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 30

KABUPATEN GOWA

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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PREFACE

This is the Kabupaten Report of the Feasibility Study of the Local Road Development in the Republic of Indonesia for Kabupaten Gowa 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.

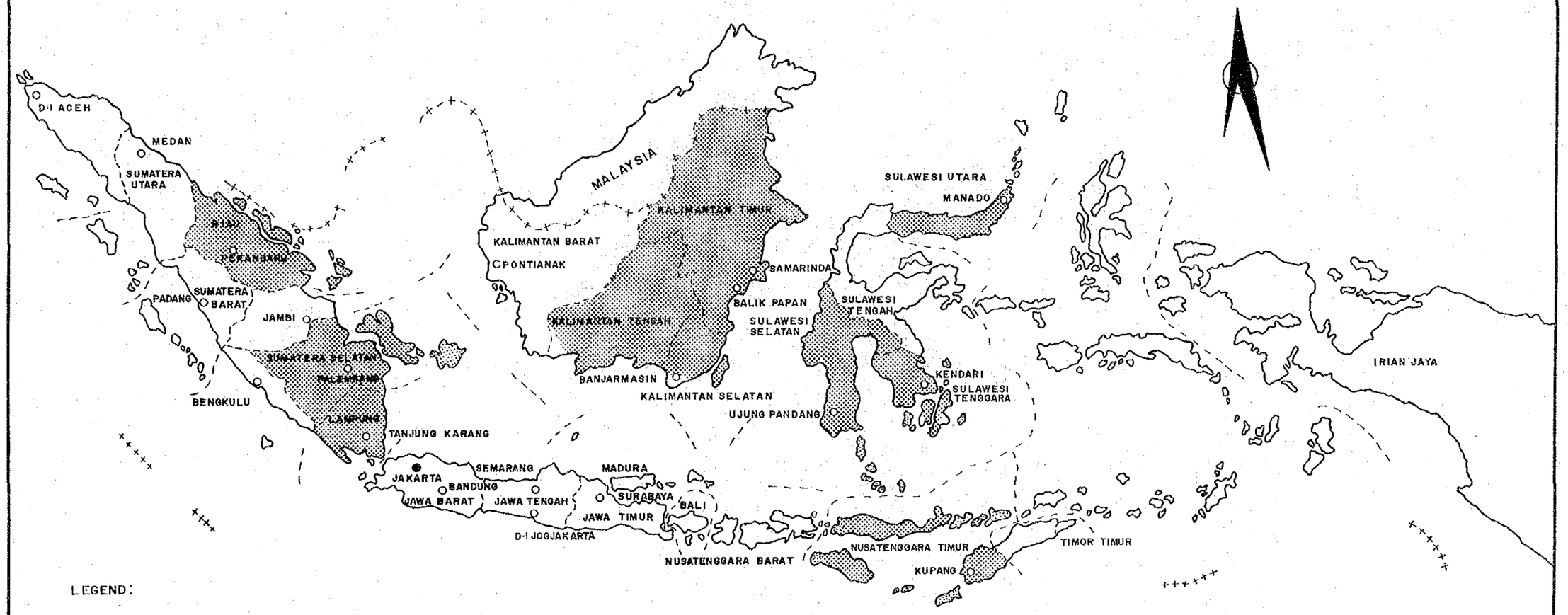
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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.

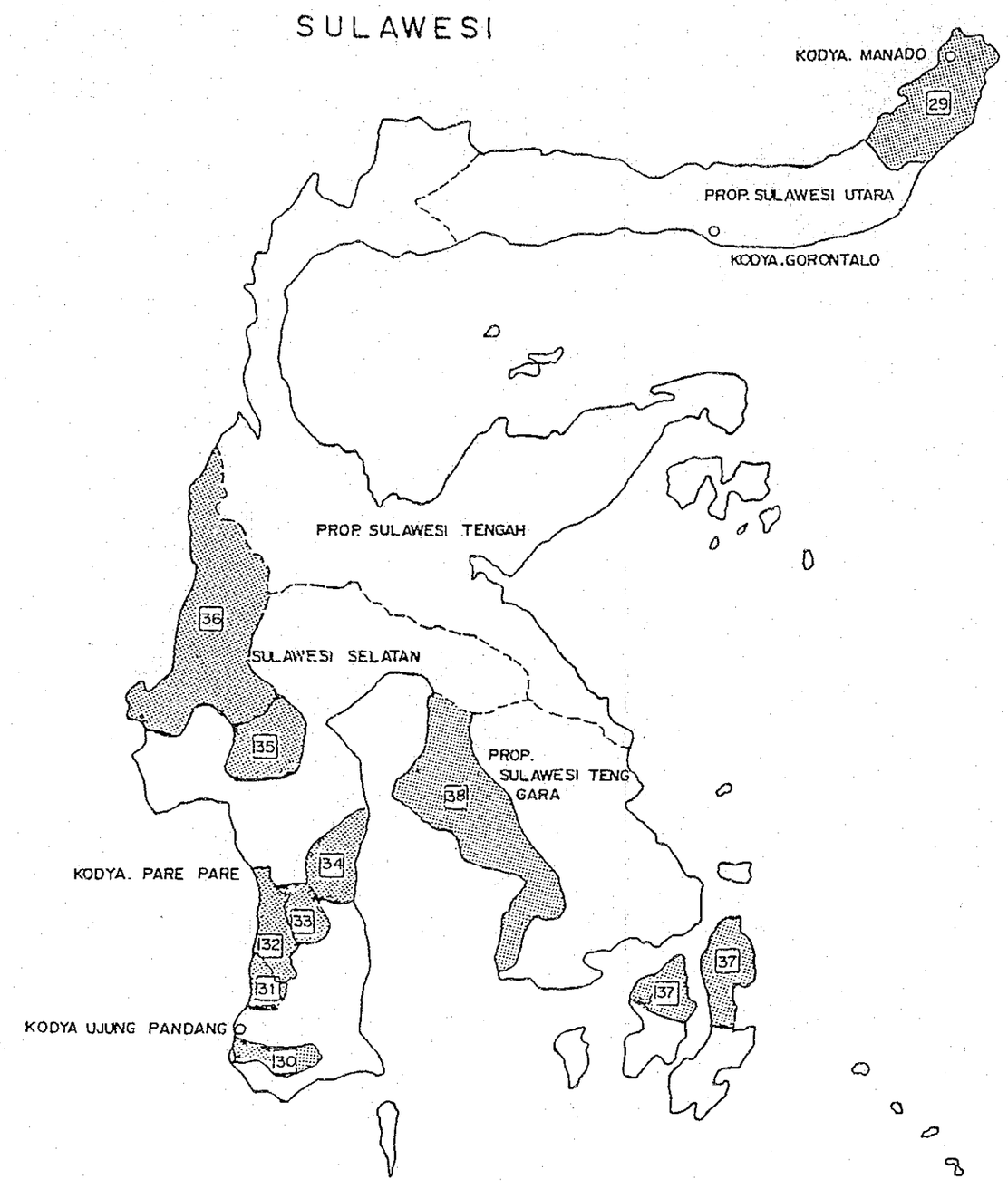
LOCATION MAP OF THE PROJECT AREAS



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 :

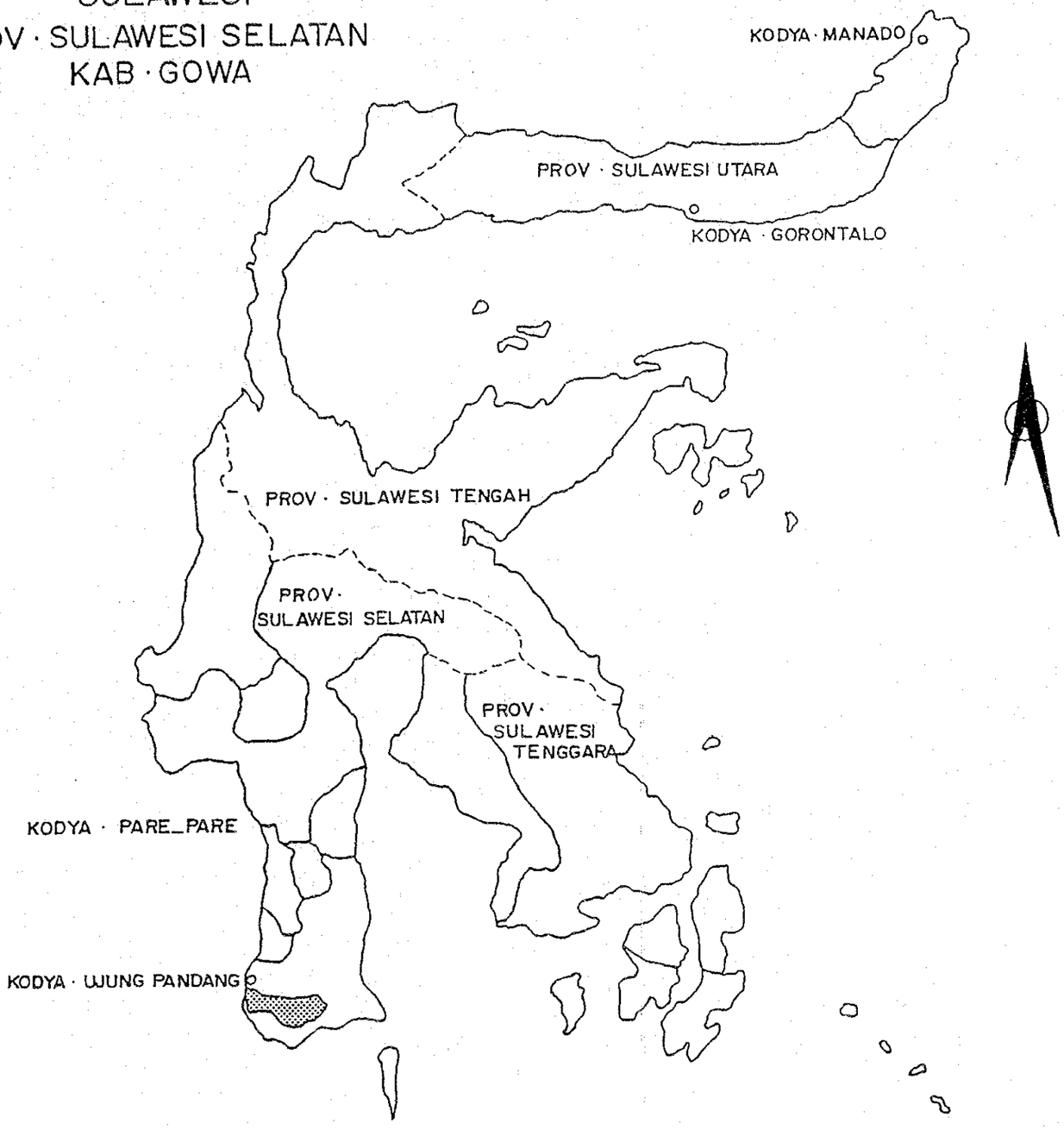
---- PROVINCIAL BOUDER

LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km

SULAWESI
PROV · SULAWESI SELATAN
KAB · GOWA



LEGEND :

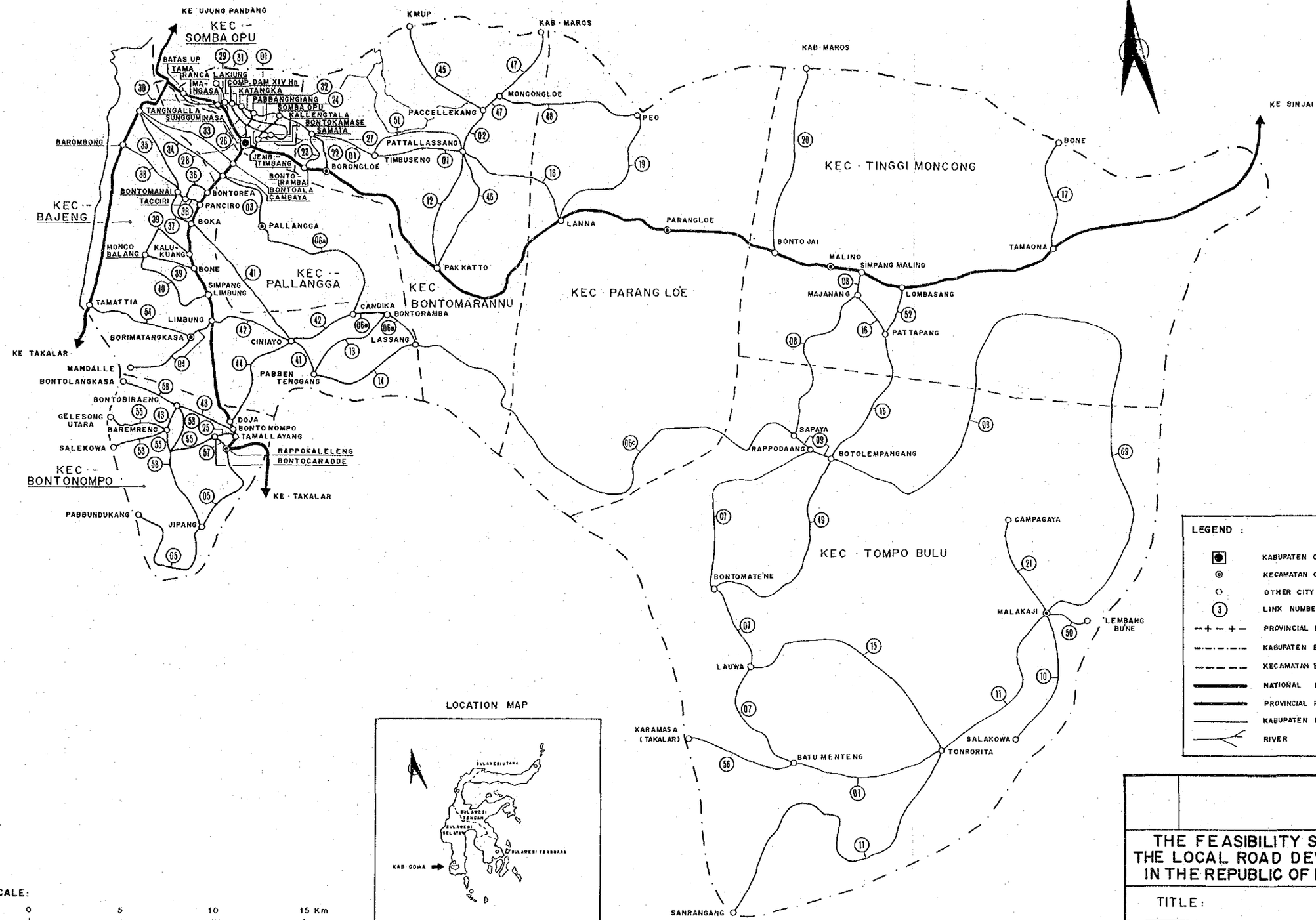
---- PROVINCIAL BOUNDARY

LOCATION OF THE PROJECT AREA

SCALE :

0 92 184 276 460 Km

KAB · GOWA



LEGEND :

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

LOCATION MAP

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 : GOWA

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 Gowa has a rectangular shape long in the east-west direction. It is bordered on the south by Kabupatens Takalar and Jeneponto, on the east by Kabupatens Bantaeng, Bulukumba and Sinjai, and on the north by Kabupaten Maros. On the west it faces the Makassar Strait and the provincial capital of Sulawesi Selatan, Ujungpandang, stands on the coast bordered by the Kabupaten.

The flat area formed by the River Jeneberang basin continues from the west coast to the center of the Kabupaten and changes into hills towards the east. Finally in the westernmost region of the Kabupaten it changes to mountains where the highest peak of Sulawesi Selatan Province, mountain Lompobatang, stands at 2871 meter height. Thus the Kabupaten can be roughly divided topographically into the flat area of the western half and the mountainous area of the eastern half.

The Kabupaten has an area of 1,883 square kilometers, approximately 3 percent of the total of the province. It consists administratively of 8 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 Gowa in 1983 was 368,552 which was approximately 5.8% of the 6,376,100 total population of Sulawesi Selatan Province as shown in Table 1-2-1.

The population density was 1.90 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 : 1983

PROVINCE : SULAWESI SELATAN

KABUPATEN : GOWA

KECAMATAN	POPULATION	PROPORTION (%)
BONTONOMPO	47,162	12.8
BAJENG	50,978	13.8
TOMPOBULU	70,764	19.2
TINGGI MONCONG	44,444	12.1
PARANG LOE	21,790	5.9
BONTO MARANNU	35,537	9.6
PALANGGA	57,408	15.6
SOMBAOPU	40,469	11.0
TOTAL	368,552	100

1.2.2 Land Use

In Kabupaten Gowa, 84,900 ha of the current available land use area, which is approximately 45.2% of the 188,332 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 75,200 ha of agricultural harvest area and 9,700 ha of residential area which are 88.6% and 11.4% of the current available land use area respectively.

The agricultural harvest area consists of 41,400 ha of paddy field and 33,800 ha of plantation area which are 55.1% and 44.9% 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 Gowa in 1983 were 123,186 ha and 322,205 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 27,300 ha and 127,901 ton respectively which are 22.2% and 39.7% of the total food crops. The yield rate of paddy production is 4.70 ton per ha. Furthermore, the production of maize, cassava and other vegetables amounts to 194,304 ton accounting for 60% of the total food crops. It particular it is remarkable that vegetables account for no less than 147,000 ton of the above amount.

Accordingly it is understood that the Kabupaten acts as a food provisioning area due to its location adjacent to the large city, Ujung Pandang.

As the table shows, average annual growth rates of area and production of paddy in 1979 through 1983 were 1.0% and 6.0% 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 population of the agricultural sector which is assumed from the employment in the Kabupaten is 61.3% of the total population as shown in Table 1-2-6. Thus this is an agricultural Kabupaten.

A future requirement for agriculture in the Kabupaten should be plant breeding and stable production of commodity crops to increase agriculture in consumable crops.

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

KABUPATEN : GOWA

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	26,118	25,834	27,332	31,982	27,300	-	
OTHERS	28,623	47,848	47,641	33,768	44,548	-	
TOTAL	54,741	73,682	74,973	65,750	71,848	-	

PRODUCTION

(ton)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	102,439	115,225	127,518	168,774	127,901	-	
OTHERS	50,829	100,235	77,109	28,191	287,429	-	
TOTAL	153,268	215,460	204,627	196,965	415,330	-	

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	3.92	4.46	4.67	5.30	4.70	-	

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

Due to the lack of data, it was obliged to omit the analysis on the notable economic activities excluding agriculture in Kabupaten Gowa.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

The regional trunk roads of Kabupaten Gowa consist of two provincial roads which run across the Kabupaten from east to west and from north to south. The provincial road which starts from Ujung Pandang is divided into two provincial roads at Jembtimbang, the Kabupaten capital, and these lead towards the south neighbouring Kabupaten Takalar and the east neighbouring Kabupaten Sinjai. There is one provincial road which runs along the west coastal line of the Kabupaten and is a supporting road to the said regional trunk roads.

The west part of the Kabupaten is covered by a flat area and its Kabupaten road networks are of high density. However the east part of the Kabupaten is mostly a mountainous area, therefore its Kabupaten roads are not as highly developed as those of the west part.

The Kabupaten road which starts from Tamattia, its junction with the provincial road running along the west coastal line, leads to Simpang Malino, its junction with the regional trunk road which runs from east to west. Simpang Malino is located in the central northeast area of the Kabupaten, and the above Kabupaten road is playing an important road for the southern regional development.

Regarding the Kabupaten road networks in the southeast part of the Kabupaten it seem to be necessary to develop roads connecting with the neighbouring Kabupaten around Malakaji as a center.

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 Gowa are confirmed as 54 links and 446 Km respectively. These figures Kabupaten roads with no data.

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

(1) Density of Kabupaten Roads

The density of the Kabupaten roads is 2.37 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. Thus, the Kabupaten progressive in density of Kabupaten roads.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Gowa	446	188,332	2.37
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 : GOWA

(Km)

I02 (7)	ASP	TNH	BTB	L.L	TOTAL
LINK 1	9	3			12
LINK 2		3			3
LINK 3	4				4
LINK 4	6				6
LINK 5			14		14
LINK 6	8		1		9
LINK 7		30			30
LINK 8					
LINK 9			45		45
LINK 10			7		7
LINK 11		39			39
LINK 12		7			7
LINK 13			6		6
LINK 14		7			7
LINK 15		14			14
LINK 16					
LINK 17					
LINK 18		9			9
LINK 19	5	9			14
LINK 20					
LINK 21		6			6
LINK 22		2			2
LINK 23		3			3
LINK 24	2				2
LINK 25			2		2
LINK 26	3				3
LINK 27	4	1			5
LINK 28	2				2
LINK 29		1			1
LINK 30	1				1
LINK 31	2				2
LINK 32	1				1
LINK 33		2	2		4
LINK 34			6		6
LINK 35		4			4
LINK 36		2			2
LINK 37		3			3
LINK 38	6				6
LINK 39			7		7
LINK 40		5	2		7
LINK 41		3	8		11
LINK 42			9		9
LINK 43		5			5
LINK 44		4	2		6
LINK 45		7			7
LINK 46		4			4
LINK 47		6			6
LINK 48		7		1	8
LINK 49		8			8
LINK 50		2			2
LINK 51	2				2
LINK 52		2		1	3
LINK 53			3		3
LINK 54		3	3		6
LINK 55		1	5		6
LINK 56		13			13
LINK 57		1			1
LINK 58		14			14
LINK 59			4		4
LINK 60	3		30		33
TOTAL	58	230	156	2	446
RATIO	13	52	35	0	(%)

KRK : Gravel/Stone/Telford/Water Bound Macadam

TNH : Earth

LL : Others

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

	ASP	KRK	TNH/LL
Kabupaten : Gowa	13.0	35.0	52.0
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 much lower than either that of Indonesia or of Jawa Island. The proportion of low grade roads such as earth roads and others is comparatively high. This means that the road classification in the Kabupaten is low.

(3) Surface Condition of Kabupaten Roads

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

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

	Good	Fair	Poor	Bad
Kabupaten : Gowa	40.3	36.3	19.7	3.7
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 EXISTING ROAD CONDITION BY SURFACE TYPE

PROVINCE : SULAWESI SELATAN

KABUPATEN : GOWA

(%)

NO	ASP				LHN				BTB				L.L			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 1	48	36	17			78	22									
LINK 2					10	45	45									
LINK 3	91	9														
LINK 4	87	13														
LINK 5									41	44	11	4				
LINK 6	95	5							90	10						
LINK 7					3	6	53	39								
LINK 8																
LINK 9									75	9	11	5				
LINK 10									7	77	16					
LINK 11						23	23	54								
LINK 12						53	33	14								
LINK 13									23	52	25					
LINK 14						19	74	7								
LINK 15					19	48	33									
LINK 16																
LINK 17																
LINK 18					27	38	34									
LINK 19	9	60	31		18	42	43	3								
LINK 20																
LINK 21						25	70	15								
LINK 22					93	50	8									
LINK 23					33	40	20	7								
LINK 24	63		18													
LINK 25									93	8						
LINK 26	78	22														
LINK 27	83	17	1			80	20									
LINK 28	52	35	13													
LINK 29					50	50										
LINK 30	80	20														
LINK 31	25	52	23													
LINK 32		80	20													
LINK 33					70	30			83	18						
LINK 34									96	4						
LINK 35					68	32										
LINK 36					5	35	60									
LINK 37					47	40	13									
LINK 38	91	9														
LINK 39									42	53	3	1				
LINK 40					19	20	10	1	3	90	8					
LINK 41					63	37			63	38						
LINK 42									25	54	21					
LINK 43					12	62	26									
LINK 44						75	25			25	75					
LINK 45					56	43	1									
LINK 46					16	76	8									
LINK 47						73	24	3								
LINK 48						61	37	1						40	60	
LINK 49					10	18	27	25								
LINK 50						45	55									
LINK 51		75	25													
LINK 52					80	13	8						80	10	10	
LINK 53									92	8						
LINK 54					37	20	43		96	4						
LINK 55					40	30	30		75	19	6					
LINK 56						14	41	45								
LINK 57					71	29										
LINK 58					26	59	16									
LINK 59									85	1	13					
LINK 60	93	7							66	6	17	11				
AVERAGE	61	29	10	0	24	43	27	6	59	29	12	1	40	25	35	0
LENGTH		58 Ke				230 Ke				156 Ke				2 Ke		
(Ke)	35	17	6	0	55	99	62	14	92	45	19	2	1	1	1	0

The surface condition level of the Kabupaten roads in the Kabupaten is higher than both that of Indonesia and of Jawa Island. The proportion in good condition is fair. Accordingly it seems that road maintenance is carried out diligently in the Kabupaten.

(4) Terrain Conditions of Kabupaten Roads

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

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

The proportions of terrain conditions in the Kabupaten are 54.0% flat, 38.0% hilly and 8.0% mountainous. There is no swampy area in the Kabupaten.

1.3.3 Bridge Inventory

A bridge inventory showing the existing condition of bridges on the Kabupaten roads in Kabupaten Gowa 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 86 bridges with a total length of 678 m of which 2 or 2.3% are timber, 68 or 67.4% are concrete and 23 or 26.7% are others. Steel bridges account for only 3 or 3.6% of the total. On the other hand, 26 bridges with a total length of 297 m are required to be newly constructed.

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

PROV : SULAWESI SELATAN KAB : GOWA

(Km)

102 (3)	DT	BK	GN	TOTAL
LINK 1	12			12
LINK 2	3			3
LINK 3	4			4
LINK 4	6			6
LINK 5	14			14
LINK 6	9			9
LINK 7		30		30
LINK 8		1		
LINK 9	3	19	23	45
LINK 10		7		7
LINK 11		39		39
LINK 12	7			7
LINK 13	6			6
LINK 14	7			7
LINK 15	14			14
LINK 16				
LINK 17				
LINK 18	4	5		9
LINK 19	3	10	1	14
LINK 20				
LINK 21		6		6
LINK 22	2			2
LINK 23	3			3
LINK 24	2			2
LINK 25	2			2
LINK 26	3			3
LINK 27	4	1		5
LINK 28	2			2
LINK 29	1			1
LINK 30	1			1

(Km)

102 (3)	DT	BK	GN	TOTAL
LINK 31	1	1		2
LINK 32	1			1
LINK 33	4			4
LINK 34	6			6
LINK 35	4			4
LINK 36	2			2
LINK 37	3			3
LINK 38	6			6
LINK 39	7			7
LINK 40	7			7
LINK 41	11			11
LINK 42	9			9
LINK 43	5			5
LINK 44	6			6
LINK 45	7			7
LINK 46	3	1		4
LINK 47	4	2		6
LINK 48	5	3		8
LINK 49		8		8
LINK 50		2		2
LINK 51	2			2
LINK 52		3		3
LINK 53	3			3
LINK 54	6			6
LINK 55	6			6
LINK 56		13		13
LINK 57	1			1
LINK 58	14			14
LINK 59	4			4
LINK 60	4	18	11	33
TOTAL	243	168	35	446
RATIO	54	38	8	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SULAWESI SELATAN KAB : GOWA

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

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	3	20.00			3	20.00
2	2	43.60	12	161.00	14	204.60
5	3	15.00			3	15.00
6	4	18.00			4	18.00
7	1	4.00	2	7.00	3	11.00
9	18	126.00			18	126.00
10	5	40.00			5	40.00
11	3	31.50	3	35.00	6	66.50
12	5	27.50			5	27.50
13	1	4.00			1	4.00
18	4	13.00			4	13.00
19	4	54.00			4	54.00
21	1	4.00	1	7.00	2	11.00
23	3	15.00			3	15.00
24	2	9.00			2	9.00
27	3	11.00			3	11.00
28	1	4.00			1	4.00
32	1	4.00			1	4.00
34	1	12.00			1	12.00
35	1	10.00			1	10.00
40	1	9.00			1	9.00
41	3	0.04			3	0.04
45	1	3.00			1	3.00
47	3	22.00			3	22.00
48			1	4.00	1	4.00
49			3	35.00	3	35.00
50			1	4.00	1	4.00
53	2	13.50			2	13.50
54	1	4.50			1	4.50
55	2	11.75			2	11.75
56			3	44.00	3	44.00
59	1	6.00			1	6.00
60	6	143.00			6	143.00
TOTAL	86	678.39	26	297.00	112	975.39

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

PROV : SULAWESI SELATAN KAB : GOWA

(No)

103 (1B)	BT	LL	RJ	KY	TOTAL
LINK 1	2	1			3
LINK 2		2			2
LINK 5	3				3
LINK 6	3	1			4
LINK 7		1			1
LINK 9	16	1	1		18
LINK 10	5				5
LINK 11	1	1	1		3
LINK 12	4	1			5
LINK 13	1		1		1
LINK 18	2	2			4
LINK 19	3		1		4
LINK 21		1			1
LINK 23	1	2			3
LINK 24	1	1			2
LINK 27	1	2			3
LINK 28		1			1
LINK 32		1			1
LINK 34	1				1
LINK 35				1	1
LINK 40	1				1
LINK 41	3				3
LINK 45		1			1
LINK 47	3				3
LINK 48					
LINK 49					
LINK 50					
LINK 53	1			1	2
LINK 54		1			1
LINK 55	2				2
LINK 56					
LINK 59	1				1
LINK 60	3	3			6
TOTAL	58	23	3	2	86
RATIO	67	27	3	2	(%)

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	-	1	-	-	-	-	-	-	-	2
Concrete	9	14	20	8	3	1	-	-	-	3	58
Steel	-	2	-	-	-	-	-	-	-	1	3
Others	7	14	-	-	-	-	-	-	-	2	23
Total	17	30	21	8	3	1	-	-	-	6	86

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 Gowa 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	1,733	490	1,704	3,293	5,580
Proportion (%)	24.00	6.79	23.60	45.61	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	1.30	0.86	6.52	91.32	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:

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

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 : GOWA

A)	Growth Rate of Population	:	0.60 (%)
B)	Growth Rate of Cultivated Area	:	0.20 (%)
C)	Growth Rate of Rice field	:	1.00 (%)
D)	Growth Rate of Rice yield rate	:	6.00 (%)
E)	Growth Rate of GDP / capita	:	6.60 (%)
a)	Geometrical Mean (A x B)	:	0.40 (%)
b)	Geometrical Mean (C x D)	:	3.47 (%)
c)	Geometrical Mean (a x b)	:	1.92 (%)
d)	Geometrical Mean (c x E)	:	4.24 (%)
	TRAFFIC GROWTH RATE	:	4.24 (%)

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 : GOWA

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	100	20	80	60	230	4.2%	172	34	137	103	395	IIIB-1
2	20	10	30	45	83	4.2%	34	17	51	77	142	IIIB-2
3	80	10	50	100	190	4.2%	137	17	86	172	326	IIIB-1
4	85	25	50	120	220	4.2%	146	43	86	206	377	IIIB-1
5	70	5	40	120	175	4.2%	120	9	69	206	300	IIIB-1
6	14	0	49	31	79	4.2%	24	0	84	53	136	IIIB-2
7	0	0	1	2	2	4.2%	0	0	2	3	3	IIIC
8	0	0	0	0	0	4.2%	0	0	0	0	0	IIIC
9	15	0	45	25	73	4.2%	26	0	77	43	125	IIIB-2
10	15	0	5	10	25	4.2%	26	0	9	17	43	IIIC
11	0	0	2	3	4	4.2%	0	0	3	5	7	IIIC
12	20	20	30	50	95	4.2%	34	34	51	86	163	IIIB-2
13	25	0	25	50	75	4.2%	43	0	43	86	129	IIIB-2
14	5	0	15	25	33	4.2%	9	0	26	43	57	IIIB-2
15	1	0	3	6	7	4.2%	2	0	5	10	12	IIIC
16	0	0	0	0	0	4.2%	0	0	0	0	0	IIIC
17	0	0	0	0	0	4.2%	0	0	0	0	0	IIIC
18	10	10	30	50	75	4.2%	17	17	51	86	129	IIIB-2
19	20	10	80	80	150	4.2%	34	17	137	137	257	IIIB-1
20	0	0	0	0	0	4.2%	0	0	0	0	0	IIIC
21	1	0	2	5	6	4.2%	2	0	3	9	10	IIIC
22	10	0	20	40	50	4.2%	17	0	34	69	86	IIIB-2
23	10	0	20	40	50	4.2%	17	0	34	69	86	IIIB-2
24	125	50	60	200	335	4.2%	214	86	103	343	575	IIIA
25	50	10	40	100	150	4.2%	86	17	69	172	257	IIIB-1
26	50	20	35	70	140	4.2%	86	34	60	120	240	IIIB-1
27	60	30	50	100	190	4.2%	103	51	86	172	326	IIIB-1
28	100	70	80	250	375	4.2%	172	120	137	429	643	IIIA
29	5	5	0	40	30	4.2%	9	9	0	69	51	IIIB-2
30	20	25	60	60	135	4.2%	34	43	103	103	232	IIIB-1
31	150	100	100	250	475	4.2%	257	172	172	429	815	IIIA
32	60	10	50	90	165	4.2%	103	17	86	154	283	IIIB-1
33	20	0	15	50	60	4.2%	34	0	26	86	103	IIIB-2
34	50	5	25	75	118	4.2%	86	9	43	129	202	IIIB-1
35	5	0	10	40	35	4.2%	9	0	17	69	60	IIIB-2
36	0	0	5	10	10	4.2%	0	0	9	17	17	IIIC
37	5	0	5	20	20	4.2%	9	0	9	34	34	IIIC
38	70	10	50	60	160	4.2%	120	17	86	103	275	IIIB-1
39	70	5	50	70	160	4.2%	120	9	86	120	275	IIIB-1
40	20	5	30	50	80	4.2%	34	9	51	86	137	IIIB-2
41	60	0	20	80	120	4.2%	103	0	34	137	206	IIIB-1
42	5	0	20	35	43	4.2%	9	0	34	60	74	IIIB-2
43	15	0	30	65	78	4.2%	26	0	51	112	134	IIIB-2
44	20	0	30	50	75	4.2%	34	0	51	86	129	IIIB-2
45	20	0	20	50	65	4.2%	34	0	34	86	112	IIIB-2
46	10	10	20	30	55	4.2%	17	17	34	51	94	IIIB-2
47	50	5	20	40	95	4.2%	86	9	34	69	163	IIIB-2
48	5	0	10	30	30	4.2%	9	0	17	51	51	IIIB-2
49	2	0	10	40	32	4.2%	3	0	17	69	55	IIIB-2
50	2	0	3	7	9	4.2%	3	0	5	12	15	IIIC

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

PROV : SULAWESI SELATAN KAB : GOWA

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	30	20	40	60	120	4.2%	51	34	69	103	206	IIIB-1
52	20	0	20	40	60	4.2%	34	0	34	69	103	IIIB-2
53	20	0	30	100	100	4.2%	34	0	51	172	172	IIIB-2
54	30	0	25	50	80	4.2%	51	0	43	86	137	IIIB-2
55	20	0	30	70	85	4.2%	34	0	51	120	146	IIIB-2
56	0	0	1	2	2	4.2%	0	0	2	3	3	IIIC
57	15	0	5	35	38	4.2%	26	0	9	60	65	IIIB-2
58	20	0	30	50	75	4.2%	34	0	51	86	129	IIIB-2
59	14	0	49	31	79	4.2%	24	0	84	53	136	IIIB-2
60	14	0	49	31	79	4.2%	24	0	84	53	136	IIIB-2
PERCENT	24.00	6.79	23.60	45.61			24.00	6.79	23.60	45.61		

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 : GOWA

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
7	IIIB-2	KRK	16	4	15	30	50
10	IIIC	KRK	4	1	3	7	12
11	IIIB-2	KRK	20	6	19	38	64
14	IIIC	KRK	8	2	8	15	26
15	IIIC	KRK	7	2	6	13	22
21	IIIC	KRK	3	1	3	6	10
22	IIIC	KRK	2	0	1	3	5
23	IIIC	KRK	2	1	2	4	7
29	IIIC	KRK	1	0	1	3	4
35	IIIC	KRK	4	1	4	8	13
36	IIIC	KRK	2	1	2	4	7
37	IIIC	KRK	3	1	3	6	10
42	IIIC	KRK	11	3	10	20	34
46	IIIC	KRK	3	1	3	6	10
48	IIIC	KRK	10	3	9	18	31
49	IIIC	KRK	4	1	4	8	13
50	IIIC	KRK	1	0	1	2	3
56	IIIC	KRK	7	2	6	13	22
57	IIIC	KRK	1	0	1	2	3

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 : GOWA

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 9	LINK 10	LINK 11
	12 Km	3 Km	4 Km	6 Km	14 Km	9 Km	30 Km	45 Km	7 Km	39 Km
	IIIB-1	IIIB-2	IIIB-1	IIIB-1	IIIB-1	IIIB-2	IIIB-2	IIIB-2	IIIC	IIIB-2
YEAR	VOC	VOC	VOC	VOC	VOC	VOC	Surplus	VOC	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	40831	8237	425	1036	32698	226	45614	20592	565	74288
1990	42561	8585	443	1085	33925	231	45772	21189	565	78243
1991	44453	8940	464	1125	35366	243	47322	22328	565	78448
1992	46356	9288	482	1174	37002	255	48806	23185	565	78448
1993	48269	9753	505	1222	38680	264	48964	24355	565	82403
1994	50171	10206	525	1278	40148	273	48964	25211	565	82403
1995	52257	10456	546	1333	42048	285	51997	26381	565	86357
1996	54671	11023	569	1382	43731	297	51997	27520	565	86562
1997	57092	11384	594	1444	45463	312	52155	28690	573	88765
1998	59350	11849	619	1508	47578	324	55189	29860	640	92720
SUM	496011	99721	5172	12587	396639	2710	496780	249311	5733	828637
COST	229878	46563	-18651	-25102	159843	-30793	192541	-13781	-21701	360060
/Km	19157	16188	-4663	-4184	11417	-3421	6418	-306	-3100	9232

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.

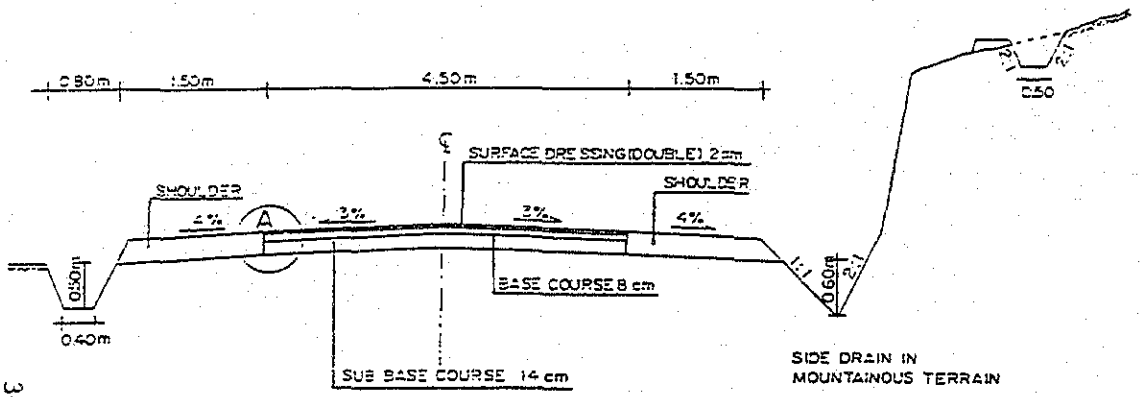
Table 3-1-1

DESIGN CRITERIA FOR KABUPATEN ROADS

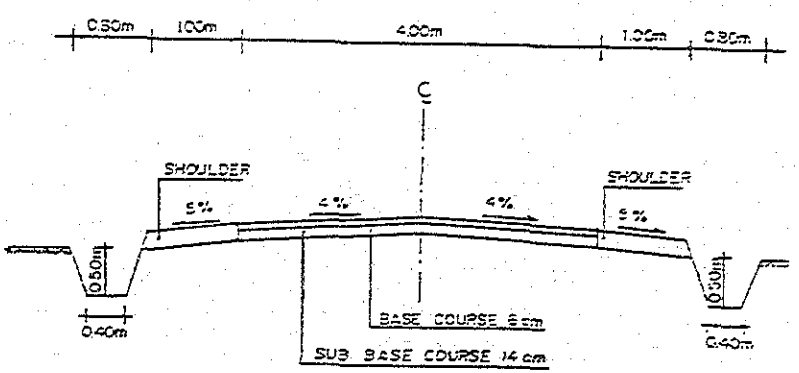
ROAD CLASSIFICATION		CLASS III A			CLASS III B-1			CLASS III B-2			CLASS III C		
SURFACE TYPE		ASPHALT SEAL (DOUBLE)			ASPHALT SEAL (SINGLE)			GRAVEL			GRAVEL		
TRAFFIC VOLUME : ADT (Forecast 10 th year average per day)		3000 - 500			500 - 200			200 - 50			50		
T E R R A I N		FLAT TO ROLLING	HILLY	MOUNT-AINOUS	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

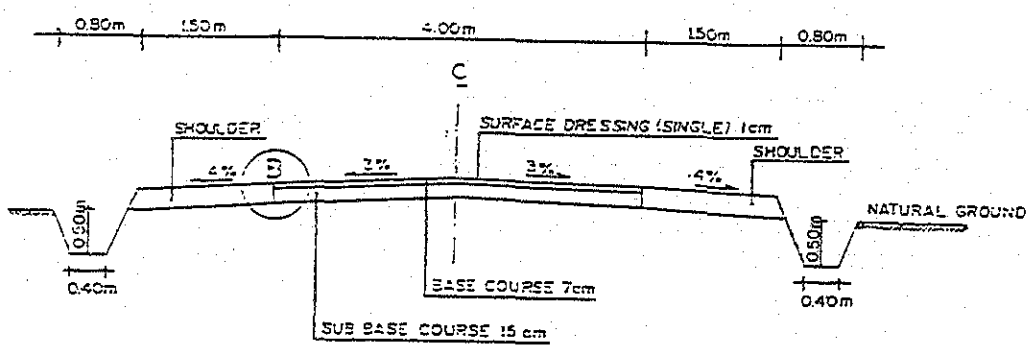
CLASS III A



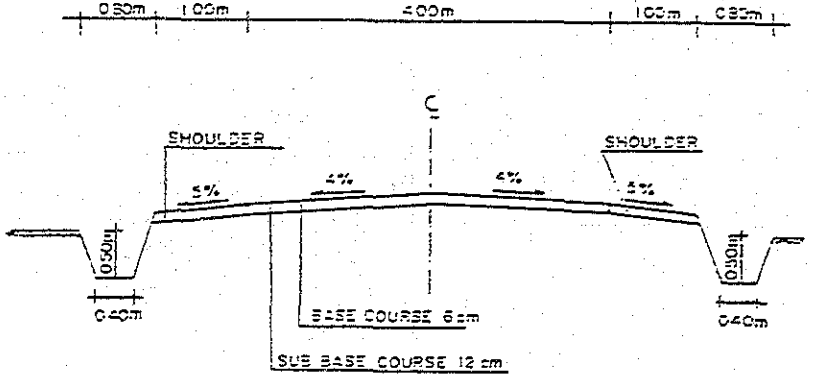
CLASS III B-2



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

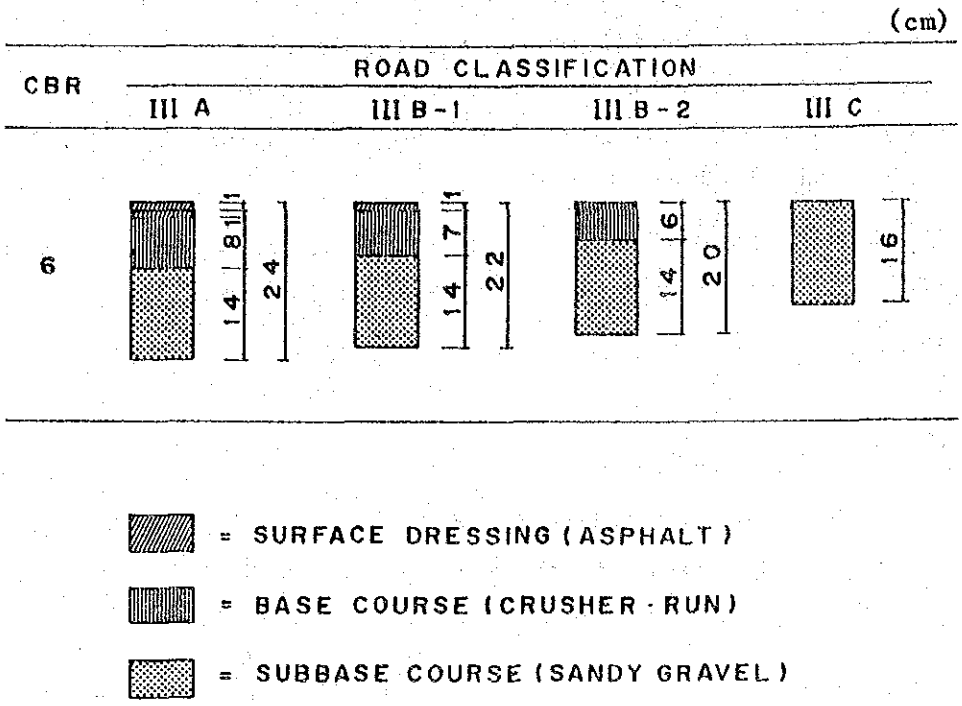
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

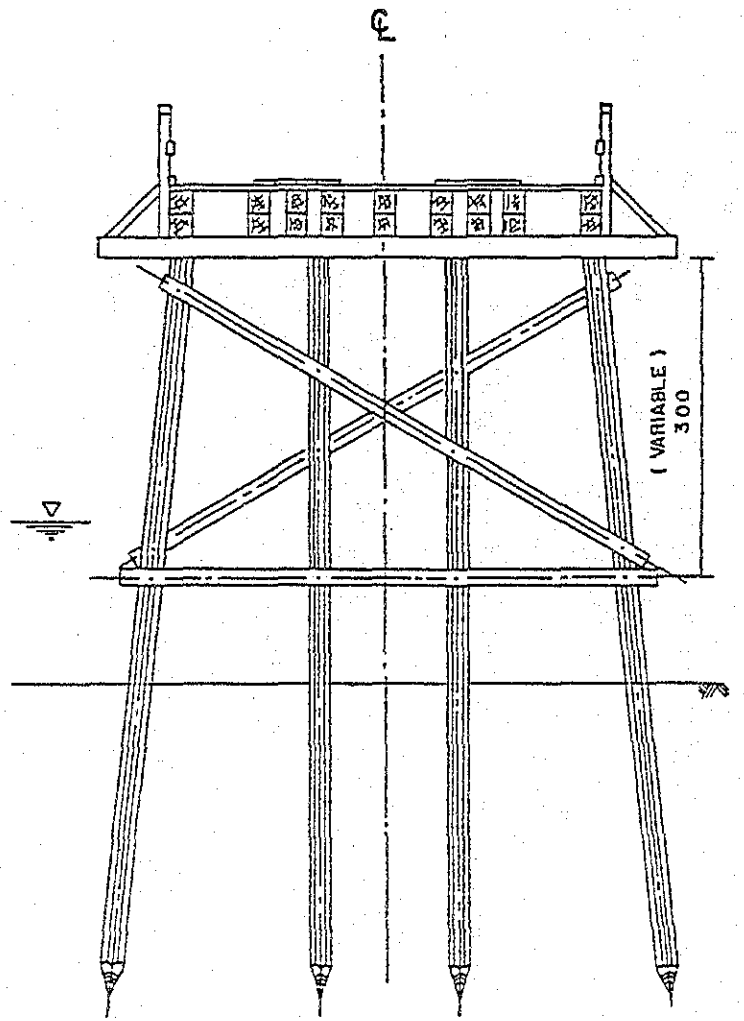
3) Foundation

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.

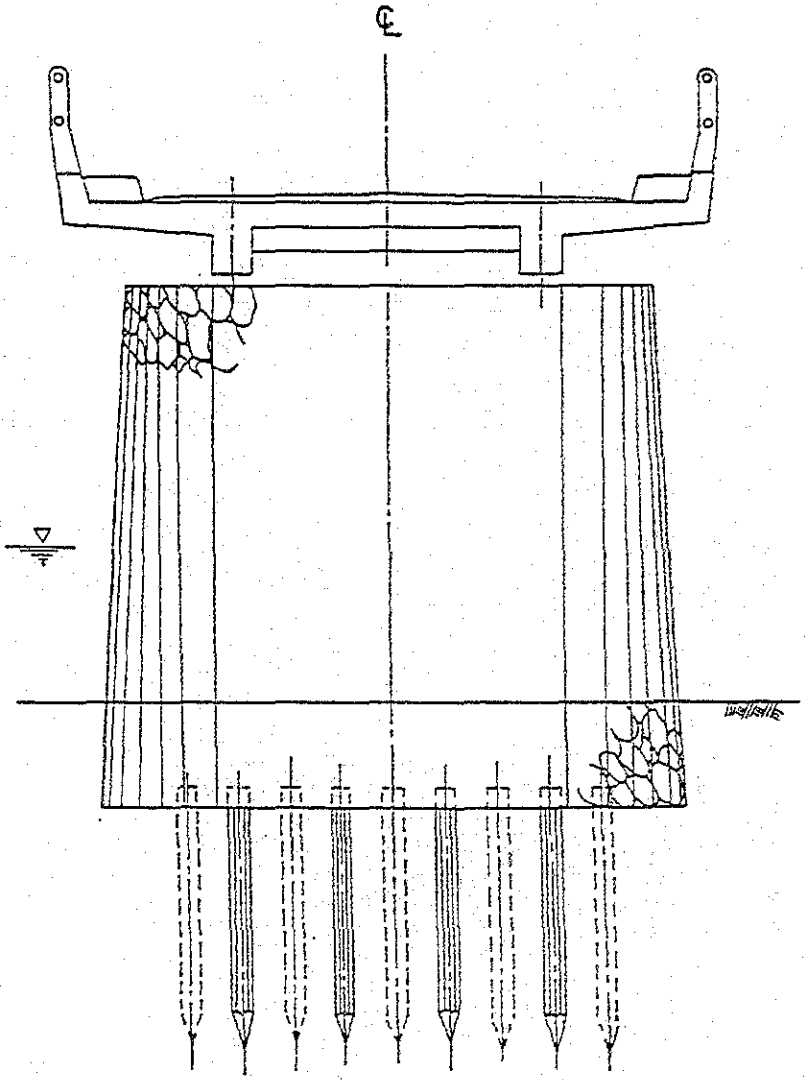
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

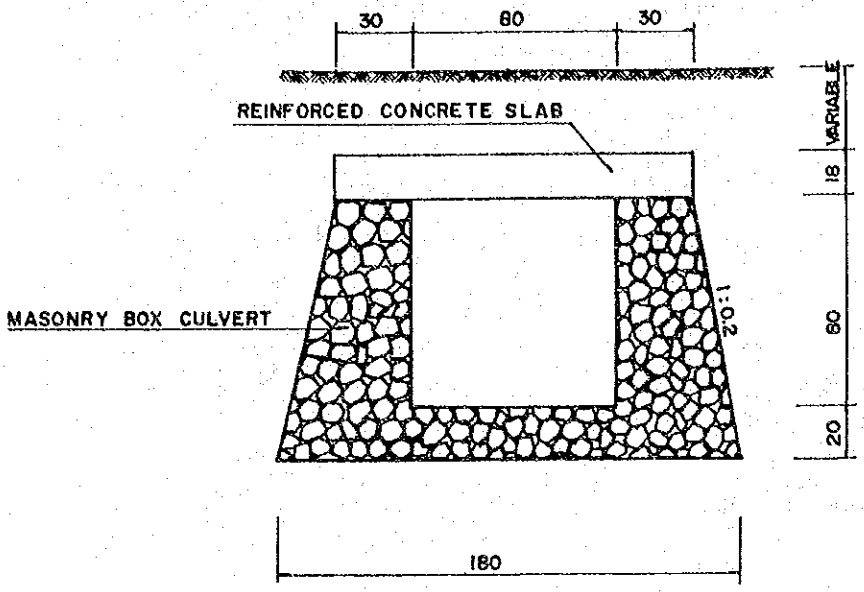
(2) Retaining Wall

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

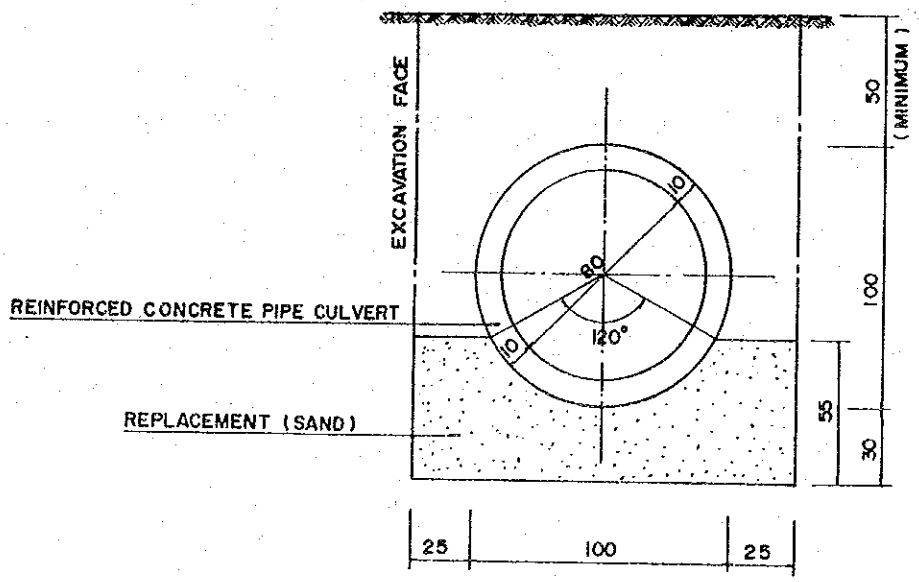
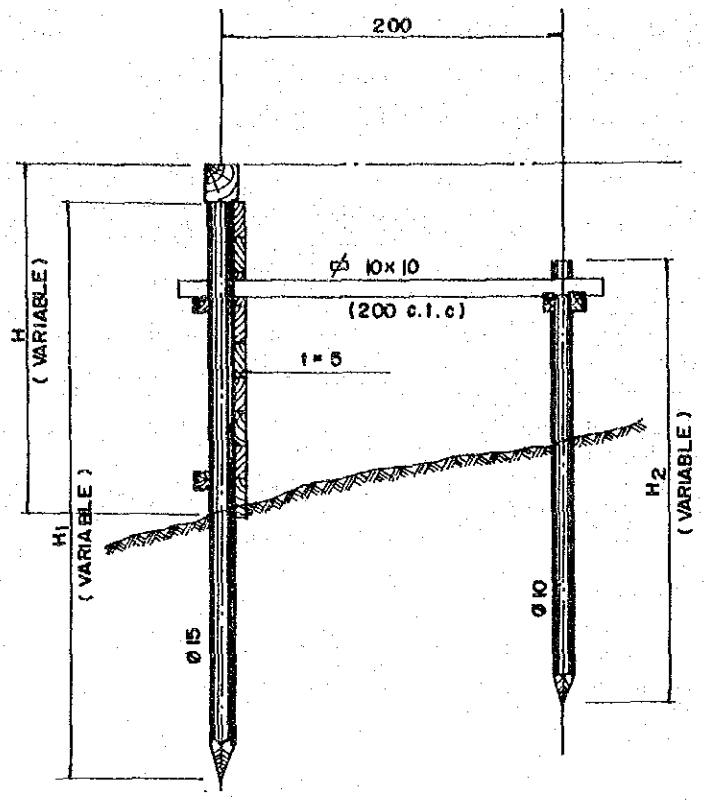
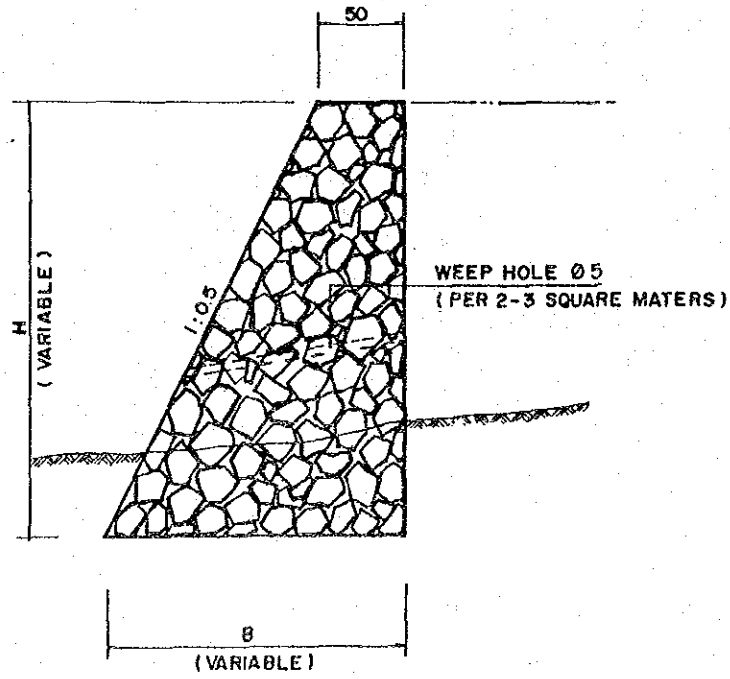


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Gowa 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 Gowa 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 : GOWA

(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	13,090	13,401	7,769	1,034	8,803	22,204
	Bulldozer/Ripper	120 HP	340	14,111	14,451	8,500	1,591	10,091	24,542
	Swamp Bulldozer	120 HP	356	14,355	14,711	8,879	1,662	10,541	25,252
	Bulldozer	90 HP	197	8,869	9,066	4,914	654	5,568	14,634
	Bulldozer/Ripper	90 HP	212	9,465	9,677	5,300	992	6,292	15,969
	Bulldozer	65 HP	140	6,445	6,585	3,500	465	3,965	10,550
	Bulldozer/Ripper	65 HP	153	6,898	7,051	3,819	714	4,533	11,584
	Swamp Bulldozer	90 HP	212	9,455	9,667	5,284	989	6,273	15,940
	Swamp Bulldozer	65 HP	162	6,787	6,949	4,050	758	4,808	11,757
	Motor Grader	110 HP	277	11,325	11,602	6,919	1,295	8,214	19,816
	Motor Grader	75 HP	192	7,762	7,954	4,779	894	5,673	13,627
	Motor Grader	65 HP	172	6,829	7,001	4,300	804	5,104	12,105
	Road Stabilizer	W=1850 mm	344	3,414	3,758	8,594	428	9,022	12,780
	Vibratory Roller	4 ton	116	3,399	3,515	2,900	385	3,285	6,800
	Hand-guide Vib. Roller	1000 Kg	102	617	719	850	30	880	1,599
	Tire Roller	8-15 ton	125	7,558	7,683	3,106	103	3,209	10,892
	Vibratory Roller (D&T)	4 ton	116	3,399	3,515	2,900	385	3,285	6,800
	Hand-guide Vib. Roller	600 Kg	72	422	494	600	21	621	1,115
	Rough Terrain Crane	10 ton	402	13,207	13,609	10,039	751	10,790	24,399
	Hydraulic Excavator; Wheel	0.3 m3	165	7,975	8,140	4,109	546	4,655	12,795
	Wheel Loader	1.2 m3	281	8,585	8,866	7,019	934	7,953	16,819
	Wheel Loader	0.3 m3	91	2,998	3,089	2,269	302	2,571	5,660
	Water Tank Truck	4000 ltr.	105	2,918	3,023	868	124	992	4,015
	Fuel Tank Truck	4000 ltr.	106	2,924	3,030	882	126	1,008	4,038
	Dump Truck	3.0 ton	177	3,654	3,831	1,469	210	1,679	5,510
	Flat Bed Truck with Crane	3.0 ton	69	3,155	3,224	1,717	128	1,845	5,069
	Dump Loader Truck	12 ton	154	19,454	19,608	3,838	127	3,965	23,573
	Dump Truck	5.0 ton	263	6,033	6,296	2,189	313	2,502	8,798
	Flat Bed Truck	3.0 ton	23	2,725	2,748	563	42	605	3,353
	Portable Crusher/Screening	30-40 t/h	752	22,091	22,843	18,800	2,502	21,302	44,145
	Concrete Mixer	0.5 m3	648	2,484	3,132	5,400	435	5,835	8,967
	Water Pump	200 l/min	23	270	293	188	6	194	487
	Concrete Vibrator	3.3 HP	9	232	241	73	2	75	316
	Asphalt Sprayer	850 ltr.	123	789	912	1,019	145	1,164	2,076

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 : GOWA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	163	91	254
Subgrade Preparation	m2	20	11	31
Normal Fill	m3	1,683	865	2,548
Fill in Swamp	m3	2,494	1,055	3,549
Normal Excavation to Spoil	m3	986	524	1,510
Sub Base Course	m3	3,189	1,351	4,540
Base Course	m3	4,364	2,303	6,667
Shoulder	m2	293	146	439
Asphalt Patching	m2	3,372	1,346	4,718
Surface Dressing (Single)	m2	587	552	1,139
Surface Dressing (Double)	m2	734	868	1,602
Earth Drain	m	773	119	892
Earth Drain in Swamp (by machine)	m3	1,157	475	1,632
Pipe Culvert D80cm	m	39,235	40,307	79,542
Masonry Culvert (80x80cm)	m	* 53,753	34,731	88,484
Retaining Wall and Wing Wall (Timber)	m2	16,836	246	17,082
Retaining Wall and Wing Wall (Masonry)	m3	37,429	11,421	48,850
Gabion Protection	m3	9,029	121	9,150
Manual routine maintenance of road	Km	121,976	7,260	129,236
Routine maintenance of earth road	Km	91,873	37,948	129,821
Routine maintenance of gravel road	Km	188,115	88,186	276,301
Routine maintenance of asphalt road	Km	337,200	134,600	471,800

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 : GOWA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	57,600	4,626	62,226
Superstructure (Timber;Span 5m;10T)	m2	63,802	5,107	68,909
Superstructure (Timber;Span 8m;10T)	m2	84,511	6,706	91,217
Superstructure (Timber;Span 3m;BM50)	m2	71,423	5,719	77,142
Superstructure (Timber;Span 5m;BM50)	m2	77,976	6,195	84,171
Superstructure (Timber;Span 8m;BM50)	m2	98,895	7,841	106,736
Superstructure (Concrete;Span 3m;BM50)	m2	57,937	81,925	139,862
Superstructure (Concrete;Span 5m;BM50)	m2	59,060	91,542	150,602
Superstructure (Concrete;Span 8m;BM50)	m2	60,502	99,704	160,206
Superstructure (Concrete;Span10m;BM50)	m2	65,879	113,234	179,113
Superstructure (Concrete;Span15m;BM50)	m2	70,320	133,369	203,689
Substructure (Pier;for Timber;10T)	NO	501,630	43,123	544,753
Substructure (Abut;for Timber;10T)	NO	1,322,754	189,655	1,512,409
Substructure (Pier;for Timber;BM50)	NO	737,732	63,842	801,574
Substructure (Abut;for Timber;BM50)	NO	1,500,543	212,676	1,713,219
Substructure (Pier;for Concrete;BM50)	NO	1,532,352	452,906	1,985,258
Substructure (Abut;for Concrete;BM50)	NO	3,265,387	959,362	4,224,749
Demolition of Bridge (Timber->Timber)	m2	15,706	1,730	17,436
Demolition of Bridge (Timber->Concrete)	m2	15,706	1,730	17,436
Demolition of Bridge (Concrete)	m2	81,154	64,824	145,978
Maintenance of Timber Bridge (New)	m2	10,222	1,344	11,566
Maintenance of Concrete Bridge (New)	m2	2,003	2,456	4,459
Maintenance of Timber Bridge (Exist)	m2	8,935	2,517	11,452
Maintenance of Concrete Bridge (Exist)	m2	4,224	2,336	6,560

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 Gowa are shown in Table 5-1-1.

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

KABUPATEN : GOWA

CRITERIA NO	ROAD LINK NO
(8)	08,16,17,20

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 : BOWA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
19	14 Km	IIIB-1	39.957	VOC
12	7 Km	IIIB-2	39.774	VOC
31	2 Km	IIIA	34.282	VOC
47	6 Km	IIIB-2	33.559	VOC
1	12 Km	IIIB-1	33.067	VOC
18	9 Km	IIIB-2	26.525	VOC
43	5 Km	IIIB-2	24.774	VOC
40	7 Km	IIIB-2	23.965	VOC
58	14 Km	IIIB-2	23.695	VOC
44	6 Km	IIIB-2	23.631	VOC
11	39 Km	IIIB-2	18.125	Surplus
5	14 Km	IIIB-1	15.647	VOC
45	7 Km	IIIB-2	15.112	VOC
39	7 Km	IIIB-1	14.363	VOC
54	6 Km	IIIB-2	11.877	VOC
41	11 Km	IIIB-1	8.897	VOC
28	2 Km	IIIA	8.086	VOC
7	30 Km	IIIB-2	7.155	Surplus
27	5 Km	IIIB-1	6.111	VOC
52	3 Km	IIIB-2	4.557	VOC
32	1 Km	IIIB-1	3.925	VOC
33	4 Km	IIIB-2	0.941	VOC
9	45 Km	IIIB-2	0.078	VOC
10	7 Km	IIIC	0.078	Surplus
29	1 Km	IIIC	0.078	Surplus
30	1 Km	IIIB-1	0.078	VOC
4	6 Km	IIIB-1	0.078	VOC
2	3 Km	IIIB-2	0.078	VOC
13	6 Km	IIIB-2	0.078	VOC
34	6 Km	IIIB-1	0.078	VOC
35	4 Km	IIIC	0.078	Surplus
36	2 Km	IIIC	0.078	Surplus
37	3 Km	IIIC	0.078	Surplus
38	6 Km	IIIB-1	0.078	VOC
14	7 Km	IIIC	0.078	Surplus
15	14 Km	IIIC	0.078	Surplus
6	9 Km	IIIB-2	0.078	VOC
42	9 Km	IIIC	0.078	Surplus
3	4 Km	IIIB-1	0.078	VOC
21	6 Km	IIIC	0.078	Surplus
22	2 Km	IIIC	0.078	Surplus
46	4 Km	IIIC	0.078	Surplus
23	3 Km	IIIC	0.078	Surplus
48	8 Km	IIIC	0.078	Surplus
49	8 Km	IIIC	0.078	Surplus
50	2 Km	IIIC	0.078	Surplus
51	2 Km	IIIB-1	0.078	VOC
24	2 Km	IIIA	0.078	VOC
53	3 Km	IIIB-2	0.078	VOC
25	2 Km	IIIB-1	0.078	VOC

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

PROVINCE : SULAWESI SELATAN KABUPATEN : GOWA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
55	6 Km	IIIB-2	0.078	VOC
56	13 Km	IIIC	0.078	Surplus
57	1 Km	IIIC	0.078	Surplus
26	3 Km	IIIB-1	0.078	VOC
59	4 Km	IIIB-2	0.078	VOC
60	33 Km	IIIB-2	0.078	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SULAWESI SELATAN KABUPATEN : GOWA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
32	1 Km	IIIB-2	36.760	VOC
27	5 Km	IIIB-2	26.705	VOC
41	11 Km	IIIB-2	11.265	VOC
7	30 Km	IIIC	11.244	Surplus
52	3 Km	IIIC	9.451	VOC
20	2 Km	IIIB-1	8.086	VOC

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SULAWESI SELATAN KABUPATEN : GOWA

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
19	14 Km	IIIB-1	251564	2.251	39.957	VOC
1	12 Km	IIIB-1	142257	1.915	33.067	VOC
11	39 Km	IIIB-2	120827	1.303	18.125	Surplus
12	7 Km	IIIB-2	99068	2.275	39.774	VOC
58	14 Km	IIIB-2	78392	1.566	23.695	VOC
47	6 Km	IIIB-2	67943	1.992	33.559	VOC
18	9 Km	IIIB-2	60969	1.677	26.525	VOC
5	14 Km	IIIB-1	41712	1.210	15.647	VOC
40	7 Km	IIIB-2	32395	1.536	23.965	VOC
44	6 Km	IIIB-2	30530	1.548	23.631	VOC
43	5 Km	IIIB-2	29242	1.614	24.774	VOC
31	2 Km	IIIA	24848	1.980	34.282	VOC
27	5 Km	IIIB-2	15607	1.490	26.705	VOC
39	7 Km	IIIB-1	14232	1.158	14.363	VOC
45	7 Km	IIIB-2	13852	1.198	15.112	VOC
7	30 Km	IIIC	13232	1.044	11.244	Surplus
32	1 Km	IIIB-2	4300	1.737	36.760	VOC
54	6 Km	IIIB-2	3540	1.066	11.877	VOC
41	11 Km	IIIB-2	3431	1.042	11.265	VOC
SUM	202 Km		1047941			

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: Gowa

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	412	1,299	1,711
MAINTENANCE	163	514	677
SUPPLEMENTATION	399	-	399
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,019	1,813	2,832

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	194	1,798	1,992
CONSTRUCTION & MAINTENANCE EQUIPMENT	719	-	719
SPARE PARTS	61	15	76
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,019	1,813	2,832

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 20 links with the total length of 205 km which is 46% of the 446 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 : GOWA

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	1,5,11,12,18,19,31,39,40,43,44,45, 47,54,58
- Secondary	7,27,32,41,
Engineering Point of View	2
Basic Human Needs	-

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

Road Links No 2 is selected from the engineering points of view.

Because without improvement of this road link improvement of feasible road links No 45 and No 47 can not be carried out.

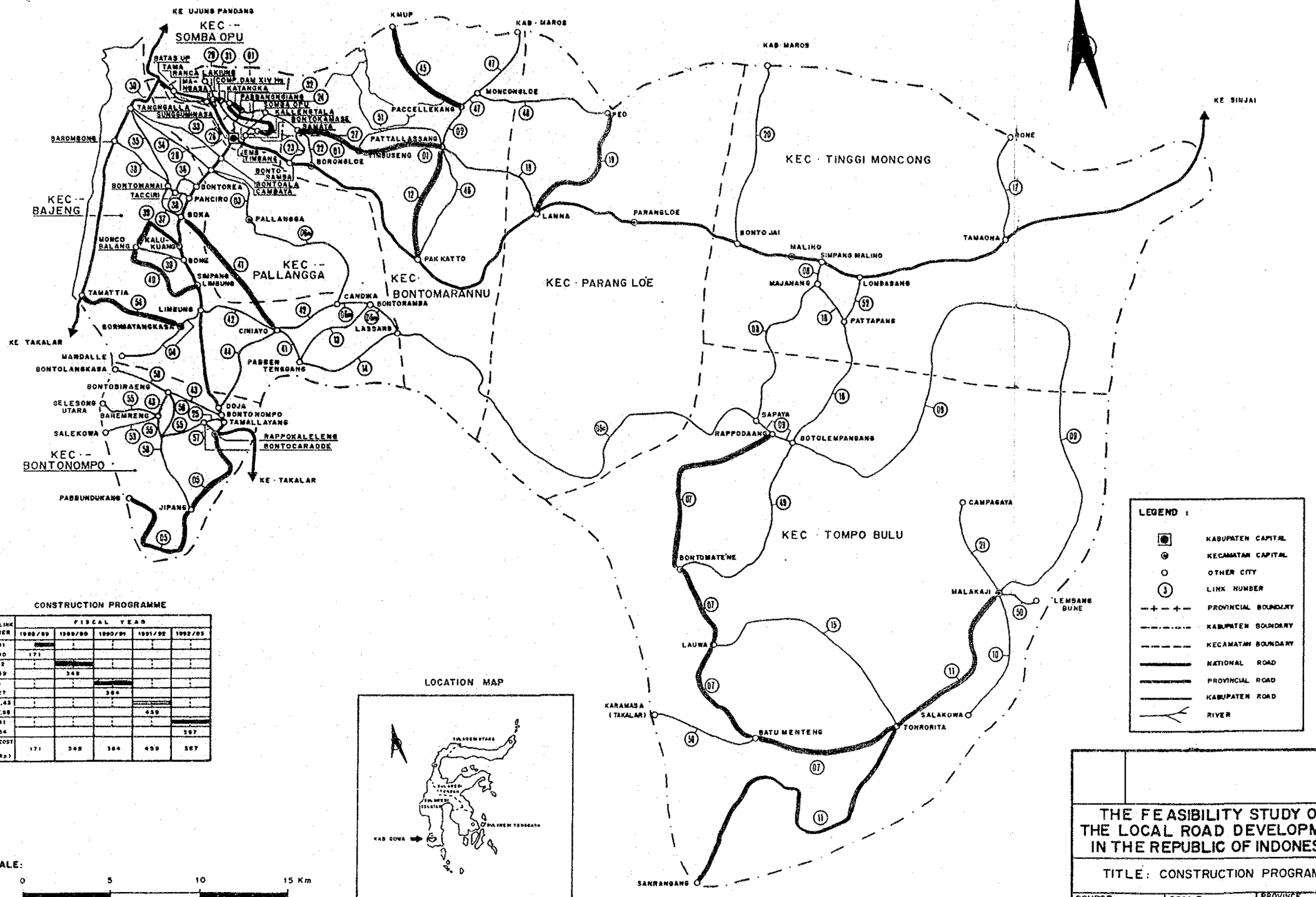
The order of proceeding with the improvement of the proposed road links are decided as shown in Table 6-1-4.

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

PROV : SULAWESI SELATAN KAB : GOWA

YEAR	LINK NO ( ) : rate
1988	1, 31, 32, 40
1989	11 (30%), 12, 19, 39
1990	5, 11 (70%), 27
1991	2, 18, 43, 44, 47, 58
1992	7, 41, 45, 54

KAB · GOWA



CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR				
	1988/89	1989/90	1990/91	1991/92	1992/93
01,31					
32,40	171				
11,12					
19,39		348			
05					
11,27			364		
02,18,43					
44,47,58				459	
07,41					
45,54					387
TOTAL COST (10^6 Rp.)	171	348	364	459	387

SCALE:

0 5 10 15 Km

LOCATION MAP

LEGEND :

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

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

TITLE: CONSTRUCTION PROGRAMME

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

(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 : GOWA

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TH NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
1	12	35.8	46.3	17.9	0.0	9	0	3	0	0.00	3	87.50	574	5,144	1,617	6,761
3	4	90.8	9.3	0.0	0.0	4	0	0	0	0.00	0	0.00	0	1,837	567	2,404
4	6	86.8	13.2	0.0	0.0	6	0	0	0	0.00	0	0.00	0	2,755	851	3,606
5	14	40.7	44.3	11.4	3.6	0	14	0	0	0.00	3	67.50	443	4,626	1,494	6,120
6	9	94.8	5.2	0.0	0.0	8	1	0	0	0.00	4	84.00	551	4,338	1,427	5,765
9	45	74.8	9.0	11.1	5.1	0	45	0	0	0.00	18	501.00	3,287	16,070	5,465	21,535
10	7	7.1	77.1	15.7	0.0	0	7	0	0	0.00	5	184.50	1,210	2,950	1,099	4,049
12	7	0.0	52.9	32.9	14.3	0	0	7	0	0.00	5	114.00	748	1,978	583	2,561
13	6	22.5	52.5	25.0	0.0	0	6	0	0	0.00	1	24.00	157	1,962	629	2,591
18	9	27.2	38.3	34.4	0.0	0	0	9	0	0.00	4	58.00	380	2,170	542	2,712
19	14	10.4	48.6	38.9	2.1	5	0	9	0	0.00	4	215.00	1,410	5,129	1,618	6,747
22	2	42.5	50.0	7.5	0.0	0	0	2	0	0.00	0	0.00	0	428	90	518
23	3	33.3	40.0	20.0	6.7	0	0	3	0	0.00	3	73.50	482	952	307	1,259
24	2	82.5	0.0	17.5	0.0	2	0	0	0	0.00	2	31.00	203	1,049	356	1,405
25	2	92.5	7.5	0.0	0.0	0	2	0	0	0.00	0	0.00	0	620	191	811
26	3	78.3	21.7	0.0	0.0	3	0	0	0	0.00	0	0.00	0	1,378	426	1,804
27	5	66.0	29.6	4.4	0.0	4	0	1	0	0.00	3	73.00	479	2,359	783	3,142
28	2	52.5	35.0	12.5	0.0	2	0	0	0	0.00	1	16.00	105	986	321	1,307
29	1	50.0	50.0	0.0	0.0	0	0	1	0	0.00	0	0.00	0	214	45	259
30	1	80.0	20.0	0.0	0.0	1	0	0	0	0.00	0	0.00	0	459	142	601
31	2	25.0	52.5	22.5	0.0	2	0	0	0	0.00	0	0.00	0	918	284	1,202
32	1	0.0	80.0	20.0	0.0	1	0	0	0	0.00	1	16.00	105	527	179	706
33	4	76.3	23.8	0.0	0.0	0	2	2	0	0.00	0	0.00	0	1,048	281	1,329

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

PROV : SULAWESI SELATAN KAB : BONE

(1000Rp)

LINK NO	LENGTH (Km)	DA (%)	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
34	6	96.3	3.7	0.0	0.0	0	6	0	0	0.00	1	40.00	315	2,063	685	2,748
35	4	68.3	31.8	0.0	0.0	0	0	4	1	25.00	0	0.00	286	1,079	244	1,323
37	3	46.7	40.0	13.3	0.0	0	0	3	0	0.00	0	0.00	0	642	136	778
38	6	70.8	9.2	0.0	0.0	6	0	0	0	0.00	0	0.00	0	2,755	851	3,606
39	7	41.9	53.4	3.3	1.4	0	7	0	0	0.00	0	0.00	0	2,171	668	2,839
40	7	14.3	75.7	9.3	0.7	0	2	5	0	0.00	1	36.00	236	1,841	501	2,342
41	11	62.7	37.3	0.0	0.0	0	8	3	0	0.00	3	0.15	1	3,123	900	4,023
42	9	25.0	54.4	20.6	0.0	0	9	0	0	0.00	0	0.00	0	2,791	859	3,650
43	5	12.0	62.0	26.0	0.0	0	0	5	0	0.00	0	0.00	0	1,069	226	1,295
44	6	0.0	58.3	41.7	0.0	0	2	4	0	0.00	0	0.00	0	1,476	372	1,848
45	7	55.7	42.9	1.4	0.0	0	0	7	0	0.00	1	12.00	79	1,548	344	1,892
46	4	16.0	76.3	7.8	0.0	0	0	4	0	0.00	0	0.00	0	855	181	1,036
47	6	0.0	73.3	24.7	2.5	0	0	6	0	0.00	3	99.00	649	1,701	503	2,204
51	2	0.0	75.0	25.0	0.0	2	0	0	0	0.00	0	0.00	0	918	284	1,202
52	3	80.0	11.7	8.3	0.0	0	1	2	0	0.00	0	0.00	0	738	186	924
53	3	91.7	8.3	0.0	0.0	0	3	0	1	16.00	1	22.00	328	1,166	378	1,544
54	6	66.5	11.8	21.7	0.0	0	3	3	1	11.25	0	0.00	129	1,672	450	2,122
55	6	69.3	20.7	10.0	0.0	0	5	1	0	0.00	2	38.25	251	1,926	612	2,538
57	1	71.0	29.0	0.0	0.0	0	0	1	0	0.00	0	0.00	0	214	45	259
58	14	25.7	58.6	15.7	0.0	0	0	14	0	0.00	0	0.00	0	2,994	633	3,627
59	4	84.5	0.5	15.0	0.0	0	4	0	0	0.00	1	24.00	157	1,342	438	1,780
60	33	68.0	5.9	15.8	10.3	3	30	0	0	0.00	6	572.00	3,752	13,076	4,625	17,701
SUM	314					58	157	99	3	52.25	74	2396.40	16,319	107,077	33,418	140,495

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 Gowa 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 1,711 x 10^6 and maintenance cost is Rp 677 x 10^6 which is approximately 28% of the total expenditure.

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

PROV : SULAWESI SELATAN KAB : GOWA

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	103,784	223,080	240,245	347,243	258,937	1,173,289	(68.6%)
Ownership Cost	1,881	4,444	4,962	5,593	5,806	22,686	(1.9%)
Operation Cost	49,762	115,055	128,015	140,506	144,855	578,193	(49.3%)
Material Cost	23,155	40,257	39,896	83,116	17,692	204,116	(17.4%)
Labour Cost	15,449	34,227	36,036	72,735	56,810	215,257	(18.3%)
Contingency	13,537	29,097	31,336	45,293	33,774	153,037	(13.0%)
FOREIGN CURRENCY :	66,337	125,815	125,289	111,903	108,651	537,995	(31.4%)
Ownership Cost	26,777	62,878	70,726	76,936	77,662	314,979	(58.5%)
Operation Cost	3,727	8,973	10,190	11,183	11,494	45,567	(8.5%)
Material Cost	27,180	37,553	28,031	9,188	5,323	107,275	(19.9%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,653	16,411	16,342	14,596	14,172	70,174	(13.0%)
TOTAL COST :	170,121	348,895	365,534	459,146	367,588	1,711,284	
Ownership Cost	28,658	67,322	75,688	82,529	83,468	337,665	(19.7%)
Operation Cost	53,489	124,028	138,205	151,689	156,349	623,760	(36.4%)
Material Cost	50,335	77,810	67,927	92,304	23,015	311,391	(18.2%)
Labour Cost	15,449	34,227	36,036	72,735	56,810	215,257	(12.6%)
Contingency	22,190	45,508	47,678	59,889	47,946	223,211	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SULAWESI SELATAN KAB : BONE

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	51,411	103,496	108,561	121,564	129,246	514,278	(75.9%)
Ownership Cost	757	1,553	1,682	1,931	2,061	7,984	(1.6%)
Operation Cost	28,117	56,406	58,504	65,675	69,934	278,636	(54.2%)
Material Cost	1,143	2,405	2,683	3,162	4,308	13,701	(2.7%)
Labour Cost	21,394	43,132	45,692	50,796	52,943	213,957	(41.6%)
FOREIGN CURRENCY :	16,060	32,483	34,326	38,827	41,522	163,218	(24.1%)
Ownership Cost	13,105	26,378	27,443	31,017	33,279	131,220	(80.4%)
Operation Cost	1,506	3,044	3,169	3,610	3,896	15,225	(9.3%)
Material Cost	1,449	3,063	3,714	4,200	4,347	16,773	(10.3%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	67,471	135,979	142,887	160,391	170,768	677,496	
Ownership Cost	13,862	27,929	29,125	32,948	35,340	139,204	(20.5%)
Operation Cost	29,623	59,450	61,673	69,285	73,830	293,861	(43.4%)
Material Cost	2,592	5,468	6,397	7,362	8,655	30,474	(4.5%)
Labour Cost	21,394	43,132	45,692	50,796	52,943	213,957	(31.6%)

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

(TOTAL)

PROV : SULAWESI SELATAN KAB : GOWA

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	155,195	326,576	348,806	468,807	388,183	1,687,567	(70.6%)
Ownership Cost	2,638	5,997	6,644	7,524	7,867	30,670	(1.8%)
Operation Cost	77,879	171,461	186,519	206,181	214,789	856,829	(50.8%)
Material Cost	24,298	42,662	42,579	86,278	22,000	217,817	(12.9%)
Labour Cost	36,843	77,359	81,728	123,531	109,753	429,214	(25.4%)
Contingency	13,537	29,097	31,336	45,293	33,774	153,037	(9.1%)
FOREIGN CURRENCY :	82,397	158,298	159,615	150,730	150,173	701,213	(29.4%)
Ownership Cost	39,882	89,254	98,169	107,953	110,941	446,199	(63.6%)
Operation Cost	5,233	12,017	13,359	14,793	15,390	60,792	(8.7%)
Material Cost	28,629	40,616	31,745	13,388	9,670	124,048	(17.7%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	8,653	16,411	16,342	14,596	14,172	70,174	(10.0%)
TOTAL COST :	237,592	484,874	508,421	619,537	538,356	2,388,780	
Ownership Cost	42,520	95,251	104,813	115,477	118,808	476,869	(20.0%)
Operation Cost	83,112	183,478	199,878	220,974	230,179	917,621	(38.4%)
Material Cost	52,927	83,278	74,324	99,666	31,670	341,865	(14.3%)
Labour Cost	36,843	77,359	81,728	123,531	109,753	429,214	(18.0%)
Contingency	22,190	45,508	47,679	59,889	47,946	223,211	(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 Gowa 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.

- 2-Steel Roller
- 1-Hand-guided Vibratory Roller
- 10-Dump Truck

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

a. Equipment for Road Maintenance

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

b. Equipment for Bridge Maintenance

- 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

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

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

Table 6-1-7 REQUIREE NUMBER OF EQUIPMENT

PROV : SULAWESI SELATAN KAB : GOWA

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	220	0	0.21	0.48	0.61	0.55	0.83
Swamp Bulldozer	220	0	0.02	0.01	0.00	0.00	0.00
Motor Grader	240	0	0.46	1.19	1.33	1.64	1.58
Hand-guide Vib. Roller	240	4	0.12	0.11	0.13	0.54	0.20
Tire Roller	220	0	0.36	0.49	0.36	0.00	0.00
Vibratory Roller (D&T)	240	0	0.35	0.93	1.03	1.31	1.29
Hydraulic Excavator; Wheel	220	0	0.14	0.01	0.00	0.01	0.01
Wheel Loader	240	0	0.53	1.38	1.64	1.69	1.78
Water Tank Truck	240	0	0.18	0.57	0.64	0.82	0.77
Dump Truck	240	0	4.30	10.58	11.81	13.90	15.18
Flat Bed.Truck with Crane	240	0	0.02	0.06	0.11	0.61	0.14
Flat Bed Truck	240	0	0.41	0.56	0.43	0.18	0.07
Portable Crusher/Screening	240	0	0.11	0.27	0.30	0.24	0.15
Concrete Mixer	220	0	0.02	0.01	0.02	0.03	0.03
Water Pump	220	0	0.02	0.01	0.01	0.02	0.03
Concrete Vibrator	220	0	0.01	0.01	0.01	0.01	0.02
Asphalt Sprayer	220	1	0.36	0.49	0.36	0.00	0.00

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

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SULAWESI SELATAN KAB : GOWA

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	-	-
Bulldozer/Ripper	90 HP	53,000	1	53,000
Swamp Bulldozer	90 HP	52,850	-	-
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	2	95,600
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	-	-
Tire Roller	8-15 ton	31,070	2	62,140
Vibratory Roller (D&T)	4 ton	29,000	-	-
Vibratory Roller	4 ton	29,000	-	-
Rough Terrain Crane	10 ton	100,400	-	-
Hydraulic Excavator; Wheel	0.3 m3	41,100	-	-
Wheel Loader	1.2 m3	70,200	2	140,400
Water Tank Truck	4000 ltr.	12,750	1	12,750
Dump Truck	3.0 ton	14,700	5	73,500
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	2	50,380
Flat Bed Truck	3.0 ton	11,275	1	11,275
Portable Crusher/Screening	30-40 t/h	188,000	1	188,000
Concrete Mixer	0.5 m3	18,000	-	-
Water Pump	200 l/min	630	-	-
Concrete Vibrator	3.3 HP	740	-	-
Asphalt Sprayer	850 ltr.	10,200	-	-
Service Car	3 ton	11,600	1	11,600
4 Wheel Drive Vehicle	70 HP	17,500	1	17,500
Motorcycle	100 cc	1,100	3	3,300

PURCHASE COST TOTAL	719,445
OWNERSHIP COST (FOREIGN)	319,988
EQUIPMENT COST SUPPLEMENTED	399,457

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Hand-guide Vib. Roller	5,522
Vibratory Roller (D&T)	20,428
Dump Truck	98,657
Asphalt Sprayer	1,604
TOTAL	126,211

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 : GOWA

I T E M	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	0.00	9000.00	21000.00	2500.00	64000.00	96500.00
Subgrade Preparation	m2	54240.00	189281.00	171000.00	306500.00	278000.00	999821.00
Normal Fill	m3	0.00	210.00	490.00	0.00	0.00	700.00
Fill in Swamp	m3	500.30	4.20	0.00	0.00	0.00	504.50
Normal Excavation to Spoil	m3	662.00	3747.00	4807.00	3585.00	4844.00	17645.00
Sub Base Course	m3	5028.00	15907.00	17964.00	23930.00	25524.40	88353.40
Base Course	m3	2520.00	8653.00	10712.00	9750.00	5760.00	37395.00
Shoulder	m2	62500.00	114400.00	130600.00	148000.00	154000.00	609500.00
Asphalt Patching	m2	729.00	464.00	71.00	0.00	0.00	1264.00
Surface Dressing (Single)	m2	56000.00	77000.00	56000.00	0.00	0.00	189000.00
Surface Dressing (Double)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Earth Drain	m	2800.00	9200.00	3200.00	19300.00	45600.00	80100.00
Earth Drain in Swamp (by machine)	m3	2400.00	60.00	0.00	0.00	0.00	2460.00
Pipe Culvert D80cm	m	2.00	18.80	10.20	0.00	127.00	158.00
Masonry Culvert (80x80cm)	m	26.00	0.00	0.00	36.00	6.00	68.00
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	1.50	9.00	21.00	2.90	22.40	56.80
Gabion Protection	m3	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 3m;10T)	m2	0.00	0.00	0.00	0.00	12.00	12.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	4.20	9.80	274.40	34.00	322.40
Superstructure (Timber;Span 8m;10T)	m2	0.00	42.00	98.00	544.00	0.00	684.00
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	0.60	1.40	18.00	0.00	20.00
Substructure (Abut;for Timber;10T)	NO	0.00	2.40	5.60	28.00	6.00	42.00
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	4.20	9.80	174.40	11.25	199.65
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	151.50	300.00	304.50	333.00	344.00	1433.00
Routine maintenance of earth road	Km	47.50	83.00	74.50	55.00	29.50	289.50
Routine maintenance of gravel road	Km	78.00	159.50	156.00	192.00	228.50	814.00
Routine maintenance of asphalt road	Km	26.00	57.50	74.00	86.00	86.00	329.50
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	0.00	154.00	154.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	26.13	52.25	52.25	66.25	60.63	257.50
Maintenance of Concrete Bridge (Exist)	m2	1163.33	2231.90	2326.15	2413.99	2486.33	10621.60

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.

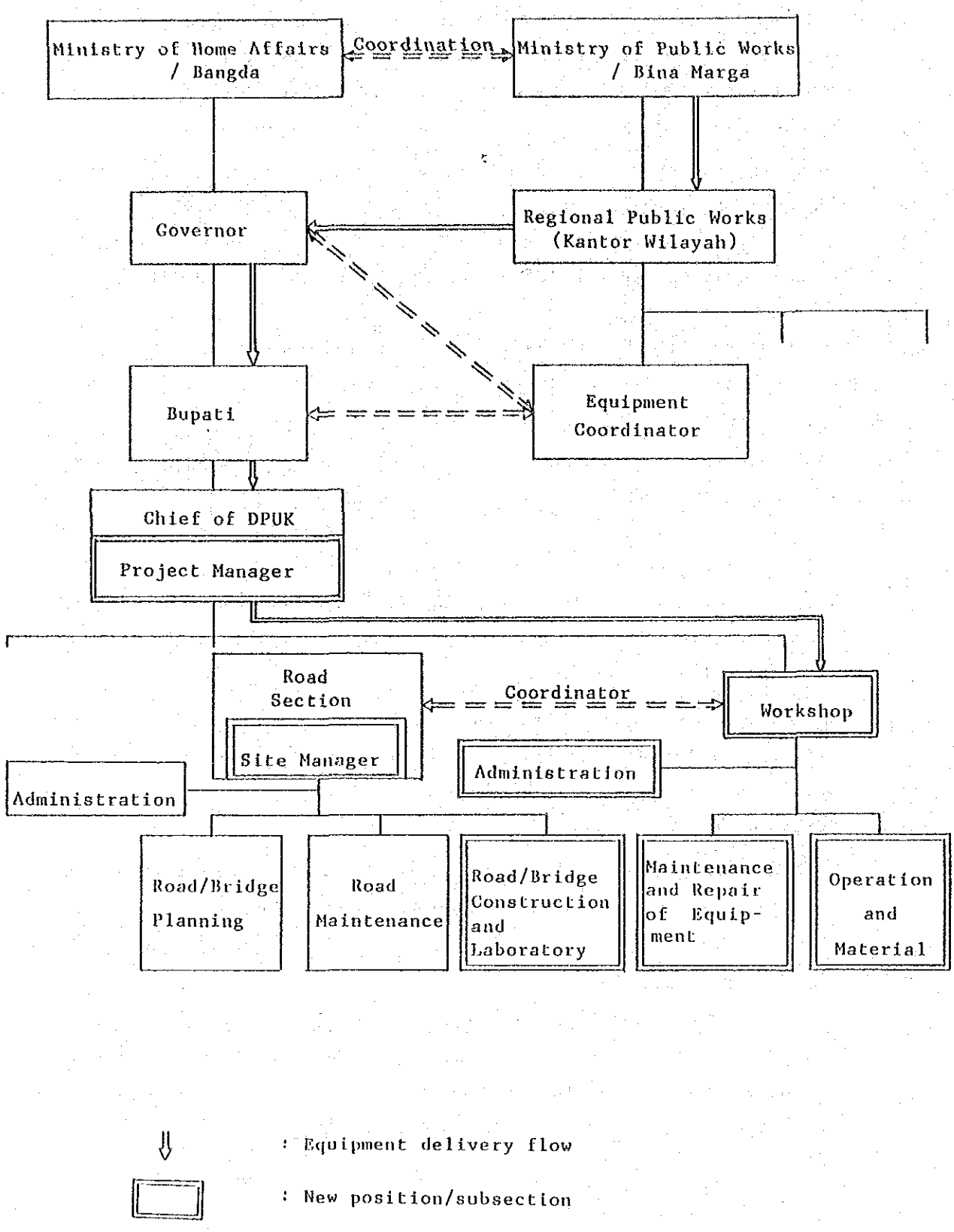
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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