
84	2	4	2	6	11	4.7%	4	7	4	11	20	IIIC
85	53	78	81	136	280	4.7%	96	141	147	246	507	IIIA
86	2	0	2	12	10	4.7%	4	0	4	22	18	IIIC
87	89	81	102	240	392	4.7%	161	147	185	435	710	IIIA
88	63	78	68	162	290	4.7%	114	141	123	294	526	IIIA
89	58	71	76	148	279	4.7%	105	129	138	268	506	IIIA
90	52	70	78	152	276	4.7%	94	127	141	275	500	IIIA
91	53	69	79	158	280	4.7%	96	125	143	286	507	IIIA
92	68	54	74	162	277	4.7%	123	98	134	294	502	IIIA
93	74	67	51	168	276	4.7%	134	121	92	304	500	IIIA
94	54	70	73	172	283	4.7%	98	127	132	312	513	IIIA
95	61	82	68	212	317	4.7%	111	149	123	384	574	IIIA
96	53	68	81	161	283	4.7%	96	123	147	292	513	IIIA
97	64	84	71	223	331	4.7%	116	152	129	404	600	IIIA
98	81	76	92	210	354	4.7%	147	138	167	381	642	IIIA
99	23	31	27	86	124	4.7%	42	56	49	156	225	IIIB-1
100	24	29	24	83	119	4.7%	43	53	43	150	216	IIIB-1

Table 2-1-2 (3) EXISTING AND FUTURE TRAFFIC VOLUME

PROV : SUMATERA SELATAN KAB : BANGKA

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
101	11	2	4	42	38	4.7%	20	4	7	76	69	IIIB-2
102	28	31	29	96	136	4.7%	51	56	53	174	246	IIIB-1
103	26	37	20	94	130	4.7%	47	67	36	170	236	IIIB-1
104	0	0	0	11	6	4.7%	0	0	0	20	11	IIIC
105	0	0	0	24	12	4.7%	0	0	0	43	22	IIIC
106	0	0	2	30	17	4.7%	0	0	4	54	31	IIIC
107	0	0	0	16	8	4.7%	0	0	0	29	14	IIIC
108	68	74	81	232	339	4.7%	123	134	147	420	614	IIIA
109	40	20	60	261	251	4.7%	72	36	109	473	455	IIIB-1
110	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
111	25	35	28	50	113	4.7%	45	63	51	91	205	IIIB-1
112	38	41	27	144	178	4.7%	69	74	49	261	323	IIIB-1
113	70	31	74	268	309	4.7%	127	56	134	486	560	IIIA
114	40	50	60	200	250	4.7%	72	91	109	362	453	IIIB-1
115	28	31	46	98	154	4.7%	51	56	83	178	279	IIIB-1
116	40	45	50	160	215	4.7%	72	82	91	290	390	IIIB-1
117	52	19	28	102	150	4.7%	94	34	51	185	272	IIIB-1
118	49	32	47	140	198	4.7%	89	58	85	254	359	IIIB-1
119	2	0	2	19	14	4.7%	4	0	4	34	25	IIIC
120	2	0	4	21	17	4.7%	4	0	7	38	31	IIIC
121	32	27	21	86	123	4.7%	58	49	38	156	223	IIIB-1
122	4	2	8	60	44	4.7%	7	4	14	109	80	IIIB-2
123	20	21	37	88	122	4.7%	36	38	67	159	221	IIIB-1
124	19	23	33	82	116	4.7%	34	42	60	149	210	IIIB-1
125	19	23	33	82	116	4.7%	34	42	60	149	210	IIIB-1
126	19	23	33	82	116	4.7%	34	42	60	149	210	IIIB-1
127	4	4	6	50	39	4.7%	7	7	11	91	71	IIIB-2
128	23	21	26	84	112	4.7%	42	38	47	152	203	IIIB-1
129	4	4	6	30	29	4.7%	7	7	11	54	53	IIIB-2
130	31	26	38	94	142	4.7%	56	47	69	170	257	IIIB-1
131	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
132	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
133	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
134	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
135	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
136	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
137	43	32	39	243	236	4.7%	78	58	71	440	428	IIIB-1
138	38	41	27	144	178	4.7%	69	74	49	261	323	IIIB-1
139	38	41	27	144	178	4.7%	69	74	49	261	323	IIIB-1
140	70	31	74	268	309	4.7%	127	56	134	486	560	IIIA
141	70	31	74	268	309	4.7%	127	56	134	486	560	IIIA
142	70	31	74	268	309	4.7%	127	56	134	486	560	IIIA
143	70	31	74	268	309	4.7%	127	56	134	486	560	IIIA
PERCENT	15.09	13.94	16.66	54.30			15.09	13.94	16.66	54.30		

2.2 Benefit

2.2.1 Benefit Estimation Method

Generally, estimation of the benefit on each Kabupaten road due to the Project was made by analyzing the direct benefit i.e. the VOC reduction benefit, which was estimated by comparing "with project" and "without project" based upon the future traffic volume on the road. However for the following road links it was decided to estimate the indirect benefit through the producer's surplus benefit.

a) Road links with present traffic volume (ADT) less than 60 equivalent 4-wheel vehicles.

b) Road links with no 4-wheel vehicle operation at present.

The indirect benefit was changed into the future traffic volume and the VOC reduction benefit was estimated.

The VOC adopted for the estimation is shown in Table 2-2-1.

Table 2-2-1 VEHICLE OPERATION COST ON KABUPATEN ROADS

(KM)

SURFACE	CONDITION	SEDAN	BUS	TRUCK	MOTORCYCLE
ASPHALT	GOOD	104.7	86.2	85.4	15.9
	Fair	125.5	101.0	98.0	18.2
	Poor	164.1	135.2	138.5	22.8
	Bad	222.1	202.0	205.0	29.1
GRAVEL	Good	125.7	101.4	102.5	18.5
	Fair	145.0	124.6	127.1	21.1
	Poor	198.6	172.6	178.4	27.1
	Bad	242.7	228.9	231.2	31.8
EARTH	Fair	201.8	180.0	185.1	28.0
	Poor	240.7	218.2	225.8	31.8
	Bad	264.9	278.0	281.7	35.5

Source : Bina Marga

Table 2-2-2 FUTURE TRAFFIC VOLUME ESTIMATED BY THE PRODUCER'S SURPLUS

PROV : SUMATERA SELATAN KAB : BANGKA

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
3	IIIC	KRK	1	1	1	5	6
4	IIIC	KRK	0	0	0	1	1
5	IIIC	KRK	1	1	1	4	5
6	IIIC	KRK	1	1	1	3	5
7	IIIC	KRK	2	2	2	7	10
17	IIIC	KRK	0	0	0	1	1
19	IIIC	KRK	1	1	1	5	6
20	IIIC	KRK	1	1	1	3	5
21	IIIC	KRK	2	1	2	6	8
22	IIIC	KRK	2	2	2	6	9
23	IIIC	KRK	1	1	1	5	6
26	IIIC	KRK	2	1	2	5	8
29	IIIC	KRK	2	2	3	9	12
33	IIIC	KRK	2	2	2	8	10
34	IIIC	KRK	1	1	1	3	5
35	IIIC	KRK	1	1	2	5	7
42	IIIC	KRK	1	1	1	2	4
43	IIIB-2	KRK	16	15	18	58	78
48	IIIC	KRK	1	1	1	3	5
49	IIIC	KRK	2	2	2	6	9
51	IIIC	KRK	1	1	1	5	6
55	IIIC	KRK	2	1	2	6	8
61	IIIC	KRK	0	0	1	2	2
63	IIIC	KRK	0	0	0	1	1
66	IIIC	KRK	1	1	1	5	6
67	IIIC	KRK	3	3	3	10	14
69	IIIC	KRK	1	1	1	2	4
70	IIIC	KRK	1	1	1	4	5
71	IIIC	KRK	0	0	0	1	1
72	IIIC	KRK	0	0	0	1	1
75	IIIC	KRK	0	0	0	1	1
76	IIIC	KRK	1	1	1	4	5
80	IIIB-2	KRK	33	30	36	118	158
81	IIIC	KRK	1	1	1	4	5
82	IIIC	KRK	1	1	1	2	4
83	IIIB-2	KRK	14	13	15	50	67
84	IIIC	KRK	2	1	2	6	8
86	IIIB-2	KRK	18	17	20	65	88
101	IIIC	KRK	3	3	3	11	15
104	IIIC	KRK	1	1	1	2	4
105	IIIC	KRK	1	1	1	5	6
106	IIIC	KRK	0	0	0	1	1
107	IIIC	KRK	2	2	3	9	12
119	IIIC	KRK	5	5	6	19	26
120	IIIC	KRK	0	0	0	1	1
122	IIIC	KRK	2	1	2	5	8
127	IIIC	KRK	1	0	1	2	3
129	IIIC	KRK	1	1	2	5	7

2.2.2 Benefit

The benefit estimation was carried out for each Kabupaten road. Table 2-2-3 shows a sample of the result of benefit estimation. In the table "surplus" and "VOC" show the estimation method utilized and III A, III B-1, III B-2 and III C show the road classification.

Table 2-2-3

RESULTS OF BENEFIT ESTIMATION

KABUPATEN : BANGKA

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 8	LINK 9	LINK 10
	27 Km	15 Km	5 Km	4 Km	16 Km	11 Km	16 Km	4 Km	7 Km	6 Km
	IIIB-1	IIIB-1	IIIC	IIIC	IIIC	IIIC	IIIC	IIIB-1	IIIB-1	IIIB-1
YEAR	VOC	VOC	Surplus	Surplus	Surplus	Surplus	Surplus	VOC	VOC	VOC
1988	0	0	0	0	0	0	0	0	0	0
1989	60327	30825	57	12	720	544	320	4027	16057	7740
1990	62549	32142	98	12	720	544	320	4247	16778	8027
1991	65400	33759	141	12	720	544	320	4421	17648	8458
1992	68842	35412	141	12	720	544	320	4641	18518	8826
1993	71692	36765	141	12	720	544	320	4855	19399	9187
1994	75835	38418	146	12	720	544	320	5075	20289	9647
1995	78761	40368	146	12	720	544	320	5334	21178	10089
1996	82278	42299	146	12	720	544	320	5560	22068	10540
1997	86422	43989	151	12	720	544	320	5824	23116	11084
1998	90642	46553	157	12	720	544	320	6123	24333	11542
SUM	742748	380530	1324	120	7200	5440	3200	50107	199384	95140
COST	293753	144226	-17231	-14329	-53187	-36265	-55645	7976	80193	23857
/Km	10880	9615	-3446	-3582	-3324	-3297	-3478	1994	11456	3976

Chapter 3 ENGINEERING

3.1 Design Criteria and Specification

3.1.1 Geometric Design Criteria

Currently a technical standard for improvement of Kabupaten roads i.e. PETUNJUK TEKNIS INPRES PENUNJANGAN JALAN KABUPATEN, TAHUN 1984-1985 is established by Bina Marga.

The geometric design criteria in the above standard are recommended to be adopted in general for the Project. Following discussions with Bina Marga, exceptions to this are allowed for Pavement width and pavement type to minimize the construction cost of the Kabupaten road improvement, if necessary. The geometric design criteria adopted for the Project are shown in Table 3-1-1. The typical cross sections of Kabupaten roads are shown in Fig. 3-1-1.

3.1.2 Loading Specification

The LOADING SPECIFICATIONS FOR HIGHWAY BRIDGES BY DIRECTORATE GENERAL BINA MARGA is used in principle as the basic specification of loading and the TECHNICAL STANDARD FOR KABUPATEN ROADS compiled by Bina Marga shows that the design live load for bridges on Kabupaten roads is 70% of the Bina Marga live road. However, after discussions with Bina Marga the following loads were decided as the design live loads for the standard bridges of Kabupaten roads:

a. 50% of Bina Marga live load (hereinafter BM 50) is applied for concrete and timber bridges on roads of III A classification.

b. 10-ton truck load is applied for timber bridges on roads of III B-1, III B-2 and III C classification.

Table 3-1-1

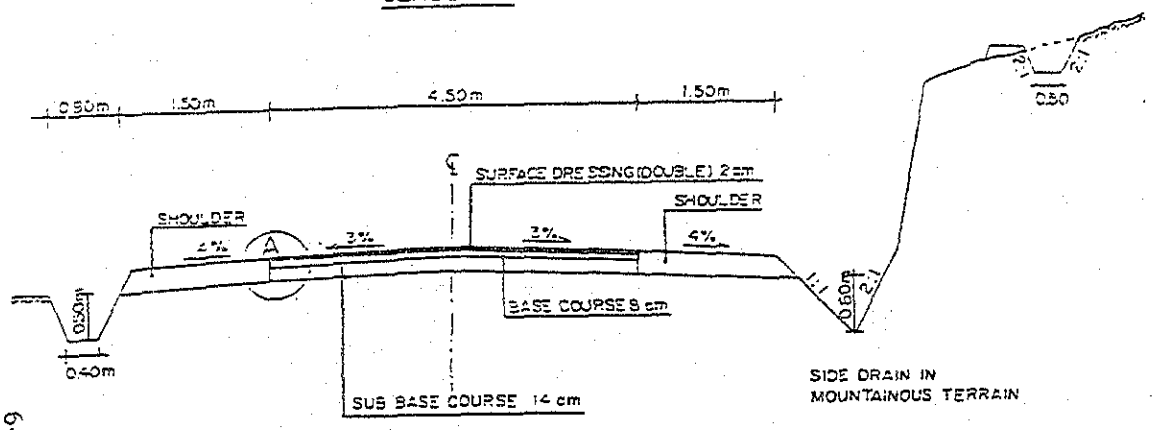
DESIGN CRITERIA FOR KABUPATEN ROADS

ROAD CLASSIFICATION		CLASS III A			CLASS III B-1			CLASS III B-2			CLASS III C		
SURFACE TYPE		ASPHALT SEAL (DOUBLE)			ASPHALT SEAL (SINGLE)			GRAVEL			GRAVEL		
TRAFFIC VOLUME : ADT (Forecast 10 th year average per day)		3000 - 500			500 - 200			200 - 50			50		
T E R R A I N		FLAT TO ROLLING	HILLY	MOUNT-AINOUS	FLAT TO ROLLING	HILLY	MOUNT-AINOUS	FLAT TO ROLLING	HILLY	MOUNT-AINOUS	FLAT TO ROLLING	HILLY	MOUNT-AINOUS
TRAFFIC LANES		1+	1+	1+	1+	1+	1+	1+	1+	1+	1	1	1
DESIGN SPEED (Km/hr)	DESIRABLE	70	60	40	70	40	30	60	40	30	50	30	AS PRACTI-CABLE
	MINIMUM	30	30	30	30	30	AS PRACTI-CABLE	30	30	AS PRACTI-CABLE	30	AS PRACTICABLE	
GRADIENT (LIMITING) (%)	DESIRABLE	4	5	8	4	6	8	4	7	8	5	8	12
	MAXIMUM	7	7	10	7	8	10	7	9	12	7	12	16
PAVEMENT WIDTH (M)	DESIRABLE	6.0	6.0	6.0	4.5	4.5	4.5	4.5	4.5	4.5	3.5	3.5	3.5
	MINIMUM	4.5	4.5	4.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0
SHOULDER WIDTH (M)	DESIRABLE	2.0	1.5	1.5	1.5	1.5	1.0	1.5	1.0	1.0	1.0	1.0	0.75
	MINIMUM	1.5	1.0	0.75	1.0	1.0	0.75	1.0	0.75	0.5	0.75	0.5	0.5
ROAD BED WIDTH (M)	DESIRABLE	10.0	9.0	9.0	8.0	7.5	6.5	7.5	6.5	6.5	5.5	5.5	5.0
	MINIMUM	6.0	6.0	6.0	5.5	5.5	5.0	5.5	5.0	4.5	4.5	4.0	4.0
RIGHT OF WAY (M)	DESIRABLE	16			12			12			12		
	MINIMUM	12			10			10			8		
ROAD CAMBER (%)	PAVEMENT	3			3			4			4		
	SHOULDER	4			4			5			5		

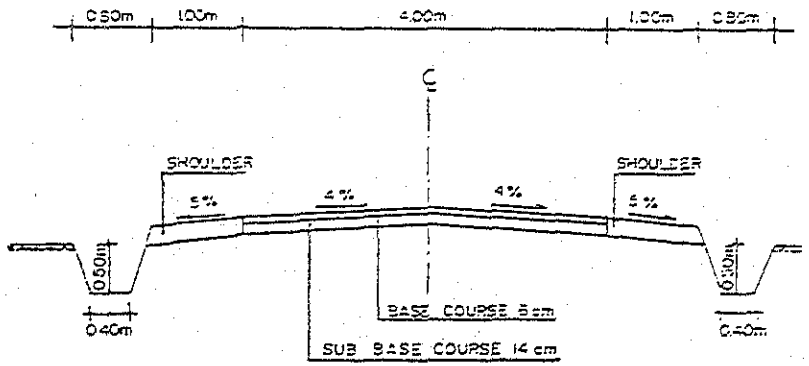
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

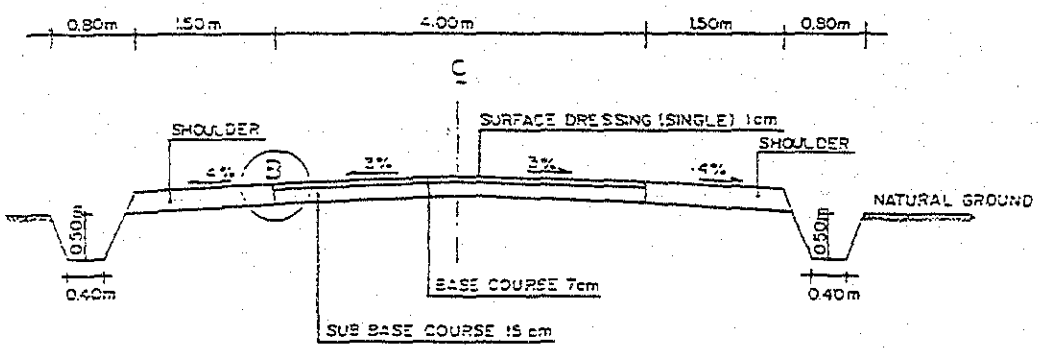
CLASS III A



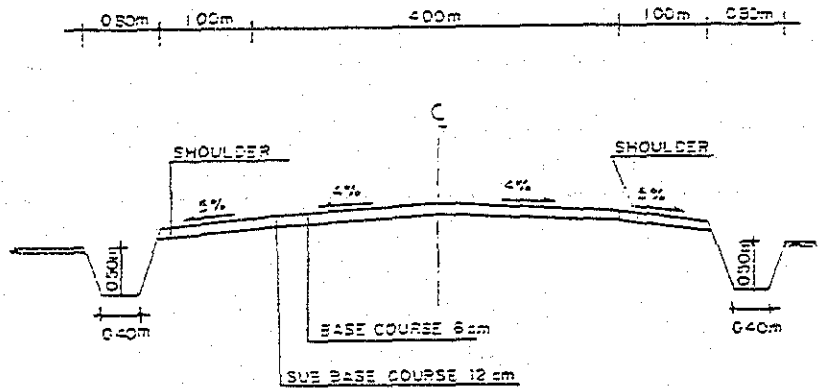
CLASS III B-2



CLASS III B-1



CLASS III C



3.2 Pavement Design

3.2.1 Design Conditions

From the engineering data prepared by the Kabupaten it is noted that the pavement structure of the Kabupaten roads seems to have been determined without adequate designs, therefore the Kabupaten roads generally have insufficient capacity. The standards generally used for highway pavement design such as Road Note 29, Road Note 31 and AASHTO are not suitable for Kabupaten roads with small traffic volumes and loads.

Therefore formulae suitable for the pavement design of Kabupaten roads are recommended as described in Chapter 5 of the Main Report.

The following are important factors for the design of pavement thickness.

1) Design Traffic Volume

As the pavement thickness is designed for each road classification the design traffic volume of which the target year is 1998, is adopted for each classification as follows:

Road Classification	Design Traffic Volume (vpd)
III A	1,000
III B-1	500
III B-2	200
III C	50

2) Strength of Roadbed

The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

CBR of the laterite is generally in the range of CBR 4 to 10. However site CBR tests should be conducted before construction to finally decide the pavement thickness.

3.2.2 Pavement Structure

Fig. 3-2-1 shows the standard pavement structure adopted for the Kabupaten roads.

Fig. 3-2-1 *PAVEMENT STRUCTURE*

(cm)

CBR	ROAD CLASSIFICATION			
	III A	III B-1	III B-2	III C
6	14 | 8 | 24	14 | 7 | 22	14 | 6 | 20	16

= SURFACE DRESSING (ASPHALT)

= BASE COURSE (CRUSHER-RUN)

= SUBBASE COURSE (SANDY GRAVEL)

3.3 Design of Bridges and Other Structures

3.3.1 Standard Bridge

There are so many bridges to be improved or to be constructed on the Kabupaten roads in the Project Area that it is very difficult to prepare an individual design for each bridge. Therefore, standardization is recommended as being necessary for the bridge design with conclusions as described below.

(1) Bridge Type

1) Superstructure

The following two types have been finally selected with the agreement of Bina Marga after studying the actual rural conditions of bridge construction. Fig. 3-3-1 shows the cross sections of standard types.

a. Timber beam bridge (hereinafter timber bridge) for roads class III B-1, III B-2 and III C.

b. Reinforced concrete T-girder bridge (hereinafter RC-bridge) for roads class III A.

2) Substructure

Taking account of the actual combinations of super and substructure types noted from the field survey, the following two types are recommended as standard because of ease of construction and economy.

a) Timber pile bents for timber bridge
b) Rubble in Mortar masonry for RC bridge

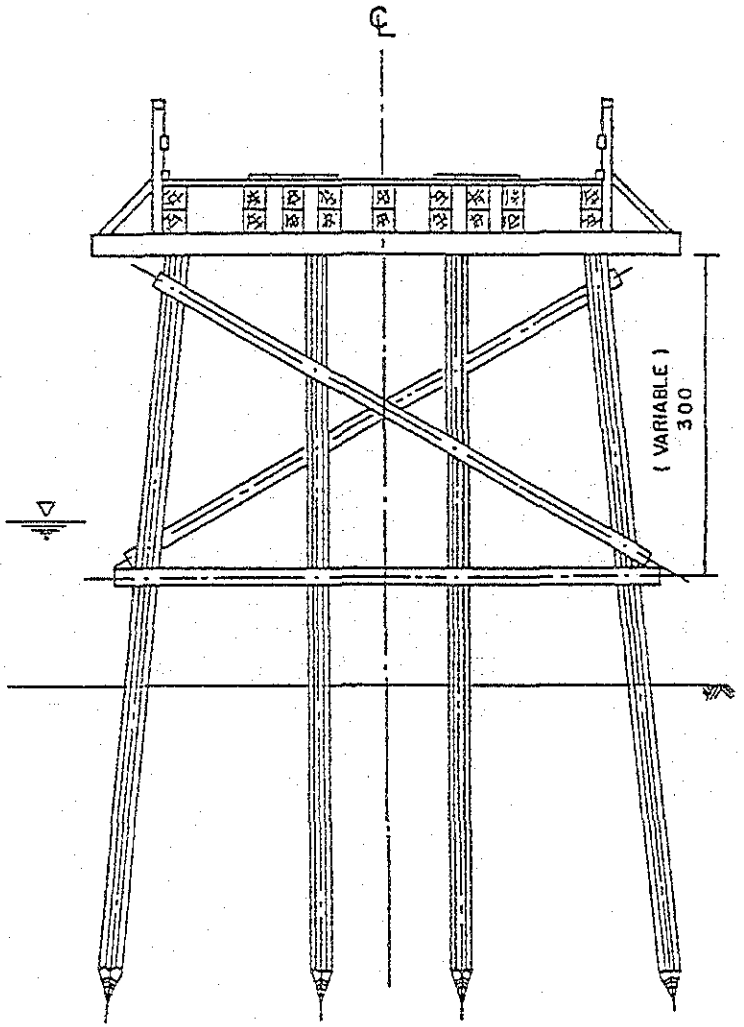
3) Foundation

There is no information of subsoil conditions in the inventory data. However, timber piles of 20 cm diameter are generally recommended as piles of this type are in common use.

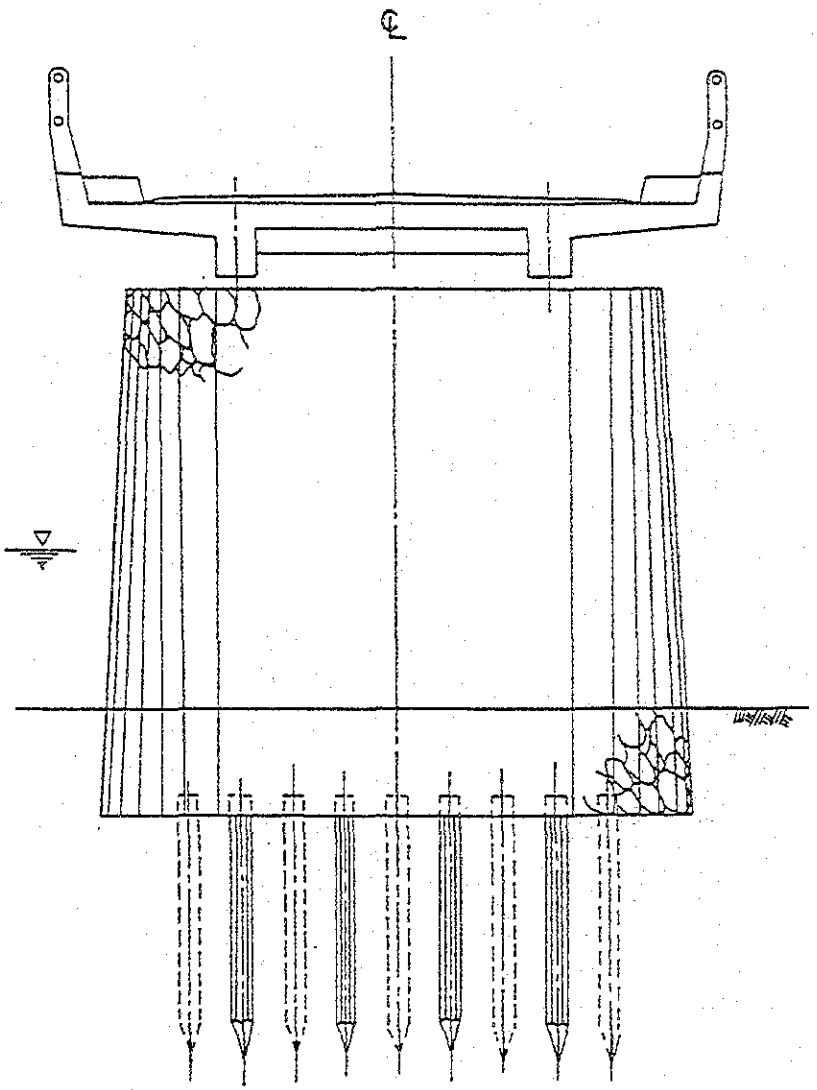
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

Fig. 3-3-1 CROSS SECTIONS OF STANDARD BRIDGES

TIMBER BRIDGE



REINFORCED CONCRETE BRIDGE



(2) Bridge Width

The effective bridge widths for the standard bridges have been decided as follows through discussions with Bina Marga considering the actual width of Kabupaten roads:

a) Timber bridge: 4.0 m in general
b) RC bridge : 4.5 m in general

(3) Span Length

The range of span lengths are determined as:

a) Timber bridge: 3.0, 5.0 and 8.0 m
b) RC bridge : 3.0, 5.0, 10.0 and 15.0 m

3.3.2 Other Structure

Culverts and retaining walls shown in Fig. 3-3-2 and Fig. 3-3-3 are recommended as standard structures.

(1) Culvert

The following two culvert types have been adopted for the transverse drainage.

a) Reinforced concrete pipe culvert ϕ 80 cm
b) Rubble in mortar box culvert with RC slab 80 cm X 80 cm

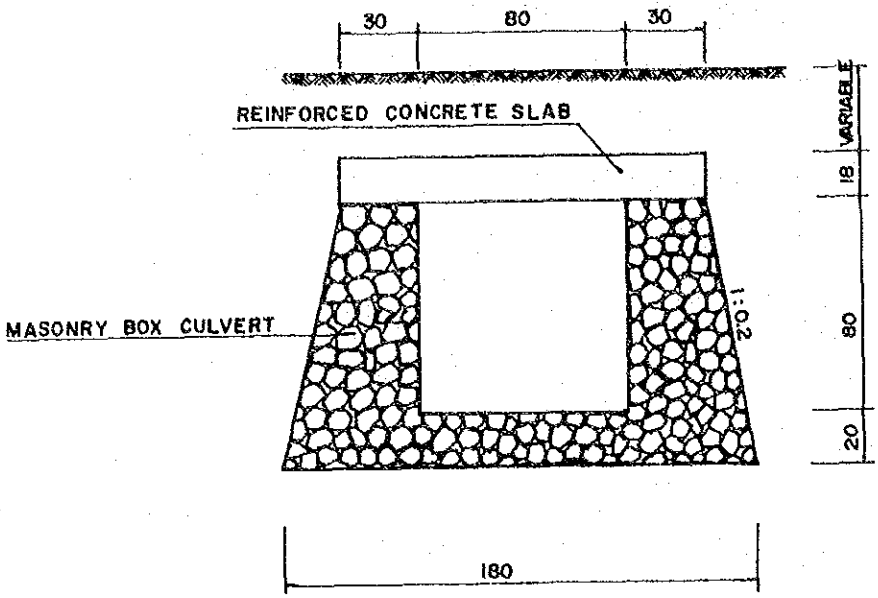
(2) Retaining Wall

The following two types of retaining walls have been adopted because of ease of construction, economy and familiarity in Indonesia.

a) Rubble in mortar retaining wall
b) Timber retaining wall

Fig. 3-3-2 STANDARD CULVERTS

80 x 80 RUBBLE IN MORTAR BOX CULVERTS



Ø 80 RENFORCED CONCRETE PIPE CULVERT

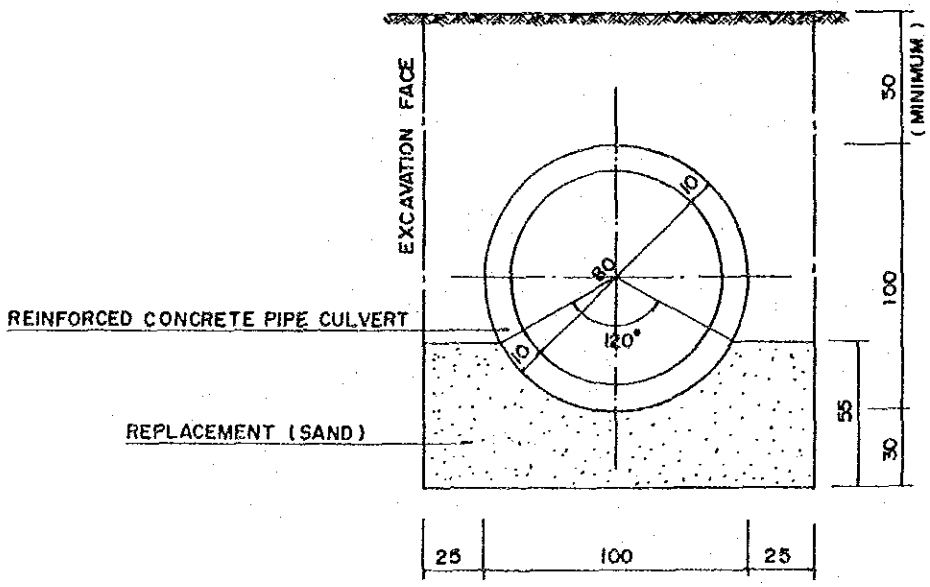
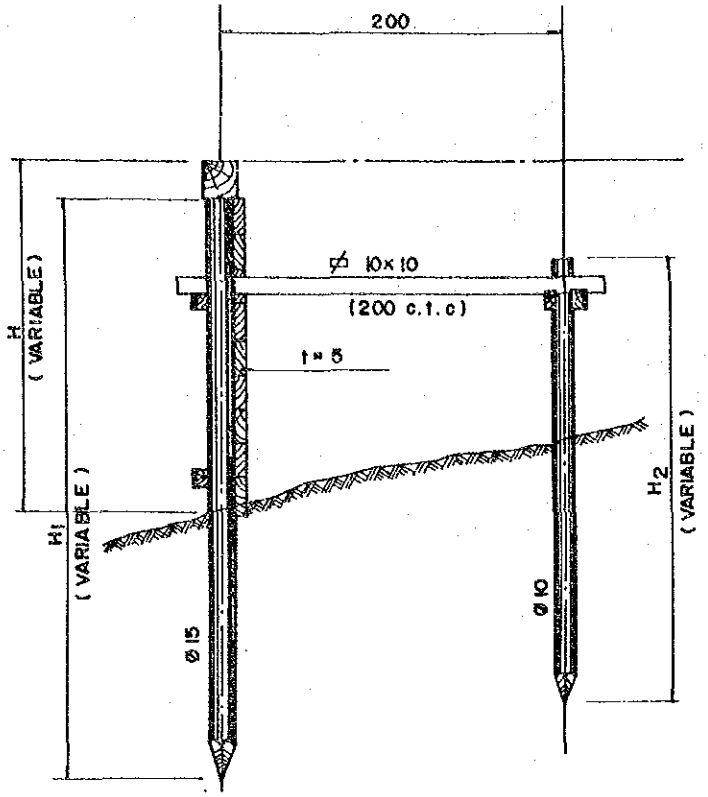
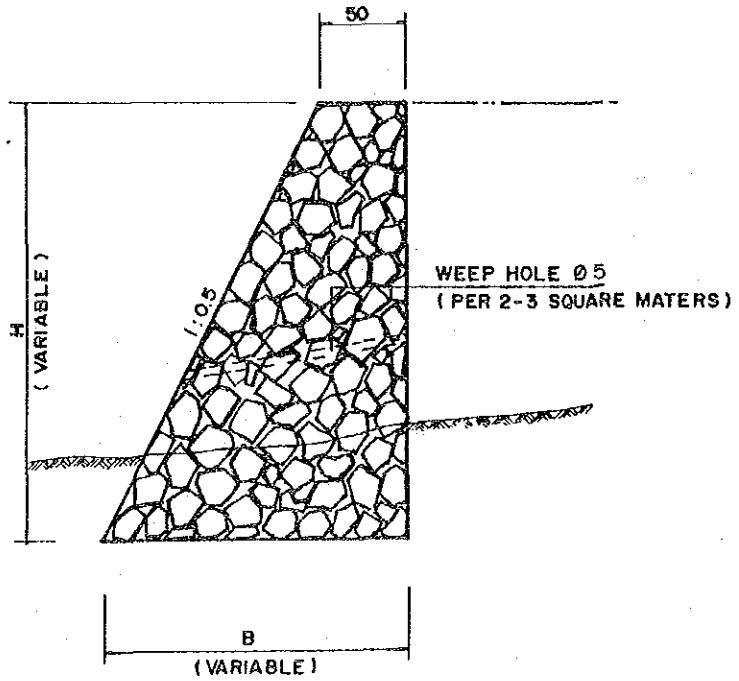


Fig. 3-3-3 STANDARD RETAINING WALLS

TIMBER RETAINING WALL



RUBBLE IN MORTAR WALL



3.4 Selection of Equipment Types

From the results of comparison of two types of Kabupaten road construction methods, i.e. equipment intensive method and labour intensive method construction methods for major works were basically decided as shown in Table 3-4-1.

Table 3-4-1 CONSTRUCTION METHODS FOR MAJOR WORKS

METHOD	WORK TYPE
Equipment Intensive	Earthwork, Base Course and Subbase Course
Labour Intensive	Surface Dressing, Drainage, Bridge and Other Structures.

3.4.1 Points to be Considered for the Selection

Full consideration was given to the following points in studying the selection of equipment type.

a. Most of the construction in the Project is pavement works for road improvement.

b. The pavement width adopted is equal to or less than 4.5 m and therefore large sized equipment is omitted from the selection process.

c. Equipment should be capable of with standing the heavy rainfall and poor soil quality. Equipment for construction in swampy areas is considered if necessary.

d. Uniformity of equipment types with existing equipment is considered to facilitate repair of the equipment in the provincial work shop.

e. Since the scale of the construction is small and transportation of equipment will frequently be necessary, wheel type equipment has been selected as much as possible as this can move by itself or by being towed.

f. The road like to be improved are scattered all over the Kabupatens and therefore a low bed truck or equivalent is necessary for transportation of crawler type equipment. It is desirable to protect the existing pavement from damage caused by the movement of crawler type equipment on the existing roads.

g. The capacity of the equipment has been decided taking into consideration the construction volume and the combination of equipment in the main work.

3.4.2 Combinations of Equipment for Major Works and Maintenance

The combinations of equipment for major works and maintenance are listed in Table 3-4-2 and 3-4-3 respectively.

Table 3-4-2 EQUIPMENT OF ONE WORK GANG FOR MAJOR TYPES OF WORK

TYPE OF WORK	EQUIPMENT REQUIRED	
1. Site Clearing in Light Bush	1- Bulldozer 90 HP 2- Dump Truck 3.0 Ton	1- Wheel Loader 1.2 m^3
2. Excavation & Embankment		
i) Normal Fill	1- Bulldozer 90 HP 1- Vibratory Roller 4.0 Ton (D&T)	1- Water Tank Truck 4,000 Ltr
ii) Fill by Borrow Material	1- Bulldozer 90 HP 3- Dump Truck 3.0 Ton	1- Wheel Loader 1.2 m^3
iii) Fill in Swamp	1- Swamp Bulldozer 90 HP 1- Water Tank Truck 4,000 Ltr	1- Vibratory Roller 4.0 Ton (D&T)
iv) Excavation to Spoil	1- Bulldozer 90 HP 1- Wheel Loader 1.2 m^3	4- Dump Truck 3.0 Ton
3. Subgrade Preparation	1- Motor Grader 75 HP 1- Vibratory Roller 4.0 Ton (D&T)	1- Water Tank Truck 4,000 Ltr
4. Subbase Course	1- Motor Grader 75 HP 1- Vibratory Roller 4.0 Ton (D&T)	1- Water Tank Truck 4,000 Ltr
5. Base Course	1- Motor Grader 75 HP 1- Vibratory Roller 4.0 Ton 1- Portable Crusher/Screens 30-40 Ton/H	1- Water Tank Truck 4,000 Ltr
6. Cement Stabilizing	1- Motor Grader 70 HP 1- Bulldozer 90 HP 1- Wheel Loader 1.2 m^3 1- Flat Bed Truck 3.0 Ton	1- Vibratory Roller 4.0 Ton (D&T) 1- Road Stabilizer 1- Water Tank Truck 4,000 Ltr
7. Surface Course	1- Asphalt Sprayer 850 Ltr 1- Tyre Roller 8-15 Ton 1- Portable Crusher/Screens 30-40 Ton/H	1- Flat Bed Truck 3.0 Ton
8. Concrete	1- Concrete Mixer 0.5 m^3 1- Water Pump 200 Ltr/Min 1- Concrete Vibrator 3.3 HP	1- Flat Bed Truck 3.0 Ton 1- Hand-Guided Vibratory Roller 1000 Kg

Table 3-4-3 EQUIPMENT OF ONE WORK GANG FOR MAINTENANCE

TYPE OF WORK	EQUIPMENT REQUIRED
Road	1- Motor Grader
	1- Tyre Roller 8-15 Ton
	1- Hand-Guided Vibratory Roller 1000 Kg
	1- Flat Bed Truck 3.0 Ton
	1- Dump Truck 3.0 Ton
Bridge and Other Structure	1- Flat Bed Truck With Crane 3.0 Ton

3.5 Workshop and Laboratory

3.5.1 Policy of the Kabupaten Workshop

A workshop will be provided for each Kabupaten. The function of the workshop is to cope with requests from the construction site. The main service will be routine maintenance while the secondary service will be light repairs which can be carried out by changing parts. Dismantling and assembling of units which need setting or adjustment using special equipment or facilities will not be carried out in the Kabupaten workshop. Such repairs are planned to be carried out by the provincial workshop or the regional Workshop of Bina Marga.

Accordingly the main tasks of the Kabupaten workshop are as follows:

1) Administration for and storage of equipment
2) Routine maintenance and light repair of equipment
3) Storage and supply of spare parts
4) Operation of equipment including crushing plant.

3.5.2 Workshop Equipment and Tools

Equipment and tools for the workshop are recommended as shown in Table 3-5-1.

Table 3-5-1 WORKSHOP EQUIPMENT AND TOOLS

DESCRIPTION	QUANTITY
Upright Drilling Machine	1 Set
Electric Hand Drill	1
Electric Portable Grinder	1
Disc Grinder	1
Bench Electric Grinder	1
Engineer's Vice	1
DC Electric Welder with Engine	1 Set
Portable Hydraulic Jack, Screw Head	1
Hydraulic Jack	1
Grease Gun	2
Suction Pump for Oil Recovery	2
High Pressure Grease Pump	1

continued

DESCRIPTION	QUANTITY
Drum Opening Spanner	1
Silicon Normal Charger	1
Tyre Changer Air Operated	1
Tyre Service Tool Set	1
Tyre Pressure Gauge	1
Automatic Tyre Inflator	1
Plug Cleaner and Tester	1
Mechanics Tool Set, Heavy Equipment	1
Mechanics Tool Set, Large Vehicle	1
Portable Air Compressor	1
Electric Cord Reel, 15 A, 50 m	1
Oil Measure, Polyethylene	1
Funnel 200 mm, Steel	3
Hand Truck (Cart), 4-Wheel	1
Nylon Sling, 10 ton	2
Chain Block, 1 ton	2
Wire Rope (for sling), 1.8 ton	2
Wire Rope (for sling) 3.2 ton	2
Generator	1

3.5.3 Laboratory

For quality control of construction in the Project it is recommended that a laboratory is provided for each Kabupaten. For each laboratory, provision of laboratory test equipment for the following tests is recommended:

- Physical characteristic, compaction and strength tests for the road bed and pavement materials.
- Slump and strength tests for the bridge concrete.

In the laboratory a fixed water tank should be provided for CBR tests and curing of concrete specimens.

The proposed laboratory equipment is listed in Table 3-5-2.

Table 3-5-2 LABORATORY TEST EQUIPMENT

DESCRIPTION	QUANTITY
Soil Moisture Test Set (JIS A1203)	1
Liquid Limit Set (JIS A1205)	1
Plastic Limit Set (JIS A1206)	1
Compaction Set (JIS A1210)	1
CBR Laboratory Set, Mechanical (JIS A1211)	1
Sand Density Apparatus (JIS A1214)	1
Aggregate Test Sieve Set	1
Portable Cone Penetrometer	1
Compression & Bending Test Machine	1
Cylinder Mould (JIS A1132, 1108)	9
Slump Test Apparatus (JIS A1101)	2

To conduct the surveys necessary for road and structure construction such as centering, profile leveling, cross section leveling etc., the surveying equipment listed in Table 3-5-3 recommended.

Table 3-5-3 SURVEYING EQUIPMENT

DESCRIPTION	QUANTITY
Transit	1
Level	1
Staff	3

Chapter 4 CONSTRUCTION AND MAINTENANCE COST ESTIMATIONS

4.1 Unit Price

With regard to the unit prices of materials and labor, the data were collected from each Kabupaten through Bina Marga. The collected data were compared with those of Jakarta using BAHAN BANGUNAN DKI-JAKARTA MAY & JUNE 1985 compiled by PUSAT INFORMASI TEHNIK PEMBANGUNAN, and then finalized.

4.1.1 Unit Labour Price

The unit labour prices of Kabupaten Bangka and other Kabupatens in Sumatera Selatan Province are shown in Table 4-1-1.

Table 4-1-1 UNIT LABOUR PRICE

(Rp)

KABUPATEN	MAN	SKL LAB	CAP	MAS	LAB	DRIV	OPE
Musi Rawas	2,750	2,200	3,850	3,850	1,650	3,500	5,000
Musi Banyuasin	2,500	2,500	3,000	3,000	2,000	2,500	3,000
Bangka	3,000	2,750	3,500	3,500	2,250	3,000	3,500
Belitung	3,000	2,750	5,000	3,750	2,250	4,000	3,000
Average	2,813	2,250	3,838	3,525	2,025	3,250	3,625

Notes :

MAN : Mandur
SKL LAB : Skilled Labour
CAP : Carpenter
MAS : Mason
LAB : Labourer
DRIV : Driver
OPE : Operater

4.1.2 Unit Price of Materials

Table 4-1-2 shows the unit price of materials for Kabupaten Bangka together with for other Kabupatens in Sumatera Selatan Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	MUSI RAWAS	MUSI BANYUASIN	BANGKA	BELITUNG	AVERAGE
Bitumen	L	380	365	300	280	330
Asphalt oil	L	800	300	850	850	700
Gasoline	L	250	250	250	250	250
Sand	M^3	7,000	6,000	5,500	4,000	5,625
Cement	bag	4,000	4,000	4,800	4,000	4,200
River Stone	M^3	8,000	25,000	7,500	6,000	11,625
Steel moulds	Set	7,000	7,000	7,000	7,000	7,000
Timber	M^3	90,000	120,000	155,000	150,000	128,750
Paint	L	3,500	2,500	3,500	3,000	3,125
Reinforcing Steel	Kg	800	1,000	800	900	875
Tying Wire	Kg	1,200	1,500	1,100	1,100	1,225
Equivalent Royalty	M^3	250	250	250	250	250

4.1.3 Hourly Equipment Cost

The hourly equipment cost for Kabupaten is shown in Table 4-1-3.

Table 4-1-3

HOURLY EQUIPMENT COST

PROVINCE : SUMATERA SELATAN
KABUPATEN : BANGKA

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST OWNERSHIP	LOCAL COST OPERATION	LOCAL COST SUB-TOTAL	FOREIGN COST OWNERSHIP	FOREIGN COST OPERATION	FOREIGN COST SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	156	12,826	12,982	7,769	1,014	8,783	21,765
	Bulldozer/Ripper	120 HP	170	13,827	13,997	8,500	1,560	10,060	24,057
	Swamp Bulldozer	120 HP	178	14,066	14,244	8,879	1,630	10,509	24,753
	Bulldozer	90 HP	99	8,658	8,757	4,914	641	5,555	14,312
	Bulldozer/Ripper	90 HP	106	9,242	9,348	5,300	973	6,273	15,621
	Bulldozer	65 HP	70	6,291	6,361	3,500	456	3,956	10,317
	Bulldozer/Ripper	65 HP	77	6,735	6,812	3,819	701	4,520	11,332
	Swamp Bulldozer	90 HP	106	9,232	9,338	5,284	970	6,254	15,592
	Swamp Bulldozer	65 HP	81	6,650	6,731	4,050	743	4,793	11,524
	Motor Grader	110 HP	139	11,068	11,207	6,919	1,270	8,189	19,396
	Motor Grader	75 HP	96	7,584	7,680	4,779	877	5,656	13,336
	Motor Grader	65 HP	86	6,673	6,759	4,300	789	5,089	11,848
	Road Stabilizer	W=1850 mm	172	3,348	3,520	8,594	420	9,014	12,534
	Vibratory Roller	4 ton	58	3,317	3,375	2,900	378	3,278	6,653
	Hand-guide Vib. Roller	1000 Kg	47	592	639	849	28	877	1,516
	Tire Roller	8-15 ton	63	7,376	7,439	3,106	101	3,207	10,646
	Vibratory Roller (D&T)	4 ton	58	3,317	3,375	2,900	378	3,278	6,653
	Hand-guide Vib. Roller	600 Kg	33	404	437	600	20	620	1,057
	Rough Terrain Crane	10 ton	201	12,906	13,107	10,039	737	10,776	23,883
	Hydraulic Excavator; Wheel	0.3 m3	83	7,789	7,872	4,109	536	4,645	12,517
	Wheel Loader	1.2 m3	141	8,392	8,533	7,019	916	7,935	16,468
	Wheel Loader	0.3 m3	46	2,931	2,977	2,269	296	2,565	5,542
	Water Tank Truck	4000 ltr.	48	2,830	2,878	869	117	986	3,864
	Fuel Tank Truck	4000 ltr.	49	2,836	2,885	882	119	1,001	3,886
	Dump Truck	3.0 ton	81	3,532	3,613	1,469	198	1,667	5,280
	Flat Bed Truck with Crane	3.0 ton	35	3,079	3,114	1,716	126	1,842	4,956
	Dump Loader Truck	12 ton	77	18,974	19,051	3,838	125	3,963	23,014
	Dump Truck	5.0 ton	121	5,838	5,959	2,189	295	2,484	8,443
	Flat Bed Truck	3.0 ton	12	2,658	2,670	563	41	604	3,274
	Portable Crusher/Screening	30-40 t/h	376	21,646	22,022	18,800	2,454	21,254	43,276
	Concrete Mixer	0.5 m3	297	2,350	2,647	5,400	410	5,810	8,457
	Water Pump	200 l/min	11	262	273	188	6	194	467
	Concrete Vibrator	3.3 HP	5	228	233	73	2	75	308
	Asphalt Sprayer	850 ltr.	57	754	811	1,019	137	1,156	1,967

4.2 Unit Construction Cost by Work Type

4.2.1 All Works Except Bridges

The unit construction costs by work type, excluding bridge construction costs, have been estimated using the combination of equipment described in Clause 3.4 and the unit prices already listed. The results are summarized in Table 4-2-1.

Table 4-2-1 UNIT COST BY WORK TYPE EXCEPT BRIDGE WORK

PROV : SUMATERA SELATAN KAB : BANGKA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	162	91	253
Subgrade Preparation	m2	21	11	32
Normal Fill	m3	1,667	861	2,528
Fill in Swamp	m3	2,449	1,050	3,499
Normal Excavation to Spoil	m3	974	521	1,495
Sub Base Course	m3	3,093	1,344	4,437
Base Course	m3	4,276	2,295	6,571
Shoulder	m2	293	145	438
Asphalt Patching	m2	3,888	1,375	5,263
Surface Dressing (Single)	m2	659	595	1,254
Surface Dressing (Double)	m2	813	935	1,748
Earth Drain	m	986	119	1,105
Earth Drain in Swamp (by machine)	m3	1,205	473	1,678
Pipe Culvert D80cm	m	45,443	44,495	89,938
Masonry Culvert (80x80cm)	m	64,708	38,085	102,793
Retaining Wall and Wing Wall (Timber)	m2	15,441	245	15,686
Retaining Wall and Wing Wall (Masonry)	m3	46,893	11,775	58,668
Gabion Protection	m3	13,174	120	13,294
Manual routine maintenance of road	Km	162,540	7,248	169,788
Routine maintenance of earth road	Km	94,822	37,868	132,690
Routine maintenance of gravel road	Km	188,778	87,939	276,717
Routine maintenance of asphalt road	Km	388,800	137,500	526,300

4.2.2 Bridges

The unit construction costs by bridge type including the cost of demolition of existing bridges are shown in Table 4-2-2.

Table 4-2-2 BRIDGE COST

PROV : SUMATERA SELATAN KAB : BANGKA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	55,634	4,625	60,259
Superstructure (Timber;Span 5m;10T)	m2	61,623	5,106	66,729
Superstructure (Timber;Span 8m;10T)	m2	81,622	6,704	88,326
Superstructure (Timber;Span 3m;BM50)	m2	68,984	5,718	74,702
Superstructure (Timber;Span 5m;BM50)	m2	75,311	6,193	81,504
Superstructure (Timber;Span 8m;BM50)	m2	95,515	7,839	103,354
Superstructure (Concrete;Span 3m;BM50)	m2	59,900	90,643	150,543
Superstructure (Concrete;Span 5m;BM50)	m2	61,331	101,196	162,527
Superstructure (Concrete;Span 8m;BM50)	m2	63,036	110,168	173,204
Superstructure (Concrete;Span10m;BM50)	m2	68,850	125,030	193,880
Superstructure (Concrete;Span15m;BM50)	m2	73,924	147,158	221,082
Substructure (Pier;for Timber;10T)	NO	484,615	43,111	527,726
Substructure (Abut;for Timber;10T)	NO	1,300,552	189,409	1,489,961
Substructure (Pier;for Timber;BM50)	NO	712,725	63,825	776,550
Substructure (Abut;for Timber;BM50)	NO	1,472,611	212,426	1,685,037
Substructure (Pier;for Concrete;BM50)	NO	1,882,835	472,599	2,355,434
Substructure (Abut;for Concrete;BM50)	NO	3,892,798	991,443	4,884,241
Demolition of Bridge (Timber->Timber)	m2	15,295	1,728	17,023
Demolition of Bridge (Timber->Concrete)	m2	15,295	1,728	17,023
Demolition of Bridge (Concrete)	m2	92,556	70,585	163,141
Maintenance of Timber Bridge (New)	m2	9,888	1,343	11,231
Maintenance of Concrete Bridge (New)	m2	2,081	2,805	4,886
Maintenance of Timber Bridge (Exist)	m2	8,658	2,513	11,171
Maintenance of Concrete Bridge (Exist)	m2	4,130	2,403	6,533

Chapter 5 RESULTS OF ECONOMIC FEASIBILITY EVALUATION

5.1 Preliminary Screening

The road links to be improved should be effective for development of the Project Area. The road links where improvements were assumed to be inefficient for development of the Project Area were generally screened out using the following cut-off criteria.

(1) Very short roads, less than 2 Km long, which have no connection with the trunk road network.

(2) Roads not connected to the network at any point

(3) Unpreferred roads, due to poor suitability for transportation compared to other existing alternative roads serving the same purpose.

(4) Road in good condition according to the Bina Marga road inventory which lists improvement projects carried out in the last two or three years

(5) Roads with asphalt surface in good condition

(6) Urban roads, except those forming part of a longer route

(7) Roads serving single large organizations rather than the general public

(8) Roads with no inventory data

(9) Kabupaten roads also assigned as provincial roads

The road links to be screened out in Kabupaten Bangka are shown in Table 5-1-1.

Table 5-1-1 ROAD LINKS TO BE SCREENED OUT

KABUPATEN : BANGKA

CRITERIA NO	ROAD LINK NO
(6)	87,88,89,90,91,92,93,94,95,96,97,108,109,110, 111,112,113,114,115,116,117,118,131,132,133, 134,135,136,137,138,139,140,141,142,143
(9)	27

5.2 Evaluation

5.2.1 Primary Analysis

The Kabupaten roads were classified by using the future traffic volume on the road links in 1998. The primary analysis of the IRR was carried out using the construction and maintenance costs. Road links where IRRs were more than 10% were defined as feasible links.

Results of primary analysis are shown in Table 5-2-1.

5.2.2 Secondary Analysis

From the infeasible road links evaluated by the primary analysis, road links where the IRRs were between 1% and 10%, i.e. road links which could become feasible if down graded by one rank, in classification were down graded and the costs re-estimated. Using these costs, a secondary analysis of IRR was carried out. Road links where these IRRs were then more than 10% were also defined as feasible links. This reflected that even though the road classification was rather low the road link should be improved.

Results of secondary analysis are shown in Table 5-2-2.

5.2.3 Ranking of Feasible Road Links

From the results of the primary and secondary analysis, road links where the IRRs were more than 10% were selected and their NPVs and B/Cs were estimated. The ranking of feasible road links from the economic evaluation are decided in the order of the NPVs, i.e. the larger the NPV the higher the road link priority as shown in Table 5-2-3.

Table 5-2-1 (1) RESULTS OF PRIMARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : BANGKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
78	4 Km	IIIB-2	47.947	VOC
102	13 Km	IIIB-1	23.413	VOC
45	14 Km	IIIB-1	22.698	VOC
73	4 Km	IIIB-1	20.715	VOC
98	5 Km	IIIA	20.566	VOC
16	12 Km	IIIA	19.321	VOC
36	32 Km	IIIB-1	19.059	VOC
59	5 Km	IIIB-1	18.373	VOC
11	25 Km	IIIB-1	16.551	VOC
9	7 Km	IIIB-1	14.377	VOC
32	9 Km	IIIB-1	14.158	VOC
18	11 Km	IIIB-1	13.129	VOC
46	14 Km	IIIB-1	11.292	VOC
37	28 Km	IIIB-1	10.387	VOC
123	2 Km	IIIB-1	9.771	VOC
103	7 Km	IIIB-1	9.757	VOC
1	27 Km	IIIB-1	8.707	VOC
62	6 Km	IIID-2	6.014	VOC
2	15 Km	IIIB-1	5.669	VOC
100	7 Km	IIIB-1	5.227	VOC
44	24 Km	IIIB-1	4.859	VOC
74	6 Km	IIIB-1	3.931	VOC
38	19 Km	IIIB-1	3.489	VOC
85	8 Km	IIIA	3.427	VOC
58	39 Km	IIIB-1	3.330	VOC
86	23 Km	IIIB-2	2.336	Surplus
28	7 Km	IIIB-1	0.078	VOC
29	15 Km	IIIC	0.078	Surplus
30	18 Km	IIIB-1	0.078	VOC
31	4 Km	IIIB-1	0.078	VOC
7	16 Km	IIIC	0.078	Surplus
33	15 Km	IIIC	0.078	Surplus
34	6 Km	IIIC	0.078	Surplus
35	8 Km	IIIC	0.078	Surplus
8	4 Km	IIIB-1	0.078	VOC
3	5 Km	IIIC	0.078	Surplus
10	6 Km	IIIB-1	0.078	VOC
39	16 Km	IIIB-1	0.078	VOC
40	23 Km	IIIB-1	0.078	VOC
41	24 Km	IIID-1	0.078	VOC
42	3 Km	IIIC	0.078	Surplus
43	13 Km	IIIB-2	0.078	Surplus
4	4 Km	IIIC	0.078	Surplus
12	10 Km	IIIB-1	0.078	VOC
13	8 Km	IIIB-1	0.078	VOC
47	6 Km	IIIB-1	0.078	VOC
48	10 Km	IIIC	0.078	Surplus
49	9 Km	IIIC	0.078	Surplus
50	2 Km	IIIB-2	0.078	VOC
51	11 Km	IIIC	0.078	Surplus
52	5 Km	IIIB-1	0.078	VOC
53	7 Km	IIID-1	0.078	VOC
54	9 Km	IIIB-1	0.078	VOC
55	13 Km	IIIC	0.078	Surplus
56	14 Km	IIIB-1	0.078	VOC
57	15 Km	IIIB-1	0.078	VOC
14	6 Km	IIIA	0.078	VOC
15	8 Km	IIIA	0.078	VOC
60	8 Km	IIIA	0.078	VOC
61	7 Km	IIIC	0.078	Surplus
5	16 Km	IIIC	0.078	Surplus
63	5 Km	IIIC	0.078	Surplus
64	14 Km	IIIB-1	0.078	VOC
65	15 Km	IIIB-1	0.078	VOC
66	5 Km	IIIC	0.078	Surplus
67	12 Km	IIIC	0.078	Surplus
68	9 Km	IIIB-1	0.078	VOC

Table 5-2-1 (2) RESULTS OF PRIMARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : BANGKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
69	9 Km	IIIC	0.078	Surplus
70	17 Km	IIIC	0.078	Surplus
71	3 Km	IIIC	0.078	Surplus
72	5 Km	IIIC	0.078	Surplus
17	4 Km	IIIC	0.078	Surplus
6	11 Km	IIIC	0.078	Surplus
75	5 Km	IIIC	0.078	Surplus
76	12 Km	IIIC	0.078	Surplus
77	9 Km	IIIB-2	0.078	VOC
19	8 Km	IIIC	0.078	Surplus
79	33 Km	IIIB-1	0.078	VOC
80	27 Km	IIIB-2	0.078	Surplus
81	14 Km	IIIC	0.078	Surplus
82	8 Km	IIIC	0.078	Surplus
83	9 Km	IIIB-2	0.078	Surplus
84	13 Km	IIIC	0.078	Surplus
20	9 Km	IIIC	0.078	Surplus
21	17 Km	IIIC	0.078	Surplus
22	18 Km	IIIC	0.078	Surplus
99	9 Km	IIIB-1	0.078	VOC
23	13 Km	IIIC	0.078	Surplus
101	12 Km	IIIC	0.078	Surplus
24	24 Km	IIIB-1	0.078	VOC
25	15 Km	IIIB-1	0.078	VOC
104	10 Km	IIIC	0.078	Surplus
105	8 Km	IIIC	0.078	Surplus
106	3 Km	IIIC	0.078	Surplus
107	20 Km	IIIC	0.078	Surplus
119	7 Km	IIIC	0.078	Surplus
120	4 Km	IIIC	0.078	Surplus
121	9 Km	IIIB-1	0.078	VOC
122	6 Km	IIIC	0.078	Surplus
26	6 Km	IIIC	0.078	Surplus
124	5 Km	IIIB-1	0.078	VOC
125	11 Km	IIIB-1	0.078	VOC
126	5 Km	IIIB-1	0.078	VOC
127	8 Km	IIIC	0.078	Surplus
128	23 Km	IIIB-1	0.078	VOC
129	6 Km	IIIC	0.078	Surplus
130	14 Km	IIIB-1	0.078	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : BANGKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
1	27 Km	IIIB-2	17.584	VOC
103	7 Km	IIIB-2	17.198	VOC
123	2 Km	IIIB-2	16.775	VOC
38	19 Km	IIIB-2	16.454	VOC
58	39 Km	IIIB-2	11.869	VOC
85	8 Km	IIIB-1	9.950	VOC
44	24 Km	IIIB-2	9.508	VOC
2	15 Km	IIIB-2	8.957	VOC
100	7 Km	IIIB-2	8.296	VOC
62	6 Km	IIIC	8.258	VOC
74	6 Km	IIIB-2	5.950	VOC
86	23 Km	IIIC	3.544	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SUMATERA SELATAN KABUPATEN : BANGKA

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
36	32 Km	IIIB-1	155346	1.327	19.059	VOC
45	16 Km	IIIB-1	131409	1.502	22.698	VOC
102	13 Km	IIIB-1	119463	1.525	23.413	VOC
11	25 Km	IIIB-1	104394	1.244	16.551	VOC
16	12 Km	IIIA	97482	1.378	19.321	VOC
1	27 Km	IIIB-2	53997	1.204	17.584	VOC
78	4 Km	IIIB-2	53373	2.589	47.947	VOC
98	5 Km	IIIA	46235	1.362	20.566	VOC
73	4 Km	IIIB-1	24339	1.364	20.715	VOC
38	19 Km	IIIB-2	23003	1.187	16.454	VOC
59	5 Km	IIIB-1	22993	1.314	18.373	VOC
32	9 Km	IIIB-1	22457	1.145	14.158	VOC
9	7 Km	IIIB-1	16605	1.160	14.377	VOC
18	11 Km	IIIB-1	16455	1.109	13.129	VOC
58	39 Km	IIIB-2	15060	1.051	11.869	VOC
103	7 Km	IIIB-2	12609	1.173	17.198	VOC
46	14 Km	IIIB-1	9716	1.044	11.292	VOC
37	28 Km	IIIB-1	5229	1.013	10.387	VOC
123	2 Km	IIIB-2	4173	1.243	16.775	VOC
SUM	279 Km		934538			

Chapter 6 IMPLEMENTATION PROGRAMME

6.1 Implementation Schedule

6.1.1 Project Cost

The total Project Cost for the Kabupaten is composed of the cost of construction and maintenance, supplementation as described later, and workshop, laboratory and survey equipment. The total Project Cost for the Kabupaten is summarized in Table 6-1-1.

Table 6-1-1 TOTAL PROJECT COST (1)

KABUPATEN: Bangka

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	1,155	2,053	3,208
MAINTENANCE	324	1,187	1,511
SUPPLEMENTATION	399	-	399
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,923	3,240	5,163

The total Project Cost can be divided into costs as shown in Table 6-1-2.

Table 6-1-2 TOTAL PROJECT COST (2)

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CIVIL WORK	635	3,214	3,849
CONSTRUCTION & MAINTENANCE EQUIPMENT	1,140	-	1,140
SPARE PARTS	103	26	129
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,923	3,240	5,163

The cost for civil work is composed of the cost of labour and materials, operation cost excluding spare parts, indirect cost and transportation cost of equipment, and ownership cost for existing equipment.

6.1.2 Proposed Road Links

(1) Road Link to be Improved

The road links to be improved were generally selected taking into consideration the following criteria:

(1) Feasible road links
- Feasible road links from the primary evaluation
- Feasible road links from the secondary evaluation

(2) Road links selected from the engineering points of view

(3) Road links selected because of basic human needs.

The final proposal for road links to be improved in the Kabupaten development plan are the 31 links with the total length of 458 km which is 31% of the 1,462 km total length of Kabupaten roads studied. The proposed road links are shown in Table 6-1-3.

Table 6-1-3 ROAD LINKS TO BE IMPROVED

KABUPATEN : BANGKA

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	9,11,16,18,32,36,37,45,46,59,73, 78,98,102
- Secondary	1,38,58,103,123,
Engineering Point of View	5,10,20,24,31,39,41,44,74,77,79,82
Basic Human Needs	-

As the table shows all feasible road links are proposed to be improved.

The key road links which are located at the strategic point to complete the local road network consisting of feasible road links, are selected from the engineering points of view.

The order of proceeding with the improvement of the proposed road links are decided as shown in Table 6-1-4.

Table 6-1-4 ROAD LINKS TO BE IMPROVED BY YEAR

PROV : SUMATERA SELATAN KAB : BANGKA

YEAR	LINK NO ( ) : rate
1988 :	31, 32, 45
1989 :	9, 11 (50%), 20, 36 (60%), 82, 102
1990 :	1, 11 (50%), 16 (70%), 24, 36 (40%), 77, 78, 103
1991 :	5, 10, 16 (30%), 18, 38, 39, 44, 58 (60%), 59, 73, 74, 79 (50%), 98
1992 :	37, 41, 46, 58 (40%), 79 (50%), 123

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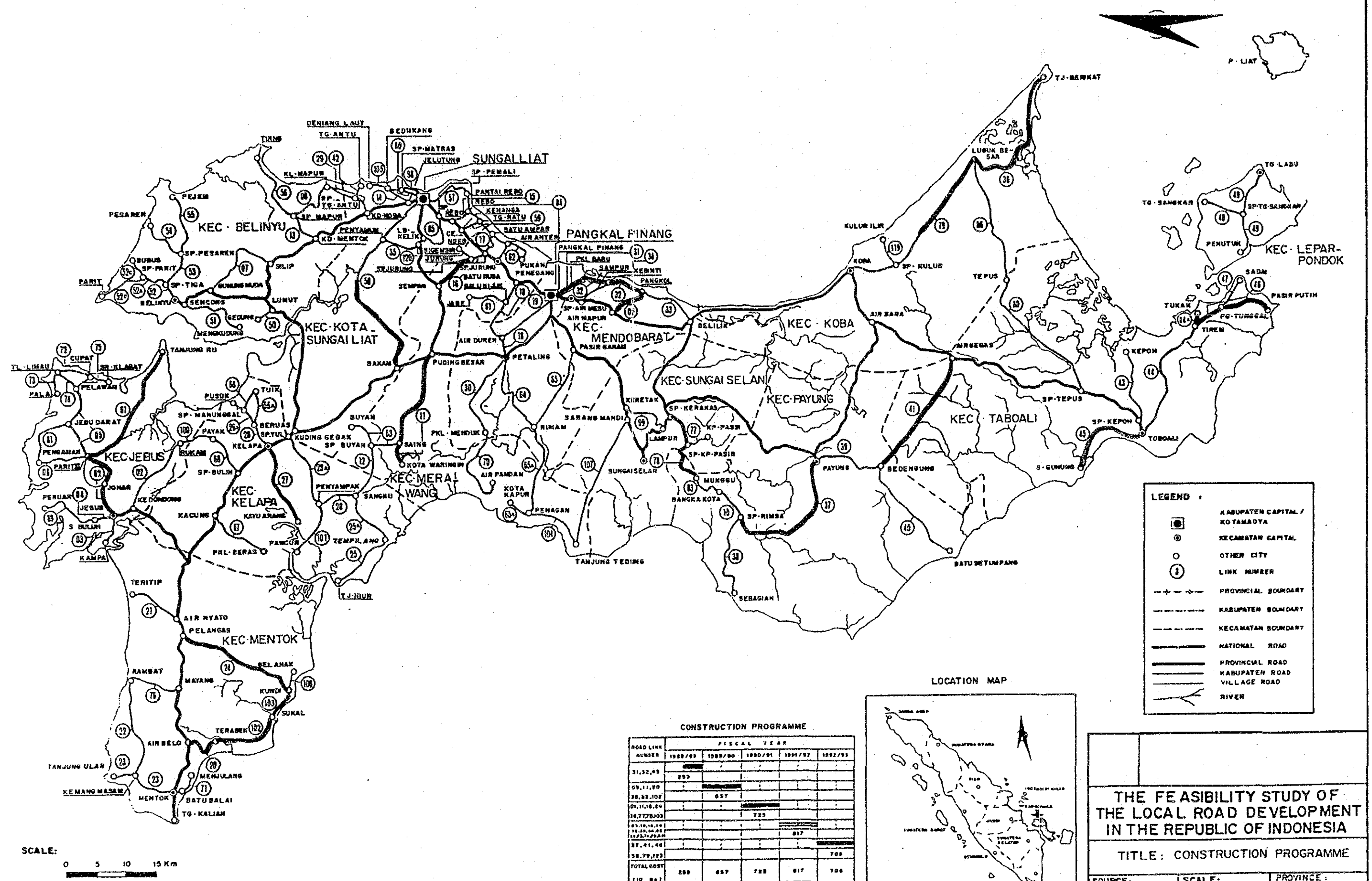


CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1988/89	1989/90	1990/91	1991/92	1992/93
31,32,43	299				
09,11,20, 26,52,102		657			
01,11,18,24, 18,77,78,103			723		
03,10,16,19, 10,39,64,80, 15,72,74,75,84				817	
37,41,46, 38,79,123					708
TOTAL COST (10 Rp)	299	657	723	817	708

LOCATION MAP

THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE : SUMATERA SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN BANGKA

(2) Road Links to Be Maintained

It is desirable that all Kabupaten roads are maintained. However, because of the limited budget it is inevitable that some road links in the Kabupatens will be left without maintenance for the time being. The budget should be used for those which are effective in producing more useful development of the Kabupaten through the road development project. The road links to be maintained are finally proposed as shown in Table 6-1-5.

Table 6-1-5 ROAD LINKS TO BE MAINTAINED

PROV : SUMATERA SELATAN KAB : BANGKA

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SO (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TN NO	AREA (m2)	BC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
5	16	28.8	31.3	26.3	13.8	16	0	0	22	875.00	0	0.00	9,775	16,397	4,515	20,912
13	8	56.9	43.1	0.0	0.0	2	6	0	5	195.30	0	0.00	2,182	4,901	1,351	6,252
14	6	81.7	18.3	0.0	0.0	2	4	0	0	0.00	0	0.00	0	2,508	670	3,178
15	8	81.3	13.1	5.6	0.0	8	0	0	0	0.00	2	36.00	235	4,559	1,244	5,803
18	11	30.9	28.2	31.8	9.1	3	8	0	0	0.00	0	0.00	0	4,465	1,196	5,661
23	13	35.4	46.2	18.5	0.0	3	10	0	4	139.50	0	0.00	1,558	6,375	1,737	8,112
24	24	49.2	42.1	8.8	0.0	5	19	0	0	0.00	6	63.00	412	9,692	2,684	12,376
25	15	57.7	38.0	4.3	0.0	2	13	0	0	0.00	0	0.00	0	5,670	1,527	7,197
31	4	70.0	27.5	2.5	0.0	4	0	0	0	0.00	0	0.00	0	2,205	579	2,784
35	8	22.5	31.3	45.0	1.3	2	6	0	0	0.00	0	0.00	0	3,211	861	4,072
37	28	18.9	44.5	36.3	0.4	5	23	0	0	0.00	8	80.00	523	11,167	3,105	14,272
38	19	40.3	40.3	19.5	0.0	7	12	0	0	0.00	8	112.50	735	8,540	2,426	10,966
39	16	59.1	40.6	0.3	0.0	5	11	0	0	0.00	5	139.35	910	7,197	2,106	9,303
41	24	45.2	46.7	6.7	1.5	3	21	0	0	0.00	7	182.40	1,192	9,785	2,871	12,656
57	15	88.7	9.7	1.7	0.0	15	0	0	2	186.00	4	48.00	2,391	10,079	2,754	12,833
58	39	34.6	45.4	13.6	6.4	5	34	0	11	303.00	11	256.00	5,057	18,382	5,337	23,719
60	8	99.0	1.0	0.0	0.0	8	0	0	0	0.00	2	27.50	180	4,524	1,224	5,748
87	14	85.4	9.6	5.0	0.0	14	0	0	0	0.00	3	69.93	457	8,008	2,195	10,203
88	3	56.7	28.3	15.0	0.0	3	0	0	0	0.00	2	38.00	248	1,811	526	2,337
90	1	10.0	80.0	10.0	0.0	1	0	0	0	0.00	0	0.00	0	551	145	696
91	2	50.0	50.0	0.0	0.0	2	0	0	1	12.60	0	0.00	141	1,212	321	1,533
93	4	20.0	40.0	25.0	15.0	3	0	1	0	0.00	0	0.00	0	1,911	479	2,390
94	2	7.5	45.0	47.5	0.0	2	0	0	0	0.00	0	0.00	0	1,103	289	1,392
95	2	0.0	65.0	35.0	0.0	1	0	1	1	12.60	0	0.00	141	918	222	1,140
99	9	73.3	23.9	2.8	0.0	3	6	0	0	0.00	1	10.00	65	3,803	1,029	4,832
108	84	45.1	19.3	21.4	14.3	51	5	28	5	236.70	4	203.08	3,971	39,969	10,204	50,173
114	17	56.9	13.4	29.7	0.0	17	0	0	0	0.00	0	0.00	0	9,373	2,461	11,834
116	15	26.7	36.3	37.0	0.0	9	0	6	0	0.00	1	62.50	408	6,764	1,724	8,488
121	9	61.1	35.6	3.3	0.0	5	4	0	0	0.00	0	0.00	0	4,162	1,104	5,266
138	1	0.0	99.0	1.0	0.0	1	0	0	0	0.00	0	0.00	0	551	145	696
140	1	85.0	15.0	0.0	0.0	1	0	0	0	0.00	0	0.00	0	551	145	696
141	1	25.0	50.0	25.0	0.0	1	0	0	0	0.00	0	0.00	0	551	145	696
SUM	427					209	182	36	51	1960.70	64	1328.26	30,581	210,893	57,321	268,216

6.1.3 Annual Construction and Maintenance Cost

The annual allocation of the total construction and maintenance cost in the five years programme for Kabupaten Bangka is finally recommended as shown in Tables 6-1-6 (1), (2) and (3) for the construction, maintenance and total respectively.

The proposed construction cost is Rp 3,208 x 10^6 and maintenance cost is Rp 1,511 x 10^6 which is approximately 32% of the total expenditure.

Table 6-1-6 (1) CONSTRUCTION AND MAINTENANCE COST
(CONSTRUCTION)

PROV : SUMATERA SELATAN KAB : BANGKA

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	180,135	405,886	452,386	516,501	438,585	1,993,493	(62.1%)
Ownership Cost	1,441	3,111	4,243	5,319	4,162	18,276	(0.9%)
Operation Cost	78,809	168,544	225,358	281,168	225,859	979,738	(49.1%)
Material Cost	47,358	107,304	78,520	68,032	80,801	382,015	(19.2%)
Labour Cost	29,031	73,985	85,258	94,612	70,556	353,442	(17.7%)
Contingency	23,496	52,942	59,007	67,370	57,207	260,022	(13.0%)
FOREIGN CURRENCY :	119,517	251,857	273,337	302,102	267,493	1,214,306	(37.9%)
Ownership Cost	44,387	95,339	120,625	161,263	120,412	558,026	(46.0%)
Operation Cost	5,944	12,662	17,590	22,389	17,636	76,221	(6.3%)
Material Cost	53,597	111,005	91,469	79,045	86,555	421,671	(34.7%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	15,589	32,851	35,653	39,405	34,890	158,388	(13.0%)
TOTAL COST :	299,652	657,743	725,722	818,602	706,078	3,207,797	
Ownership Cost	45,828	98,450	132,868	166,582	132,574	576,302	(18.0%)
Operation Cost	84,753	181,206	242,948	303,557	243,495	1,055,959	(32.9%)
Material Cost	100,955	218,309	169,989	147,077	167,356	803,686	(25.1%)
Labour Cost	29,031	73,985	85,258	94,612	70,556	353,442	(11.0%)
Contingency	39,085	85,793	94,659	106,774	92,097	418,408	(13.0%)

(Contingency : 15%)

Table 6-1-6 (2) CONSTRUCTION AND MAINTENANCE COST

(MAINTENANCE)

PROV : SUMATERA SELATAN KAB : BANGKA

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	104,884	225,663	241,651	285,980	328,559	1,186,737	(78.5%)
Ownership Cost	717	1,558	1,664	1,955	2,220	8,114	(0.7%)
Operation Cost	43,511	93,277	99,517	117,693	136,796	490,794	(41.4%)
Material Cost	5,009	10,771	12,208	16,192	20,361	64,541	(5.4%)
Labour Cost	55,647	120,057	128,262	150,140	169,182	623,288	(52.5%)
FOREIGN CURRENCY :	28,511	61,548	65,871	78,072	90,189	324,191	(21.5%)
Ownership Cost	21,250	45,607	48,725	57,839	67,542	240,963	(74.3%)
Operation Cost	2,373	5,081	5,410	6,377	7,379	26,620	(8.2%)
Material Cost	4,888	10,860	11,736	13,856	15,268	56,608	(17.5%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	133,395	287,211	307,522	364,052	418,748	1,510,928	
Ownership Cost	21,967	47,165	50,389	59,794	69,762	249,077	(16.5%)
Operation Cost	45,884	98,358	104,927	124,070	144,175	517,414	(34.2%)
Material Cost	9,897	21,631	23,944	30,048	35,629	121,149	(8.0%)
Labour Cost	55,647	120,057	128,262	150,140	169,182	623,288	(41.3%)

Table 6-1-6 (3) CONSTRUCTION AND MAINTENANCE COST

(TOTAL)

PROV : SUMATERA SELATAN KAB : BANGKA

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	285,019	631,549	694,037	802,481	767,144	3,180,230	(67.4%)
Ownership Cost	2,150	4,669	5,907	7,274	6,382	26,390	(0.8%)
Operation Cost	122,320	261,821	324,875	398,861	362,655	1,470,532	(46.2%)
Material Cost	52,367	118,075	90,728	84,224	101,162	446,556	(14.0%)
Labour Cost	84,678	194,042	213,520	244,752	239,738	976,730	(30.7%)
Contingency	23,496	52,942	59,007	67,370	57,207	260,022	(8.2%)
FOREIGN CURRENCY :	148,028	313,405	339,208	380,174	357,682	1,538,497	(32.6%)
Ownership Cost	65,637	140,946	177,350	219,102	195,954	798,989	(51.9%)
Operation Cost	8,317	17,743	23,000	28,766	25,015	102,841	(6.7%)
Material Cost	58,485	121,865	103,205	92,901	101,823	478,279	(31.1%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	15,589	32,851	35,653	39,405	34,890	158,388	(10.3%)
TOTAL COST :	433,047	944,954	1,033,244	1,182,654	1,124,826	4,718,725	
Ownership Cost	67,795	145,615	183,257	226,376	202,336	825,379	(17.5%)
Operation Cost	130,637	279,564	347,875	427,627	387,670	1,573,373	(33.3%)
Material Cost	110,852	239,940	193,933	177,125	202,985	924,835	(19.6%)
Labour Cost	84,678	194,042	213,520	244,752	239,738	976,730	(20.7%)
Contingency	39,085	85,793	94,659	106,774	92,097	418,408	(8.9%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Bangka are estimated from the annual proposed construction quantities as shown in Table 6-1-7.

The proposed numbers of equipment to be purchased are finally decided considering the following number of existing equipment in the Kabupaten which are available for the Project.

- 2-Hand-guided vib. Roller
- 2-Dump Truck

The proposed numbers of maintenance equipment have been decided as shown below from the proposed annual maintenance volume taking into account the capacity of the proposed maintenance gangs.

a. Equipment for Road Maintenance

- 1-Motor Grader 75 HP
- 1-Tire Roller 8-15 Ton
- 1-Dump Truck 3 Ton
- 1-Hand Guided Vibratory Roller 1000 Kg
- 1-Flat Bed Truck 3 Ton

b. Equipment for Bridge Maintenance

- 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

The proposed construction and maintenance equipment and their purchase costs are shown in Table 6-1-8. In the Project the supplementation cost or equipment cost supplemented is the difference between the purchase cost for newly supplied equipment and the depreciated value.

This comes about because full depreciation of the supplied equipment would not be completed within the Project Period of 5 years.

Table 6-1-7 REQUIRED NUMBER OF EQUIPMENT

PROV : SUMATERA SELATAN KAB : BANGKA

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	240	0	0.30	0.51	0.82	1.23	0.92
Swamp Bulldozer	240	0	0.00	0.00	0.00	0.00	0.04
Motor Grader	250	0	0.70	1.34	2.02	2.73	2.08
Hand-guide Vib. Roller	250	2	0.02	0.11	0.09	0.31	0.03
Tire Roller	240	0	0.61	1.24	0.95	0.80	0.98
Vibratory Roller (D&T)	250	0	0.49	0.92	1.35	1.80	1.40
Hydraulic Excavator; Wheel	240	0	0.00	0.00	0.00	0.00	0.55
Wheel Loader	250	0	0.90	1.96	2.74	3.49	2.67
Water Tank Truck	250	0	0.27	0.61	0.82	0.98	0.76
Dump Truck	250	0	6.52	14.23	20.25	25.61	19.38
Flat Bed Truck with Crane	250	0	0.00	0.10	0.06	0.04	0.01
Flat Bed Truck	250	0	0.70	1.46	1.12	0.93	1.13
Portable Crusher/Screening	250	0	0.24	0.58	0.74	0.86	0.66
Concrete Mixer	240	0	0.00	0.01	0.02	0.01	0.01
Water Pump	240	0	0.00	0.01	0.01	0.01	0.01
Concrete Vibrator	240	0	0.00	0.01	0.01	0.01	0.01
Asphalt Sprayer	240	0	0.61	1.24	0.95	0.80	0.98

NOTE WORKABLE : workable days in a year
EXISTING : number of existing equipment

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SUMATERA SELATAN KAB : BANGKA

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	-	-
Bulldozer/Ripper	90 HP	53,000	1	53,000
Swamp Bulldozer	90 HP	52,850	-	-
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	3	143,400
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	-	-
Tire Roller	8-15 ton	31,070	2	62,140
Vibratory Roller (D&T)	4 ton	29,000	1	29,000
Vibratory Roller	4 ton	29,000	-	-
Rough Terrain Crane	10 ton	100,400	-	-
Hydraulic Excavator; Wheel	0.3 m3	41,100	-	-
Wheel Loader	1.2 m3	70,200	3	210,600
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	20	294,000
Dump Loader Truck	12 ton	56,300	1	56,300
Flat Bed Truck with Crane	3.0 ton	25,190	1	25,190
Flat Bed Truck	3.0 ton	11,275	2	22,550
Portable Crusher/Screening	30-40 t/h	188,000	1	188,000
Concrete Mixer	0.5 m3	18,000	-	-
Water Pump	200 l/min	630	-	-
Concrete Vibrator	3.3 HP	740	-	-
Asphalt Sprayer	850 ltr.	10,200	1	10,200
Service Car	3 ton	11,600	1	11,600
4 Wheel Drive Vehicle	70 HP	17,500	1	17,500
Motorcycle	100 cc	1,100	3	3,300

PURCHASE COST TOTAL	1,139,530
OWNERSHIP COST (FOREIGN)	740,045
EQUIPMENT COST SUPPLEMENTED	399,485

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Hand-guide Vib. Roller	15,558
Vibratory Roller (D&T)	19,383
Dump Truck	24,003
TOTAL	58,944

6.1.5 Other Costs

Cost other items includes the costs of workshop equipment and tools, laboratory test equipment and survey equipment which are recommended in Sub-Clause 3.5. These total costs are summarized in Table 6-1-1.

6.1.6 Quantities by Work Type

The annual construction and maintenance quantities for all proposed road links are shown in Table 6-1-9.

Table 6-1-9 CONSTRUCTION QUANTITIES FOR ALL PROPOSED LINKS

PROV : SUMATERA SELATAN KAB : BANGKA

I T E M	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	0.00	16000.00	8400.00	3600.00	0.00	28000.00
Subgrade Preparation	m2	48000.00	35000.00	0.00	0.00	14175.00	97175.00
Normal Fill	m3	0.00	0.00	0.00	0.00	0.00	0.00
Fill in Swamp	m3	0.00	0.00	0.00	0.00	1557.90	1557.90
Normal Excavation to Spoil	m3	1176.00	702.00	410.00	792.00	168.00	3248.00
Sub Base Course	m3	6633.00	14450.70	20136.30	24080.40	18248.70	83549.10
Base Course	m3	7315.00	18993.50	26721.50	31948.00	23512.00	108490.00
Shoulder	m2	96500.00	152150.00	267550.00	454300.00	316500.00	1247000.00
Asphalt Patching	m2	103.00	0.00	103.00	2737.60	198.40	3144.00
Surface Dressing (Single)	m2	104500.00	213050.00	107450.00	80000.00	168000.00	673000.00
Surface Dressing (Double)	m2	0.00	0.00	42000.00	43000.00	0.00	85000.00
Earth Drain	m	5100.00	18800.00	24600.00	14000.00	2500.00	65000.00
Earth Drain in Swamp (by machine)	m3	0.00	0.00	0.00	0.00	10500.00	10500.00
Pipe Culvert D80cm	m	0.00	8.00	50.00	53.00	10.00	121.00
Masonry Culvert (80x80cm)	m	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Masonry)	m3	0.00	0.00	12.80	6.40	0.00	19.20
Gabion Protection	m3	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 3m;10t)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;10t)	m2	0.00	32.00	16.00	0.00	0.00	48.00
Superstructure (Timber;Span 8m;10t)	m2	0.00	80.00	0.00	0.00	0.00	80.00
Superstructure (Timber;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span10m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span15m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Timber;10t)	NO	0.00	2.00	0.00	0.00	0.00	2.00
Substructure (Abut;for Timber;10t)	NO	0.00	6.00	2.00	0.00	0.00	8.00
Substructure (Pier;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Timber)	m2	0.00	108.00	18.00	0.00	0.00	126.00
Demolition of Bridge (Timber->Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	212.50	452.00	477.00	550.30	621.20	2313.00
Routine maintenance of earth road	Km	18.00	36.00	36.00	36.00	36.00	162.00
Routine maintenance of gravel road	Km	91.00	186.00	193.50	229.30	282.20	982.00
Routine maintenance of asphalt road	Km	103.50	230.00	247.50	285.00	303.00	1169.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	96.00	32.00	128.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	980.35	2060.70	2485.20	3537.55	5118.35	14182.15
Maintenance of Concrete Bridge (Exist)	m2	664.13	1556.20	1560.70	1806.48	2048.80	7636.31

6.2 Organization and Construction System

6.2.1 Organization

The Bupati as head of the Kabupaten has been authorized by Law No. 13, 1980 as an official responsible for the Local Road Development Project implementation. This means that the DPUK is considered as a responsible agency for the actual execution of the Project.

According to instruction letter dated June 24, 1982 Ref. No. 620/975-/BANGDA, the Project Manager appointed by the Bupati will be responsible for the operation and maintenance of the equipment. Accordingly the Equipment Coordinator appointed from the staff of the Regional Public Works (Kantor Wilayah) by Bina Marga as a coordinator between the Governor and the Bupati will be responsible for delivery, effectual utilization and maintenance of the equipment.

The standard organization of DPUK consists of a minimum of four sections, i.e. Road Section, Housing and City Planning Section, Irrigation Section and Administration Section. For execution of the Project it is strongly recommended that the structural organization of DPUK is established. It will be necessary not only to organize new sections but also to reorganize the current structure through a review of the roles and responsibilities of each inter-related section.

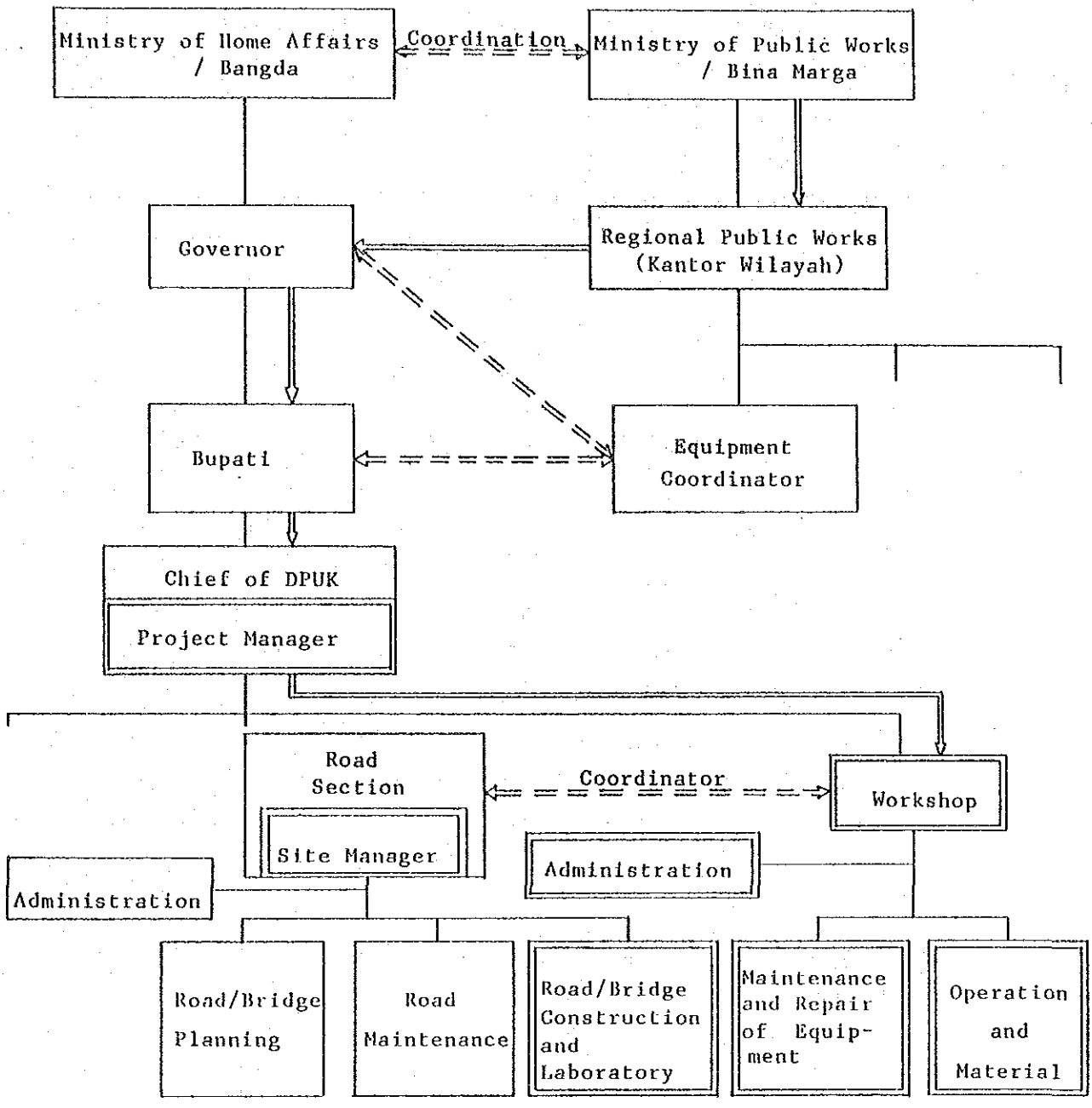
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

The sub-section of laboratory would be under the relevant Road Section. The proposed organization is shown in Fig. 6-2-1.

6.2.2 Construction System

For the construction of Kabupaten roads with a ten year effective design life, it has been recommended in Clause 3.4 that the equipment intensive method should be adopted for earth work and pavement work with the exception of surface dressing.

Fig. 6-2-1 PROPOSED ORGANIZATION



⇓ : Equipment delivery flow

▭ : New position/subsection

Current road construction in the Kabupatens is obliged to rely upon the traditional labour intensive method. It is therefore assumed that both the DPUK and the local contractors in the Kabupatens do not have sufficient experience and technique for the equipment intensive method of road construction.

For realization of the Local Road Development Project the GOI has ensured availability of the required human resources of DPUK and intends to conduct training programmes for those human resources as described in Clause 8.3 of the Main Report. This means that the GOI intends the Kabupatens to have the ability to execute the Project by force account (Swakelola).

It should be recognized from the experiences in the first local road project, which was assisted by OECF, ADB and IBRD, that because of their poor construction management and traditional labour intensive methods most of the road construction by local contractors could not be completed within the contract periods. Therefore execution of the road improvement by force account is desirable as recommended from their experience by the consultants for the first local road project.

It is strongly recommended that except for labourers the staff of the force account team should not be hired by the day as it would then not be able to consolidate the foundations for development of self reliability.

However, it will be very difficult to execute all the Projects by force account because of the need for many Kabupaten staff. The GOI has emphasized the need to promote the employment of local weak contractors in order to up-grade their capability in the road project schemes within the Fourth Five-Year Plan (REPELITA)

Taking into consideration the conditions mentioned above it is strongly recommended that the DPUK is obliged to lend some equipment with skilled operators to the local contractors in the Kabupatens for the execution of a part of the road improvement works.

The types of work executed only by force account are recommended as follows:

- Routine maintenance work for the Kabupaten roads
- Laboratory tests
- Production of crushed stone
- Technical service for the equipment