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 16

KABUPATEN BULUNGAN

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 Bulungan in Kalimantan Timur 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.

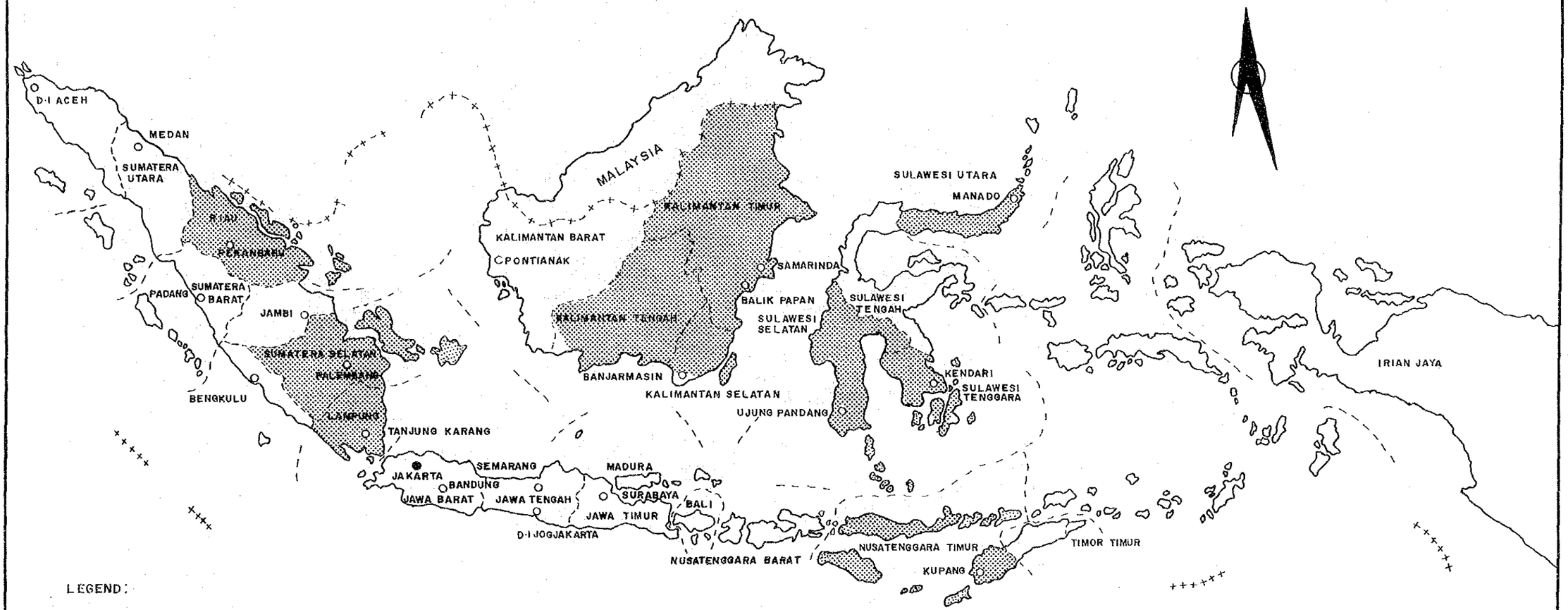
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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



IV · PROPINSI KALIMANTAN TENGAH
09 · KAB · KOTA WARINGIN TIMUR
10 · KAB · KAPUAS
11 · KAB · BARITO SELATAN
12 · KAB · BARITO UTARA

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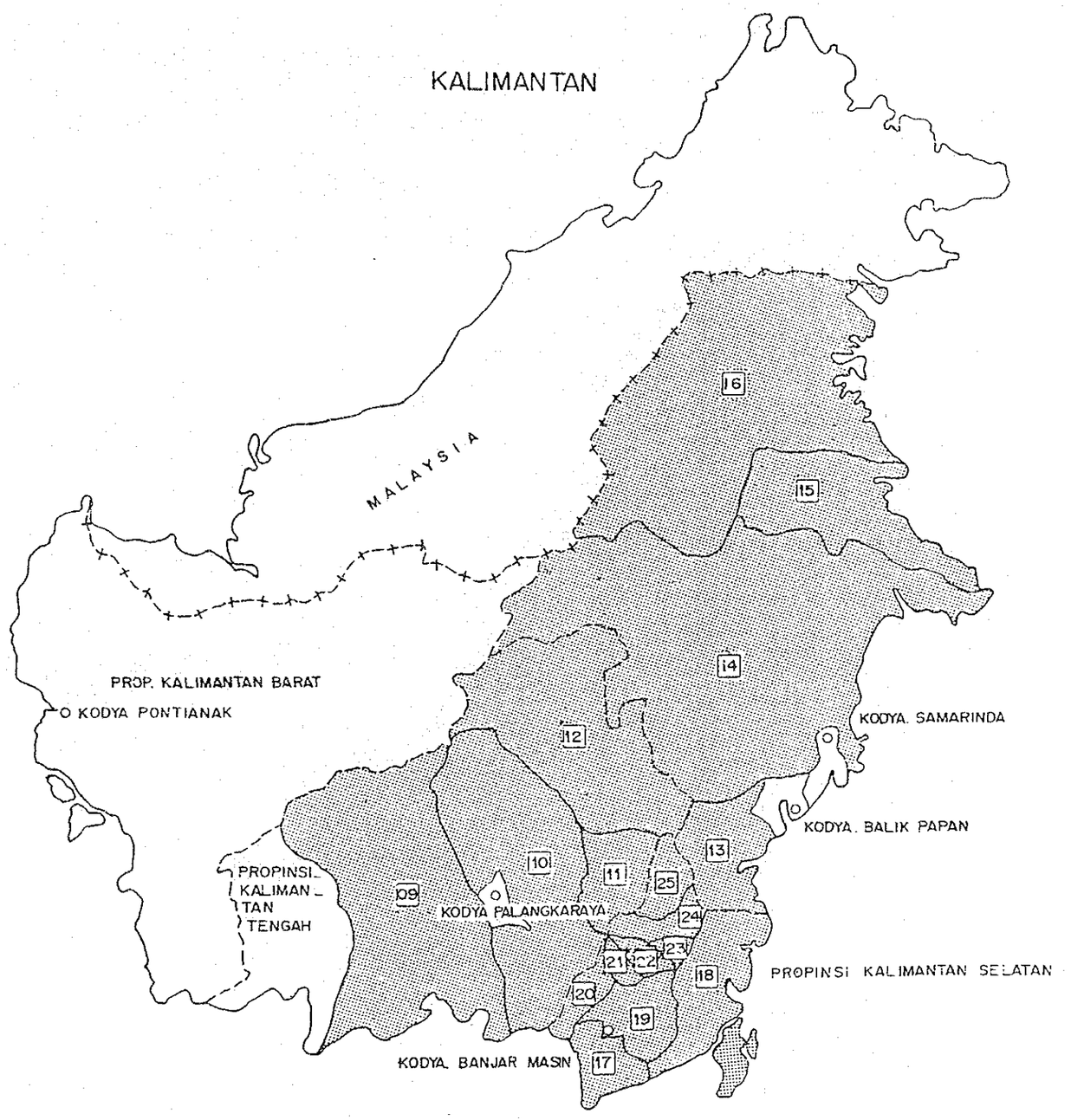
22 · KAB · HULU SUNGAI SELATAN
23 · KAB · HULU SUNGAI TENGAH
24 · KAB · HULU SUNGAI UTARA
25 · KAB · TABALONG



LEGEND :
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LOCATION OF THE PROPOSED AREA

SCALE :
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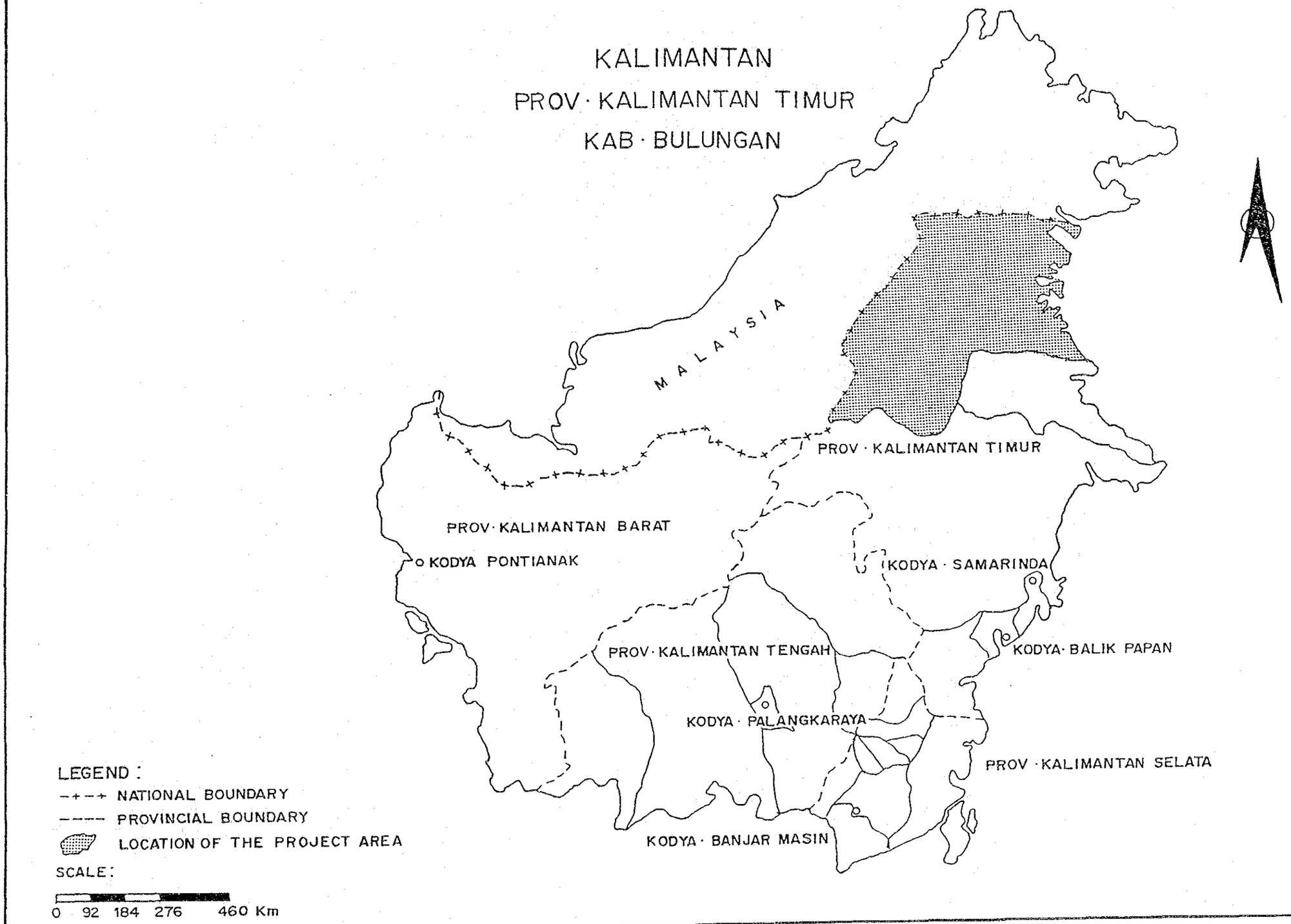
KALIMANTAN
PROV · KALIMANTAN TIMUR
KAB · BULUNGAN
MALAYSIA
PROV · KALIMANTAN TIMUR
PROV · KALIMANTAN BARAT
KODYA PONTIANAK
KODYA · SAMARINDA
PROV · KALIMANTAN TENGAH
KODYA · BALIK PAPAN
KODYA · PALANGKARAYA
PROV · KALIMANTAN SELATA
KODYA · BANJAR MASIN
LEGEND :
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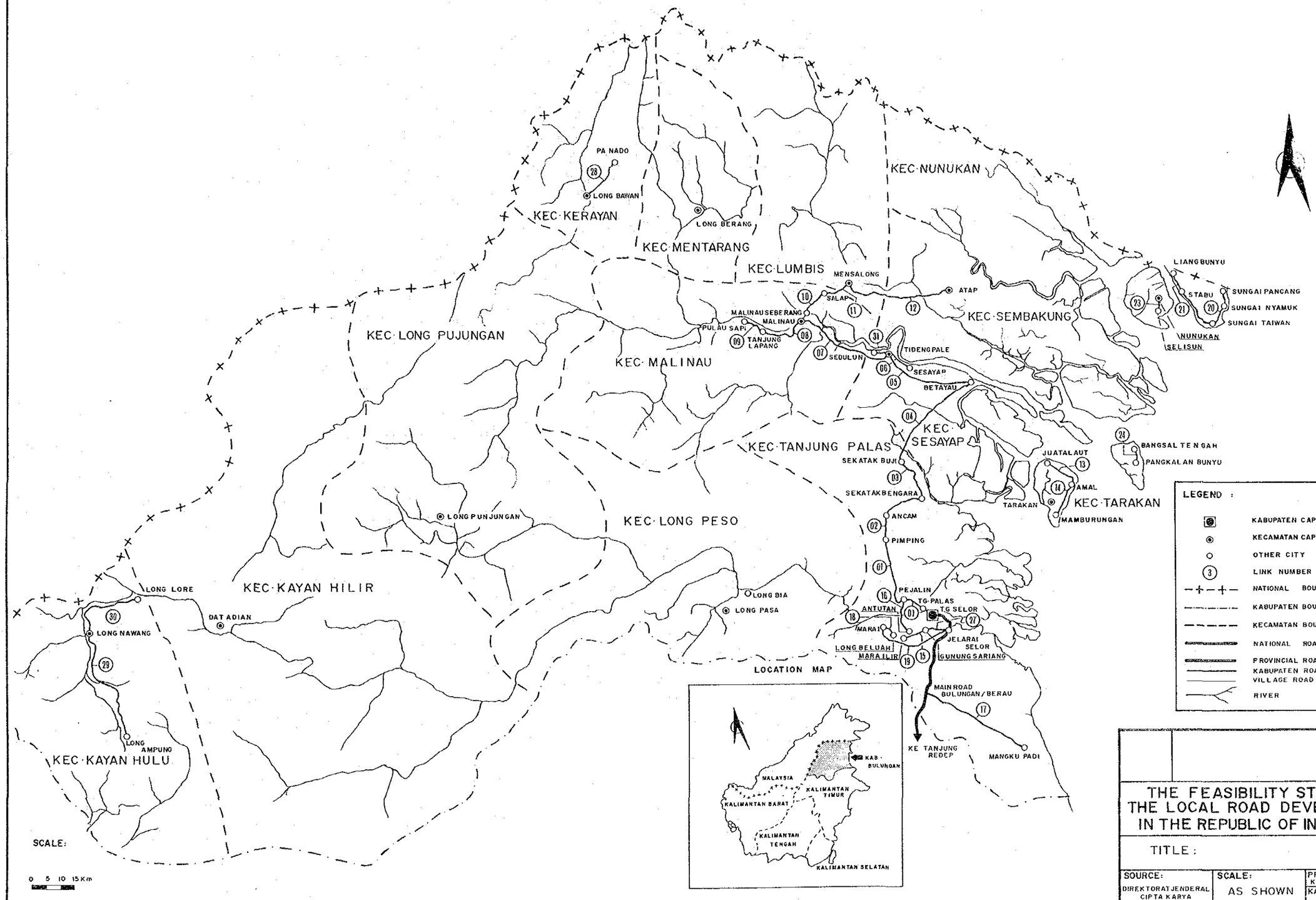
PROVINCIAL BOUNDARY
LOCATION OF THE PROJECT AREA
SCALE :
0 92 184 276 460 Km

KAB · BULUNGAN



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

TITLE :

SOURCE:	SCALE:	PROVINCE : KALIMANTAN TIMUR
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : BULUNGAN

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

Bulungan is the northernmost Kabupaten in Kalimantan Timur Province. It is directly bordered on the northwest by the Sabah and Serawak Provinces of the Republic of Malaysia, on the south by Kabupatens Kutai and Berau, and on the east faces the Sulawesi Sea.

The central and southern areas of the Kabupaten are mountainous districts covering approximately 70 to 80 percent of the total Kabupaten area. Their ridges stretch from the west national boundary through to the south Kabupaten boundary. In the rest of the Kabupaten several river basins shape flat plains and form low swampy areas on the river mounths. From the north the Sebuku, the Sembakung, the Sesayap, the Sekatak and Kayan Rivers flow into the Sulawesi Sea. In the waters around the estuaries of the rivers such as the Sebuku, the Sembakung and the Sesayap several islands are formed. Of these the islands of Bunju and Tarakan both produce oils, while Subatik and Nunukan are busy in trade with the Sabah province of Malaysia. The national boundary crosses in an eastwest direction in the centre of Subatik Island.

The area of the Kabupaten is about 64,000 square kilometers, approximately 32 percent of the total of Kalimantan Timur Province. It consists administratively of 13 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Bulungan are 94 days and 1,452 mm respectively.

The number of working days per year, 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 : Kalimantan Timur
KABUPATEN : Bulungan

STATION : Tarakan

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										
February										
March										
April										
May										
June										
July										
August										
September										
October										
November										
December										
Total	57	1,140	61	1,599	48	959	130	1,588	176	1,975

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Bulungan in 1984 was 198,570 which was approximately 13.1% of the 1,518,800 total population of Kalimantan Timur Province as shown in Table 1-2-1.

The population density was 0.03 persons per ha which was lower than the provincial density of 0.07 and indicates the underpopulation of the Kabupaten becuase it is a vast area in a remote regional.

The recent annual average growth rate of population of the Kabupaten is 5.0% which is almost the same as the provincial rate of 5.7% and higher than the national rate of 2.2%. This may be a result of the on-going transmigration programme and development of oil bases in the Kabupaten.

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

Table 1-2-1 POPULATION BY KABUPATEN

DESCRIPTION	POPULATION	AAGR (%)	AREA (ha)	POPULATION DENSITY (persons/ha)	SURVEY YEAR
KABUPATEN:					
PASIR	94,620	4.5	2,004,000	0.05	1984
KUTAI	440,129	6.3	9,102,700	0.05	1983
BERAU	48,900	4.3	3,270,000	0.01	1984
BULUNGAN	198,570	5.0	6,400,000	0.03	1984
PROVINCE:					
KALIMANTAN TIMUR	1,362,800		20,244,000		1982
	1,438,700	5.7	20,244,000	0.07	1983
	1,518,800		20,244,000		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 : KALIMANTAN TIMUR

KABUPATEN : BULUNGAN

KECAMATAN	POPULATION	PROPORTION (%)
KAYAN HULU	4,964	2.5
KAYAN HILIR	834	0.4
LONG PUJUNGAN	3,447	1.7
MALINAU	18,105	9.1
LONG PESO	6,714	3.4
TANJUNG PALAS	36,108	18.2
TARAKAN	73,918	37.2
SESAYAP	6,182	3.1
SEMBAKUNG	6,210	3·2
MENTARANG	2,430	1·2
KERAYAN	8,920	4·5
LUMBIS	5,625	2.8
NUNUKAN	25,113	12·7
TOTAL	198,570	100

1.2.2 Land Use

In Kabupaten Bulungan, 32,766 ha of the current available land use area, which is approximately 0.5% of the 6,765,000 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 29,974 ha of agricultural harvest area and 2,792 ha of residential area which are 92.5% and 8.5% of the current available land use area respectively.

The agricultural harvest area consists of 20,697 ha of paddy field, 2,785 ha of plantation and 6,492 ha of other cultivated area which are 69.0%, 9.3% and 21.7% 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 : KALIMANTAN TIMUR

(ha)

KABUPATEN	WET PADDY FIELD	UPLAND PADDY FIELD	OTHER GULTIVATED AREA	PLANTATION AREA	RESIDENTIAL AREA	USABLE OPEN SPACE	RIVER & LAKE	FORESTRY AREA	OTHERS	TOTAL AREA	SURVEY YEAR
PASIR	7,881 (0.4)	19,666 (1.0)	-	21,557 (1.1)	3,204 (0.2)	-	32,685 (1.6)	1,038,033 (51.8)	880,974 (44.0)	2,004,000 (100)	1984
KUTAI	52,400 (0.6)		94,000 (1.0)	-	25,000 (0.3)	45,300 (0.5)	34,500 (0.4)	8,831,500 (97.0)	20,000 (0.2)	9,102,700 (100)	1982
BERAU	—	—	—	—	—	—	—	—	—	—	—
BULUNGAN	7,203 (0.1)	13,494 (0.2)	6,492 (0.1)	2,785 (0.04)	2,792 (0.04)	-	-	6,732,000 (99.5)	225 (0.003)	6,765,000 (100)	1982

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 Bulungan in 1984 were 22,006 ha and 68,353 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 18,482 ha and 56,633 ton respectively which are 84% and 82.8% of the total food crops. The yield rate of paddy production is 3.06 ton per ha. Thus, paddy is the most predominant agricultural crop of the Kabupaten.

As the table shows, average annual growth rates of area and production of paddy in 1979 through 1984 were 3.7% and 16.5% respectively which indicate favorable development of the paddy production. It is desirable for future paddy production that the existing wet paddy fields and paddy fields which can yield twice a year are increased through the development of irrigation.

The commodity crops are produced in the plantations. The area and production of plantation crops in 1983 were 2,954 ha and 465 ton respectively with current growth rates of 17.0% and 9.5% as shown in Table 1-2-5. Thus the plantation crop which is exported is an important agricultural product. Some changes are expected considering the international balance of supply and demand.

The population of the agricultural sector which is assumed from the employment in the Kabupaten is 75% of the total population as shown in Table 1-2-6. Thus this is an agricultural Kabupaten.

Future agricultural development is desirable by increasing the cultivated area for food crops suitable for future demand in a scheme of forestry development linked to the transmigration programme.

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

KABUPATEN : BULUNGAN

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	15,390	16,690	16,730	20,731	17,220	18,482	
OTHERS	1,082	1,667	1,682	1,532	3,506	3,524	
TOTAL	16,472	18,357	18,357	22,263	20,726	22,006	

PRODUCTION

(ton)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	26,433	31,649	32,829	23,582	34,639	56,633	
OTHERS	4,600	5,863	6,237	5,756	10,780	11,720	
TOTAL	31,033	37,512	39,066	29,338	45,419	68,353	

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	1.72	1.90	1.96	1.14	2.01	3.06	

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 : KALIMANTAN TIMUR

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AAGR (%) AREA	AAGR (%) PRODUCTION
PASIR	10,021	4,645	0.7	0
KUTAI	-	-	-	-
BERAU	6,814	3,771	17.5	28.7
BULUNGAN	2,954	465	17.0	9.5

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : KALIMANTAN TIMUR

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
PASIR	83,000	94,620	87.6	4.5	1984
KUTAI	358,000	440,129	81.4	6.0	1982
BERAU	37,000	48,900	76.1	5.4	1984
BULUNGAN	149,000	198,570	75.2	5.5	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 Bulungan are fishery, livestock, forestry and petroleum sectors. The fishery and the livestock sectors, among the above sectors, are based upon the local investment capital in the Kabupaten. Then the following table show their current growth rates.

	1980	1984	AAGR (%)
Catch (ton)	14,746	15,965	2.0

	1980	1984	AAGR (%)
Livestock	614	5,032	70.0

Yearly approx. the catch of 14,000 tons and the livestock of 4,000 tons excluding the consumption of the Kabupaten itself are respectively exported out of the Kabupaten. Both sectors are intending to increase renarkably as shown in the above tables.

And the following tables show the current growth of the forestry and the petroleum productions. Timber production indicates a high growth tendency.

	1980	1984	AAGR (%)
Timber production (m^3)	92,094	282,045	32.3

	1980	1984	AAGR (%)
Petroleum production (ton)	679,800	889,353	7.0

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

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Bulungan there is one provincial road which leads to T.G. Selor, the Kabupaten capital, from the south neighbouring Kabupaten Berau. A Kabupaten road runs toward the north along the east coastal areas of the Kabupaten, and then along the route of the Sesayapo river.

Only the areas along the Kabupaten road form a flat area. Besides the above Kabupaten road, Kabupaten roads are developed in both Sebalik and Tarakan Islands.

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 Bulungan are confirmed as 51 links and 522 Km respectively. These figures exclude Kabupaten roads with no data.

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

(1) Density of Kabupaten Roads

The density of the Kabupaten roads is 0.08 m per ha. This is distinctly lower than the national density of 0.48 m per ha and far lower than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table. Thus, the Kabupaten lags behind in density of Kabupaten roads.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Bulungan	522	6,400,000	0.08
Province : Kalimantan Timur	1,340	20,776,700	0.06
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 EXISTING ROAD LENGTH BY SURFACE TYPE

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(Km)

NO	TI	THN	KRK	L.L	ASP	BTB	TOTAL
LINK	1	1	24				25
LINK	2	12	20				32
LINK	3			24			24
LINK	4	24					24
LINK	5	12					12
LINK	6	12					12
LINK	7						
LINK	8	13					13
LINK	9		3				3
LINK	10		15				15
LINK	11	16					16
LINK	12	43					43
LINK	13		37				37
LINK	14	4					4
LINK	15	16	24				40
LINK	16	1					1
LINK	17	23					23
LINK	18	15					15
LINK	19						
LINK	20		20				20
LINK	21		15				15
LINK	22	15					15
LINK	23		3				3
LINK	24	10					10
LINK	25	1	3	1			5
LINK	26	7					7

(Km)

NO	TI	THN	KRK	L.L	ASP	BTB	TOTAL
LINK	27	7					7
LINK	28	14					14
LINK	29	20					20
LINK	30	22					22
LINK	31	2					2
LINK	32				2		2
LINK	33			1			1
LINK	34				2		2
LINK	35			2			2
LINK	36				3	2	5
LINK	37				1		1
LINK	38	2					2
LINK	39	1			1		1
LINK	40	1					1
LINK	41			1			1
LINK	42	1			3		4
LINK	43	1					1
LINK	44				2		2
LINK	45					1	1
LINK	46				1	3	3
LINK	47				1	1	1
LINK	48			1			1
LINK	49	1					1
LINK	50	1					1
LINK	51		1		4		4
LINK	52	5			1		5
LINK	53				1		1
TOTAL		303	164	30	18	7	522
RATIO		58	31	6	3	1	(2)

KRK : Gravel/Stone/Telford/Water Bound Macadam

TNH : Earth

LL : Others

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

	ASP	KRK	TNH/LL
Kabupaten : Bulungan	3.4	32.7	63.9
Province : Kalimantan Timur	5.8	37.5	56.7
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 distinctly high. This means that the road classification in the Kabupaten is low.

(3) Surface Condition of Kabupaten Roads

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

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

	Good	Fair	Poor	Bad
Kabupaten : Bulungan	56.1	25.7	15.1	3.1
Province : Kalimantan Timur	38.1	29.7	23.2	9.0
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

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

PROVINCE : KALIMANTAN TIMUR

KABUPATEN : BULUNGAN (%)

NO	TANAH				KRIKIL				LATASIR				ASPAL				BETON			
	BAIK	SEDANG	RUSAK	RUSAK BERAT	BAIK	SEDANG	RUSAK	RUSAK BERAT	BAIK	SEDANG	RUSAK	RUSAK BERAT	BAIK	SEDANG	RUSAK	RUSAK BERAT	BAIK	SEDANG	RUSAK	RUSAK BERAT
LINK 1	97	2	1		99	1														
LINK 2		67	33		90	10														
LINK 3											90	10								
LINK 4		40	50	10																
LINK 5		50	30	20																
LINK 6		40	50	10																
LINK 7																				
LINK 8	70	19	8	4																
LINK 9					70	15	10	5												
LINK 10					90	10														
LINK 11	98	2																		
LINK 12		20	50	30																
LINK 13					90	10														
LINK 14		70	30																	
LINK 15	70	15	10	5	70	15	10	5												
LINK 16		60	40																	
LINK 17		1	99	1																
LINK 18		70	30																	
LINK 19																				
LINK 20					90	10														
LINK 21					90	10														
LINK 22		90	10																	
LINK 23					90	10														
LINK 24	50	40	10																	
LINK 25	70	15	10	5	70	15	10	5	70	15	10	5								
LINK 26	77	9	13																	
LINK 27			90	10																
LINK 28	50	25	25																	
LINK 29		50	50																	
LINK 30	50	40	10																	
LINK 31	87	13																		
LINK 32													75	10	5	10				
LINK 33											70	30								
LINK 34													50	31	20					
LINK 35									95	5										
LINK 36													86	14			99	1		
LINK 37													40	20	40					
LINK 38	50	40	10																	
LINK 39	99	1																		
LINK 40	99	1																		
LINK 41									70	20	10									
LINK 42	30	70											77	17	5	2				
LINK 43	70	30																		
LINK 44													70	30						
LINK 45																	99	1		
LINK 46																	66	30	3	
LINK 47																	99	1		
LINK 48										50	50									
LINK 49	10	90																		
LINK 50	99	1																		
LINK 51													74	16		10				
LINK 52	60	12	6	22																
LINK 53													99	1						
AVERAGE	41	33	22	4	85	11	3	2	39	42	18	1	71	17	9	3	91	8	1	0
LENGTH	303 Km				164 Km				30 Km				18 Km				7 Km			
(Km)	124	100	67	12	139	18	5	3	12	13	5	0	13	3	2	1	6	1	0	0

The surface condition level of the Kabupaten roads in the Kabupaten is higher than both that of Indonesia and of Jawa Island. The proportion in good condition is relatively high. It seems that road maintenance in the Kabupaten is carried out diligently in spite of the low asphalted portion.

(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 31.0% flat, 48.0% hilly, 20.0% mountainous and 1.0% swampy.

1.3.3 Bridge Inventory

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

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

The inventory shown in Table 1-3-5 indicates a total of 84 bridges with a total length of 1,118 m of which 82 or 97.6% are timber, and 1 or 1.2% are others. Eight bridges with a total length of 228 m are required to be newly constructed.

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

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(Km)

102 (3)	BK	DT	GN	RW	TOTAL
LINK 1	21	4			25
LINK 2	32				32
LINK 3	24				24
LINK 4	24				24
LINK 5	12				12
LINK 6	12				12
LINK 7					
LINK 8		13			13
LINK 9		3			3
LINK 10		15			15
LINK 11		9	7		16
LINK 12	43				43
LINK 13			37		37
LINK 14			4		4
LINK 15	3	35	2		40
LINK 16	1				1
LINK 17	23				23
LINK 18	15				15
LINK 19					
LINK 20	20				20
LINK 21		15			15
LINK 22			15		15
LINK 23		3			3
LINK 24			10		10
LINK 25		3	2		5
LINK 26		6	1		7
LINK 27		7			7
LINK 28		14			14

(Km)

102 (3)	BK	DT	GN	RW	TOTAL
LINK 29	20				20
LINK 30			22		22
LINK 31	1	1			2
LINK 32		1	1		2
LINK 33	1			1	1
LINK 34		2			2
LINK 35				2	2
LINK 36		3	2		5
LINK 37		1			1
LINK 38		2			2
LINK 39			1		1
LINK 40		1			1
LINK 41			1		1
LINK 42		4			4
LINK 43		1			1
LINK 44		1		1	2
LINK 45		1			1
LINK 46		3			3
LINK 47		1			1
LINK 48		1			1
LINK 49		1			1
LINK 50		1			1
LINK 51		3	1		4
LINK 52		5			5
LINK 53		1			1
TOTAL	252	161	106	3	522
RATIO	48	31	20	1	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

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

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	8	100.00			8	100.00
2	1	15.00			1	15.00
3	1	15.00			1	15.00
4	1	15.00			1	15.00
5	2	30.00			2	30.00
6	3	45.00			3	45.00
8	3	35.00			3	35.00
10	7	49.00			7	49.00
11	6	85.00			6	85.00
12			4	60.00	4	60.00
13	2	25.00			2	25.00
14	1	6.00			1	6.00
15	10	125.00			10	125.00
16	1	25.00			1	25.00
17	8	120.00			8	120.00
18			4	168.00	4	168.00
20	6	57.00			6	57.00
21	7	68.00			7	68.00
22	2	30.00			2	30.00
23	2	34.00			2	34.00
25	1	12.00			1	12.00
26	1	40.00			1	40.00
27	1	10.00			1	10.00
28	3	65.00			3	65.00
29	1	40.00			1	40.00
30	2	30.00			2	30.00
31	1	5.60			1	5.60
32	1	11.00			1	11.00
42	1	8.70			1	8.70
51	1	16.60			1	16.60
TOTAL	84	1117.90	8	228.00	92	1345.90

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

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

	<<< BRIDGE >>>			(No)
IO3 (18)	KY	BJ	LL	TOTAL
LINK 1	0			0
LINK 2	1			1
LINK 3	1			1
LINK 4	1			1
LINK 5	2			2
LINK 6	3			3
LINK 8	3			3
LINK 10	7			7
LINK 11	6			6
LINK 12				
LINK 13	2			2
LINK 14	1			1
LINK 15	10			10
LINK 16	1			1
LINK 17	8			8
LINK 18				
LINK 20	6			6
LINK 21	7			7
LINK 22	2			2
LINK 23	2		1	2
LINK 25	1			1
LINK 26		1		1
LINK 27	1			1
LINK 28	3			3
LINK 29	1			1
LINK 30	2			2
LINK 31	1			1
LINK 32	1			1
LINK 42			1	1
LINK 51	1			1
TOTAL	82	1	1	84
RATIO	98	1	1	(%)

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

Bridges Type	Span Length (m)										
	⟨3	⟨5	⟨8	⟨10	⟨12	⟨14	⟨16	⟨18	⟨20	⟨99	Total
Timber	2	17	33	2	1	1	20	1	2	3	82
Concrete	-	-	-	-	-	-	-	-	-	-	-
Steel	-	-	-	-	-	1	-	-	-	-	1
Others	1	-	-	-	-	-	-	-	-	-	1
Total	3	17	33	2	1	2	20	1	2	3	84

Thus, most of the existing bridges on the Kabupaten roads are timber and the majority of spanlengths is less than 3 m.

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Bulungan 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	916	108	519	1,771	3,314
Proportion (%)	27.64	3.26	15.66	53.44	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	4.97	1.75	93.28	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 : KALIMANTAN TIMUR KAB : BULUNGAN

A)	Growth Rate of Population	:	5.00 (%)
B)	Growth Rate of Cultivated Area	:	6.00 (%)
C)	Growth Rate of Rice field	:	4.00 (%)
D)	Growth Rate of Rice yield rate	:	10.00 (%)
E)	Growth Rate of GDP / capita	:	3.90 (%)
a)	Geometrical Mean (A x B)	:	5.50 (%)
b)	Geometrical Mean (C x D)	:	6.96 (%)
c)	Geometrical Mean (a x b)	:	6.23 (%)
d)	Geometrical Mean (c x E)	:	5.06 (%)
	TRAFFIC GROWTH RATE	:	5.06 (%)

2.1.2 Present and Future Traffic Volume

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

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

Where :

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

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

Table 2-1-2 EXISTING AND FUTURE TRAFFIC VOLUME

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	0	0	2	15	10	5.1%	0	0	4	28	19	IIIC
2	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
3	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
4	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
5	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
6	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
7	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
8	800	50	150	350	1175	5.1%	1520	95	285	665	2232	IIIA
9	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
10	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
11	0	0	1	2	2	5.1%	0	0	2	4	4	IIIC
12	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
13	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
14	0	0	5	5	8	5.1%	0	0	9	9	15	IIIC
15	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
16	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
17	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
18	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
19	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
20	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
21	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
22	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
23	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
24	0	0	0	5	3	5.1%	0	0	0	9	6	IIIC
25	0	50	100	200	250	5.1%	0	95	190	380	475	IIIB-1
26	0	0	1	5	4	5.1%	0	0	2	9	8	IIIC
27	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
28	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
29	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
30	0	0	0	0	0	5.1%	0	0	0	0	0	IIIC
31	0	0	0	20	10	5.1%	0	0	0	38	19	IIIC
32	20	0	8	20	38	5.1%	38	0	15	38	72	IIIB-2
33	3	0	0	7	7	5.1%	6	0	0	13	13	IIIC
34	22	0	8	30	45	5.1%	42	0	15	57	85	IIIB-2
35	0	0	200	700	550	5.1%	0	0	380	1330	1045	IIIA
36	20	0	10	40	50	5.1%	38	0	19	76	95	IIIB-2
37	8	0	2	15	18	5.1%	15	0	4	28	34	IIIC
38	0	0	0	10	5	5.1%	0	0	0	19	9	IIIC
39	19	0	2	30	36	5.1%	36	0	4	57	68	IIIB-2
40	0	0	0	5	3	5.1%	0	0	0	9	6	IIIC
41	0	0	3	4	5	5.1%	0	0	6	8	9	IIIC
42	0	0	0	10	5	5.1%	0	0	0	19	9	IIIC
43	0	0	0	200	100	5.1%	0	0	0	380	190	IIIB-2
44	0	0	0	9	5	5.1%	0	0	0	17	9	IIIC
45	0	0	0	3	2	5.1%	0	0	0	6	4	IIIC
46	0	0	0	20	10	5.1%	0	0	0	38	19	IIIC
47	0	0	0	1	1	5.1%	0	0	0	2	2	IIIC
48	0	0	0	2	1	5.1%	0	0	0	4	2	IIIC
49	0	0	0	3	2	5.1%	0	0	0	6	4	IIIC
50	0	0	0	7	4	5.1%	0	0	0	13	8	IIIC
51	15	0	5	30	35	5.1%	28	0	9	57	66	IIIB-2
52	5	8	20	20	43	5.1%	9	15	38	38	82	IIIB-2
53	4	0	2	3	8	5.1%	8	0	4	6	15	IIIC
PERCENT	27.64	3.26	15.66	53.44			27.64	3.26	15.66	53.44		

2.2 Benefit

2.2.1 Benefit Estimation Method

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

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

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

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

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

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

(KM)

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

Source : Bina Marga

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

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
1	IIIB-2	KRK	48	6	27	92	127
2	IIIB-2	KRK	30	4	17	58	80
3	IIIB-2	KRK	37	4	21	72	98
4	IIIB-2	KRK	27	3	15	52	71
5	IIIB-2	KRK	22	3	12	42	58
6	IIIC	KRK	9	1	5	18	24
9	IIIC	KRK	11	1	6	21	29
10	IIIC	KRK	18	2	10	35	48
11	IIIB-2	KRK	24.	3	14	46	64
12	IIIB-2	KRK	71	9	41	138	190
13	IIIC	KRK	0	0	0	0	0
14	IIIC	KRK	0	0	0	0	0
15	IIIB-2	KRK	42	5	24	81	112
16	IIIB-2	KRK	37	4	21	72	98
17	IIIB-2	KRK	37	4	21	72	98
18	IIIB-2	KRK	60	7	34	116	159
20	IIIB-2	KRK	31	4	18	60	83
21	IIIB-2	KRK	31	4	18	60	83
23	IIIC	KRK	6	1	4	12	17
24	IIIC	KRK	0	0	0	0	0
27	IIIC	KRK	11	1	6	22	29
28	IIIB-1	ASP	188	22	107	364	499
29	IIIC	KRK	11	1	6	22	29
30	IIIC	KRK	15	2	9	29	41
31	IIIC	KRK	1	0	1	2	3
32	IIIC	KRK	0	0	0	0	0
33	IIIC	KRK	0	0	0	0	0

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 : BULUNGAN

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 8	LINK 9	LINK 10	LINK 11
	25 Km	32 Km	24 Km	24 Km	12 Km	12 Km	13 Km	3 Km	15 Km	16 Km
	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIC	IIIA	IIIC	IIIC	IIIB-2
YEAR	Surplus	Surplus	Surplus	Surplus	Surplus	Surplus	VOC	Surplus	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	1546	12823	9274	26140	10479	4713	621354	205	226	11459
1990	1650	14169	9791	28231	10972	4713	652486	227	238	12497
1991	1788	15111	10351	30429	12551	5266	685642	246	241	13535
1992	1895	15662	11128	31535	13044	5759	720248	248	267	14090
1993	2002	17020	11933	33626	13650	6259	756461	268	293	15183
1994	2145	18415	12493	36716	14636	6312	794731	290	320	16666
1995	2317	19406	13759	39856	15735	6811	835451	309	333	17276
1996	2490	20800	14824	40961	16728	7358	877264	329	360	18773
1997	2630	22244	15629	44158	17327	7857	921648	352	387	20311
1998	2838	24105	16461	47249	19346	7910	968534	372	400	21349
SUM	21301	179755	125643	358901	144468	62958	7833919	2846	3065	161139
COST	-77597	-10454	-13105	123188	41147	-6380	4561130	-9139	-52225	36229
/Km	-3104	-327	-546	5133	3429	-532	350856	-3046	-3482	2264

Chapter 3 ENGINEERING

3.1 Design Criteria and Specification

3.1.1 Geometric Design Criteria

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

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

3.1.2 Loading Specification

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

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

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

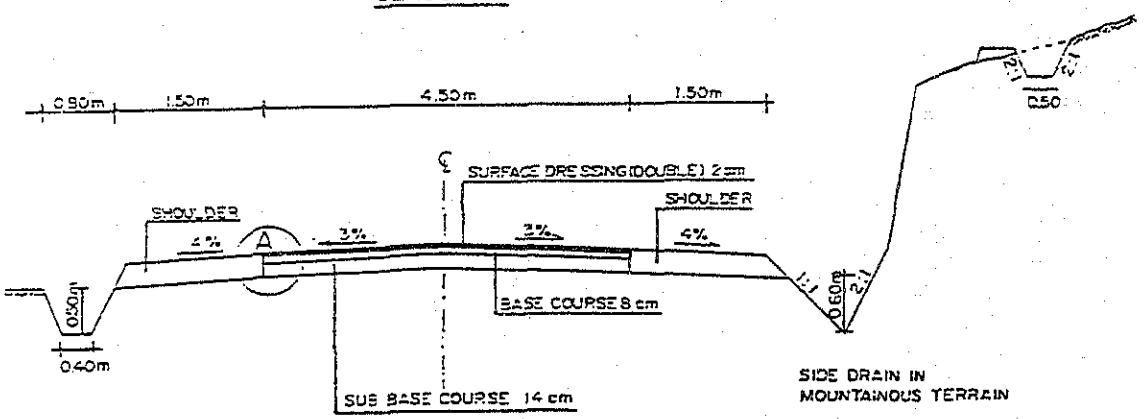
Table 3-1-1 DESIGN CRITERIA FOR KABUPATEN ROADS

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

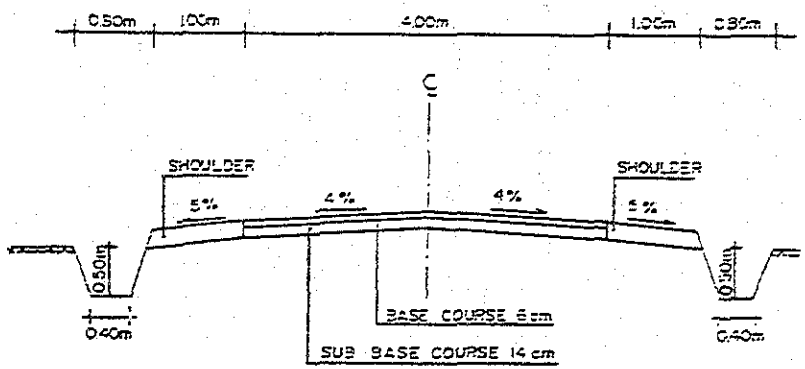
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

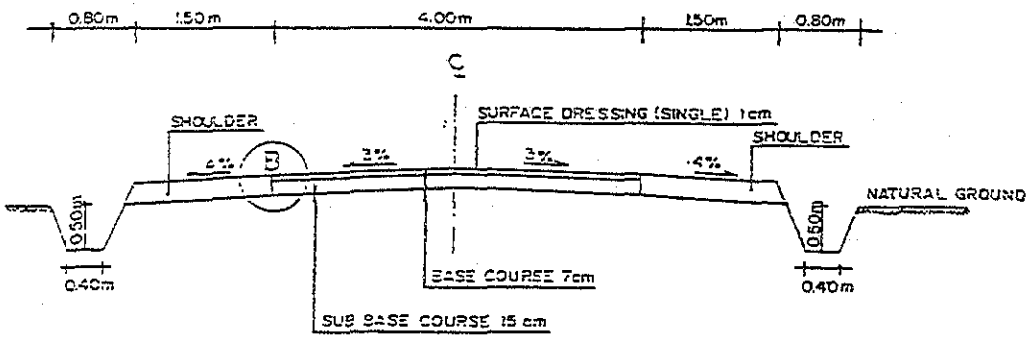
CLASS III A



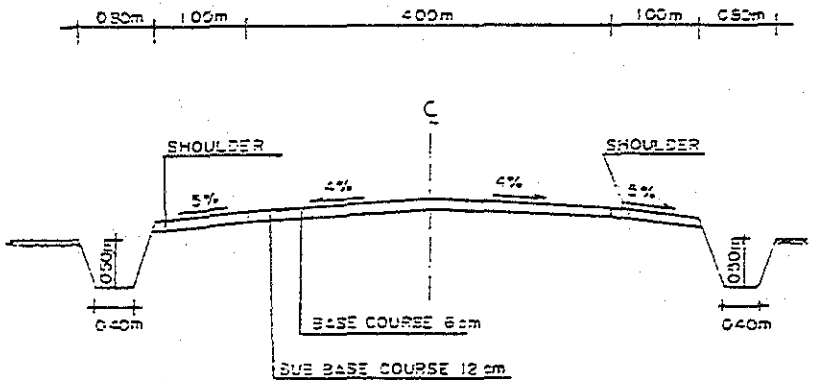
CLASS III B-2



CLASS III B-1



CLASS III C



3.2 Pavement Design

3.2.1 Design Conditions

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

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

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

1) Design Traffic Volume

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

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

2) Strength of Roadbed

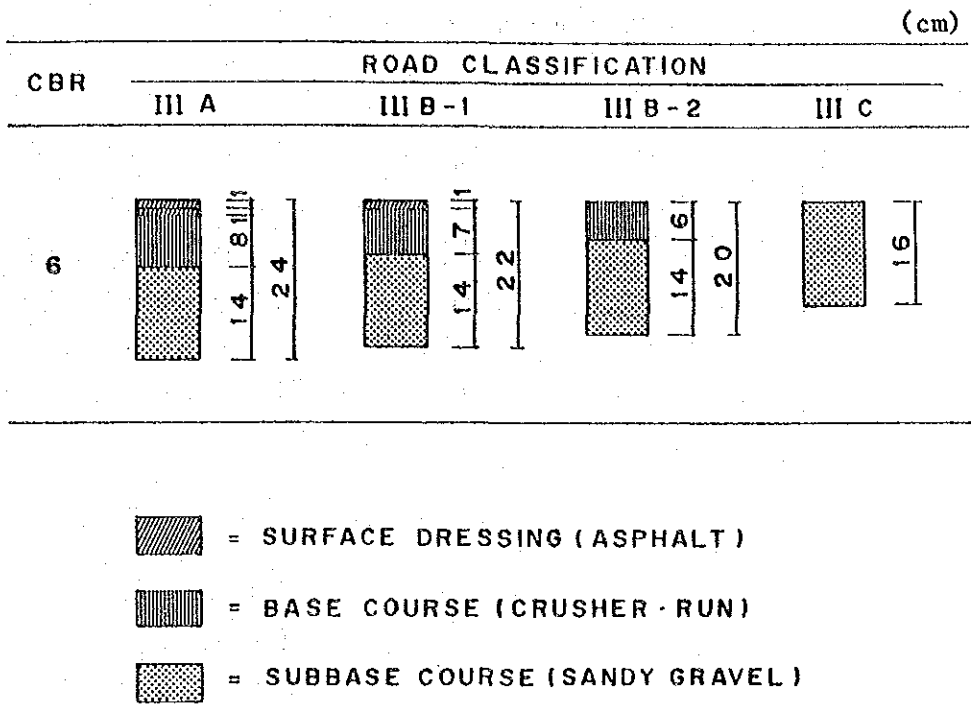
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

3.2.2 Pavement Structure

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

Fig. 3-2-1 PAVEMENT STRUCTURE



3.3 Design of Bridges and Other Structures

3.3.1 Standard Bridge

There are so many bridges to be improved or to be newly 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 deseribed below.

(1) Bridge Type

1) Superstructure

A timber beam bridge (hereinafter timber bridge has been finally selected regardless of road classification by the agreement of Bina Marga after studying the actual rurall condition of bridge construction. Fig. 3-3-1 shows the cross section of the standard type.

2) Substructure

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

3) Foundation

There is no information of subsoil conditions in the inventory data. However, timber piles of 20 cm diamenter 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 or river bed.

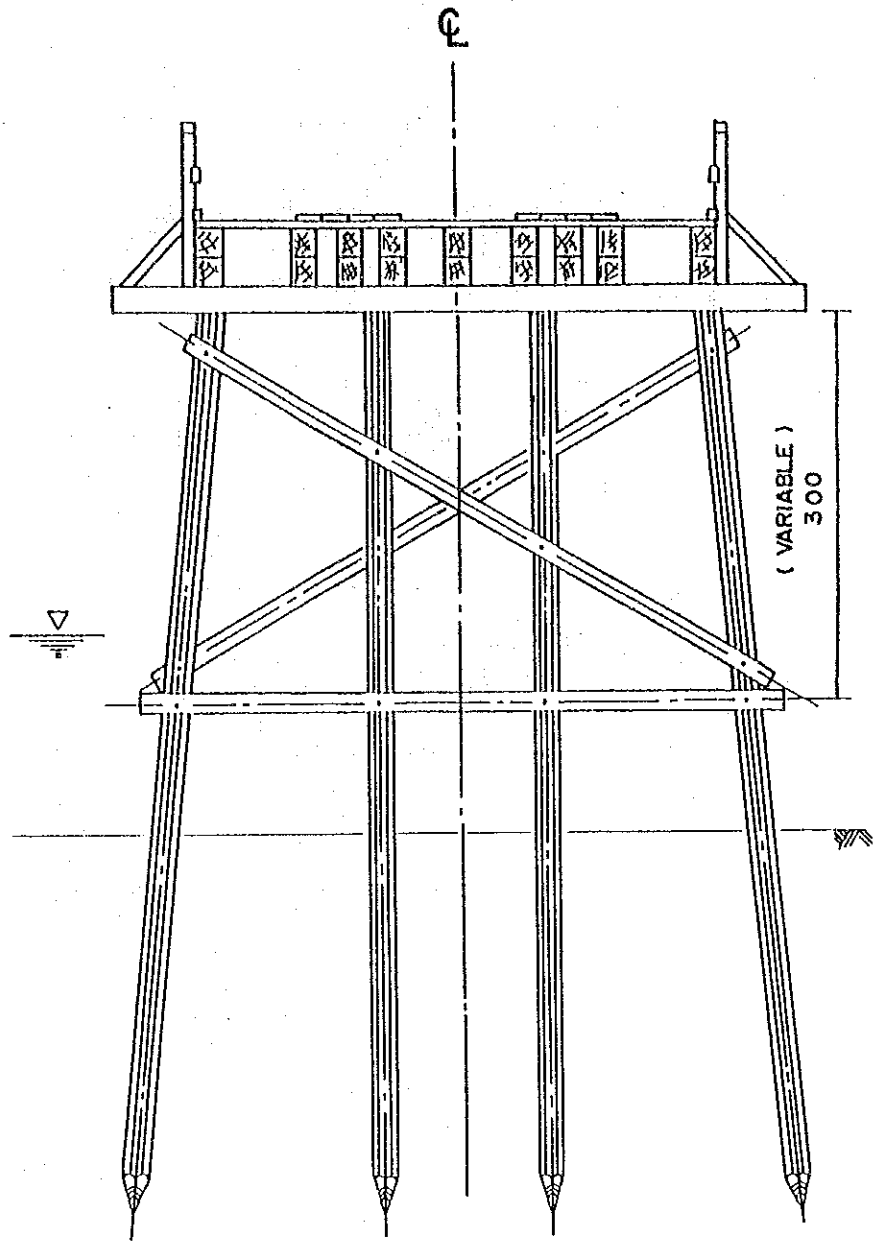
The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

(2) Bridge Width

The effective bridge width for the standard bridge has been generally decided as 4.0 m through discussions with Bina Marga and considering the actual width of Kabupaten roads.

Fig. 3-3-1 CROSS SECTION OF STANDARD BRIDGE

TIMBER BRIDGE



(3) Span Length

The range of span lengths are determined as:

Timber bridge: 3.0, 5.0 and 8.0 m

3.3.2 Other Structures

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 tranverse drainage.

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

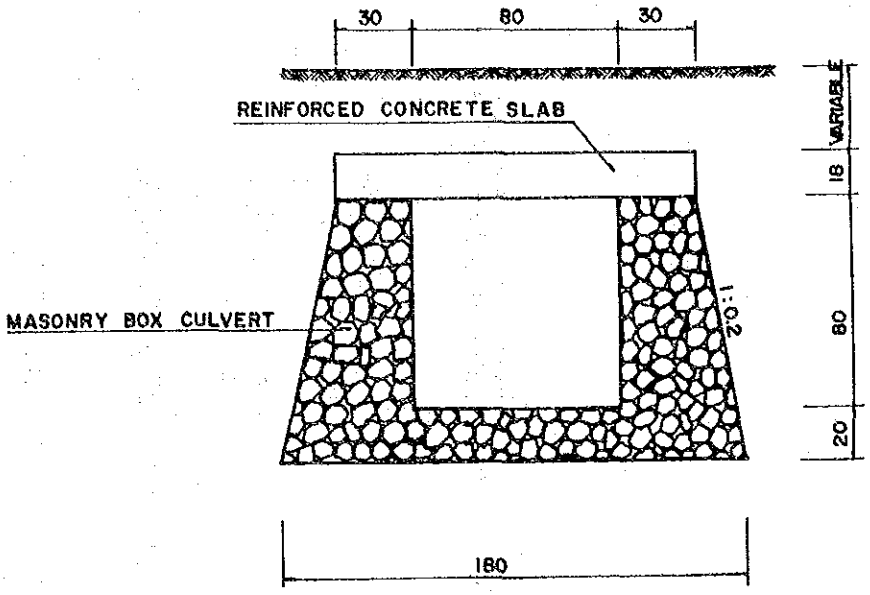
(2) Retaining Wall

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

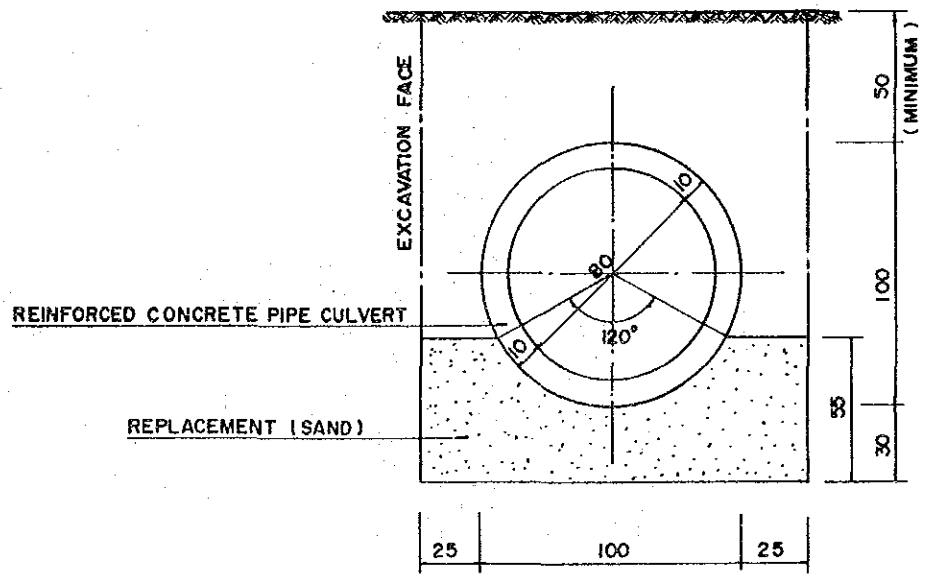
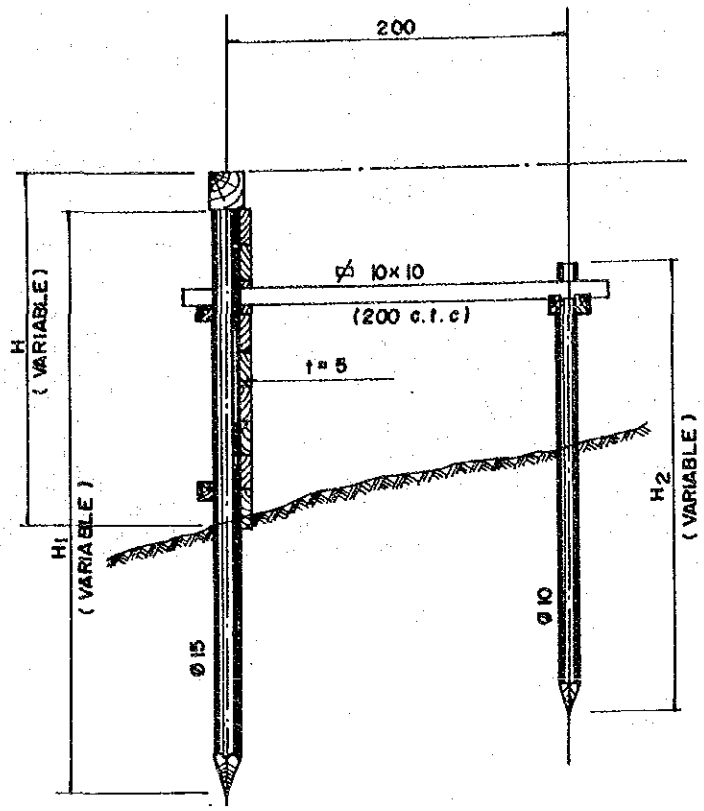
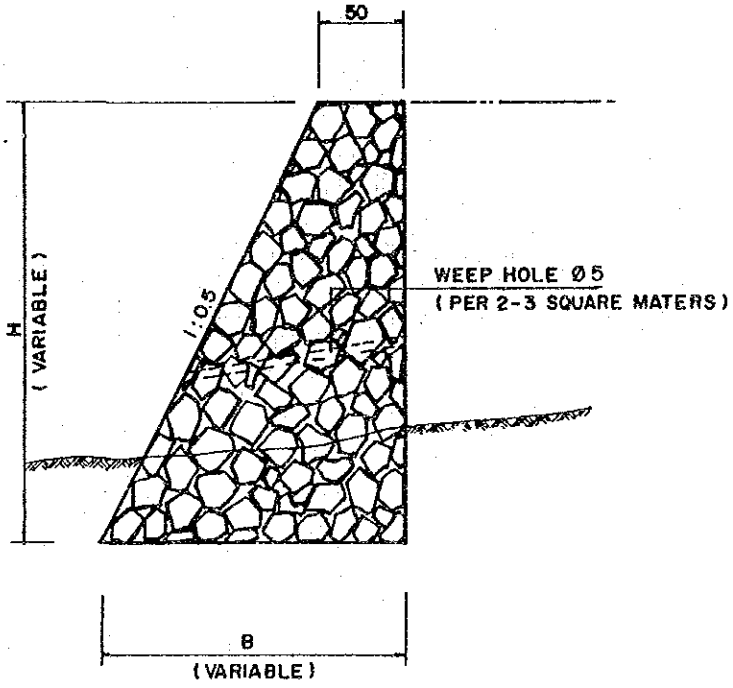


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Bulungan and other Kabupatens in Kalimantan Timur 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
Pasir	3,500	3,000	4,000	4,000	2,500	3,500	5,000
Kutai	2,500	2,000	2,500	2,500	1,500	3,000	3,500
Berau	2,500	2,000	2,500	2,500	1,500	3,000	3,500
Bulungan	3,000	2,000	2,500	2,500	1,500	2,000	3,500
Average	2,875	2,250	2,875	2,875	1,750	2,875	4,125

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 Bulungan together with for other Kabupatens in Kalimantan Timur Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	PASIR	KUTAI	BERAU	BULUNGAN	AVERAGE
Bitumen	L	300	400	400	400	375
Asphalt oil	L	600	600	600	600	600
Gasoline	L	250	250	250	250	250
Sand	M^3	9,000	8,000	4,500	4,500	6,500
Cement	bag	5,000	4,500	6,000	4,500	5,000
River Stone	M^3	13,500	15,000	12,000	15,000	13,875
Steel moulds	Set	8,000	8,000	8,000	8,000	8,000
Timber	M^3	150,000	100,000	100,000	150,000	125,000
Paint	L	3,000	2,000	2,000	2,200	2,250
Reinforcing Steel	Kg	800	1,000	1,000	1,000	950
Tying Wire	Kg	900	1,200	1,200	1,200	1,125
Equivalent Royalty	M^3	250	250	250	250	250

4.1.3 Hourly Equipment Cost

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

Table 4-1-3

HOURLY EQUIPMENT COST

PROVINCE : KALIMANTAN TIMUR
KABUPATEN : BULUNGAN

(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	272	24,563	24,835	7,769	1,029	8,798	33,633
	Bulldozer/Ripper	120 HP	298	25,579	25,877	8,499	1,583	10,082	35,959
	Swamp Bulldozer	120 HP	311	25,823	26,134	8,879	1,654	10,533	36,667
	Bulldozer	90 HP	173	17,226	17,399	4,914	650	5,564	22,963
	Bulldozer/Ripper	90 HP	186	17,818	18,004	5,299	987	6,286	24,290
	Bulldozer	65 HP	123	12,572	12,695	3,499	463	3,962	16,657
	Bulldozer/Ripper	65 HP	134	13,024	13,158	3,819	711	4,530	17,688
	Swamp Bulldozer	90 HP	185	17,808	17,993	5,284	984	6,268	24,261
	Swamp Bulldozer	65 HP	142	12,336	12,478	4,049	754	4,803	17,281
	Motor Grader	110 HP	243	20,742	20,985	6,919	1,289	8,208	29,193
	Motor Grader	75 HP	168	14,181	14,349	4,779	890	5,669	20,018
	Motor Grader	65 HP	151	12,391	12,542	4,299	801	5,100	17,642
	Road Stabilizer	W=1850 mm	301	3,398	3,699	8,594	426	9,020	12,719
	Vibratory Roller	4 ton	102	6,375	6,477	2,899	384	3,283	9,760
	Hand-guide Vib. Roller	1000 Kg	77	1,082	1,159	849	29	878	2,037
	Tire Roller	8-15 ton	109	16,132	16,241	3,106	102	3,208	19,449
	Vibratory Roller (D&T)	4 ton	102	6,375	6,477	2,899	384	3,283	9,760
	Hand-guide Vib. Roller	600 Kg	54	731	785	600	20	620	1,405
	Rough Terrain Crane	10 ton	352	24,336	24,688	10,039	748	10,787	35,475
	Hydraulic Excavator; Wheel	0.3 m3	144	15,685	15,829	4,109	544	4,653	20,482
	Wheel Loader	1.2 m3	246	14,829	15,075	7,019	929	7,948	23,023
	Wheel Loader	0.3 m3	80	5,327	5,407	2,269	300	2,569	7,976
	Water Tank Truck	4000 ltr.	79	6,367	6,446	868	120	988	7,434
	Fuel Tank Truck	4000 ltr.	80	6,374	6,454	882	122	1,004	7,458
	Dump Truck	3.0 ton	133	7,405	7,538	1,469	204	1,673	9,211
	Flat Bed Truck with Crane	3.0 ton	61	6,614	6,675	1,716	127	1,843	8,518
	Dump Loader Truck	12 ton	135	44,615	44,750	3,837	127	3,964	48,714
	Dump Truck	5.0 ton	198	12,431	12,629	2,189	305	2,494	15,123
	Flat Bed Truck	3.0 ton	20	6,186	6,206	563	41	604	6,810
	Portable Crusher/Screening	30-40 t/h	658	40,747	41,405	18,800	2,490	21,290	62,695
	Concrete Mixer	0.5 m3	486	2,850	3,336	5,400	423	5,823	9,159
	Water Pump	200 l/min	18	550	568	188	6	194	762
	Concrete Vibrator	3.3 HP	7	514	521	73	2	75	596
	Asphalt Sprayer	850 ltr.	92	1,201	1,293	1,019	142	1,161	2,454

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 : KALIMANTAN TIMUR KAB : BULUNGAN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	278	91	369
Subgrade Preparation	m2	35	11	46
Normal Fill	m3	2,924	863	3,787
Fill in Swamp	m3	4,067	1,053	5,120
Normal Excavation to Spoil	m3	1,705	523	2,228
Sub Base Course	m3	5,293	1,348	6,641
Base Course	m3	7,317	2,300	9,617
Shoulder	m2	499	146	645
Asphalt Patching	m2	4,997	1,512	6,509
Surface Dressing (Single)	m2	711	766	1,477
Surface Dressing (Double)	m2	924	1,207	2,131
Earth Drain	m	1,038	119	1,157
Earth Drain in Swamp (by machine)	m3	2,008	474	2,482
Pipe Culvert D80cm	m	51,840	50,140	101,980
Masonry Culvert (80x80cm)	m	81,531	40,282	121,813
Retaining Wall and Wing Wall (Timber)	m2	14,144	246	14,390
Retaining Wall and Wing Wall (Masonry)	m3	60,126	11,682	71,808
Gabion Protection	m3	20,721	120	20,841
Manual routine maintenance of road	Km	165,472	7,248	172,720
Routine maintenance of earth road	Km	165,184	37,924	203,108
Routine maintenance of gravel road	Km	329,067	88,092	417,159
Routine maintenance of asphalt road	Km	499,700	151,200	650,900

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 : KALIMANTAN TIMUR KAB : BULUNGAN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	49,834	3,215	53,049
Superstructure (Timber;Span 5m;10T)	m2	55,199	3,550	58,749
Superstructure (Timber;Span 8m;10T)	m2	73,115	4,665	77,780
Superstructure (Timber;Span 3m;BM50)	m2	61,793	3,975	65,768
Superstructure (Timber;Span 5m;BM50)	m2	67,462	4,309	71,771
Superstructure (Timber;Span 8m;BM50)	m2	85,560	5,455	91,015
Superstructure (Concrete;Span 3m;BM50)	m2	54,675	105,767	160,442
Superstructure (Concrete;Span 5m;BM50)	m2	56,060	118,299	174,359
Superstructure (Concrete;Span 8m;BM50)	m2	57,678	128,919	186,597
Superstructure (Concrete;Span10m;BM50)	m2	62,984	146,517	209,501
Superstructure (Concrete;Span15m;BM50)	m2	67,745	172,712	240,457
Substructure (Pier;for Timber;10T)	NO	434,033	29,776	463,809
Substructure (Abut;for Timber;10T)	NO	1,243,048	143,803	1,386,851
Substructure (Pier;for Timber;BM50)	NO	638,325	44,057	682,382
Substructure (Abut;for Timber;BM50)	NO	1,396,980	159,216	1,556,196
Substructure (Pier;for Concrete;BM50)	NO	2,390,993	467,275	2,858,268
Substructure (Abut;for Concrete;BM50)	NO	5,007,281	982,926	5,990,207
Demolition of Bridge (Timber->Timber)	m2	14,125	1,266	15,391
Demolition of Bridge (Timber->Concrete)	m2	14,125	1,266	15,391
Demolition of Bridge (Concrete)	m2	107,156	79,820	186,976
Maintenance of Timber Bridge (New)	m2	9,710	1,054	10,764
Maintenance of Concrete Bridge (New)	m2	2,380	3,001	5,381
Maintenance of Timber Bridge (Exist)	m2	11,930	2,370	14,300
Maintenance of Concrete Bridge (Exist)	m2	7,551	2,443	9,994

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 Bulungan are shown in Table 5-1-1.

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

KABUPATEN : BULUNGAN

CRITERIA NO	ROAD LINK NO
(2)	28,29,30
(6)	31,32,33
(8)	07,19,22,25,26,34,35,36,37,38,39,40,41,42,43,44, 45,46,47,48,49,50,51,52,53

5.2 Evaluation

5.2.1 Primary Analysis

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

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

5.2.2 Secondary Analysis

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

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

5.2.3 Ranking of Feasible Road Links

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

Table 5-2-1 RESULTS PRIMARY ANALYSIS

PROVINCE : KALIMANTAN TIMUR KABUPATEN : BULUNGAN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
8	13 Km	IIIA	163.409	VOC
28	14 Km	IIIB-1	33.134	Surplus
12	43 Km	IIIB-2	14.119	Surplus
4	24 Km	IIIB-2	0.078	Surplus
5	12 Km	IIIB-2	0.078	Surplus
6	12 Km	IIIC	0.078	Surplus
1	25 Km	IIIB-2	0.078	Surplus
9	3 Km	IIIC	0.078	Surplus
10	15 Km	IIIC	0.078	Surplus
11	16 Km	IIIB-2	0.078	Surplus
2	32 Km	IIIB-2	0.078	Surplus
13	37 Km	IIIC	0.078	Surplus
14	4 Km	IIIC	0.078	Surplus
15	40 Km	IIIB-2	0.078	Surplus
16	1 Km	IIIB-2	0.078	Surplus
17	23 Km	IIIB-2	0.078	Surplus
18	15 Km	IIIB-2	0.078	Surplus
20	20 Km	IIIB-2	0.078	Surplus
21	15 Km	IIIB-2	0.078	Surplus
23	3 Km	IIIC	0.078	Surplus
24	10 Km	IIIC	0.078	Surplus
27	7 Km	IIIC	0.078	Surplus
3	24 Km	IIIB-2	0.078	Surplus
29	20 Km	IIIC	0.078	Surplus
30	22 Km	IIIC	0.078	Surplus
31	2 Km	IIIC	0.078	Surplus
32	2 Km	IIIC	0.078	Surplus
33	1 Km	IIIC	0.078	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : KALIMANTAN TIMUR KABUPATEN : BULUNGAN

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
8	13 Km	IIIA	4190570	10.065	163.409	VOC
28	14 Km	IIIB-1	478078	2.149	33.134	Surplus
12	43 Km	IIIB-2	180326	1.181	14.119	Surplus
SUM	70 Km		4848974			

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

Nil

Chapter 6 IMPLEMENTATION PROGRAMME

6.1 Implementation Schedule

6.1.1 Project Cost

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

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

KABUPATEN: Bulungan

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	591	2,342	2,933
MAINTENANCE	111	564	675
SUPPLEMENTATION	363	-	363
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,110	2,906	4,016

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	179	2,888	3,067
CONSTRUCTION & MAINTENANCE EQUIPMENT	815	-	815
SPARE PARTS	71	18	89
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,110	2,906	4,016

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

6.1.2 Proposed Road Links

(1) Road Link to be Improved

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

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

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

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

The road links finally proposed to be improved in the Kabupaten are the 8 links with the total length of 189 km which is 35% of the 547 km total length of Kabupaten roads studied. The proposed road links are shown in Table 6-1-3.

Table 6-1-3 ROAD LINKS TO BE IMPROVED

KABUPATEN : BULUNGAN

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	8,12,
- Secondary	-
Engineering Point of View	2,3,4,5,7,11
Basic Human Needs	

As the table shows two feasible road links out of three are proposed to be improved.

Road Link No 28 does not form the local road network, therefore this road link is not selected.

The key road links which are located at the strategic point to complete the local road network near Tanjung Selor, the Kabupaten capital are selected from the engineering points of view.

Road Link No 7 is screened out in the primary screening, because of no data. However this road link is also a key road link to complete the road network, therefore this road link to complete the road network, therefore this road link is proposed to be constructed as a new road.

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

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

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

YEAR	LINK NO ( ) : rate
1988	2, 3 (80%)
1989	3 (20%), 4, 5, 7 (15%)
1990	7 (75%)
1991	7 (10%), 8, 11, 12 (20%)
1992	12 (80%)

KAB · BULUNGAN

CONSTRUCTION PROGRAMME

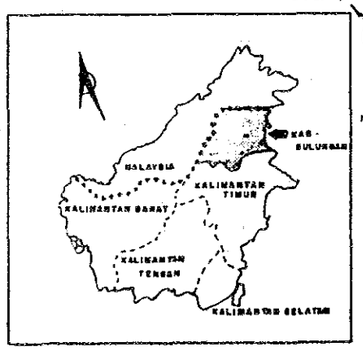
ROAD LINK NUMBER	FISCAL YEAR 1988/89	1989/90	1990/91	1991/92	1992/93
02,05	292				
03,04		348			
06,07			834		
07					
07,08				788	
11,12					644
12					
TOTAL COST 10^6 Rp	292	648	834	788	644

KEC · KERAYAN
KEC · MENTARANG
KEC · NUNUKAN
KEC · LUMBIS
KEC · SEMBAKUNG
KEC · LONG PUJUNGAN
KEC · MALINAU
KEC · TANJUNG PALAS
KEC · SESAYAP
KEC · LONG PESO
KEC · KAYAN HILIR
KEC · KAYAN HULU
KEC · TARAKAN

PA NADO
LONG BAWAN
LONG BERANG
LONG PUJUNGAN
LONG LORE
DATADIAN
LONG NAWANG
LONG AMPUNG
LONG BIA
LONG PASA
NENSALONG
SALAP
ATAP
MALINAU SEBERANG
MALINAU
PULAU SAPI
TANJUNG LAPANG
SEDULUR
TIDENGPALE
SESAYAP
BETAYAU
SEKATAK BUAH
SEKATAK BENGARA
ANCAS
PIMPIKS
PEJALIN
TG PALAS
TG SELOR
ANTUTAN
MARAT
LONG BELUANI MARALIH
JELARAI SELOR
GUNUNG SARIANG
MAIN ROAD BULUNGAN / BERAU
KE TANJUNG REDEP
MANGKU PADI
LIANGSUMYU
STABU
SUNGAI PANCANG
SUNGAI HYAMUK
SUNGAI TAIWAN
NUNUKAN
PELISUN
JUATALAUT
ANAL
TARAKAN
MAMBURUNGAN
SANGSAL TENGAH
PANGKALAN BUNYU

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

LOCATION MAP



SCALE:
0 5 10 15 KM

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

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE : KALIMANTAN TIMUR
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : BULUNGAN

(2) Road Links to Be Maintained

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

Table 6-1-5 ROAD LINKS TO BE MAINTAINED

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TH NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
1	25	98.8	1.1	0.0	0.0	0	24	1	6	400.00	0	0.00	5,720	16,972	3,281	20,253
2	32	56.3	31.3	12.5	0.0	0	20	12	1	60.00	0	0.00	858	14,574	2,591	17,165
3	24	0.0	90.0	10.0	0.0	0	24	0	1	60.00	0	0.00	858	12,585	2,430	15,015
8	13	69.5	19.0	7.6	3.8	0	0	13	3	176.00	0	0.00	2,517	6,398	1,004	7,402
9	3	70.0	15.0	10.0	5.0	0	3	0	0	0.00	0	0.00	0	1,484	286	1,770
10	15	90.0	10.0	0.0	0.0	0	15	0	7	196.00	0	0.00	2,803	9,756	1,895	11,651
20	20	90.0	10.0	0.0	0.0	0	20	0	6	228.00	0	0.00	3,260	12,611	2,447	15,058
21	15	90.0	10.0	0.0	0.0	0	15	0	7	272.00	0	0.00	3,890	10,663	2,075	12,738
23	3	90.0	10.0	0.0	0.0	0	3	0	2	136.00	0	0.00	1,945	3,106	608	3,714
32	2	75.0	10.0	5.0	10.0	2	0	0	1	66.00	0	0.00	944	2,118	473	2,591
34	2	49.5	30.5	20.0	0.0	2	0	0	0	0.00	0	0.00	0	1,330	317	1,647
35	2	93.0	5.0	0.0	0.0	0	2	0	0	0.00	0	0.00	0	989	191	1,180
36	5	91.4	8.6	0.0	0.0	3	2	0	0	0.00	0	0.00	0	2,985	666	3,651
37	1	40.0	20.0	40.0	0.0	1	0	0	0	0.00	0	0.00	0	665	158	823
39	1	99.0	1.0	0.0	0.0	0	0	1	0	0.00	0	0.00	0	331	45	376
42	4	65.0	30.0	3.8	1.3	3	0	1	1	40.02	0	0.00	572	2,804	615	3,419
43	1	70.0	30.0	0.0	0.0	0	0	1	0	0.00	0	0.00	0	331	45	376
44	2	70.0	30.0	0.0	0.0	2	0	0	0	0.00	0	0.00	0	1,330	317	1,647
51	4	74.3	15.8	0.0	10.0	4	0	0	1	99.60	0	0.00	1,424	3,849	870	4,719
52	5	60.0	12.0	6.0	22.0	0	0	5	0	0.00	0	0.00	0	1,653	226	1,879
53	1	99.0	1.0	0.0	0.0	1	0	0	0	0.00	0	0.00	0	665	158	823
SUM	180					18	128	34	38	1733.62	0	0.00	24,791	107,199	20,698	127,897

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 Bulungan 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 2,933 x 10^6 and maintenance cost is Rp 675 x 10^6 which is approximately 19% of the total expenditure.

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

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	226,250	429,754	508,536	590,645	525,802	2,280,987	(77.8%)
Ownership Cost	2,765	4,566	5,107	6,075	5,865	24,378	(1.1%)
Operation Cost	171,318	280,894	329,817	370,669	375,101	1,527,799	(67.0%)
Material Cost	5,130	30,359	37,666	58,624	27,514	159,293	(7.0%)
Labour Cost	17,526	57,880	69,615	78,236	48,739	271,996	(11.9%)
Contingency	29,511	56,055	66,331	77,041	68,583	297,521	(13.0%)
FOREIGN CURRENCY :	66,590	125,167	125,541	194,919	139,452	651,669	(22.2%)
Ownership Cost	50,136	76,580	86,216	102,601	104,915	420,448	(64.5%)
Operation Cost	7,337	10,992	12,130	14,302	15,119	59,880	(9.2%)
Material Cost	431	21,269	10,820	52,592	1,229	86,341	(13.2%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,686	16,326	16,375	25,424	18,189	85,000	(13.0%)
TOTAL COST :	292,839	554,921	634,077	785,564	665,254	2,932,655	
Ownership Cost	52,901	81,146	91,323	108,676	110,780	444,826	(15.2%)
Operation Cost	178,655	291,886	341,947	384,971	390,220	1,587,679	(54.1%)
Material Cost	5,561	51,628	48,486	111,216	28,743	245,634	(8.4%)
Labour Cost	17,526	57,880	69,615	78,236	48,739	271,996	(9.3%)
Contingency	38,196	72,381	82,706	102,465	86,772	382,520	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	47,424	107,884	127,677	125,630	155,596	564,211	(83.6%)
Ownership Cost	346	797	945	931	1,191	4,210	(0.7%)
Operation Cost	32,917	75,543	90,064	88,204	109,553	396,281	(70.2%)
Material Cost	2,441	5,152	5,533	5,878	6,657	25,661	(4.5%)
Labour Cost	11,720	26,392	31,135	30,617	38,195	138,059	(24.5%)
FOREIGN CURRENCY :	9,216	21,064	24,882	24,507	30,922	110,591	(16.4%)
Ownership Cost	7,666	17,667	21,053	20,680	25,768	92,834	(83.9%)
Operation Cost	859	2,002	2,418	2,379	2,974	10,632	(9.6%)
Material Cost	691	1,395	1,411	1,448	2,180	7,125	(6.4%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	56,640	128,948	152,559	150,137	186,518	674,802	
Ownership Cost	8,012	18,464	21,998	21,611	26,959	97,044	(14.4%)
Operation Cost	33,776	77,545	92,482	90,583	112,527	406,913	(60.3%)
Material Cost	3,132	6,547	6,944	7,326	8,837	32,786	(4.9%)
Labour Cost	11,720	26,392	31,135	30,617	38,195	138,059	(20.5%)

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

(TOTAL)

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(UNIT : 1000Rp)

I T E M	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	273,674	537,638	636,213	716,275	681,398	2,845,198	(78.9%)
Ownership Cost	3,111	5,363	6,052	7,006	7,056	28,588	(1.0%)
Operation Cost	204,235	356,437	419,881	458,873	484,654	1,924,080	(67.6%)
Material Cost	7,571	35,511	43,199	64,502	34,171	184,954	(6.5%)
Labour Cost	29,246	84,272	100,750	108,853	86,934	410,055	(14.4%)
Contingency	29,511	56,055	66,331	77,041	68,583	297,521	(10.5%)
FOREIGN CURRENCY :	75,806	146,231	150,423	219,426	170,374	762,260	(21.1%)
Ownership Cost	57,802	94,247	107,269	123,281	130,683	513,282	(67.3%)
Operation Cost	8,196	12,994	14,548	16,681	18,093	70,512	(9.3%)
Material Cost	1,122	22,664	12,231	54,040	3,409	93,466	(12.3%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,686	16,326	16,375	25,424	18,189	85,000	(11.2%)
TOTAL COST :	349,479	683,869	786,636	935,701	851,772	3,607,457	
Ownership Cost	60,913	99,610	113,321	130,287	137,739	541,870	(15.0%)
Operation Cost	212,431	369,431	434,429	475,554	502,747	1,994,592	(55.3%)
Material Cost	8,693	58,175	55,430	118,542	37,580	278,420	(7.7%)
Labour Cost	29,246	84,272	100,750	108,853	86,934	410,055	(11.4%)
Contingency	38,196	72,381	82,706	102,465	86,772	382,520	(10.6%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Bulungan 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.

- 3-Dump Truck

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

a. Equipment for Road Maintenance

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

b. Equipment for Bridge Maintenance

- 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

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

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

Table 6-1-7 REQUIRED NUMBER OF EQUIPMENT

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	250	0	0.45	0.62	0.15	0.64	0.82
Swamp Bulldozer	250	0	0.00	0.20	0.96	0.28	0.60
Motor Grader	250	0	1.02	1.28	0.52	1.54	1.22
Hand-guide Vib. Roller	250	0	0.01	0.45	0.26	0.93	0.11
Tire Roller	250	0	0.00	0.00	0.00	0.33	0.00
Vibratory Roller (D&T)	250	0	0.71	1.26	1.24	1.51	1.46
Hydraulic Excavator; Wheel	250	0	0.00	0.47	2.35	0.68	1.44
Wheel Loader	250	0	1.13	1.63	1.64	2.01	2.45
Water Tank Truck	250	0	0.36	0.78	0.87	0.93	0.99
Dump Truck	250	0	8.01	14.28	16.29	17.92	17.24
Flat Bed Truck with Crane	250	0	0.01	0.42	0.32	0.51	0.14
Flat Bed Truck	250	0	0.01	0.16	0.10	0.65	0.04
Portable Crusher/Screening	250	0	0.23	0.04	0.01	0.19	0.20
Concrete Mixer	250	0	0.01	0.10	0.03	0.28	0.00
Water Pump	250	0	0.01	0.09	0.03	0.20	0.00
Concrete Vibrator	250	0	0.01	0.06	0.03	0.03	0.00
Asphalt Sprayer	250	0	0.00	0.00	0.00	0.33	0.00

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

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : KALIMANTAN TIMUR KAB : BULUNGAN

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	-	-
Bulldozer/Ripper	90 HP	53,000	-	-
Swamp Bulldozer	90 HP	52,850	1	52,850
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	3	143,400
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	1	8,500
Tire Roller	8-15 ton	31,070	1	31,070
Vibratory Roller (D&T)	4 ton	29,000	2	58,000
Vibratory Roller	4 ton	29,000	-	-
Rough Terrain Crane	10 ton	100,400	-	-
Hydraulic Excavator; Wheel	0.3 m3	41,100	2	82,200
Wheel Loader	1.2 m3	70,200	2	140,400
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	14	205,800
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	1	25,190
Flat Bed Truck	3.0 ton	11,275	2	22,550
Portable Crusher/Screening	30-40 t/h	188,000	-	-
Concrete Mixer	0.5 m3	18,000	-	-
Water Pump	200 l/min	630	-	-
Concrete Vibrator	3.3 HP	740	-	-
Asphalt Sprayer	850 ltr.	10,200	-	-
Service Car	3 ton	11,600	1	11,600
4 Wheel Drive Vehicle	70 HP	17,500	1	17,500
Motorcycle	100 cc	1,100	3	3,300

PURCHASE COST TOTAL	815,110
OWNERSHIP COST (FOREIGN)	452,230
EQUIPMENT COST SUPPLEMENTED	362,880

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Dump Truck	30,290
Portable Crusher/Screening	30,265
Asphalt Sprayer	497
TOTAL	61,052

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 : KALIMANTAN TIMUR KAB : BULUNGAN

ITEM	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	0.00	68062.50	10312.50	37275.00	137600.00	253250.00
Subgrade Preparation	m2	84000.00	262500.00	112500.00	319700.00	240800.00	1019500.00
Normal Fill	m3	0.00	0.00	0.00	1150.00	0.00	1150.00
Fill in Swamp	m3	0.00	8625.00	43125.00	12410.00	26640.00	90800.00
Normal Excavation to Spoil	m3	1280.00	3420.00	300.00	2649.20	4024.80	11674.00
Sub Base Course	m3	8604.80	25651.20	12000.00	24846.00	19264.00	90366.00
Base Course	m3	9408.00	1152.00	0.00	6159.00	8256.00	24975.00
Shoulder	m2	153600.00	117900.00	37500.00	152800.00	103200.00	565000.00
Asphalt Patching	m2	0.00	0.00	0.00	0.00	0.00	0.00
Surface Dressing (Single)	m2	0.00	0.00	0.00	58500.00	0.00	58500.00
Surface Dressing (Double)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Earth Drain	m	0.00	28350.00	33750.00	37560.00	0.00	99660.00
Earth Drain in Swamp (by machine)	m3	0.00	9375.00	46875.00	13450.00	28800.00	98500.00
Pipe Culvert D80cm	m	10.00	461.25	206.25	221.50	0.00	899.00
Masonry Culvert (80x80cm)	m	0.00	0.00	0.00	40.00	0.00	40.00
Retaining Wall and Wing Wall (Timber)	m2	0.00	12.00	60.00	308.00	0.00	380.00
Retaining Wall and Wing Wall (Masonry)	m3	0.00	115.20	0.00	574.50	0.00	689.70
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	64.00	0.00	64.00
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	176.25	281.25	85.50	192.00	735.00
Superstructure (Timber;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span10m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span15m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Timber;10T)	NO	0.00	2.70	4.50	6.40	3.20	17.00
Substructure (Abut;for Timber;10T)	NO	0.00	5.80	9.00	4.80	6.40	26.00
Substructure (Pier;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Timber)	m2	0.00	63.30	196.50	90.20	0.00	350.00
Demolition of Bridge (Timber->Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	77.20	177.60	216.00	209.50	257.00	937.30
Routine maintenance of earth road	Km	14.00	22.00	22.00	15.50	9.00	82.50
Routine maintenance of gravel road	Km	54.20	137.60	176.00	176.00	217.00	760.80
Routine maintenance of asphalt road	Km	9.00	18.00	18.00	18.00	31.00	94.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	120.00	0.00	120.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	839.81	1727.62	1793.62	1705.62	2069.62	8136.29
Maintenance of Concrete Bridge (Exist)	m2	0.00	0.00	0.00	0.00	0.00	0.00

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.

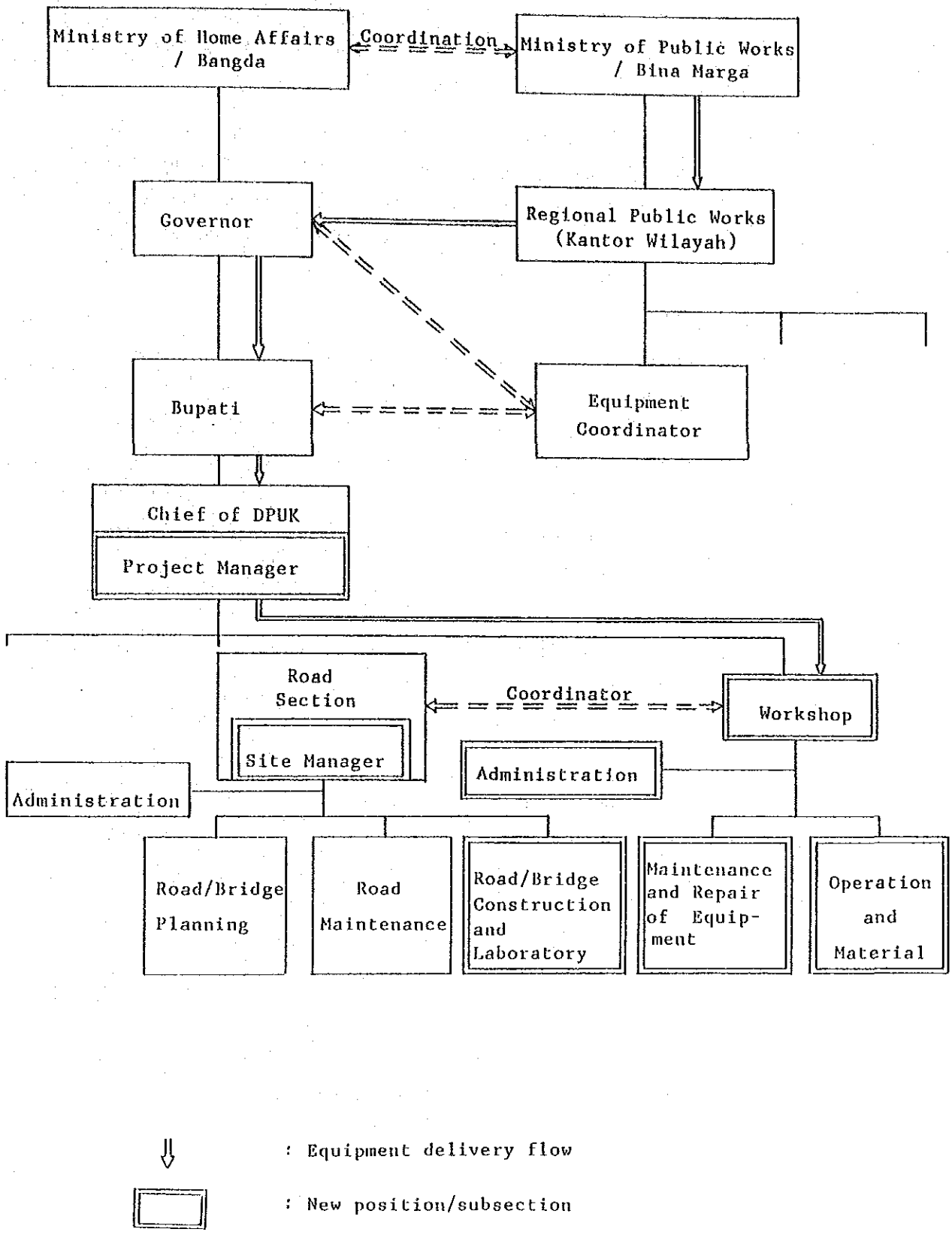
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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