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 7

KABUPATEN BELITUNG

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 Belitung 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.

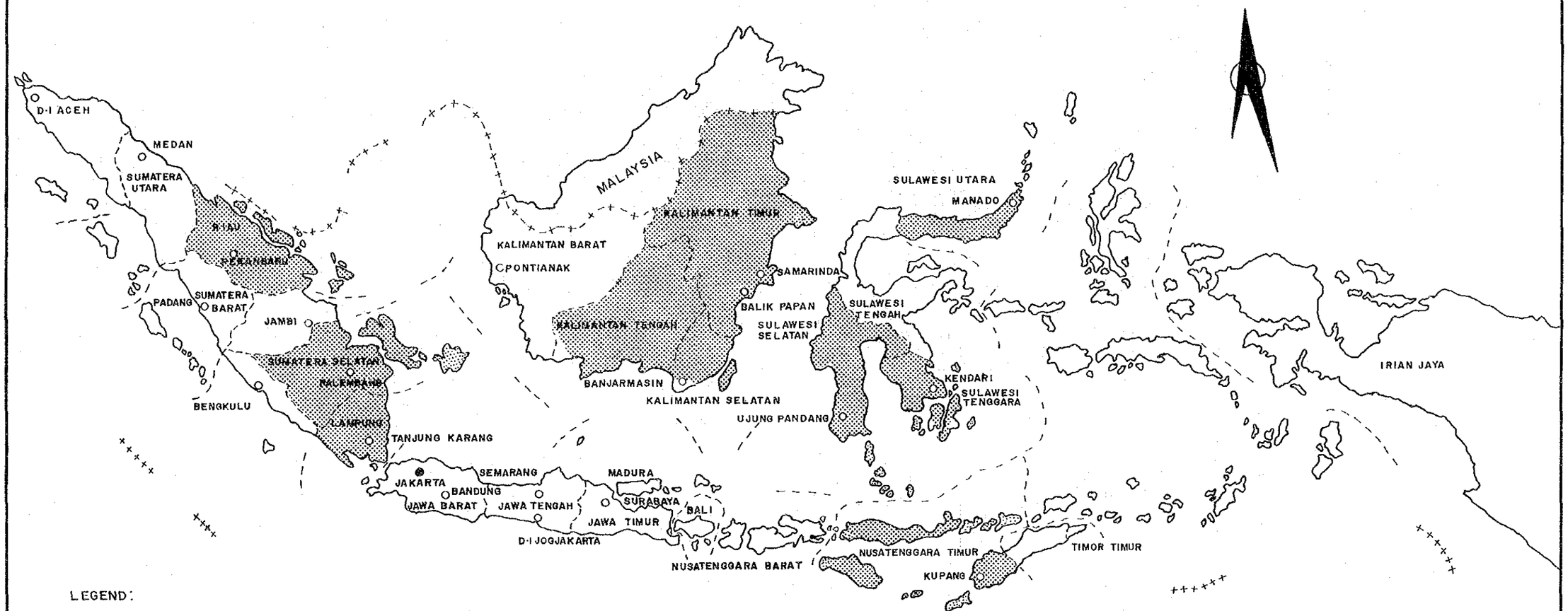
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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.

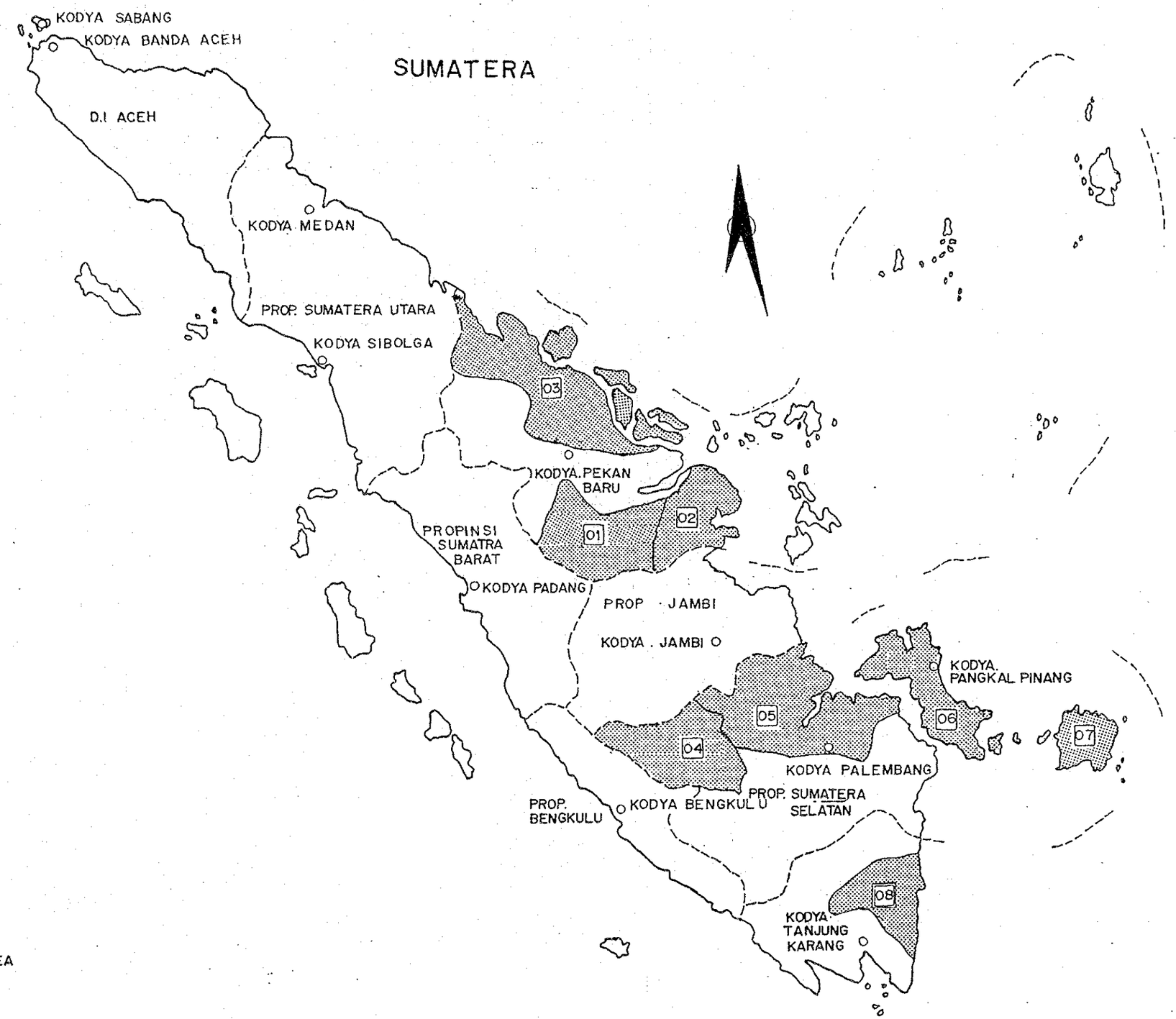
LOCATION MAP OF THE PROJECT AREAS



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



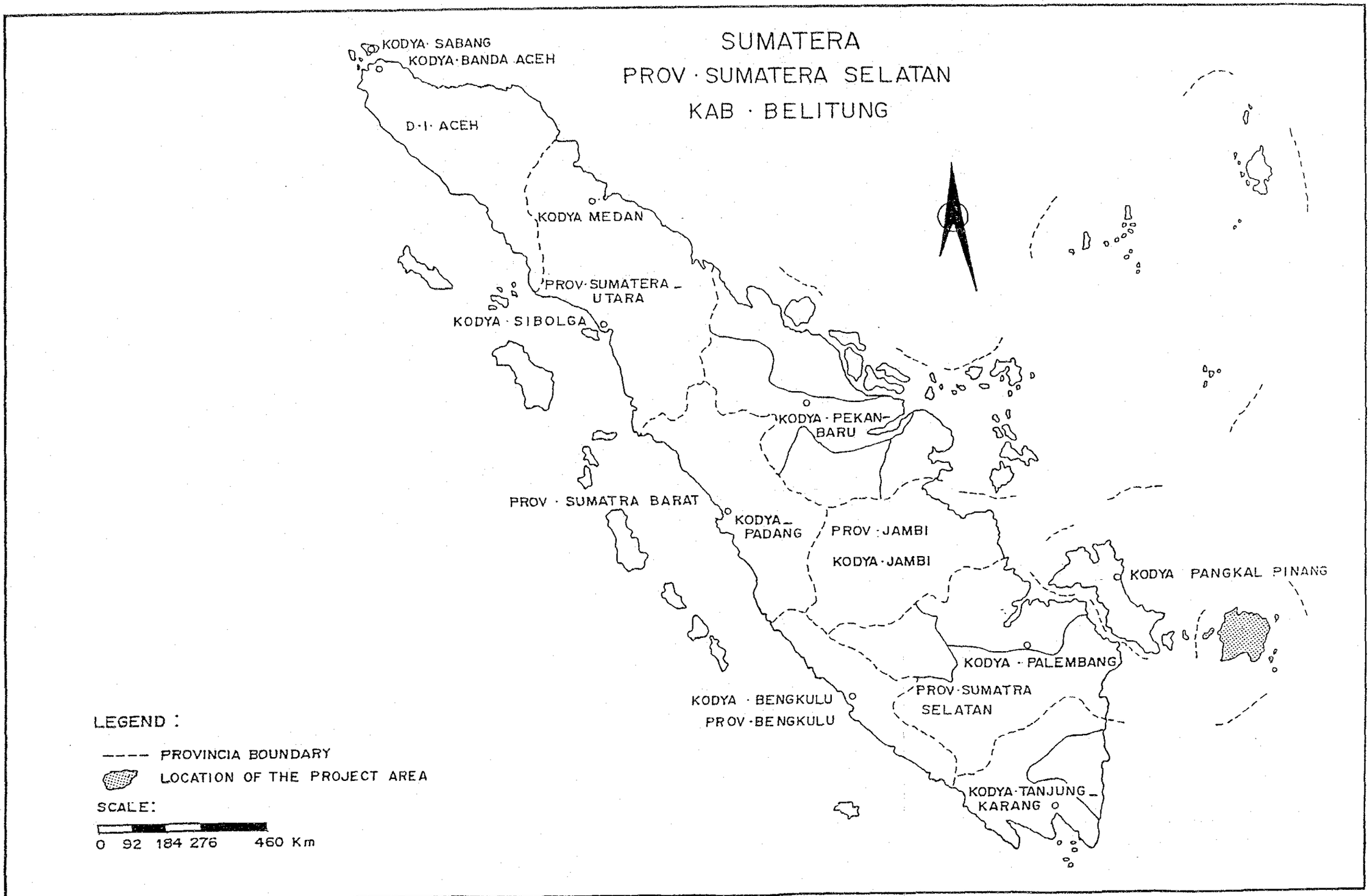
LEGEND :

----- PROVINCIAL BOUNDARY

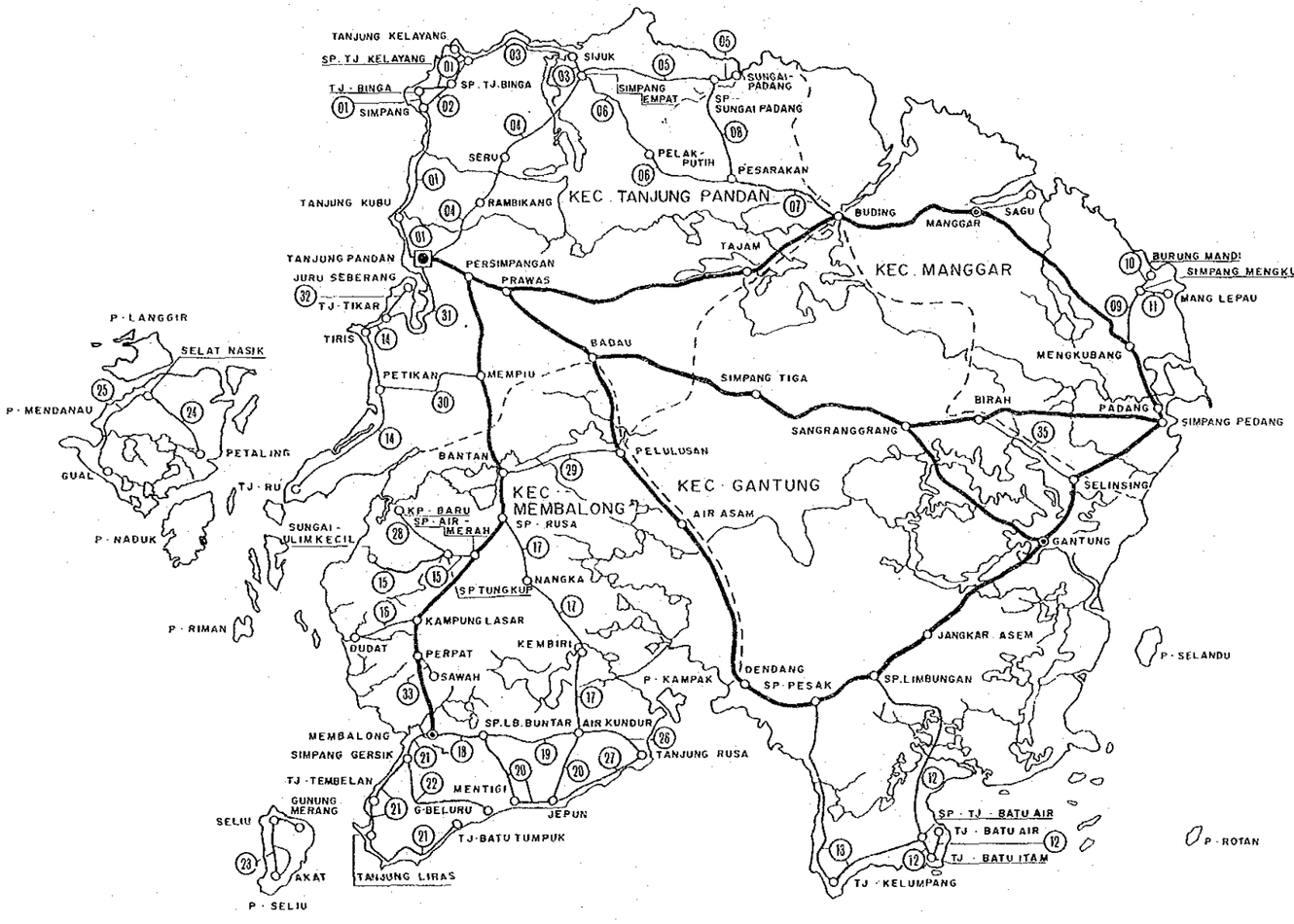
LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km


SUMATERA
PROV · SUMATERA SELATAN
KAB · BELITUNG
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 PROJECT AREA
SCALE:
0 92 184 276 460 Km

KAB · BELITUNG



LOCATION MAP

LEGEND :

- KABUPATEN CAPITAL
- KECAMATAN CAPITAL
- OTHER CITY
- (3) LINK NUMBER
- PROVINCIAL BOUNDARY
- KABUPATEN BOUNDARY
- KECAMATAN BOUNDARY
- NATIONAL ROAD
- PROVINCIAL ROAD
- KABUPATEN ROAD
- VILLAGE ROAD
- RIVER

SCALE :

0 5 10 15 Km

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 : BELITUNG

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 Belitung is a solitary island in the Jawa Sea, being 370 kilometers from Jawa Island.

As in Bangka Island, tin mining and copra plantations have been conducted since the time of the Dutch rule, so that large and small ponds due to the old mining are to be found here and there around the central plateu. This mining still continues.

The features of the island present comparatively undulating hills and unsurpassed views due to the coral reefs which surround most of the shoreline.

The area of the Kabupaten, including the adjacent small island, is about 4,620 square kilometers, approximately 5 percent of the total of Sumatera Selatan Province. It consists administratively of 4 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Belitung are 213 days and 2,979 mm respectively.

One year in the Kabupaten consists of a rainy season and a dry season. The dry season is from July through September 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 170 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 : Belitung STATION : Buluh Tumbang

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	-	-	-	-	17	192	27	468	24	214
February	-	-	-	-	12	80	18	240	16	106
March	-	-	-	-	25	365	11	202	21	387
April	-	-	-	-	21	225	17	212	23	425
May	-	-	-	-	19	246	25	162	23	508
June	-	-	-	-	9	97	13	182	12	113
July	-	-	-	-	4	57	18	142	18	370
August	-	-	-	-	5	-	6	40	8	59
September	-	-	-	-	6	121	9	60	18	232
October	-	-	-	-	14	155	24	25	25	426
November	-	-	-	-	23	315	28	583	26	425
December	-	-	-	-	28	651	30	375	27	474
Total	-	-	-	-	183	2,506	226	2,692	231	3,738

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Belitung in 1984 was 173,379 which was approximately 3.3% 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 1.8% which is lower than both the provincial rate of 3.3% and the national rate of 2.2%. This may be the result of out flow from the Kabupaten and because there is no transmigration programme.

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 and 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 : BELITUNG

KECAMATAN	POPULATION	PROPORTION (%)
MEMBALONG	13,892	8.0
GANTUNG	26,894	15.5
MANGGAR	48,267	27.8
TANJUNG PANDAN	84,326	48.7
TOTAL	173,379	100

1.2.2 Land Use

In Kabupaten Belitung, 27,855 ha of the current available land use area, which is approximately 6.0% of the 462,305 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 22,519 ha of agricultural harvest area and 5,336 ha of residential area which are 80.8% and 19.2% of the current available land use area respectively.

The agricultural harvest area consists of 2,377 ha of paddy field and 20,142 ha of plantation area which are 10.6% and 89.4% 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 Belitung in 1984 were 2,188 ha and 8,010 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 was 801 ha and 456 ton respectively which are 36.6% and 5.7% of the total food crops. The yield rate of paddy production is 0.57 ton per ha. Thus, paddy is an insignificant agricultural crop of the Kabupaten. In general the agricultural crops show small developed growth rates.

Because the island is located in the Jawa Sea, it seems that Kabupaten Belitung is not suitable for production of agricultural crops judging from the geographical, weather and agronomical points of view. Therefor, yearly approximately 95% of the 23,000 tons which are required for the consumption of the Kabupaten have to be imported from other Kabupatens.

The commodity crops, of which rubber, palm and clove (cengke) are major, are produced in the plantations. The area and production of plantation crops in 1983 were 9,105 ha and 3,185 ton respectively with current growth rates being 6.8% and 11.8% 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.

It is desirable that future agricultural development in the Kabupaten should be enhanced to promote production of plantation crops and the processing industries.

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

KABUPATEN : BELITUNG

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	1,025	1,134	1,134	1,075	759	801	-4.8
OTHERS	1,401	638	784	1,054	1,011	1,387	-0.2
TOTAL	2,426	1,817	1,918	2,129	1,770	2,188	-2.0

PRODUCTION

(ton)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	465	536	536	526	383	456	-0.4
OTHERS	7,185	3,052	3,484	4,458	5,143	7,554	1.0
TOTAL	7,650	3,588	4,020	4,984	5,526	8,010	0.9

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	0.45	0.47	0.47	0.50	0.50	0.57	4.8

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 Belitung 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.

The following shows the current growth of tin production.

	1980	1984	AAGR (%)
Production (ton)	146,651	271,534	16.7

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

However, it should be noted that future development of the tin industry relys much upon the international market.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

The road networks in Kabupaten Belitung are highly consolidated with the provincial roads taking an important role as a regional trunk road which runs through the Kabupaten.

These provincial roads consists of four provincial roads which have the same origin, that is, Tanjung Pandan, the Kabupaten capital. Three of the provincial roads lead to Manggar via three different routes and include a so-called "Service road". The three roads also form a circular route.

The routes are :

1. Simpang Pedang via Prawas, Badau and Sangranggrang as the service road
2. Simpang Pedang via Prawas, Buding, Peniruhan and Mengkubang
3. Simpang Pedang via Prawas, Badau, Pelulusan, S.P Pesak and Limbungan, and Gantung.

The fourth provincial road is the road leading from Tanjung Pandan to Membalong and acting as a regional trunk road for the southeastern part of the Kabupaten.

The Kabupaten roads, are developed mainly in both the northern areas of Tanjung Pandan and the southwestern coastal areas of the Kabupaten. This is because these areas are the only areas available for regional development in the Kabupaten apart from the tin industry.

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 Belitung are confirmed as 35 links and 429 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 0.93 m per ha. This is higher than the national density of 0.48 m per ha but distinctly 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 with road development.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Belitung	429	462,305	0.93
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 EXISTING ROAD LENGTH BY SURFACE TYPE

PROV : SUMATERA SELATAN KAB : BELITUNG

(Km)

NO		ASP	THN	L.L	TOTAL
LINK	1	25			25
LINK	2	2			2
LINK	3	3	10		13
LINK	4	23			23
LINK	5	1		15	16
LINK	6			27	27
LINK	7		2	10	12
LINK	8			11	11
LINK	9		1	5	6
LINK	10		2		2
LINK	11			3	3
LINK	12			25	25
LINK	13	3	29		32
LINK	14			23	23
LINK	15		8	5	13
LINK	16			7	7
LINK	17	4	1	19	24
LINK	18			5	5
LINK	19		5	5	10
LINK	20		20		20
LINK	21	11	10		21
LINK	22			13	13
LINK	23			10	10
LINK	24		9		9
LINK	25		9	4	13
LINK	26		8		8
LINK	27		10		10
LINK	28			8	8
LINK	29		6	6	12
LINK	30		12		12
LINK	31				
LINK	32				
LINK	33		2		2
LINK	34				
LINK	35		12		12
TOTAL		72	156	201	429
RATIO		17	36	47	(%)

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 : Belitung	16.8	-	83.2
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 : Belitung	48.9	20.9	16.3	13.7
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 EXISTING ROAD CONDITION BY SURFACE TYPE

PROVINCE : SUMATERA SELATAN

KABUPATEN : BELITUNG

(%)

NO	ASP				INS				L.L			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 1	59	22	19	0								
LINK 2		20	70	10								
LINK 3	70	30			58	28	14					
LINK 4	86	14										
LINK 5	99	1							52	20	20	
LINK 6									56	13	26	4
LINK 7					65	15	20		64	9	27	
LINK 8									10	3	18	69
LINK 9					75	25			61	35	4	
LINK 10					75	25						
LINK 11									75	25		
LINK 12									62	26	11	
LINK 13	3	63	33		63	23	7	8				
LINK 14									70	24	6	
LINK 15					19	6	23	52	54	26	20	
LINK 16									28	3	44	26
LINK 17		83	9	79			20	80	39	15	14	33
LINK 18									80	18	2	
LINK 19					62	30	2	6	74	22	4	
LINK 20					76	13	10	1				
LINK 21	88	12			64	19	18					
LINK 22									64	30	6	
LINK 23									28	15	57	
LINK 24					40	22	8	10				
LINK 25					12	18	10	60	15	10	13	62
LINK 26					69	22	9					
LINK 27					53	30	17					
LINK 28									36	3	45	16
LINK 29					37	20	15	28	22	25	22	32
LINK 30					15	41	20	25				
LINK 31												
LINK 32												
LINK 33					35	50	15					
LINK 34												
LINK 35					23	30	28	18				
AVERAGE	51	22	16	11	48	23	13	16	49	18	19	63
LENGTH	72 Ke				156 Ke				201 Ke			
(Ke)	37	16	12	8	75	36	20	25	98	36	38	26

The surface condition level of the Kabupaten roads in the Kabupaten is almost same as or surpasses either 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 in the Kabupaten are 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 69.0% flat, 27.0% hilly, 1.0% mountainous and 3.0% swampy.
There is very few mountainous area in the Kabupaten. 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 Belitung 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 85 bridges with a total length of 809 m of which 43 or 50.6% are timber, 32 or 37.6% are concrete and 7 or 8.2% are others. Steel bridges account for only 4 or 3.5% of the total. On the other hand, 31 bridges with a total length of 686 m are required to be newly constructed.

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

PROV : SUMATERA SELATAN KAB : BELITUNG

(Km)

102 (3)	BT	RW	BK	GW	TOTAL
LINK 1	22	3			25
LINK 2	2				2
LINK 3	13				13
LINK 4	21	2			23
LINK 5	4		12		16
LINK 6	7		20		27
LINK 7		1	11		12
LINK 8			11		11
LINK 9	6				6
LINK 10	2				2
LINK 11	3				3
LINK 12	25				25
LINK 13	32				32
LINK 14	22	1			23
LINK 15	7		6		13
LINK 16	3		4		7
LINK 17	24				24
LINK 18	5				5
LINK 19	7	3			10
LINK 20	20				20
LINK 21	21				21
LINK 22	13				13
LINK 23	3		4	3	10
LINK 24	1		8		9
LINK 25	3		10		13
LINK 26	6		2		8
LINK 27	5	5			10
LINK 28	2		6		8
LINK 29	3		9		12
LINK 30	1		11		12
LINK 31					
LINK 32					
LINK 33	2				2
LINK 34					
LINK 35	9		3		12
TOTAL	294	15	117	3	429
RATIO	69	3	27	1	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SUMATERA SELATAN KAB : BANGKA

LINK NO	EXISTING BRIDGE NO.	EXISTING BRIDGE LENGTH	NOT EXIST BRIDGE NO.	NOT EXIST BRIDGE LENGTH	TOTAL BRIDGE NO.	TOTAL BRIDGE LENGTH
1	22	176.00			22	176.00
2	8	60.00			8	60.00
3	5	64.00			5	64.00
4	4	46.00			4	46.00
5	22	175.00			22	175.00
6	10	79.00			10	79.00
7	9	58.00			9	58.00
8	4	46.00			4	46.00
11	15	76.50			15	76.50
12	3	28.00	2	6.00	5	34.00
13	5	46.50			5	46.50
15	2	6.00			2	6.00
16	8	37.00			8	37.00
17	4	40.00			4	40.00
19	4	10.00	1	2.00	5	70.00
20	3	21.00			3	21.00
21	4	39.00			4	39.00
22	7	76.00			7	76.00
23	4	27.50			4	27.50
24	6	13.00			6	13.00
26	1	10.00			1	10.00
27	2	527.00			2	527.00
28	2	61.00			2	61.00
29	5	22.50			5	22.50
30	3	15.50			3	15.50
32	4	38.00			4	38.00
33	10	93.00			10	93.00
34	1	9.00			1	9.00
36	8	59.00			8	59.00
37	8	16.00			8	16.00
38	8	22.50			8	22.50
39	5	21.50			5	21.50
40	4	18.60			4	18.60
41	7	35.50			7	35.50
43	6	18.50			6	18.50
44	16	81.00			16	81.00
45	6	26.20			6	26.20
46	12	58.00			12	58.00
48	7	44.50			7	44.50
49	7	24.20			7	24.20
50	1	4.00			1	4.00
51	1	23.00			1	23.00
52	1	3.00			1	3.00
53	6	36.50			6	36.50
54	5	38.50			5	38.50
55	10	116.00			10	116.00
56	13	83.00			13	83.00
57	6	39.00			6	39.00
58	22	105.00			22	105.00
60	2	5.50			7	5.50
61	1	7.00			1	7.00
62	4	65.00			4	65.00
63	6	11.00			6	11.00
64	3	112.00			3	112.00
65	4	26.00			4	26.00
67	3	13.80			3	13.80
68	1	3.00			1	3.00
69	2	18.00			2	18.00
70	11	39.00	1	3.00	12	42.00
72	5	41.00			5	41.00
73	4	30.00			4	30.00
74	7	43.00			7	43.00
75	4	34.00			4	34.00
76	2	25.00			2	25.00
77	6	35.00			6	35.00
79	18	167.00			18	167.00
80	17	108.40			17	160.40
81	16	133.00			16	133.00
82	7	59.00			7	59.00
83	5	13.00	1	75.00	6	88.00
84	5	26.00	2	20.00	7	46.00
85	1	2.00			1	2.00
86	5	43.00	1	10.00	6	53.00
87	3	7.00			3	7.00
89	2	5.00			2	5.00
91	1	3.00			1	3.00
95	1	3.00			1	3.00
97	2	6.00			2	6.00
98	2	63.00			2	63.00
99	1	2.00			1	2.00
100	6	40.00			6	40.00
101	9	28.00			9	28.00
102	4	22.00	1	4.00	5	26.00
103	1	65.00			1	65.00
104			7	57.00	7	57.00
105	3	12.50			3	12.50
106	2	14.00			2	14.00
107			7	29.00	7	29.00
108	9	89.50			9	89.50
109	8	28.00			8	28.00
112	2	6.00			2	6.00
116	1	12.50			1	12.50
117	1	2.00			1	2.00
118	10	40.00			10	40.00
119	4	36.00			4	36.00
120	1	5.00			1	5.00
122	1	3.00			1	3.00
124	3	15.00			3	15.00
125	6	136.00			6	136.00
126	3	49.00			3	49.00
127	4	15.00			4	15.00
128	6	35.00			6	35.00
TOTAL	571	4594.20	23	206.00	594	4800.20

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

PROV : SUMATERA SELATAN KAB : BANGKA

	<<< BRIDGE >>>				(No)
I03 (18)	KY	BT	LL	BJ	TOTAL
LINK 1	22				22
LINK 2	3	5			8
LINK 3	5				5
LINK 4	3	1			4
LINK 5	22				22
LINK 6	10				10
LINK 7	9				9
LINK 8	4				4
LINK 11	8		7		15
LINK 12			3		3
LINK 13	5				5
LINK 15		2			2
LINK 16		7		1	8
LINK 17	4				4
LINK 19			4		4
LINK 20	3				3
LINK 21		3	1		4
LINK 22	7				7
LINK 23	4				4
LINK 24		6			6
LINK 26	1				1
LINK 27		2			2
LINK 28			2		2
LINK 29		5			5
LINK 30		1		2	3
LINK 32		3	1		4
LINK 33	10				10
LINK 34	1				1
LINK 36	5	3			8
LINK 37		8			8
LINK 38		8			8
LINK 39		5			5
LINK 40	4				4
LINK 41		3	2	2	7
LINK 43	6				6
LINK 44	16				16
LINK 45	2	2	1	1	6
LINK 46		12			12
LINK 48	6		1		7
LINK 49	2	3	2		7
LINK 50	1				1
LINK 51	1				1
LINK 52	1				1
LINK 53	6				6
LINK 54			5		5
LINK 55	5	4		1	10
LINK 56	13				13
LINK 57		4	2		6
LINK 58	10	11	1		22
LINK 60		2			2
LINK 61		1			1
LINK 62	1	2		1	4
LINK 63	2		4		6

	<<< BRIDGE >>>				(No)
I03 (18)	KY	BT	LL	BJ	TOTAL
LINK 64		2		1	3
LINK 65	4				4
LINK 67	3				3
LINK 68			1		1
LINK 69	2				2
LINK 70		7	4		11
LINK 72	5				5
LINK 73	4				4
LINK 74	7				7
LINK 75	4				4
LINK 76	2				2
LINK 77	1	4	1		6
LINK 79	18				18
LINK 80	13		4		17
LINK 81	15		1		16
LINK 82	7				7
LINK 83		5			5
LINK 84			5		5
LINK 85		1			1
LINK 86	5				5
LINK 87			3		3
LINK 88		1	1		2
LINK 91	1				1
LINK 95	1				1
LINK 97	1	1			2
LINK 98	2				2
LINK 99		1			1
LINK 100		4	2		6
LINK 101		9			9
LINK 102	2	2			4
LINK 103	1				1
LINK 104					
LINK 105		1	2		3
LINK 106	2				2
LINK 107					
LINK 108	4	2	3		9
LINK 109	4		3	1	8
LINK 112	1		1		2
LINK 116				1	1
LINK 117	1				1
LINK 118	7	2		1	10
LINK 119	4				4
LINK 120	1				1
LINK 122		1			1
LINK 124	3				3
LINK 125	6				6
LINK 126	3				3
LINK 127	4				4
LINK 128	6				6
TOTAL	346	146	67	12	571
RATIO	61	26	12	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	14	24	3	1	-	-	-	-	-	1	43
Concrete	4	21	4	1	1	-	-	-	-	1	32
Steel	1	1	1	-	-	-	-	-	-	-	3
Others	3	3	1	-	-	-	-	-	-	-	7
Total	22	49	9	2	1	-	-	-	-	2	85

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 Bangka 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	3,821	3,530	4,217	13,747	18,452
Proportion (%)	15.09	13.94	16.66	54.30	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	-	-	-	-	-

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 : BELITUNG

A)	Growth Rate of Population	:	1.80 (%)
B)	Growth Rate of Cultivated Area	:	2.50 (%)
C)	Growth Rate of Rice field	:	3.90 (%)
D)	Growth Rate of Rice yield rate	:	4.40 (%)
E)	Growth Rate of GDP / capita	:	6.70 (%)
a)	Geometrical Mean (A x B)	:	2.15 (%)
b)	Geometrical Mean (C x D)	:	4.15 (%)
c)	Geometrical Mean (a x b)	:	3.14 (%)
d)	Geometrical Mean (c x E)	:	4.91 (%)
	TRAFFIC GROWTH RATE	:	4.91 (%)

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 EXISTING AND FUTURE TRAFFIC VOLUME

PROV : SUMATERA SELATAN KAB : BELITUNG

< SPD : 1/2 >

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	6	2	4	20	22	4.9%	11	4	7	37	41	IIIC
2	0	0	0	5	3	4.9%	0	0	0	9	6	IIIC
3	4	0	4	10	13	4.9%	7	0	7	19	24	IIIC
4	0	0	2	15	10	4.9%	0	0	4	28	19	IIIC
5	0	0	5	5	8	4.9%	0	0	9	9	15	IIIC
6	6	0	4	15	18	4.9%	11	0	7	28	34	IIIC
7	4	0	3	15	15	4.9%	7	0	6	28	28	IIIC
8	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
9	2	0	2	20	14	4.9%	4	0	4	37	26	IIIC
10	2	0	0	20	12	4.9%	4	0	0	37	22	IIIC
11	1	0	0	10	6	4.9%	2	0	0	19	11	IIIC
12	3	0	0	10	8	4.9%	6	0	0	19	15	IIIC
13	4	0	0	20	14	4.9%	7	0	0	37	26	IIIC
14	4	0	2	20	16	4.9%	7	0	4	37	30	IIIC
15	3	0	4	10	12	4.9%	6	0	7	19	22	IIIC
16	2	0	1	5	6	4.9%	4	0	2	9	11	IIIC
17	2	0	2	10	9	4.9%	4	0	4	19	17	IIIC
18	2	0	1	20	13	4.9%	4	0	2	37	24	IIIC
19	2	0	1	5	6	4.9%	4	0	2	9	11	IIIC
20	2	0	3	20	15	4.9%	4	0	6	37	28	IIIC
21	4	0	4	20	18	4.9%	7	0	7	37	34	IIIC
22	4	0	1	20	15	4.9%	7	0	2	37	28	IIIC
23	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
24	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
25	0	0	0	3	2	4.9%	0	0	0	6	4	IIIC
26	2	0	1	5	6	4.9%	4	0	2	9	11	IIIC
27	1	0	4	15	13	4.9%	2	0	7	28	24	IIIC
28	2	0	3	3	7	4.9%	4	0	6	6	13	IIIC
29	0	0	4	4	6	4.9%	0	0	7	7	11	IIIC
30	0	0	0	10	5	4.9%	0	0	0	19	9	IIIC
31	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
32	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
33	0	0	2	2	3	4.9%	0	0	4	4	6	IIIC
34	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
35	0	0	0	10	5	4.9%	0	0	0	19	9	IIIC
PERCENT	13.25	0.43	12.18	74.15			13.25	0.43	12.18	74.15		

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 : BELITUNG

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
1	IIIB-2	KRK	19	1	17	106	90
2	IIIC	KRK	2	0	1	9	8
3	IIIC	KRK	10	0	9	55	47
4	IIIB-2	KRK	18	1	17	102	87
5	IIIB-2	KRK	13	0	12	72	61
6	IIIB-2	KRK	21	1	19	115	99
7	IIIC	KRK	8	0	8	47	40
8	IIIC	KRK	8	0	8	47	40
9	IIIB-2	KRK	31	1	29	176	149
10	IIIC	KRK	8	0	7	44	37
11	IIIB-2	KRK	12	0	11	66	56
12	IIIB-2	KRK	14	0	13	77	66
13	IIIB-2	KRK	18	1	16	99	85
14	IIIB-2	KRK	17	1	15	94	80
15	IIIC	KRK	5	0	4	27	23
16	IIIC	KRK	3	0	3	16	14
17	IIIC	KRK	8	0	8	47	40
18	IIIC	KRK	2	0	2	10	9
19	IIIC	KRK	3	0	3	20	16
20	IIIC	KRK	7	0	6	37	32
21	IIIC	KRK	7	0	6	39	33
22	IIIC	KRK	5	0	4	25	22
23	IIIC	KRK	4	0	4	23	20
24	IIIC	KRK	7	0	6	38	32
25	IIIC	KRK	10	0	9	55	47
26	IIIC	KRK	3	0	3	16	14
27	IIIC	KRK	3	0	3	20	16
28	IIIC	KRK	3	0	3	16	14
29	IIIC	KRK	4	0	4	23	20
30	IIIC	KRK	9	0	8	51	43
33	IIIC	KRK	1	0	1	4	4
35	IIIC	KRK	7	0	6	37	32

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 : BELITUNG

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 8	LINK 9	LINK 10
	25 Km	2 Km	13 Km	23 Km	16 Km	27 Km	12 Km	11 Km	6 Km	2 Km
	IIIB-2	IIIC	IIIC	IIIB-2	IIIB-2	IIIB-2	IIIC	IIIC	IIIB-2	IIIC
YEAR	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	4284	104	5056	606	2789	8969	1916	5209	3629	1088
1990	4335	104	5093	652	2948	9031	1933	5252	3629	1088
1991	4644	109	5473	660	3113	9385	2088	5673	3704	1095
1992	4713	109	5510	709	3145	9790	2104	5717	3704	1095
1993	5038	109	5911	717	3321	10425	2286	6216	3704	1095
1994	5107	109	6290	769	3502	11077	2319	6303	3824	1158
1995	5467	113	6403	820	3693	11805	2491	6767	3824	1158
1996	5965	113	7146	880	3890	12533	2672	7267	3886	1165
1997	6493	118	7258	937	4247	13292	2861	7774	3886	1165
1998	6905	165	8038	1015	4603	14656	3076	8360	3961	1172
SUM	52951	1153	62178	7765	35251	110963	23746	64538	37751	11279
COST	-58818	-6511	-10111	-78247	-36828	-31946	-29211	-1565	1416	-325
/Km	-2353	-3256	-778	-3402	-2302	-1183	-2434	-142	236	-163

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.

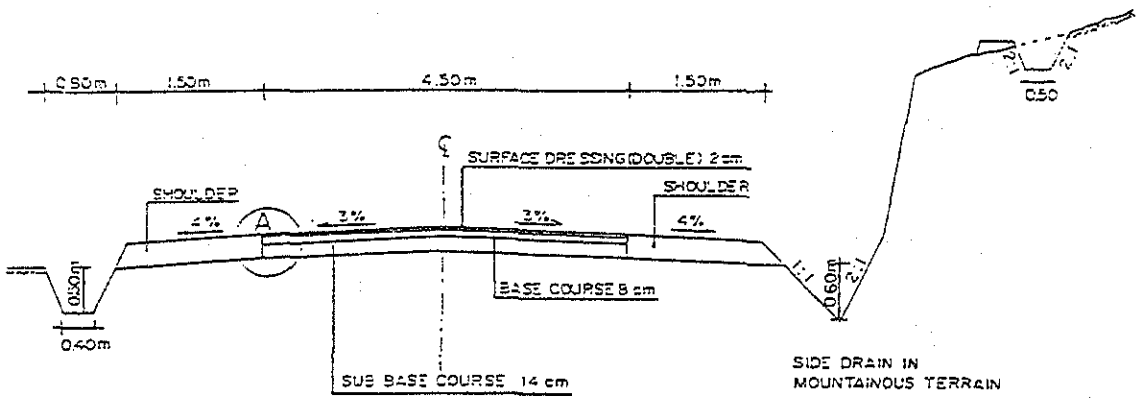
Table 3-1-1 DESIGN CRITERIA FOR KABUPATEN ROADS

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		

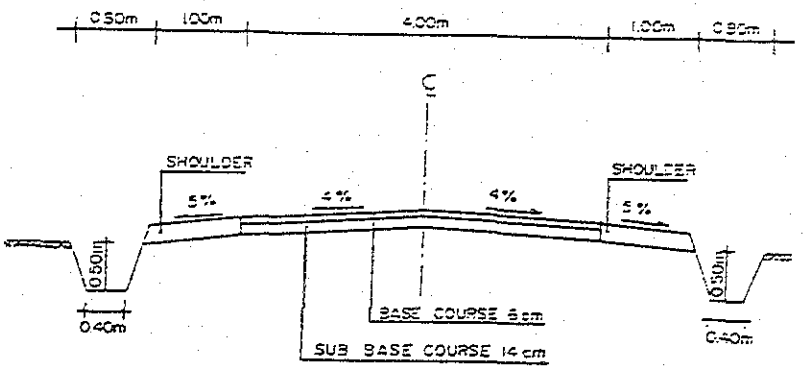
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

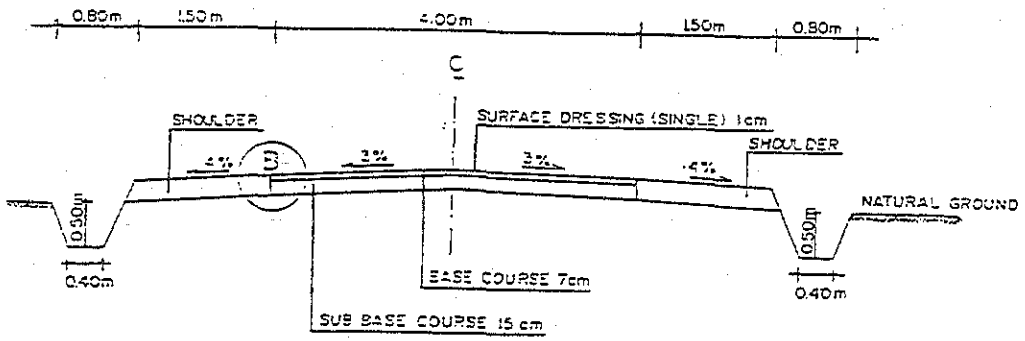
CLASS III A



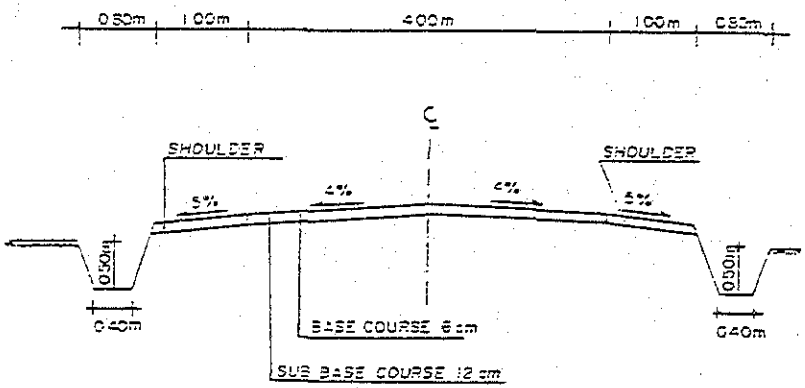
CLASS III B-2



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

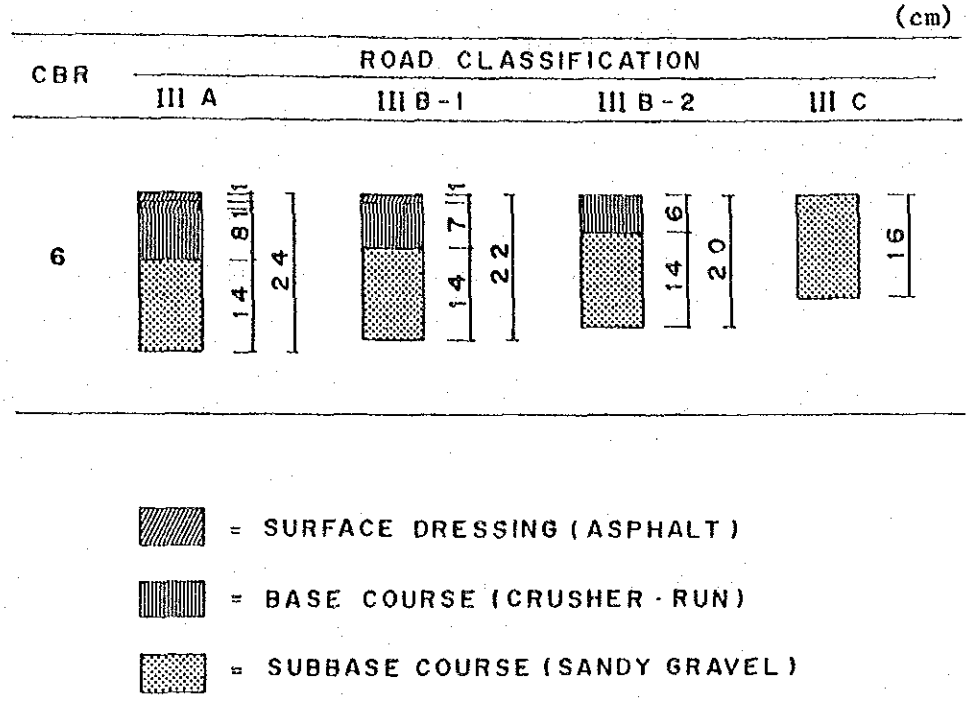
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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



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

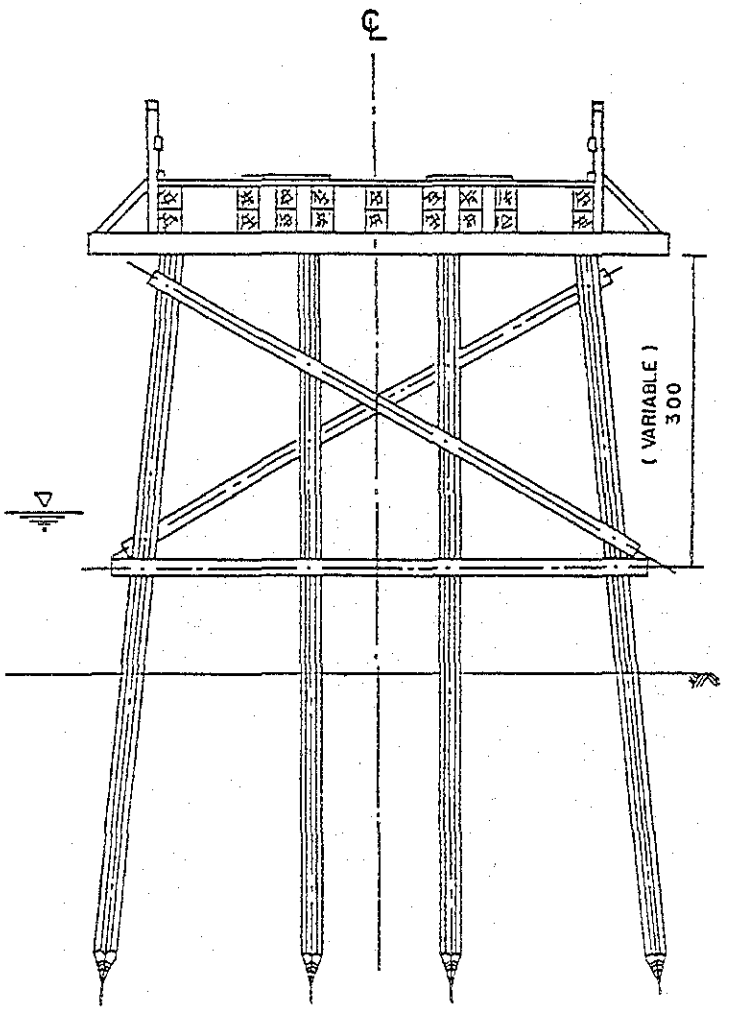
3) Foundation

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.

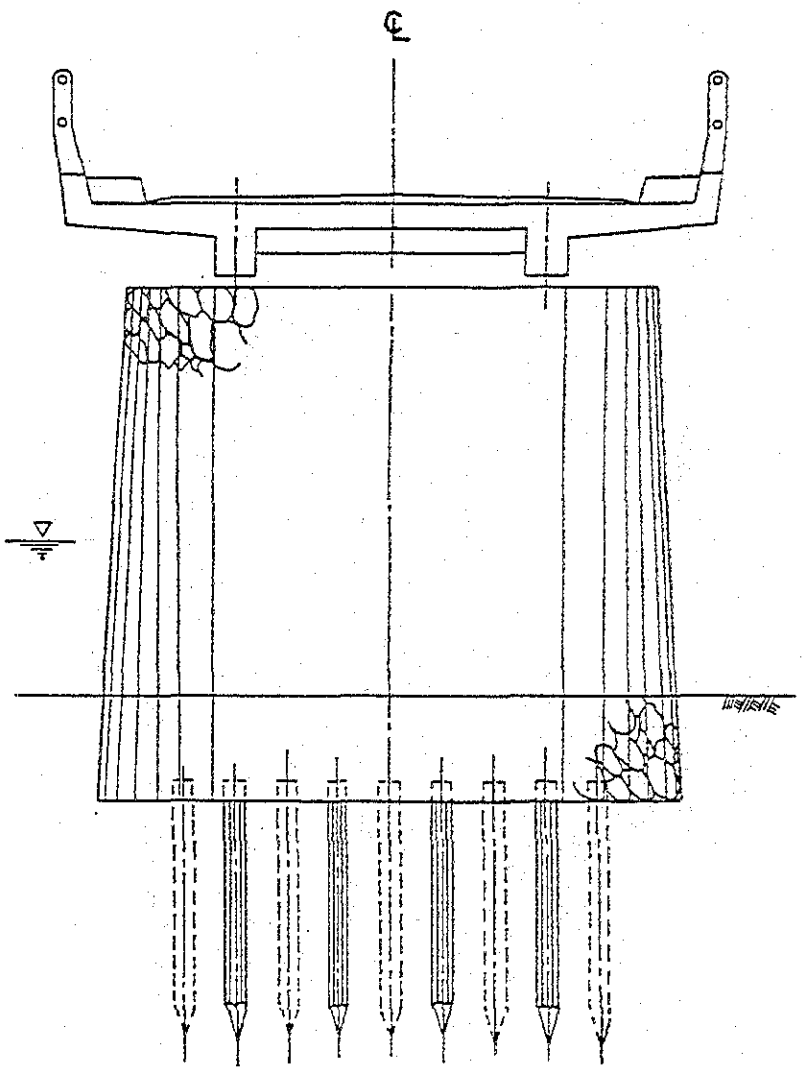
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

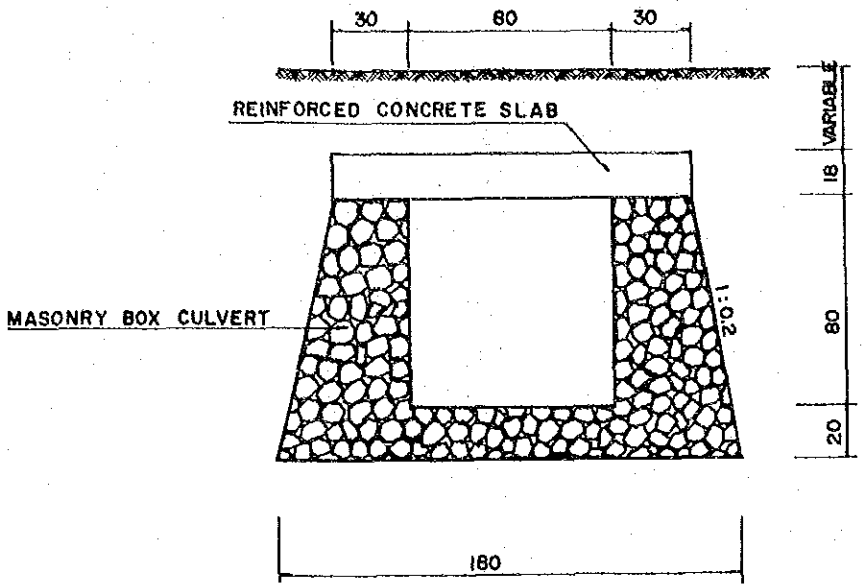
(2) Retaining Wall

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

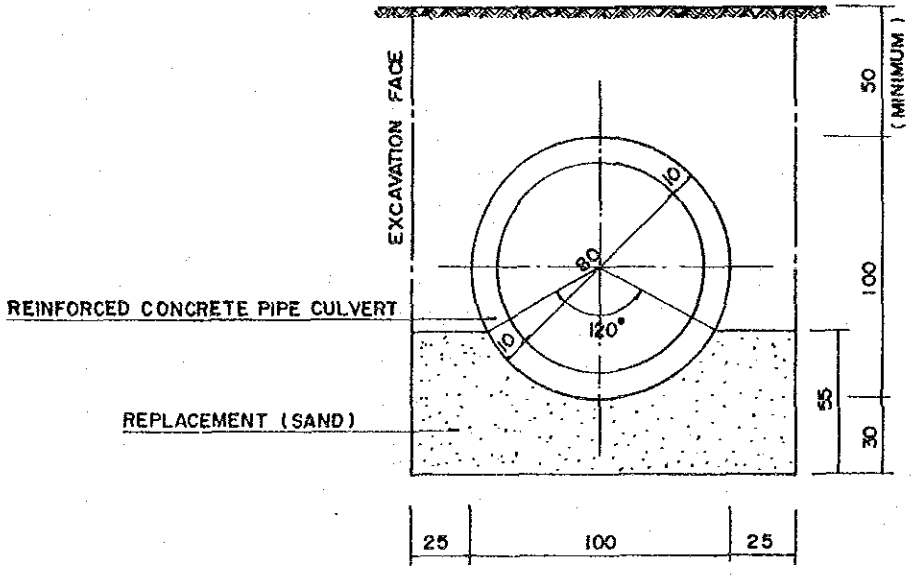
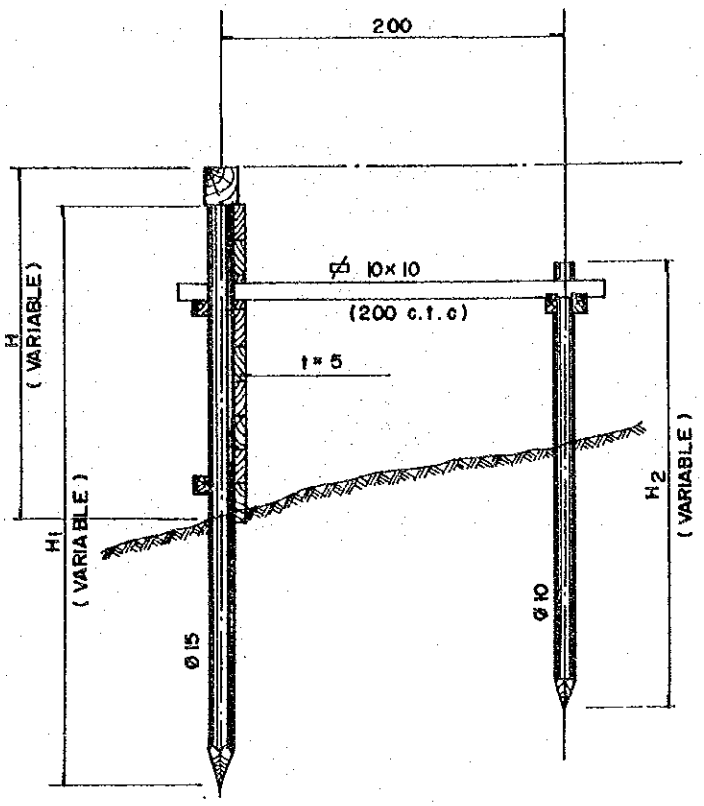
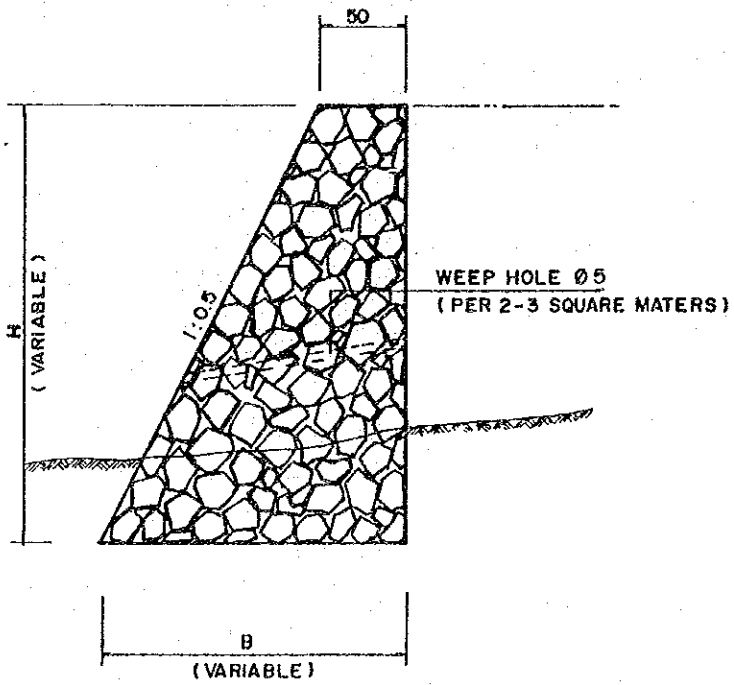


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Belitung 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 Belitung 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 : BELITUNG

(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	12,491	12,647	7,769	1,014	8,783	21,430
	Bulldozer/Ripper	120 HP	170	13,492	13,662	8,500	1,560	10,060	23,722
	Swamp Bulldozer	120 HP	178	13,731	13,909	8,879	1,630	10,509	24,418
	Bulldozer	90 HP	99	8,496	8,595	4,914	641	5,555	14,150
	Bulldozer/Ripper	90 HP	106	9,080	9,186	5,300	973	6,273	15,459
	Bulldozer	65 HP	70	6,172	6,242	3,500	456	3,956	10,198
	Bulldozer/Ripper	65 HP	77	6,617	6,694	3,819	701	4,520	11,214
	Swamp Bulldozer	90 HP	106	9,070	9,176	5,284	970	6,254	15,430
	Swamp Bulldozer	65 HP	81	6,488	6,569	4,050	743	4,793	11,362
	Motor Grader	110 HP	139	10,870	11,009	6,919	1,270	8,189	19,198
	Motor Grader	75 HP	96	7,450	7,546	4,779	877	5,656	13,202
	Motor Grader	65 HP	86	6,557	6,643	4,300	789	5,089	11,732
	Road Stabilizer	W=1850 mm	172	3,348	3,520	8,594	420	9,014	12,534
	Vibratory Roller	4 ton	58	3,260	3,318	2,900	378	3,278	6,596
	Hand-guide Vib. Roller	1000 Kg	47	583	630	849	28	877	1,507
	Tire Roller	8-15 ton	63	7,196	7,259	3,106	101	3,207	10,466
	Vibratory Roller (D&T)	4 ton	58	3,260	3,318	2,900	378	3,278	6,596
	Hand-guide Vib. Roller	600 Kg	33	397	430	600	20	620	1,050
	Rough Terrain Crane	10 ton	201	12,672	12,873	10,039	737	10,776	23,649
	Hydraulic Excavator; Wheel	0.3 m3	83	7,627	7,710	4,109	536	4,645	12,355
	Wheel Loader	1.2 m3	141	8,262	8,403	7,019	916	7,935	16,338
	Wheel Loader	0.3 m3	46	2,882	2,928	2,269	296	2,565	5,493
	Water Tank Truck	4000 ltr.	48	2,757	2,805	869	117	986	3,791
	Fuel Tank Truck	4000 ltr.	49	2,763	2,812	882	119	1,001	3,813
	Dump Truck	3.0 ton	81	3,452	3,533	1,469	198	1,667	5,200
	Flat Bed Truck with Crane	3.0 ton	35	3,007	3,042	1,716	126	1,842	4,884
	Dump Loader Truck	12 ton	77	18,446	18,523	3,838	125	3,963	22,486
	Dump Truck	5.0 ton	121	5,703	5,824	2,189	295	2,484	8,308
	Flat Bed Truck	3.0 ton	12	2,586	2,598	563	41	604	3,202
	Portable Crusher/Screening	30-40 t/h	376	21,101	21,477	18,800	2,454	21,254	42,731
	Concrete Mixer	0.5 m3	297	2,338	2,635	5,400	410	5,810	8,445
	Water Pump	200 l/min	11	253	264	188	6	194	458
	Concrete Vibrator	3.3 HP	5	219	224	73	2	75	299
	Asphalt Sprayer	850 ltr.	57	742	799	1,019	137	1,156	1,955

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 : BELITUNG

(Rp)

I T E M	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	160	91	251
Subgrade Preparation	m2	20	11	31
Normal Fill	m3	1,662	861	2,523
Fill in Swamp	m3	2,457	1,050	3,507
Normal Excavation to Spoil	m3	972	521	1,493
Sub Base Course	m3	3,108	1,344	4,452
Base Course	m3	4,263	2,295	6,558
Shoulder	m2	291	145	436
Asphalt Patching	m2	3,874	1,348	5,222
Surface Dressing (Single)	m2	651	561	1,212
Surface Dressing (Double)	m2	805	881	1,686
Earth Drain	m	995	119	1,114
Earth Drain in Swamp (by machine)	m3	1,193	473	1,666
Pipe Culvert D80cm	m	44,157	45,685	89,842
Masonry Culvert (80x80cm)	m	62,922	37,509	100,431
Retaining Wall and Wing Wall (Timber)	m2	15,825	245	16,070
Retaining Wall and Wing Wall (Masonry)	m3	45,110	11,471	56,581
Gabion Protection	m3	11,739	120	11,859
Manual routine maintenance of road	Km	163,676	7,248	170,924
Routine maintenance of earth road	Km	93,278	37,868	131,146
Routine maintenance of gravel road	Km	186,973	87,939	274,912
Routine maintenance of asphalt road	Km	387,400	134,800	522,200

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 : BELITUNG

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	57,945	4,082	62,027
Superstructure (Timber;Span 5m;10T)	m2	64,184	4,507	68,691
Superstructure (Timber;Span 8m;10T)	m2	85,014	5,919	90,933
Superstructure (Timber;Span 3m;BM50)	m2	71,850	5,047	76,897
Superstructure (Timber;Span 5m;BM50)	m2	78,440	5,468	83,908
Superstructure (Timber;Span 8m;BM50)	m2	99,483	6,922	106,405
Superstructure (Concrete;Span 3m;BM50)	m2	61,697	95,341	157,038
Superstructure (Concrete;Span 5m;BM50)	m2	63,087	106,628	169,715
Superstructure (Concrete;Span 8m;BM50)	m2	64,780	116,193	180,973
Superstructure (Concrete;Span10m;BM50)	m2	70,735	132,047	202,782
Superstructure (Concrete;Span15m;BM50)	m2	75,821	155,643	231,464
Substructure (Pier;for Timber;10T)	NO	504,733	37,981	542,714
Substructure (Abut;for Timber;10T)	NO	1,348,395	171,829	1,520,224
Substructure (Pier;for Timber;BM50)	NO	742,310	56,220	798,530
Substructure (Abut;for Timber;BM50)	NO	1,527,554	191,921	1,719,475
Substructure (Pier;for Concrete;BM50)	NO	1,809,455	456,543	2,265,998
Substructure (Abut;for Concrete;BM50)	NO	3,779,057	964,550	4,743,607
Demolition of Bridge (Timber->Timber)	m2	15,897	1,550	17,447
Demolition of Bridge (Timber->Concrete)	m2	15,897	1,550	17,447
Demolition of Bridge (Concrete)	m2	91,528	73,157	164,685
Maintenance of Timber Bridge (New)	m2	10,319	1,232	11,551
Maintenance of Concrete Bridge (New)	m2	2,140	2,729	4,869
Maintenance of Timber Bridge (Exist)	m2	9,001	2,458	11,459
Maintenance of Concrete Bridge (Exist)	m2	4,270	2,387	6,657

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 Belitung are shown in Table 5-1-1.

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

KABUPATEN : BELITUNG

CRITERIA NO	ROAD LINK NO
(8)	31,32,34

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 RESULTS OF PRIMARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : BELITUNG

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
13	32 Km	IIIB-2	2.957	Surplus
2	2 Km	IIIC	0.078	Surplus
3	13 Km	IIIC	0.078	Surplus
4	23 Km	IIIB-2	0.078	Surplus
5	16 Km	IIIB-2	0.078	Surplus
6	27 Km	IIIB-2	0.078	Surplus
7	12 Km	IIIC	0.078	Surplus
8	11 Km	IIIC	0.078	Surplus
9	6 Km	IIIB-2	0.078	Surplus
10	2 Km	IIIC	0.078	Surplus
11	3 Km	IIIB-2	0.078	Surplus
12	25 Km	IIIB-2	0.078	Surplus
1	25 Km	IIIB-2	0.078	Surplus
14	23 Km	IIIB-2	0.078	Surplus
15	13 Km	IIIC	0.078	Surplus
16	7 Km	IIIC	0.078	Surplus
17	24 Km	IIIC	0.078	Surplus
18	5 Km	IIIC	0.078	Surplus
19	10 Km	IIIC	0.078	Surplus
20	20 Km	IIIC	0.078	Surplus
21	21 Km	IIIC	0.078	Surplus
22	13 Km	IIIC	0.078	Surplus
23	10 Km	IIIC	0.078	Surplus
24	9 Km	IIIC	0.078	Surplus
25	13 Km	IIIC	0.078	Surplus
26	8 Km	IIIC	0.078	Surplus
27	10 Km	IIIC	0.078	Surplus
28	8 Km	IIIC	0.078	Surplus
29	12 Km	IIIC	0.078	Surplus
30	12 Km	IIIC	0.078	Surplus
33	2 Km	IIIC	0.078	Surplus
35	12 Km	IIIC	0.078	Surplus

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : BELITUNG

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
13	32 Km	IIIC	6.155	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

Nil

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: Belitung

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	282	1,138	1,420
MAINTENANCE	99	371	470
SUPPLEMENTATION	387	-	387
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	813	1,509	2,322

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	103	1,499	1,602
CONSTRUCTION & MAINTENANCE EQUIPMENT	623	-	623
SPARE PARTS	42	10	52
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	813	1,509	2,322

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 road links finally proposed to be improved in the Kabupaten are the 9 links with the total length of 174 km which is 41% of the 429 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 : BELITUNG

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	-
- Secondary	-
Engineering Point of View	-
Basic Human Needs	3,6,7,12,13,14,19,20,30

As the table shows there are no feasible road links from the economic evaluation. Therefore the following minimum required road links are selected regardless of any result of economic evaluation from the view point of basic human needs:

- Road links which connect the Kabupaten capital with the Kecamatan capital provided the population density of the Kecamtan is greater than the mean for the Kabupaten; and
- Road links connecting isolated Kabupaten or Kecamatan capital to a trunk road.

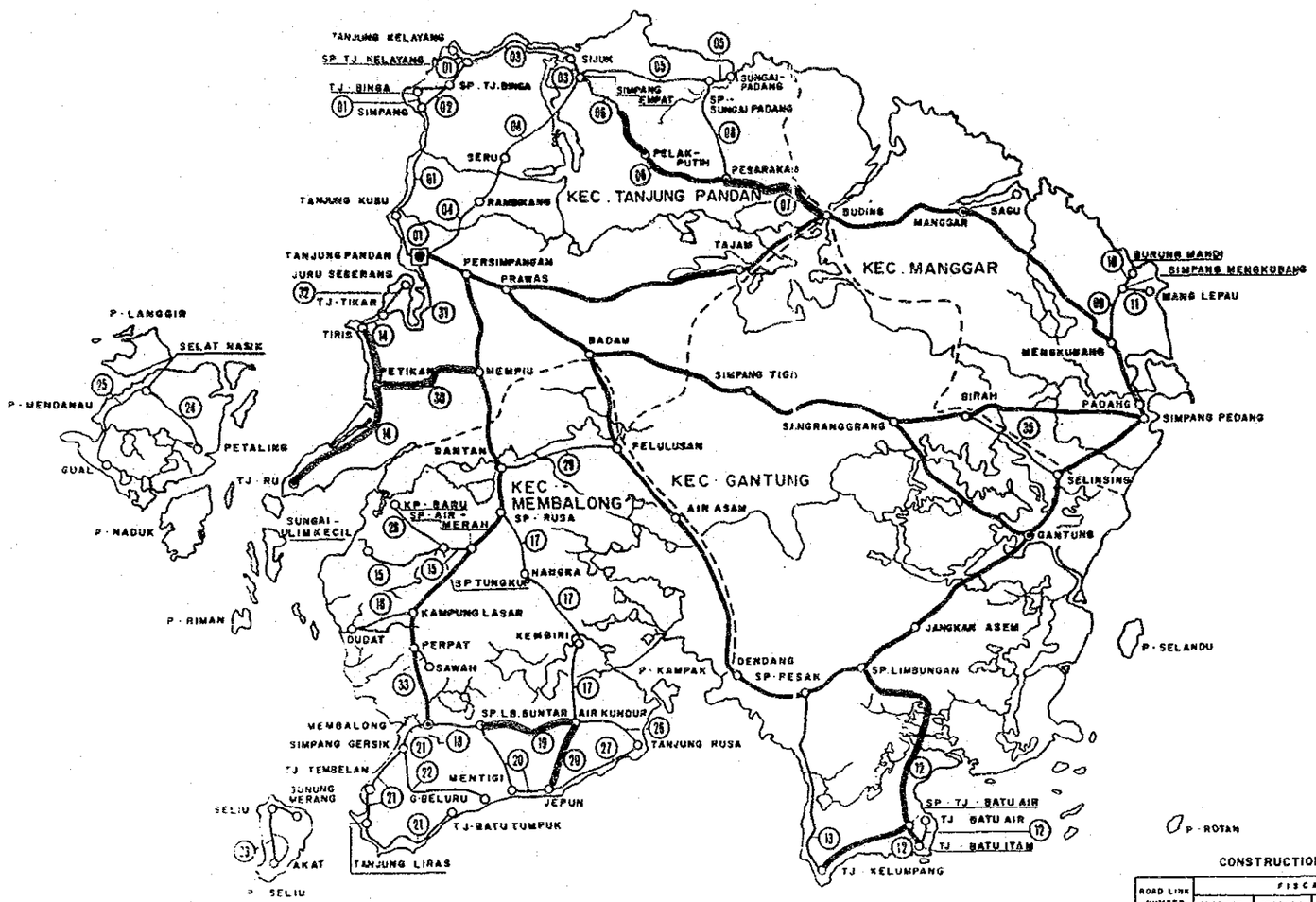
The order of proceeding with the improvement of the proposed road links are decided as shown in Table 6-1-4.

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

PROV : SUMATERA SELATAN KAB : BELITUNG

YEAR	LINK NO ( ) : rate
1988 :	14, 19
1989 :	7, 20, 30
1990 :	6 (70%), 12, 13 (30%)
1991 :	3, 6 (30%), 13 (70%)
1992 :	

KAB · BELITUNG



SCALE :

0 5 0 5 Km

LOCATION MAP

LEGEND :

- KABUPATEN CAPITAL
- KECAMATAN CAPITAL
- OTHER CITY
- (3) LINK NUMBER
- PROVINCIAL BOUNDARY
- KABUPATEN BOUNDARY
- KECAMATAN BOUNDARY
- NATIONAL ROAD
- PROVINCIAL ROAD
- KABUPATEN ROAD
- VILLAGE ROAD
- RIVER

CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1988/89	1989/90	1990/91	1991/92	1992/93
14,18	130				
07,20,30		387			
06,12,13			474		
03,06,15				426	
TOTAL COST (10^6 Rp.)	130	387	474	426	

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 : BELITUNG

(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 : BELITUNG

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TN NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
1	25	59.0	21.6	18.6	0.8	25	0	0	0	0.00	4	160.00	3,062	15,741	4,649	20,390
4	23	85.6	14.4	0.0	0.0	23	0	0	0	0.00	6	231.00	1,538	13,661	3,819	17,480
5	16	54.9	18.8	26.3	0.0	1	15	0	5	224.80	1	21.60	2,720	7,926	2,174	10,100
7	12	64.5	10.0	25.5	0.0	0	10	2	1	40.00	1	60.00	858	4,637	1,284	5,921
9	6	63.3	33.3	3.3	0.0	0	5	1	1	24.00	2	48.00	595	2,431	695	3,126
10	2	75.0	25.0	0.0	0.0	0	0	2	0	0.00	2	48.00	320	719	205	924
11	3	75.0	25.0	0.0	0.0	0	3	0	0	0.00	2	48.00	320	1,257	400	1,657
12	25	62.4	26.2	11.4	0.0	0	25	0	2	102.80	1	24.00	1,338	9,794	2,690	12,484
13	32	57.3	26.4	9.1	7.2	3	0	29	5	218.00	1	24.00	2,658	11,170	2,328	13,498
14	23	69.7	24.2	6.1	0.0	0	23	0	9	580.00	1	52.00	6,992	13,508	3,739	17,247
18	5	80.0	18.0	2.0	0.0	0	5	0	0	0.00	0	0.00	0	1,753	476	2,229
20	20	76.1	12.7	10.0	1.3	0	0	20	3	35.00	1	32.00	614	5,391	1,065	6,656
21	21	76.6	14.9	8.6	0.0	11	0	10	0	0.00	0	0.00	0	8,631	2,014	10,645
22	13	64.2	29.6	6.2	0.0	0	13	0	2	32.00	0	0.00	367	4,846	1,316	6,162
26	8	68.8	21.9	9.4	0.0	0	0	8	1	28.00	0	0.00	321	2,308	430	2,738
33	2	35.0	50.0	15.0	0.0	0	0	2	0	0.00	0	0.00	0	514	90	604
SUM	236					63	99	74	29	1284.60	22	1048.60	21,701	104,487	27,374	131,861

6.1.3 Annual Construction and Maintenance Cost

The annual allocation of the total construction and maintenance cost in the four years programme for Kabupaten Belitung 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 1,420 x 10^6 and maintenance cost is Rp 470 x 10^6 which is approximately 25% of the total expenditure.

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

PROV : SUMATERA SELATAN KAB : BELITUNG

(UNIT : 1000Rp)

I T E M	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	104,141	267,404	378,252	310,216	0	1,060,013	(74.6%)
Ownership Cost	1,138	2,649	2,121	2,215	0	8,123	(0.8%)
Operation Cost	58,755	133,801	110,435	109,869	0	412,860	(38.9%)
Material Cost	4,118	13,793	88,647	54,177	0	160,735	(15.2%)
Labour Cost	26,546	82,282	127,712	103,492	0	340,032	(32.1%)
Contingency	13,584	34,879	49,337	40,463	0	138,263	(13.0%)
FOREIGN CURRENCY :	45,888	100,902	96,807	116,580	0	360,177	(25.4%)
Ownership Cost	34,311	73,885	64,196	62,279	0	234,671	(65.2%)
Operation Cost	4,879	10,444	9,033	8,756	0	33,112	(9.2%)
Material Cost	713	3,412	10,951	30,339	0	45,415	(12.6%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	5,985	13,161	12,627	15,206	0	46,979	(13.0%)
TOTAL COST :	150,029	368,306	475,059	426,796	0	1,420,190	
Ownership Cost	35,449	76,534	66,317	64,494	0	242,794	(17.1%)
Operation Cost	63,634	144,245	119,468	118,625	0	445,972	(31.4%)
Material Cost	4,831	17,205	99,598	84,516	0	206,150	(14.5%)
Labour Cost	26,546	82,282	127,712	103,492	0	340,032	(23.9%)
Contingency	19,569	48,040	61,964	55,669	0	185,242	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SUMATERA SELATAN KAB : BELITUNG

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	48,840	103,140	108,062	111,107	0	371,149	(78.9%)
Ownership Cost	299	638	682	703	0	2,322	(0.6%)
Operation Cost	20,487	43,696	46,560	48,091	0	158,834	(42.8%)
Material Cost	1,942	4,590	4,640	4,882	0	16,054	(4.3%)
Labour Cost	26,112	54,216	56,180	57,431	0	193,939	(52.3%)
FOREIGN CURRENCY :	12,741	27,276	29,013	29,937	0	98,967	(21.1%)
Ownership Cost	10,051	21,624	23,176	23,991	0	78,842	(79.7%)
Operation Cost	1,100	2,368	2,565	2,666	0	8,699	(8.8%)
Material Cost	1,590	3,284	3,272	3,280	0	11,426	(11.5%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	61,581	130,416	137,075	141,044	0	470,116	
Ownership Cost	10,350	22,262	23,858	24,694	0	81,164	(17.3%)
Operation Cost	21,587	46,064	49,125	50,757	0	167,533	(35.6%)
Material Cost	3,532	7,874	7,912	8,162	0	27,480	(5.8%)
Labour Cost	26,112	54,216	56,180	57,431	0	193,939	(41.3%)

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

(TOTAL)

PROV : SUMATERA SELATAN KAB : BELITUNG

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	152,981	370,544	486,314	421,323	0	1,431,162	(75.7%)
Ownership Cost	1,437	3,287	2,603	2,918	0	10,445	(0.7%)
Operation Cost	79,242	177,497	156,995	157,960	0	571,694	(39.9%)
Material Cost	6,060	18,383	93,287	59,059	0	176,789	(12.4%)
Labour Cost	52,658	136,498	183,892	160,923	0	533,971	(37.3%)
Contingency	13,584	34,879	49,337	40,463	0	138,263	(9.7%)
FOREIGN CURRENCY :	58,629	128,178	125,820	146,517	0	459,144	(24.3%)
Ownership Cost	44,362	95,509	87,372	86,270	0	313,513	(68.3%)
Operation Cost	5,979	12,812	11,598	11,422	0	41,811	(9.1%)
Material Cost	2,303	6,696	14,223	33,619	0	56,841	(12.4%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	5,985	13,161	12,627	15,206	0	46,979	(10.2%)
TOTAL COST :	211,610	498,722	612,134	567,840	0	1,890,306	
Ownership Cost	45,799	98,796	90,175	89,188	0	323,958	(17.1%)
Operation Cost	85,221	190,309	168,593	169,382	0	613,505	(32.5%)
Material Cost	8,363	25,079	107,510	92,678	0	233,630	(12.4%)
Labour Cost	52,658	136,498	183,892	160,923	0	533,971	(28.2%)
Contingency	19,569	48,040	61,964	55,669	0	185,242	(9.8%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Belitung 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 .

- 8-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-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 : BELITUNG

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	170	0	0.41	0.83	1.01	0.84	0.00
Swamp Bulldozer	170	0	0.03	0.21	0.01	0.01	0.00
Motor Grader	190	0	0.81	1.72	1.46	1.73	0.00
Hand-guide Vib. Roller	190	0	0.05	0.44	0.18	0.28	0.00
Tire Roller	170	0	0.00	0.00	0.00	0.00	0.00
Vibratory Roller (D&T)	190	0	0.56	1.62	1.04	1.43	0.00
Hydraulic Excavator; Wheel	170	0	0.18	0.95	0.11	0.06	0.00
Wheel Loader	190	0	0.96	1.85	1.75	1.58	0.00
Water Tank Truck	190	0	0.28	0.92	0.48	0.73	0.00
Dump Truck	190	0	7.49	18.64	13.75	14.89	0.00
Flat Bed Truck with Crane	190	0	0.03	0.22	1.16	0.89	0.00
Flat Bed Truck	190	0	0.02	0.13	0.06	0.10	0.00
Portable Crusher/Screening	190	0	0.21	0.07	0.33	0.07	0.00
Concrete Mixer	170	0	0.01	0.14	0.02	0.27	0.00
Water Pump	170	0	0.01	0.10	0.02	0.76	0.00
Concrete Vibrator	170	0	0.01	0.02	0.01	0.08	0.00
Asphalt Sprayer	170	1	0.00	0.00	0.00	0.00	0.00

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

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SUMATERA SELATAN KAB : BELITUNG

(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	2	95,600
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	1	8,500
Tire Roller	8-15 ton	31,070	1	31,070
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	1	41,100
Wheel Loader	1.2 m3	70,200	2	140,400
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	8	117,600
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	2	50,380
Flat Bed Truck	3.0 ton	11,275	1	11,275
Portable Crusher/Screening	30-40 t/h	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	-	-
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	623,075
OWNERSHIP COST (FOREIGN)	235,625
EQUIPMENT COST SUPPLEMENTED	387,450

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Dump Truck	54,743
Portable Crusher/Screening	23,145
TOTAL	77,888

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 : BELITUNG

ITEM	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	0.00	0.00	0.00	0.00	0.00	0.00
Subgrade Preparation	m2	38240.00	250405.00	71459.76	243197.04	0.00	603301.80
Normal Fill	m3	3.00	2100.00	2660.00	1140.00	0.00	5903.00
Fill in Swamp	m3	855.00	6292.30	254.03	108.87	0.00	7510.20
Normal Excavation to Spoil	m3	197.00	4123.00	3865.40	2836.60	0.00	11022.00
Sub Base Course	m3	3833.20	22029.30	6759.10	19692.30	0.00	52313.90
Base Course	m3	6720.00	2100.00	10536.00	1944.00	0.00	21300.00
Shoulder	m2	99000.00	150000.00	189000.00	174000.00	0.00	612000.00
Asphalt Patching	m2	0.00	0.00	88.80	273.20	0.00	362.00
Surface Dressing (Single)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Surface Dressing (Double)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Earth Drain	m	11280.00	46460.00	26334.00	32186.00	0.00	116260.00
Earth Drain in Swamp (by machine)	m3	2400.00	12900.00	1377.60	590.40	0.00	17268.00
Pipe Culvert D80cm	m	12.00	63.00	41.00	21.00	0.00	137.00
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	245.00	105.00	0.00	350.00
Retaining Wall and Wing Wall (Masonry)	m3	0.00	203.20	15.68	6.72	0.00	225.60
Gabion Protection	m3	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 3m;10T)	m2	12.00	48.00	0.00	0.00	0.00	60.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;10T)	m2	0.00	0.00	1554.20	735.80	0.00	2290.00
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	162.00	0.00	162.00
Substructure (Pier;for Timber;10T)	NO	0.00	2.00	47.10	21.90	0.00	71.00
Substructure (Abut;for Timber;10T)	NO	2.00	4.00	4.80	3.20	0.00	14.00
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	2.00	0.00	2.00
Substructure (Abut;for Concrete;BM50)	NO	0.00	0.00	0.00	2.00	0.00	2.00
Demolition of Bridge (Timber->Timber)	m2	0.00	25.50	36.60	85.40	0.00	147.50
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	1.44	0.00	1.44
Manual routine maintenance of road	Km	112.25	230.00	240.70	246.80	0.00	829.75
Routine maintenance of earth road	Km	37.00	63.00	47.65	41.85	0.00	189.50
Routine maintenance of gravel road	Km	43.75	104.00	130.50	143.00	0.00	421.25
Routine maintenance of asphalt road	Km	31.50	63.00	62.55	61.95	0.00	219.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	12.00	48.00	0.00	60.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	497.30	1257.10	1212.50	1220.30	0.00	4189.20
Maintenance of Concrete Bridge (Exist)	m2	511.30	1044.60	1075.00	1082.20	0.00	3713.10

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.

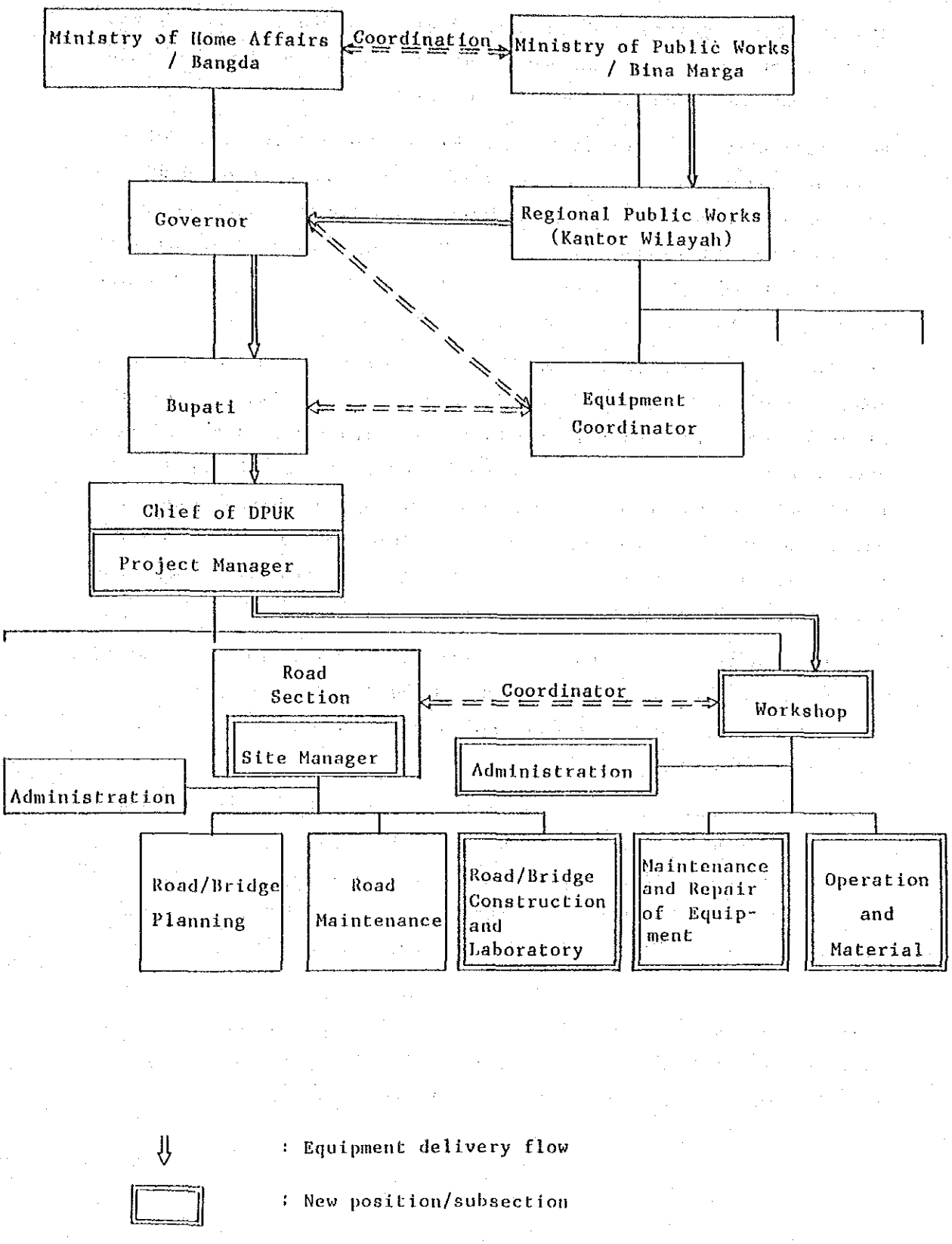
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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



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