

**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 15

KABUPATEN BERAU

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団

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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 Berau 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.

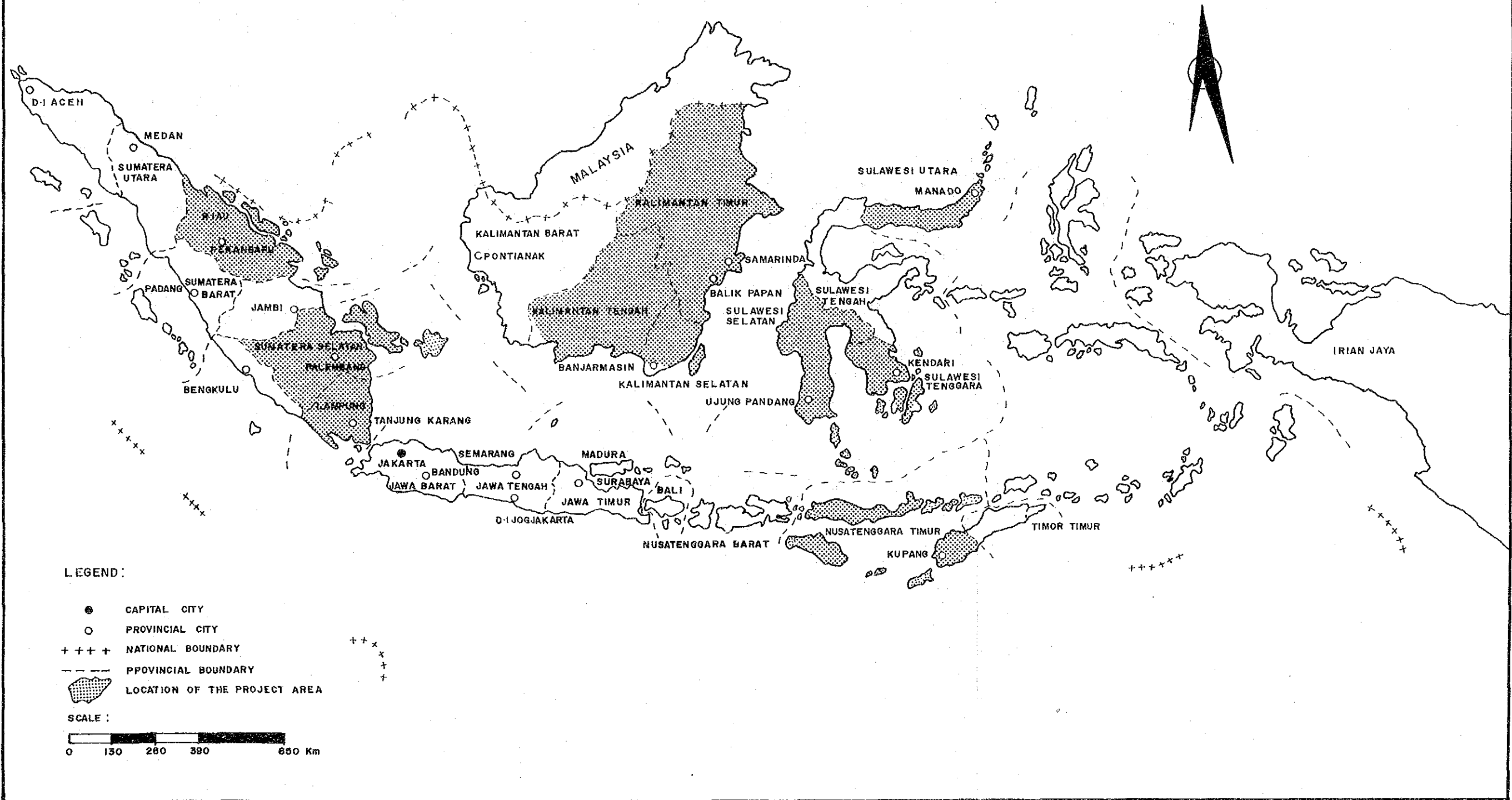
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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


V · PROPINSI KALIMANTAN TIMUR

- 13 · KAB · PASIR
- 14 · KAB · KUTAI
- 15 · KAB · BERAU
- 16 · KAB · BULUNGAN

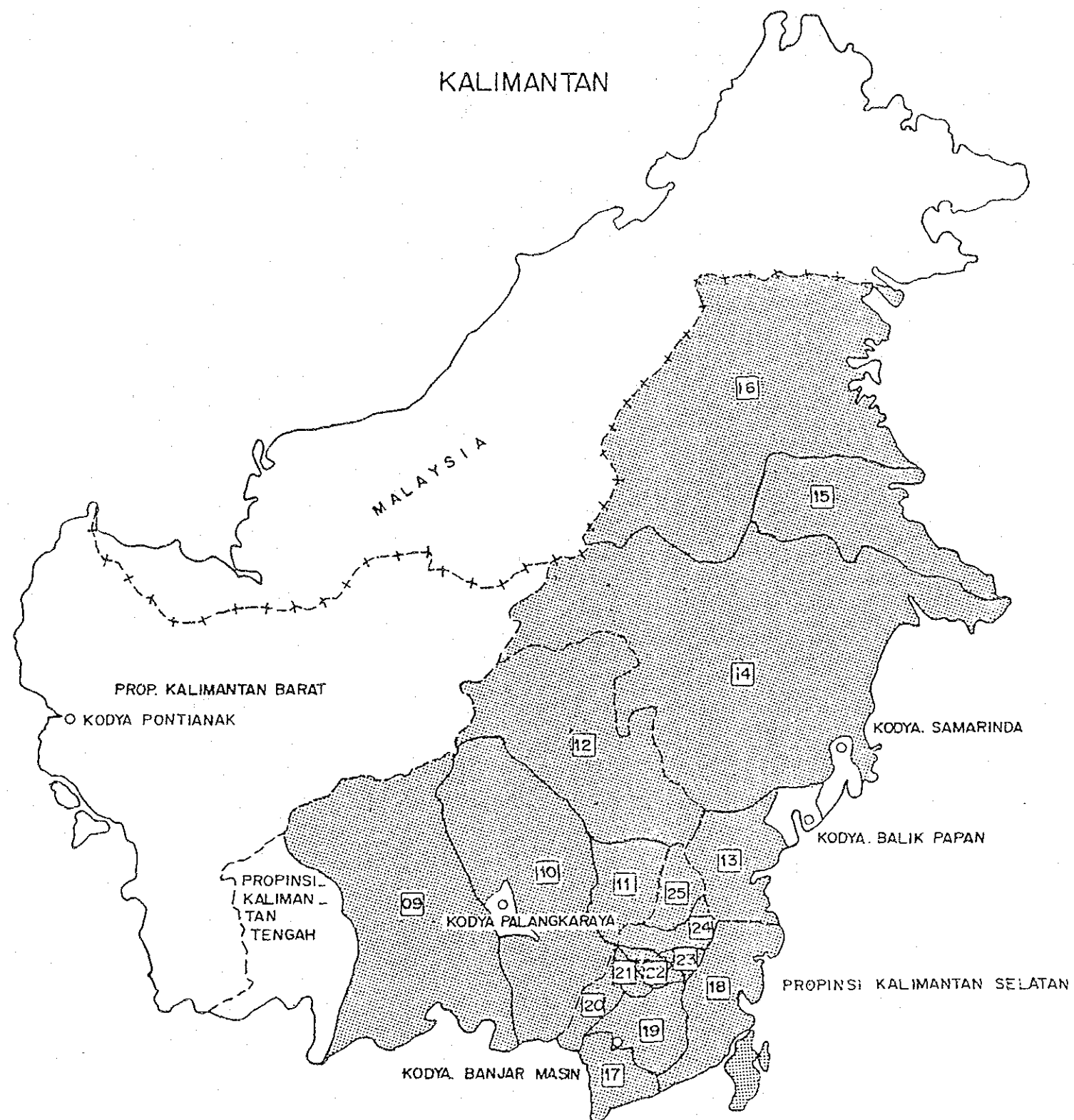
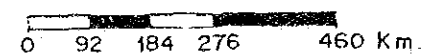
VI · PROPINSI KALIMANTAN SELATAN

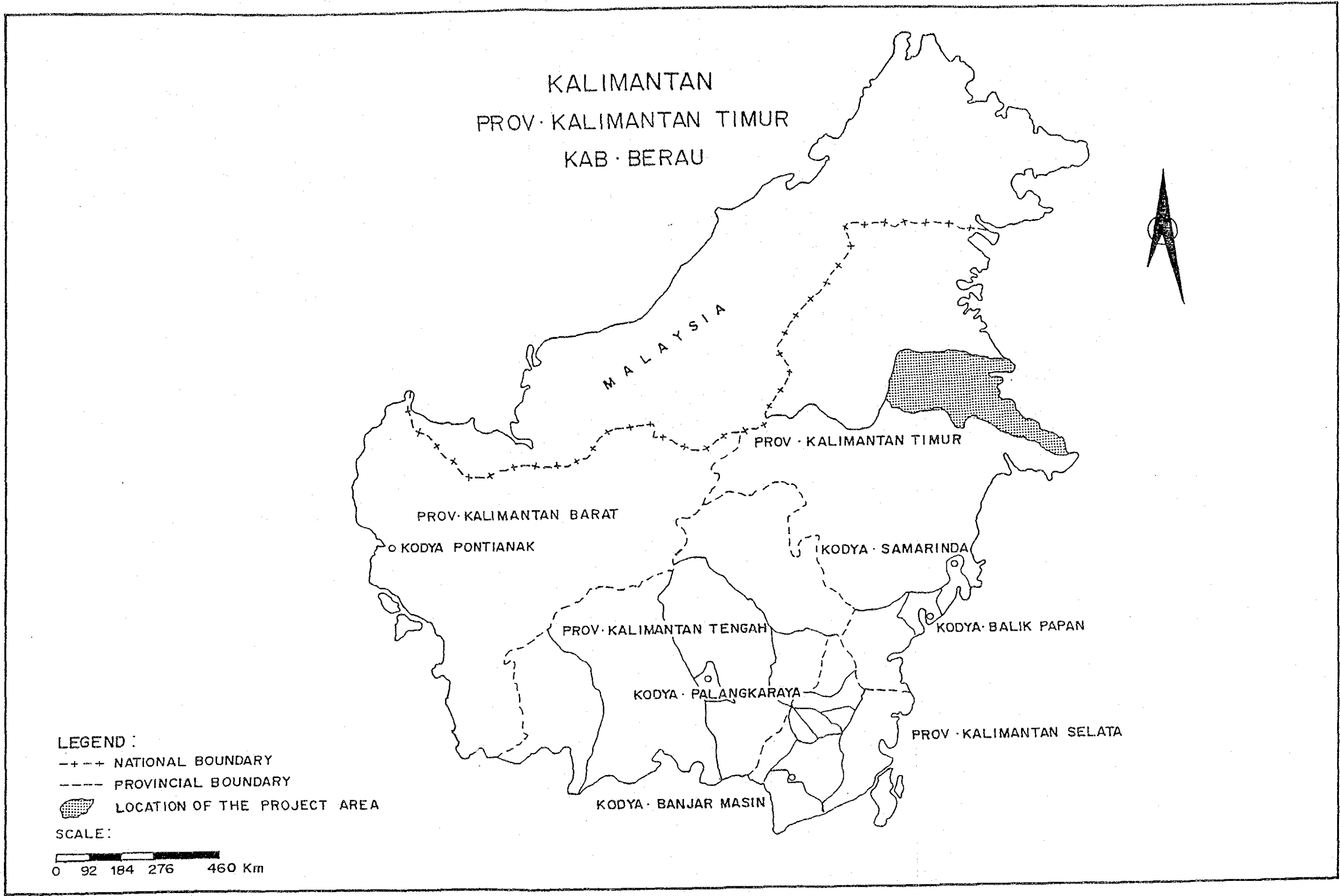
- 17 · KAB · TANAH LAUT
- 18 · KAB · KOTA BARU
- 19 · KAB · BANJAR
- 20 · KAB · BARITO KUALA
- 21 · KAB · TAPIN
- 22 · KAB · HULU SUNGAI SELATAN
- 23 · KAB · HULU SUNGAI TENGAH
- 24 · KAB · HULU SUNGAI UTARA
- 25 · KAB · TABALONG

LEGEND :

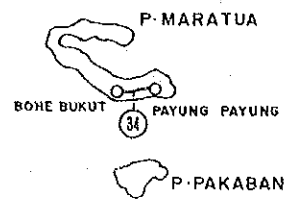
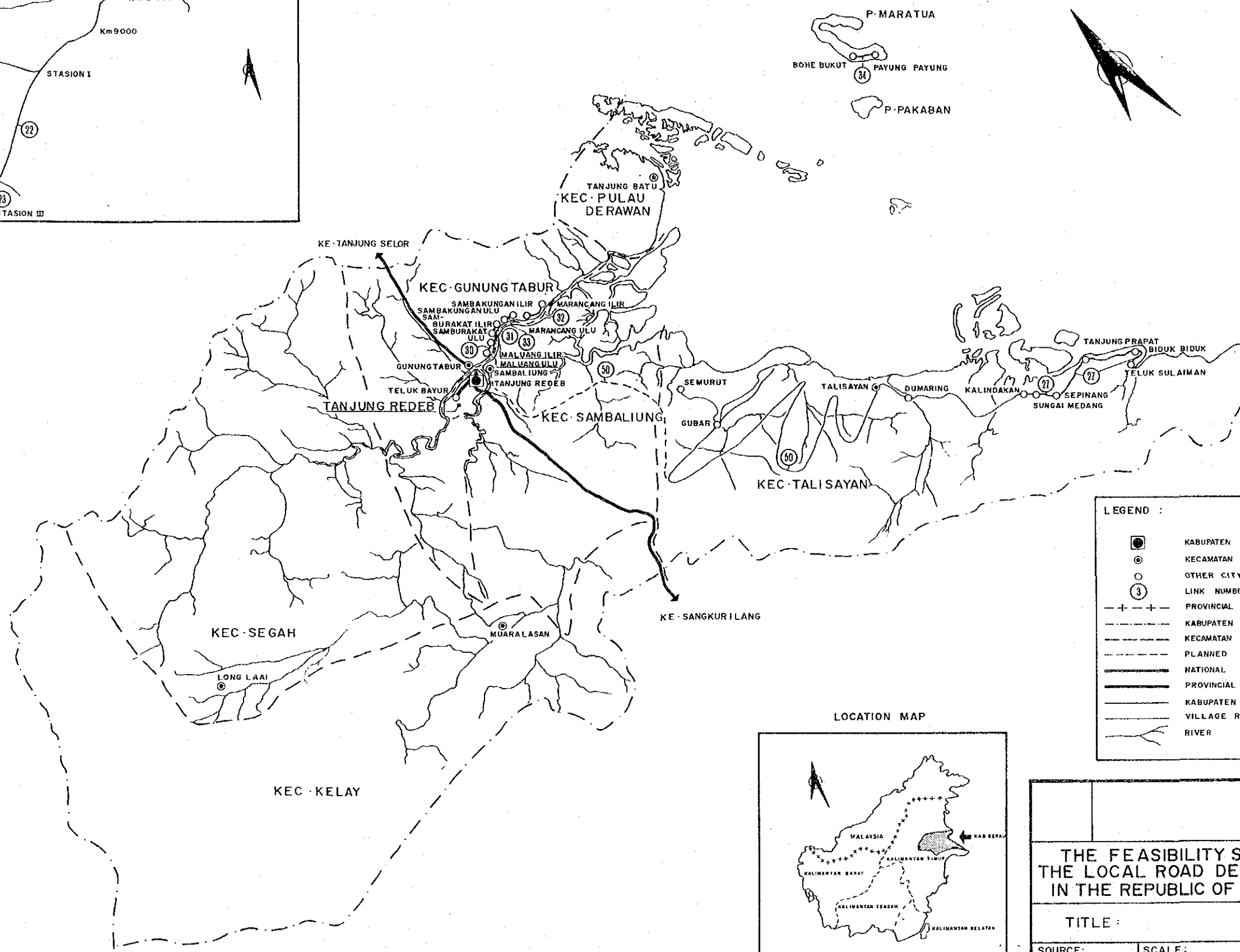
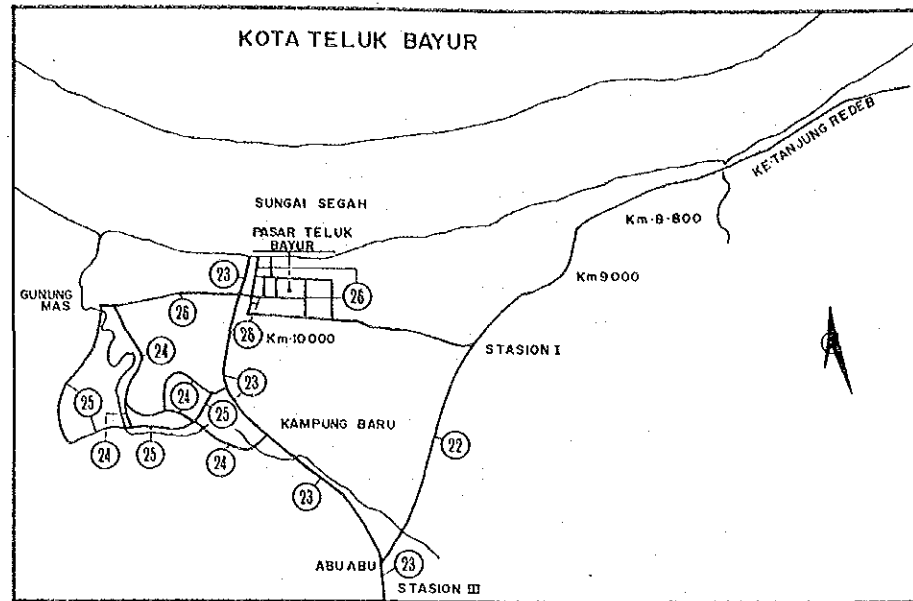
- +--+ NATIONAL BOUNDARY
- PROVINCIAL BOUNDARY
-  LOCATION OF THE PROPOSED AREA

SCALE :



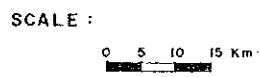
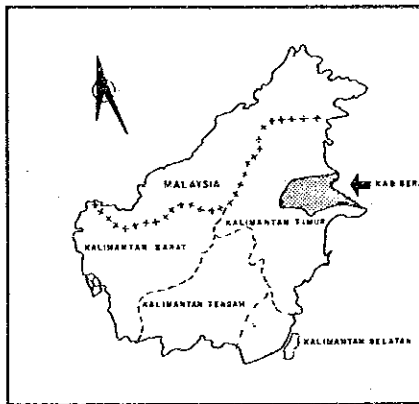


KAB. BERAU



LEGEND :

- KABUPATEN CAPITAL
- KECAMATAN CAPITAL
- OTHER CITY
- LINK NUMBER
- PROVINCIAL BOUNDARY
- KABUPATEN BOUNDARY
- KECAMATAN BOUNDARY
- PLANNED ROAD
- NATIONAL ROAD
- PROVINCIAL ROAD
- KABUPATEN ROAD
- VILLAGE ROAD
- RIVER



THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA		
TITLE :		
SOURCE: DIREKTORAT JENDERAL CIPTA KARYA	SCALE: AS SHOWN	PROVINCE : KALIMANTAN TIMUR KABUPATEN : BERAU

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Chapter 1 BACKGROUND OF THE KABUPATEN

1.1 Topographic and Meteorological Conditions

1.1.1 Location and Topography

Kabupaten Berau is bordered on the north and west by Kabupaten Bulungan and on the south by Kabupaten Kutai halving the Sambaliung Peninsula. On the east it faces the Sulawesi Sea.

The topographic feature of the Kabupaten is that of mountains ranging along the boundaries to the north, west and south surrounding a central plain where the capital of the Kabupaten, Tanjungredeb, is located. The east side opens to the sea. The mountainous district occupies approximately 70 percent of the total Kabupaten area. The mountains of Mantam 2,467 meter high located in the west and Nyapa in the south are notable. The central plain is on the basin of the River Berau. Along most of the shore coral reefs have developed except at the marshy islands at the Berau estuary.

The area of the Kabupaten is about 32,700 square kilometers, approximately 16 percent of the total of Kalimantan Timur Province. It consists administratively of 9 Kecamatan.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Berau are 133 days and 1,781 mm respectively.

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

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

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

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 : Berau

STATION : T.J. Redep

MONTH	1 9 8 0		1 9 8 1		1 9 8 2		1 9 8 3		1 9 8 4	
	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)
January	11	166	-	-	13	304	16	129	20	184
February	10	104	-	-	9	305	8	38	28	331
March	13	345	-	-	12	287	6	14	17	191
April	14	316	-	-	7	97	6	34	16	155
May	1	4	3	90	12	174	13	162	14	195
June	4	25	3	75	-	-	9	177	8	157
July	5	162	8	177	-	-	31	513	15	123
August	5	39	5	145	-	-	7	30	9	157
September	3	100	7	225	1	5	9	113	7	104
October	2	100	9	202	11	287	15	111	9	82
November	-	-	6	184	5	60	8	107	9	104
December	-	-	11	265	11	100	17	343	22	170
Total	68	1,361	52	1,363	81	1,619	145	1,771	174	1,953

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Berau in 1984 was 48,900 which was approximately 3.2% of the 1,518,800 total population of Kalimantan Timur Province as shown in Table 1-2-1.

The population density was 0.05 persons per ha which was lower than the provincial density of 0.07 and indicates the underpopulation of the Kabupaten.

The recent annual average growth rate of population of the Kabupaten is 4.3% which is lower than the provincial rate of 5.7% and higher than the national rate of 2.2%. This may be because there is no transmigration programme in the Kabupaten and because there is little in flow or outflow of the population due to the geographic condition.

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 : BERAU

KECAMATAN	POPULATION	PROPORTION (%)
KELAY	2,571	5.3
TALISAYAN	9,950	20.3
SEMBALIUNG	5,414	11.1
SEGAH	1,802	3.7
TANJUNG REDEB	15,543	31.8
GUNUNG TABUR	8,811	18.0
PULAU DERAWAN	4,809	9.8
TOTAL	48,900	100

1.2.2 Land Use

Although the precise condition of land use in Kabupaten Berau is unknown because no relevant data were collected, an outline can be given from the topographical condition.

The Kabupaten has a high portion covered by forest and is still in an undeveloped condition of land use. Future development is expected.

Table 1-2-3

LAND USE

PROVINCE : KALIMANTAN TIMUR

KABUPATEN	(ha)										SURVEY YEAR	
	WET PADDY FIELD	UPLAND PADDY FIELD	PADDY FIELD TIVATED AREA	OTHER GUL-TIVATED AREA	PLANTATION AREA	RESIDENTIAL AREA	USABLE OPEN SPACE	RIVER & LAKE	FORESTRY AREA	OTHERS		TOTAL AREA
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 Berau in 1984 was 3,959 ha and 9,821 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 3,715 ha and 8,597 ton respectively which are 93.8% and 87.5% of the total food crops. The yield rate of paddy production is 2.31 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 3.0% and 16.8% respectively which indicate favorable development of the paddy production. It should be noted that the paddy production in 1982 and 1983 could not be taken into account for estimation of the growth rate because these years had extraordinarily bad weather.

The production of both upland and wet paddy are each 50% of the total paddy production of the Kabupaten at present. It is desirable that productivity of paddy increases and this depends upon future expansion of the existing wet paddy fields through the development of irrigation together with river improvement.

The commodity crops, of which palm oil is major, are produced in the plantations. The area and production of plantation crops in 1983 were 6,814 ha and 3,771 ton respectively with current growth rates of 17.5% and 28.7% 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 76% of the total population as shown in Table 1-2-6. Thus this is an agricultural Kabupaten.

Future agricultural development of the Kabupaten depends upon increase of the existing wet paddy fields through consolidation of the infra-structure in order to promote more intensive productivity.

Table 1-2-4

AREA AND PRODUCTION OF FOOD CROPS

KABUPATEN : BERAU

CULTIVATED AREA

ITEM	YEAR						(ha)
	1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	3,800	3,625	3,901	4,175	1,791	3,715	
OTHERS	353	466	487	323	1,023	244	
TOTAL	4,153	4,091	4,388	4,498	2,814	3,959	

PRODUCTION

ITEM	YEAR						(ton)
	1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	6,894	6,890	7,120	10,999	2,103	8,597	
OTHERS	1,468	1,786	1,860	1,572	5,129	1,224	
TOTAL	8,362	8,676	8,980	12,571	7,227	9,821	

YIELD RATE

ITEM	YEAR						(ton/ha)
	1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	1.81	1.90	1.83	2.63	1.17	2.31	

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	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 Berau are forestry, coal mining and fishery sectors.

The following tables show the current growth of the forestry and the coal mining productions.

	<u>1980</u>	<u>1984</u>	<u>AAGR (%)</u>
Timber production (m ³)	16,786	289,929	200
	<u>1979</u>	<u>1984</u>	<u>AAGR (%)</u>
Coal production (ton)	3,600	13,500	30.3

Notes : 1. AAGR : Average annual growth rate

2. Source : Kabupaten data

As can be seen in the above tables, both sectors indicate a high growth tendency. However these industries are based upon the foreign investment capital and their transportation relies mainly upon the river.

The following table shows the current growth of the fishery production.

	<u>1980</u>	<u>1984</u>	<u>AAGR (%)</u>
Catch (ton)	3,262	3,911	4.6

Notes : 1. AAGR : Average annual growth rate

2. Source : Kabupaten data

Yearly approx. 3,000 tons excluding the consumption of the Kabupaten itself are presumed for export out of the Kabupaten.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Berau there is one provincial road which runs across the Kabupaten from south to north crossing the Segah river. However its transportation capacity is limited because there is no bridge to cross the river. At present transportation between Tanjung Redes, the Kabupaten capital, and Gunung Taburon on the opposite river bank is obliged to rely upon ferry boat.

Since flat areas in the Kabupaten are limited to the areas which extend from around the Kabupaten capital to the east coast and also as these areas are crossed by rivers, the said provincial road only functions as a trunk road between the neighbouring Kabupatens.

Therefore the Kabupaten roads consist of an isolated road along the Berau river and a road centering on Talisayan in the eastern area and there does not appear to be a road network at present.

The present regional transportation system of the Kabupaten still relies upon the river.

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 Berau are confirmed as 34 links and 80 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 0.02 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 greatly in density of Kabupaten roads.

	<u>Total Length</u> (km)	<u>Area</u> (ha)	<u>Density</u> (m/ha)
Kabupaten : Berau	80	3,270,000	0.02
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 KAD : DENAU

(Km)							(Km)						
102 (7)	ASP	BTS	THH	KRK	L.L	TOTAL	102 (7)	ASP	BTS	THH	KRK	L.L	TOTAL
LINK 1	1					1	LINK 18				2		2
LINK 2	1					1	LINK 19				1		1
LINK 3	1					1	LINK 20				2		2
LINK 4	1					1	LINK 21			1			1
LINK 5	1					1	LINK 22			1			1
LINK 6	1					1	LINK 23	2					2
LINK 7	1					1	LINK 24			1			1
LINK 8		1				1	LINK 25			1			1
LINK 9		1				1	LINK 26	1					1
LINK 10	1					1	LINK 27			27		9	36
LINK 11	1					1	LINK 28						
LINK 12	1					1	LINK 29						
LINK 13	1					1	LINK 30			1			1
LINK 14	1					1	LINK 31				1		1
LINK 15	2					3	LINK 32				5		5
LINK 16		1				1	LINK 33				1		1
LINK 17							LINK 34					6	6
TOTAL							17	3	33	12	15	80	
RATIO							21	4	41	15	19	(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:

	<u>ASP</u>	<u>KRK</u>	<u>TNH/LL</u>
Kabupaten : Berau	21.3	18.8	60.1
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 lower than either that of Indonesia or of Jawa Island. The proportion of low grade roads such as earth roads and others is comparatively 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:

	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>Bad</u>
Kabupaten : Berau	42.5	36.2	21.3	-
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 : BERAU

(1)

102 (7)	ASP				BIB				INH				KPK				L.L				
	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	
LINK 1		99																			
LINK 2		99																			
LINK 3	99																				
LINK 4	99																				
LINK 5		99																			
LINK 6	99																				
LINK 7	99																				
LINK 8					99																
LINK 9						99															
LINK 10		99																			
LINK 11		99																			
LINK 12		99																			
LINK 13	30																				
LINK 14	99																				
LINK 15	65	36								99											
LINK 16						99															
LINK 17																					
LINK 18														84		17					
LINK 19														43		57					
LINK 20															85	16					
LINK 21																					
LINK 22										99											
LINK 23	71	28	2							97	3										
LINK 24																					
LINK 25										52	48										
LINK 26		99								40	60										
LINK 27										87	13								99		
LINK 28																					
LINK 29																					
LINK 30											20	80									
LINK 31														99							
LINK 32														28	32	40					
LINK 33														99							
LINK 34																			99		
AVERAGE	44	55	1	0	33	66	1	0	12	16	12	0	59	29	12	0	99	1	0	0	0
LENGKAP		17 Km				3 Km				33 Km				12 Km					15 Km		
(Kil)	7	9	0	0	1	2	0	0	4	15	14	0	7	3	1	0	15	0	0	0	0

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

(4) Terrain Conditions of Kabupaten Roads

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

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

The proportions of terrain conditions in the Kabupaten are 79.0% flat and 21.0% hilly.

There is no swampy or mountainous area in the Kabupaten so that road construction is anticipated to be comparatively simple.

1.3.3 Bridge Inventory

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

The bridge types are classified 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 92 bridges with a total length of 938 m of which 89 or 96.7% are timber, 2 or 2.2% are concrete and 1 or 1.1% are others. One bridge with a length of 7 m is required to be newly constructed.

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

PROV : KALIMANTAN TIMUR KAB : BERAU

(Km)

LINK	DT	BK	TOTAL
LINK 1	1	1	1
LINK 2	1	1	1
LINK 3	1	1	1
LINK 4	1	1	1
LINK 5	1	1	1
LINK 6	1	1	1
LINK 7	1	1	1
LINK 8	1	1	1
LINK 9	1	1	1
LINK 10	1	1	1
LINK 11	1	1	1
LINK 12	1	1	1
LINK 13	1	1	1
LINK 14	1	1	1
LINK 15	1	2	3
LINK 16	1	1	1
LINK 17	1	1	1
LINK 18	2	1	2
LINK 19	1	1	1
LINK 20	2	1	2
LINK 21	1	1	1
LINK 22	1	1	1
LINK 23	2	1	2
LINK 24	1	1	1
LINK 25	1	1	1
LINK 26	1	1	1
LINK 27	27	9	36
LINK 28	1	1	1
LINK 29	1	1	1
LINK 30	1	1	1
LINK 31	1	1	1
LINK 32	4	1	5
LINK 33	1	1	1
LINK 34	2	4	6
TOTAL	63	17	80
RATIO	79	21	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : KALINANTAN TIMUR KAB : BERAU

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

		EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH	
1	8	49.40			8	49.40	
2	3	14.15			3	14.15	
3	8	34.60			8	34.60	
4	1	4.00			1	4.00	
5	4	14.50			4	14.50	
6	2	16.00			2	16.00	
7	3	9.00			3	9.00	
8	1	4.00			1	4.00	
12	2	7.70			2	7.70	
14	1	5.00			1	5.00	
15	1	3.80			1	3.80	
18	18	104.50	1	7.00	19	111.50	
19	4	35.50			4	35.50	
20	15	100.50			15	100.50	
21	1	3.60			1	3.60	
23	1	3.00			1	3.00	
24	2	4.00			2	4.00	
25	3	17.00			3	17.00	
27	11	455.00			11	455.00	
30	1	15.50			1	15.50	
32	2	37.00			2	37.00	
TOTAL	92	937.75	1	7.00	93	944.75	

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

PROV : KALINANTAN TIMUR KAB : BERAU

<< BRIDGE >>					(No)
NO (18)	KY	BT	LL	TOTAL	
LINK 1	8			8	
LINK 2	3			3	
LINK 3	8			8	
LINK 4		1		1	
LINK 5	4			4	
LINK 6	2			2	
LINK 7	3			3	
LINK 8	1			1	
LINK 12	1	1		2	
LINK 14	1			1	
LINK 15			1	1	
LINK 18	18			18	
LINK 19	4			4	
LINK 20	15			15	
LINK 21	1			1	
LINK 23	1			1	
LINK 24	2			2	
LINK 25	3			3	
LINK 27	11			11	
LINK 30	1			1	
LINK 32	2			2	
TOTAL	89	2	1	92	
RATIO	97	2	1	(%)	

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

<u>Bridges Type</u>	<u><3</u>	<u><5</u>	<u><8</u>	<u><10</u>	<u><12</u>	<u><14</u>	<u><16</u>	<u><18</u>	<u><20</u>	<u><99</u>	<u>Total</u>
Timber	52	36	1	-	-	-	-	-	-	-	89
Concrete	-	2	-	-	-	-	-	-	-	-	2
Steel	-	-	-	-	-	-	-	-	-	-	-
Others	-	1	-	-	-	-	-	-	-	-	1
Total	52	39	1	-	-	-	-	-	-	-	92

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 Berau 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:

	<u>SEDAN</u>	<u>BUS</u>	<u>TRUCK</u>	<u>MOTOR- CYCLE</u>	<u>TOTAL</u>
Total Trips	659	0	193	1,694	2,546
Proportion (%)	25.88	0.00	7.58	66.54	100.00

Source : Bina Marga Inventory

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

	<u>SEDAN</u>	<u>BUS</u>	<u>TRUCK</u>	<u>MOTOR- CYCLE</u>	<u>TOTAL</u>
Proportion (%)	0.18	2.87	5.20	91.75	100.00

Source : Kabupaten.

Thus, the proportion of motorcyces 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:

$$GR^i = \sqrt{A \times B}$$

Traffic Growth Rate GR = Final adjusted figure:

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

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

Table 2-1-1 TRAFFIC GROWTH RATE ESTIMATION

PROV : KALIMANTAN TIMUR		KAB : BERAU	
A)	Growth Rate of Population	:	4.30 (%)
B)	Growth Rate of Cultivated Area	:	5.00 (%)
C)	Growth Rate of Rice field	:	3.00 (%)
D)	Growth Rate of Rice yield rate	:	5.00 (%)
E)	Growth Rate of GDP / capita	:	3.90 (%)
<hr/>			
a)	Geometrical Mean (A x B)	:	4.65 (%)
b)	Geometrical Mean (C x D)	:	4.00 (%)
c)	Geometrical Mean (a x b)	:	4.32 (%)
d)	Geometrical Mean (c x E)	:	4.11 (%)
<hr/>			
TRAFFIC GROWTH RATE		:	4.11 (%)

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 :

$$T_n = T_e (1 + r)^n$$

Where :

T_n : Future traffic volume n years later

T_e : 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 : BERAU

< SPD : 1/2 >

LINK NO	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
2	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
3	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
4	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
5	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
6	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
7	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
8	35	0	5	80	80	4.1%	59	0	8	135	135	111B-2
9	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
10	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
11	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
12	45	0	15	120	120	4.1%	76	0	25	203	203	111B-1
13	40	0	10	100	100	4.1%	68	0	17	169	169	111B-2
14	30	0	10	80	80	4.1%	51	0	17	135	135	111B-2
15	12	0	8	40	40	4.1%	20	0	14	68	68	111B-2
16	10	0	0	20	20	4.1%	17	0	0	34	34	111C
17	0	0	0	0	0	4.1%	0	0	0	0	0	111C
18	0	0	0	2	1	4.1%	0	0	0	3	2	111C
19	0	0	0	2	1	4.1%	0	0	0	3	2	111C
20	0	0	0	5	3	4.1%	0	0	0	8	5	111C
21	0	0	0	5	3	4.1%	0	0	0	8	5	111C
22	0	0	0	20	10	4.1%	0	0	0	34	17	111C
23	5	0	25	40	50	4.1%	8	0	42	68	84	111B-2
24	25	0	5	30	45	4.1%	42	0	8	51	76	111B-2
25	25	0	5	40	50	4.1%	42	0	8	68	84	111B-2
26	30	0	10	40	60	4.1%	51	0	17	68	101	111B-2
27	2	0	0	50	27	4.1%	3	0	0	84	46	111C
28	0	0	0	0	0	4.1%	0	0	0	0	0	111C
29	0	0	0	0	0	4.1%	0	0	0	0	0	111C
30	0	0	0	0	0	4.1%	0	0	0	0	0	111C
31	0	0	0	0	0	4.1%	0	0	0	0	0	111C
32	0	0	0	20	10	4.1%	0	0	0	34	17	111C
33	0	0	0	0	0	4.1%	0	0	0	0	0	111C
34	0	0	0	0	0	4.1%	0	0	0	0	0	111C
PERCENT	25.88	0.00	7.58	66.54			25.88	0.00	7.58	66.54		

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

SURFACE	CONDITION	(KM)			
		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 : BERAU

< 1998 >

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
15	111C	KRK	5	0	2	13	14
16	111C	KRK	1	0	0	3	3
18	111B-2	KRK	37	0	11	94	95
19	111C	KRK	13	0	4	34	34
20	111B-2	KRK	62	0	18	159	160
21	111B-2	KRK	20	0	6	52	52
22	111C	KRK	1	0	0	3	3
23	111C	KRK	3	0	1	8	8
24	111C	KRK	2	0	0	4	4
25	111C	KRK	2	0	0	4	4
26	111C	KRK	1	0	0	4	3
27	111B-1	ASP	143	0	42	369	370
30	111C	KRK	15	0	4	38	38
31	111C	KRK	9	0	3	24	24
32	111B-2	KRK	73	0	21	188	188
33	111C	KRK	10	0	3	26	26
34	111C	KRK	7	0	2	18	18

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 : BERAU

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 8	LINK 9	LINK 10
	1 Km	1 Km	1 Km	1 Km	1 Km	1 Km	1 Km	1 Km	1 Km	1 Km
	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-2
YEAR	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC
1988	0	0	0	0	0	0	0	0	0	0
1989	521	521	5	5	521	5	5	4	584	521
1990	540	540	5	5	540	5	5	4	583	540
1991	565	565	6	6	565	6	6	5	612	565
1992	585	585	6	6	585	6	6	5	632	585
1993	610	610	6	6	610	6	6	5	661	610
1994	631	631	6	6	631	6	6	5	681	631
1995	664	664	7	7	664	7	7	5	718	664
1996	689	689	7	7	689	7	7	6	747	689
1997	717	717	7	7	717	7	7	6	775	717
1998	751	751	7	7	751	7	7	6	812	751
SUM	6273	6273	62	62	6273	62	62	51	6785	6273
COST	134	134	-3564	-3564	134	-3564	-3564	-3570	439	134
/Km	134	134	-3564	-3564	134	-3564	-3564	-3570	439	134

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.

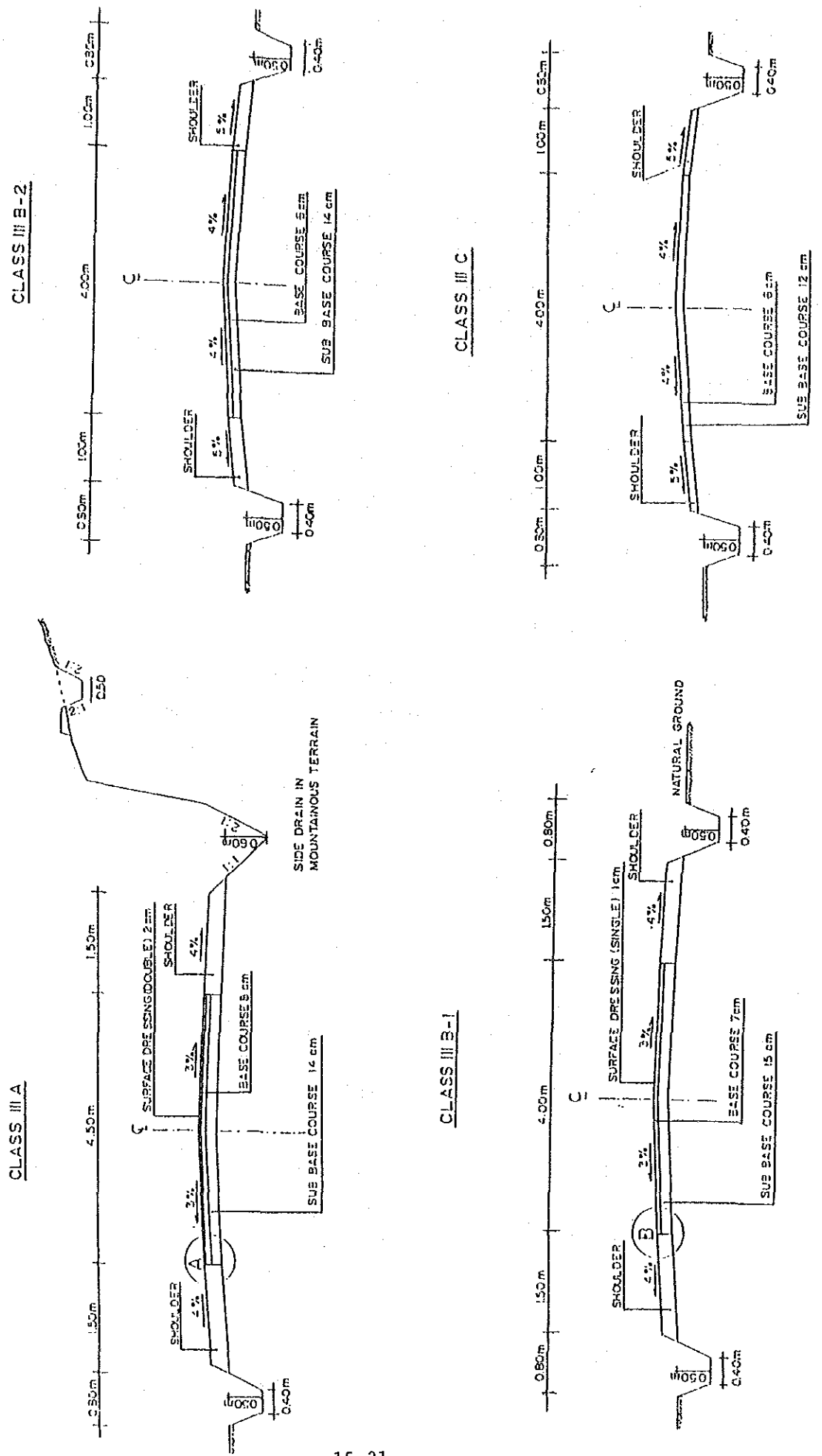
Table 3-1-1

DESIGN CRITERIA FOR KABUPATEN ROADS

ROAD CLASSIFICATION	CLASS III A				CLASS III B-1				CLASS III B-2				CLASS III C			
	ASPHALT SEAL (DOUBLE)		ASPHALT SEAL (SINGLE)		ASPHALT SEAL (DOUBLE)		ASPHALT SEAL (SINGLE)		GRAVEL		GRAVEL		GRAVEL		GRAVEL	
TRAFFIC VOLUME (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	FLAT TO ROLLING	HILLY	MOUNT- AINOUS	
TRAFFIC LANES	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1+	1	1	1	1
DESIGN (Km/hr)	70	60	40	70	40	30	60	40	30	60	40	30	50	30	30	AS PRACTI- CABLE
SPEED	30	30	30	30	30	AS PRACTI- CABLE	30	30	AS PRACTI- CABLE	30	30	AS PRACTI- CABLE	30	AS PRACTI- CABLE	AS PRACTI- CABLE	
GRADIENT (LIMITING)	4	5	8	4	6	8	4	6	8	4	7	8	5	8	12	12
PAVEMENT WIDTH (M)	7	7	10	7	8	10	7	8	10	7	9	12	7	12	16	16
SHOULDER WIDTH (M)	6.0	6.0	6.0	4.5	4.5	3.5	4.5	4.5	4.5	4.5	4.5	4.5	3.5	3.5	3.5	3.5
ROAD BED WIDTH (M)	4.5	4.5	4.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.0	3.0	3.0	3.0
RIGHT OF WAY (M)	2.0	1.5	1.5	1.5	1.5	1.0	1.5	1.5	1.0	1.5	1.0	1.0	1.0	1.0	1.0	0.75
ROAD CAMBER (%)	1.5	1.0	0.75	1.0	1.0	0.75	1.0	1.0	0.75	1.0	0.75	0.5	0.75	0.5	0.5	0.5
	10.0	9.0	9.0	8.0	7.5	6.5	7.5	7.5	6.5	7.5	6.5	6.5	5.5	5.5	5.0	5.0
	6.0	6.0	6.0	5.5	5.5	5.0	5.5	5.5	5.0	5.5	5.0	4.5	4.5	4.0	4.0	4.0
	16	16	16	12	12	12	12	12	12	12	12	12	12	12	12	12
	12	12	12	10	10	10	10	10	10	10	10	10	10	10	10	8
	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3
	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4

STANDARD ROAD CROSS SECTIONS

Fig. 3-1-1



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:

<u>Road Classification</u>	<u>Design Traffic Volume (vpd)</u>
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.

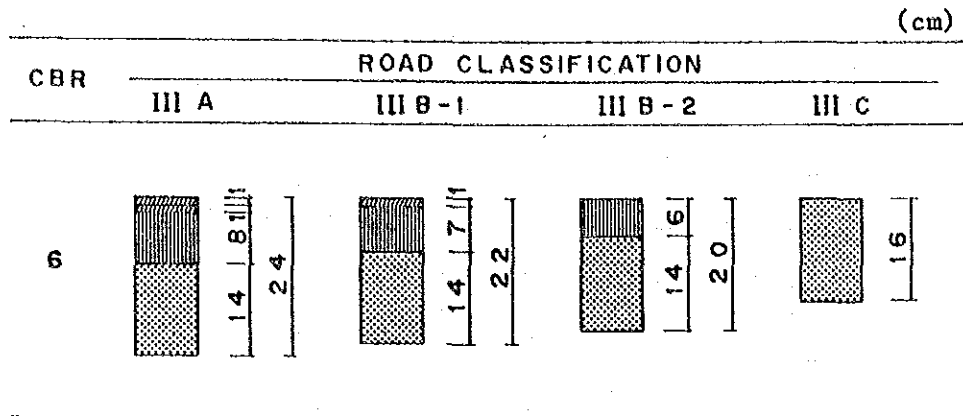
CBR of the laterite is generally in the range of CBR 4 to 10. However site CBR tests should be conducted before construction to finally decide the pavement thickness.

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



- = SURFACE DRESSING (ASPHALT)
- = BASE COURSE (CRUSHER - RUN)
- = SUBBASE COURSE (SANDY GRAVEL)

3.3 Design of Bridges and Other Structures

3.3.1 Standard Bridge

There are so many bridges to be improved or to be 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 described 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 rural 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 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 or river bed.

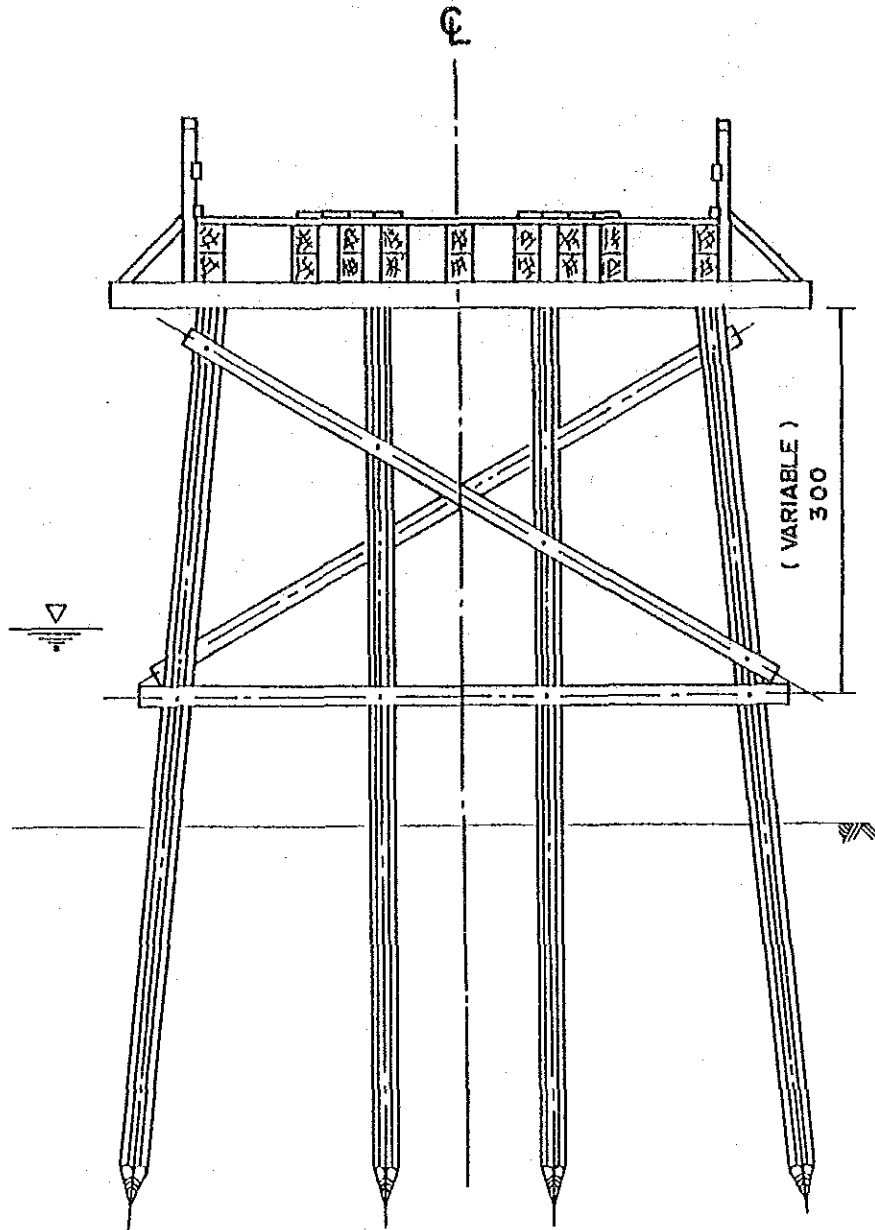
The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

(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 transverse drainage.

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

(2) Retaining Wall

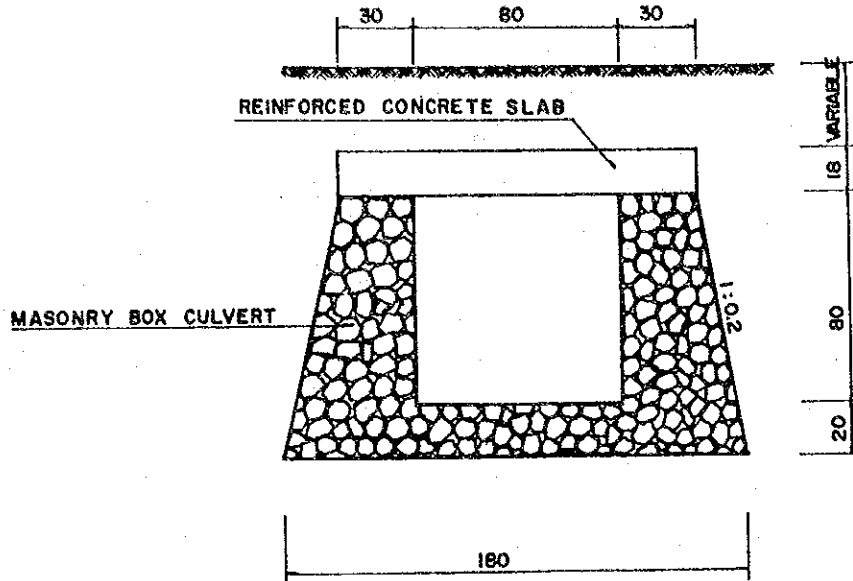
The following two types of retaining walls have been adopted because of ease of construction, economy and familiarity in Indonesia.

- 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 REINFORCED CONCRETE PIPE CULVERT

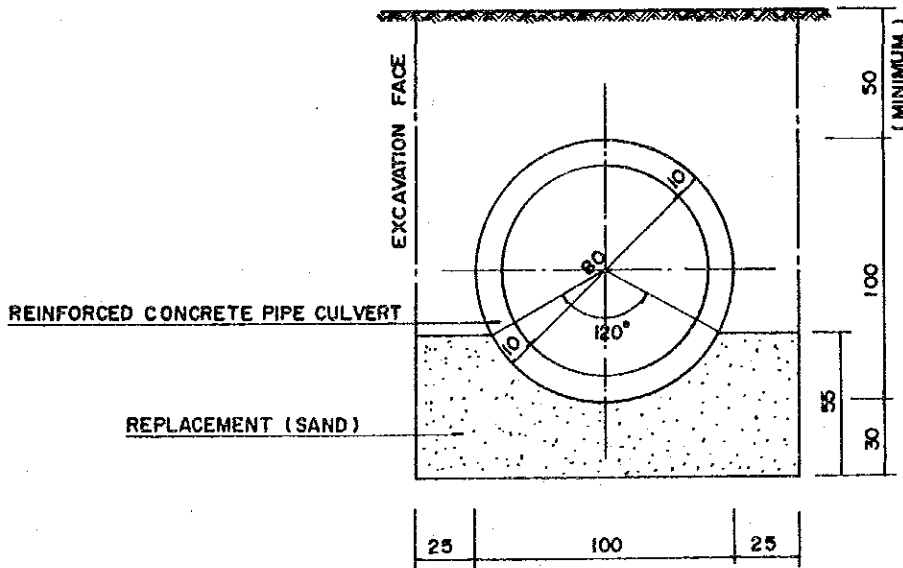
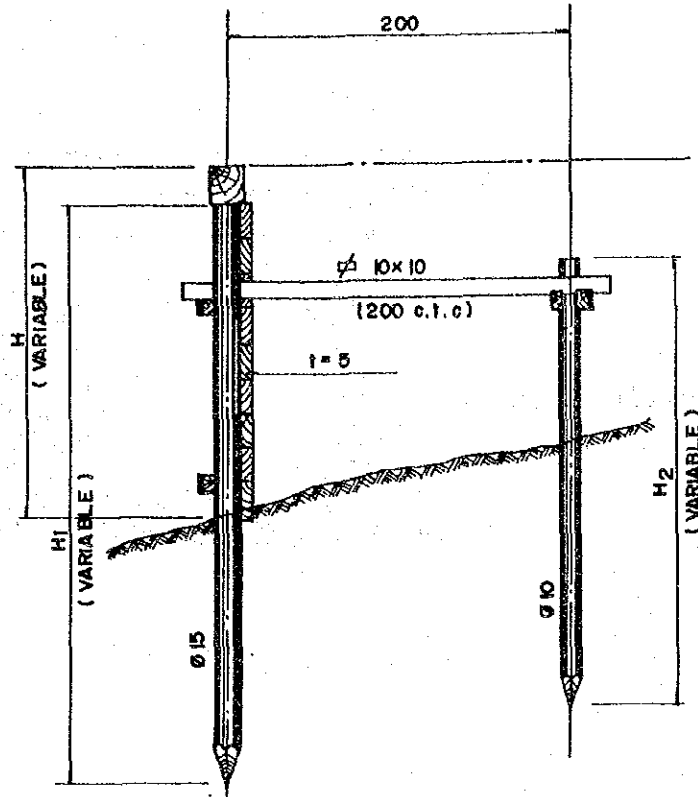


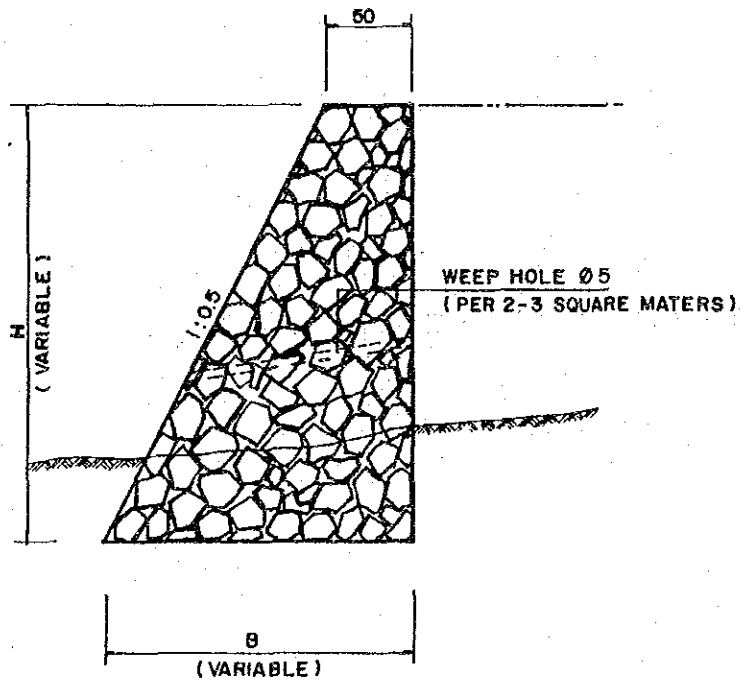
Fig. 3-3-3

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 Berau and other Kabupatens in Kalimantan Timur Province are shown in Table 4-1-1.

Table 4-1-1 UNIT LABOUR PRICE

KABUPATEN	(Rp)						
	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 Berau together with for other Kabupatens in Kalimantan Timur Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

MATERIAL	UNIT	(Rp)				
		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 : BERAU

(UNIT : Rp) (6 '85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST			FOREIGN COST			TOTAL COST
			OWERSHIP	OPERATION	SUB-TOTAL	OWERSHIP	OPERATION	SUB-TOTAL	
	Bulldozer	120 HP	272	13,180	13,452	7,769	1,029	8,798	22,250
	Bulldozer/Ripper	120 HP	298	14,196	14,494	8,499	1,583	10,082	24,576
	Swamp Bulldozer	120 HP	311	14,440	14,751	8,879	1,654	10,533	25,284
	Bulldozer	90 HP	173	8,910	9,083	4,914	650	5,564	14,647
	Bulldozer/Ripper	90 HP	186	9,502	9,688	5,299	987	6,286	15,974
	Bulldozer	65 HP	123	6,473	6,596	3,499	463	3,962	10,558
	Bulldozer/Ripper	65 HP	134	6,925	7,059	3,819	711	4,530	11,589
	Swamp Bulldozer	90 HP	185	9,492	9,677	5,284	984	6,268	15,945
	Swamp Bulldozer	65 HP	142	6,828	6,970	4,049	754	4,803	11,773
	Motor Grader	110 HP	243	11,370	11,613	6,919	1,289	8,208	19,821
	Motor Grader	75 HP	168	7,791	7,959	4,779	890	5,669	13,628
	Motor Grader	65 HP	151	6,853	7,004	4,299	801	5,100	12,104
	Road Stabilizer	W-1850 mm	301	3,398	3,699	8,594	426	9,020	12,719
	Vibratory Roller	4 ton	102	3,410	3,512	2,899	384	3,283	6,795
	Hand-guide Vib. Roller	1000 Kg	77	613	690	849	29	878	1,568
	Tire Roller	8-15 ton	109	7,612	7,721	3,106	102	3,208	10,929
	Vibratory Roller (D&I)	4 ton	102	3,410	3,512	2,899	384	3,283	6,795
	Hand-guide Vib. Roller	600 Kg	54	419	473	600	20	620	1,093
	Rough Terrain Crane	10 ton	352	13,260	13,612	10,039	748	10,787	24,399
	Hydraulic Excavator; Wheel	0.3 m3	144	8,017	8,161	4,109	544	4,653	12,814
	Wheel Loader	1.2 m3	246	8,609	8,855	7,019	929	7,948	16,803
	Wheel Loader	0.3 m3	80	3,009	3,089	2,269	300	2,569	5,658
	Water Tank Truck	4000 ltr.	79	2,931	3,010	868	120	988	3,998
	Fuel Tank Truck	4000 ltr.	80	2,937	3,017	882	122	1,004	4,021
	Dump Truck	3.0 ton	133	3,656	3,789	1,469	204	1,673	5,462
	Flat Bed Truck with Crane	3.0 ton	61	3,178	3,239	1,716	127	1,843	5,082
	Dump Loader Truck	12 ton	135	19,623	19,758	3,837	127	3,964	23,722
	Dump Truck	5.0 ton	198	6,041	6,239	2,189	305	2,494	8,733
	Flat Bed Truck	3.0 ton	20	2,749	2,769	563	41	604	3,373
	Portable Crusher/Screening	30-40 t/h	658	22,234	22,892	18,800	2,490	21,290	44,182
	Concrete Mixer	0.5 m3	486	2,429	2,915	5,400	423	5,823	8,738
	Water Pump	200 l/min	18	272	290	188	6	194	484
	Concrete Vibrator	3.3 HP	7	235	242	73	2	75	317
	Asphalt Sprayer	850 ltr.	92	779	871	1,019	142	1,161	2,032

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 : BERAU

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m ²	162	91	253
Subgrade Preparation	m ²	20	11	31
Normal Fill	m ³	1,677	863	2,540
Fill in Swamp	m ³	2,484	1,053	3,537
Normal Excavation to Spoil	m ³	982	523	1,505
Sub Base Course	m ³	3,173	1,348	4,521
Base Course	m ³	4,347	2,300	6,647
Shoulder	m ²	292	146	438
Asphalt Patching	m ²	3,390	1,512	4,902
Surface Dressing (Single)	m ²	556	766	1,322
Surface Dressing (Double)	m ²	700	1,207	1,907
Earth Drain	m	777	119	896
Earth Drain in Swamp (by machine)	m ³	1,158	474	1,632
Pipe Culvert 80cm	m	40,363	53,890	94,253
Masonry Culvert (80x80cm)	m	60,501	44,112	104,613
Retaining Wall and Wing Wall (Timber)	m ²	10,533	246	10,779
Retaining Wall and Wing Wall (Masonry)	m ³	45,512	12,252	57,764
Gabion Protection	m ³	17,073	120	17,193
Manual routine maintenance of road	Km	124,228	7,248	131,476
Routine maintenance of earth road	Km	92,129	37,924	130,053
Routine maintenance of gravel road	Km	188,043	88,092	276,135
Routine maintenance of asphalt road	Km	339,000	151,200	490,200

4.2.2 Bridges

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

Table 4-2-2

BRIDGE COST

PROV : KALIMANTAN TIMUR		KAB : BERAU		
(Rp)				
ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber; Span 3m; IOT)	m ²	38,349	2,998	41,347
Superstructure (Timber; Span 5m; IOT)	m ²	42,478	3,311	45,789
Superstructure (Timber; Span 8m; IOT)	m ²	56,263	4,351	60,614
Superstructure (Timber; Span 3m; BH50)	m ²	47,552	3,707	51,259
Superstructure (Timber; Span 5m; BH50)	m ²	51,913	4,019	55,932
Superstructure (Timber; Span 8m; BH50)	m ²	65,839	5,088	70,927
Superstructure (Concrete; Span 3m; BH50)	m ²	43,462	112,368	155,830
Superstructure (Concrete; Span 5m; BH50)	m ²	44,655	125,491	170,146
Superstructure (Concrete; Span 8m; BH50)	m ²	46,014	136,642	182,656
Superstructure (Concrete; Span 10m; BH50)	m ²	50,335	155,105	205,440
Superstructure (Concrete; Span 15m; BH50)	m ²	54,286	182,607	236,893
Substructure (Pier; for Timber; IOT)	NO	334,068	27,724	361,792
Substructure (Abut; for Timber; IOT)	NO	938,472	136,771	1,075,243
Substructure (Pier; for Timber; BH50)	NO	491,317	41,015	532,332
Substructure (Abut; for Timber; BH50)	NO	1,057,121	151,014	1,208,135
Substructure (Pier; for Concrete; BH50)	NO	1,819,378	497,347	2,316,725
Substructure (Abut; for Concrete; BH50)	NO	3,720,885	1,033,296	4,754,181
Demolition of Bridge (Timber->Timber)	m ²	10,771	1,195	11,966
Demolition of Bridge (Timber->Concrete)	m ²	10,771	1,195	11,966
Demolition of Bridge (Concrete)	m ²	81,473	84,507	165,980
Maintenance of Timber Bridge (New)	m ²	7,145	1,009	8,154
Maintenance of Concrete Bridge (New)	m ²	1,701	3,403	5,104
Maintenance of Timber Bridge (Exist)	m ²	7,411	2,347	9,758
Maintenance of Concrete Bridge (Exist)	m ²	4,179	2,523	6,702

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 Berau are shown in Table 5-1-1.

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

KABUPATEN : BERAU

CRITERIA NO	ROAD LINK NO
(6)	01,02,03,04,05,06,07,08,09,10,11,12,13,14,15,16, 17,18,19,20,21,22,23,24,25,26
(8)	17,28,29

5.2 Evaluation

5.2.1 Primary Analysis

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

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

5.2.2 Secondary Analysis

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

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

5.2.3 Ranking of Feasible Road Links

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

Table 5-2-1 RESULTS OF PRIMARY ANALYSIS

PROVINCE : KALIMANTAN TIMUR KABUPATEN : BERAU

LINK NO	LENGTH	CLASS	IRR (%)	REMARK
27	36 Km	IIIB-1	23.412	Surplus
2	1 Km	IIIB-2	0.078	VOC
3	1 Km	IIIB-2	0.078	VOC
4	1 Km	IIIB-2	0.078	VOC
5	1 Km	IIIB-2	0.078	VOC
6	1 Km	IIIB-2	0.078	VOC
7	1 Km	IIIB-2	0.078	VOC
8	1 Km	IIIB-2	0.078	VOC
9	1 Km	IIIB-2	0.078	VOC
10	1 Km	IIIB-2	0.078	VOC
11	1 Km	IIIB-2	0.078	VOC
12	1 Km	IIIB-1	0.078	VOC
13	1 Km	IIIB-2	0.078	VOC
14	1 Km	IIIB-2	0.078	VOC
15	3 Km	IIIC	0.078	Surplus
16	1 Km	IIIC	0.078	Surplus
18	2 Km	IIIB-2	0.078	Surplus
19	1 Km	IIIC	0.078	Surplus
20	2 Km	IIIB-2	0.078	Surplus
21	1 Km	IIIB-2	0.078	Surplus
22	1 Km	IIIC	0.078	Surplus
23	2 Km	IIIC	0.078	Surplus
24	1 Km	IIIC	0.078	Surplus
25	1 Km	IIIC	0.078	Surplus
26	1 Km	IIIC	0.078	Surplus
1	1 Km	IIIB-2	0.078	VOC
30	1 Km	IIIC	0.078	Surplus
31	1 Km	IIIC	0.078	Surplus
32	5 Km	IIIB-2	0.078	Surplus
33	1 Km	IIIC	0.078	Surplus
34	6 Km	IIIC	0.078	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : KALIMANTAN TIMUR KABUPATEN : BERAU

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
27	36 Km	IIIB-1	378976	1.516	23.412	Surplus

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: Berau

(Rp $\times 10^6$)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	844	1,430	2,274
MAINTENANCE	78	255	333
SUPPLEMENTATION	318	-	318
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,285	1,685	2,970

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

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

(Rp $\times 10^6$)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CIVIL WORK	458	1,670	2,128
CONSTRUCTION & MAINTENANCE EQUIPMENT	723	-	723
SPARE PARTS	59	15	74
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,285	1,685	2,970

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 2 links with the total length of 286 km which is 87% of the 330 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 : BERAU

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	27
- Secondary	-
Engineering Point of View	50*
Basic Human Needs	-

* Link 50 is New Construction Road

Road Link No 27 is only one feasible road link in the Kabupaten. The construction of a new Kabupaten road which connects Road Link No 27 with the opposite bank of the Kabupaten capital is on-going and will be completed in 1986/87. The new road is constructed as an earth road, therefore grading up to a gravel road is recommended.

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

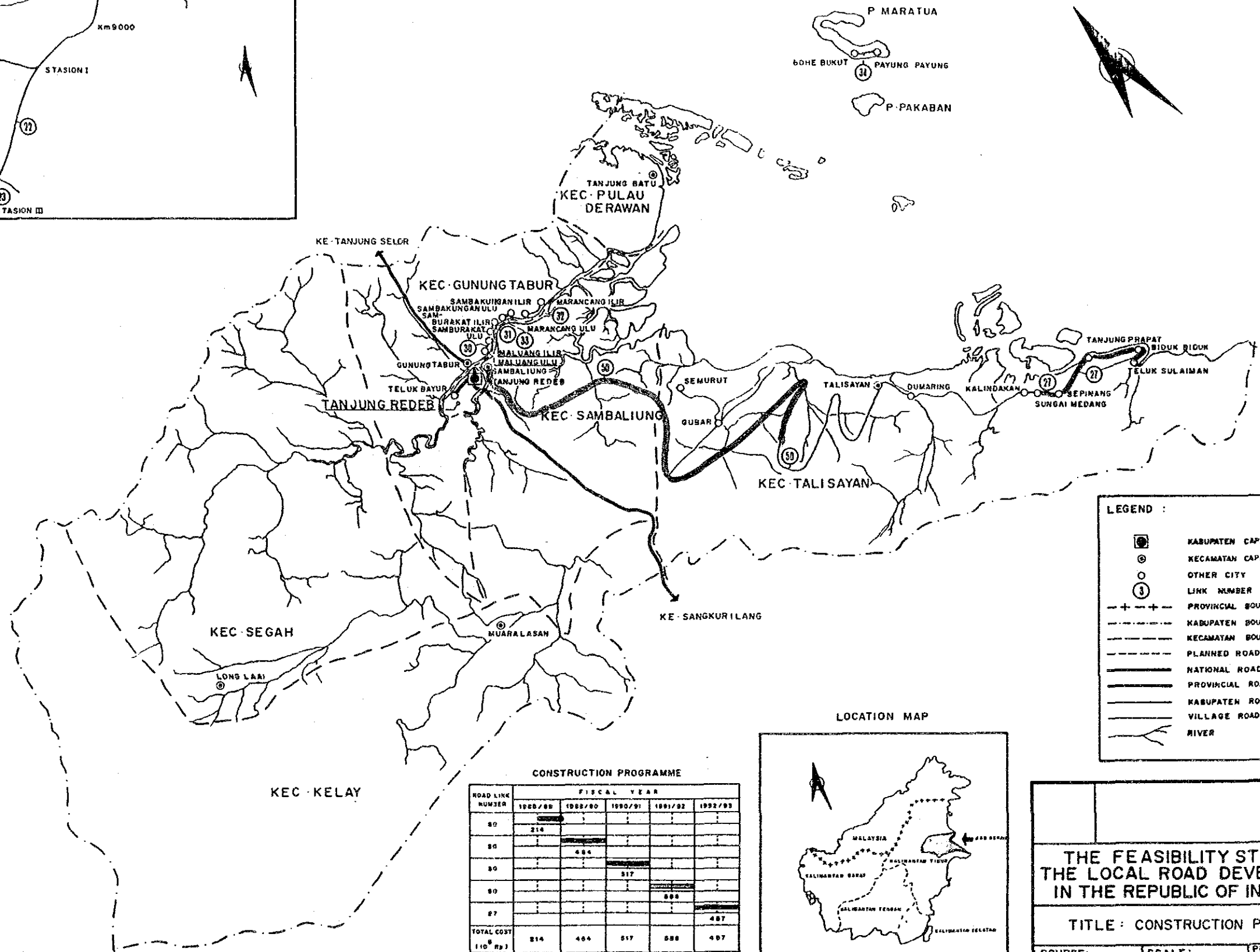
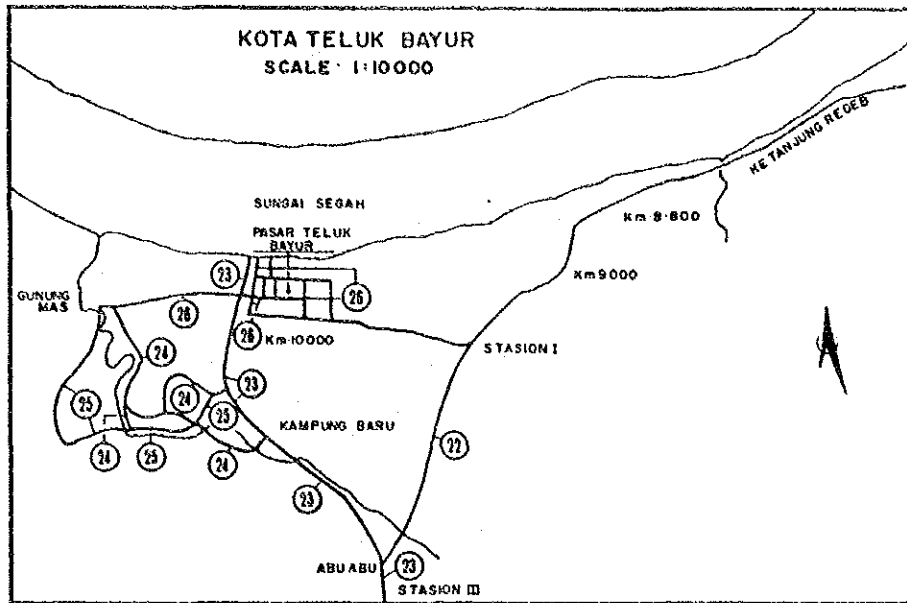
Table 6-1-4

ROAD LINKS TO BE IMPROVED BY YEAR

PROV : KALIMANTAN TIMUR KAB : BERAU

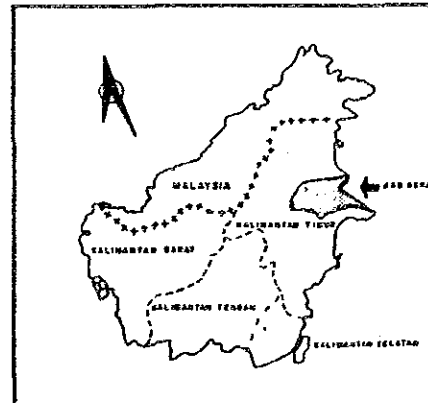
YEAR	LINK NO	() : rate
1988	: 50	(12%)
1989	: 50	(26%)
1990	: 50	(29%)
1991	: 50	(33%)
1992	: 27	

KAB. BERAU



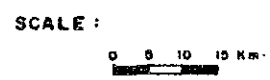
LEGEND :

- KABUPATEN CAPITAL
- KECAMATAN CAPITAL
- OTHER CITY
- LINK NUMBER
- PROVINCIAL BOUNDARY
- KABUPATEN BOUNDARY
- KECAMATAN BOUNDARY
- PLANNED ROAD
- NATIONAL ROAD
- PROVINCIAL ROAD
- KABUPATEN ROAD
- VILLAGE ROAD
- RIVER



CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR				
	1988/89	1989/90	1990/91	1991/92	1992/93
27	214				
30		464			
30			517		
30				588	
27					487
TOTAL COST (10⁸ Rp)	214	464	517	588	487



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

TITLE : CONSTRUCTION PROGRAMME

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

(1000Rp)

LINK NO	LENGTH (Km)	BA (Z)	SD (Z)	RU (Z)	RD (Z)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TR NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
1	1	0.0	99.0	1.0	0.0	1	0	0	7	165.60	1	60.00	2,018	1,941	698	2,639
2	1	0.0	99.0	1.0	0.0	1	0	0	3	82.10	0	0.00	801	1,072	351	1,423
3	1	99.0	1.0	0.0	0.0	1	0	0	8	142.43	0	0.00	1,390	1,519	493	2,012
4	1	99.0	1.0	0.0	0.0	1	0	0	0	0.00	1	36.00	241	614	249	863
5	1	0.0	99.0	1.0	0.0	1	0	0	4	79.00	0	0.00	771	1,049	344	1,393
6	1	99.0	1.0	0.0	0.0	1	0	0	2	72.60	0	0.00	708	1,091	329	1,330
8	1	99.0	1.0	0.0	0.0	0	1	0	1	19.20	0	0.00	187	455	140	595
9	1	0.0	99.0	1.0	0.0	0	1	0	0	0.00	0	0.00	0	312	95	407
10	1	0.0	99.0	1.0	0.0	1	0	0	0	0.00	0	0.00	0	463	158	621
11	1	0.0	99.0	1.0	0.0	1	0	0	0	0.00	0	0.00	0	463	158	621
12	1	0.0	99.0	1.0	0.0	1	0	0	1	15.00	1	40.50	428	751	298	1,049
13	1	30.0	70.0	0.0	0.0	1	0	0	0	0.00	0	0.00	0	463	158	621
14	1	99.0	1.0	0.0	0.0	1	0	0	1	20.00	0	0.00	195	611	205	816
15	3	43.0	23.7	33.0	0.3	2	0	1	1	11.40	0	0.00	111	1,227	389	1,616
16	1	0.0	99.0	1.0	0.0	0	1	0	0	0.00	0	0.00	0	312	95	407
19	1	43.0	57.0	0.0	0.0	0	1	0	4	71.00	0	0.00	693	838	262	1,100
20	2	0.0	84.5	15.5	0.0	0	2	0	15	380.38	0	0.00	3,712	3,444	1,083	4,527
21	1	0.0	99.0	1.0	0.0	0	0	1	1	14.04	0	0.00	137	320	78	398
22	1	0.0	97.0	3.0	0.0	0	0	1	0	0.00	0	0.00	0	216	45	261
23	2	70.5	28.0	1.5	0.0	2	0	0	1	12.00	0	0.00	117	1,015	345	1,360
24	1	0.0	52.0	48.0	0.0	0	0	1	2	16.00	0	0.00	156	335	83	418
25	1	0.0	40.0	60.0	0.0	0	0	1	3	68.00	0	0.00	664	720	205	925
26	1	0.0	99.0	1.0	0.0	1	0	0	0	0.00	0	0.00	0	463	158	621
27	36	89.8	10.2	0.0	0.0	0	9	27	11	1820.00	0	0.00	17,760	22,140	6,349	28,489
SUM	63					16	15	32	65	2989.75	3	136.50	30,089	41,744	12,768	54,512

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 Berau 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 2,274 x 10⁶ and maintenance cost is Rp 333 x 10⁶ which is approximately 13% of the total expenditure.

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

PROV : KALIMANTAN TIMUR KAB : BERAU

(UNIT : 1000Rp)

ITEM	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >	
LOCAL CURRENCY :	133,601	289,488	322,894	367,434	284,985	1,398,402	(61.5%)
Ownership Cost	2,281	4,942	5,314	6,274	4,019	23,030	(1.6%)
Operation Cost	68,616	148,678	165,832	188,709	130,552	702,387	(50.2%)
Material Cost	15,309	33,171	36,999	42,103	55,805	183,467	(13.1%)
Labour Cost	29,969	64,938	72,432	82,422	57,357	307,118	(22.0%)
Contingency	17,426	37,759	42,117	47,926	37,172	182,400	(13.0%)
FOREIGN CURRENCY :	80,663	174,778	194,948	221,840	203,277	875,506	(38.5%)
Ownership Cost	36,460	79,004	88,121	100,277	68,968	372,830	(42.6%)
Operation Cost	5,105	11,059	12,337	14,039	9,396	51,936	(5.9%)
Material Cost	28,577	61,918	69,062	78,588	98,399	336,544	(38.4%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	10,521	22,797	25,428	28,936	26,514	114,196	(13.0%)
TOTAL COST :	214,265	464,267	517,842	589,274	488,262	2,273,910	
Ownership Cost	38,741	83,946	93,435	106,551	72,987	395,660	(17.4%)
Operation Cost	73,721	159,737	178,169	202,748	139,948	754,323	(33.2%)
Material Cost	43,886	95,089	106,061	120,691	154,284	520,011	(22.9%)
Labour Cost	29,969	64,938	72,432	82,422	57,357	307,118	(13.5%)
Contingency	27,948	60,557	67,545	76,862	63,686	296,598	(13.0%)

< Contingency : 15% >

Table 6-1-6 (2)

CONSTRUCTION AND MAINTENANCE COST
(MAINTENANCE)

PROV : KALIMANTAN TIMUR KAB : BERAU

(UNIT : 1000Rp)

I T E M	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >	
LOCAL CURRENCY :	20,849	41,725	41,725	41,725	108,720	254,744	(76.5%)
Ownership Cost	216	432	432	432	1,271	2,783	(1.1%)
Operation Cost	10,348	20,704	20,704	20,704	60,340	132,800	(52.1%)
Material Cost	2,525	5,062	5,062	5,062	5,013	22,724	(8.9%)
Labour Cost	7,760	15,527	15,527	15,527	42,096	96,437	(37.9%)
FOREIGN CURRENCY :	6,378	12,770	12,770	12,770	33,439	78,127	(23.5%)
Ownership Cost	5,106	10,222	10,222	10,222	28,704	64,476	(82.5%)
Operation Cost	469	939	939	939	3,328	6,614	(8.5%)
Material Cost	803	1,609	1,609	1,609	1,407	7,037	(9.0%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	27,227	54,495	54,495	54,495	142,159	332,871	
Ownership Cost	5,322	10,654	10,654	10,654	29,975	67,259	(20.2%)
Operation Cost	10,817	21,643	21,643	21,643	63,668	139,414	(41.9%)
Material Cost	3,328	6,671	6,671	6,671	6,420	29,761	(8.9%)
Labour Cost	7,760	15,527	15,527	15,527	42,096	96,437	(29.0%)

Table 6-1-6 (3)

CONSTRUCTION AND MAINTENANCE COST
(TOTAL)

PROV : KALIMANTAN TIMUR KAB : BERAU

(UNIT : 1000Rp)

I T E M	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >	
LOCAL CURRENCY :	154,450	331,213	364,619	409,159	393,705	1,653,146	(63.4%)
Ownership Cost	2,497	5,374	5,946	6,706	5,290	25,813	(1.6%)
Operation Cost	78,964	169,382	186,536	209,413	190,892	835,187	(50.5%)
Material Cost	17,834	38,233	42,061	47,165	60,898	206,191	(12.5%)
Labour Cost	37,729	80,465	87,959	97,949	99,453	403,555	(24.4%)
Contingency	17,426	37,759	42,117	47,926	37,172	182,400	(11.0%)
FOREIGN CURRENCY :	87,041	187,548	207,718	234,610	236,716	953,633	(36.6%)
Ownership Cost	41,566	89,226	98,343	110,499	97,672	437,306	(45.9%)
Operation Cost	5,574	11,998	13,276	14,978	12,724	58,550	(6.1%)
Material Cost	29,380	63,527	70,671	80,197	99,806	343,581	(36.0%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	10,521	22,797	25,428	28,936	26,514	114,196	(12.0%)
TOTAL COST :	241,492	518,762	572,337	643,769	630,421	2,606,781	
Ownership Cost	44,063	94,600	104,289	117,205	102,962	463,119	(17.8%)
Operation Cost	84,538	181,380	199,812	224,391	203,616	893,737	(34.3%)
Material Cost	47,214	101,760	112,732	127,362	160,704	549,772	(21.1%)
Labour Cost	37,729	80,465	87,959	97,949	99,453	403,555	(15.5%)
Contingency	27,948	60,557	67,545	76,862	63,686	296,598	(11.4%)

< Contingency : 15% >

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Berau 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-Tire Roller
- 2-Hand-guided Vibratory Roller
- 1-Portable Crusher

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

- a. Equipment for Road Maintenance
 - 1-Flat Bed Truck 3 Ton
- b. Equipment for Bridge Maintenance
 - 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

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

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

Table 6-1-7

REQUIRED NUMBER OF EQUIPMENT

PROV : KALIMANTAN TIMUR KAB : BERAU

EQUIPMENT NAME	WORKABLE	EXISTING	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >
Bulldozer/Ripper	240	0	0.30	0.64	0.71	0.81	0.24
Swamp Bulldozer	240	0	0.00	0.00	0.00	0.00	0.00
Motor Grader	250	0	0.66	1.42	1.58	1.80	1.04
Hand-guide Vib. Roller	250	2	0.51	1.09	1.22	1.38	0.00
Tire Roller	240	1	0.00	0.00	0.00	0.00	0.84
Vibratory Roller (D&T)	250	0	0.69	1.48	1.65	1.88	0.83
Hydraulic Excavator; Wheel	240	0	0.00	0.00	0.00	0.00	0.00
Wheel Loader	250	0	0.69	1.48	1.66	1.88	1.30
Water Tank Truck	250	0	0.43	0.94	1.04	1.19	0.58
Dump Truck	250	0	7.10	15.38	17.16	19.52	12.20
Flat Bed Truck with Crane	250	0	0.40	0.87	0.97	1.10	0.00
Flat Bed Truck	250	0	0.18	0.38	0.42	0.48	0.96
Portable Crusher/Screening	250	1	0.01	0.02	0.02	0.02	0.33
Concrete Mixer	240	0	0.16	0.33	0.37	0.42	0.00
Water Pump	240	0	0.13	0.28	0.31	0.35	0.00
Concrete Vibrator	240	0	0.08	0.16	0.18	0.20	0.00
Asphalt Sprayer	240	0	0.00	0.00	0.00	0.00	0.84

NOTE WORKABLE : workable days in a year

EXISTING : number of existing equipment

Table 6-1-8

EQUIPMENT PURCHASE COST

PROV : KALIMANTAN TIMUR KAB : BERAU

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	-	-
Bulldozer/Ripper	90 HP	53,000	1	53,000
Swamp Bulldozer	90 HP	52,850	-	-
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	2	95,600
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	-	-
Tire Roller	8-15 ton	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 m ³	41,100	-	-
Wheel Loader	1.2 m ³	70,200	2	140,400
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	17	249,900
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	2	50,380
Flat Bed Truck	3.0 ton	11,275	1	11,275
Portable Crusher/Screening	30-40 t/h	188,000	-	-
Concrete Mixer	0.5 m ³	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	-	-
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 723,075

OWNERSHIP COST (FOREIGN) 405,251

EQUIPMENT COST SUPPLEMENTED 317,824

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Hand-guide Vib. Roller	6,237
Tire Roller	9,722
Portable Crusher/Screening	16,096

TOTAL 32,055

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 : BERAU

ITEM	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
Site Clearance in Light Bush	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Subgrade Preparation	m ²	105000.00	227500.00	253750.00	288750.00	162000.00	1037000.00
Normal Fill	m ³	4500.00	9750.00	10875.00	12375.00	0.00	37500.00
Fill in Swamp	m ³	0.00	0.00	0.00	0.00	0.00	0.00
Normal Excavation to Spoil	m ³	0.00	0.00	0.00	0.00	1820.00	1820.00
Sub Base Course	m ³	16800.00	36400.00	40600.00	46200.00	17192.70	157192.70
Base Course	m ³	0.00	0.00	0.00	0.00	10080.00	10080.00
Shoulder	m ²	45000.00	97500.00	108750.00	123750.00	72000.00	447000.00
Asphalt Patching	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Surface Dressing (Single)	m ²	0.00	0.00	0.00	0.00	144000.00	144000.00
Surface Dressing (Double)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Earth Drain	m	9000.00	19500.00	21750.00	24750.00	55440.00	130440.00
Earth Drain in Swamp (by machine)	m ³	0.00	0.00	0.00	0.00	0.00	0.00
Pipe Culvert 80cm	m	600.00	1300.00	1450.00	1650.00	0.00	5000.00
Masonry Culvert (80x80cm)	m	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Timber)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Masonry)	m ³	192.00	416.00	464.00	528.00	0.00	1600.00
Gabion Protection	m ³	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 3m; 10T)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 5m; 10T)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 8m; 10T)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 3m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 5m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber; Span 8m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete; Span 3m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete; Span 5m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete; Span 8m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete; Span 10m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete; Span 5m; BMS0)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier; for Timber; 10T)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut; for Timber; 10T)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier; for Timber; BMS0)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut; for Timber; BMS0)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier; for Concrete; BMS0)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut; for Concrete; BMS0)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Timber)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Concrete)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Concrete)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	31.50	63.00	63.00	63.00	295.00	515.50
Routine maintenance of earth road	Km	16.00	32.00	32.00	32.00	18.50	130.50
Routine maintenance of gravel road	Km	7.50	15.00	15.00	15.00	260.50	313.00
Routine maintenance of asphalt road	Km	8.00	16.00	16.00	16.00	16.00	72.00
Maintenance of Timber Bridge (New)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Concrete Bridge (New)	m ²	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m ²	1494.88	2989.75	2989.75	2989.75	2079.75	12543.98
Maintenance of Concrete Bridge (Exist)	m ²	68.25	136.50	136.50	136.50	136.50	614.25

6.2 Organization and Construction System

6.2.1 Organization

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

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

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

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

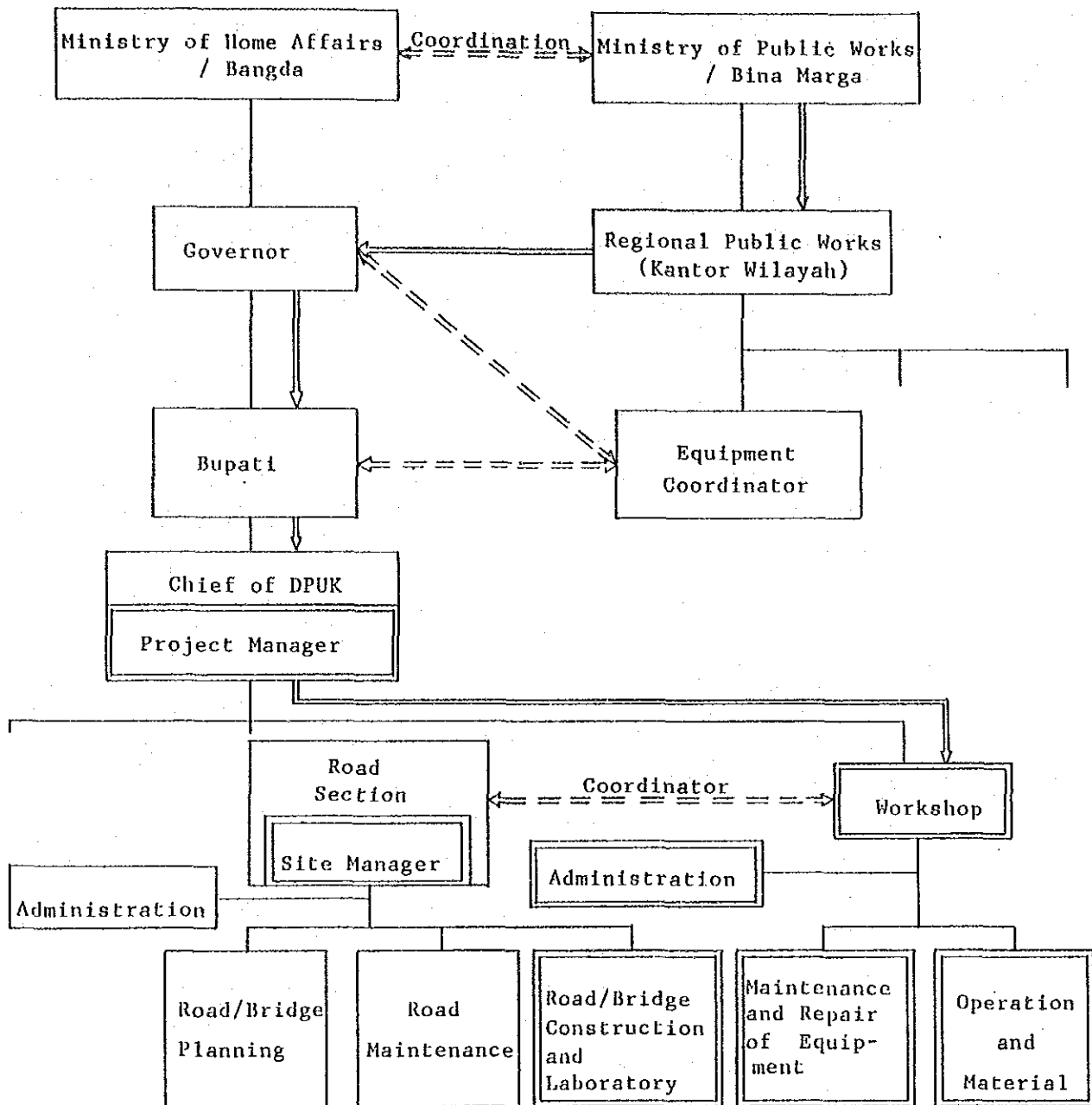
The sub-section of laboratory would be under the relevant Road Section. The proposed organization is shown in Fig. 6-2-1.

6.2.2 Construction System

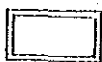
For the construction of Kabupaten roads with a ten year effective design life, it has been recommended in Clause 3.4 that the equipment intensive method should be adopted for earth work and pavement work with the exception of surface dressing.

Fig. 6-2-1

PROPOSED ORGANIZATION



: Equipment delivery flow



: New position/subsection

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

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

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

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

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

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

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

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

APPENDIX

INPUT DATA

Appendix A-1 FOR ESTIMATION OF THE PRODUCER'S SURPLUS BENEFIT

PRV. : *KALIMANTAN TIMUR* KAB. : *BEAU*

Code No.	KECAMATAN NAME	CULTIVATED AREA : (PA)	YIELD RATE : (Y)	FARMER'S POPULATION : (AP)	CIRCULATED COMMODITY : (PG)
01	<i>KELAY</i>	<i>243</i>	<i>2.0</i>	<i>1,700</i>	<i>0</i>
02	<i>TALISAYAN</i>	<i>1,021</i>	<i>2.3</i>	<i>2,030</i>	<i>0</i>
03	<i>SAMBALIUNG</i>	<i>728</i>	<i>2.1</i>	<i>3,555</i>	<i>0</i>
04	<i>SEGAH</i>	<i>242</i>	<i>2.1</i>	<i>1,440</i>	<i>0</i>
05	<i>TANJUNG REDEB</i>	<i>331</i>	<i>2.5</i>	<i>3,500</i>	<i>0</i>
06	<i>GUNUNG TABUR</i>	<i>1,082</i>	<i>2.5</i>	<i>4,395</i>	<i>0</i>
07	<i>PULAU DERAWAN</i>	<i>68</i>	<i>2.1</i>	<i>470</i>	<i>0</i>

ANNUAL AVERAGE GROWTH RATE %	<i>f₁</i>	<i>r₁</i>	<i>f₂</i>	<i>r₂</i>	FARMER'S CONSUMPTION : (Cp)	NON-AGRO REQUIREMENT : (NG)
	3.0	3.1	5.4	4.1	0.14 Ton/head/year	0.53 Ton/ton

RATE OF EACH VEHICLE TYPE %	SEDAN	BUS	TRUCK	MOTOR CYCLE	AVERAGE FREIGHT TONAGE
	25.88	0.00	7.58	66.54	0.5 Ton/Truck

Appendix A-2 Engineering Data

ROAD LINK DATA

PROVINCE : Kalimantan Timur

KABUPATEN: Berau

LINK NO.	BEGINNING POINT (DESA NAME)	END POINT (DESA NAME)	LENGTH (KM)	THROUGH THE KEC. NAME & LENGTH		REMARKS
				KEC. NAME	LENGTH (KM)	
25	Kampung Baru	Gunung Mas	1	Tanjung Redep	1	
26	Pasar Teluk Bayur	Gunung Mas	1	Tanjung Redep	1	
27	Teluk Sulaiman	Kalindakan	36	Talisayan	36	
28						
29						
30	Maluang Ulu	Maluang Ilir	1	Gunung Tabur	1	
31	Samburakat Ilir	Samburakat Ulu	1	Gunung Tabur	1	
32	Marancang Ulu	Marancang Ilir	5	Gunung Tabur	5	
33	Sambakungan Ulu	Sambakungan Ilir	1	Gunung Tabur	1	
34	Bohe Bukut	Payung-payung	6	Pulau Derawan	6	

Please note the priority No. in the Remarks of this list for each links No. according to the each Kabupaten's development plan.

ROAD LINK DATA

PROVINCE : Kalimantan Timur

KABUPATEN: Berau

LINK NO.	BEGINNING POINT (DESA NAME)	END POINT (DESA NAME)	LENGTH (KM)	THROUGH THE KEC. NAME & LENGTH		REMARKS
				KEC. NAME	LENGTH (KM)	
01	D u m l i	Batu Miang	1	Tanjung Redep	1	
02	Kampung Bugis	Pangeran Antasari	1	Tanjung Redep	1	
03	Kampung Bugis	R.A Kartini	1	Tanjung Redep	1	
04	Kampung Bugis	Slr.Maulana	1	Tanjung Redep	1	
05	Kampung Bugis	Pasar Inpres	1	Tanjung Redep	1	
06	D u m l i	Jl.Sudirman	1	Tanjung Redep	1	
07	Jl.Sudirman	Jl.A.Yani	1	Tanjung Redep	1	
08	Pulau Derawan	Jl. Dr. Murjani	1	Tanjung Redep	1	
09	Jl. SA. Maulana	Jl.Mangga	1	Tanjung Redep	1	
10	Pasar Inpres	Kampung Baru	1	Tanjung Redep	1	
11	Pasar Inpres	Tanah Seribu	1	Tanjung Redep	1	
12	Pelabuhan	Kantor BKDH	1	Tanjung Redep	1	
13	Jl. Dr. Murjani	Kantor BKDH	1	Tanjung Redep	1	
14	Kampung Baru	Rumah Sakit Umum	1	Tanjung Redep	1	
15	Kampung Baru	Gunung Panjang	3	Tanjung Redep	3	
16	APT. Pranoto	Melonoa	1	Tanjung Redep	1	
17	Kampung Bugis	Muliono		Tanjung Redep		
18	K u r a u	N a k e p	2	Gunung Tabur	2	
19	Laksamana	K u r a u	1	Gunung Tabur	1	
20	Sambaliung Ulu	Sambaliung Ilir	2	Sambaliung	2	
21	Sambaliung A	Sambaliung B	1	Sambaliung	1	
22	Abu-abu	Station I	1	Tanjung Redep	1	
23	Pasar Teluk Bayur	Station III	2	Tanjung Redep	2	
24	Kampung Baru	Gunung Mas	1	Tanjung Redep	1	

Please note the priority No. in the Remarks of this list for each links No. according to the each Kabupaten's development plan.

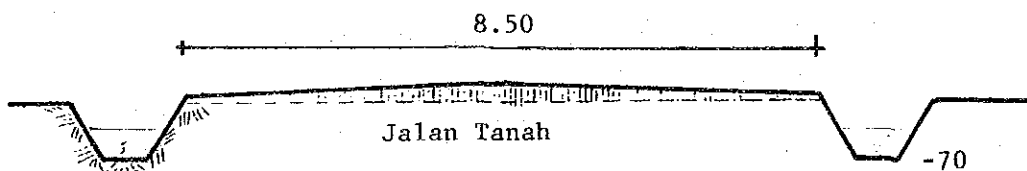
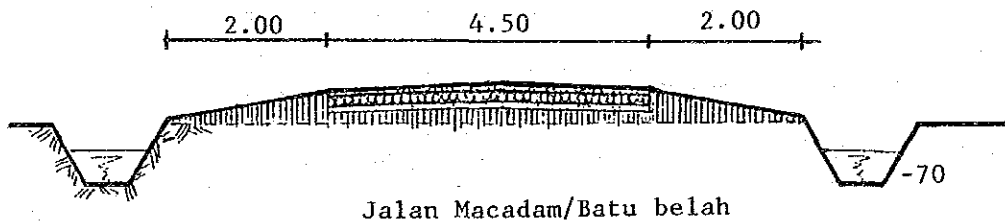
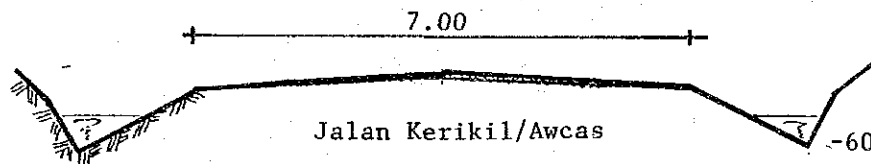
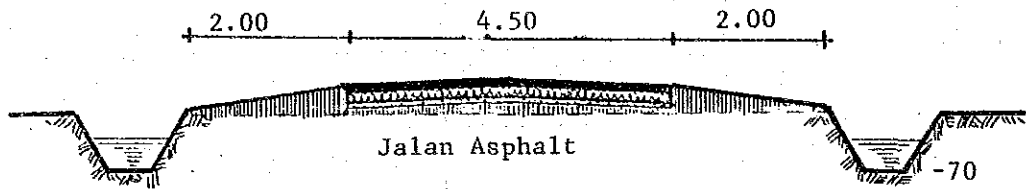
What Kind of Design Criteria has being applied for the new road construction and the improvement for the Kabupaten Road ?

Kriteria Perencanaan yang dipakai pada program penanganan jalan Kabupaten, baik untuk jalan lama maupun pembangunan baru.

Please draw the Typical Cross Section of the Kabupaten Road.

Buat gambar dan penjelasan dari: Typical cross section yang dipakai pada program penanganan jalan selama ini (baik untuk jalan lama, maupun pembangunan baru)

TYPICAL CROSS SECTION.



LINK NO : Nomor Ruas	LOCATION From - To (dari ~ ke)	Lebar per- kerasan(m)	Type per- kerasan	LENGTH Panjang (KM)	COSTS Harga (Rp 10 ⁶)	REMARKS
		Lebar Jembatan	Type Jembatan			Keterangan
29	Talisayan - Batu Putih	4	Gravel	36.25		
		4	Timber			

* PAVEMENT TYPE : Pls note the appropriate No. below.

- 1. : Asphalt surface / penetrasi macadam
- 2. : Asphalt seal / pelaburan aspal
- 3. : Gravel / kerikil
- 4. : Gravel /AWCAS / kerikil / japat

LINK NO Nomor Ruas	LOCATION From - To (dari - ke)	Lebar per- kerasan(m)	Type per- kerasan	LENGTH Panjang (KM)	COSTS Harga (Rp 10 ⁶)	REMARKS Keterangan
		Lebar Jembatan	Type Jembatan			
18	Gunung Tabur - Malurang - Samburakat	4	Gravel	9.6	90,680	
20	Sambaliung-Bangun Gurimbang	4	Gravel	18	190,880	
29	Talisayan - Batu Putih	4	Timber	85 m	52,440	

* PAVEMENT TYPE : PIs note the appropriate No. below.

1. : Asphalt surface / penetrasi macadam
2. : Asphalt seal / pelaburan aspal
3. : Gravel / kerikil
4. : Gravel /AWCAS / kerikil / japat

ROADS CONSTRUCTED OR IMPROVED IN 1984/1985

Biaya konstruksi penanganan

jalan dan jembatan Kabupaten thn. 1984/1985

LINK NO Nomor Ruas	L O C A T I O N From - To (dari - ke)	Lebar per- kerasan(m)	Type per- kerasan	LENGTH Panjang (KM)	COSTS Harga (Rp 10 ⁶)	REMARKS Keterang: an
		Lebar Jembatan	Type Jembatan			
35	Talisayan - Kr. Bajau	4.5	Sirtu	17.10	182,970	
		4	Timber	55 m		
43	Samburakat - Sembakungan	4.5	Sirtu	9	91,417	
		4	Timber	-		
44	Sembakungan - Mer.Ulu	4.5	Sirtu	14	154,000	
		4	Timber	65 m		
45	Mer.Ulu - Mer Ilir	4.5	Sirtu	9	93,900	
		-	-	-		
	Peningkatan Jalan di Sam- baliung	4	Gravel	7.5	23,312	
		-	-	-		
35	Peningkata Jalan di desa Inaran	4	Gravel	7.5	26,000	
		-	-	-		

* PAVEMENT TYPE : PIs note the appropriate No. below.

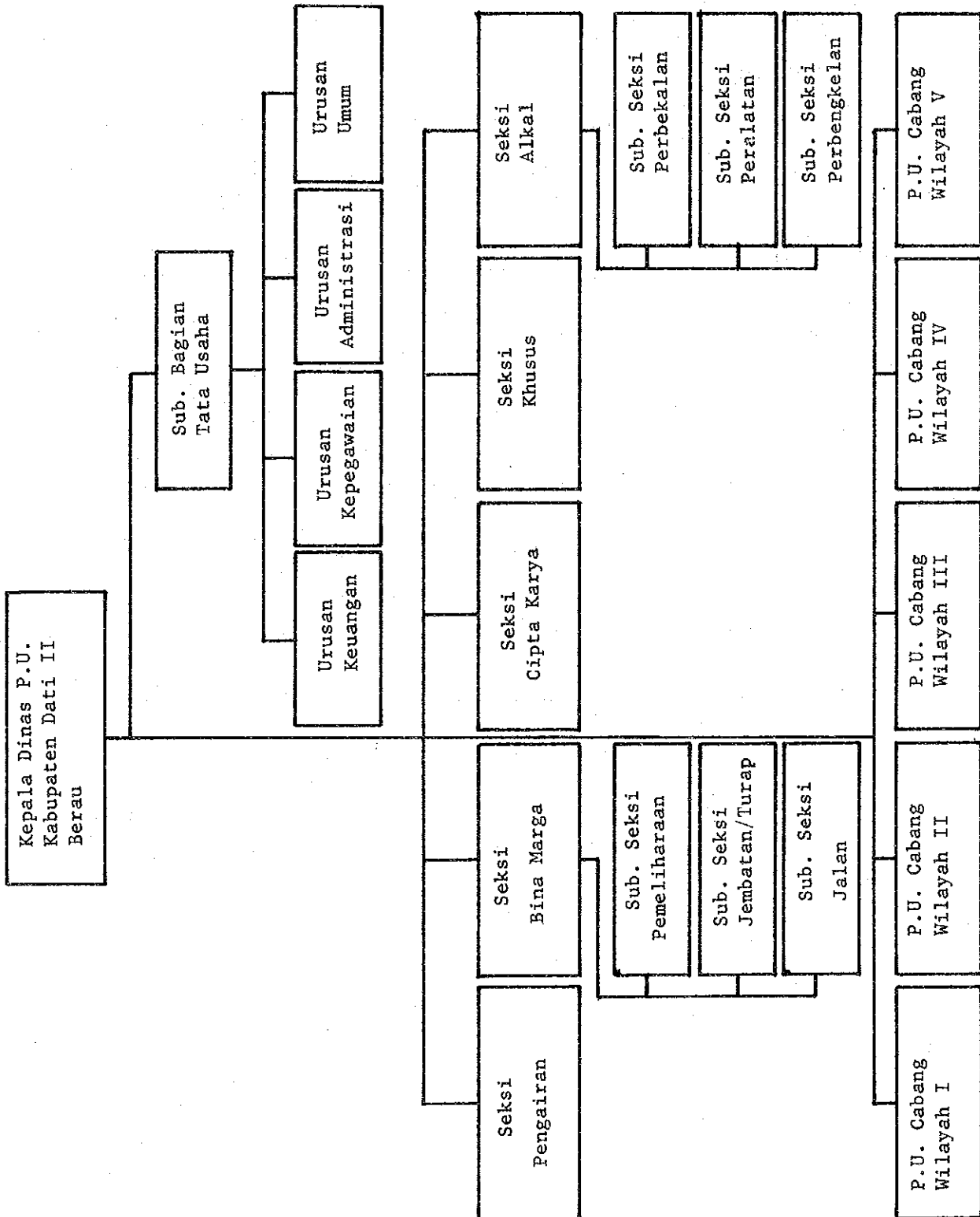
- 1. : Asphalt surface / penetrasi macadam
- 2. : Asphalt seal / pelaburan aspal
- 3. : Gravel / kerikil
- 4. : Gravel /AWCAS / kerikil / japat

EXISTING ORGANIZATION IN KABUPATEN

Structur Organisasi yang ada dari P.U Kabupaten

Please draw the Cart of the Existing Organization in the Kabupaten.

Harap digambar bagan organisasi dari DPUK.



EXISTING STAFF RESOURCES OF BINA MARGA OF PU KABUPATENTenaga Dinas PUK yang adaPROPINSI: Kalimantan TimurKABUPATEN: Berau

DESCRIPTION / Uraian	NUMBER / Jumlah	REMARKS Keterangan
CONTROLLING STAFF Staff teknis. PUK	(9)	
DPUK ENGINEER Sarjana Teknik	-	
ASSISTANT ENGINEER Sarjana Muda Teknik	-	
TECHNICIAN STAFF Staff Teknik (STM)	9	
ADMINISTRATION Tenaga Administrasi	5	
SUPERVISOR Tenaga Pengawas	-	
WORKING FORCE Tenaga Pelaksana Lapangan	(7)	
OPERATORS Operators	2	
DRIVERS Supir	1	
MECHANICS Mechanic	2	
TRADESMAN Tukang	2	
LABOUR Buruh / Pekerja	-	
OTHERS Lain-lain	-	
TOTAL / JUMLAH	21	

Catatan ; Untuk kolom keterangan harap diisi berapa orang yang telah mendapat Training.

LOCATION AND AREA OF DPUK WORKSHOP

E-06

Lokasi Workshop DPUK

PROPINSI : Kalimantan Timur

KABUPATEN: Berau

LOCATION Lokasi	AREA (m2) Luas	NUMBER Jumlah	REMARKS Keterangan
-	2.000	1	

PROPINSI: Kalimantan Timur

E-07

KABUPATEN: Berau

LAND ACQUISITION COST
Daftar harga pembebasan tanah

DESCRIPTION Uraian	UNIT Satuan	RATE (RP) Harga	REMARKS Keterangan
CITY/kota	M2	1,500	
VILLAGE / desa	M2	500	
RICE FIELD/sawah	M2	-	
DRY FIELD/ladang	M2	-	
MIX CROPS/panen	M2	-	
FOREST/hutan	M2	-	
SWAMP / rawa	M2	-	
OTHERS / lain-lain	M2	-	

LIST OF EXISTING EQUIPMENT OF LOCAL CONTRACTOR

Name of contractor

NAME OF EQUIPMENT Jenis peralatan	EXISTING CONDITION/ Kondisi Peralatan					REASON OF BAD CONDIT TION/Sebab Kerusakan	REQUIRE - MENT / Ke- butuhan peralatan baru
	TYPE/ Tipe	P. Y	NUMBER / Jumlah				
			GOOD Baik	BAD Rusak	TOTAL Jumlah		
Bulldozer							1
Motor Grader	MV. 6 P		1	-	1		2
Tyre Roller							
Steel Wheel Roller							
Vibration Roller	MGB - I	1981	2	-	2		
Wheel Loader							1
Front End Loader and Backhoe							
Mobile Crane							
Concrete Mixer							
Stone Crusher	MF-36- 912	1978	1	-	1		
Portable Compressor							
Hydraulic Excavator							
Asphalt Paving Machine							
Asphalt Sprayer							
Asphalt Mixing Machine							
Mobile Workshop							
Mechanic Rammer							
Plate Tamper	MP - 150		2	-	2		2
Pile Driver							
Leg Drill							
Hand Hammer							
Farm Tractor							
Dump Truck							1
Water Tank Truck							
Fuel Tank Truck							
Pick Up	Chevrolet	1980	1	-	1		
Jeep							1
Motorcycle							
Generator							1
Water Pump							
Others							
-							

LIST OF EXISTING EQUIPMENT OF P.U KABUPATEN

NAME OF EQUIPMENT Jenis peralatan	EXISTING CONDITION/ Kondisi Peralatan					REASON OF BAD CONDI TION/Sebab Kerusakan	REQUIRE - MENT /Ke- butuhan peralatan baru
	TYPE/ Tipe	P.Y	NUMBER / Jumlah				
			GOOD Baik	BAD Rusak	TOTAL Jumlah		
Bulldozer							
Motor Grader							
Tyre Roller			1	-	1		
Steel Whell Roller							
Vibration Roller			2	-	2		
Wheel Loader							
Front End Loader and Backhoe							
Mobile Crane							
Concrete Mixer							
Stone Crusher			1	-	1		
Portable Compressor							
Hydraulic Excavator							
Asphalt Paving Machine							
Asphalt Sprayer							
Asphalt Mixing Machine							
Mobile Workshop							
Mechanic Rammer							
Plate Tamper			2	-	2		
Pile Driver							
Leg Drill							
Hand Hammer							
Farm Tractor							
Dump Truck							
Water Tank Truck							
Fuel Tank Truck							
Pick Up			1	-	1		
Jeep							
Motorcycle							
Generator							
Water Pump							
Others							
.							

Appendix A-3

CONSTRUCTION AND MAINTENANCE COST FOR PROPOSED ROAD LINKS

PROV : KALIMANTAN TIMUR KAB : BERAU

LINK NO : 27 (IIB-1) LENGTH : 36 Km

UPGRADE : 4.0m road bed, 4.0m road with surface Dressing (1)

(Rp)

ITEM	UNIT	QUANTITY	<<< UNIT COST >>>		<<<<< COST >>>>>		TOTAL	
			LOCAL	FOREIGN	LOCAL	FOREIGN		
Site Clearance in Light Bush	m ²	0.0	162	91	0	0	0	
Subgrade Preparation	m ²	162000.0	20	11	3,240,000	1,782,000	5,022,000	
Normal Fill	m ³	0.0	1,677	863	0	0	0	
Fill in Swamp	m ³	0.0	2,484	1,053	0	0	0	
Normal Excavation to Spoil	m ³	1820.0	982	523	1,787,240	951,860	2,739,100	
Sub Base Course	m ³	17192.7	3,173	1,348	54,552,437	23,175,759	77,728,196	
Base Course	m ³	10080.0	4,347	2,300	43,817,760	23,184,000	67,001,760	
Shoulder	m ²	72000.0	292	146	21,024,000	10,512,000	31,536,000	
Asphalt Patching	m ²	0.0	3,390	1,512	0	0	0	
Surface Dressing (Single)	m ²	144000.0	556	766	80,064,000	110,304,000	190,368,000	
Surface Dressing (Double)	m ²	0.0	700	1,207	0	0	0	
Earth Drain	m	55440.0	777	119	43,076,880	6,597,360	49,674,240	
Earth Drain in Swamp (by machine)	m ³	0.0	1,158	474	0	0	0	
Pipe Culvert 80cm	m	0.0	40,363	53,890	0	0	0	
Masonry Culvert (80x80cm)	m	0.0	60,501	44,112	0	0	0	
Retaining Wall and Wing Wall (Timber)	m ²	0.0	10,533	246	0	0	0	
Retaining Wall and Wing Wall (Masonry)	m ³	0.0	45,512	12,252	0	0	0	
Gabion Protection	m ³	0.0	17,073	120	0	0	0	
New Bridge (Timber)	SET	1.0	--	--	0	0	0	
New Bridge (Concrete)	SET	1.0	--	--	0	0	0	
					Sub Total	247,562,317	176,506,979	424,069,296
Overhead (15%)						37,134,347	26,476,046	63,610,393
					TOTAL COST	284,696,664	202,983,025	487,679,689

Manual routine maintenance of road	Km	36.0	124,228	7,248	4,472,208	260,928	4,733,136
Routine maintenance of asphalt road	Km	36.0	339,000	151,200	12,204,000	5,443,200	17,647,200
			Sub Total		16,676,208	5,704,128	22,380,336
Maintenance of Timber Bridge (New)	m ²	0.0	7,145	1,009	0	0	0
Maintenance of Concrete Bridge (New)	m ²	0.0	1,701	3,403	0	0	0
Maintenance of Timber Bridge (Exist)	m ²	1820.0	7,411	2,347	13,488,020	4,271,540	17,759,560
Maintenance of Concrete Bridge (Exist)	m ²	0.0	4,179	2,523	0	0	0

Earthwork & Pavement	Unit Cost	(Rp/Km)	:	13,546,658
Timber Bridge	Unit Cost	(Rp/m ²)	:	
Concrete Bridge	Unit Cost	(Rp/m ²)	:	
Survived Value		(Rp)	:	67,810,089
Maintenance Rate without Bridge		(%)	:	4.59
New Bridge Cost Rate		(%)	:	

PROV : KALIMANTAN TIMUR KAB : BERAU

LINK NO : 50 (IIC) LENGTH : 250 Km

UPGRADE : 5.0m road bed, 3.5m road with surface Subbase Course

(Rp)

ITEM	UNIT	QUANTITY	(((UNIT COST)))		((((COST))))		TOTAL	
			LOCAL	FOREIGN	LOCAL	FOREIGN		
Site Clearance in Light Bush	m2	0.0	162	91	0	0	0	
Subgrade Preparation	m2	875000.0	20	11	17,500,000	9,675,000	27,125,000	
Normal Fill	m3	37500.0	1,677	863	62,897,500	32,362,500	95,250,000	
Fill in Swamp	m3	0.0	2,484	1,053	0	0	0	
Normal Excavation to Spoil	m3	0.0	982	523	0	0	0	
Sub Base Course	m3	140000.0	3,173	1,348	444,220,000	188,720,000	632,940,000	
Base Course	m3	0.0	4,347	2,300	0	0	0	
Shoulder	m2	375000.0	292	146	109,500,000	54,750,000	164,250,000	
Asphalt Patching	m2	0.0	3,390	1,512	0	0	0	
Surface Dressing (Single)	m2	0.0	556	766	0	0	0	
Surface Dressing (Double)	m2	0.0	700	1,207	0	0	0	
Earth Drain	m	75000.0	777	119	58,275,000	8,925,000	67,200,000	
Earth Drain in Swamp (by machine)	m3	0.0	1,158	474	0	0	0	
Pipe Culvert Ø80cm	m	5000.0	40,363	53,890	201,815,000	269,450,000	471,265,000	
Masonry Culvert (80x80cm)	m	0.0	60,501	44,112	0	0	0	
Retaining Wall and Wing Wall (Timber)	m2	0.0	10,533	246	0	0	0	
Retaining Wall and Wing Wall (Masonry)	m3	1600.0	45,512	12,252	72,819,200	19,603,200	92,422,400	
Gabion Protection	m3	0.0	17,073	120	0	0	0	
New Bridge (Timber)	SET	1.0	--	--	0	0	0	
New Bridge (Concrete)	SET	1.0	--	--	0	0	0	
					967,016,700	583,435,700	1,550,452,400	
Overhead (15%)					145,052,505	87,515,355	232,567,860	
					TOTAL COST	1,112,069,205	670,951,055	1,783,020,260

Manual routine maintenance of road	Ka	250.0	124,228	7,248	31,057,000	1,812,000	32,869,000
Routine maintenance of gravel road	Ka	250.0	180,043	88,092	47,010,750	22,023,000	69,033,750
			Sub Total		78,067,750	23,835,000	101,902,750
Maintenance of Timber Bridge (New)	m2	0.0	7,145	1,009	0	0	0
Maintenance of Concrete Bridge (New)	m2	0.0	1,701	3,403	0	0	0
Maintenance of Timber Bridge (Exist)	m2	0.0	7,411	2,347	0	0	0
Maintenance of Concrete Bridge (Exist)	m2	0.0	4,179	2,523	0	0	0

Earthwork & Pavement Unit Cost (Rp/Km)	:	7,132,081
Timber Bridge Unit Cost (Rp/m2)	:	
Concrete Bridge Unit Cost (Rp/m2)	:	
Survived Value (Rp)	:	253,176,000
Maintenance Rate without Bridge (%)	:	5.72
New Bridge Cost Rate (%)	:	

Appendix A-4

CONSTRUCTION AND MAINTENANCE QUANTITIES
FOR ALL PROPOSED ROAD LINKS
(CONSTRUCTION)

PROV : KALIMANTAN TIMUR KAB : BERAU

ITEM	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EQUIPMENT :							
Bulldozer/Ripper	hr	420.0	909.9	1014.9	1154.9	345.5	3845.2
Swap Bulldozer	hr	0.0	0.0	0.0	0.0	0.0	0.0
Motor Grader	hr	978.4	2119.9	2364.5	2690.7	1554.9	9708.4
Hand-guide Vib. Roller	hr	752.2	1629.8	1817.9	2068.6	0.0	6268.5
Tire Roller	hr	0.0	0.0	0.0	0.0	1199.9	1199.9
Vibratory Roller (D&T)	hr	1023.4	2217.4	2473.2	2814.4	1233.0	9761.4
Hydraulic Excavator; Wheel	hr	0.0	0.0	0.0	0.0	0.0	0.0
Wheel Loader	hr	1024.5	2219.9	2476.1	2817.7	1936.4	10474.6
Water Tank Truck	hr	643.9	1395.3	1556.3	1770.9	868.0	6234.4
Dump Truck	hr	10645.9	23066.3	25727.8	29276.4	18296.5	107012.9
Flat Bed Truck with Crane	hr	599.4	1298.8	1448.7	1648.5	0.0	4995.4
Flat Bed Truck	hr	259.4	562.1	626.9	713.4	1440.0	3601.8
Portable Crusher/Screening	hr	9.3	20.2	22.5	25.7	486.6	564.3
Concrete Mixer	hr	218.0	472.4	526.9	599.6	0.0	1816.9
Water Pump	hr	179.6	389.2	434.1	494.0	0.0	1496.9
Concrete Vibrator	hr	102.8	222.8	248.5	282.8	0.0	856.9
Asphalt Sprayer	hr	0.0	0.0	0.0	0.0	1199.9	1199.9
LABOUR :							
Mandar	man day	1189.8	2578.3	2875.8	3272.3	1684.3	11600.5
Skilled Labourer	man day	415.2	899.7	1003.6	1142.0	720.0	4180.5
Carpenter	man day	34.2	74.2	82.8	94.2	0.0	285.4
Mason	man day	192.0	416.0	464.0	528.0	0.0	1600.0
Labourer	man day	10439.3	22619.0	25228.8	28708.8	23233.7	110229.6
Driver	man day	2026.0	4390.0	4896.5	5571.9	3819.6	20704.0
Operator	man day	1104.0	2391.9	2667.8	3035.9	1542.8	10742.4
MATERIAL :							
Bitumen	l	0.0	0.0	0.0	0.0	245999.9	245999.9
Asphalt Oil	l	0.0	0.0	0.0	0.0	49200.0	49200.0
Kerosene	l	0.0	0.0	0.0	0.0	58799.9	58799.9
Sand	m ³	565.4	1225.1	1366.5	1555.0	720.0	5432.0
Cement	bag	1572.9	3408.0	3801.3	4325.6	0.0	13107.8
River Stone	m ³	192.0	416.0	464.0	528.0	0.0	1600.0
Steel Houlds	set	600.0	1300.0	1450.0	1650.0	0.0	5000.0
Timber	m ³	0.0	0.0	0.0	0.0	0.0	0.0
Paint	l	0.0	0.0	0.0	0.0	0.0	0.0
Reinforcing Steel	kg	19140.0	41470.0	46255.0	52635.0	0.0	159500.0
Tying Wire	kg	174.0	377.0	420.5	478.5	0.0	1450.0
Equivalent Royalty	m ³	21812.7	47260.9	52714.1	59985.0	33705.5	215478.2

CONSTRUCTION AND MAINTENANCE QUANTITIES
FOR ALL PROPOSED ROAD LINKS
(MAINTENANCE)

PROV : KALIMANTAN TIMUR KAB : BERAU

ITEM	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EDIFICMENT :							
Bulldozer/Ripper	hr	0.0	0.0	0.0	0.0	0.0	0.0
Swamp Bulldozer	hr	0.0	0.0	0.0	0.0	0.0	0.0
Motor Grader	hr	97.7	195.5	195.5	195.5	1246.2	1930.4
Hand-guide Vib. Roller	hr	120.0	240.0	240.0	240.0	240.0	1080.0
Tire Roller	hr	97.7	195.5	195.5	195.5	1246.2	1930.4
Vibratory Roller (D&T)	hr	0.0	0.0	0.0	0.0	0.0	0.0
Hydraulic Excavator; Wheel	hr	0.0	0.0	0.0	0.0	0.0	0.0
Wheel Loader	hr	21.2	42.4	42.4	42.4	432.3	580.7
Water tank Truck	hr	0.0	0.0	0.0	0.0	0.0	0.0
Dusp Truck	hr	367.2	734.7	734.7	734.7	3074.2	5645.5
Flat Bed Truck with Crane	hr	1793.6	3587.3	3587.3	3587.3	2538.0	15093.5
Flat Bed Truck	hr	475.7	951.6	951.6	951.6	4786.3	8116.8
Portable Crusher/Screening	hr	10.7	21.6	21.6	21.6	216.5	292.0
Concrete Mixer	hr	0.2	0.5	0.5	0.5	0.5	2.2
Water Pump	hr	0.2	0.5	0.5	0.5	0.5	2.2
Concrete Vibrator	hr	0.2	0.5	0.5	0.5	0.5	2.2
Asphalt Sprayer	hr	0.0	0.0	0.0	0.0	0.0	0.0
LABOUR :							
Handur	man day	251.3	502.9	502.9	502.9	1631.1	3391.1
Skilled Labourer	man day	560.0	1120.0	1120.0	1120.0	828.7	4748.7
Carpenter	man day	257.5	515.1	515.1	515.1	358.7	2161.5
Mason	man day	0.0	0.0	0.0	0.0	0.0	0.0
Labourer	man day	2441.3	4882.9	4882.9	4882.9	10636.0	35726.0
Driver	man day	523.4	1047.1	1047.1	1047.1	1851.6	5516.3
Operator	man day	39.7	79.5	79.5	79.5	559.7	837.9
MATERIAL :							
Bitumen	l	1080.0	2160.0	2160.0	2160.0	2160.0	9720.0
Asphalt Oil	l	0.0	0.0	0.0	0.0	0.0	0.0
Kerosene	l	120.0	240.0	240.0	240.0	240.0	1080.0
Sand	m ³	20.2	40.5	40.5	40.5	40.5	182.2
Cement	bag	3.6	7.3	7.3	7.3	7.3	32.8
River Stone	m ³	0.0	0.0	0.0	0.0	0.0	0.0
Steel Moulds	set	0.0	0.0	0.0	0.0	0.0	0.0
Timber	m ³	23.3	46.7	46.7	46.7	32.4	195.8
Paint	l	166.4	332.8	332.8	332.8	231.5	1396.3
Reinforcing Steel	kg	18.8	37.6	37.6	37.6	37.6	169.2
lyng Wire	kg	0.1	0.3	0.3	0.3	0.3	1.3
Equivalent Royalty	m ³	301.1	602.3	602.3	602.3	6126.0	8234.0

CONSTRUCTION AND MAINTENANCE QUANTITIES
FOR ALL PROPOSED ROAD LINKS
(TOTAL)

PROV : KALIMANTAN TIMUR KAB : BERAU

I T E M	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EQUIPMENT :							
Bulldozer/Ripper	hr	420.0	909.9	1014.9	1154.9	345.5	3845.2
Swamp Bulldozer	hr	0.0	0.0	0.0	0.0	0.0	0.0
Motor Grader	hr	1076.1	2315.4	2560.0	2886.2	2801.1	11638.8
Hand-guide Vib. Roller	hr	872.2	1869.8	2057.9	2308.6	240.0	7348.5
Tire Roller	hr	97.7	195.5	195.5	195.5	2446.1	3130.3
Vibratory Roller (D&T)	hr	1023.4	2217.4	2473.2	2814.4	1233.0	9761.4
Hydraulic Excavator; Wheel	hr	0.0	0.0	0.0	0.0	0.0	0.0
Wheel Loader	hr	1045.7	2262.3	2518.5	2860.1	2368.7	11055.3
Water Tank Truck	hr	643.9	1395.3	1556.3	1770.9	868.0	6234.4
Dump Truck	hr	11013.1	23801.0	26462.5	30011.1	21370.7	112658.4
Flat Bed Truck with Crane	hr	2393.0	4886.1	5036.0	5235.8	2538.0	20088.9
Flat Bed Truck	hr	735.1	1513.7	1578.5	1665.0	6226.3	11718.6
Portable Crusher/Screening	hr	20.0	41.8	44.1	47.3	703.1	856.3
Concrete Mixer	hr	218.2	472.9	527.4	600.1	0.5	1819.1
Water Pump	hr	179.8	389.7	434.6	494.5	0.5	1499.1
Concrete Vibrator	hr	103.0	223.3	249.0	283.3	0.5	859.1
Asphalt Sprayer	hr	0.0	0.0	0.0	0.0	1199.9	1199.9
LABOUR :							
Handor	man day	1441.1	3081.2	3378.7	3775.2	3315.4	14991.6
Skilled Labourer	man day	975.2	2019.7	2123.6	2262.0	1548.7	8929.2
Carpenter	man day	291.7	589.3	597.9	609.3	358.7	2446.9
Mason	man day	192.0	416.0	464.0	528.0	0.0	1600.0
Labourer	man day	12880.6	27501.9	30111.7	33591.7	41869.7	145955.6
Driver	man day	2549.4	5437.1	5943.6	6619.0	5671.2	26220.3
Operator	man day	1143.7	2471.4	2747.3	3115.4	2102.5	11580.3
MATERIAL :							
Bitumen	l	1080.0	2160.0	2160.0	2160.0	248159.9	255719.9
Asphalt Oil	l	0.0	0.0	0.0	0.0	49200.0	49200.0
Kerosene	l	120.0	240.0	240.0	240.0	59039.9	59879.9
Sand	m ³	585.6	1265.6	1407.0	1595.5	760.5	5614.2
Cement	bag	1576.5	3415.3	3808.6	4332.9	7.3	13140.6
River Stone	m ³	192.0	416.0	464.0	528.0	0.0	1600.0
Steel Houlds	set	600.0	1300.0	1450.0	1650.0	0.0	5000.0
Timber	m ³	23.3	46.7	46.7	46.7	32.4	195.8
Paint	l	166.4	332.8	332.8	332.8	231.5	1376.3
Reinforcing Steel	kg	19158.8	41507.6	46292.6	52672.6	37.6	159669.2
Tying Wire	kg	174.1	377.3	420.8	478.8	0.3	1451.3
Equivalent Royalty	m ³	22113.8	47863.2	53316.4	60587.3	39831.5	223712.2

CONSTRUCTION AND MAINTENANCE COSTS
FOR ALL PROPOSED ROAD LINKS
(CONSTRUCTION)

PROV : KALIMANTAN TIMUR KAB : BERAU

(1000 Rp)

I T E M	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EQUIPMENT :		112,462	243,683	271,804	309,299	212,935	1,150,183
Bulldozer/Ripper	15974	6,709	14,534	16,212	18,448	5,519	61,422
Swamp Bulldozer	11773	0	0	0	0	0	0
Motor Grader	13628	13,333	28,889	32,223	36,668	21,190	132,303
Hand-guide Vib. Roller	1568	1,179	2,555	2,850	3,243	0	9,827
Tire Roller	10929	0	0	0	0	13,113	13,113
Vibratory Roller (D&T)	6795	6,954	15,067	16,805	19,123	8,378	66,327
Hydraulic Excavator; Wheel	12814	0	0	0	0	0	0
Wheel Loader	16803	17,214	37,300	41,605	47,345	32,537	176,001
Water Tank Truck	3998	2,574	5,578	6,222	7,080	3,470	24,924
Dump Truck	5462	58,147	125,988	140,525	159,907	99,935	584,502
Flat Bed Truck with Crane	5082	3,046	6,600	7,362	8,377	0	25,385
Flat Bed Truck	3373	874	1,895	2,114	2,406	4,857	12,146
Portable Crusher/Screening	44182	410	892	994	1,135	21,498	24,929
Concrete Mixer	8738	1,904	4,127	4,604	5,239	0	15,874
Water Pump	484	86	188	210	239	0	723
Concrete Vibrator	317	32	70	78	89	0	269
Asphalt Sprayer	2032	0	0	0	0	2,438	2,438
LABOUR :		29,969	64,938	72,432	82,422	57,357	307,118
Handur	2500	2,974	6,445	7,189	8,180	4,210	28,998
Skilled Labourer	2000	830	1,799	2,007	2,284	1,440	8,360
Carpenter	2500	85	185	207	235	0	712
Mason	2500	480	1,040	1,160	1,320	0	4,000
Labourer	1500	15,658	33,928	37,843	43,063	34,850	165,342
Driver	3000	6,078	13,170	14,689	16,715	11,458	62,110
Operator	3500	3,864	8,371	9,337	10,625	5,399	37,596
MATERIAL :		43,886	95,089	106,061	120,691	154,284	520,011
Bitumen	400	0	0	0	0	98,399	98,399
Asphalt Oil	600	0	0	0	0	29,520	29,520
Kerosene	250	0	0	0	0	14,699	14,699
Sand	4500	2,544	5,512	6,149	6,997	3,240	24,442
Cement	6000	9,437	20,448	22,807	25,953	0	78,645
River Stone	12000	2,304	4,992	5,568	6,336	0	19,200
Steel Moulds	8000	4,800	10,400	11,600	13,200	0	40,000
Timber	100000	0	0	0	0	0	0
Paint	2000	0	0	0	0	0	0
Reinforcing Steel	1000	19,140	41,470	46,255	52,635	0	159,500
Tying Wire	1200	208	452	504	574	0	1,738
Equivalent Royalty	250	5,453	11,815	13,178	14,996	8,426	53,868

CONSTRUCTION AND MAINTENANCE COSTS
FOR ALL PROPOSED ROAD LINKS
(MAINTENANCE)

PROV : KALIMANTAN TIMUR KAB : BERAU

(1000 Rp)

I T E M	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EQUIPMENT :		16,139	32,297	32,297	32,297	93,643	206,673
Bulldozer/Ripper	15974	0	0	0	0	0	0
Swamp Bulldozer	11773	0	0	0	0	0	0
Motor Grader	13628	1,331	2,664	2,664	2,664	16,983	26,306
Hand-guide Vib. Roller	1568	188	376	376	376	376	1,692
Tire Roller	10929	1,067	2,136	2,136	2,136	13,619	21,094
Vibratory Roller (D&T)	6795	0	0	0	0	0	0
Hydraulic Excavator; Wheel	12814	0	0	0	0	0	0
Wheel Loader	16803	356	712	712	712	7,263	9,755
Water Tank Truck	3998	0	0	0	0	0	0
Dump Truck	5462	2,005	4,012	4,012	4,012	16,791	30,832
Flat Bed Truck with Crane	5082	9,115	18,230	18,230	18,230	12,898	76,703
Flat Bed Truck	3373	1,604	3,209	3,209	3,209	16,144	27,375
Portable Crusher/Screening	44182	472	954	954	954	9,565	12,899
Concrete Mixer	8738	1	4	4	4	4	17
Water Pump	484	0	0	0	0	0	0
Concrete Vibrator	317	0	0	0	0	0	0
Asphalt Sprayer	2032	0	0	0	0	0	0
LABOUR :		7,760	15,527	15,527	15,527	42,096	96,437
Mandur	2500	628	1,257	1,257	1,257	4,077	8,476
Skilled Labourer	2000	1,120	2,240	2,240	2,240	1,657	9,497
Carpenter	2500	643	1,287	1,287	1,287	896	5,400
Mason	2500	0	0	0	0	0	0
Labourer	1500	3,661	7,324	7,324	7,324	27,954	53,587
Driver	3000	1,570	3,141	3,141	3,141	5,554	16,547
Operator	3500	138	278	278	278	1,958	2,930
MATERIAL :		3,328	6,671	6,671	6,671	6,420	29,761
Bitumen	400	432	864	864	864	864	3,888
Asphalt Oil	600	0	0	0	0	0	0
Kerosene	250	30	60	60	60	60	270
Sand	4500	90	182	182	182	182	818
Cement	6000	21	43	43	43	43	193
River Stone	12000	0	0	0	0	0	0
Steel Moulds	8000	0	0	0	0	0	0
Timber	100000	2,330	4,670	4,670	4,670	3,240	19,580
Paint	2000	332	665	665	665	463	2,790
Reinforcing Steel	1000	18	37	37	37	37	166
Tying Wire	1200	0	0	0	0	0	0
Equivalent Royalty	250	75	150	150	150	1,531	2,056

CONSTRUCTION AND MAINTENANCE COSTS
FOR ALL PROPOSED ROAD LINKS
(TOTAL)

PROV : KALIMANTAN TIMUR

KAB : BERAU

(1000 Rp)

I T E M	UNIT	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >	< TOTAL >
EQUIPMENT :		128,601	275,980	304,101	341,596	306,578	1,356,856
Bulldozer/Ripper	15974	6,709	14,534	16,212	18,448	5,519	61,422
Swamp Bulldozer	11773	0	0	0	0	0	0
Motor Grader	13628	14,664	31,553	34,887	39,332	38,173	158,609
Hand-guide Vib. Roller	1568	1,367	2,931	3,226	3,619	376	11,519
Tire Roller	10929	1,067	2,136	2,136	2,136	26,732	34,207
Vibratory Roller (D&T)	6795	6,954	15,067	16,805	19,123	8,378	66,327
Hydraulic Excavator; Wheel	12814	0	0	0	0	0	0
Wheel Loader	16803	17,570	38,012	42,317	48,057	39,800	185,756
Water Tank Truck	3998	2,574	5,578	6,222	7,080	3,470	24,924
Dump Truck	5462	60,152	130,000	144,537	163,919	116,726	615,334
Flat Bed Truck with Crane	5082	12,161	24,830	25,592	26,607	12,898	102,088
Flat Bed Truck	3373	2,478	5,104	5,323	5,615	21,001	39,521
Portable Crusher/Screening	4182	882	1,846	1,948	2,089	31,063	37,828
Concrete Mixer	8738	1,905	4,131	4,608	5,243	4	15,891
Water Pump	484	86	188	210	239	0	723
Concrete Vibrator	317	32	70	78	89	0	269
Asphalt Sprayer	2032	0	0	0	0	2,438	2,438
LABOUR :		37,729	80,465	87,959	97,949	99,453	403,555
Mandur	2500	3,602	7,702	8,446	9,437	8,287	37,474
Skilled Labourer	2000	1,950	4,039	4,247	4,524	3,897	17,857
Carpenter	2500	728	1,472	1,494	1,522	896	6,112
Mason	2500	480	1,040	1,160	1,320	0	4,000
Labourer	1500	19,319	41,252	45,167	50,387	62,804	218,929
Driver	3000	7,648	16,311	17,830	19,856	17,012	78,657
Operator	3500	4,002	8,649	9,615	10,903	7,357	40,526
MATERIAL :		47,214	101,760	112,732	127,362	160,704	549,772
Bitumen	400	432	864	864	864	99,263	102,287
Asphalt Oil	600	0	0	0	0	29,520	29,520
Kerosene	250	30	60	60	60	14,759	14,969
Sand	4500	2,634	5,694	6,331	7,179	3,422	25,260
Cement	6000	9,458	20,491	22,850	25,996	43	78,838
River Stone	12000	2,304	4,992	5,568	6,336	0	19,200
Steel Moulds	8000	4,800	10,400	11,600	13,200	0	40,000
Timber	100000	2,330	4,670	4,670	4,670	3,240	19,580
Paint	2000	332	665	665	665	463	2,790
Reinforcing Steel	1000	19,158	41,507	46,292	52,672	37	159,666
Tying Wire	1200	208	452	504	574	0	1,738
Equivalent Royalty	250	5,528	11,965	13,328	15,146	9,957	55,924

Appendix A-6

QUANTITIES OF BRIDGE ON PROPOSED ROAD LINKS

PROV : KALIMANTAN TIMUR KAB : BERAU

LINK NO	BRIDGE NAME	Km	From	<< TYPE >>		DESIGN LOAD	SPAN CLASS	SPAN LENGTH (m)	SPAN NO (no)	SPAN LENGTH (m)	WIDTH (m)	AREA	AREA	PIER (no)	ABUT (no)	ROAD CLASS
				(EXIST)	(NEW)							(EXIST)	(NEW)			
27	TLK SULAIMAN 1	1	TLN	KK				7.00	2	3.50	4.00	28.00		1	2	III-B-1
	TLK SULAIMAN 2	2	TLN	KK				10.00	3	3.33	4.00	40.00		2	2	
	KAPUT	9	TLN	KK				33.00	11	3.00	4.00	132.00		10	2	
	LABUHAN KELABU	14	TLN	KK				150.00	38	3.95	4.00	600.00		37	2	
	LEMPOT	15	TLN	KK				90.00	23	3.91	4.00	360.00		22	2	
	SERAI	18	TLN	KK				40.00	10	4.00	4.00	160.00		9	2	
	SIBURUNG	25	TLN	KK				30.00	10	3.00	4.00	120.00		9	2	
	SANTING	27	TLN	KK				15.00	5	3.00	4.00	60.00		4	2	
	SINUHAMAD	31	TLN	KK				25.00	8	3.13	4.00	100.00		7	2	
	SISILAY	34	TLN	KK				15.00	5	3.00	4.00	60.00		4	2	
	SYUKUR	35	TLN	KK				40.00	10	4.00	4.00	160.00		9	2	

Appendix A-7

CONSTRUCTION AND MAINTENANCE COST OF BRIDGES
ON PROPOSED ROAD LINKS

PROV : KALIMANTAN TIMUR KAB : BERAU
LINK NO : 27 (IIIB-1) LENGTH : 36 Km

(Rp)

ITEM	UNIT	QUANTITY	<<< UNIT COST >>>		<<<<< COST >>>>>		>>>>> TOTAL
			LOCAL	FOREIGN	LOCAL	FOREIGN	
Superstructure (Timber; Span 3m; 10T)	m2	0.00	38,349	2,998	0	0	0
Superstructure (Timber; Span 5m; 10T)	m2	0.00	42,478	3,311	0	0	0
Superstructure (Timber; Span 8m; 10T)	m2	0.00	56,263	4,351	0	0	0
Superstructure (Timber; Span 3m; BHSO)	m2	0.00	47,552	3,707	0	0	0
Superstructure (Timber; Span 5m; BHSO)	m2	0.00	51,913	4,019	0	0	0
Superstructure (Timber; Span 8m; BHSO)	m2	0.00	65,839	5,088	0	0	0
Superstructure (Concrete; Span 3m; BHSO)	m2	0.00	43,462	112,368	0	0	0
Superstructure (Concrete; Span 5m; BHSO)	m2	0.00	44,655	125,491	0	0	0
Superstructure (Concrete; Span 8m; BHSO)	m2	0.00	46,014	136,642	0	0	0
Superstructure (Concrete; Span 10m; BHSO)	m2	0.00	50,335	155,105	0	0	0
Superstructure (Concrete; Span 15m; BHSO)	m2	0.00	54,286	182,607	0	0	0
Substructure (Pier; for Timber; 10T)	NO	0.00	334,068	27,724	0	0	0
Substructure (Abut; for Timber; 10T)	NO	0.00	938,472	136,771	0	0	0
Substructure (Pier; for Timber; BHSO)	NO	0.00	491,317	41,015	0	0	0
Substructure (Abut; for Timber; BHSO)	NO	0.00	1,057,124	151,014	0	0	0
Substructure (Pier; for Concrete; BHSO)	NO	0.00	1,819,378	497,347	0	0	0
Substructure (Abut; for Concrete; BHSO)	NO	0.00	3,720,885	1,033,296	0	0	0
Demolition of Bridge (Timber->Timber)	m2	0.00	10,771	1,195	0	0	0
Demolition of Bridge (Timber->Concrete)	m2	0.00	10,771	1,195	0	0	0
Demolition of Bridge (Concrete)	m2	0.00	81,473	84,507	0	0	0
Maintenance of Timber Bridge (New)	m2	0.00	7,145	1,009	0	0	0
Maintenance of Concrete Bridge (New)	m2	0.00	1,701	3,403	0	0	0
Maintenance of Timber Bridge (Exist)	m2	1820.00	7,411	2,347	13,488,020	4,271,540	17,759,560
Maintenance of Concrete Bridge (Exist)	m2	0.00	4,179	2,523	0	0	0
(Without Overhead)			TOTAL COST (Timber Bridge)		0	0	0
			(Concrete Bridge)		0	0	0
			TOTAL COST (without Maintenance)		0	0	0
(Overhead : 15%)			TOTAL COST (Timber Bridge)		0	0	0
			(Concrete Bridge)		0	0	0
			TOTAL COST (without Maintenance)		0	0	0

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