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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 31

KABUPATEN PANGKAJENE KEPULAUAN

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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86-46(1/3)

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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 Pangkajene Kepulauan in Sulawesi Selatan Province. The report has been prepared by the Study Team of the Japan International Cooperation Agency (hereinafter called JICA).

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

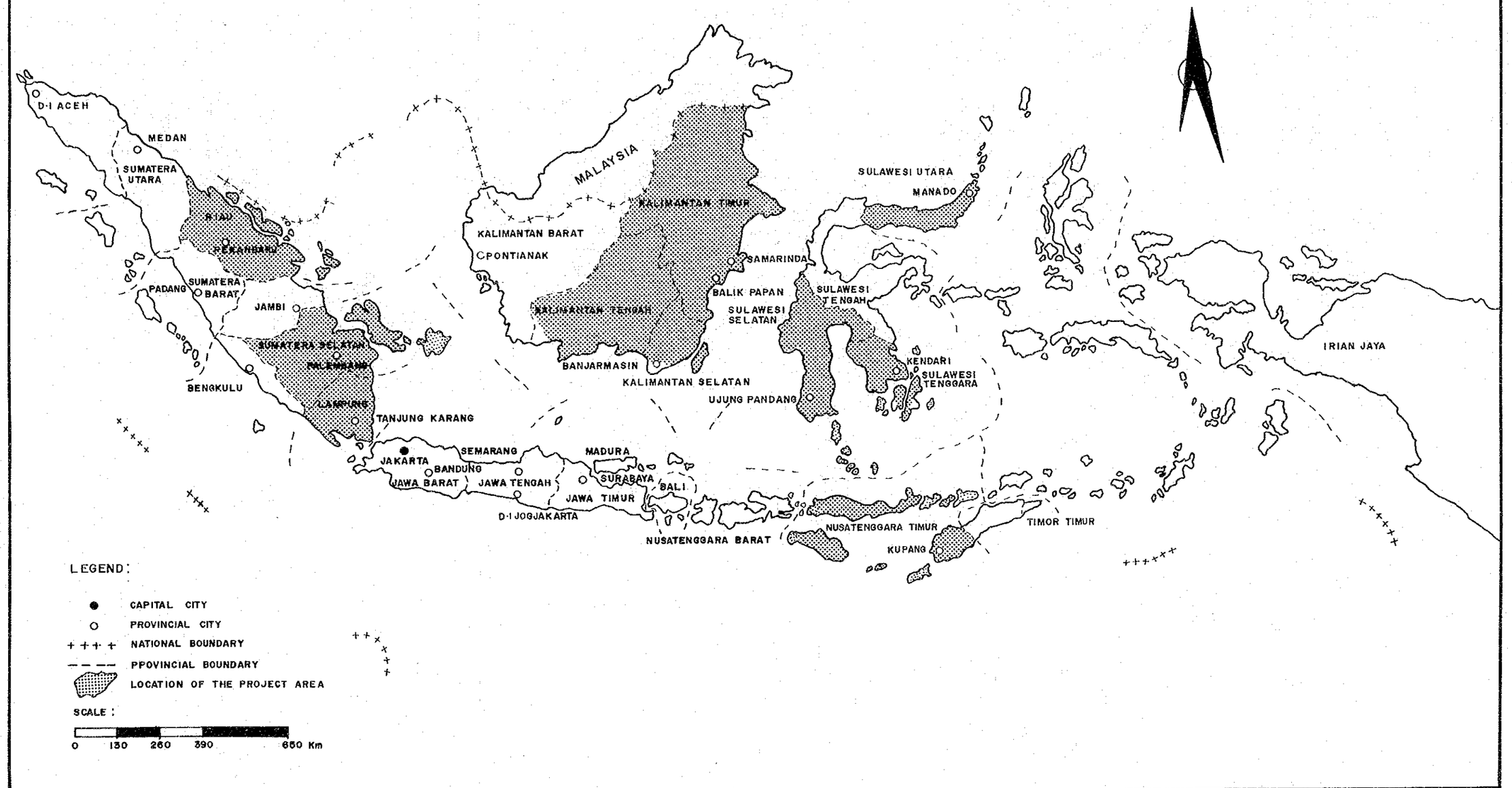
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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

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

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

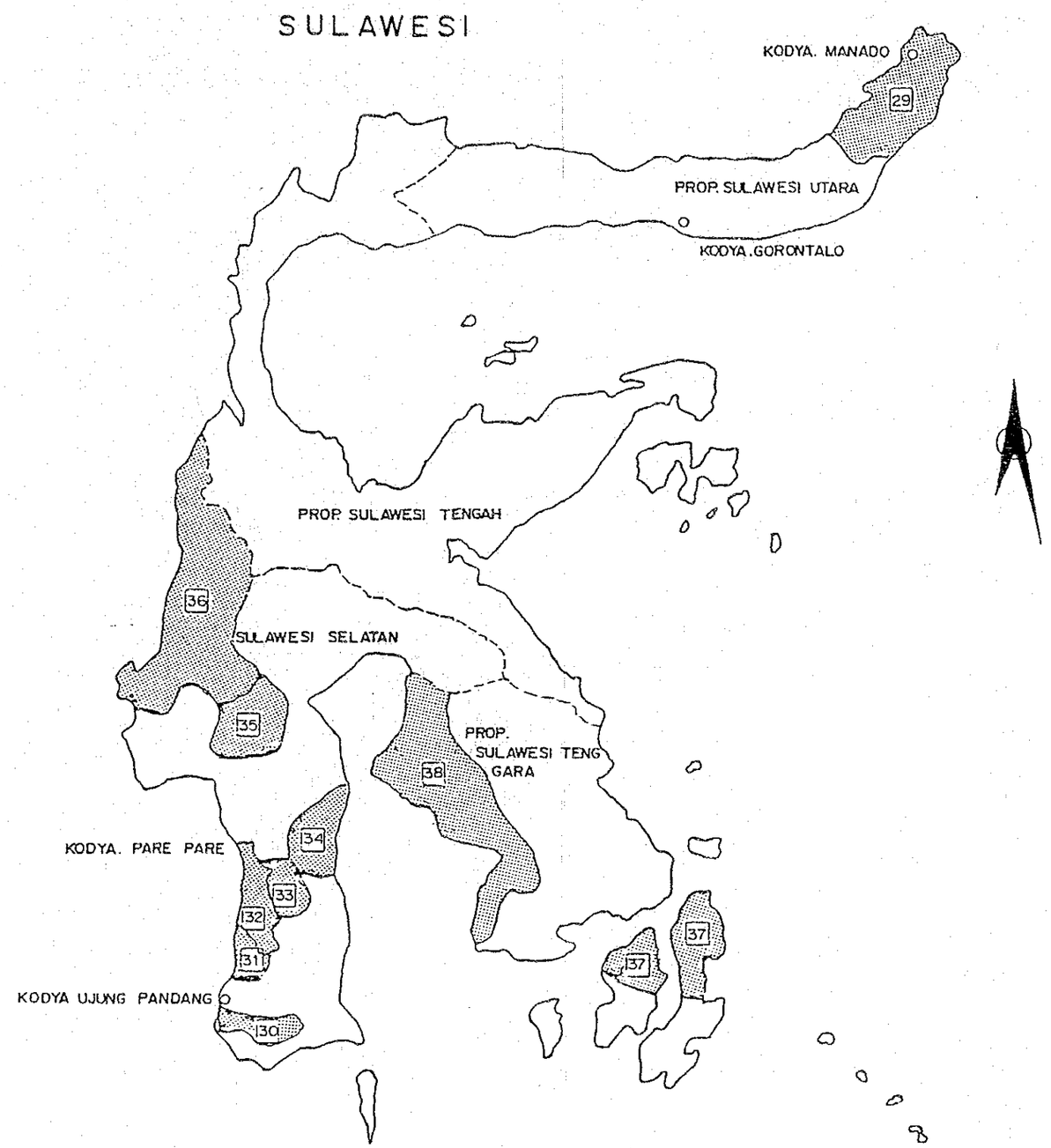
LOCATION MAP OF THE PROJECT AREAS



VIII · PROPINSI SULAWESI UTARA
29 · KAB · MINAHASA

IX · PROPINSI SULAWESI SELATAN
30 · KAB · GOWA
31 · KAB · PANGKAJENE KEPULAUAN
32 · KAB · BARRU
33 · KAB · SOPENG
34 · KAB · WAJO
35 · KAB · TANA TORAJA
36 · KAB · MAMUJU

X · PROPINSI SULAWESI TENGGARA
37 · KAB · MUNA
38 · KAB · KOLAKA



LEGEND :

---- PROVINCIAL BOUDER

LOCATION OF THE PROPOSED AREA

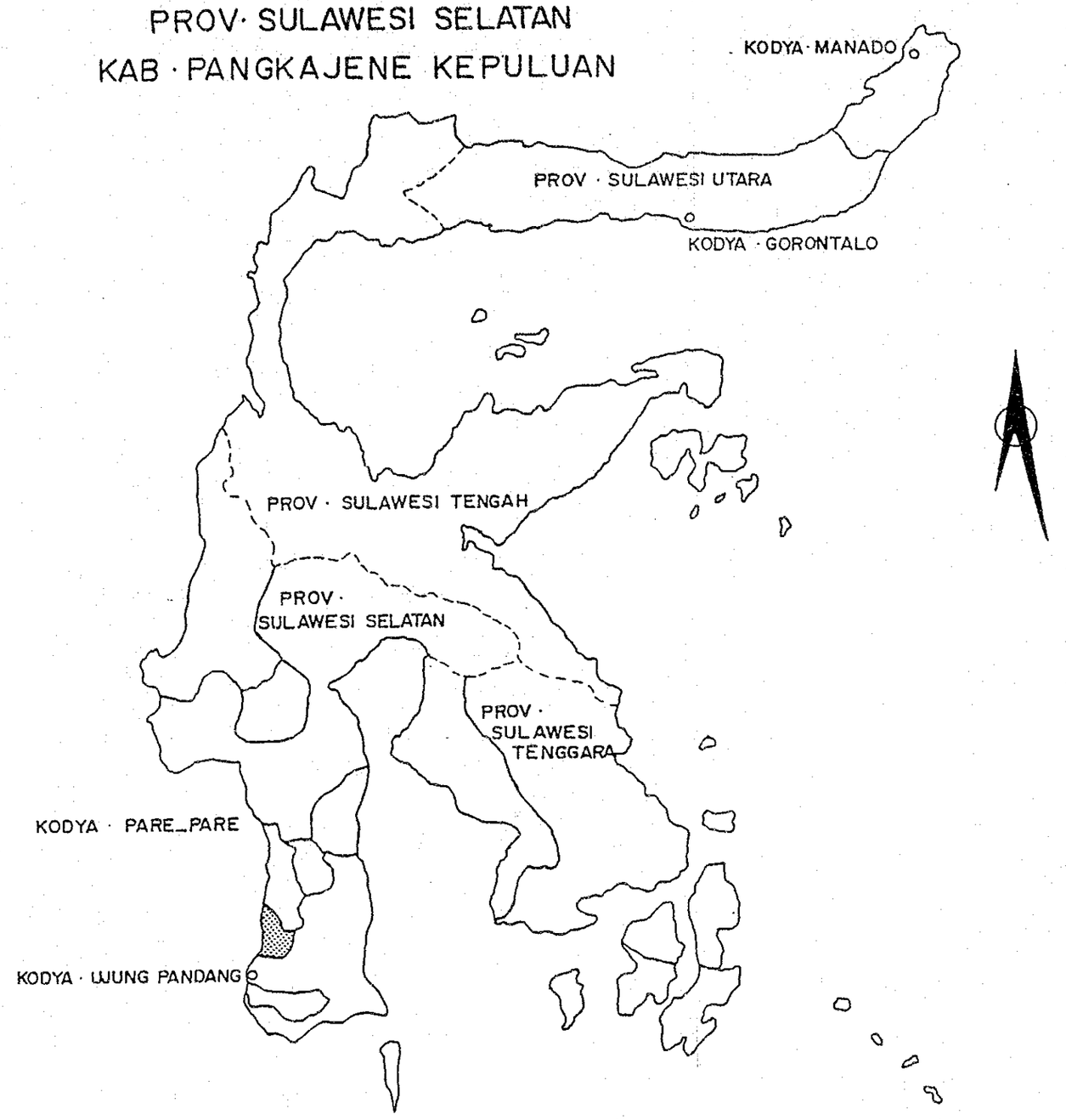
SCALE :

0 92 184 276 460 Km

SULAWESI

PROV. SULAWESI SELATAN

KAB. PANGKAJENE KEPULUAN



LEGEND :

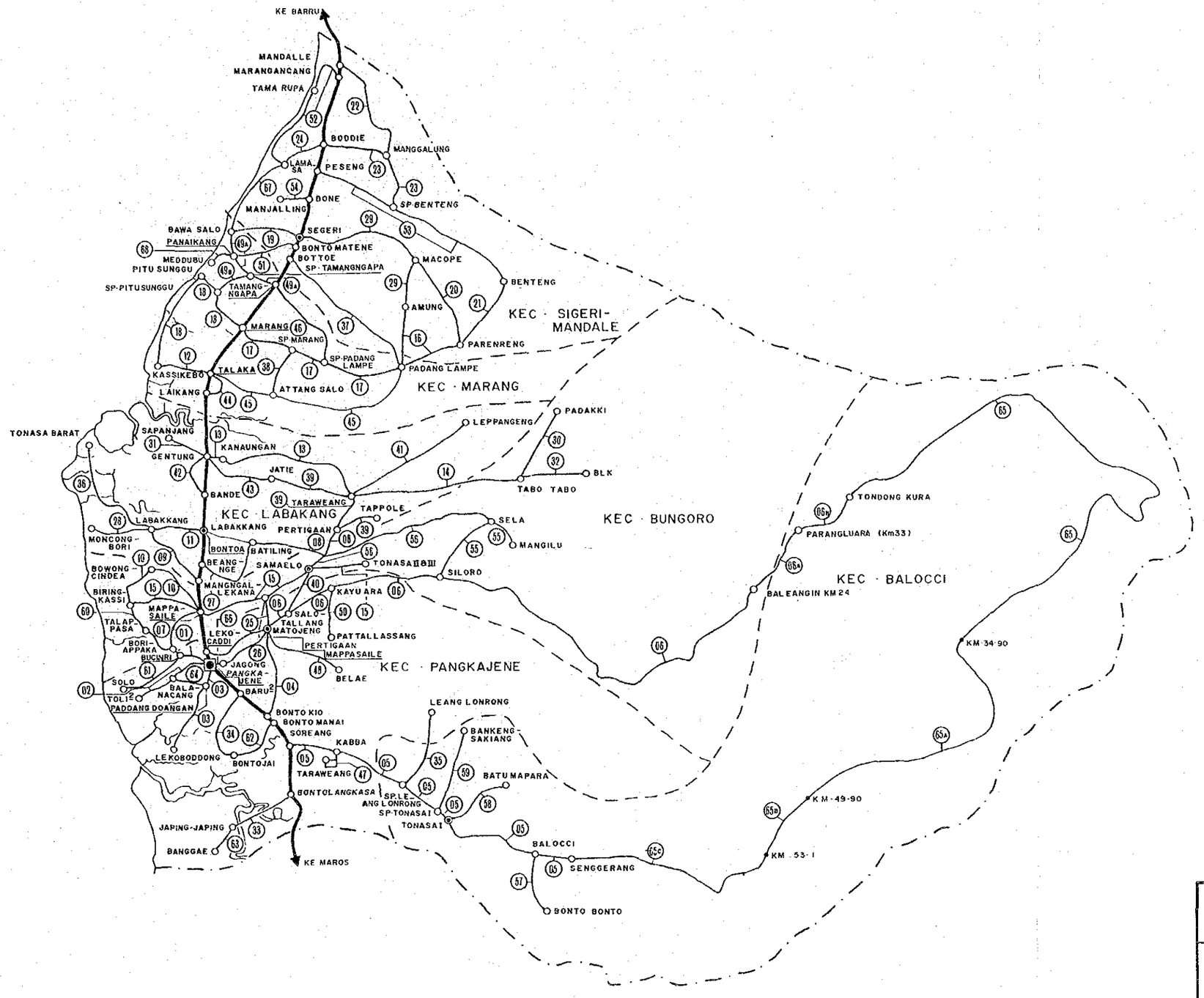
---- PROVINCIAL BOUNDARY

LOCATION OF THE PROJECT AREA

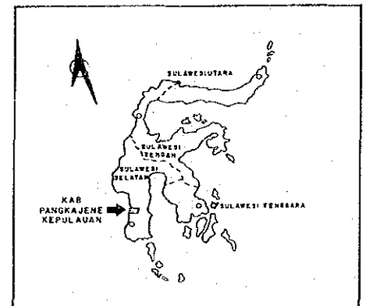
SCALE :

0 92 184 276 460 Km

KAB · PANGKAJENE KEPULAUAN



LOCATION MAP



LEGEND :

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

SCALE

0 5 10 15 Km

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

TITLE :

SOURCE:	SCALE:	PROVINCE : SULAWESI SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : PANGKAJENE KEPULAUAN

C O N T E N T S

Chapter 1 BACKGROUND OF THE KABUPATEN

1.1 Topographic And Meteorological Conditions

1.1.1 Location and Topography

Kabupaten Pangkajene Kepulauan faces the Makassar Strait on the west coast. It includes the isles in the west offing. It is bordered on the north by Kabupatens Barru and Bone, and on the east and south by Kabupaten Maros. The Trans Sulawesi National Highway runs along the west coast.

The geographical features of the Kabupaten change in order towards the east, i.e swampy at the coast, followed by a flat region, then hills and finally a mountainous district at the easternmost boundary.

The Kabupaten has an area of 1,112 square kilometers, approximately 2 percent of the total of the province. It consists administratively of 9 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Pangkajene Kepulauan are 149 days and 2,767 mm respectively.

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

The number of working days which is necessary for planning the construction schedule in chapter 6, is estimated at 220 days using the following formula based upon the data shown in the table referred to above.

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

Where :

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

Table 1-1-1

METEOROLOGICAL CONDITIONS

PROVINCE : Sulawesi Selatan
KABUPATEN : Pangkajene Kepulauan STATION : Baring

MONTH	1980		1981		1982		1983		1984	
	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)	RAINY DAYS	RAINFALL (mm)
January	20	25	27	26	22	25	19	23	25	20
February	14	53	16	20	21	31	5	10	20	31
March	15	43	18	24	21	22	13	11	21	22
April	17	18	11	28	14	9	17	8	22	14
May	11	14	14	8	5	12	15	13	23	13
June	7	9	11	10	6	11	14	16	10	8
July	2	10	13	14	-	-	4	3	7	5
August	4	9	-	-	-	-	-	-	4	18
September	2	5	5	9	-	-	-	-	13	14
October	6	11	8	28	1	8	6	10	6	20
November	17	19	18	22	3	10	22	29	16	18
December	28	32	25	40	20	17	24	42	16	39
Total	143	248	166	229	113	145	139	165	183	222

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Pangkajene Kepulauan in 1984 was 224,630 which was approximately 3.5% of the 6,475,000 total population of Sulawesi Selatan Province as shown in Table 1-2-1.

The population density was 2.02 persons per ha which was higher than the provincial density of 0.88.

The recent annual average growth rate of population of the Kabupaten is 0.6% which is lower than both the provincial rate of 1.7% and the national rate of 2.2%. This is caused by outflow of population to other Kabupatens and cities.

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:					
GOWA	368,552	0.6	188,332	1.90	1983
PANGKAJENE KEPULAUAN	224,630	0.6	111,229	2.02	1984
BARRU	137,392	0.5	117,472	1.17	1982
SOPPENG	239,335	0.5	135,944	1.76	1984
WAJO	379,948	0.5	250,619	1.52	1984
TANA TORAJA	340,015	0.6	195,000	1.73	1984
MAMUJU	124,315	6.0	1,105,781	0.11	1984
PROVINCE:					
SULAWESI SELATAN	6,278,200		7,278,100		1982
	6,376,100	1.7	7,278,100	0.88	1983
	6,475,000		7,278,100		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 : SULAWESI SELATAN

KABUPATEN : PANGKAJENE KEPULAUAN

KECAMATAN	POPULATION	PROPORTION (%)
LIUKANG TANGAYA	10,727	4.8
KALUKUANG MASALIMA	7,775	3.5
LIUKANG TAPABIRING	21,640	9.6
PANGKAJENE	47,509	21.1
BALOCCI	20,579	9.2
BUNGORO	26,324	11.7
LABAKANG	33,846	15.1
MA'RANG	25,164	11.2
SIGERI MANDALE	31,066	13.8
TOTAL	224,630	100

1.2.2 Land Use

In Kabupaten Pangkajene Kepulauan, 39,421 ha of the current available land use area, which is approximately 35.4% of the 111,229 ha total area of the Kabupaten, is used for living purposes and for industrial activity of the inhabitants of the Kabupaten. It is the total value of columns (1) through (6) in Table 1-2-3.

The current available land use area consists of 34,741 ha of agricultural harvest area, 2,538 ha of residential area and 2,142 ha of usable open space which are 88.2%, 6.4% and 5.4% of the current available land use area respectively.

The agricultural harvest area consists of 21,354 ha of paddy field, 10,079 ha of plantation and 3,308 ha of other cultivated area which are 62.5%, 29.0% and 9.5% of the agricultural harvest area respectively.

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

Table 1-2-3

LAND USE

PROVINCE : SULAWESI SELATAN

(ha)

KABUPATEN	WET PADDY FIELD	UPLAND PADDY FIELD	OTHER CULTIVATED AREA	PLANTATION AREA	RESIDENTIAL AREA	USABLE OPEN SPACE	RIVER & LAKE	FORESTRY AREA	OTHERS	TOTAL AREA	SURVEY YEAR
GOWA	28,800 (15.3)	12,600 (6.7)	-	33,800 (17.9)	9,700 (5.1)	-	-	78,900 (41.9)	24,532 (13.0)	188,332 (100)	1981
PANGKAJENE KEPULAUAN	20,800 (18.7)	554 (0.5)	3,308 (3.0)	10,079 (9.1)	2,538 (2.3)	2,142 (1.9)	5,972 (5.4)	10,754 (9.7)	55,084 (49.5)	111,229 (100)	1983
BARRU	12,653 (11.1)	-	6,262 (5.5)	-	2,870 (2.5)	-	2,362 (2.1)	77,325 (67.5)	13,000 (11.3)	114,472 (100)	1982
SOPPENG	36,098 (28.7)	721 (0.6)	35,968 (28.6)	10,162 (8.1)	750 (0.6)	-	36,607 (29.1)	5,501 (4.4)	-	125,807 (100)	1983
WAJO	56,220 (22.4)	2,154 (0.9)	26,128 (10.4)	14,400 (5.7)	6,422 (2.6)	48,600 (19.4)	39,000 (15.6)	47,753 (19.1)	10,730 (4.3)	250,619 (100)	1984
TANA TORAJA	28,328 (14.5)	-	5,662 (2.9)	11,036 (5.6)	-	13,000 (6.7)	-	137,165 (70.3)	-	195,191 (100)	1983
MAMUJU	5,946 (0.5)	3,979 (0.4)	10,141 (0.9)	-	-	-	-	-	-	1,105,781 (100)	1984

Notes :

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

1.2.3 Agriculture

The cultivated area and food crop production in Kabupaten Pangkajene Kepulauan in 1984 were 29,056 ha and 136,982 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 25,028 ha and 130,474 ton respectively which are 86.1% and 95.2% of the total food crops. The yield rate of paddy production is 5.21 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 1980 through 1984 were 4.0% and 5.0% respectively which indicate favorable development of the paddy production. It is desirable that productivity of paddy increases and this depends upon the future development of irrigation and the increase of double crop fields.

The commodity crops, of which palm oil and coffee are major, are produced in the plantations. The area and production of plantation crops in 1983 were 11,200 ha and 4,025 ton respectively with current growth rates of 2.8% and 5.6% 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 64.8% of the total population as shown in Table 1-2-7. Thus this is an agricultural Kabupaten.

It is suggested that the Kabupaten takes measures to improve paddy guality by plant breading and to obtain a stable increase in its production.

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

KABUPATEN : PANGKAJENE KEPULAUAN

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	21,346	21,479	21,097	21,152	19,190	25,028	
OTHERS	5,181	4,456	4,457	3,522	5,274	4,028	
TOTAL	26,527	25,935	25,554	24,674	24,464	29,056	

PRODUCTION

(ton)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	107,456	113,908	113,913	123,825	102,459	130,474	
OTHERS	7,863	8,150	12,122	8,778	14,663	6,508	
TOTAL	115,328	122,058	126,035	132,603	117,122	136,982	

YIELD RATE

ITEM	YEAR						(%)
	1979	1980	1981	1982	1983	1984	
PADDY	5.03	5.30	5.40	5.85	5.34	5.21	

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 : SULAWESI SELATAN

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AREA	PRODUCTION
GOWA	-	-	-	-
PANGKAJENE KEPULAUAN	11,200	4,025	2.8	5.6
BARRU	-	-	-	-
SOPPENG	-	-	-	-
WAJO	21,437	19,396	7.1	11.0
TANA TORAJA	11,306	11,400	-	-
MAMUJU	-	-	-	-

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : SULAWESI SELATAN

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
GOWA	226,000	368,552	61.3	0.05	1983
PANGKAJENE KEPULAUAN	146,000	224,630	64.8	2.0	1984
BARRU	89,000	137,392	64.8	1.0	1982
SOPPENG	166,000	293,335	69.4	0.25	1984
WAJO	243,000	379,948	63.8	4.0	1984
TANA TORAJA	260,000	340,015	76.4	3.0	1984
MAMUJU	101,000	124,315	81.5	6.0	1984

Notes :

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

1.2.4 Other Economic Activities

Notable economic activities excluding agriculture in Kabupaten Pangkajene Kepulauan are manufacturing, fishery and livestock sectors. In the kabupaten there are two big cement factories managed by an average of 1,000 employees and are other three small scale tile factories as a home industry.

The following table shows the current growth rates of the manufacturing production.

	1980	1984	AAGR (%)
Production (ton)	350,421	445,874	6.2

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

The current growth of the catch is shown in table below.

	1980	1984	AAGR (%)
Catch (ton)	15,791	19,085	4.9

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

It is presumed that yealy approx. 17,000 tons excluding the consumption of the Kabupaten itself are exported out of the Kabupaten.

And the current growth of the livestock production is shown in table below.

	1980	1984	AAGR (%)
Production (ton)	1,489	2,252	10 9

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

It is presumed that yearly approx. 1,500 tons excluding the consumption of the Kabupaten itself are expected out of the Kabupaten.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

The national road called 'Trans Sulawesi Highway' which runs across Kabupaten Pangkajene Kepulauan from south to north along the west coast line is acting as the regional trunk road of the Kabupaten.

With regard to Kabupaten roads the Kabupaten can be divided geographically into the following three parts to summarize the different road functions due to the natural features.

1. The coastal area west of the national road which is covered by low swamps:
   The Kabupaten roads which form around Segiri and Marang as centers and which are located on the national road are acting as service roads for development of the fishery and the agricultural industries in the northern area. However in the southern area the Kabupaten road networks are not developed except for the small scale road networks around Mappasaile and Pangkajene.

2. The area east of the said national road which flat:
   There are two Kabupaten road networks in the north and central areas of the Kabupaten which play an important role as regional roads for development of rice production.

3. The inland region extending to the east boundary with the neighbouring Kabupaten, mostly covered by hills and mountains:
   There is a large scale circular route covering most of the southeast regions of the Kabupaten. It runs towards the east along the southern boundary area via Tonasai and Balocci, continues towards the north and goes around the east edge of the Kabupaten, then it returns to Pangkajene via Tondong Kura, Baleangin Km 24 and Siloro.

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 Pangkajene Kepulauan are confirmed as 74 links and 431 Km respectively. These figures exclude Kabupaten roads with no data are not included.

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 3.87 m per ha. This is distinctly higher than the national density of 0.48 m per ha and also higher than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Pangkajene Kepulauan	431	111,229	3.87
Province : Sulawesi Selatan	2,730	2,104,377	1.30
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 : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(Km)

NO (7)	ASP	TNH	BTB	KRK	TOTAL
LINK 1	6				6
LINK 2	4	1			5
LINK 3	2		2		4
LINK 4	5				5
LINK 5	16				16
LINK 6	8		22	1	31
LINK 7	1	1	2		3
LINK 8		1	6		6
LINK 9	4		1		4
LINK 10	6		3	1	10
LINK 11	2				2
LINK 12	2		1		3
LINK 13			9		9
LINK 14			4		4
LINK 15	11			1	12
LINK 16			6		6
LINK 17		1	10		11
LINK 18	2	6	4		12
LINK 19	3	2			5
LINK 20			5		5
LINK 21			4		4
LINK 22			6		6
LINK 23			6		6
LINK 24			2		2
LINK 25	6				6
LINK 26	4				4
LINK 27			5		5
LINK 28	6				6
LINK 29	3		6		9
LINK 30			4		4
LINK 31			3		3
LINK 32		5			5
LINK 33		2	4		6
LINK 34	4				4
LINK 35			2		2
LINK 36	4	2	4		10
LINK 37			8		8
LINK 38			4		4
LINK 39			8		8
LINK 40			3		3
LINK 41			7		7
LINK 42			3		3
LINK 43		3	1		4
LINK 44		2			2
LINK 45			9		9
LINK 46			5		5
LINK 47			2		2
LINK 48			3	1	4
LINK 49	1	1	2		4
LINK 50			2	1	3
LINK 51	1		2		3
LINK 52			7		7
LINK 53			12		12
LINK 54			2		2
LINK 55		1	4		5
LINK 56		1	8		9
LINK 57		1	2		3
LINK 58		3	2		5
LINK 59		3	1		4
LINK 60			2		2
LINK 61		3			3
LINK 62			3		3
LINK 63		1	1		2
LINK 64	3				3
LINK 65			6		6
LINK 66				6	6
LINK 67		6			6
LINK 68		1	2		3
LINK 69		3			3
LINK 70		4			4
LINK 71		8	7		15
LINK 72		4			4
LINK 73		11			11
LINK 74	3				3
TOTAL	106	76	238	11	431
RATIO	25	18	55	3	(%)

KRK : Gravel/Stone/Telford/Water Bound Macadam

TNH : Earth

LL : Others

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

	ASP	KRK	TNH/LL
Kabupaten : Pangkajene Kepulauan	24.6	57.8	17.6
Province : Sulawesi Selatan	13.0	46.0	41.0
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 almost the same level as that of Indonesia but is still low compared with the Jawa Islands figure. The proportion of low grade roads such as earth roads and others is relatively low. However the asphalted portion in the Kabupaten should be improved and maintained.

(3) Surface Condition of Kabupaten Roads

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

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

	Good	Fair	Poor	Bad
Kabupaten : Pangkajene Kepulauan	45.9	25.3	23.2	6.0
Province : Sulawesi Selatan	41.1	27.3	25.8	5.8
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

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

PROVINCE : SULAWESI SELATAN

KABUPATEN : PANGKAJENE KEPULAUAN

NO	ASP				TLM				[illegible]				KRK			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 1	22	47	26	6												
LINK 2	84	10	6			90	10									
LINK 3	80		20						55	23	23					
LINK 4	66	26	6	2												
LINK 5	27	23	43	8												
LINK 6	93	7							22	19	42	12	16	25	35	
LINK 7					10	50	35	5	28	45	25	3				
LINK 8									60	20	20					
LINK 9	91	9														
LINK 10	72	3	25						85	4	10		97	3		
LINK 11		48	52													
LINK 12	85	3	13						70	10	20					
LINK 13									67	14	19					
LINK 14									21	50	29					
LINK 15	99	1											99	1		
LINK 16									70	10	20					
LINK 17							1	99	76	10	15					
LINK 18	80	13	9				1	99	65	8	28					
LINK 19	35	33	28	3	9	55	30	8								
LINK 20									70	10	20					
LINK 21									85	10						
LINK 22									88	1	11					
LINK 23									23	39	38					
LINK 24									65	8	28					
LINK 25	25	52	23													
LINK 26	50	30	20													
LINK 27									70	16	14					
LINK 28	17	31	52													
LINK 29	58	18	18	5					48	30	16	6				
LINK 30									12	58	30					
LINK 31									75	25						
LINK 32					26	34	24	16								
LINK 33						5	26	69	71	29						
LINK 34	20	40	26	14												
LINK 35									28	45	20	5				
LINK 36		52	48				50	50	45	46	9					
LINK 37									62	13	25					
LINK 38									60	14	26					
LINK 39									48	24	28					
LINK 40									40	30	30					
LINK 41									78	13	9					
LINK 42									67	28	5					
LINK 43						1	99		85	5	10					
LINK 44					65		35									
LINK 45									76	24						
LINK 46									75	14	11					
LINK 47									65		35					
LINK 48									99	1						
LINK 49	10	80	10		20	30	50		23	55	20	2	99	1		
LINK 50									15	35	50					
LINK 51	35	50	15						42	45	13		30	45	25	

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

PROVINCE : SULAWESI SELATAN

KABUPATEN : PANGKAJENE KEPULAUAN

(%)

NO	ASP				LPN				BTU				KRK			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 52									68	6	26					
LINK 53									73		27					
LINK 54									45	13	42					
LINK 55					10	50	25	15	21	39	38	2				
LINK 56						50	30	20	36	35	21	8				
LINK 57					10	50	30	10	23	52	20	5				
LINK 58					3	52	45			55	45					
LINK 59					10	80	10		10	10	80					
LINK 60									32	48	20					
LINK 61					8	28	53	10								
LINK 62									30	33	37					
LINK 63						65	35		55	10	35					
LINK 64	95	5														
LINK 65									88	8	4					
LINK 66													34	10	56	
LINK 67							1	99								
LINK 68					10	50	30	10	35	25	25	15				
LINK 69					20	20	38	22								
LINK 70					15	41	35	9								
LINK 71						4	35	61	91	9						
LINK 72							30	70								
LINK 73						7	35	58								
LINK 74	45	33	22													
AVERAGE	57	22	20	1	9	36	33	22	51	22	22	4	42	11	47	0
LENGTH	106 Km				76 Km				238 Km				11 Km			
(Km)	55	24	21	2	7	25	25	22	121	55	57	2	2	2	2	0

The surface condition level of the Kabupaten roads in the Kabupaten is at the same level as both that of Indonesia and of Jawa Island. Moreover the proportion in good condition is comparatively high.

However, further improvement for the Kabupaten roads classed as poor or bad condition is desirable.

(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 84.0% flat, 15.0% hilly, 1.0% mountainous. This the Kabupaten generally has favorable terrain conditions for road construction.

1.3.3 Bridge Inventory

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

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

The inventory shown in Table 1-3-4 and Table 1-3-5 indicates a total of 156 bridges with a total length of 785 m of which 9 or 5.8% are timber, 132 or 84.6% are concrete and 12 or 7.7% are others. Steel bridges account for only 3 or 1.9% of the total. However, 26 bridges with a total length of 845 m are required to be newly constructed.

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(Km)

I02 (3)	DT	BK	GN	RW	TOTAL
LINK 1	6				6
LINK 2	5				5
LINK 3	4				4
LINK 4	5				5
LINK 5	12	3	1		16
LINK 6	28	3			31
LINK 7	3				3
LINK 8	6				6
LINK 9	4				4
LINK 10	10				10
LINK 11	2				2
LINK 12	3				3
LINK 13	9				9
LINK 14	4				4
LINK 15	12				12
LINK 16	6				6
LINK 17	11				11
LINK 18	12				12
LINK 19	5				5
LINK 20	5				5
LINK 21	4				4
LINK 22	6				6
LINK 23	6				6
LINK 24	2				2
LINK 25	6				6
LINK 26	4				4
LINK 27	5				5
LINK 28	6				6
LINK 29	9				9
LINK 30	1	3			4
LINK 31	3				3
LINK 32		2	3		5
LINK 33	6				6
LINK 34	4				4
LINK 35	2				2
LINK 36	10				10
LINK 37	8				8

(Km)

I02 (3)	DT	BK	GN	RW	TOTAL
LINK 38	4				4
LINK 39	8				8
LINK 40	3				3
LINK 41	3	4			7
LINK 42	3				3
LINK 43	4				4
LINK 44	2				2
LINK 45	9				9
LINK 46	5				5
LINK 47	2				2
LINK 48	4				4
LINK 49	4				4
LINK 50	3				3
LINK 51	3				3
LINK 52	7				7
LINK 53	12				12
LINK 54	2				2
LINK 55	2	3			5
LINK 56	9				9
LINK 57	2	1			3
LINK 58	3	2			5
LINK 59	4				4
LINK 60	2				2
LINK 61	3				3
LINK 62	3				3
LINK 63	2				2
LINK 64	3				3
LINK 65		6			6
LINK 66	6				6
LINK 67	5			1	6
LINK 68	3				3
LINK 69		3			3
LINK 70		4			4
LINK 71		15			15
LINK 72		4			4
LINK 73		11			11
LINK 74	3				3
TOTAL	362	64	4	1	431
RATIO	84	15	1	0	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

((((BRIDGE)))) (UNIT: m)

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	6	48.00			6	48.00
2	1	8.50			1	8.50
5	6	47.00			6	47.00
6	16	122.00	1	40.00	17	162.00
7	1	2.50			1	2.50
8	4	19.00			4	19.00
10	1	6.00			1	6.00
12	4	17.50	1	300.00	5	317.50
13	5	18.00			5	18.00
14	4	20.00			4	20.00
15	2	110.00			2	110.00
16	4	18.00	1	12.00	5	30.00
17	5	24.50	1	40.00	6	64.50
18	1	10.00	8	28.00	9	38.00
19	1	5.00			1	5.00
20	2	9.00			2	9.00
21	6	31.00			6	31.00
22	6	23.50			6	23.50
23	3	15.00			3	15.00
25	3	13.00			3	13.00
27	1	4.00			1	4.00
28	1	7.00			1	7.00
29	1	6.00			1	6.00
30	3	12.00			3	12.00
32	2	7.00			2	7.00
33			2	23.00	2	23.00
35	2	7.50			2	7.50
36	1	5.00			1	5.00
37	1	4.00			1	4.00
38	2	8.50			2	8.50
39	7	21.50			7	21.50
41	3	17.00			3	17.00
42	1	3.50	1	11.00	2	14.50
43	1	6.50	1	7.00	2	13.50
45	4	24.50			4	24.50
46	4	15.50			4	15.50
47	2	9.00			2	9.00
50	1	4.00			1	4.00
51	2	15.50			2	15.50
52	2	19.00			2	19.00
53	4	22.00			4	22.00
55	5	25.50			5	25.50
56	1	11.00			1	11.00
57	3	13.00	1	12.00	4	25.00
58	1	2.00			1	2.00
59	1	4.00	1	300.00	2	304.00
60	1	11.00			1	11.00
61	1	11.00			1	11.00
62	1	8.00			1	8.00
64	2	4.00			2	4.00
65	2	22.00			2	22.00
66	6	23.00			6	23.00
67			7	57.00	7	57.00
68	1	6.00			1	6.00
71	4	19.00			4	19.00
74	1	5.50	1	15.00	2	20.50
TOTAL	156	784.50	26	845.00	182	1629.50

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

103 (18)	BT	BJ	KY	LL	TOTAL
LINK 1	6				6
LINK 2	1				1
LINK 5	6				6
LINK 6	10	1	2	3	16
LINK 7			1		1
LINK 8	4				4
LINK 10				1	1
LINK 12	3		1		4
LINK 13	5				5
LINK 14	4				4
LINK 15	1	1			2
LINK 16	4				4
LINK 17	5				5
LINK 18	1				1
LINK 19	1				1
LINK 20	2				2
LINK 21	6				6
LINK 22	6				6
LINK 23	3				3
LINK 25	3				3
LINK 27				1	1
LINK 28	1				1
LINK 29	1				1
LINK 30	3				3
LINK 32	2				2
LINK 33					
LINK 35			2		2

103 (18)	BT	BJ	KY	LL	TOTAL
LINK 36	1				1
LINK 37	1				1
LINK 38	1			1	2
LINK 39	7				7
LINK 41	3				3
LINK 42	1				1
LINK 43	1				1
LINK 45	4				4
LINK 46	4				4
LINK 49	1			1	2
LINK 50	1				1
LINK 51	1		1		2
LINK 52				2	2
LINK 53	3		1		4
LINK 55	3		1	1	5
LINK 56	1				1
LINK 57	2			1	3
LINK 58				1	1
LINK 59	1				1
LINK 60	1				1
LINK 61	1				1
LINK 62	1				1
LINK 64	2				2
LINK 65	2				2
LINK 66	6				6
LINK 67					
LINK 68		1			1
LINK 71	4				4
LINK 74	1				1
TOTAL	132	3	9	12	156
RATIO	85	2	6	8	(%)

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

Bridge Type	Span Length (m)										
	<3	<5	<8	<10	<12	<14	<16	<18	<20	<99	Total
Timber	1	8	-	-	-	-	-	-	-	-	9
Concrete	31	60	21	10	8	1	-	-	-	-	131
Steel	-	-	1	-	-	1	-	-	-	1	3
Others	1	5	3	-	1	1	1	-	-	-	12
Total	33	73	25	10	9	3	1	-	-	1	155

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

1.3.4 Traffic

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

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Total Trips	2,267	1,028	1,556	2,917	6,320
Proportion (%)	29.18	13.23	20.03	37.56	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	0.88	1.46	7.93	89.73	100.00

Source : Kabupaten.

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

From the above tables the following can be observed:

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

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

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

Chapter 2 ESTIMATIONS OF FUTURE TRAFFIC VOLUME AND BENEFIT

2.1 Future Traffic Volume

2.1.1 Traffic Growth Rate

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

Growth of Production Basis "A":

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

Growth of Productivity "B" :

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

Traffic Growth Rate: Initial estimated figure:

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

Traffic Growth Rate GR =Final adjusted figure:

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

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

Table 2-1-1 TRAFFIC GROWTH RATE ESTIMATION

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

A)	Growth Rate of Population	:	0.60 (%)
B)	Growth Rate of Cultivated Area	:	6.00 (%)
C)	Growth Rate of Rice field	:	4.00 (%)
D)	Growth Rate of Rice yield rate	:	2.00 (%)
E)	Growth Rate of GDP / capita	:	6.60 (%)
a)	Geometrical Mean (A x B)	:	3.26 (%)
b)	Geometrical Mean (C x D)	:	3.00 (%)
c)	Geometrical Mean (a x b)	:	3.13 (%)
d)	Geometrical Mean (c x E)	:	4.85 (%)
	TRAFFIC GROWTH RATE	:	4.85 (%)

2.1.2 Present and Future Traffic Volume

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

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

Where :

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

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

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	125	65	85	140	345	4.9%	231	120	157	259	639	IIIA
2	30	10	5	25	58	4.9%	56	19	9	46	107	IIIB-2
3	30	15	5	30	65	4.9%	56	28	9	56	120	IIIB-2
4	50	20	30	30	115	4.9%	93	37	56	56	213	IIIB-1
5	130	60	60	100	300	4.9%	241	111	111	185	555	IIIA
6	50	20	30	30	115	4.9%	93	37	56	56	213	IIIB-1
7	16	8	6	25	43	4.9%	30	15	11	46	80	IIIB-2
8	15	5	10	12	36	4.9%	28	9	19	22	67	IIIB-2
9	25	10	15	20	60	4.9%	46	19	28	37	111	IIIB-2
10	25	10	5	30	55	4.9%	46	19	9	56	102	IIIB-2
11	25	10	15	30	65	4.9%	46	19	28	56	120	IIIB-2
12	10	5	5	10	25	4.9%	19	9	9	19	46	IIIC
13	15	5	10	15	38	4.9%	28	9	19	28	70	IIIB-2
14	25	12	13	20	60	4.9%	46	22	24	37	111	IIIB-2
15	155	85	200	350	615	4.9%	287	157	370	648	1138	IIIA
16	18	5	2	20	35	4.9%	33	9	4	37	65	IIIB-2
17	90	40	62	120	252	4.9%	167	74	115	222	466	IIIB-1
18	95	35	60	105	243	4.9%	176	65	111	194	450	IIIB-1
19	110	75	65	125	313	4.9%	204	139	120	231	579	IIIA
20	15	7	8	20	40	4.9%	28	13	15	37	74	IIIB-2
21	10	2	10	15	30	4.9%	19	4	19	28	56	IIIB-2
22	25	5	5	40	55	4.9%	46	9	9	74	102	IIIB-2
23	16	10	8	20	44	4.9%	30	19	15	37	81	IIIB-2
24	10	3	2	20	25	4.9%	19	6	4	37	46	IIIC
25	50	30	20	70	135	4.9%	93	56	37	130	250	IIIB-1
26	65	60	85	100	260	4.9%	120	111	157	185	481	IIIB-1
27	15	2	5	10	27	4.9%	28	4	9	19	50	IIIC
28	20	5	15	20	50	4.9%	37	9	28	37	93	IIIB-2
29	25	10	15	25	63	4.9%	46	19	28	46	117	IIIB-2
30	20	5	15	20	50	4.9%	37	9	28	37	93	IIIB-2
31	15	5	10	10	35	4.9%	28	9	19	19	65	IIIB-2
32	15	5	5	10	30	4.9%	28	9	9	19	56	IIIB-2
33	15	5	10	20	40	4.9%	28	9	19	37	74	IIIB-2
34	40	20	15	30	90	4.9%	74	37	28	56	167	IIIB-2
35	20	10	20	20	60	4.9%	37	19	37	37	111	IIIB-2
36	15	5	10	20	40	4.9%	28	9	19	37	74	IIIB-2
37	25	10	20	20	65	4.9%	46	19	37	37	120	IIIB-2
38	25	10	20	30	70	4.9%	46	19	37	56	130	IIIB-2
39	75	45	63	145	256	4.9%	139	83	117	268	474	IIIB-1
40	20	5	10	20	45	4.9%	37	9	19	37	83	IIIB-2
41	95	30	80	150	280	4.9%	176	56	148	278	518	IIIA
42	15	3	2	25	33	4.9%	28	6	4	46	61	IIIB-2
43	85	20	60	110	220	4.9%	157	37	111	204	407	IIIB-1
44	18	4	3	30	40	4.9%	33	7	6	56	74	IIIB-2
45	20	5	10	20	45	4.9%	37	9	19	37	83	IIIB-2
46	15	5	10	25	43	4.9%	28	9	19	46	80	IIIB-2
47	15	5	10	15	38	4.9%	28	9	19	28	70	IIIB-2
48	15	5	20	20	50	4.9%	28	9	37	37	93	IIIB-2
49	18	10	12	25	53	4.9%	33	19	22	46	98	IIIB-2
50	10	5	15	15	38	4.9%	19	9	28	28	70	IIIB-2

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	18	8	2	25	41	4.9%	33	15	4	46	76	IIIB-2
52	17	5	3	30	40	4.9%	31	9	6	56	74	IIIB-2
53	10	5	10	15	33	4.9%	19	9	19	28	61	IIIB-2
54	8	3	1	20	22	4.9%	15	6	2	37	41	IIIC
55	15	7	8	20	40	4.9%	28	13	15	37	74	IIIB-2
56	20	10	10	25	53	4.9%	37	19	19	46	98	IIIB-2
57	10	8	7	15	33	4.9%	19	15	13	28	61	IIIB-2
58	20	10	24	10	59	4.9%	37	19	44	19	109	IIIB-2
59	20	10	50	25	93	4.9%	37	19	93	46	172	IIIB-2
60	20	15	15	30	65	4.9%	37	28	28	56	120	IIIB-2
61	15	5	10	20	40	4.9%	28	9	19	37	74	IIIB-2
62	65	20	35	100	170	4.9%	120	37	65	185	315	IIIB-1
63	10	5	10	15	33	4.9%	19	9	19	28	61	IIIB-2
64	30	5	15	60	80	4.9%	56	9	28	111	148	IIIB-2
65	10	8	10	15	36	4.9%	19	15	19	28	67	IIIB-2
66	30	20	30	40	100	4.9%	56	37	56	74	185	IIIB-2
67	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
68	8	2	6	20	26	4.9%	15	4	11	37	48	IIIC
69	15	8	7	20	40	4.9%	28	15	13	37	74	IIIB-2
70	15	5	5	15	33	4.9%	28	9	9	28	61	IIIB-2
71	10	5	10	10	30	4.9%	19	9	19	19	56	IIIB-2
72	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
73	0	0	0	0	0	4.9%	0	0	0	0	0	IIIC
74	20	18	12	30	65	4.9%	37	33	22	56	120	IIIB-2
PERCENT	29.18	13.23	20.03	37.55			29.18	13.23	20.03	37.55		

2.2 Benefit

2.2.1 Benefit Estimation Method

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

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

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

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

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

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

(KM)

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

Source : Bina Marga

Table 2-2-2 FUTURE TRAFFIC VOLUME ESTIMATED

BY THE PRODUCER'S SURPLUS

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
2	IIIC	KRK	1	0	0	1	2
7	IIIC	KRK	5	2	3	5	13
8	IIIB-2	KRK	23	10	15	27	62
10	IIIB-2	KRK	19	8	12	22	50
12	IIIC	KRK	10	5	7	12	28
13	IIIB-2	KRK	39	17	25	45	104
16	IIIC	KRK	18	8	12	21	49
20	IIIC	KRK	16	7	10	19	43
21	IIIC	KRK	10	5	7	12	28
22	IIIC	KRK	17	7	11	20	45
23	IIIC	KRK	17	8	11	20	46
24	IIIC	KRK	6	3	4	7	17
27	IIIB-2	KRK	20	9	13	23	54
28	IIIB-2	KRK	25	11	16	30	67
30	IIIC	KRK	8	4	5	9	22
31	IIIC	KRK	10	4	6	12	26
32	IIIC	KRK	7	3	4	8	18
33	IIIC	KRK	0	0	0	0	0
36	IIIB-2	KRK	46	20	29	54	122
40	IIIC	KRK	2	1	2	3	7
42	IIIC	KRK	12	5	7	14	31
44	IIIC	KRK	6	2	4	6	15
45	IIIB-2	KRK	36	16	23	42	96
46	IIIC	KRK	17	7	11	20	45
47	IIIC	KRK	0	0	0	0	0
48	IIIC	KRK	0	0	0	0	0
49	IIIB-2	KRK	21	9	13	24	55
50	IIIC	KRK	0	0	0	0	0
51	IIIC	KRK	10	4	6	11	26
52	IIIB-2	KRK	20	9	13	24	54
53	IIIB-2	KRK	34	15	22	40	91
54	IIIC	KRK	4	2	3	5	12
55	IIIC	KRK	11	5	7	13	30
56	IIIB-2	KRK	20	9	12	23	53
57	IIIC	KRK	4	2	3	5	12
58	IIIC	KRK	4	2	3	5	12
61	IIIC	KRK	0	0	0	0	0
63	IIIC	KRK	0	0	0	0	0
65	IIIB-2	KRK	46	20	29	54	122
67	IIIC	KRK	17	8	11	20	46
68	IIIC	KRK	12	5	7	13	31
69	IIIC	KRK	4	2	3	5	12
70	IIIC	KRK	7	3	5	8	19
71	IIIB-2	KRK	20	9	13	23	54
72	IIIC	KRK	4	2	3	5	12
73	IIIC	KRK	14	6	9	17	38

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 : PANGKAJENE KEPULAUAN

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 8	LINK 9	LINK 10
	6 Km	5 Km	4 Km	5 Km	16 Km	31 Km	3 Km	6 Km	4 Km	10 Km
	IIIA	IIIC	IIIB-2	IIIB-1	IIIA	IIIB-1	IIIC	IIIB-2	IIIB-2	IIIB-2
YEAR	VOC	Surplus	VOC	VOC	VOC	VOC	Surplus	Surplus	VOC	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	22439	0	1513	2304	67403	70638	368	1375	138	1102
1990	23455	0	1589	2419	70551	74190	375	1464	148	1188
1991	24607	0	1690	2552	74091	78281	375	1509	152	1233
1992	25817	0	1766	2688	77632	82411	375	1600	162	1277
1993	27097	0	1842	2803	81425	85963	489	1689	171	1363
1994	28372	0	1942	2956	85218	90631	489	1734	175	1451
1995	29738	0	2018	3072	89263	94183	496	1865	185	1456
1996	31150	0	2120	3243	93676	99493	557	1910	194	1583
1997	32759	42	2221	3379	98140	103623	557	2046	203	1631
1998	34248	42	2346	3571	103032	109509	613	2135	214	1720
SUM	279682	84	19047	28987	840431	888922	4694	17327	1742	14004
COST	133043	-17970	-3127	-10004	410875	357693	-8053	-11351	-13371	-27719
/Km	22174	-3594	-782	-2001	25680	11538	-2684	-1892	-3343	-2772

Chapter 3 ENGINEERING

3.1 Design Criteria and Specification

3.1.1 Geometric Design Criteria

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

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

3.1.2 Loading Specification

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

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

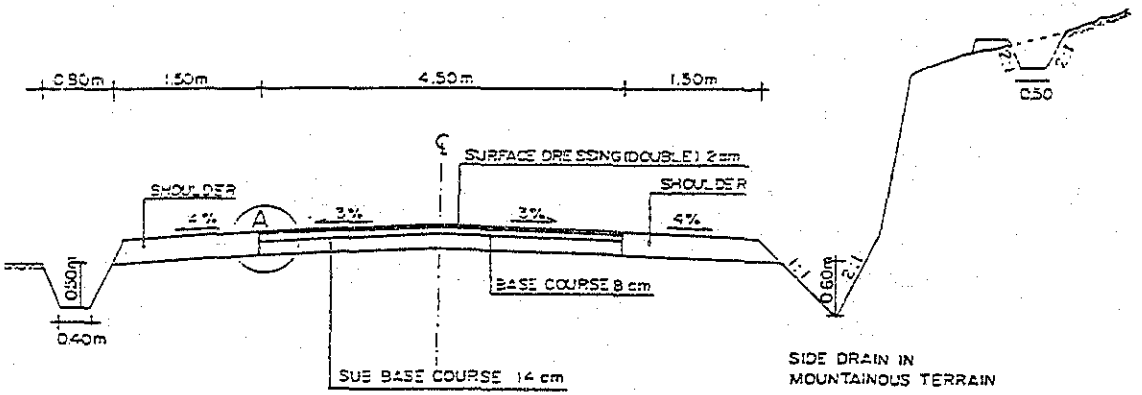
b. 10-ton truck load is applied for timber bridges on roads of III B-1, III B-2 and III C classification.

Table 3-1-1 DESIGN CRITERIA FOR KABUPATEN ROADS

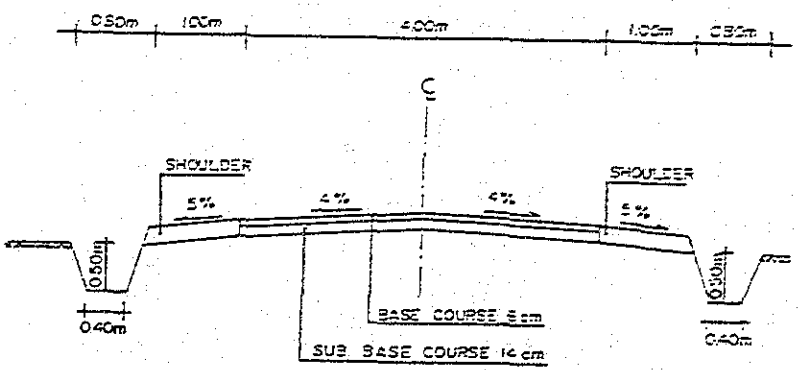
ROAD CLASSIFICATION		CLASS III A			CLASS III B-1			CLASS III B-2			CLASS III C		
SURFACE TYPE		ASPHALT SEAL (DOUBLE)			ASPHALT SEAL (SINGLE)			GRAVEL			GRAVEL		
TRAFFIC VOLUME : ADT (Forecast 10 th year average per day)		3000 - 500			500 - 200			200 - 50			50		
T E R R A I N		FLAT TO ROLLING	HILLY	MOUNT-AINOUS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

Fig. 3-1-1 STANDARD ROAD CROSS SECTIONS

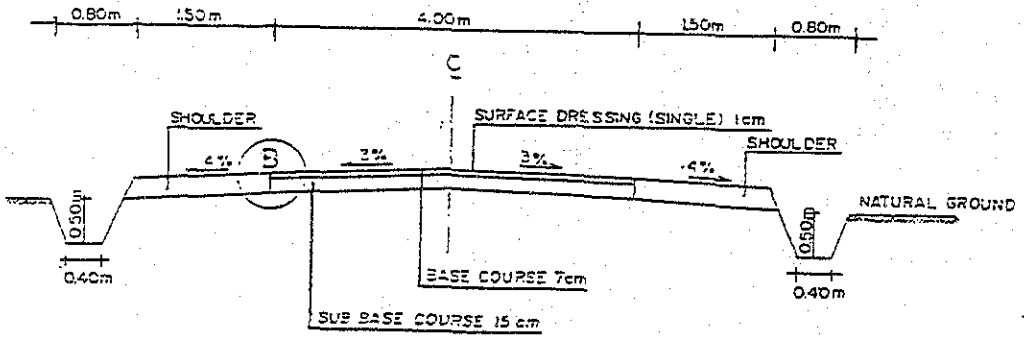
CLASS III A



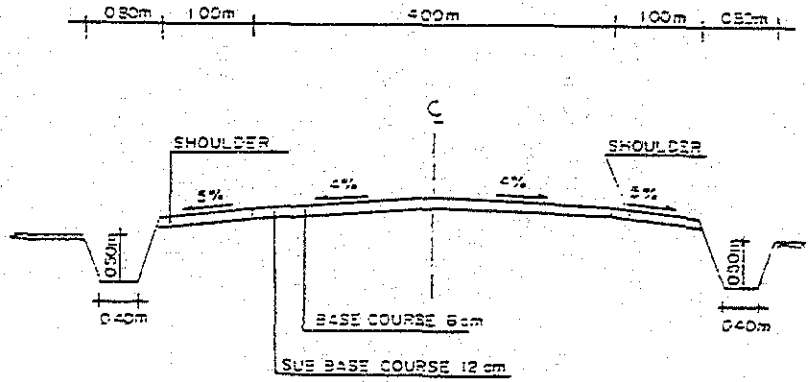
CLASS III B-2



CLASS III B-1



CLASS III C



3.2 Pavement Design

3.2.1 Design Conditions

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

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

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

1) Design Traffic Volume

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

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

2) Strength of Roadbed

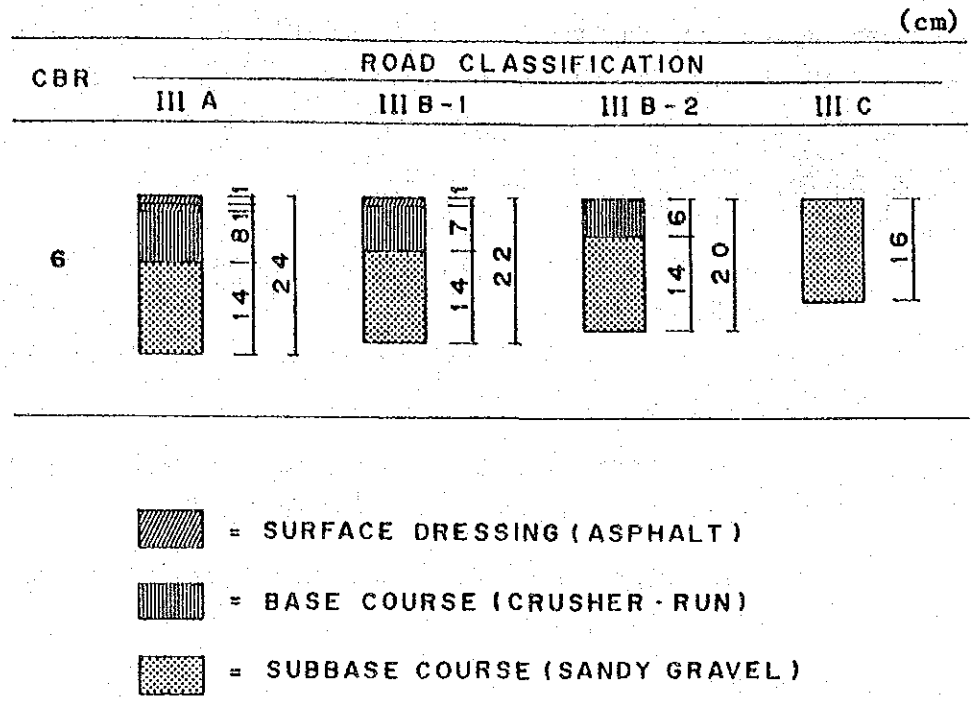
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

3.2.2 Pavement Structure

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

Fig. 3-2-1 PAVEMENT STRUCTURE



3.3 Design of Bridges and Other Structures

3.3.1 Standard Bridge

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

(1) Bridge Type

1) Superstructure

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

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

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

2) Substructure

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

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

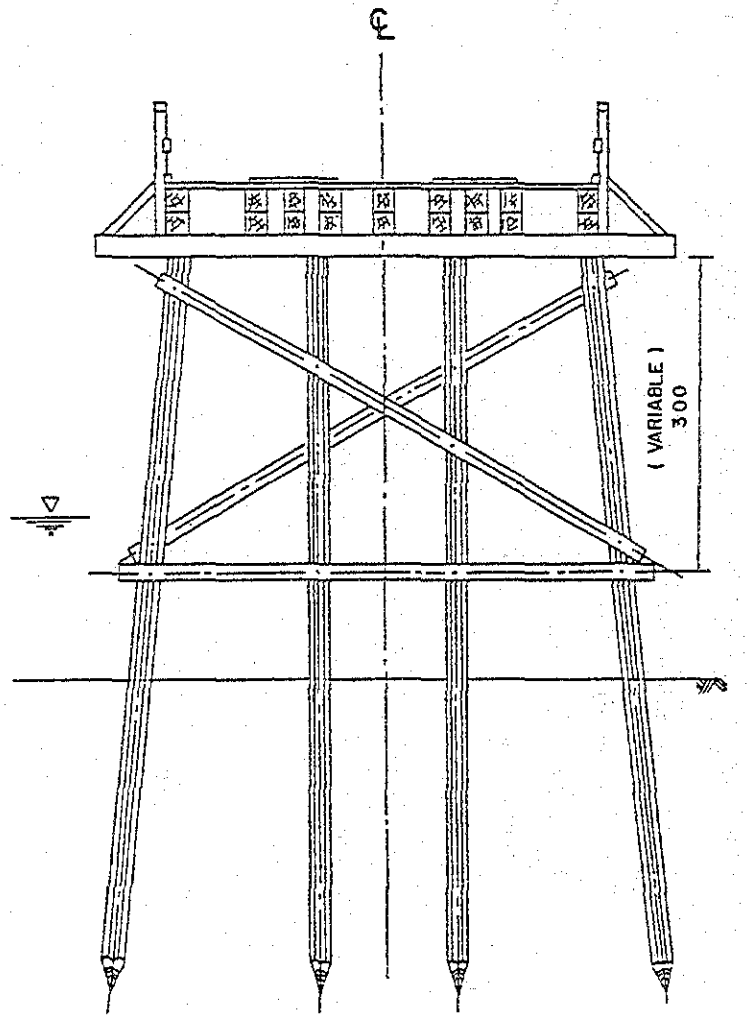
3) Foundation

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

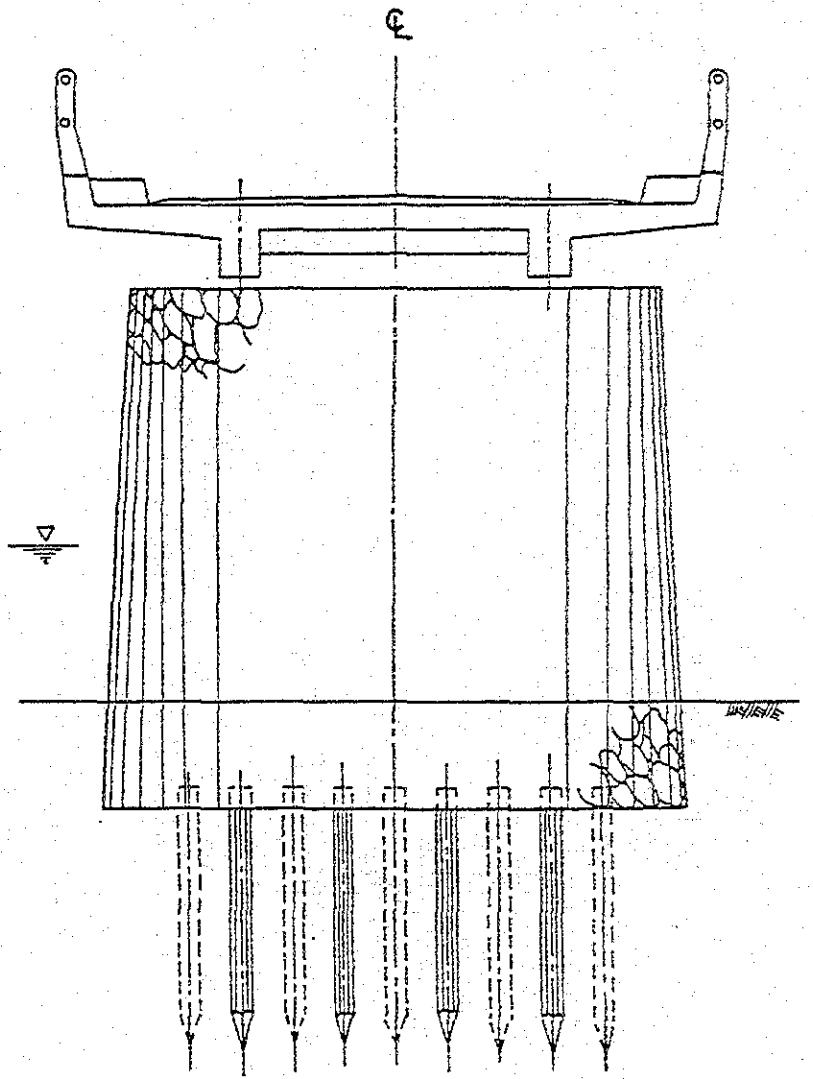
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

TIMBER BRIDGE



REINFORCED CONCRETE BRIDGE



(2) Bridge Width

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

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

(3) Span Length

The range of span lengths are determined as:

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

3.3.2 Other Structure

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

(1) Culvert

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

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

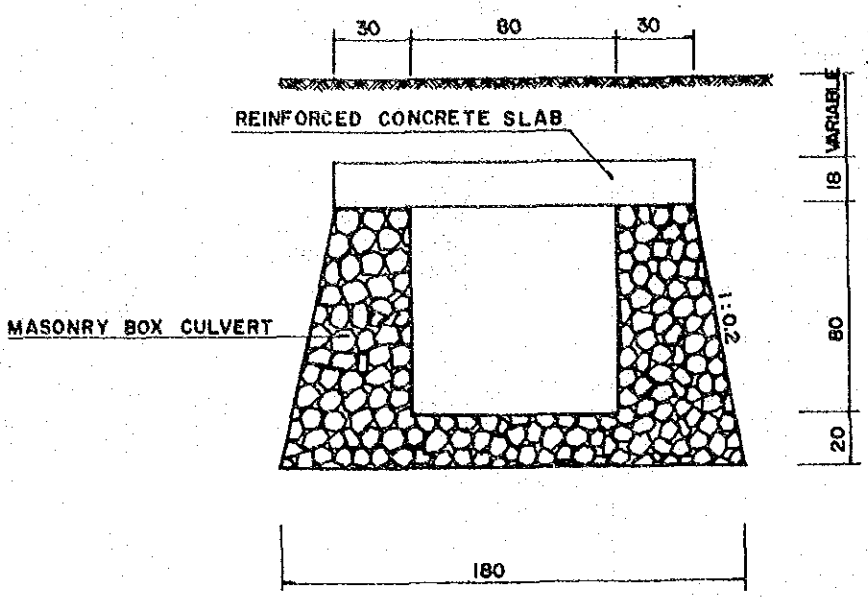
(2) Retaining Wall

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

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

Fig. 3-3-2 STANDARD CULVERTS

80 x 80 RUBBLE IN MORTAR BOX CULVERTS



Ø 80 RENFORCED CONCRETE PIPE CULVERT

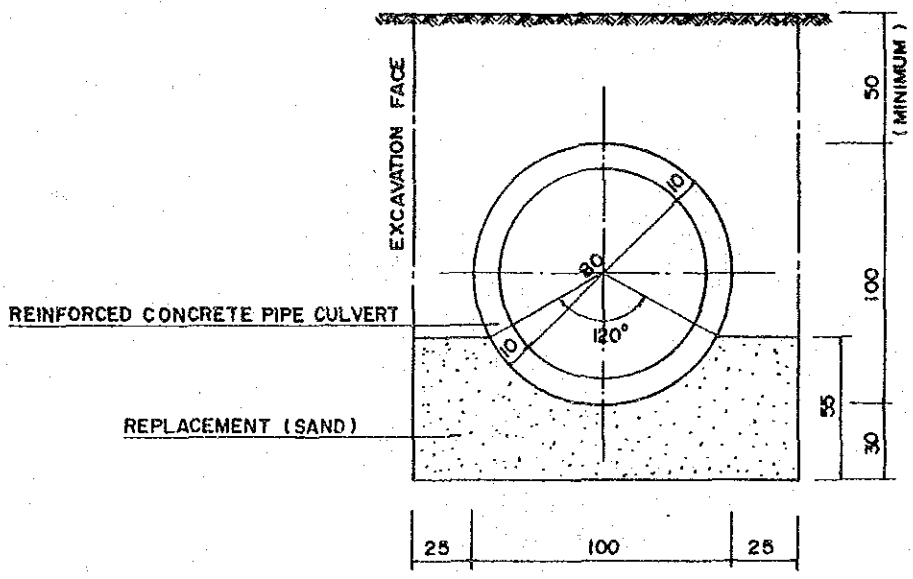
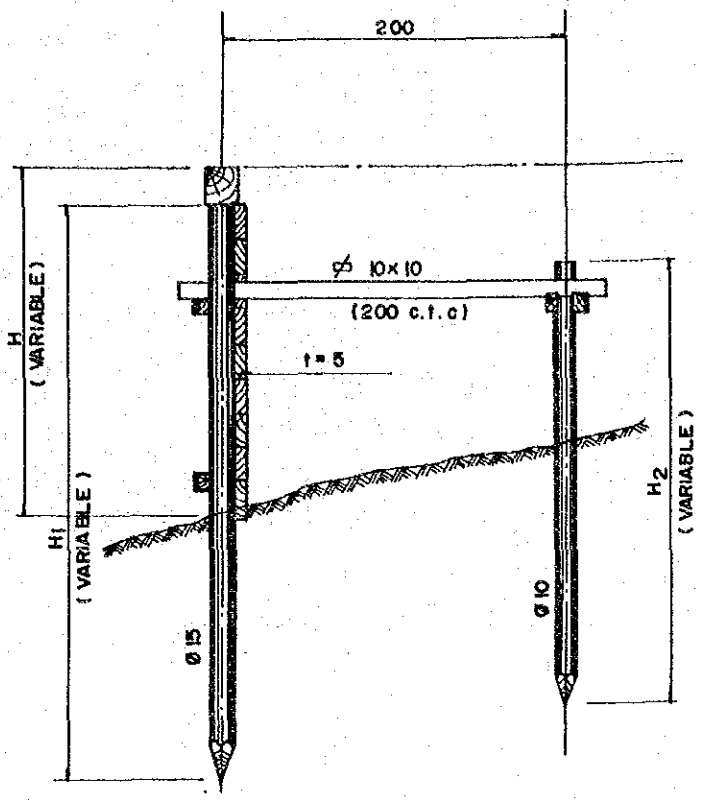
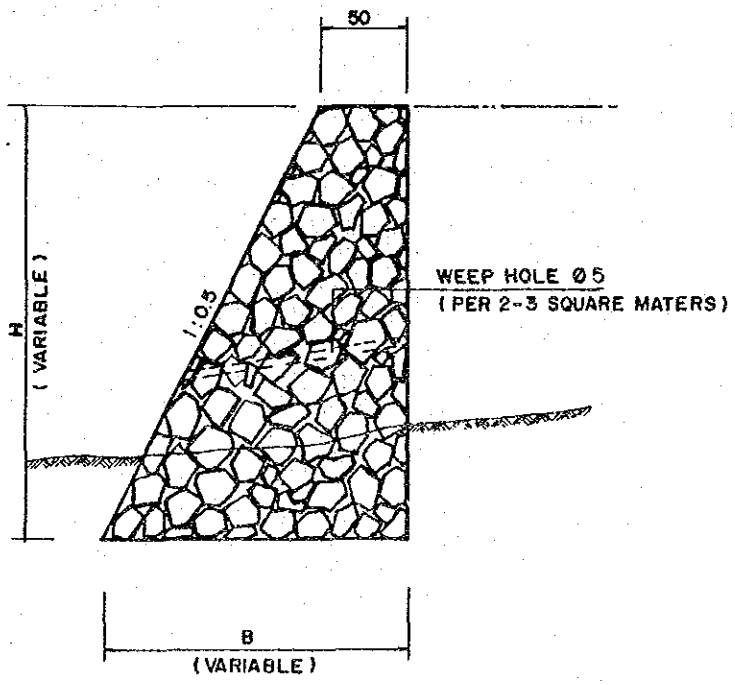


Fig. 3-3-3 STANDARD RETAINING WALLS

TIMBER RETAINING WALL



RUBBLE IN MORTAR WALL



3.4 Selection of Equipment Types

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

Table 3-4-1 CONSTRUCTION METHODS FOR MAJOR WORKS

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

3.4.1 Points to be Considered for the Selection

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

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

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

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

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

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

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

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

3.4.2 Combinations of Equipment for Major Works and Maintenance

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

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

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

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

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

3.5 Workshop and Laboratory

3.5.1 Policy of the Kabupaten Workshop

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

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

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

3.5.2 Workshop Equipment and Tools

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

Table 3-5-1 WORKSHOP EQUIPMENT AND TOOLS

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

continued

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

3.5.3 Laboratory

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

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

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

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

Table 3-5-2 LABORATORY TEST EQUIPMENT

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

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

Table 3-5-3 SURVEYING EQUIPMENT

DESCRIPTION	QUANTITY
Transit	1
Level	1
Staff	3

Chapter 4 CONSTRUCTION AND MAINTENANCE COST ESTIMATIONS

4.1 Unit Price

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

4.1.1 Unit Labour Price

The unit labour prices of Kabupaten Pangkajene Kepulauan and other Kabupatens in Sulawesi Selatan Province are shown in Table 4-1-1.

Table 4-1-1 UNIT LABOUR PRICE

(Rp)

KABUPATEN	MAN	SKL LAB	CAP	MAS	LAB	DRIV	OPE
Gowa	2,000	2,000	2,500	2,500	1,500	3,000	3,750
Pangkajene Kepulauan	2,000	2,000	3,000	3,000	1,500	3,500	3,500
Barru	3,000	2,500	3,000	3,000	2,000	3,000	3,500
Soppeng	2,250	2,200	3,000	3,000	1,700	2,750	3,000
Wajo	2,500	2,000	3,000	3,000	1,500	3,000	4,500
Tana Toraja	3,000	2,500	3,000	3,000	2,000	3,500	7,500
Mamuju	2,500	2,000	3,500	3,500	1,500	3,500	5,000
Average	2,464	2,171	3,000	3,000	1,671	3,179	4,393

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 Pangkajene Kepulauan together with for other Kabupatens in Sulawesi Selatan Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	GOWA	PANGKAJENE KEPULAUAN	BARRU	SOPPENG
Bitumen	L	275	250	325	250
Asphalt Oil	L	700	700	750	700
Gasoline	L	250	250	250	250
Sand	M^3	4,000	5,000	6,000	5,250
Cement	bag	3,750	3,750	3,750	4,250
River Stone	M^3	4,000	4,500	6,000	5,250
Steel Moulds	Set	7,500	7,000	7,000	7,000
Timber	M^3	200,000	150,000	180,000	225,000
Pain	L	3,500	2,500	2,500	2,500
Reinforcing Steel	Kg	750	750	750	1,000
Tying Wire	Kg	1,200	1,200	1,500	1,500
Equivalent Royalty	M^3	250	250	250	250

MATERIAL	UNIT	WAJO	TANA TORAJA	MAMUJU	AVERAGE
Bitumen	L	275	400	270	295
Asphalt Oil	L	700	800	700	1,000
Gasoline	L	250	250	250	250
Sand	L	5,000	8,000	3,500	5,250
Cement	bag	4,000	4,500	4,500	4,070
River Stone	M^3	7,500	7,000	3,500	5,393
Steel Moulds	Set	7,500	7,000	7,000	7,143
Timber	M^3	200,000	175,000	160,000	184,285
Paint	L	3,500	2,500	2,750	2,820
Reinforcing Steel	Kg	750	1,000	800	825
Tying Wire	Kg	1,500	1,500	1,100	1,357
Equivalent Royalty	M^3	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 : SULAWESI SELATAN
KABUPATEN : PANGKAJENE KEPULAUAN

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST OWNERSHIP	LOCAL COST OPERATION	LOCAL COST SUB-TOTAL	FOREIGN COST OWNERSHIP	FOREIGN COST OPERATION	FOREIGN COST SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	311	12,733	13,044	7,769	1,034	8,803	21,847
	Bulldozer/Ripper	120 HP	340	13,753	14,093	8,500	1,591	10,091	24,184
	Swamp Bulldozer	120 HP	356	13,998	14,354	8,879	1,662	10,541	24,895
	Bulldozer	90 HP	197	8,696	8,893	4,914	654	5,568	14,461
	Bulldozer/Ripper	90 HP	212	9,292	9,504	5,300	992	6,292	15,796
	Bulldozer	65 HP	140	6,318	6,458	3,500	465	3,965	10,423
	Bulldozer/Ripper	65 HP	153	6,771	6,924	3,819	714	4,533	11,457
	Swamp Bulldozer	90 HP	212	9,283	9,495	5,284	989	6,273	15,768
	Swamp Bulldozer	65 HP	162	6,614	6,776	4,050	758	4,808	11,584
	Motor Grader	110 HP	277	11,114	11,391	6,919	1,295	8,214	19,605
	Motor Grader	75 HP	192	7,618	7,810	4,779	894	5,673	13,483
	Motor Grader	65 HP	172	6,704	6,876	4,300	804	5,104	11,980
	Road Stabilizer	W=1850 mm	344	3,414	3,758	8,594	428	9,022	12,780
	Vibratory Roller	4 ton	116	3,337	3,453	2,900	385	3,285	6,738
	Hand-guide Vib. Roller	1000 Kg	102	606	708	850	30	880	1,588
	Tire Roller	8-15 ton	125	7,366	7,491	3,106	103	3,209	10,700
	Vibratory Roller (D&T)	4 ton	116	3,337	3,453	2,900	385	3,285	6,738
	Hand-guide Vib. Roller	600 Kg	72	414	486	600	21	621	1,107
	Rough Terrain Crane	10 ton	402	12,958	13,360	10,039	751	10,790	24,150
	Hydraulic Excavator; Wheel	0.3 m3	165	7,802	7,967	4,109	546	4,655	12,622
	Wheel Loader	1.2 m3	281	8,444	8,725	7,019	934	7,953	16,678
	Wheel Loader	0.3 m3	91	2,946	3,037	2,269	302	2,571	5,608
	Water Tank Truck	4000 ltr.	105	2,839	2,944	868	124	992	3,936
	Fuel Tank Truck	4000 ltr.	106	2,846	2,952	882	126	1,008	3,960
	Dump Truck	3.0 ton	177	3,569	3,746	1,469	210	1,679	5,425
	Flat Bed Truck with Crane	3.0 ton	69	3,077	3,146	1,717	128	1,845	4,991
	Dump Loader Truck	12 ton	154	18,890	19,044	3,838	127	3,965	23,009
	Dump Truck	5.0 ton	263	5,889	6,152	2,189	313	2,502	8,654
	Flat Bed Truck	3.0 ton	23	2,647	2,670	563	42	605	3,275
	Portable Crusher/Screening	30-40 t/h	752	21,510	22,262	18,800	2,502	21,302	43,564
	Concrete Mixer	0.5 m3	648	2,471	3,119	5,400	435	5,835	8,954
	Water Pump	200 l/min	23	261	284	188	6	194	478
	Concrete Vibrator	3.3 HP	9	224	233	73	2	75	308
	Asphalt Sprayer	850 ltr.	123	776	899	1,019	145	1,164	2,063

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 : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	161	91	252
Subgrade Preparation	m2	20	11	31
Normal Fill	m3	1,666	865	2,531
Fill in Swamp	m3	2,477	1,055	3,532
Normal Excavation to Spoil	m3	976	524	1,500
Sub Base Course	m3	3,170	1,351	4,521
Base Course	m3	4,319	2,303	6,622
Shoulder	m2	290	146	436
Asphalt Patching	m2	3,389	1,312	4,701
Surface Dressing (Single)	m2	590	509	1,099
Surface Dressing (Double)	m2	736	800	1,536
Earth Drain	m	774	119	893
Earth Drain in Swamp (by machine)	m3	1,140	475	1,615
Pipe Culvert D80cm	m	39,421	40,307	79,728
Masonry Culvert (80x80cm)	m	54,374	34,731	89,105
Retaining Wall and Wing Wall (Timber)	m2	13,887	246	14,133
Retaining Wall and Wing Wall (Masonry)	m3	38,541	11,421	49,962
Gabion Protection	m3	9,554	121	9,675
Manual routine maintenance of road	Km	122,040	7,260	129,300
Routine maintenance of earth road	Km	90,217	37,948	128,165
Routine maintenance of gravel road	Km	185,442	88,186	273,628
Routine maintenance of asphalt road	Km	338,900	131,200	470,100

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 : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	48,923	3,541	52,464
Superstructure (Timber;Span 5m;10T)	m2	54,190	3,910	58,100
Superstructure (Timber;Span 8m;10T)	m2	71,778	5,137	76,915
Superstructure (Timber;Span 3m;BM50)	m2	60,663	4,379	65,042
Superstructure (Timber;Span 5m;BM50)	m2	66,227	4,745	70,972
Superstructure (Timber;Span 8m;BM50)	m2	83,994	6,007	90,001
Superstructure (Concrete;Span 3m;BM50)	m2	51,718	81,925	133,643
Superstructure (Concrete;Span 5m;BM50)	m2	52,886	91,542	144,428
Superstructure (Concrete;Span 8m;BM50)	m2	54,305	99,704	154,009
Superstructure (Concrete;Span10m;BM50)	m2	59,245	113,234	172,479
Superstructure (Concrete;Span15m;BM50)	m2	63,503	133,369	196,872
Substructure (Pier;for Timber;10T)	NO	426,099	32,863	458,962
Substructure (Abut;for Timber;10T)	NO	1,149,320	154,495	1,303,815
Substructure (Pier;for Timber;BM50)	NO	626,657	48,632	675,289
Substructure (Abut;for Timber;BM50)	NO	1,300,451	171,666	1,472,117
Substructure (Pier;for Concrete;BM50)	NO	1,530,113	452,906	1,983,019
Substructure (Abut;for Concrete;BM50)	NO	3,249,225	959,362	4,208,587
Demolition of Bridge (Timber->Timber)	m2	13,480	1,374	14,854
Demolition of Bridge (Timber->Concrete)	m2	13,480	1,374	14,854
Demolition of Bridge (Concrete)	m2	77,837	64,824	142,661
Maintenance of Timber Bridge (New)	m2	8,854	1,121	9,975
Maintenance of Concrete Bridge (New)	m2	1,895	2,456	4,351
Maintenance of Timber Bridge (Exist)	m2	8,273	2,405	10,678
Maintenance of Concrete Bridge (Exist)	m2	4,225	2,336	6,561

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 Pangkajene Kepulauan are shown in Table 5-1-1.

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

KABUPATEN : PANGKAJENE KEPULAUAN

CRITERIA NO	ROAD LINK NO
(8)	68

5.2 Evaluation

5.2.1 Primary Analysis

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

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

5.2.2 Secondary Analysis

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

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

5.2.3 Ranking of Feasible Road Links

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

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

PROVINCE : SULAWESI SELATAN KABUPATEN : PANGKAJENE KEPULAUAN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
19	5 Km	IIIA	61.855	VOC
43	4 Km	IIIB-1	53.756	VOC
34	4 Km	IIIB-2	52.218	VOC
1	6 Km	IIIA	45.329	VOC
5	16 Km	IIIA	39.240	VOC
18	12 Km	IIIB-1	32.351	VOC
17	11 Km	IIIB-1	25.595	VOC
11	2 Km	IIIB-2	24.247	VOC
62	3 Km	IIIB-1	19.257	VOC
66	6 Km	IIIB-2	18.810	VOC
39	8 Km	IIIB-1	17.887	VOC
41	7 Km	IIIA	13.907	VOC
6	31 Km	IIIB-1	13.832	VOC
73	11 Km	IIIC	4.127	Surplus
71	15 Km	IIIB-2	2.331	Surplus
16	6 Km	IIIC	0.078	Surplus
2	5 Km	IIIC	0.078	Surplus
3	4 Km	IIIB-2	0.078	VOC
7	3 Km	IIIC	0.078	Surplus
20	5 Km	IIIC	0.078	Surplus
21	4 Km	IIIC	0.078	Surplus
22	6 Km	IIIC	0.078	Surplus
23	6 Km	IIIC	0.078	Surplus
24	2 Km	IIIC	0.078	Surplus
25	6 Km	IIIB-1	0.078	VOC
26	4 Km	IIIB-1	0.078	VOC
27	5 Km	IIIB-2	0.078	Surplus
28	6 Km	IIIB-2	0.078	Surplus
29	9 Km	IIIB-2	0.078	VOC
30	4 Km	IIIC	0.078	Surplus
31	3 Km	IIIC	0.078	Surplus
32	5 Km	IIIC	0.078	Surplus
33	6 Km	IIIC	0.078	Surplus
8	6 Km	IIIB-2	0.078	Surplus
35	2 Km	IIIB-2	0.078	VOC
36	10 Km	IIIB-2	0.078	Surplus
37	8 Km	IIIB-2	0.078	VOC
38	4 Km	IIIB-2	0.078	VOC
9	4 Km	IIIB-2	0.078	VOC
40	3 Km	IIIC	0.078	Surplus
10	10 Km	IIIB-2	0.078	Surplus
42	3 Km	IIIC	0.078	Surplus
4	5 Km	IIIB-1	0.078	VOC
44	2 Km	IIIC	0.078	Surplus
45	9 Km	IIIB-2	0.078	Surplus
46	5 Km	IIIC	0.078	Surplus
47	2 Km	IIIC	0.078	Surplus
48	4 Km	IIIC	0.078	Surplus
49	4 Km	IIIB-2	0.078	Surplus
50	3 Km	IIIC	0.078	Surplus

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

PROVINCE : SULAWESI SELATAN KABUPATEN : PANGKAJENE KEPULAUAN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
51	3 Km	IIIC	0.078	Surplus
52	7 Km	IIIB-2	0.078	Surplus
53	12 Km	IIIB-2	0.078	Surplus
54	2 Km	IIIC	0.078	Surplus
55	5 Km	IIIC	0.078	Surplus
56	9 Km	IIIB-2	0.078	Surplus
57	3 Km	IIIC	0.078	Surplus
58	5 Km	IIIC	0.078	Surplus
59	4 Km	IIIB-2	0.078	VOC
60	2 Km	IIIB-2	0.078	VOC
61	3 Km	IIIC	0.078	Surplus
12	3 Km	IIIC	0.078	Surplus
63	2 Km	IIIC	0.078	Surplus
64	3 Km	IIIB-2	0.078	VOC
65	6 Km	IIIB-2	0.078	Surplus
13	9 Km	IIIB-2	0.078	Surplus
67	6 Km	IIIC	0.078	Surplus
68	3 Km	IIIC	0.078	Surplus
69	3 Km	IIIC	0.078	Surplus
70	4 Km	IIIC	0.078	Surplus
14	4 Km	IIIB-2	0.078	VOC
72	4 Km	IIIC	0.078	Surplus
15	12 Km	IIIA	0.078	VOC
74	3 Km	IIIB-2	0.078	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SULAWESI SELATAN KABUPATEN : PANGKAJENE KEPULAUAN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
71	15 Km	IIIC	5.004	Surplus
73	11 Km	IIIC	4.127	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SULAWESI SELATAN KABUPATEN : PANGKAJENE KEPULAUAN

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
18	12 Km	IIIB-1	435261	2.118	32.351	VOC
5	16 Km	IIIA	272081	2.193	39.240	VOC
19	5 Km	IIIA	189578	3.496	61.855	VOC
43	4 Km	IIIB-1	176790	3.194	53.756	VOC
17	11 Km	IIIB-1	132467	1.653	25.595	VOC
1	6 Km	IIIA	93029	2.281	45.329	VOC
6	31 Km	IIIB-1	64499	1.137	13.832	VOC
39	8 Km	IIIB-1	59242	1.334	17.887	VOC
34	4 Km	IIIB-2	21028	2.194	52.218	VOC
62	3 Km	IIIB-1	19204	1.376	19.257	VOC
41	7 Km	IIIA	18885	1.152	13.907	VOC
66	6 Km	IIIB-2	17586	1.316	18.810	VOC
11	2 Km	IIIB-2	3628	1.384	24.247	VOC
SUM	115 Km		1503278			

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: Pangkajene Kepulauan

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	535	1,168	1,703
MAINTENANCE	170	509	679
SUPPLEMENTATION	313	-	313
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,063	1,677	2,740

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

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

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CIVIL WORK	321	1,665	1,986
CONSTRUCTION & MAINTENANCE EQUIPMENT	647	-	647
SPARE PARTS	50	12	62
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,063	1,677	2,740

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 17 links with the total length of 137 km which is 32% of the 431 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 : PANGKAJENE KEPULAUAN

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	1,5,6,11,17,18,19,34,39,41,43,62, 66
- Secondary	-
Engineering Point of View	8,26,40,56
Basic Human Needs	-

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

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

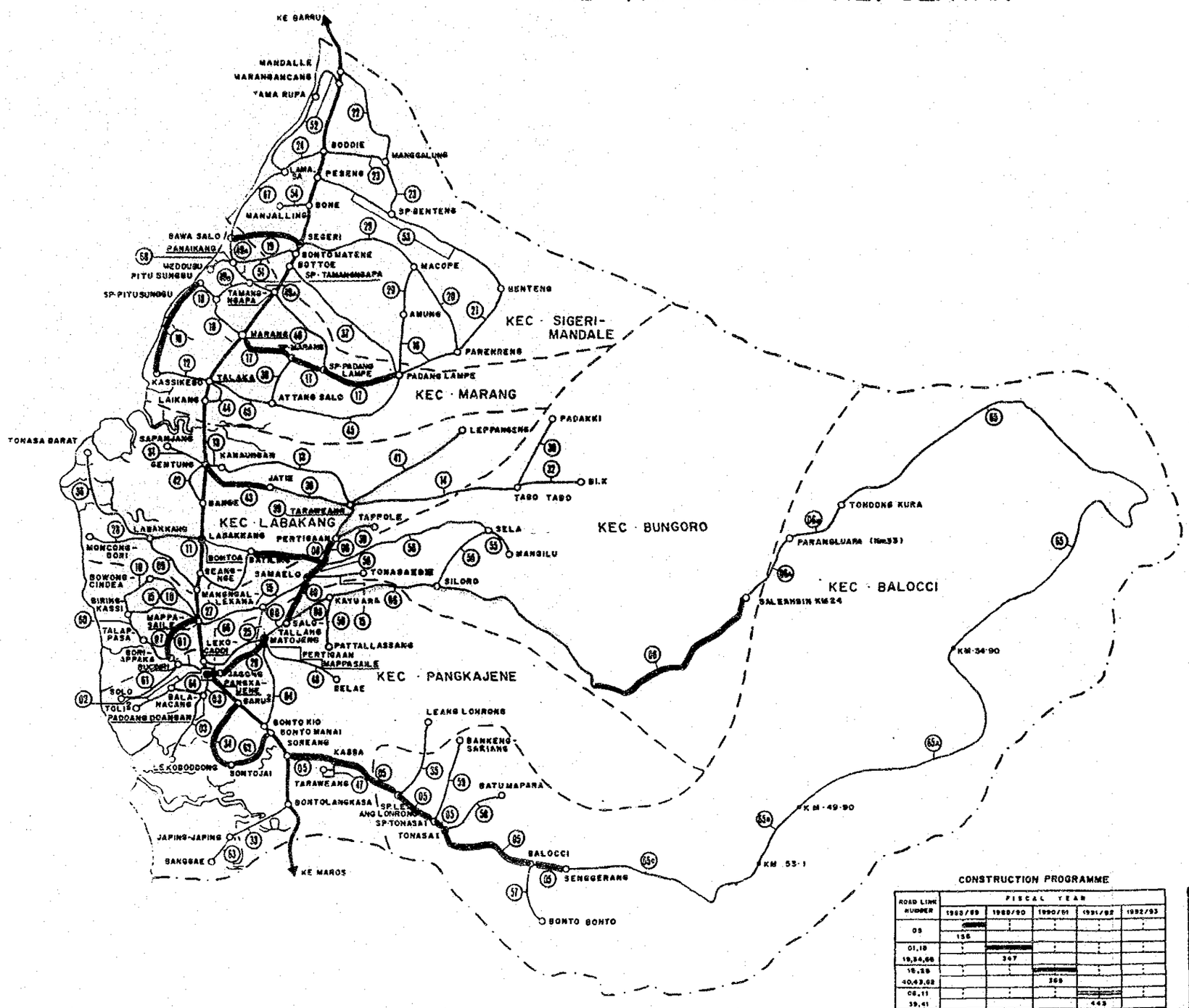
The order of proceeding with the improvement of the proposed road links are decided as shown in Table 6-1-4.

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

YEAR	LINK NO ( ) : rate
1988 :	5
1989 :	1, 18 (50%), 19, 34, 66
1990 :	18 (50%), 26, 40, 43, 62
1991 :	6 (65%), 11, 39, 41
1992 :	6 (35%), 8, 17, 56

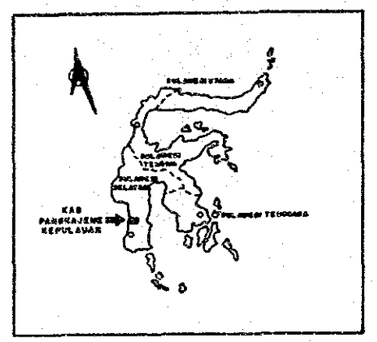
KAB · PANGKAJENE KEPULAUAN



SCALE

0 5 10 15 Km

LOCATION MAP



LEGEND :

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

CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1988/89	1989/90	1990/91	1991/92	1992/93
05	156				
01,10		347			
19,34,66			388		
18,26				443	
40,43,02					371
08,11					
39,41					
08,09					
17,58					
TOTAL COST (10⁶ Rp.)	156	347	388	443	371

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

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE : SULAWESI SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN : PANGKAJENE KEPULAUAN

(2) Road Links to Be Maintained

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

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TM NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
1	6	21.7	46.7	25.8	5.8	6	0	0	0	0.00	6	192.00	1,260	3,577	1,279	4,856
2	5	67.0	26.0	7.0	0.0	4	0	1	0	0.00	1	34.00	223	2,200	678	2,878
3	4	67.5	11.3	21.3	0.0	2	2	0	0	0.00	0	0.00	0	1,537	468	2,005
4	5	66.0	26.0	6.0	2.0	5	0	0	0	0.00	0	0.00	0	2,305	692	2,997
7	3	21.7	46.7	28.3	3.3	0	2	1	1	7.50	0	0.00	80	889	254	1,143
8	6	60.0	20.0	20.0	0.0	0	6	0	0	0.00	4	76.00	499	2,166	750	2,916
9	4	91.3	8.8	0.0	0.0	4	0	0	0	0.00	0	0.00	0	1,844	554	2,398
10	10	78.8	2.7	18.5	0.0	6	4	0	0	0.00	1	24.00	157	4,097	1,269	5,366
13	9	67.2	14.4	18.3	0.0	0	9	0	0	0.00	5	72.00	472	3,072	1,027	4,099
14	4	21.3	50.0	28.8	0.0	0	4	0	0	0.00	4	80.00	525	1,568	569	2,137
15	12	99.0	1.0	0.0	0.0	11	1	0	0	0.00	2	1120.00	7,348	10,110	4,235	14,345
19	5	24.0	42.0	29.0	5.0	3	0	2	0	0.00	1	20.00	131	1,692	553	2,445
20	5	70.0	10.0	20.0	0.0	0	5	0	0	0.00	2	34.00	223	1,681	557	2,239
21	4	82.5	17.5	0.0	0.0	0	4	0	0	0.00	6	136.00	892	1,805	699	2,504
22	6	88.3	0.8	10.8	0.0	0	6	0	0	0.00	6	94.00	617	2,242	792	3,034
23	6	23.3	39.2	37.5	0.0	0	6	0	0	0.00	3	60.00	394	2,098	713	2,811
24	2	65.0	7.5	27.5	0.0	0	2	0	0	0.00	0	0.00	0	615	191	806
25	6	25.8	51.7	22.5	0.0	6	0	0	0	0.00	3	52.00	341	2,985	952	3,937
26	4	50.0	30.0	20.0	0.0	4	0	0	0	0.00	0	0.00	0	1,844	554	2,398
27	5	70.0	16.0	14.0	0.0	0	5	0	0	0.00	1	16.00	105	1,605	515	2,120
29	9	51.7	26.1	16.7	5.6	3	6	0	0	0.00	1	24.00	157	3,329	1,044	4,373
30	4	12.5	57.5	30.0	0.0	0	4	0	0	0.00	3	48.00	315	1,433	494	1,927
31	3	75.0	25.0	0.0	0.0	0	3	0	0	0.00	0	0.00	0	922	286	1,208
32	5	26.0	34.0	29.0	11.0	0	0	5	0	0.00	2	31.50	207	1,194	300	1,494
34	4	20.0	40.0	26.3	13.8	4	0	0	0	0.00	0	0.00	0	1,844	554	2,398

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TN NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
35	2	27.5	40.0	27.5	5.0	0	2	0	2	30.00	0	0.00	320	863	263	1,126
37	8	62.5	12.5	25.0	0.0	0	8	0	0	0.00	1	16.00	105	2,527	801	3,328
38	4	60.0	13.8	26.3	0.0	0	4	0	0	0.00	2	34.00	223	1,374	461	1,835
39	8	47.5	24.4	28.1	0.0	0	8	0	0	0.00	7	86.00	564	2,823	964	3,787
40	3	40.0	30.0	30.0	0.0	0	3	0	0	0.00	0	0.00	0	922	286	1,208
41	7	79.3	12.9	7.9	0.0	0	7	0	0	0.00	3	68.00	446	2,440	827	3,267
44	2	65.0	0.0	35.0	0.0	0	0	2	0	0.00	0	0.00	0	425	90	515
45	9	76.1	23.9	0.0	0.0	0	9	0	0	0.00	4	98.00	643	3,181	1,088	4,269
46	5	74.8	14.2	11.0	0.0	0	5	0	0	0.00	4	62.00	407	1,799	622	2,421
47	2	65.0	0.0	35.0	0.0	0	2	0	0	0.00	0	0.00	0	615	191	806
48	4	99.0	1.0	0.0	0.0	0	4	0	0	0.00	0	0.00	0	1,230	382	1,612
49	4	18.8	55.0	25.0	1.3	1	2	1	0	0.00	2	36.00	236	1,440	459	1,899
50	3	20.0	38.3	41.7	0.0	0	3	0	0	0.00	1	16.00	105	990	324	1,314
51	3	40.0	46.7	13.3	0.0	1	2	0	0	0.00	2	62.00	407	1,338	474	1,812
52	7	67.9	5.7	26.4	0.0	0	7	0	1	60.00	1	16.00	746	2,716	850	3,566
53	12	71.3	0.0	28.8	0.0	0	12	0	1	20.00	3	60.00	660	4,143	1,357	5,495
54	2	45.0	15.0	40.0	0.0	0	2	0	0	0.00	0	0.00	0	615	191	806
55	5	19.0	50.0	27.0	4.0	0	4	1	1	18.00	4	87.75	781	1,970	680	2,650
56	9	32.2	36.7	21.7	9.4	0	8	1	0	0.00	1	44.00	289	2,058	912	3,770
60	2	32.5	40.0	27.5	0.0	0	2	0	0	0.00	1	44.00	287	801	294	1,095
62	3	30.0	33.3	36.7	0.0	0	3	0	0	0.00	1	32.00	210	1,058	361	1,419
63	2	32.5	37.5	30.0	0.0	0	1	1	0	0.00	0	0.00	0	520	141	661
64	3	94.7	5.3	0.0	0.0	3	0	0	0	0.00	2	16.00	105	1,450	453	1,903
65	8	87.5	8.3	4.2	0.0	0	8	0	0	0.00	2	88.00	577	2,217	778	2,995
68	3	26.7	33.3	26.7	13.3	0	2	1	1	24.00	0	0.00	256	1,026	294	1,320
70	4	13.8	43.8	35.0	7.5	0	0	4	0	0.00	0	0.00	0	849	181	1,030
SUM	258					63	175	20	7	159.50	92	2989.25	21,316	101,044	33,698	134,742

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 Pangkajene Kepulauan is finally recommended as shown in Tables 6-1-6 (1), (2) and (3) for the construction, maintenance and total respectively.

The proposed construction cost is Rp 1,703 x 10^6 and maintenance cost is Rp 679 x 10^6 which is approximately 40% of the total expenditure.

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

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	94,096	227,266	260,970	284,915	246,888	1,114,135	(65.4%)
Ownership Cost	1,385	3,858	4,655	4,694	4,075	18,667	(1.7%)
Operation Cost	34,442	100,097	113,518	111,424	102,633	462,114	(41.5%)
Material Cost	20,844	45,174	47,472	70,006	51,847	243,343	(21.8%)
Labour Cost	17,152	48,494	61,285	61,628	56,130	244,689	(22.0%)
Contingency	12,273	29,643	34,040	37,163	32,203	145,322	(13.0%)
FOREIGN CURRENCY :	61,619	119,591	125,236	158,660	123,708	588,814	(34.6%)
Ownership Cost	18,797	53,445	62,547	63,257	56,408	254,454	(43.2%)
Operation Cost	2,421	7,342	8,418	8,298	7,802	34,281	(5.8%)
Material Cost	32,364	43,205	37,936	66,410	43,362	223,277	(37.9%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,037	15,599	16,335	20,695	16,136	76,802	(13.0%)
TOTAL COST :	155,716	346,857	386,206	443,575	370,596	1,702,950	
Ownership Cost	20,182	57,303	67,202	67,951	60,483	273,121	(16.0%)
Operation Cost	36,863	107,439	121,936	119,722	110,435	496,395	(29.1%)
Material Cost	61,208	88,379	85,408	136,416	95,209	466,620	(27.4%)
Labour Cost	17,152	48,494	61,285	61,628	56,130	244,689	(14.4%)
Contingency	20,311	45,242	50,375	57,858	48,339	222,125	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(UNIT : 1000Rp)

ITEM		(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :		50,489	106,148	110,931	118,770	123,035	509,373	(75.0%)
Ownership	Cost	818	1,737	1,831	2,005	2,088	8,479	(1.7%)
Operation	Cost	27,589	57,686	60,004	62,861	63,741	271,881	(53.4%)
Material	Cost	1,481	3,193	3,392	3,822	4,702	16,590	(3.3%)
Labour	Cost	20,601	43,532	45,704	50,082	52,504	212,423	(41.7%)
FOREIGN CURRENCY :		16,846	35,513	37,166	39,493	40,555	169,573	(25.0%)
Ownership	Cost	13,605	28,479	29,647	31,002	31,431	134,164	(79.1%)
Operation	Cost	1,548	3,232	3,356	3,517	3,559	15,212	(9.0%)
Material	Cost	1,693	3,802	4,163	4,974	5,565	20,197	(11.9%)
Labour	Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :		67,335	141,661	148,097	158,263	163,590	678,946	
Ownership	Cost	14,423	30,216	31,478	33,007	33,519	142,643	(21.0%)
Operation	Cost	29,137	60,918	63,360	66,378	67,300	287,093	(42.3%)
Material	Cost	3,174	6,995	7,555	8,796	10,267	36,787	(5.4%)
Labour	Cost	20,601	43,532	45,704	50,082	52,504	212,423	(31.3%)

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

(TOTAL)

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	144,585	333,414	371,901	403,685	369,923	1,623,508	(68.2%)
Ownership Cost	2,203	5,595	6,486	6,699	6,163	27,146	(1.7%)
Operation Cost	62,031	157,783	173,522	174,285	166,374	733,995	(45.2%)
Material Cost	30,325	48,367	50,864	73,828	56,549	259,933	(16.0%)
Labour Cost	37,753	92,026	106,989	111,710	108,634	457,112	(28.2%)
Contingency	12,273	29,643	34,040	37,163	32,203	145,322	(9.0%)
FOREIGN CURRENCY :	78,465	155,104	162,402	198,153	164,263	758,387	(31.8%)
Ownership Cost	32,402	81,924	92,194	94,259	87,839	388,618	(51.2%)
Operation Cost	3,969	10,574	11,774	11,815	11,361	49,493	(6.5%)
Material Cost	34,057	47,007	42,099	71,384	48,927	243,474	(32.1%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,037	15,599	16,335	20,695	16,136	76,802	(10.1%)
TOTAL COST :	223,051	488,518	534,303	601,838	534,186	2,381,896	
Ownership Cost	34,605	87,519	98,680	100,958	94,002	415,764	(17.5%)
Operation Cost	66,000	168,357	185,296	186,100	177,735	783,488	(32.9%)
Material Cost	64,382	95,374	92,963	145,212	105,476	503,407	(21.1%)
Labour Cost	37,753	92,026	106,989	111,710	108,634	457,112	(19.2%)
Contingency	20,311	45,242	50,375	57,858	48,339	222,125	(9.3%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Pangkajene Kepulauan 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-Hand-guided Vibratory Roller
- 1-Portable Crusher
- 1-Asphalt Sprayer

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

- Nil

(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 : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	220	0	0.24	0.42	0.53	0.55	0.48
Swamp Bulldozer	220	0	0.00	0.14	0.14	0.01	0.08
Motor Grader	240	0	0.19	0.49	0.52	0.64	0.63
Hand-guide Vib. Roller	240	3	0.44	0.40	1.09	1.14	0.26
Tire Roller	220	0	0.46	0.58	0.49	0.89	0.56
Vibratory Roller (D&T)	240	0	0.14	0.47	0.50	0.50	0.51
Hydraulic Excavator; Wheel	220	0	0.01	1.10	1.21	0.06	0.36
Wheel Loader	240	0	0.35	0.98	1.15	1.18	1.12
Water Tank Truck	240	0	0.04	0.29	0.32	0.29	0.31
Dump Truck	240	0	2.90	9.19	10.38	9.95	9.76
Flat Bed Truck with Crane	240	0	0.08	0.13	0.44	0.49	0.26
Flat Bed Truck	240	0	0.56	0.72	0.83	1.30	0.70
Portable Crusher/Screening	240	1	0.06	0.16	0.15	0.30	0.26
Concrete Mixer	220	0	0.08	0.04	0.33	0.40	0.08
Water Pump	220	0	0.06	0.03	0.23	0.27	0.06
Concrete Vibrator	220	0	0.01	0.01	0.02	0.02	0.02
Asphalt Sprayer	220	1	0.46	0.58	0.49	0.89	0.56

NOTE WORKABLE : workable days in a year

EXISTING : number of existing equipment

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	-	-
Bulldozer/Ripper	90 HP	53,000	-	-
Swamp Bulldozer	90 HP	52,850	1	52,850
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	1	47,800
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	-	-
Tire Roller	8-15 ton	31,070	2	62,140
Vibratory Roller (D&T)	4 ton	29,000	1	29,000
Vibratory Roller	4 ton	29,000	-	-
Rough Terrain Crane	10 ton	100,400	-	-
Hydraulic Excavator; Wheel	0.3 m3	41,100	1	41,100
Wheel Loader	1.2 m3	70,200	2	140,400
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	11	161,700
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	1	25,190
Flat Bed Truck	3.0 ton	11,275	2	22,550
Portable Crusher/Screening	30-40 t/h	188,000	-	-
Concrete Mixer	0.5 m3	18,000	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	647,250
OWNERSHIP COST (FOREIGN)	334,592
EQUIPMENT COST SUPPLEMENTED	312,658

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Hand-guide Vib. Roller	9,254
Portable Crusher/Screening	40,794
Asphalt Sprayer	3,978
TOTAL	54,026

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 : SULAWESI SELATAN KAB : PANGKAJENE KEPULAUAN

I T E M	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	16000.00	14000.00	28000.00	16000.00	9000.00	83000.00
Subgrade Preparation	m2	0.00	55515.00	66945.00	1215.00	20505.00	144180.00
Normal Fill	m3	305.00	0.00	0.00	3243.00	1557.00	5105.00
Fill in Swamp	m3	0.00	5164.05	5421.75	165.90	3118.50	13870.20
Normal Excavation to Spoil	m3	2017.00	9875.00	13830.00	5211.00	6414.00	37347.00
Sub Base Course	m3	1680.00	6001.15	7005.65	5646.60	4688.80	25022.20
Base Course	m3	0.00	3545.00	4025.00	8386.00	8214.00	24170.00
Shoulder	m2	40000.00	57000.00	50000.00	82300.00	82700.00	312000.00
Asphalt Patching	m2	2182.00	1517.00	269.00	323.30	35.70	4327.00
Surface Dressing (Single)	m2	72000.00	81000.00	77000.00	140600.00	87400.00	458000.00
Surface Dressing (Double)	m2	0.00	8000.00	0.00	0.00	0.00	8000.00
Earth Drain	m	4000.00	30290.00	29430.00	28530.00	40570.00	132820.00
Earth Drain in Swamp (by machine)	m3	0.00	19350.00	21150.00	900.00	6300.00	47700.00
Pipe Culvert D80cm	m	15.00	48.50	84.50	130.00	130.00	408.00
Masonry Culvert (80x80cm)	m	8.00	6.00	0.00	7.80	16.20	38.00
Retaining Wall and Wing Wall (Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Masonry)	m3	151.50	57.80	700.60	825.43	98.67	1834.00
Gabion Protection	m3	0.00	0.00	0.00	169.00	91.00	260.00
Superstructure (Timber;Span 3m;10T)	m2	0.00	24.00	24.00	0.00	0.00	48.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	32.00	32.00	0.00	0.00	64.00
Superstructure (Timber;Span 8m;10T)	m2	0.00	0.00	28.00	104.00	216.00	348.00
Superstructure (Timber;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span10m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span15m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Timber;10T)	NO	0.00	0.00	0.00	2.60	5.40	8.00
Substructure (Abut;for Timber;10T)	NO	0.00	8.00	10.00	1.30	2.70	22.00
Substructure (Pier;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	129.00	266.50	275.00	288.50	290.50	1249.50
Routine maintenance of earth road	Km	10.00	19.00	18.00	18.00	17.50	82.50
Routine maintenance of gravel road	Km	87.50	175.00	176.00	165.50	153.00	757.00
Routine maintenance of asphalt road	Km	31.50	72.50	81.00	105.00	120.00	410.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	0.00	140.00	140.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	79.75	159.50	159.50	159.50	159.50	717.75
Maintenance of Concrete Bridge (Exist)	m2	1494.63	3218.75	3400.75	3402.50	3419.50	14936.13

6.2 Organization and Construction System

6.2.1 Organization

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

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

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

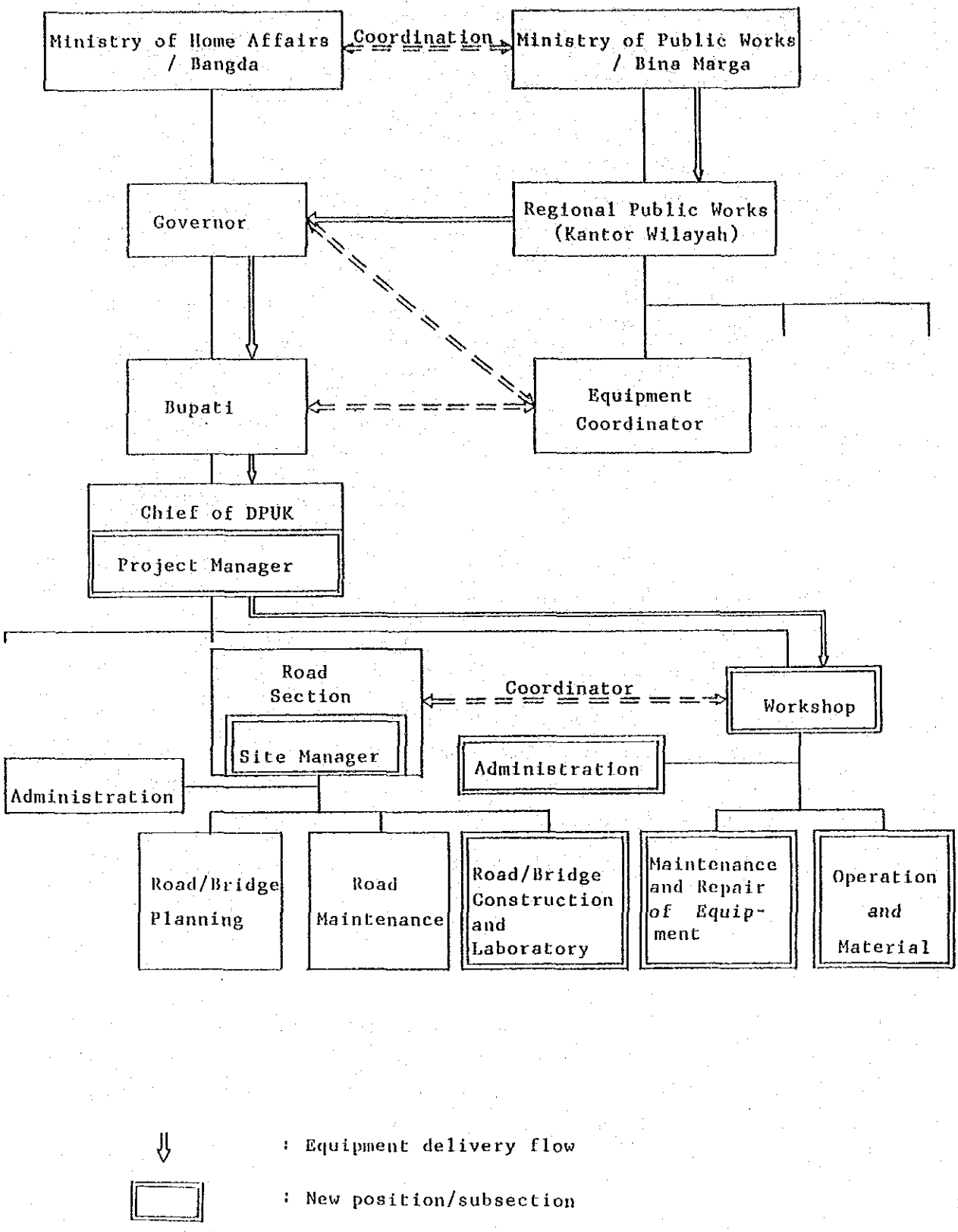
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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

6.2.2 Construction System

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

Fig. 6-2-1 PROPOSED ORGANIZATION



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

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

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

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

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

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

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

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