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 8

KABUPATEN LAMPUNG TENGAH

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 Lampung Tengah in Lampung 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.

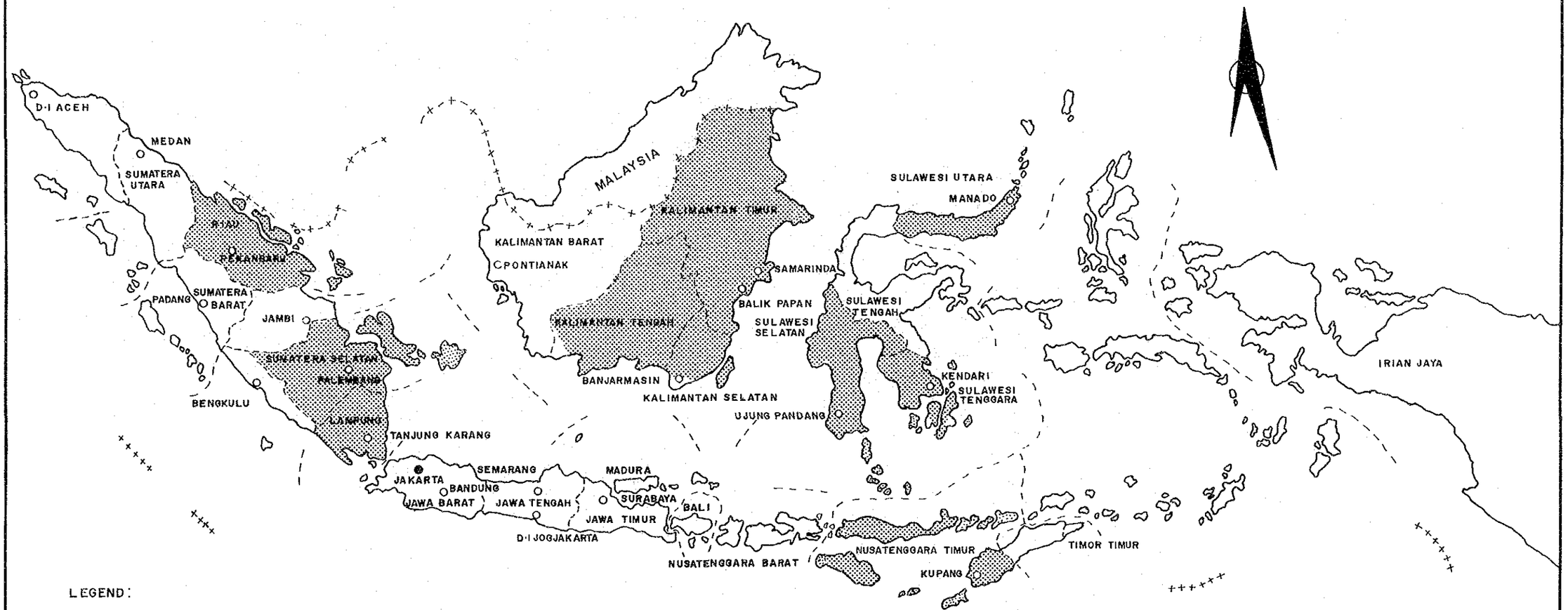
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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

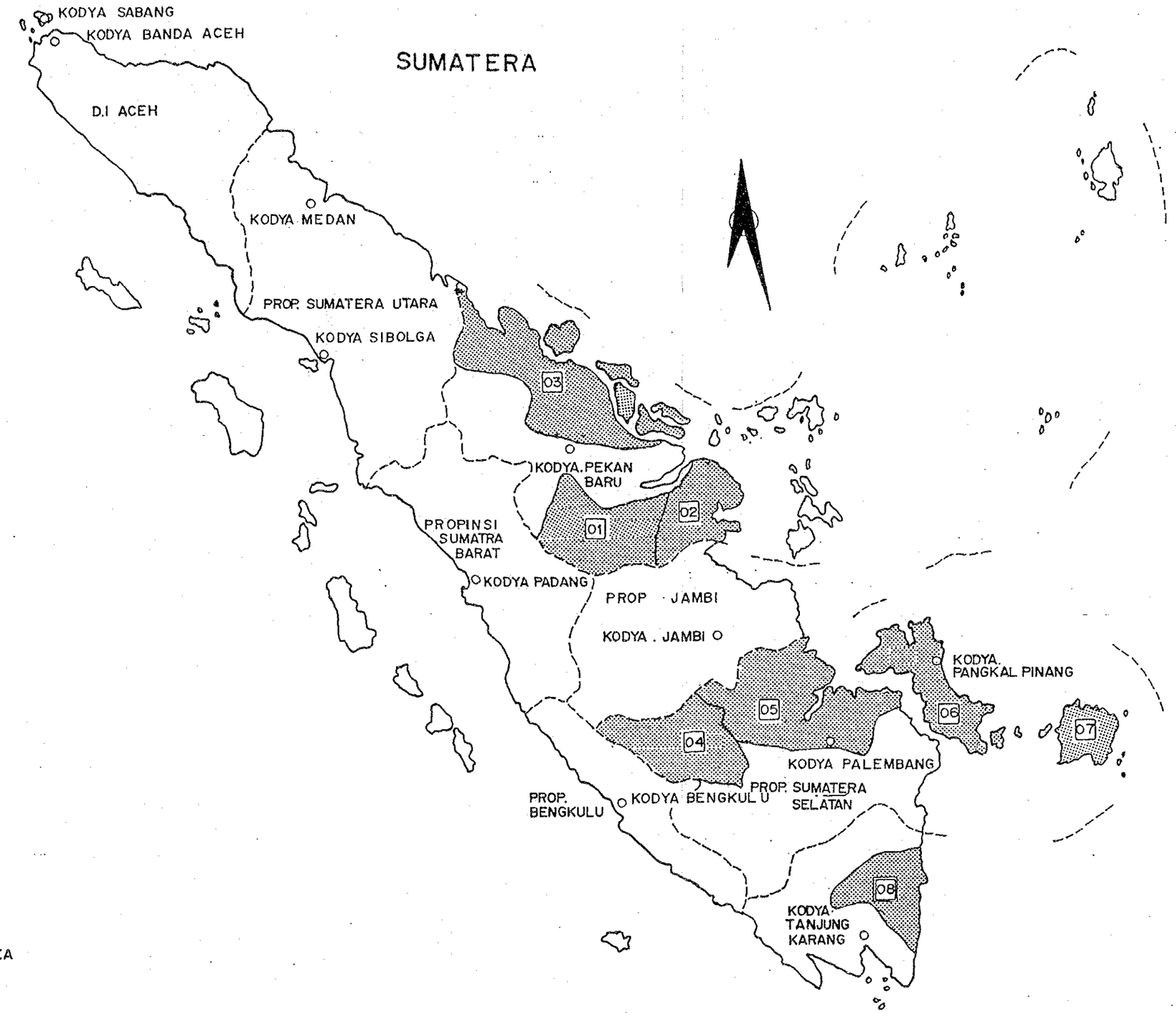
01· KAB · INDRAGIRI HULU
02· KAB · INDRAGIRI HILIR
03· KAB · BENGKALIS

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



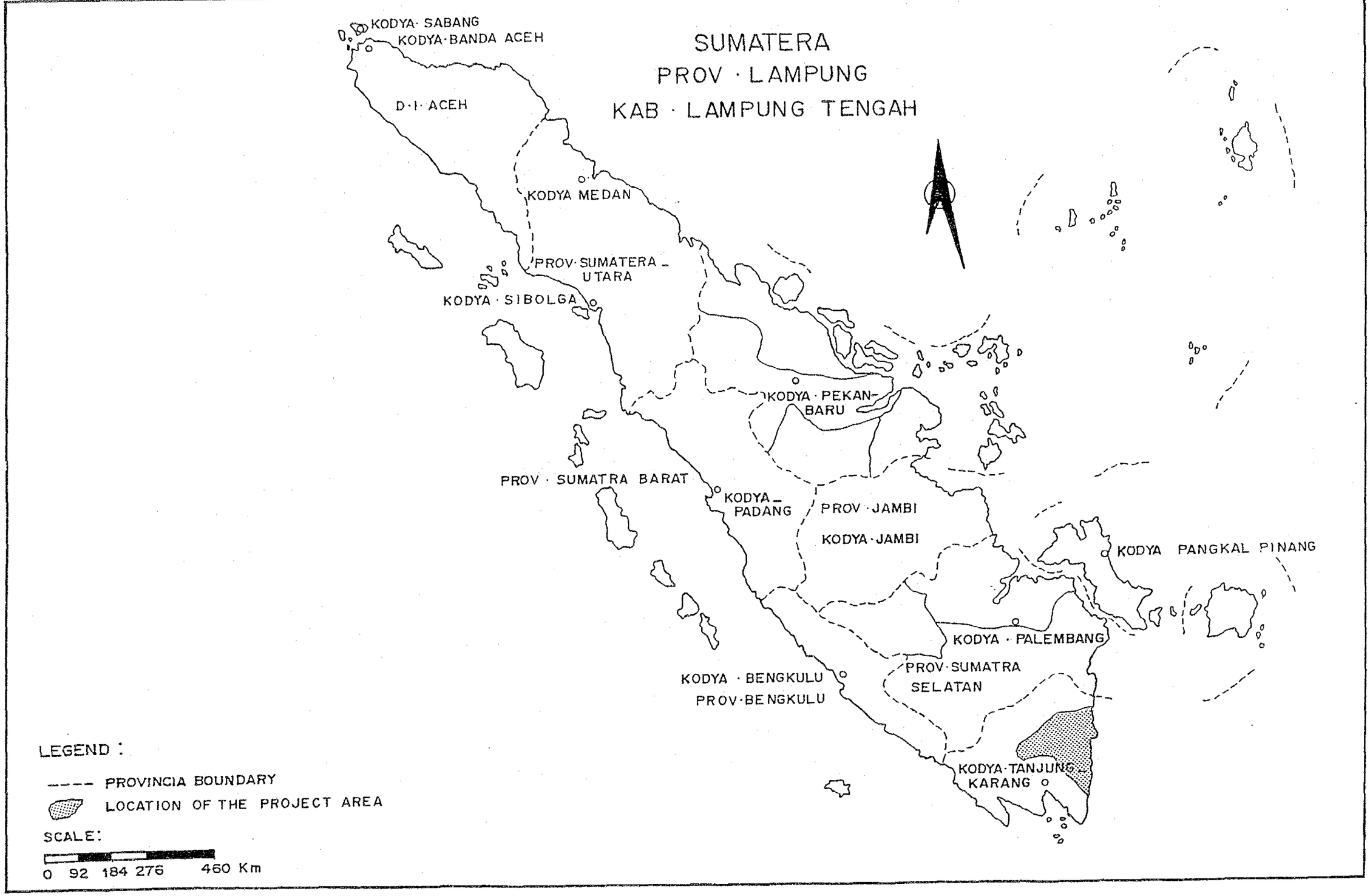
LEGEND :

---- PROVINCIAL BOUNDARY

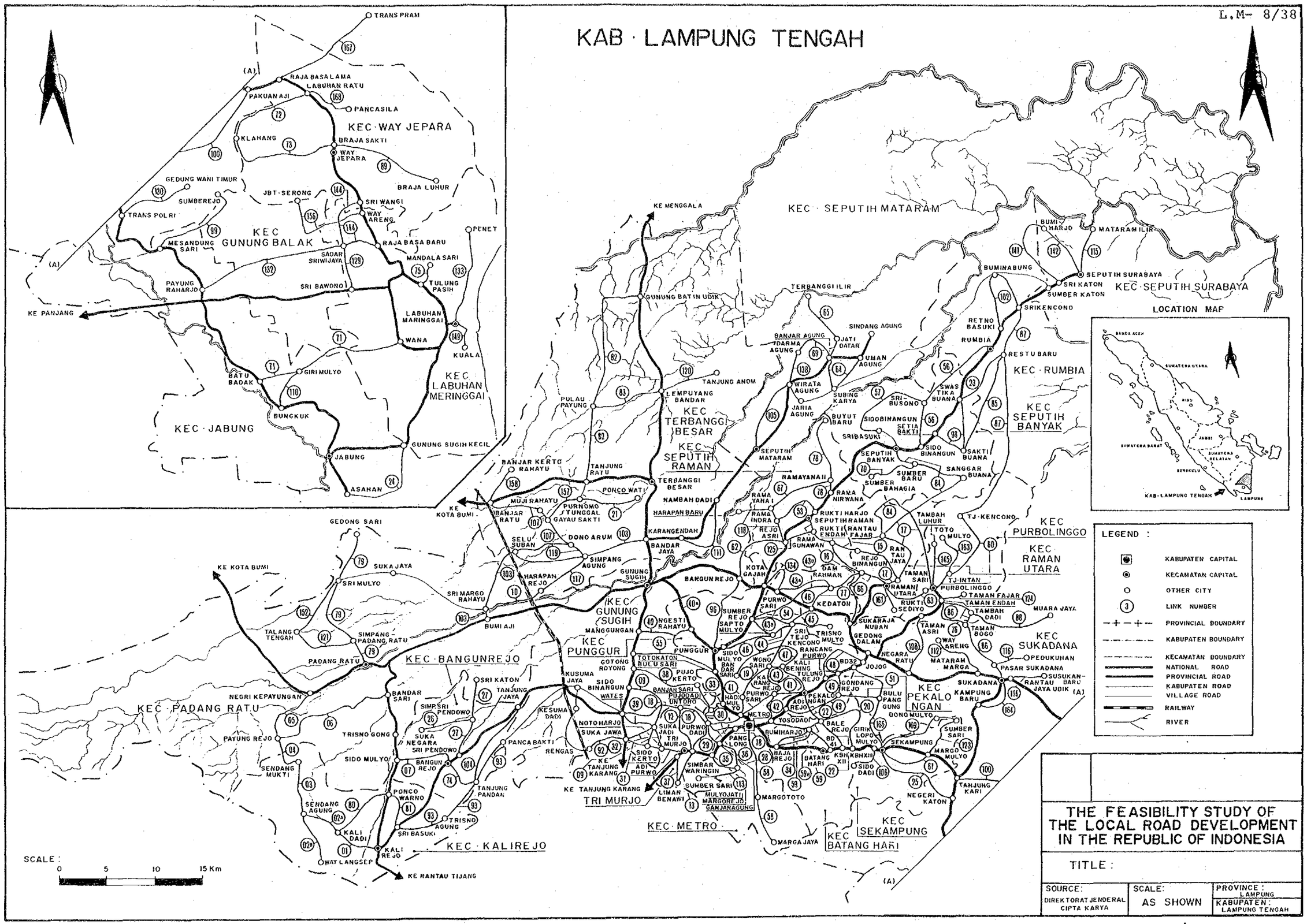
LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km


SUMATERA
PROV · LAMPUNG
KAB · LAMPUNG TENGAH
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 · LAMPUNG TENGAH



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

TITLE :

SOURCE:	SCALE:	PROVINCE : LAMPUNG
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : LAMPUNG TENGAH

C O N T E N T S

Chapter 1 BACKGROUND OF THE KABUPATEN

1.1 Topographic and Meteorological Conditions

1.1.1 Location and Topography

Kabupaten Lampung Tengah is located in the southeast of Lampung Province. Its east coast faces the Jawa Sea. It is bordered on the north by Kabupaten Lampung Utara and on the west and south by Kabupaten Lampung Selata. Metro City, the capital of the Kabupaten is located almost in the center of the broad plain.

On the east coast of the Kabupaten swamps extend from the north to the south. In the Kabupaten a number of medium/smaller rivers flow towards the east into the Jawa Sea however there is no big river.

The area of the Kabupaten is about 8,400 square kilometers, approximately 25 percent of the total of Lampung Province. It administers 23 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Lampung Tengah are 102 days and 2,704 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 250 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 : Lampung
KABUPATEN : Lampung Tengah STATION : No. 288 D

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	16	305	17	394	15	299	15	747	11	449
February	16	400	19	475	19	404	10	402	14	480
March	7	203	13	383	10	474	9	420	11	533
April	7	163	5	119	10	159	7	264	8	232
May	6	64	17	237	2	33	8	180	10	452
June	5	84	3	80	7	79	2	28	5	118
July	6	154	6	41	4	36	2	60	5	242
August	5	117	5	79	-	-	-	-	2	136
September	7	62	14	202	2	91	-	-	4	68
October	6	43	8	74	1	13	6	182	5	226
November	15	268	16	255	6	96	11	354	9	268
December	16	309	14	234	13	530	10	270	10	450
Total	112	2,172	137	2,573	89	2,214	80	2,907	94	3,654

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Lampung Tengah in 1984 was 1,745,433 which was approximately 30.3% of the 5,769,000 total population of Lampung Province as shown in Table 1-2-1.

The population density was 2.08 persons per ha which was higher than the provincial density of 1.64 and indicates that the Kabupaten is one of high population density areas in the islands outside Jawa.

The recent annual average growth rate of population of the Kabupaten is 0.8% which is lower than both the provincial rate of 5.7% and the national rate of 2.2%. This indicates that in spite of the on-going transmigration programme in the Kabupaten there is a large outflow of the population from the Kabupaten to find employment in Jakarta since the Kabupaten is located close to Jawa Island.

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:					
LAMPUNG TENGAH	1,745,433	0.8	840,890	2.08	1984
PROVINCE:					
LAMPUNG	5,464,700		3,330,700		1983
	5,769,000	5.7	3,330,700	1.64	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 : LAMPUNG

KABUPATEN : LAMPUNG TENGAH

KECAMATAN	POPULATION	PROPORTION (%)
MALIREJO	82,203	4.7
BANGUN REJO	47,484	2.7
PADANG RATU	129,505	7.4
GUNUNG SUGIH	94,422	5.4
TRIMURJO	41,134	2.4
METRO	109,857	6.3
BATANGHARI	42,867	2.5
SEKAMPUNG	51,803	3.0
JABUNG	150,807	8.6
LABUHAN MARINGGAI	127,489	7.3
WAY JEPARA	87,834	5.0
SUKADANA	152,751	8.8
PEKALONGAN	35,328	2.1
PUNGUR	54,770	3.1
TERBANGGI BESAR	133,663	7.6
SEPUTIH RAMAN	40,350	2.3
RAMAN UTARA	33,780	1.9
PURBOLINGGO	50,763	2.9
RUMBIA	59,824	3.4
SEPUTIH BANYAK	49,930	2.9
SEPUTIH MATARAM	60,124	3.4
SEPUTIH SURABAYA	46,471	2.7
GUNUNG BALAK	62,724	3.6
TOTAL	1,745,433	100

1.2.2 Land Use

In Kabupaten Lampung Tengah, 446,203 ha of the current available land use area, which is approximately 53.1% of the 840,890 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 377,586 ha of agricultural harvest area and 68,617 ha of residential area which are 84.6% and 15.4% of the current available land use area respectively.

The agricultural harvest area consists of 325,717 ha of paddy field and 51,869 ha of plantation area which are 86.3% and 13.7% of the agricultural harvest area respectively.

It can be realized from the land use that the main industrial production in the Kabupaten is food crops, especially paddy.

Table 1-2-3

LAND USE

PROVINCE : LAMPUNG

(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
LAMPUNG TENGAH	81,897 (9.7)	243,820 (29.0)	-	51,869 (6.2)	68,617 (8.2)	-	35,382 (4.2)	97,084 (11.6)	133,464 (15.9)	840,890 (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 Lampung Tengah in 1984 were 307,927 ha and 1,504,897 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 185,122 ha and 604,113 ton respectively which are 60.1% and 40.1% of the total food crops. The yield rate of paddy production is 3.26 ton per ha. Thus, paddy is the most predominant agricultural crop of the Kabupaten. A notable food crop excluding paddy in the Kabupaten is cassava. The production recorded 793,952 tons in 1984, which is much more than the consumption volume of the Kabupaten itself. The production is also much higher than that of the paddy.

As the table shows, average annual growth rates of area and production of paddy in 1979 through 1984 were 6.0% and 12.8% respectively which show a favourable development of paddy production. It is desirable that productivity of paddy becomes higher and this depends upon the future development of the water facilities relating to the agricultural sector, such as irrigation.

The commodity crops, of which rubber, coffee and cocoa are produced by the plantations. The area and production of plantation crops in 1983 were 77,892 ha and 33,283 ton respectively with current growth rates being 0% and 17.9% respectively. Thus the plantation crop which is an export product is important agriculturally. Some change is 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 84.6% of the total population as shown in Table 1-2-6. Thus the Kabupaten is an agricultural Kabupaten.

Future agricultural development will be needed to promote the various commodity crops which can supply the great market of Jakarta which is geographically convenient.

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

KABUPATEN : LAMPUNG TENGAH

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	138,578	144,490	151,317	164,712	202,134	185,122	6.0
OTHERS	79,840	93,959	103,573	91,847	102,123	122,805	9.0
TOTAL	218,418	238,449	254,890	256,559	304,257	307,927	7.1

PRODUCTION

(ton)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	331,361	355,427	430,188	459,695	444,756	604,113	12.8
OTHERS	561,430	640,631	739,177	614,460	672,604	900,784	9.9
TOTAL	892,791	996,058	1,169,365	1,074,155	1,117,360	1,504,897	11.0

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	2.39	2.46	2.84	2.79	2.20	3.26	6.5

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 : LAMPUNG

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AAGR (%) AREA	AAGR (%) PRODUCTION
LAMPUNG TENGAH	77,892	33,283	0	17.9

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : LAMPUNG

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
LAMPUNG TENGAH	1,476,000	1,745,433	84.6	0	1984

Notes :

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

1.2.4 Other Economic Activities

Notable economic activities excluding agriculture in Kabupaten Lampung Tengah are manufacturing industries such as the food and funiture industries. However, these industries are still small scale and production is tending to decline as can be seen from the following figures.

	1980	1984	AAGR (%)
Manufacturing production (ton)	497,290	436,109	- 3.2

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

The other sectors in the Kabupaten are industries having just enough production volume to supply the consumption of the Kabupaten itself.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Lampung Tengah there is one national road called the "Trans Sumatra Highway" which runs across the Kabupaten from south to northwest starting from Tanjung Karang, the provincial capital. Crossing this national road at Gunung Sugih there is a provincial road which runs across the Kabupaten from east to west, that is the route between Sukadana and Negri Kepayungan. Another provincial road which passes through the Kabupaten capital Metro, runs parallel with the said provincial road.

Apart from the above, several provincial roads which run from south to north form road networks linking with the above national and provincial roads in a "ladder pattern". There is also a provincial road which leads to Gunung Batin Udik from Terbanggi Besar, its junction with the said national road.

Therefore, the Kabupaten road networks have been developed in conjunction with the above national and provincial roads mainly east of the national road around Metro City and also northeast of Metro City. This indicates that these are flat areas which have been developed for some time.

South and north along the national road are judged as important areas for development of Kabupaten roads in collaboration with the Sumatra Railway which runs parallel with the national road. The Kabupaten roads in the north and the east coastal area are obliged to remain less advanced because these areas are mostly covered by low swamp. Therefore improvement is expected of other sectors of the infra-structure such as river improvement as one of the transportation systems in the area.

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 Lampung Tengah are confirmed as 176 links and 1,231 Km respectively. 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 1.46 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, there is yet scope for improvement in density of Kabupaten roads.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Lampung Tengah	1,231	840,890	1.46
Province : Lampung	1,231	840,890	1.46
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 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 : LAMPUNG KAB : LAMPUNG TENGAH

(Km)

NO	BIB	TNH	KRK	L.L	ASP	TOTAL
LINK 1	6					6
LINK 2		4				4
LINK 3		5				5
LINK 4		4				4
LINK 5	3					3
LINK 6		8				8
LINK 7	2	5				7
LINK 8						
LINK 9						
LINK 10						
LINK 11						
LINK 12			8			8
LINK 13	3					3
LINK 14						
LINK 15			15			15
LINK 16				17		17
LINK 17	1				14	15
LINK 18					17	17
LINK 19					13	13
LINK 20	2		6			8
LINK 21					10	10
LINK 22					9	9
LINK 23					9	9
LINK 24	1				11	12
LINK 25	12	2				14
LINK 26				12		12
LINK 27				9		9
LINK 28	6					6
LINK 29			6			6
LINK 30			7			7
LINK 31			7			7
LINK 32			6			6
LINK 33			3			3
LINK 34	9					9
LINK 35	2		2			4
LINK 36	3	4	2			9
LINK 37	4					4
LINK 38			17			17
LINK 39			4			4
LINK 40	6					6
LINK 41			8			8
LINK 42			3			3
LINK 43			7			7
LINK 44			7	3		10
LINK 45			4			4
LINK 46				7		7
LINK 47	8					8
LINK 48			7			7
LINK 49			9			9
LINK 50						
LINK 51			10			10
LINK 52						
LINK 53				7		7

(Km)

NO	BIB	TNH	KRK	L.L	ASP	TOTAL
LINK 54	1			3		4
LINK 55		3	7			10
LINK 56				13		13
LINK 57		2		8		10
LINK 58	9				7	16
LINK 59	2		5			7
LINK 60	6					6
LINK 61	4					4
LINK 62		13		2		15
LINK 63					6	6
LINK 64	9					9
LINK 65	2	7				9
LINK 66				9		9
LINK 67				9		9
LINK 68						
LINK 69	8					8
LINK 70		4		2		6
LINK 71			20			20
LINK 72	2	4				6
LINK 73	5	6				11
LINK 74				7		7
LINK 75		4	5			9
LINK 76	6					6
LINK 77	4	4				8
LINK 78		7		4		11
LINK 79				20		20
LINK 80	3	5				8
LINK 81						
LINK 82						
LINK 83						
LINK 84	17					17
LINK 85				6		6
LINK 86					12	12
LINK 87		10	10			20
LINK 88				12		12
LINK 89	6	11		1		18
LINK 90						
LINK 91						
LINK 92		3		10		13
LINK 93		20				20
LINK 94						
LINK 95						
LINK 96				12		12
LINK 97						
LINK 98				6		6
LINK 99	12					12
LINK 100	30					30
LINK 101						
LINK 102	10	2				12
LINK 103	25					25
LINK 104		7				7
LINK 105						
LINK 106	4					4

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

PROV : KALIMANTAN TENGAH KAB : KOTA WARINGIN TIMUR

(Km)

I02 (7)	KRK	BTB	TNH	TOTAL
LINK 1	12			12
LINK 2		2	1	3
LINK 3			65	65
LINK 4			71	71
LINK 5			18	18
LINK 6			9	9
LINK 7			25	25
LINK 8			5	5
LINK 9		40		40
LINK 10			10	10
LINK 11	10			10
LINK 12	45			45
LINK 13	7			7
LINK 14	10			10
LINK 15	14			14
TOTAL	98	42	204	344
RATIO	28	12	59	(%)

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 : Lampung Tengah	14.9	48.7	36.4
Province : Lampung	14.9	48.7	36.4
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 much lower than either that of Indonesia or of Jawa Island. The proportion of low grade roads such as earth roads and others is still high. This means that the classification in the Kabupaten road has not improved much.

(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 : Lampung Tengah	46.8	33.9	18.9	0.2
Province : Lampung	46.8	33.9	18.9	0.2
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 : LAMPUNG

KABUPATEN : LAMPUNG TENGAH

(1)

	BTB				TNH				KRK				L.T				ASP			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 1		85	15																	
LINK 2						43	43	15												
LINK 3						76	24													
LINK 4						79	21													
LINK 5	80	10	10																	
LINK 6						77	23													
LINK 7	85	8	8		70	17	13													
LINK 8																				
LINK 9																				
LINK 10																				
LINK 11																				
LINK 12										59	41									
LINK 13		70	30																	
LINK 14																				
LINK 15										65	35									
LINK 16													74	14	13					
LINK 17	60	30	10														59	24	17	
LINK 18																	77	12	10	
LINK 19																	84	16		
LINK 20		55	45						12	67	22									
LINK 21																	71	15	15	
LINK 22																	66	27	8	
LINK 23																	39	46	15	
LINK 24	75	15	10														78	12	10	
LINK 25		77	23			75	25													
LINK 26																				
LINK 27													69	18	13					
LINK 28		83	18										65	19	16					
LINK 29										78	23									
LINK 30									14	49	37									
LINK 31									9	66	28									
LINK 32										75	25									
LINK 33									17	60	23									
LINK 34	23	65	12																	
LINK 35		65	35							35	65									
LINK 36		80	20			85	15			68	33									
LINK 37	33	56	14																	
LINK 38									19	54	26									
LINK 39										48	52									
LINK 40	45	48	7																	
LINK 41									29	50	21									
LINK 42									53	47										
LINK 43									3	56	41									
LINK 44										75	25			77	23					
LINK 45										84	16									
LINK 46													69	20	11					
LINK 47		75	25																	
LINK 48										50	50									
LINK 49										59	41									
LINK 50																				
LINK 51									9	55	36									
LINK 52																				
LINK 53													72	15	13					
LINK 54	70	15	15										53	32	10	5				
LINK 55						50	50			63	36									
LINK 56													68	17	15					
LINK 57					75	15	10						69	14	16					
LINK 58		83	17														46	31	23	
LINK 59		73	28							76	24									
LINK 60	73	15	12																	
LINK 61		73	28																	
LINK 62					75	14	12						80	10	10					
LINK 63																	78	13	9	
LINK 64	73	15	12																	
LINK 65	75	13	13		71	15	14													
LINK 66													68	18	14					
LINK 67													72	15	13					
LINK 68																				
LINK 69	67	18	15																	
LINK 70						33	68							40	60					
LINK 71									75	13	13									
LINK 72	78	13	10		78	14	9													
LINK 73	75	11	14		69	18	13													
LINK 74													71	16	12					
LINK 75					69	14	18		73	14	13									

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

PROVINCE : LAMPUNG

KABUPATEN : LAMPUNG TENGAH

(1)

I02	BIB				TNH				KRK				L.L				ASP			
I02	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 76	77	13	11																	
LINK 77	71	18	11		68	15	18													
LINK 78					69	14	16						76	13	11					
LINK 79													65	19	17					
LINK 80	77	13	10		70	16	12	2												
LINK 81																				
LINK 82																				
LINK 83																				
LINK 84	73	18	9																	
LINK 85													76	13	12					
LINK 86																	36	12	12	
LINK 87						63	37			79	21									
LINK 88													74	13	13					
LINK 89	73	13	14		74	12	14						80	10	10					
LINK 90																				
LINK 91																				
LINK 92					37	17	33	13					88	6	6					
LINK 93						58	42													
LINK 94																				
LINK 95																				
LINK 96													73	16	11					
LINK 97																				
LINK 98													82	9	9					
LINK 99	69	14	18																	
LINK 100		75	25																	
LINK 101																				
LINK 102	74	15	12		65	20	15													
LINK 103	77	12	10																	
LINK 104						66	34													
LINK 105																				
LINK 106		68	33																	
LINK 107					76	14	10													
LINK 108																				
LINK 109																				
LINK 110					75	11	14													
LINK 111		71	29																	
LINK 112	7	59	34																	
LINK 113		82	18																	
LINK 114					68	14	19													
LINK 115					72	13	15													
LINK 116	74	13	13																	
LINK 117																				
LINK 118					73	13	15						73	18	10					
LINK 119					80	10	10													
LINK 120	77	14	9																	
LINK 121																				
LINK 122		79	21			73	27											80	20	
LINK 123						67	33													
LINK 124										80	20									
LINK 125						58	42										70	30		
LINK 126																	27	13	10	
LINK 127																				
LINK 128	78	13	9																	
LINK 129																				
LINK 130		68	33																	
LINK 131																				
LINK 132	75	12	13																	
LINK 133	77	13	11		74	14	12													
LINK 134													71	14	15					
LINK 135																				
LINK 136																				
LINK 137																				
LINK 138					77	13	10													
LINK 139																				
LINK 140																				
LINK 141																				
LINK 142	77	12	12		75	13	13													
LINK 143																				
LINK 144	78	13	9																	
LINK 145	70	16	14																	

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

PROVINCE : LAMPUNG

KABUPATEN : LAMPUNG TENGAH

(Km)

102	77	DIB				PAV				KRK				L.L				ASP			
102	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RD	BA	SD	RU	RB
LINK 146																				
LINK 147																				
LINK 148																				
LINK 149													70	15	15		70	10	20	
LINK 150																				
LINK 151						60	40										80	10	10	
LINK 152																				
LINK 153																				
LINK 154					73	13	13										80	10	10	
LINK 155					70	15	15										70	13	18	
LINK 156																	65	22	13	
LINK 157	76	14	9																	
LINK 158					68	20	13													
LINK 159	75	14	11																	
LINK 160	70	15	15		68	23	10													
LINK 161	71	14	14																	
LINK 162	73	13	15						73	15	13									
LINK 163	65	18	17		75	13	13													
LINK 164	73	14	14		75	10	15													
LINK 165	73	13	13		72	16	12													
LINK 166		77	23			70	23													
LINK 167	73	13	14														74	15	11	
LINK 168	85	8	7		73	17	10													
LINK 169		77	23														73	13	13	
LINK 170	75	10	15		75	13	13													
LINK 171																				
LINK 172					33	37	23	7	6	73	21									
LINK 173																	59	27	14	
LINK 174		80	20																	
LINK 175									20	62	18									
LINK 176									1	47	53									
AVERAGE	47	36	17	0	47	32	21	1	14	57	29	0	66	19	15	0	66	21	12	0
LENGTH		383 Km				260 Km				217 Km				188 Km				183 Km		
(Km)	180	138	65	0	122	83	55	3	30	124	63	0	124	36	28	0	121	38	22	0

The surface condition level of the Kabupaten roads in the Kabupaten is the same as or surpasses that of Indonesia and of Jawa Island. The proportion in good condition is relatively high.

Therefore, it seems that road maintenance in the Kabupaten is practiced diligently.

(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 97.0% flat, and 3% swampy. There are no hilly or mountainous areas in the Kabupaten so that road construction is anticipated to be easy.

1.3.3 Bridge Inventory

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

The bridge 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 1-3-4 and Table 1-3-5 indicates a total of 148 bridges with a total length of 1,455 m of which 11 or 7.4% are timber, 71 or 47.9% are concrete and 64 or 43.2% are others. Steel bridges account for only 2 or 1.3% of the total. On the other hand, 14 bridges with a total length of 231 m are required to be newly constructed.

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(Km)

102 (3)	DT	RW	BK	TOTAL
LINK 1	6			6
LINK 2	4			4
LINK 3	5			5
LINK 4	4			4
LINK 5	3			3
LINK 6	8			8
LINK 7	7			7
LINK 8				
LINK 9				
LINK 10				
LINK 11				
LINK 12	5	3		8
LINK 13	2	1		3
LINK 14				
LINK 15	15			15
LINK 16	17			17
LINK 17	15			15
LINK 18	17			17
LINK 19	13			13
LINK 20	7	1		8
LINK 21	10			10
LINK 22	9			9
LINK 23	7	2		9
LINK 24	12			12
LINK 25	14			14
LINK 26	12			12
LINK 27	9			9
LINK 28	6			6
LINK 29	6			6
LINK 30	7			7
LINK 31	5	2		7
LINK 32	6			6
LINK 33	3			3
LINK 34	9			9
LINK 35	4			4
LINK 36	7	2		9
LINK 37	2	2		4
LINK 38	16		1	17
LINK 39	4			4
LINK 40	6			6
LINK 41	8			8
LINK 42	3			3
LINK 43	7			7
LINK 44	10			10
LINK 45	4			4
LINK 46	7			7
LINK 47	8			8
LINK 48	6	1		7
LINK 49	9			9
LINK 50				

(Km)

102 (3)	DT	RW	BK	TOTAL
LINK 51	7	3		10
LINK 52	1			1
LINK 53	7			7
LINK 54	4			4
LINK 55	10			10
LINK 56	13			13
LINK 57	10			10
LINK 58	13	3		16
LINK 59	7			7
LINK 60	6			6
LINK 61	4			4
LINK 62	15			15
LINK 63	6			6
LINK 64	9			9
LINK 65	9			9
LINK 66	9			9
LINK 67	9			9
LINK 68				
LINK 69	8			8
LINK 70	4	2		6
LINK 71	20			20
LINK 72	6			6
LINK 73	11			11
LINK 74	7			7
LINK 75	9			9
LINK 76	6			6
LINK 77	8			8
LINK 78	11			11
LINK 79	20			20
LINK 80	8			8
LINK 81				
LINK 82				
LINK 83				
LINK 84	17			17
LINK 85	6			6
LINK 86	12			12
LINK 87	20			20
LINK 88	12			12
LINK 89	18			18
LINK 90				
LINK 91				
LINK 92	13			13
LINK 93	16	4		20
LINK 94				
LINK 95				
LINK 96	12			12
LINK 97				
LINK 98	6			6
LINK 99	12			12
LINK 100	29		1	30

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(Km)

102 (3)	DT	RW	BK	TOTAL
LINK 101				
LINK 102	12			12
LINK 103	25			25
LINK 104	7			7
LINK 105				
LINK 106	4			4
LINK 107	6			6
LINK 108				
LINK 109				
LINK 110	5			5
LINK 111	5	2		7
LINK 112	6			6
LINK 113	3			3
LINK 114	4			4
LINK 115	5			5
LINK 116	7			7
LINK 117				
LINK 118	8			8
LINK 119	15			15
LINK 120	7			7
LINK 121				
LINK 122	70			70
LINK 123	5	1		6
LINK 124	3			3
LINK 125	4	2		6
LINK 126	3			3
LINK 127				
LINK 128	3			3
LINK 129				
LINK 130	4			4
LINK 131				
LINK 132	9			9
LINK 133	15			15
LINK 134	4			4
LINK 135				
LINK 136				
LINK 137				
LINK 138	3			3
LINK 139				

(Km)

102 (3)	DT	RW	BK	TOTAL
LINK 140				
LINK 141				
LINK 142	5			5
LINK 143				
LINK 144	9			9
LINK 145	5			5
LINK 146				
LINK 147				
LINK 148				
LINK 149	3			3
LINK 150				
LINK 151	3			3
LINK 152				
LINK 153				
LINK 154	4			4
LINK 155	4			4
LINK 156	8	3		11
LINK 157	8			8
LINK 158	4			4
LINK 159	4			4
LINK 160	4			4
LINK 161	8			8
LINK 162	4			4
LINK 163	5			5
LINK 164	11			11
LINK 165	8			8
LINK 166	8			8
LINK 167	10			10
LINK 168	6			6
LINK 169	6			6
LINK 170	4			4
LINK 171				
LINK 172	10			10
LINK 173	11			11
LINK 174	8			8
LINK 175	17			17
LINK 176	3			3
TOTAL	1195	34	2	1231
RATIO	97	3	0	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SUMATERA SELATAN KAB : BELITUNG

<<<< BRIDGE >>>> (UNIT: m)

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	4	107.00			4	107.00
3	6	111.00			6	111.00
4	6	51.50			6	51.50
5	6	59.80			6	59.80
6	1	10.00	3	542.00	4	552.00
7	2	25.00			2	25.00
8	1	10.00	3	20.00	4	30.00
9	3	14.00			3	14.00
10	2	8.00			2	8.00
11	2	8.00			2	8.00
12	3	31.70			3	31.70
13	6	58.50			6	58.50
14	10	158.00			10	158.00
15			1	7.00	1	7.00
16	1	5.00			1	5.00
17	11	51.60			11	51.60
19	3	10.00	1	3.00	4	13.00
20	4	17.50			4	17.50
22	2	8.00			2	8.00
23	1	3.00			1	3.00
24	3	12.00	6	24.00	9	36.00
25	3	22.00			3	22.00
26	1	7.00			1	7.00
27	2	8.00	1	20.00	3	28.00
28			3	14.00	3	14.00
29			7	30.00	7	30.00
30	2	12.00			2	12.00
35			6	26.00	6	26.00
TOTAL	85	808.60	31	686.00	116	1494.60

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

PROV : SUMATERA SELATAN KAB : BELITUNG

(No)

103 (18)	BT	LL	KY	BJ	TOTAL
LINK 1	3	1			4
LINK 3	3		3		6
LINK 4	4	1		1	6
LINK 5	1		3	2	6
LINK 6	1				1
LINK 7	2				2
LINK 8			1		1
LINK 9			3		3
LINK 10		1	1		2
LINK 11		2			2
LINK 12			3		3
LINK 13	1	1	4		6
LINK 14			10		10
LINK 15					
LINK 16			1		1
LINK 17	10		1		11
LINK 19	2		1		3
LINK 20	2		2		4
LINK 22	1		1		2
LINK 23		1			1
LINK 24			3		3
LINK 25			3		3
LINK 26			1		1
LINK 27	2				2
LINK 28					
LINK 29					
LINK 30			2		2
LINK 35					
TOTAL	32	7	43	3	85
RATIO	38	8	51	4	(%)

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

Bridge Type	Span Length (m)										
	〈3	〈5	〈8	〈10	〈12	〈14	〈16	〈18	〈20	〈99	Total
Timber	1	8	1	-	1	-	-	-	-	-	11
Concrete	2	9	31	17	7	3	2	-	-	-	71
Steel	-	-	-	1	1	-	-	-	-	-	2
Others	1	5	31	9	9	8	-	-	-	1	64
Total	4	22	62	27	18	11	2	-	-	1	148

There are many different types of bridge with different spanlengths in the Kabupaten except for steel bridge. The majority of spanlengths is within the range of 5 m to 8 m.

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Belitung 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	62	2	57	347	300
Proportion (%)	13.25	0.43	12.17	74.15	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	0.88	6.09	93.03	-	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 : LAMPUNG KAB : LAMPUNG TENGAH

A)	Growth Rate of Population	:	0.80 (%)
B)	Growth Rate of Cultivated Area	:	7.00 (%)
C)	Growth Rate of Rice field	:	6.00 (%)
D)	Growth Rate of Rice yield rate	:	6.50 (%)
E)	Growth Rate of GDP / capita	:	3.00 (%)
a)	Geometrical Mean (A x B)	:	3.85 (%)
b)	Geometrical Mean (C x D)	:	6.25 (%)
c)	Geometrical Mean (a x b)	:	5.04 (%)
d)	Geometrical Mean (c x E)	:	4.02 (%)
	TRAFFIC GROWTH RATE	:	4.02 (%)

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 : LAMPUNG KAB : LAMPUNG TENGAH

< SPD : 1/2 >

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	10	0	6	70	51	4.0%	17	0	10	117	85	IIIB-2
2	0	0	0	20	10	4.0%	0	0	0	33	17	IIIC
3	0	0	0	40	20	4.0%	0	0	0	67	33	IIIC
4	0	0	0	40	20	4.0%	0	0	0	67	33	IIIC
5	0	0	6	115	64	4.0%	0	0	10	192	107	IIIB-2
6	0	0	0	60	30	4.0%	0	0	0	100	50	IIIB-2
7	10	0	20	150	105	4.0%	17	0	33	250	175	IIIB-2
8	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
9	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
10	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
11	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
12	0	0	4	60	34	4.0%	0	0	7	100	57	IIIB-2
13	0	0	0	40	20	4.0%	0	0	0	67	33	IIIC
14	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
15	15	0	6	60	51	4.0%	25	0	10	100	85	IIIB-2
16	75	0	10	350	260	4.0%	125	0	17	584	434	IIIB-1
17	10	0	10	80	60	4.0%	17	0	17	134	100	IIIB-2
18	20	0	10	70	65	4.0%	33	0	17	117	109	IIIB-2
19	20	0	10	60	60	4.0%	33	0	17	100	100	IIIB-2
20	0	0	0	30	15	4.0%	0	0	0	50	25	IIIC
21	75	0	20	300	245	4.0%	125	0	33	501	409	IIIB-1
22	10	0	6	50	41	4.0%	17	0	10	83	68	IIIB-2
23	0	0	6	70	41	4.0%	0	0	10	117	68	IIIB-2
24	15	0	5	100	70	4.0%	25	0	8	167	117	IIIB-2
25	20	0	10	60	60	4.0%	33	0	17	100	100	IIIB-2
26	10	0	20	150	105	4.0%	17	0	33	250	175	IIIB-2
27	15	0	5	150	95	4.0%	25	0	8	250	159	IIIB-2
28	10	0	6	50	41	4.0%	17	0	10	83	68	IIIB-2
29	60	20	20	200	200	4.0%	100	33	33	334	334	IIIB-1
30	0	0	5	60	35	4.0%	0	0	8	100	58	IIIB-2
31	15	0	15	60	60	4.0%	25	0	25	100	100	IIIB-2
32	20	0	10	70	65	4.0%	33	0	17	117	109	IIIB-2
33	0	0	0	30	15	4.0%	0	0	0	50	25	IIIC
34	10	0	4	70	49	4.0%	17	0	7	117	82	IIIB-2
35	0	0	0	10	5	4.0%	0	0	0	17	8	IIIC
36	0	0	4	40	24	4.0%	0	0	7	67	40	IIIC
37	0	0	2	40	22	4.0%	0	0	3	67	37	IIIC
38	10	0	5	60	45	4.0%	17	0	8	100	75	IIIB-2
39	0	0	0	30	15	4.0%	0	0	0	50	25	IIIC
40	5	0	6	60	41	4.0%	8	0	10	100	68	IIIB-2
41	0	0	0	30	15	4.0%	0	0	0	50	25	IIIC
42	2	0	4	40	26	4.0%	3	0	7	67	43	IIIC
43	20	0	10	70	65	4.0%	33	0	17	117	109	IIIB-2
44	6	0	6	60	42	4.0%	10	0	10	100	70	IIIB-2
45	0	0	4	40	24	4.0%	0	0	7	67	40	IIIC
46	15	0	5	200	120	4.0%	25	0	9	334	200	IIIB-1
47	20	0	10	60	60	4.0%	33	0	17	100	100	IIIB-2
48	20	0	5	70	60	4.0%	33	0	8	117	100	IIIB-2
49	0	0	6	60	36	4.0%	0	0	10	100	60	IIIB-2
50	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	0	0	0	60	30	4.0%	0	0	0	100	50	IIIB-2
52	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
53	4	0	1	50	30	4.0%	7	0	2	83	50	IIIB-2
54	5	0	1	100	56	4.0%	8	0	2	167	93	IIIB-2
55	10	0	5	60	45	4.0%	17	0	8	100	75	IIIB-2
56	5	0	1	100	56	4.0%	8	0	2	167	93	IIIB-2
57	5	0	10	75	53	4.0%	8	0	17	125	88	IIIB-2
58	6	0	2	70	43	4.0%	10	0	3	117	72	IIIB-2
59	15	0	5	60	50	4.0%	25	0	8	100	83	IIIB-2
60	15	0	5	200	120	4.0%	25	0	8	334	200	IIIB-1
61	10	0	4	30	29	4.0%	17	0	7	50	48	IIIC
62	0	0	0	25	13	4.0%	0	0	0	42	22	IIIC
63	50	5	25	150	155	4.0%	83	8	42	250	259	IIIB-1
64	5	0	1	100	56	4.0%	8	0	2	167	93	IIIB-2
65	5	0	2	50	32	4.0%	8	0	3	83	53	IIIB-2
66	5	0	2	125	70	4.0%	8	0	3	209	117	IIIB-2
67	40	0	25	300	215	4.0%	67	0	42	501	359	IIIB-1
68	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
69	2	0	2	75	42	4.0%	3	0	3	125	70	IIIB-2
70	0	0	0	40	20	4.0%	0	0	0	67	33	IIIC
71	25	0	10	100	85	4.0%	42	0	17	167	142	IIIB-2
72	10	0	5	150	90	4.0%	17	0	8	250	150	IIIB-2
73	10	0	5	100	65	4.0%	17	0	8	167	109	IIIB-2
74	10	0	2	100	62	4.0%	17	0	3	167	103	IIIB-2
75	10	0	5	100	65	4.0%	17	0	8	167	109	IIIB-2
76	15	0	5	125	83	4.0%	25	0	8	209	139	IIIB-2
77	10	0	4	100	64	4.0%	17	0	7	167	107	IIIB-2
78	5	0	2	125	70	4.0%	8	0	3	209	117	IIIB-2
79	5	0	5	125	73	4.0%	8	0	8	209	122	IIIB-2
80	5	0	10	100	65	4.0%	8	0	17	167	109	IIIB-2
81	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
82	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
83	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
84	15	0	5	150	95	4.0%	25	0	8	250	159	IIIB-2
85	15	0	10	70	60	4.0%	25	0	17	117	100	IIIB-2
86	35	0	10	250	170	4.0%	58	0	17	417	284	IIIB-1
87	5	0	4	50	34	4.0%	8	0	7	83	57	IIIB-2
88	15	0	5	250	145	4.0%	25	0	8	417	242	IIIB-1
89	20	0	10	75	68	4.0%	33	0	17	125	114	IIIB-2
90	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
91	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
92	5	0	10	100	65	4.0%	8	0	17	167	109	IIIB-2
93	0	0	4	60	34	4.0%	0	0	7	100	57	IIIB-2
94	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
95	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
96	10	0	10	50	45	4.0%	17	0	17	83	75	IIIB-2
97	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
98	5	0	2	100	57	4.0%	8	0	3	167	95	IIIB-2
99	10	0	5	100	65	4.0%	17	0	8	167	109	IIIB-2
100	10	0	6	70	51	4.0%	17	0	10	117	85	IIIB-2

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
101	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
102	5	0	10	50	40	4.0%	8	0	17	83	67	IIIB-2
103	50	0	25	200	175	4.0%	83	0	42	334	292	IIIB-1
104	0	0	5	60	35	4.0%	0	0	8	100	58	IIIB-2
105	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
106	10	0	5	50	40	4.0%	17	0	8	83	67	IIIB-2
107	10	0	5	75	53	4.0%	17	0	8	125	88	IIIB-2
108	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
109	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
110	10	0	5	50	40	4.0%	17	0	8	83	67	IIIB-2
111	15	0	5	70	55	4.0%	25	0	8	117	92	IIIB-2
112	8	0	6	60	44	4.0%	13	0	10	100	73	IIIB-2
113	6	0	6	60	42	4.0%	10	0	10	100	70	IIIB-2
114	15	0	5	125	83	4.0%	25	0	8	209	139	IIIB-2
115	5	0	2	125	70	4.0%	8	0	3	209	117	IIIB-2
116	10	0	5	150	90	4.0%	17	0	8	250	150	IIIB-2
117	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
118	15	0	5	150	95	4.0%	25	0	8	250	159	IIIB-2
119	5	0	3	100	58	4.0%	8	0	5	167	97	IIIB-2
120	5	0	2	125	70	4.0%	8	0	3	209	117	IIIB-2
121	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
122	100	10	40	500	400	4.0%	167	17	67	835	668	IIIA
123	0	0	4	30	19	4.0%	0	0	7	50	32	IIIC
124	0	0	0	60	30	4.0%	0	0	0	100	50	IIIB-2
125	0	0	2	30	17	4.0%	0	0	3	50	28	IIIC
126	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
127	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
128	0	0	4	75	42	4.0%	0	0	7	125	70	IIIB-2
129	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
130	10	0	5	60	45	4.0%	17	0	8	100	75	IIIB-2
131	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
132	20	0	10	150	105	4.0%	33	0	17	250	175	IIIB-2
133	10	0	5	200	115	4.0%	17	0	8	334	192	IIIB-2
134	15	0	5	150	95	4.0%	25	0	8	250	159	IIIB-2
135	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
136	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
137	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
138	2	0	1	50	28	4.0%	3	0	2	83	47	IIIC
139	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
140	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
141	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
142	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
143	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
144	15	0	15	200	130	4.0%	25	0	25	334	217	IIIB-1
145	10	0	5	100	65	4.0%	17	0	8	167	109	IIIB-2
146	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
147	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
148	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
149	50	0	100	250	275	4.0%	83	0	167	417	459	IIIB-1
150	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC

Table 2-1-2 (4) EXISTING AND FUTURE TRAFFIC VOLUME

PROV : LAMPUNG KAB : LAMPUNG TENGAH

< SPD : 1/2 >

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
151	5	0	3	30	23	4.0%	8	0	5	50	38	IIIC
152	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
153	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
154	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
155	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
156	30	0	10	80	80	4.0%	50	0	17	134	134	IIIB-2
157	10	0	5	150	90	4.0%	17	0	8	250	150	IIIB-2
158	1	0	3	15	12	4.0%	2	0	5	25	20	IIIC
159	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
160	50	0	10	300	210	4.0%	83	0	17	501	351	IIIB-1
161	15	0	10	50	50	4.0%	25	0	17	83	83	IIIB-2
162	50	0	10	10	65	4.0%	83	0	17	17	109	IIIB-2
163	5	0	2	100	57	4.0%	8	0	3	167	95	IIIB-2
164	10	0	5	150	90	4.0%	17	0	8	250	150	IIIB-2
165	50	0	20	300	220	4.0%	83	0	33	501	367	IIIB-1
166	0	0	0	40	20	4.0%	0	0	0	67	33	IIIC
167	50	10	25	200	185	4.0%	83	17	42	334	309	IIIB-1
168	5	0	3	100	58	4.0%	8	0	5	167	97	IIIB-2
169	10	0	6	70	51	4.0%	17	0	10	117	85	IIIB-2
170	20	0	5	300	175	4.0%	33	0	8	501	292	IIIB-1
171	0	0	0	0	0	4.0%	0	0	0	0	0	IIIC
172	10	0	6	50	41	4.0%	17	0	10	83	68	IIIB-2
173	30	0	10	60	70	4.0%	50	0	17	100	117	IIIB-2
174	10	0	5	60	45	4.0%	17	0	8	100	75	IIIB-2
175	5	0	5	40	30	4.0%	8	0	8	67	50	IIIB-2
176	0	0	0	20	10	4.0%	0	0	0	33	17	IIIC
PERCENT	11.19	0.26	5.62	82.94			11.19	0.26	5.62	82.94		

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 (1) FUTURE TRAFFIC VOLUME ESTIMATED BY THE PRODUCER'S SURPLUS

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(1990)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
1	IIIB-2	KRK	36	1	18	264	107
2	IIIB-2	KRK	24	1	12	176	125
3	IIIB-2	KRK	30	1	15	220	156
4	IIIB-1	ASP	66	2	33	488	345
6	IIIA	ASP	246	5	108	1599	1129
12	IIIA	ASP	100	2	50	742	523
13	IIIB-2	KRK	38	1	19	278	197
15	IIIA	ASP	129	3	65	957	676
20	IIIA	ASP	221	5	111	1641	1158
22	IIIA	ASP	174	4	87	1287	909
23	IIIA	ASP	128	3	64	949	670
28	IIIB-1	ASP	73	2	37	539	382
30	IIIB-1	ASP	57	1	28	420	296
33	IIIB-2	KRK	19	0	9	139	98
34	IIIA	ASP	249	6	125	1846	1303
35	IIIB-2	KRK	32	1	16	234	166
36	IIIB-1	ASP	71	2	36	526	372
37	IIIB-1	ASP	50	1	25	371	262
38	IIIA	ASP	105	2	53	779	550
39	IIIB-2	KRK	25	1	12	183	130
40	IIIB-1	ASP	60	1	30	445	314
41	IIIB-1	ASP	64	1	32	472	333
42	IIIB-2	KRK	24	1	12	175	125
44	IIIA	ASP	292	7	146	2161	1526
45	IIIB-1	ASP	67	2	34	496	351
49	IIIA	ASP	98	2	49	728	513
51	IIIA	ASP	124	3	62	922	650
53	IIIA	ASP	101	2	51	746	527
54	IIIA	ASP	117	3	59	864	611
55	IIIB-1	ASP	82	2	41	611	431
56	IIIA	ASP	99	2	50	734	518
57	IIIB-1	ASP	45	1	23	336	237
58	IIIA	ASP	126	3	63	936	660
59	IIIA	ASP	174	4	87	1289	910
61	IIIA	ASP	148	3	74	1098	774
62	IIIA	ASP	162	4	82	1204	850
64	IIIA	ASP	143	3	73	1076	759
65	IIIA	ASP	145	3	73	1076	759
69	IIIA	ASP	113	3	57	837	592
70	IIIB-2	KRK	27	1	14	202	143

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
87	111A	ASP	242	6	121	1791	1265
93	111A	ASP	186	4	93	1375	971
96	111A	ASP	275	6	138	2038	1438
98	111B-2	KRK	27	1	14	202	143
100	111A	ASP	378	9	190	2799	1977
102	111A	ASP	188	4	94	1391	982
104	111B-1	ASP	79	2	39	583	412
106	111A	ASP	148	3	74	1098	774
107	111A	ASP	132	3	66	979	691
110	111A	ASP	134	3	67	998	702
111	111B-1	ASP	88	2	44	653	461
112	111B-1	ASP	76	2	38	560	396
113	111B-2	KRK	38	1	19	282	199
119	111A	ASP	206	5	104	1530	1080
123	111A	ASP	222	5	112	1647	1163
124	111B-2	KRK	13	0	6	93	66
125	111B-1	ASP	93	2	47	689	487
130	111B-1	ASP	88	2	44	653	461
138	111B-1	ASP	48	1	24	359	253
150	111B-1	ASP	55	1	28	408	288
161	111B-1	ASP	63	1	32	465	329
163	111B-2	KRK	21	0	11	156	110
166	111A	ASP	178	4	88	1294	914
168	111B-1	ASP	57	1	29	425	300
169	111A	ASP	210	5	105	1557	1099
172	111B-1	ASP	59	1	30	440	310
174	111A	ASP	101	2	51	746	527
175	111A	ASP	242	6	122	1795	1268
176	111B-1	ASP	83	2	42	618	435

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 : LAMPUNG TENGAH

(1000Rupiah)

	LINK 46	LINK 47	LINK 48	LINK 49	LINK 51	LINK 53	LINK 54	LINK 55	LINK 56	LINK 57
	7 Km	8 Km	7 Km	9 Km	10 Km	7 Km	4 Km	10 Km	13 Km	10 Km
	IIIB-1	IIIB-2	IIIB-2	IIIA	IIIA	IIIA	IIIA	IIIB-1	IIIA	IIIB-1
YEAR	VOC	VOC	VOC	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	4450	4346	4653	28418	37179	11902	9328	32585	23115	11556
1990	4555	4477	4813	30065	39728	12585	9874	34458	24460	12171
1991	4734	4718	4988	31764	42143	13456	10497	36651	26155	12964
1992	5013	4849	5277	34162	44796	14266	11138	38911	27770	13824
1993	5202	5090	5452	36165	47316	15192	11789	41553	29572	14683
1994	5317	5329	5745	38423	50310	16111	12565	44461	31249	15565
1995	5528	5569	5920	40781	53382	17090	13312	46852	33247	16424
1996	5817	5713	6224	43344	56702	18137	14123	49916	35194	17350
1997	6028	5953	6399	45751	60353	19320	15062	53076	37315	18626
1998	6249	6206	6588	48668	63870	20514	16033	55957	39645	19552
SUM	52893	52250	56059	377541	495779	158573	123721	434420	307722	152715
COST	-6485	2311	8178	172452	236417	54913	50809	200206	109823	35291
/Km	-926	289	1168	19161	23642	7845	12702	20021	8448	3529

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		

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

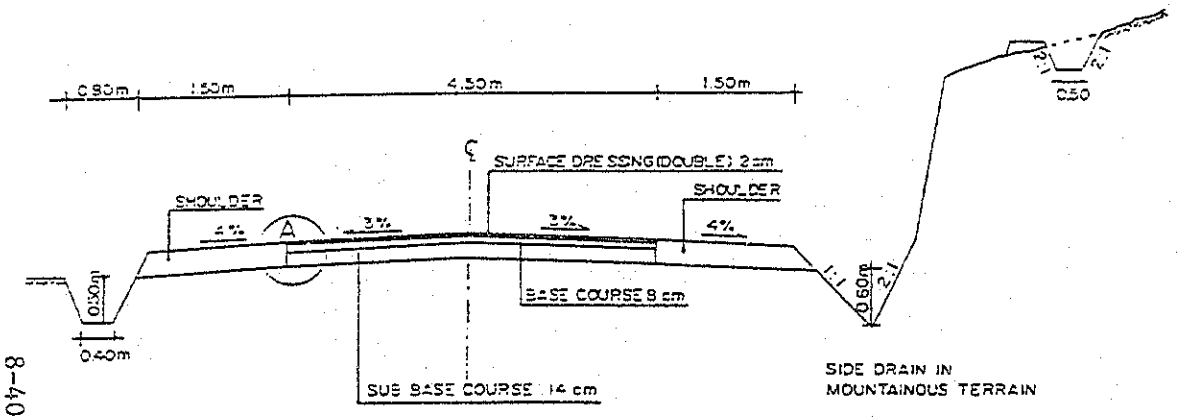
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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.

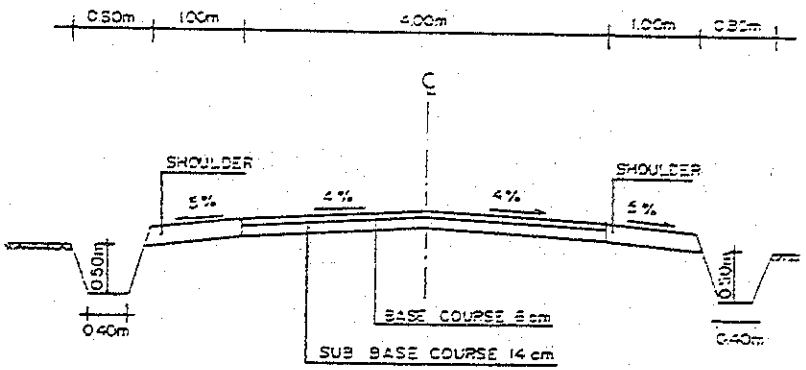
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

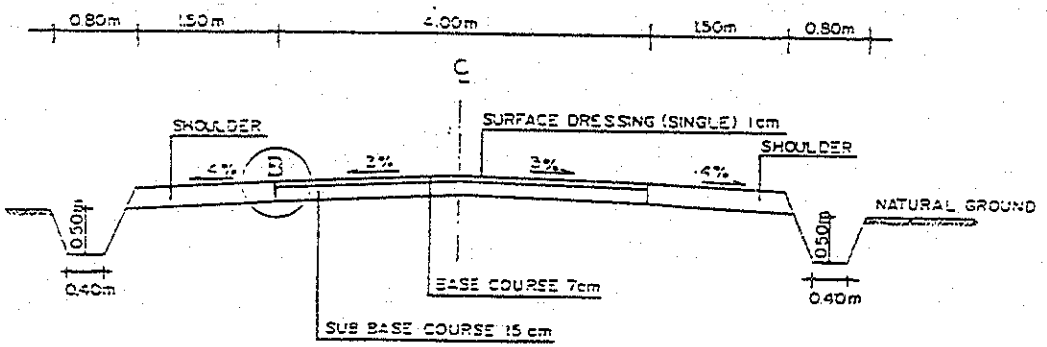
CLASS III A



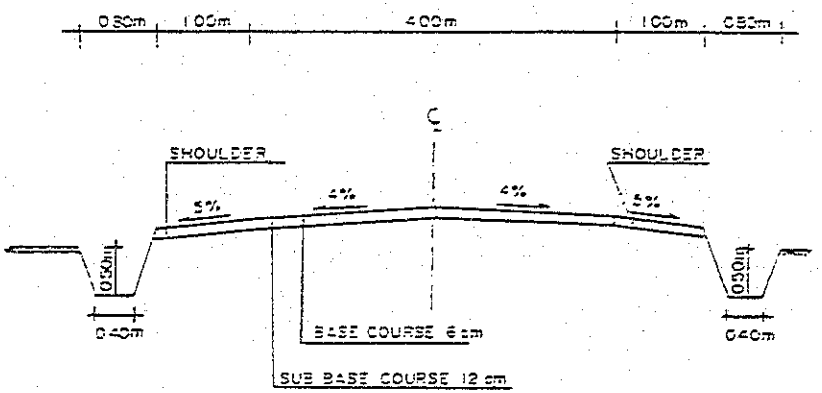
CLASS III B-2



CLASS III B-1



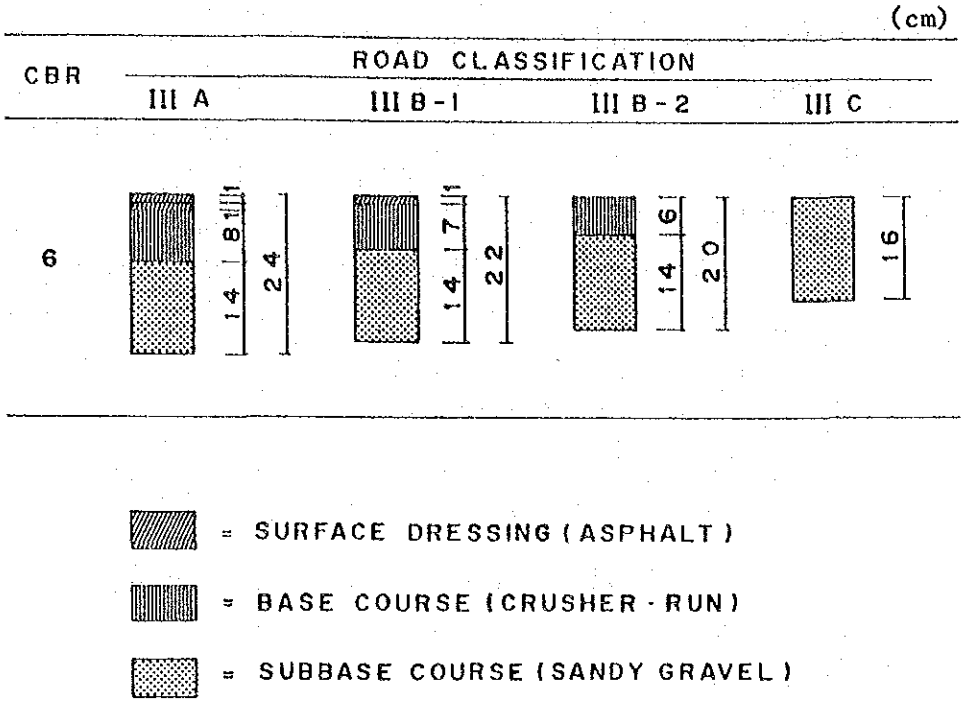
CLASS III C



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

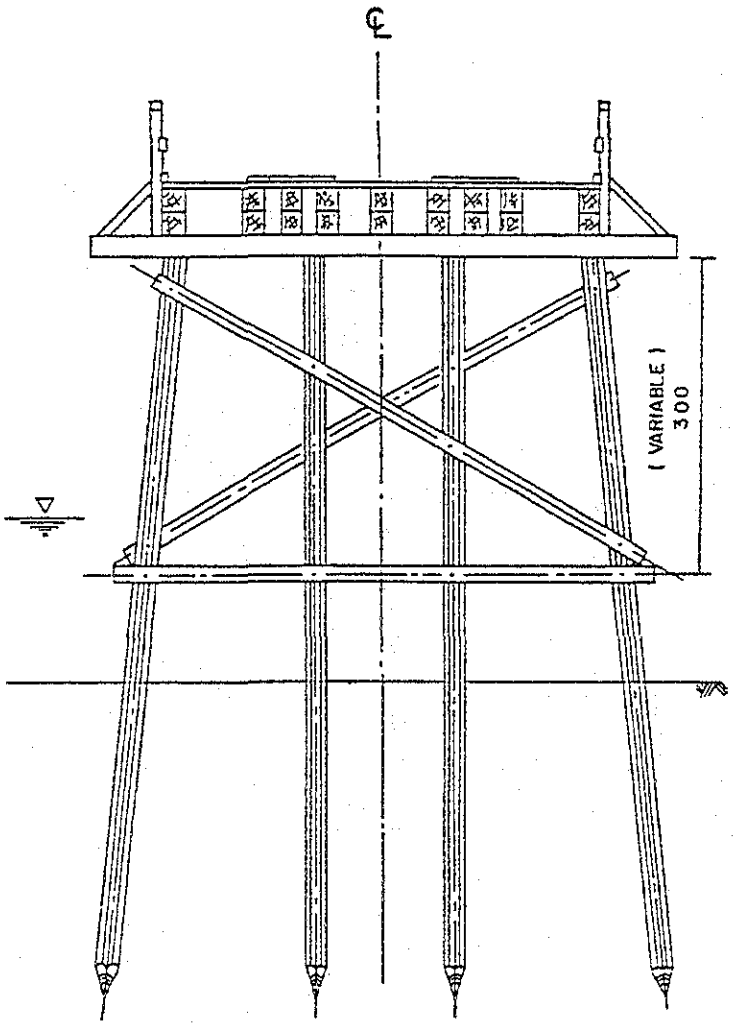
3) Foundation

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.

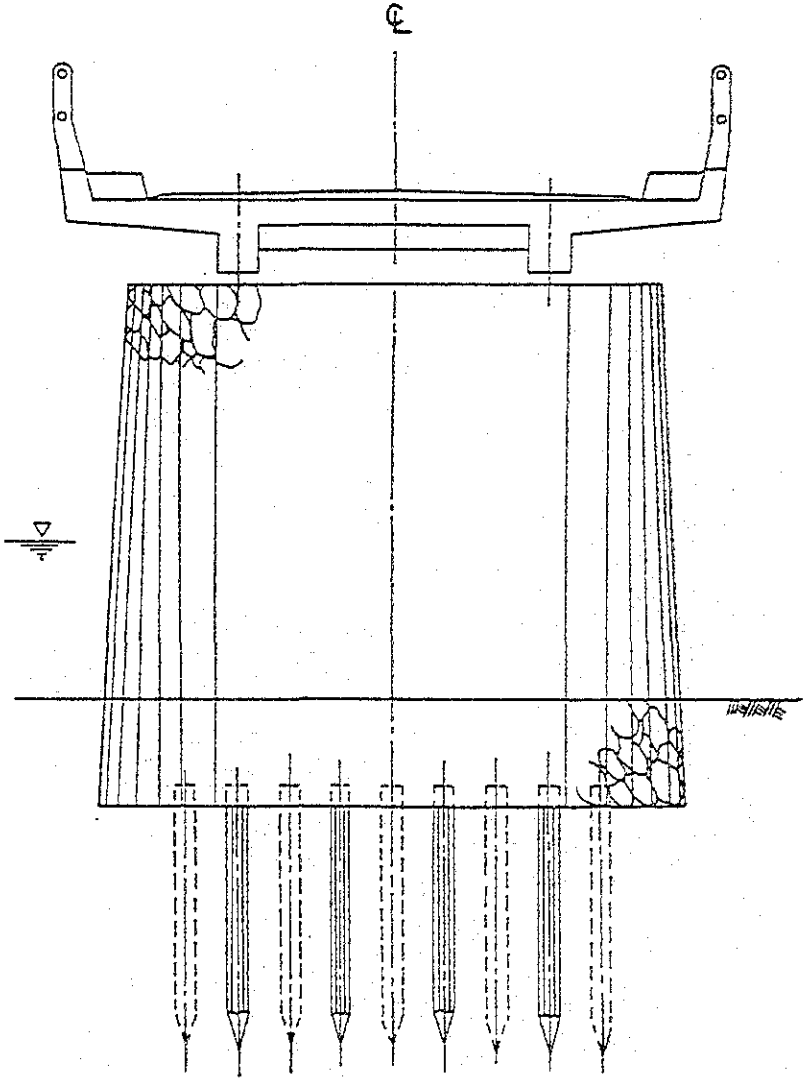
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

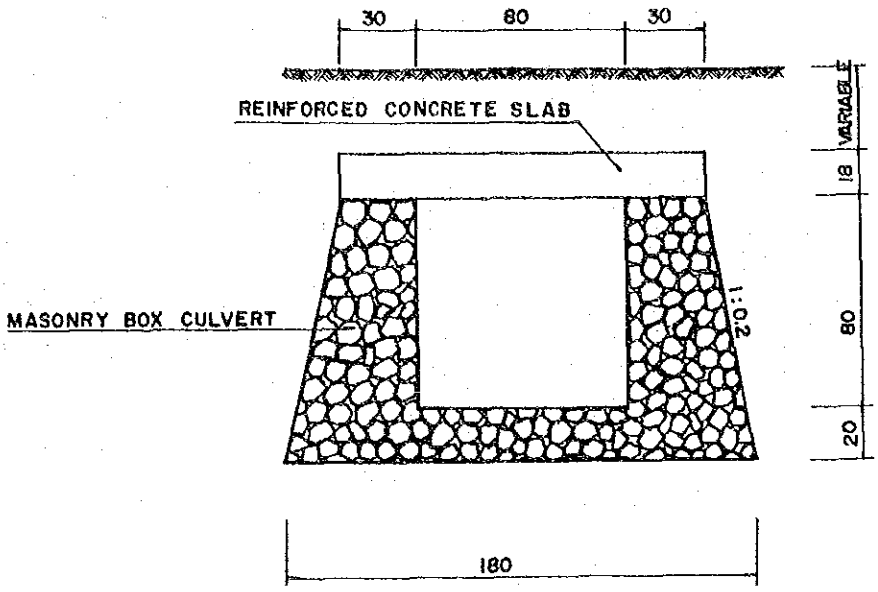
(2) Retaining Wall

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

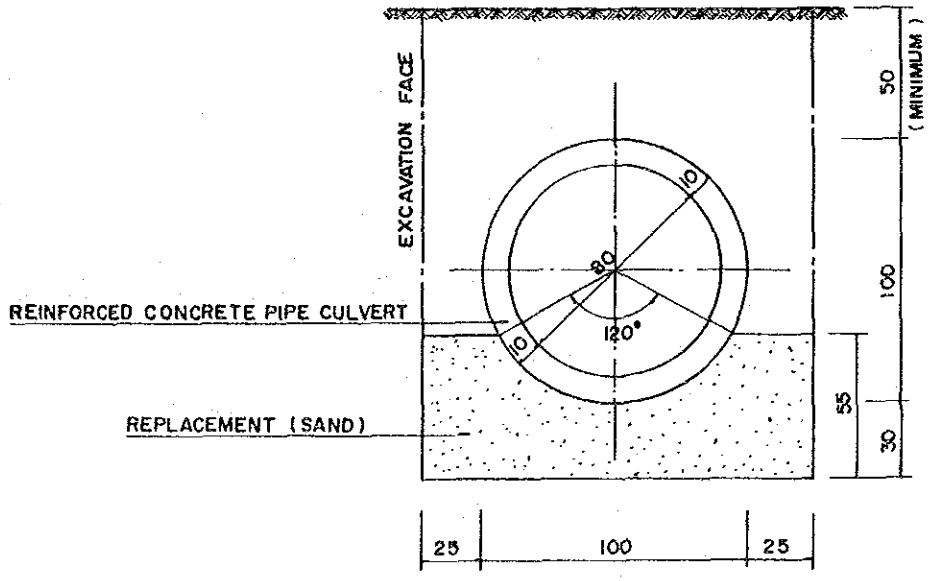
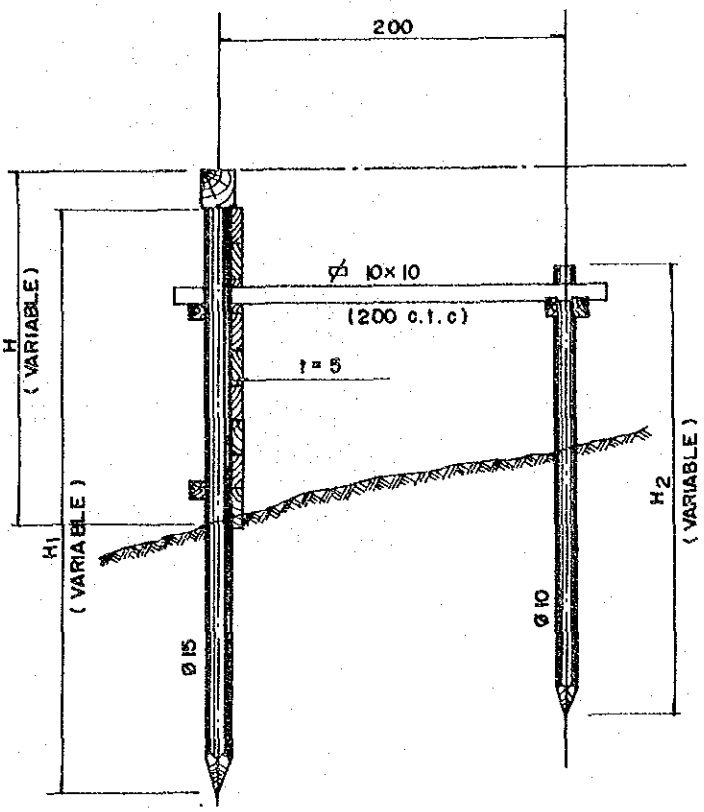
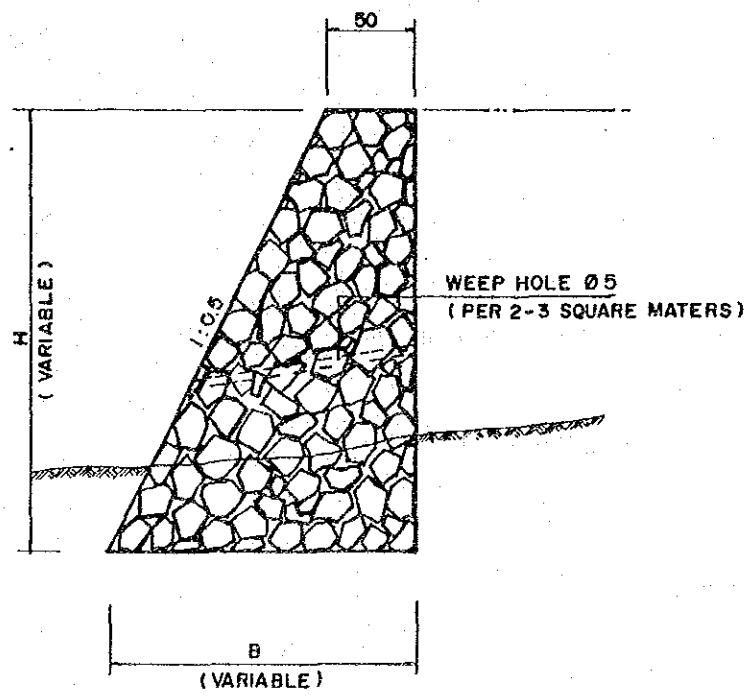


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Lampung Tengah and other Kabupatens in Lampung 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
Lampung Tengah	1,750	1,750	2,250	2,250	1,500	1,600	1,500
Average	1,750	1,750	2,250	2,250	1,500	1,600	1,500

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 Lampung Tengah together with for other Kabupatens in Lampung Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	LAMPUNG TENGAH	AVERAGE
Bitumen	L	300	300
Asphalt	L	800	800
Gasoline	L	250	250
Sand	M^3	5,000	5,000
Cement	bag	4,000	4,000
River Stone	M^3	7,500	7,500
Steel moulds	Set	7,000	7,000
Timber	M^3	120,000	120,000
Paint	L	2,500	2,500
Reinforcing Steel	Kg	1,000	1,000
tying Wire	Kg	7,500	7,500
Equivalent Royalty	M^3	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 : LAMPUNG
KABUPATEN : LAMPUNG TENGAH

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST OWERSHIP	LOCAL COST OPERATION	LOCAL COST SUB-TOTAL	FOREIGN COST OWERSHIP	FOREIGN COST OPERATION	FOREIGN COST SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	78	12,402	12,480	7,769	1,004	8,773	21,253
	Bulldozer/Ripper	120 HP	85	13,393	13,478	8,500	1,545	10,045	23,523
	Swamp Bulldozer	120 HP	89	13,631	13,720	8,879	1,614	10,493	24,213
	Bulldozer	90 HP	50	8,447	8,497	4,914	635	5,549	14,046
	Bulldozer/Ripper	90 HP	53	9,026	9,079	5,300	963	6,263	15,342
	Bulldozer	65 HP	35	6,136	6,171	3,500	452	3,952	10,123
	Bulldozer/Ripper	65 HP	39	6,576	6,615	3,819	694	4,513	11,128
	Swamp Bulldozer	90 HP	53	9,016	9,069	5,284	960	6,244	15,313
	Swamp Bulldozer	65 HP	41	6,442	6,483	4,049	736	4,785	11,268
	Motor Grader	110 HP	70	10,801	10,871	6,919	1,257	8,176	19,047
	Motor Grader	75 HP	48	7,403	7,451	4,779	868	5,647	13,098
	Motor Grader	65 HP	43	6,514	6,557	4,300	781	5,081	11,638
	Road Stabilizer	W=1850 mm	86	3,316	3,402	8,594	416	9,010	12,412
	Vibratory Roller	4 ton	29	3,240	3,269	2,900	374	3,274	6,543
	Hand-guide Vib. Roller	1000 Kg	13	570	583	849	27	876	1,459
	Tire Roller	8-15 ton	32	7,160	7,192	3,106	100	3,206	10,398
	Vibratory Roller (D&T)	4 ton	29	3,240	3,269	2,900	374	3,274	6,543
	Hand-guide Vib. Roller	600 Kg	9	389	398	600	19	619	1,017
	Rough Terrain Crane	10 ton	101	12,592	12,693	10,039	730	10,769	23,462
	Hydraulic Excavator; Wheel	0.3 m3	42	7,583	7,625	4,109	531	4,640	12,265
	Wheel Loader	1.2 m3	71	8,205	8,276	7,019	907	7,926	16,202
	Wheel Loader	0.3 m3	23	2,863	2,886	2,269	293	2,562	5,448
	Water Tank Truck	4000 ltr.	14	2,733	2,747	868	112	980	3,727
	Fuel Tank Truck	4000 ltr.	14	2,739	2,753	882	114	996	3,749
	Dump Truck	3.0 ton	23	3,409	3,432	1,469	190	1,659	5,091
	Flat Bed Truck with Crane	3.0 ton	18	2,991	3,009	1,716	124	1,840	4,849
	Dump Loader Truck	12 ton	39	18,364	18,403	3,838	124	3,962	22,365
	Dump Truck	5.0 ton	33	5,636	5,669	2,189	284	2,473	8,142
	Flat Bed Truck	3.0 ton	6	2,574	2,580	563	40	603	3,183
	Portable Crusher/Screening	30-40 t/h	188	20,951	21,139	18,800	2,430	21,230	42,369
	Concrete Mixer	0.5 m3	81	2,260	2,341	5,400	394	5,794	8,135
	Water Pump	200 l/min	3	250	253	188	6	194	447
	Concrete Vibrator	3.3 HP	2	217	219	73	2	75	294
	Asphalt Sprayer	850 ltr.	16	725	741	1,019	132	1,151	1,892

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 : LAMPUNG KAB : LAMPUNG TENGAH

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	144	90	234
Subgrade Preparation	m2	18	11	29
Normal Fill	m3	1,484	859	2,343
Fill in Swamp	m3	2,208	1,047	3,255
Normal Excavation to Spoil	m3	873	520	1,393
Sub Base Course	m3	2,813	1,340	4,153
Base Course	m3	3,861	2,290	6,151
Shoulder	m2	256	145	401
Asphalt Patching	m2	3,079	1,371	4,450
Surface Dressing (Single)	m2	601	595	1,196
Surface Dressing (Double)	m2	740	935	1,675
Earth Drain	m	721	118	839
Earth Drain in Swamp (by machine)	m3	1,039	472	1,511
Pipe Culvert D80cm	m	38,324	48,854	87,178
Masonry Culvert (80x80cm)	m	51,373	38,938	90,311
Retaining Wall and Wing Wall (Timber)	m2	11,313	245	11,558
Retaining Wall and Wing Wall (Masonry)	m3	36,883	11,442	48,325
Gabion Protection	m3	24,904	120	25,024
Manual routine maintenance of road	Km	116,160	7,236	123,396
Routine maintenance of earth road	Km	83,125	37,824	120,949
Routine maintenance of gravel road	Km	168,711	87,777	256,488
Routine maintenance of asphalt road	Km	307,900	137,100	445,000

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 : LAMPUNG KAB : LAMPUNG TENGAH

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	40,079	3,539	43,618
Superstructure (Timber;Span 5m;10T)	m2	44,394	3,908	48,302
Superstructure (Timber;Span 8m;10T)	m2	58,802	5,134	63,936
Superstructure (Timber;Span 3m;BM50)	m2	49,696	4,376	54,072
Superstructure (Timber;Span 5m;BM50)	m2	54,255	4,742	58,997
Superstructure (Timber;Span 8m;BM50)	m2	68,810	6,003	74,813
Superstructure (Concrete;Span 3m;BM50)	m2	48,185	103,551	151,736
Superstructure (Concrete;Span 5m;BM50)	m2	49,858	115,886	165,744
Superstructure (Concrete;Span 8m;BM50)	m2	51,623	126,328	177,951
Superstructure (Concrete;Span10m;BM50)	m2	56,675	143,635	200,310
Superstructure (Concrete;Span15m;BM50)	m2	61,652	169,392	231,044
Substructure (Pier;for Timber;10T)	NO	349,086	32,844	381,930
Substructure (Abut;for Timber;10T)	NO	945,723	154,108	1,099,831
Substructure (Pier;for Timber;BM50)	NO	513,397	48,605	562,002
Substructure (Abut;for Timber;BM50)	NO	1,069,576	171,273	1,240,849
Substructure (Pier;for Concrete;BM50)	NO	1,524,140	455,692	1,979,832
Substructure (Abut;for Concrete;BM50)	NO	3,131,466	962,632	4,094,098
Demolition of Bridge (Timber->Timber)	m2	11,066	1,371	12,437
Demolition of Bridge (Timber->Concrete)	m2	11,066	1,371	12,437
Demolition of Bridge (Concrete)	m2	74,972	78,195	153,167
Maintenance of Timber Bridge (New)	m2	7,257	1,120	8,377
Maintenance of Concrete Bridge (New)	m2	1,676	2,866	4,542
Maintenance of Timber Bridge (Exist)	m2	6,957	2,400	9,357
Maintenance of Concrete Bridge (Exist)	m2	3,664	2,413	6,077

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 Lampung Tengah are shown in Table 5-1-1.

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

KABUPATEN : LAMPUNG TENGAH

CRITERIA NO	ROAD LINK NO
(6)	122,128,151,154,155,159,160,162,165,170
(8)	08,09,10,11,14,50,52,68,81,82,83,90,91,94,95, 97,101,105,108,109,117,121,127,129,131,135,136, 137,139,140,141,143,146,147,148,150,152,153,171

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 : LAMPUNG KABUPATEN : LAMPUNG TENGAH

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
100	30 Km	IIIA	73.179	Surplus
97	20 Km	IIIA	72.147	Surplus
44	10 Km	IIIA	62.581	Surplus
82	15 Km	IIIA	49.301	Surplus
93	20 Km	IIIA	47.542	Surplus
175	17 Km	IIIA	45.485	Surplus
123	6 Km	IIIA	43.844	Surplus
119	15 Km	IIIA	41.399	Surplus
70	8 Km	IIIA	41.040	Surplus
65	9 Km	IIIA	39.399	Surplus
166	8 Km	IIIA	39.240	Surplus
6	8 Km	IIIA	39.227	Surplus
125	6 Km	IIIB-1	38.129	Surplus
34	9 Km	IIIA	36.770	Surplus
104	7 Km	IIIB-1	33.796	Surplus
59	7 Km	IIIA	33.429	Surplus
96	12 Km	IIIA	32.964	Surplus
106	4 Km	IIIA	29.257	Surplus
55	10 Km	IIIB-1	28.565	Surplus
15	15 Km	IIIA	28.400	Surplus
102	12 Km	IIIA	27.905	Surplus
51	10 Km	IIIA	27.610	Surplus
61	4 Km	IIIA	26.994	Surplus
169	6 Km	IIIA	26.973	Surplus
110	5 Km	IIIA	26.510	Surplus
107	6 Km	IIIA	24.820	Surplus
111	7 Km	IIIB-1	24.693	Surplus
4	4 Km	IIIB-1	23.102	Surplus
36	9 Km	IIIB-1	23.080	Surplus
176	3 Km	IIIB-1	22.982	Surplus
12	8 Km	IIIA	21.890	Surplus
29	6 Km	IIIB-1	21.271	VOC
49	9 Km	IIIA	20.919	Surplus
130	4 Km	IIIB-1	20.452	Surplus
112	6 Km	IIIB-1	19.797	Surplus
158	4 Km	IIIB-1	17.744	Surplus
142	5 Km	IIIB-1	17.673	VOC
138	3 Km	IIIB-1	16.326	Surplus
38	17 Km	IIIA	15.932	Surplus
28	6 Km	IIIB-1	14.257	Surplus
174	8 Km	IIIA	14.070	Surplus
114	4 Km	IIIB-2	13.721	VOC
58	16 Km	IIIA	13.333	Surplus
172	10 Km	IIIB-1	12.179	Surplus
54	4 Km	IIIA	12.163	Surplus
168	6 Km	IIIB-1	11.448	Surplus
64	9 Km	IIIA	11.405	Surplus
7	7 Km	IIIB-2	10.951	VOC
35	4 Km	IIIB-2	10.455	Surplus
45	4 Km	IIIB-1	9.680	Surplus
16	17 Km	IIIB-1	8.288	VOC
69	8 Km	IIIA	7.587	Surplus
30	7 Km	IIIB-1	6.747	Surplus
89	18 Km	IIIB-2	6.207	VOC
56	13 Km	IIIA	5.787	Surplus
149	3 Km	IIIB-1	5.568	VOC
53	7 Km	IIIA	5.459	Surplus
2	4 Km	IIIB-2	4.996	Surplus
3	5 Km	IIIB-2	3.829	Surplus
70	6 Km	IIIB-2	2.729	Surplus
13	3 Km	IIIB-2	2.679	Surplus
67	9 Km	IIIB-1	1.978	VOC
72	6 Km	IIIB-2	1.562	VOC
41	8 Km	IIIB-1	1.486	Surplus
23	9 Km	IIIA	0.965	Surplus
118	8 Km	IIIB-2	0.828	VOC
103	25 Km	IIIB-1	0.196	VOC

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

PROVINCE : LAMPUNG KABUPATEN : LAMPUNG TENGAH

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
76	6 Km	IIIB-2	0.07B	VOC
77	8 Km	IIIB-2	0.07B	VOC
78	11 Km	IIIB-2	0.07B	VOC
79	20 Km	IIIB-2	0.07B	VOC
80	8 Km	IIIB-2	0.07B	VOC
84	17 Km	IIIB-2	0.07B	VOC
85	6 Km	IIIB-2	0.07B	VOC
86	12 Km	IIIB-1	0.07B	VOC
43	7 Km	IIIB-2	0.07B	VOC
88	12 Km	IIIB-1	0.07B	VOC
25	14 Km	IIIB-2	0.07B	VOC
92	13 Km	IIIB-2	0.07B	VOC
26	12 Km	IIIB-2	0.07B	VOC
46	7 Km	IIIB-1	0.07B	VOC
98	6 Km	IIIB-2	0.07B	Surplus
99	12 Km	IIIB-2	0.07B	VOC
47	8 Km	IIIB-2	0.07B	VOC
48	7 Km	IIIB-2	0.07B	VOC
27	9 Km	IIIB-2	0.07B	VOC
17	15 Km	IIIB-2	0.07B	VOC
18	17 Km	IIIB-2	0.07B	VOC
19	13 Km	IIIB-2	0.07B	VOC
31	7 Km	IIIB-2	0.07B	VOC
32	6 Km	IIIB-2	0.07B	VOC
57	10 Km	IIIB-1	0.07B	Surplus
113	3 Km	IIIB-2	0.07B	Surplus
33	3 Km	IIIB-2	0.07B	Surplus
115	5 Km	IIIB-2	0.07B	VOC
116	7 Km	IIIB-2	0.07B	VOC
1	6 Km	IIIB-2	0.07B	Surplus
60	6 Km	IIIB-1	0.07B	VOC
120	7 Km	IIIB-2	0.07B	VOC
21	10 Km	IIIB-1	0.07B	VOC
124	3 Km	IIIB-2	0.07B	Surplus
22	9 Km	IIIA	0.07B	Surplus
126	3 Km	IIIB-1	0.07B	VOC
63	6 Km	IIIB-1	0.07B	VOC
132	9 Km	IIIB-2	0.07B	VOC
133	15 Km	IIIB-2	0.07B	VOC
134	4 Km	IIIB-2	0.07B	VOC
37	4 Km	IIIB-1	0.07B	Surplus
5	3 Km	IIIB-2	0.07B	VOC
144	9 Km	IIIB-1	0.07B	VOC
145	5 Km	IIIB-2	0.07B	VOC
66	9 Km	IIIB-2	0.07B	VOC
156	11 Km	IIIB-2	0.07B	VOC
157	8 Km	IIIB-2	0.07B	VOC
39	4 Km	IIIB-2	0.07B	Surplus
161	8 Km	IIIB-1	0.07B	Surplus
163	5 Km	IIIB-2	0.07B	Surplus
164	11 Km	IIIB-2	0.07B	VOC
40	6 Km	IIIB-1	0.07B	Surplus
167	10 Km	IIIB-1	0.07B	VOC
24	12 Km	IIIB-2	0.07B	VOC
71	20 Km	IIIB-2	0.07B	VOC
42	3 Km	IIIB-2	0.07B	Surplus
173	11 Km	IIIB-2	0.07B	VOC
73	11 Km	IIIB-2	0.07B	VOC
74	7 Km	IIIB-2	0.07B	VOC
75	9 Km	IIIB-2	0.07B	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : LAMPUNG KABUPATEN : LAMPUNG TENGAH

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
69	9 Km	IIIB-1	16.151	Surplus
147	3 Km	IIIB-2	15.464	VOC
45	4 Km	IIIB-2	11.555	Surplus
30	7 Km	IIIB-2	11.154	Surplus
56	13 Km	IIIB-1	9.531	Surplus
93	7 Km	IIIB-1	9.289	Surplus
89	18 Km	IIIC	9.259	VOC
2	4 Km	IIIC	7.373	Surplus
3	5 Km	IIIC	5.977	Surplus
70	6 Km	IIIC	5.438	Surplus
72	6 Km	IIIC	4.069	VOC
13	3 Km	IIIC	3.895	Surplus
67	9 Km	IIIB-2	0.078	VOC
41	8 Km	IIIB-2	0.078	Surplus
16	17 Km	IIIB-2	0.078	VOC

Table 5-2-3 (1) RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : LAMPUNG KABUPATEN : LAMPUNG TENGAH

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
100	30 Km	IIIA	1944773	4.482	73.179	Surplus
87	20 Km	IIIA	1245339	4.444	72.147	Surplus
93	20 Km	IIIA	1173544	3.115	47.542	Surplus
119	15 Km	IIIA	822877	2.755	41.399	Surplus
62	15 Km	IIIA	628660	3.114	49.301	Surplus
175	17 Km	IIIA	496537	2.757	45.485	Surplus
6	8 Km	IIIA	472383	2.643	39.227	Surplus
44	10 Km	IIIA	467742	3.795	62.581	Surplus
123	6 Km	IIIA	398272	2.920	43.844	Surplus
65	9 Km	IIIA	284936	2.520	37.399	Surplus
20	8 Km	IIIA	234352	2.533	41.040	Surplus
166	8 Km	IIIA	227709	2.485	39.240	Surplus
34	9 Km	IIIA	221123	2.323	36.770	Surplus
96	12 Km	IIIA	217518	2.056	32.964	Surplus
15	15 Km	IIIA	214708	1.845	28.400	Surplus
102	12 Km	IIIA	183817	1.838	27.905	Surplus
107	6 Km	IIIA	143073	1.748	24.820	Surplus
59	7 Km	IIIA	137789	2.078	33.429	Surplus
104	7 Km	IIIB-1	133900	2.147	33.796	Surplus
110	5 Km	IIIA	132851	1.853	26.510	Surplus
51	10 Km	IIIA	130782	1.797	27.610	Surplus
125	6 Km	IIIB-1	125116	2.344	38.129	Surplus
55	10 Km	IIIB-1	113744	1.783	28.565	Surplus
38	17 Km	IIIA	73050	1.245	15.932	Surplus
49	9 Km	IIIA	72522	1.475	20.919	Surplus
12	8 Km	IIIA	70727	1.529	21.890	Surplus
169	6 Km	IIIA	70437	1.760	26.973	Surplus
36	9 Km	IIIB-1	67894	1.511	23.080	Surplus
106	4 Km	IIIA	67526	1.918	29.257	Surplus
61	4 Km	IIIA	58857	1.773	26.994	Surplus
111	7 Km	IIID-1	52743	1.600	24.693	Surplus
4	4 Km	IIIB-1	42161	1.576	23.102	Surplus

Table 5-2-3 (2) RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : LAMPUNG KABUPATEN : LAMPUNG TENGAH

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
29	6 Km	IIIB-1	36966	1.440	21.271	VOC
58	16 Km	IIIA	35909	1.133	13.333	Surplus
112	6 Km	IIIB-1	29040	1.373	19.797	Surplus
174	8 Km	IIIA	25319	1.172	14.070	Surplus
130	4 Km	IIIB-1	25140	1.429	20.452	Surplus
176	3 Km	IIIB-1	25124	1.561	22.982	Surplus
69	8 Km	IIIB-1	24745	1.237	16.151	Surplus
150	4 Km	IIIB-1	23793	1.339	17.744	Surplus
142	5 Km	IIIB-1	20862	1.298	17.673	VOC
172	10 Km	IIIB-1	13386	1.086	12.179	Surplus
138	3 Km	IIIB-1	13165	1.269	16.326	Surplus
28	6 Km	IIIB-1	12714	1.163	14.257	Surplus
64	9 Km	IIIA	9340	1.056	11.405	Surplus
54	4 Km	IIIA	5826	1.085	12.163	Surplus
168	6 Km	IIIB-1	4693	1.054	11.448	Surplus
114	4 Km	IIIB-2	4604	1.138	13.721	VOC
149	3 Km	IIIB-2	2688	1.138	15.464	VOC
30	7 Km	IIIB-2	2332	1.040	11.154	Surplus
7	7 Km	IIIB-2	2069	1.032	10.951	VOC
45	4 Km	IIIB-2	1698	1.055	11.555	Surplus
35	4 Km	IIIB-2	352	1.015	10.455	Surplus
SUM	460 Km		11051447			

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: *Lampung Tengah*

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	2,647	4,418	7,065
MAINTENANCE	550	1,564	2,114
SUPPLEMENTATION	577	-	577
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	19	-	19
SURVEY EQUIPMENT	5	-	5
TOTAL	3,826	5,982	9,808

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	2,018	5,933	7,951
CONSTRUCTION & MAINTENANCE EQUIPMENT	1,562	-	1,562
SPARE PARTS	194	49	243
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	52	-	52
TOTAL	3,826	5,982	9,808

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 final proposal for road links to be improved in the Kabupaten development plan are the 59 links with the total length of 523 km which is 43% of the 1,231 km total length of Kabupaten roads to be studied. The proposed road links are shown in Table 6-1-3.

Table 6-1-3 ROAD LINKS TO BE IMPROVED

KABUPATEN : LAMPUNG TENGAH

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	2b,4,6,7,12,15,20,28,29,34,35,38,43a, 43b,44,49,51,54,55,58,59a,59b,61,62, 64,65,87,93,96,100,102,104,106,107, 110,111,112,114,119,123,125,130,138 142,158,166,168,169
- Secondary	30,45,69,149,
Engineering Point of View	1,2a,3,16,60,103

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

Since Road Links No 1, No 2a, No 3, No 16, No 60 and No 103 are key road links which are located at the strategic point to complete the local road network consisting of feasible road links, these 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.

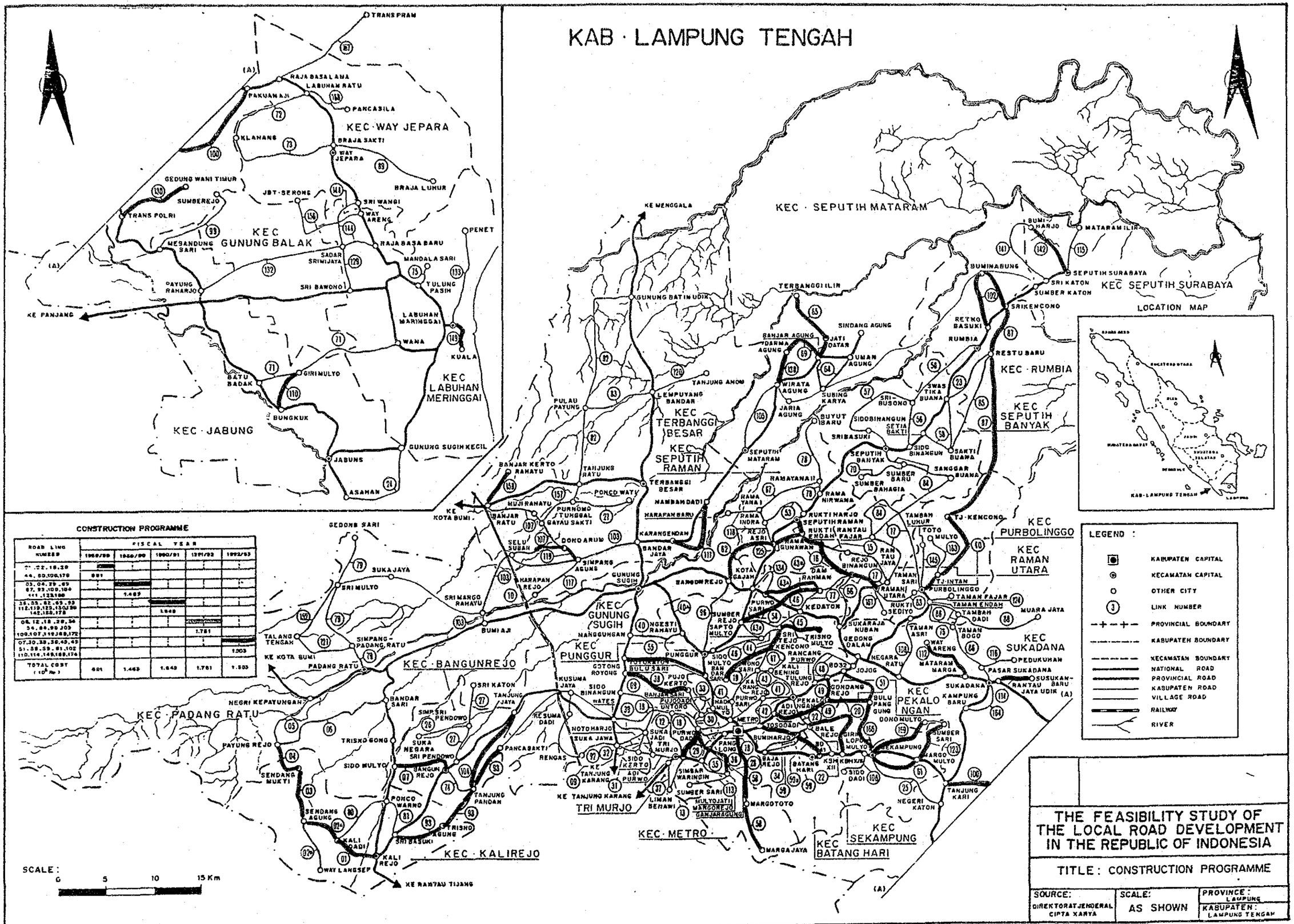
Table 6-1-4 ROAD LINKS TO BE IMPROVED BY YEAR

PROV : LAMPUNG KAB : LAMPUNG TENGAH

YEAR		LINK NO ( ) : rate
1988	:	1, 2, 16, 20, 44, 60, 100 (50%), 176
1989	:	3, 4, 29, 69, 87, 93 (50%), 100 (50%), 104, 111, 123, 166
1990	:	36, 55, 62, 65, 93 (50%), 112, 119 (67%), 125, 130, 138, 142, 158, 175
1991	:	6, 12, 15, 28, 34, 54, 64, 96, 103, 106, 107, 119 (33%), 168, 172
1992	:	7, 30, 35, 38, 45, 49, 51, 58, 59, 61, 102, 110, 114, 149, 169, 174

Note: Link numbers 172, 174 and 175 shows link numbers 2b, 43b and 59b respectively.

KAB · LAMPUNG TENGAH



CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1989/90	1990/91	1991/92	1992/93
01, 02, 18, 20				
44, 80, 106, 170	881			
03, 04, 29, 69 87, 93, 100, 104 111, 123, 186		1.469		
35, 53, 82, 89, 92 112, 119, 122, 130, 136 142, 158, 173			1.849	
08, 12, 18, 28, 36 38, 88, 90, 103				1.781
07, 30, 39, 58, 63, 65 81, 88, 89, 91, 102 112, 114, 148, 168, 174				1.503
TOTAL COST (10^6 Rp)	881	1.469	1.849	1.781	1.503

SCALE : 0 5 10 15 Km

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

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

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE : LAMPUNG
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : LAMPUNG TENGAH

(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 (1) ROAD LINKS TO BE MAINTAINED

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(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	6	0.0	85.0	15.0	0.0	0	6	0	0	0.00	4	272.00	1,653	2,706	1,226	3,932
7	7	74.3	14.3	11.4	0.0	0	2	5	0	0.00	3	117.60	715	1,997	699	2,696
12	8	0.0	58.8	41.3	0.0	0	8	0	0	0.00	0	0.00	0	2,279	760	3,039
13	3	0.0	70.0	30.0	0.0	0	3	0	0	0.00	1	19.50	119	926	332	1,258
15	15	0.0	65.3	34.7	0.0	0	15	0	0	0.00	1	49.00	298	4,453	1,543	5,996
16	17	73.5	13.5	12.9	0.0	0	17	0	0	0.00	1	29.40	179	4,951	1,686	6,637
17	15	59.3	24.3	16.3	0.0	14	1	0	0	0.00	2	181.30	1,102	6,806	2,553	9,439
18	17	77.4	12.4	10.3	0.0	17	0	0	0	0.00	6	331.66	2,015	8,424	3,254	11,678
19	13	84.3	15.5	0.2	0.0	13	0	0	0	0.00	4	199.25	1,211	6,243	2,357	8,600
22	9	65.6	26.7	7.8	0.0	9	0	0	0	0.00	2	99.00	602	4,179	1,538	5,717
23	9	38.9	46.1	15.0	0.0	9	0	0	0	0.00	2	88.20	536	4,140	1,512	5,652
24	12	77.5	12.1	10.4	0.0	11	1	0	0	0.00	0	0.00	0	4,950	1,683	6,633
25	14	0.0	76.8	23.2	0.0	0	12	2	0	0.00	1	96.00	583	4,169	1,462	5,631
26	12	68.8	17.9	13.3	0.0	0	12	0	0	0.00	1	49.00	298	3,598	1,258	4,856
27	9	65.0	18.9	16.1	0.0	0	9	0	0	0.00	3	274.40	1,668	3,569	1,517	5,086
28	6	0.0	82.5	17.5	0.0	0	6	0	0	0.00	0	0.00	0	1,709	570	2,279
29	6	0.0	77.5	22.5	0.0	0	6	0	0	0.00	1	39.20	238	1,853	665	2,518
30	7	14.3	48.6	37.1	0.0	0	7	0	0	0.00	1	58.80	357	2,210	807	3,017
31	7	8.6	63.6	27.9	0.0	0	7	0	0	0.00	1	165.30	1,005	2,600	1,064	3,664
32	6	0.0	75.0	25.0	0.0	0	6	0	1	44.10	0	0.00	413	2,016	676	2,692
34	9	23.3	65.0	11.7	0.0	0	9	0	0	0.00	1	25.20	153	2,656	916	3,572
36	9	0.0	79.4	20.6	0.0	0	5	4	0	0.00	3	299.70	1,821	3,320	1,378	4,698
37	4	32.5	53.8	13.8	0.0	0	4	0	0	0.00	0	0.00	0	1,139	380	1,519
38	17	19.4	54.1	26.5	0.0	0	17	0	0	0.00	4	186.20	1,132	5,525	2,065	7,590
40	6	45.0	48.3	6.7	0.0	0	6	0	0	0.00	2	127.40	774	2,176	877	3,053
42	3	53.3	46.7	0.0	0.0	0	3	0	0	0.00	0	0.00	0	855	285	1,140
44	10	0.0	75.5	24.5	0.0	0	10	0	0	0.00	0	0.00	0	2,849	950	3,799
45	4	0.0	83.8	16.3	0.0	0	4	0	0	0.00	0	0.00	0	1,139	380	1,519
46	7	68.6	20.0	11.4	0.0	0	7	0	0	0.00	2	68.60	417	2,245	831	3,076
47	8	0.0	75.0	25.0	0.0	0	8	0	0	0.00	1	53.90	328	2,476	890	3,366
49	9	0.0	59.4	40.6	0.0	0	9	0	0	0.00	1	27.00	164	2,663	920	3,583
51	10	9.0	55.0	36.0	0.0	0	10	0	0	0.00	1	34.30	208	2,974	1,033	4,007
53	7	72.1	15.0	12.9	0.0	0	7	0	0	0.00	0	0.00	0	1,994	665	2,659
54	4	57.5	27.5	11.3	3.8	0	4	0	0	0.00	1	39.20	238	1,283	475	1,758
55	10	0.0	60.0	40.0	0.0	0	7	3	0	0.00	3	201.00	1,221	3,328	1,285	4,613
56	13	68.1	16.9	15.0	0.0	0	13	0	0	0.00	1	34.30	208	3,829	1,310	5,147
58	16	20.0	60.6	19.4	0.0	7	9	0	1	22.00	3	213.74	1,505	6,468	2,434	8,902

Table 6-1-5 (2) ROAD LINKS TO BE MAINTAINED

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(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
59	7	0.0	75.0	25.0	0.0	0	7	0	0	0.00	2	179.00	1,088	2,650	1,097	3,747
60	6	73.3	15.0	11.7	0.0	0	6	0	0	0.00	2	91.00	553	2,043	790	2,833
61	4	0.0	72.5	27.5	0.0	0	4	0	0	0.00	2	68.60	417	1,391	546	1,937
63	6	77.5	13.3	9.2	0.0	6	0	0	0	0.00	1	120.00	729	2,904	1,156	4,140
64	9	72.8	15.0	12.2	0.0	0	9	0	1	24.50	2	58.80	587	2,950	1,036	4,006
66	9	67.8	18.3	13.9	0.0	0	9	0	0	0.00	1	49.00	298	2,743	973	3,716
69	8	66.9	18.1	15.0	0.0	0	8	0	0	0.00	1	32.00	194	2,396	837	3,233
71	20	74.5	13.0	12.5	0.0	0	20	0	0	0.00	0	0.00	0	5,697	1,900	7,597
72	6	77.5	13.3	9.2	0.0	0	2	4	0	0.00	1	15.00	91	1,422	406	1,828
73	11	71.8	15.0	13.2	0.0	0	5	6	0	0.00	0	0.00	0	2,620	745	3,365
74	7	71.4	16.4	12.1	0.0	0	7	0	0	0.00	2	119.70	727	2,433	954	3,387
75	9	71.1	13.9	15.0	0.0	0	5	4	0	0.00	0	0.00	0	2,221	655	2,876
76	6	76.7	12.5	10.8	0.0	0	6	0	0	0.00	1	31.50	191	1,825	646	2,471
77	8	69.4	16.3	14.4	0.0	0	4	4	0	0.00	1	34.30	208	2,062	643	2,705
78	11	71.8	13.6	14.5	0.0	0	4	7	0	0.00	1	34.30	208	2,660	778	3,438
79	20	64.5	19.0	16.5	0.0	0	20	0	0	0.00	1	63.00	383	5,928	2,052	7,980
84	17	73.2	17.9	8.8	0.0	0	17	0	0	0.00	3	277.40	1,686	5,859	2,285	8,144
85	6	75.8	12.5	11.7	0.0	0	6	0	0	0.00	0	0.00	0	1,709	570	2,279
86	12	76.3	12.1	11.7	0.0	12	0	0	0	0.00	0	0.00	0	5,089	1,732	6,821
87	20	0.0	71.0	29.0	0.0	0	10	10	0	0.00	0	0.00	0	4,842	1,401	6,243
88	12	74.2	12.5	13.3	0.0	0	12	0	3	127.40	0	0.00	1,192	4,305	1,446	5,751
89	18	73.9	12.2	13.9	0.0	0	7	11	0	0.00	0	0.00	0	4,186	1,161	5,347
92	13	76.2	8.5	12.3	3.1	0	10	3	0	0.00	0	0.00	0	3,447	1,085	4,532
96	12	72.9	16.3	10.8	0.0	0	12	0	2	95.00	1	20.00	1,010	4,153	1,416	5,569
98	6	81.7	9.2	9.2	0.0	0	6	0	0	0.00	0	0.00	0	1,709	570	2,279
99	12	68.8	13.8	17.5	0.0	0	12	0	0	0.00	0	0.00	0	3,410	1,140	4,550
100	30	0.0	74.7	25.3	0.0	0	30	0	0	0.00	4	151.90	923	9,103	3,217	12,320
102	12	72.5	15.4	12.1	0.0	0	10	2	0	0.00	1	34.30	208	3,373	1,123	4,496
103	25	77.4	12.4	10.2	0.0	0	25	0	0	0.00	5	245.00	1,489	8,019	2,967	10,986
106	4	0.0	67.5	32.5	0.0	0	4	0	0	0.00	0	0.00	0	1,139	380	1,519
111	7	0.0	71.4	28.6	0.0	0	7	0	0	0.00	1	34.30	208	2,120	748	2,868
112	6	6.7	59.2	34.2	0.0	0	6	0	0	0.00	1	96.00	583	2,061	802	2,863
113	3	0.0	81.7	18.3	0.0	0	3	0	0	0.00	2	107.80	655	1,250	545	1,795
116	7	74.3	12.9	12.9	0.0	0	7	0	0	0.00	2	78.40	476	2,281	854	3,135
118	8	72.5	15.0	12.5	0.0	0	4	4	0	0.00	0	0.00	0	1,937	560	2,497
120	7	77.1	13.6	9.3	0.0	0	7	0	0	0.00	2	117.60	715	2,425	949	3,374
122	70	0.0	77.2	22.8	0.0	35	10	25	0	0.00	0	0.00	0	22,673	7,128	29,801

Table 6-1-5 (3) ROAD LINKS TO BE MAINTAINED

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(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
124	3	0.0	80.0	20.0	0.0	0	3	0	0	0.00	0	0.00	0	855	285	1,140
126	3	76.7	13.3	10.0	0.0	3	0	0	0	0.00	0	0.00	0	1,272	433	1,705
128	3	78.3	13.3	8.3	0.0	0	3	0	0	0.00	0	0.00	0	855	285	1,140
130	4	0.0	67.5	32.5	0.0	0	4	0	0	0.00	1	34.30	208	1,265	463	1,728
132	9	75.0	11.7	13.3	0.0	0	9	0	0	0.00	0	0.00	0	2,564	855	3,419
134	4	71.3	13.8	15.0	0.0	0	4	0	0	0.00	1	34.30	208	1,265	463	1,728
142	5	76.0	12.0	12.0	0.0	0	3	2	0	0.00	0	0.00	0	1,253	375	1,628
144	9	78.3	12.8	8.9	0.0	0	9	0	0	0.00	1	39.20	238	2,707	950	3,657
145	5	70.0	16.0	14.0	0.0	0	5	0	0	0.00	0	0.00	0	1,424	475	1,899
149	3	70.0	11.7	18.3	0.0	2	1	0	0	0.00	2	78.40	476	1,420	573	1,993
151	3	53.3	26.7	20.0	0.0	2	0	1	0	0.00	0	0.00	0	1,047	334	1,381
155	4	70.0	13.8	16.3	0.0	2	0	2	0	0.00	0	0.00	0	1,247	379	1,626
156	11	64.5	22.3	13.2	0.0	11	0	0	0	0.00	3	127.40	774	5,131	1,895	7,026
157	8	76.3	14.4	9.4	0.0	0	8	0	0	0.00	2	146.00	887	2,814	1,112	3,926
159	4	75.0	13.8	11.3	0.0	0	4	0	0	0.00	0	0.00	0	1,139	380	1,519
160	4	68.8	18.8	12.5	0.0	0	2	2	0	0.00	0	0.00	0	968	280	1,248
161	8	71.3	14.4	14.4	0.0	0	8	0	0	0.00	0	0.00	0	2,279	760	3,039
162	4	72.5	13.8	13.8	0.0	0	4	0	0	0.00	0	0.00	0	1,139	380	1,519
163	5	69.0	16.0	15.0	0.0	0	3	2	0	0.00	0	0.00	0	1,253	375	1,628
164	11	73.2	13.2	13.6	0.0	0	10	1	0	0.00	3	117.60	715	3,479	1,279	4,758
166	8	0.0	76.9	23.1	0.0	0	6	2	0	0.00	0	0.00	0	2,108	660	2,768
167	10	73.0	14.0	13.0	0.0	4	6	0	0	0.00	1	39.20	238	3,549	1,242	4,791
168	6	79.2	12.5	8.3	0.0	0	3	3	0	0.00	1	96.00	583	1,804	652	2,456
169	6	36.7	45.0	18.3	0.0	3	3	0	0	0.00	0	0.00	0	2,127	718	2,845
170	4	75.0	11.3	13.8	0.0	0	2	2	0	0.00	0	0.00	0	968	280	1,248
173	11	59.1	27.3	13.6	0.0	11	0	0	0	0.00	0	0.00	0	4,665	1,588	6,253
174	8	0.0	80.0	20.0	0.0	0	8	0	0	0.00	0	0.00	0	2,279	760	3,039
175	17	20.0	61.8	18.2	0.0	0	17	0	0	0.00	1	98.00	596	5,202	1,852	7,054
SUM	978					171	696	111	8	313.00	113	6249.45	40,907	317,978	111,640	429,618

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 Lampung Tengah 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 7,065 x 10^6 and maintenance cost is Rp 2,114 x 10^6 which is approximately 23% of the total expenditure.

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

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	380,549	806,750	901,966	956,375	808,827	3,854,467	(54.6%)
Ownership Cost	1,470	2,769	3,061	3,374	2,802	13,476	(0.3%)
Operation Cost	208,573	395,228	433,420	480,637	396,850	1,914,708	(49.7%)
Material Cost	80,706	219,162	253,279	252,014	216,744	1,021,905	(26.5%)
Labour Cost	40,163	84,363	94,558	95,605	86,932	401,621	(10.4%)
Contingency	49,637	105,228	117,648	124,745	105,499	502,757	(13.0%)
FOREIGN CURRENCY :	301,259	659,535	748,203	806,020	695,037	3,210,054	(45.4%)
Ownership Cost	122,423	229,813	253,478	281,013	232,767	1,119,494	(34.9%)
Operation Cost	16,406	30,126	32,860	36,921	30,304	146,617	(4.6%)
Material Cost	123,135	313,570	364,273	382,953	341,309	1,525,240	(47.5%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	39,295	86,026	97,592	105,133	90,657	418,703	(13.0%)
TOTAL COST :	681,807	1,466,286	1,650,168	1,762,395	1,503,864	7,064,520	
Ownership Cost	123,893	232,582	256,539	284,387	235,569	1,132,970	(16.0%)
Operation Cost	224,979	425,354	466,280	517,558	427,154	2,061,325	(29.2%)
Material Cost	203,841	532,732	617,552	634,967	558,053	2,547,145	(36.1%)
Labour Cost	40,163	84,363	94,558	95,605	86,932	401,621	(5.7%)
Contingency	88,931	191,255	215,239	229,878	196,156	921,459	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(UNIT : 1000Rp)

ITEM		(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :		154,713	316,827	338,754	364,933	388,860	1,564,087	(74.0%)
Ownership	Cost	511	1,047	1,111	1,188	1,261	5,118	(0.3%)
Operation	Cost	88,344	180,067	186,880	195,261	202,934	853,486	(54.6%)
Material	Cost	4,253	8,980	10,668	12,897	14,393	51,191	(3.3%)
Labour	Cost	61,605	126,733	140,095	155,587	170,272	654,292	(41.8%)
FOREIGN CURRENCY :		54,267	111,505	119,100	128,260	136,677	549,809	(26.0%)
Ownership	Cost	44,320	90,447	93,884	98,125	101,961	428,737	(78.0%)
Operation	Cost	4,968	10,116	10,471	10,888	11,272	47,715	(8.7%)
Material	Cost	4,979	10,942	14,745	19,247	23,444	73,357	(13.3%)
Labour	Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :		208,980	428,332	457,854	493,193	525,537	2,113,896	
Ownership	Cost	44,831	91,494	94,995	99,313	103,222	433,855	(20.5%)
Operation	Cost	93,312	190,183	197,351	206,149	214,206	901,201	(42.6%)
Material	Cost	9,232	19,922	25,413	32,144	37,837	124,548	(5.9%)
Labour	Cost	61,605	126,733	140,095	155,587	170,272	654,292	(31.0%)

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

(TOTAL)

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	535,262	1,123,577	1,240,720	1,321,308	1,197,687	5,418,554	(59.0%)
Ownership Cost	1,981	3,816	4,172	4,562	4,063	18,594	(0.3%)
Operation Cost	296,917	575,295	620,300	675,898	599,784	2,768,194	(51.1%)
Material Cost	84,959	228,142	263,947	284,911	231,137	1,073,096	(19.8%)
Labour Cost	101,768	211,096	234,653	251,192	257,204	1,055,913	(19.5%)
Contingency	49,637	105,228	117,648	124,745	105,499	502,757	(9.3%)
FOREIGN CURRENCY :	355,526	771,040	867,303	934,280	831,714	3,759,863	(41.0%)
Ownership Cost	166,743	320,260	347,362	379,138	334,728	1,548,231	(41.2%)
Operation Cost	21,374	40,242	43,331	47,809	41,576	194,332	(5.2%)
Material Cost	128,114	324,512	379,018	402,200	364,753	1,598,597	(42.5%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	39,295	86,026	97,592	105,133	90,657	418,703	(11.1%)
TOTAL COST :	890,787	1,894,618	2,108,022	2,255,588	2,029,401	9,178,416	
Ownership Cost	168,724	324,076	351,534	383,700	338,791	1,566,825	(17.1%)
Operation Cost	318,291	615,537	663,631	723,707	641,360	2,962,526	(32.3%)
Material Cost	213,073	552,654	642,965	687,111	595,890	2,671,693	(29.1%)
Labour Cost	101,768	211,096	234,653	251,192	257,204	1,055,913	(11.5%)
Contingency	88,931	191,255	215,239	229,878	196,156	921,459	(10.0%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Lampung Tengah 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.

- 1-Bulldozer
- 1-Motor Grader
- 3-Stell Roller
- 17-Dump Truck
- 6-Tire Roller
- 2-Hand-guided vib. Roller
- 1-Hydraulic Excavator

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

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

b. Equipment for Bridge Maintenance

- 2-Flat Bed Truck with Crane 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 depreciation 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 : LAMPUNG KAB : LAMPUNG TENGAH

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	250	1	1.04	1.42	1.33	1.91	1.60
Swamp Bulldozer	250	0	0.01	0.00	0.00	0.00	0.00
Motor Grader	250	1	2.02	3.71	4.00	4.41	3.48
Hand-guide Vib. Roller	250	2	0.10	0.14	0.46	0.10	0.47
Tire Roller	250	6	1.13	2.95	3.34	3.56	3.05
Vibratory Roller (D&T)	250	1	1.33	2.74	3.00	3.06	2.37
Hydraulic Excavator; Wheel	250	4	0.25	0.01	0.02	0.01	0.02
Wheel Loader	250	0	2.55	4.70	5.09	5.82	4.74
Water Tank Truck	250	0	0.61	1.62	1.88	1.70	1.27
Dump Truck	250	3	17.84	33.50	36.43	40.27	33.05
Flat Bed Truck with Crane	250	0	0.04	0.13	0.38	0.05	0.26
Flat Bed Truck	250	0	1.38	3.58	4.15	4.30	3.78
Portable Crusher/Screening	250	0	0.61	1.17	1.32	1.52	1.27
Concrete Mixer	250	0	0.04	0.04	0.26	0.03	0.20
Water Pump	250	0	0.03	0.03	0.64	0.02	0.37
Concrete Vibrator	250	0	0.01	0.01	0.03	0.01	0.03
Asphalt Sprayer	250	0	1.13	2.95	3.34	3.56	3.05

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

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : LAMPUNG KAB : LAMPUNG TENGAH

(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	5	239,000
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	2	17,000
Tire Roller	8-15 ton	31,070	-	-
Vibratory Roller (D&T)	4 ton	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	4	280,800
Water Tank Truck	4000 ltr.	12,750	2	25,500
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	2	50,380
Flat Bed Truck	3.0 ton	11,275	6	67,650
Portable Crusher/Screening	30-40 t/h	188,000	2	376,000
Concrete Mixer	0.5 m3	18,000	1	18,000
Water Pump	200 l/min	630	1	630
Concrete Vibrator	3.3 HP	740	1	740
Asphalt Sprayer	850 ltr.	10,200	3	30,600
Service Car	3 ton	11,600	1	11,600
4 Wheel Drive Vehicle	70 HP	17,500	2	35,000
Motorcycle	100 cc	1,100	5	5,500

PURCHASE COST TOTAL	1,561,700
OWNERSHIP COST (FOREIGN)	985,168
EQUIPMENT COST SUPPLEMENTED	576,532

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Bulldozer/Ripper	28,923
Motor Grader	32,374
Hand-guide Vib. Roller	10,107
Tire Roller	107,136
Vibratory Roller (D&T)	54,234
Hydraulic Excavator; Wheel	1,689
Wheel Loader	93,047
Dump Truck	235,553
TOTAL	563,063

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 : LAMPUNG KAB : LAMPUNG TENGAH

ITEM	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	0.00	9200.00	25800.00	29100.00	18000.00	82100.00
Subgrade Preparation	m2	38000.00	439500.00	552550.00	274450.00	143000.00	1447500.00
Normal Fill	m3	0.00	0.00	0.00	0.00	0.00	0.00
Fill in Swamp	m3	336.00	0.00	0.00	0.00	0.00	336.00
Normal Excavation to Spoil	m3	3693.00	9425.00	5002.40	5763.60	6380.00	30264.00
Sub Base Course	m3	14425.00	44364.80	51172.90	43490.20	31819.20	185272.10
Base Course	m3	19100.00	33035.00	37517.00	44478.00	36080.00	170210.00
Shoulder	m2	352000.00	440500.00	416150.00	615350.00	515500.00	2339500.00
Asphalt Patching	m2	0.00	0.00	22.00	0.00	687.00	709.00
Surface Dressing (Single)	m2	12000.00	120500.00	175000.00	82000.00	45000.00	434500.00
Surface Dressing (Double)	m2	143500.00	307500.00	318900.00	418600.00	377500.00	1566000.00
Earth Drain	m	0.00	4000.00	0.00	0.00	4000.00	8000.00
Earth Drain in Swamp (by machine)	m3	4800.00	0.00	0.00	0.00	0.00	4800.00
Pipe Culvert D80cm	m	0.00	0.00	0.00	0.00	8.00	8.00
Masonry Culvert (80x80cm)	m	12.00	44.00	0.00	20.00	93.00	169.00
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	62.25	33.05	188.00	33.00	129.30	445.60
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	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;10T)	m2	0.00	140.00	28.00	24.00	0.00	192.00
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	27.00	0.00	0.00	27.00
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	67.50	0.00	49.50	117.00
Substructure (Pier;for Timber;10T)	NO	0.00	4.00	0.00	0.00	0.00	4.00
Substructure (Abut;for Timber;10T)	NO	0.00	2.00	2.00	2.00	0.00	6.00
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	4.00	0.00	2.00	6.00
Demolition of Bridge (Timber->Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Concrete)	m2	0.00	0.00	0.00	0.00	22.00	22.00
Demolition of Bridge (Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	475.50	961.00	989.50	1023.00	1056.00	4505.00
Routine maintenance of earth road	Km	55.50	105.00	94.50	88.50	83.50	427.00
Routine maintenance of gravel road	Km	334.50	664.00	607.00	538.50	470.50	2614.50
Routine maintenance of asphalt road	Km	85.50	192.00	288.00	396.00	502.00	1463.50
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	140.00	28.00	168.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	156.50	337.00	372.00	312.25	393.00	1570.75
Maintenance of Concrete Bridge (Exist)	m2	3007.64	6271.43	6076.95	6214.05	6101.68	27671.74

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.

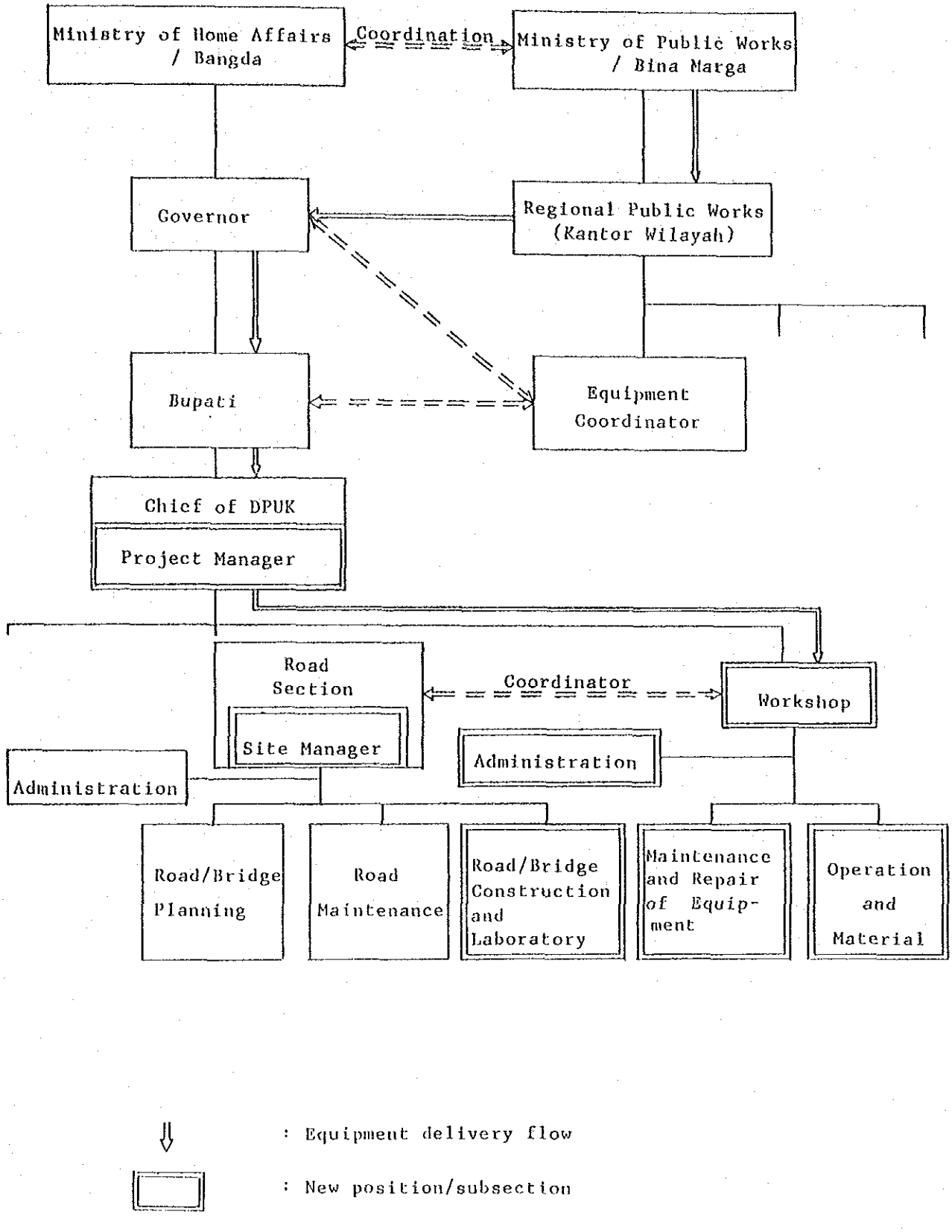
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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