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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 33

KABUPATEN SOPPENG

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

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国際協力事業団		
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PREFACE

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

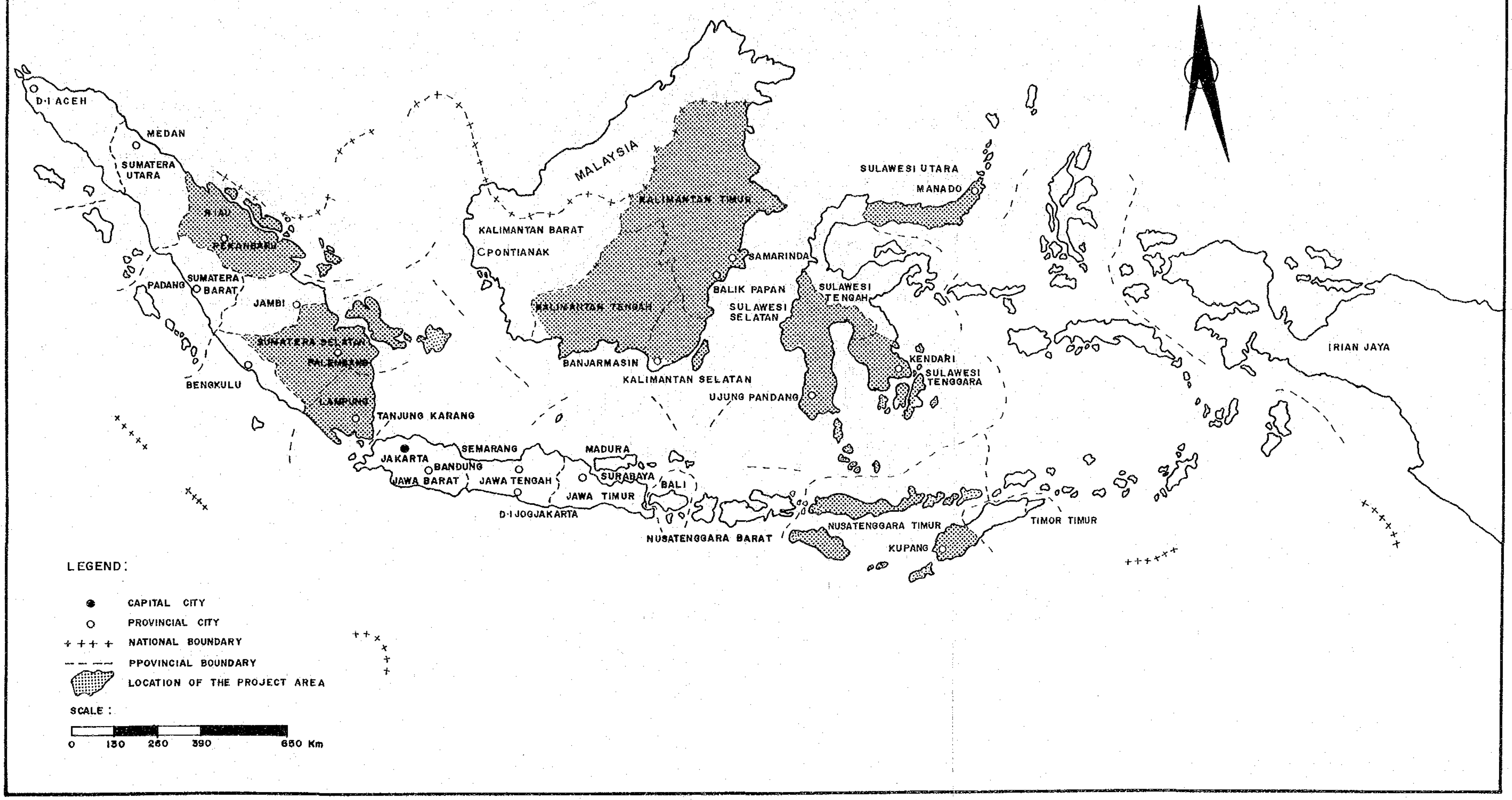
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

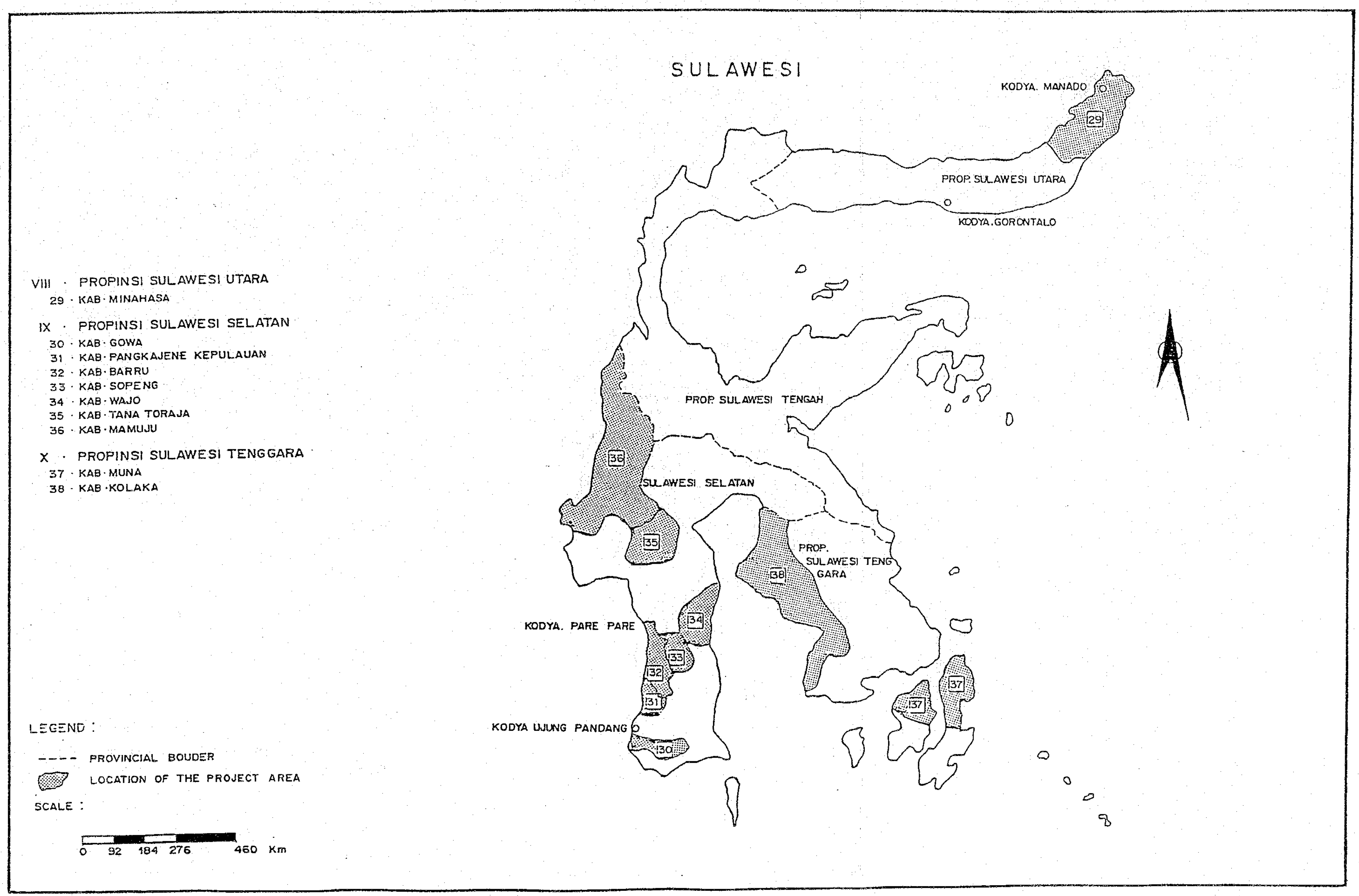
The report consists of the results of the feasibility study and proposed implementation programme of the local road development in the Kabupaten.

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





SULAWESI
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 PROJECT AREA
SCALE :
0 92 184 276 460 Km
KODYA. MANADO
29
PROP. SULAWESI UTARA
KODYA.GORONTALO
PROP. SULAWESI TENGAH
36
SULAWESI SELATAN
35
PROP. SULAWESI TENG GARA
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KODYA. PARE PARE
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KODYA UJUNG PANDANG
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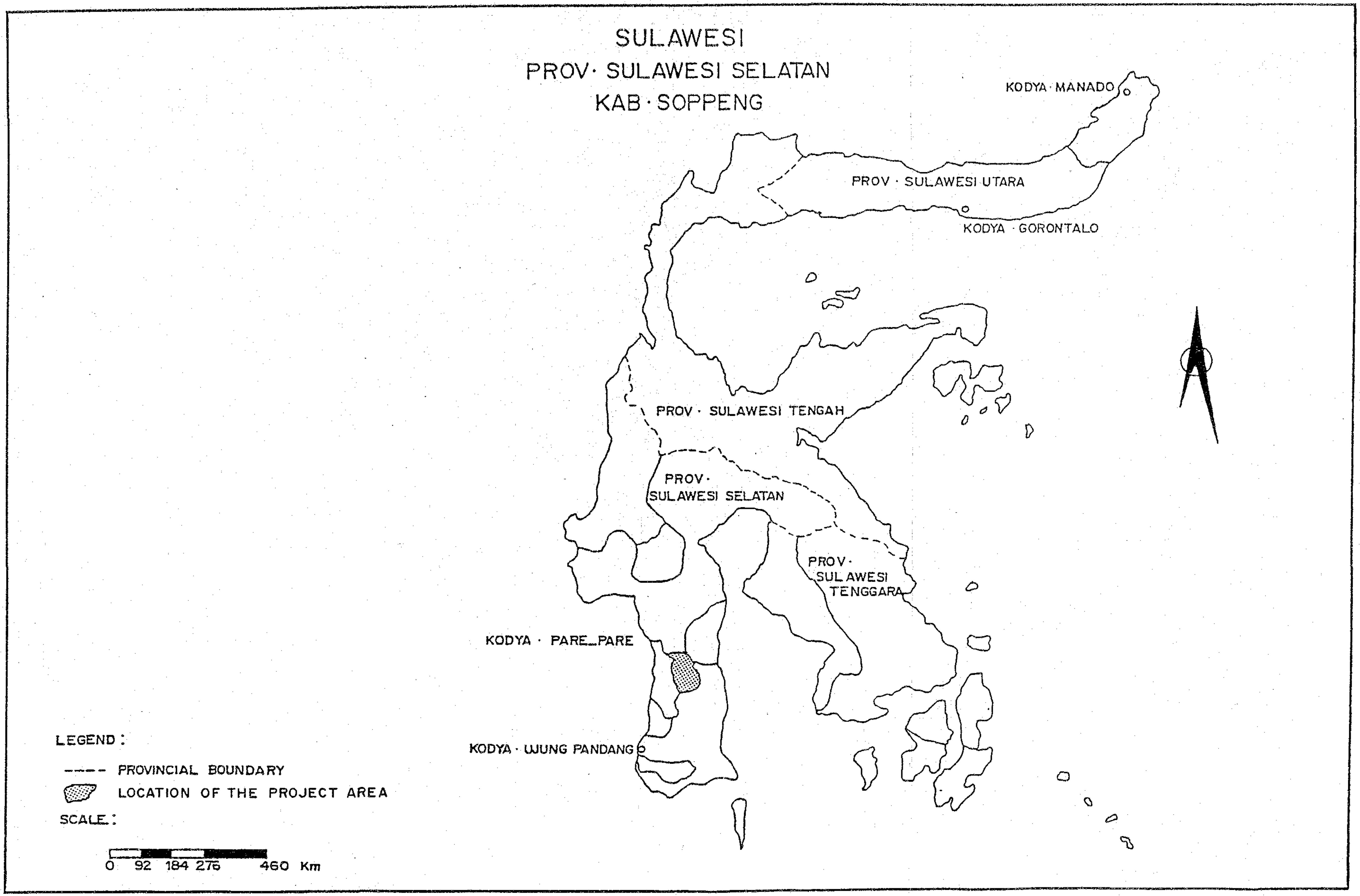
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PROV · SULAWESI TENGAH
PROV · SULAWESI SELATAN
PROV · SULAWESI TENGGARA
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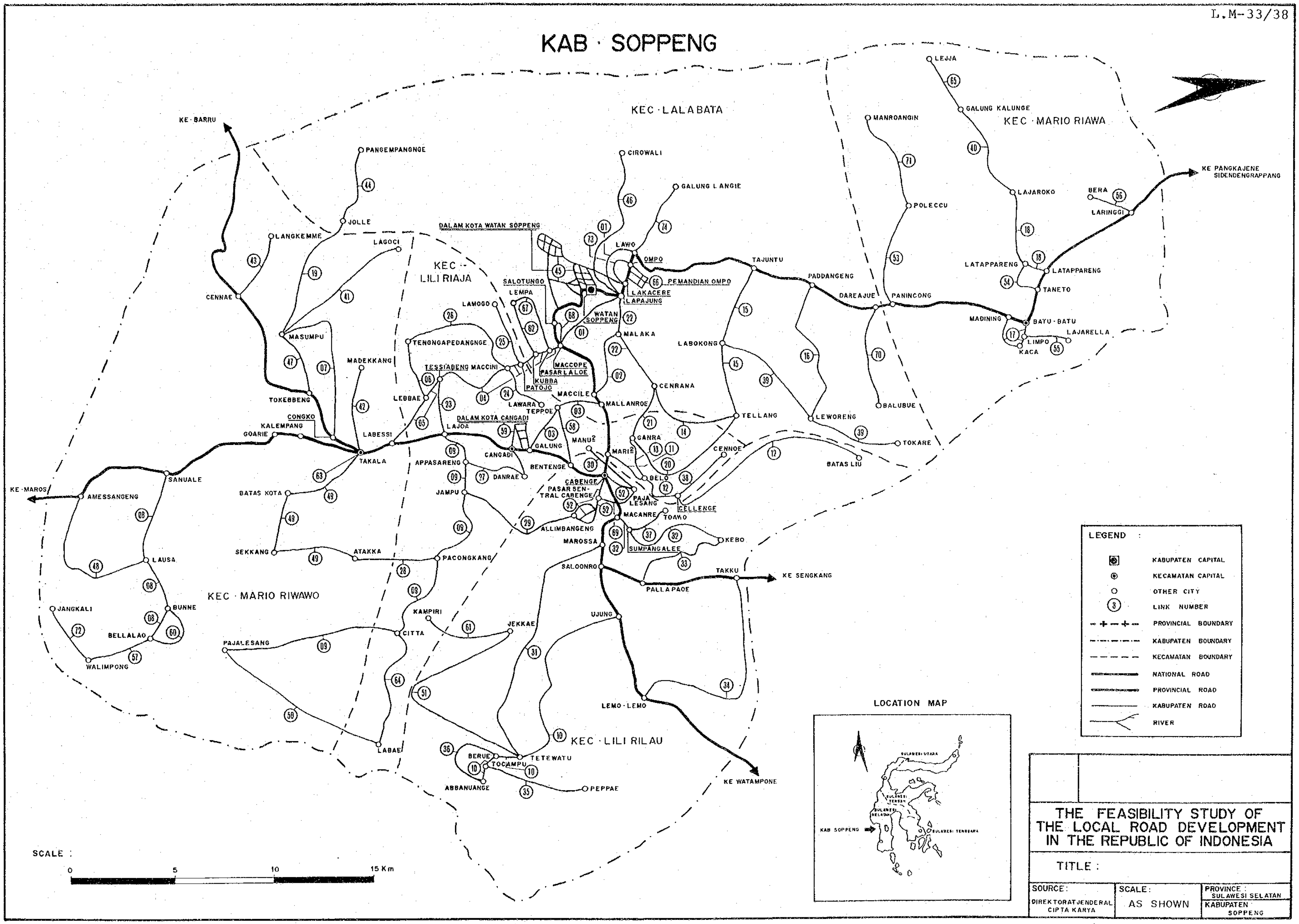
KODYA · UJUNG PANDANG
LEGEND :
PROVINCIAL BOUNDARY
LOCATION OF THE PROJECT AREA
SCALE :
0 92 184 276 460 Km


KAB · SOPPENG
KEC · LALABATA
KEC · MARIO RIAWA
KEC · LILI RIAJA
KEC · MARIO RIWAWO
KEC · LILI RILAU
KE · BARRU
KE · MAROS
KE PANGKAJENE SIDENDENGRAPPANG
KE SENGKANG
KE WATAMPONE
DALAM KOTA WATAN SOPPENG
DALAM KOTA CANGADI
WATAN SOPPENG
TAKALA
CANGADI
CITTA
TETEWATU
LEGEND :
KABUPATEN CAPITAL
KECAMATAN CAPITAL
OTHER CITY
LINK NUMBER
PROVINCIAL BOUNDARY
KABUPATEN BOUNDARY
KECAMATAN BOUNDARY
NATIONAL ROAD
PROVINCIAL ROAD
KABUPATEN ROAD
RIVER
LOCATION MAP
KAB SOPPENG
SCALE :
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5
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15 Km
THE FEASIBILITY STUDY OF THE LOCAL ROAD DEVELOPMENT IN THE REPUBLIC OF INDONESIA
TITLE :
SOURCE : DIREKTORAT JENDERAL CIPTA KARYA
SCALE : AS SHOWN
PROVINCE : SULAWESI SELATAN
KABUPATEN : SOPPENG

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 Soppeng is an inland Kabupaten in the south of Sulawesi Selatan Province. It is bordered on the north by Kabupatens Sindereng Rappang and Wajo, on the east and south by Kabupaten Bone, and on the west by Kabupaten Barru.

From the middle of the Kabupaten to the east, extensive flat areas lie on the basins formed by the Asalan River rising at the west boundary with Kabupaten Barru and by the Walanae River rising in the mountains in the south of the province. Both these rivers flow into Tempe Lake and form swamps on the south of the lake.

The Kabupaten has an area of 1,359 square kilometers, approximately 2 percent of the total of the province. It consists administratively of 5 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Soppeng are 121 days and 1,539 mm respectively.

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

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

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

Where :

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

Table 1-1-1

METEOROLOGICAL CONDITIONS

PROVINCE : Sulawesi Selatan
KABUPATEN : Soppeng

STATION : Wutan Soppeng

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	8	143	14	144	8	53	17	179	9	57
February	7	137	7	92	11	207	13	132	12	98
March	13	143	13	292	12	127	11	61	13	81
April	15	207	16	289	12	233	16	184	17	211
May	9	261	17	233	7	109	23	194	21	414
June	10	106	10	115	5	55	18	161	17	148
July	3	21	13	264	1	0	18	126	12	183
August	8	69	2	18	1	0	4	18	4	16
September	1	0	10	211	2	0	7	15	9	120
October	6	93	7	94	-	-	7	102	4	80
November	3	99	8	142	4	2	10	26	9	127
December	19	271	11	151	16	278	11	128	13	174
Total	102	1,550	128	2,045	79	1,064	155	1,326	140	1,709

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Soppeng in 1984 was 239,335 which was approximately 3.7% of the 6,475,000 total population of Sulawesi Selatan Province as shown in Table 1-2-1.

The population density was 1.76 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 0.5% which is lower than both the provincial rate of 1.7% and the national rate of 2.2%. This may be 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 :

Table 1-2-2 POPULATION BY KECAMATAN

Year : 1984

PROVINCE : SULAWESI SELATAN

KABUPATEN : SOPPENG

KECAMATAN	POPULATION	PROPORTION (%)
MARIO RIWAWO	45,006	18.8
LILIRIAJA	47,176	19.7
LILIRILAU	51,432	21.5
LALABATA	67,220	28.1
MARIO RIAWA	28,501	11.9
TOTAL	239,335	100

1.2.2 Land Use

In Kabupaten Soppeng, 83,699 ha of the current available land use area, which is approximately 66.6% of the 125,807 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 82,949 ha of agricultural harvest area and 750 ha of residential area which are 99.1% and 0.9% of the current available land use area respectively.

The agricultural harvest area consists of 36,819 ha of paddy field, 10,162 ha of plantation and 35,968 ha of other cultivated area which are 44.4%, 12.3% and 43.3% 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.

The major part of the Kabupaten is flat with rich water resources. It is desirable that the land is used more efficiently to increase the productivity.

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 Soppeng in 1984 were 72,251 ha and 242,748 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 36,462 ha and 197,225 ton respectively which are 50.5% and 81.2% of the total food crops. The yield rate of paddy production is 5.41 ton per ha. Thus, paddy is the most predominant agricultural crop of the Kabupaten.

As the table showns, average annual growth rates of area and production of paddy in 1982 through 1984 were 4.3% and 8.2% respectively which show a favorable development of the paddy production.Due to the good geographical conditions 98% of paddy field is wet paddy field. This is the cause of the high productivity.

Of food crops produced in the Kabupaten, production of maize was approximately 37,000 ton in 1984 which is much more than the 7,000 ton of assumed consumption in the Kabupaten. The remainry 30,000 ton is shipped out of the Kabupaten. A high growth rate of maze production is noticeable.

There are no notable plantation crops in the Kabupaten. The population of the agricultural sector which is assumed from the employment in the Kabupaten is 69.4% of the total population as shown in Table 1-2-7. Thus it is an agricultural Kabupaten.

1.2.4 Other Economic Activities

Due to lack of data the analysis on economic activities excluding agriculture in Kabupaten Soppeng has been admitted.

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

KABUPATEN : SOPPENG

CULTIVATED AREA

(ha)

ITEM	1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	36,105	31,154	37,068	33,493	32,889	36,462	4.3
OTHERS	24,376	49,463	48,700	35,783	43,365	35,789	0
TOTAL	60,481	80,617	85,768	69,276	76,254	72,251	2.1

PRODUCTION

(ton)

ITEM	1979	1980	1980	1982	1983	1984	AAGR (%)
PADDY	149,675	135,751	186,406	168,384	169,256	197,225	8.2
OTHERS	16,749	42,819	36,576	30,793	50,755	45,523	21.6
TOTAL	166,424	178,570	222,982	199,177	220,011	242,748	10.4

YIELD RATE

(ton/ha)

ITEM	1979	1980	1981	1982	1983	1984	AGGR (%)
PADDY	4.15	4.36	5.03	5.03	5.15	5.41	3.7

ITEM	1979	1980	1981	1982	1983	1984	AAGR (%)
AREA (ha)	19,244	35,103	32,296	26,859	33,420	25,068	0
PRODUCTION (ton)	13,416	31,702	24,485	23,995	43,441	37,226	24.6

Notes :

1. AAGR : Average annual growth rate
2. Source : Kabupaten concorned with the study

Table 1-2-5 AREA AND PRODUCTION OF PLANTATION CROPS
Year : 1983

PROVINCE : SULAWESI SELATAN

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AAGR (%) AREA	AAGR (%) 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

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

Regional trunk roads the Kabupaten Soppeng are coincidentally consolidated by the provincial road networks of the central-southern region of Sulawesi Selatan Province. This is because the provincial roads all meet in the Kabupaten due to its central location.

The provincial roads leading to the neighbouring Kabupatens Barru and Maros meet at Takalala and then connect with the other two provincial roads at Cabenge. There other roads lead to Kabupaten Sidrap, running through the northwestern part of the Kabupaten and lead to the neighbouring Kabupaten Bone, running through the northeastern part of the Kabupaten.

The Kabupaten, from the topographic point of view, has fundamentally three kinds of natural features. The western part is a hilly and mountainous areas, flat land extends widely to the east from the central area and some parts of the northeastern boundary are covered by low swampy areas.

The Kabupaten roads along the provincial road leading to the neighbouring Kabupaten Sidrap from Takalala via Cangadi, Cabenge and Watan Soppeng form a regional road network connecting with the said provincial road, and have an important role as the facility for promoting rice production in the district.

The Kabupaten roads, of the above road networks, which lead to Maccope from Labessi, which are located in the north of Takalala on the same provincial road, form a regional trunk road connecting with the provincial road for the southern triangular districts of Labessi, Cabenge and Wattan Soppeng, the Kabupaten capital.

Since the are west of Wattan Soppeng is a less developed hilly and mountainous area extending to the boundary with the neighbouring Kabupaten Barru, the road network is not yet developed.

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 Soppeng are confirmed as 74 links and 399 Km respectively. These figures exclude Kabupaten roads with no data.

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

(1) Density of Kabupaten Roads

The density of the Kabupaten roads is 2.94 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 is progressive in density of Kabupaten roads.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Soppeng	399	135,944	2.94
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.

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

PROV : SULAWESI SELATAN KAB : SOPPENG

(Km)

102 (3)	BK	DT	RW	GN	TOTAL
LINK 1	4	3			7
LINK 2		3			3
LINK 3		5			5
LINK 4		7			7
LINK 5		5			5
LINK 6		3			3
LINK 7	9				9
LINK 8	8				8
LINK 9	9	12			21
LINK 10	1	10	1	1	13
LINK 11		2			2
LINK 12		13			13
LINK 13		2			2
LINK 14	1	4			5
LINK 15	1	6			7
LINK 16		7			7
LINK 17		3			3
LINK 18		5			5
LINK 19		1		5	6
LINK 20	2	5			7
LINK 21		3			3
LINK 22		4			4
LINK 23		2			2
LINK 24		3			3
LINK 25		2		1	3
LINK 26	1	3			4
LINK 27		3			3
LINK 28	2	2			4
LINK 29		9			9
LINK 30			2		2
LINK 31	12	1			13
LINK 32		8			8
LINK 33		5			5
LINK 34	20				20
LINK 35		4		1	5
LINK 36		3			3
LINK 37		2			2
LINK 38		3			3
LINK 39		10			10
LINK 40	3	2			5
LINK 41				6	6
LINK 42	3				3
LINK 43		3			3
LINK 44				4	4
LINK 45	12	2			14
LINK 46	1			7	8
LINK 47		3			3
LINK 48	3	5			8
LINK 49	1	2	3	3	9
LINK 50		9			9
LINK 51	12				12
LINK 52		3			3
LINK 53		5			5
LINK 54		2			2
LINK 55		2			2
LINK 56		2			2
LINK 57	3				3
LINK 58		3			3
LINK 59		2			2
LINK 60				3	3
LINK 61	5				5
LINK 62	1	1		1	3
LINK 63		2			2
LINK 64	6				6
LINK 65	2				2
LINK 66		1			1
LINK 67	4				4
LINK 68		1			1
LINK 69		3			3
LINK 70		5			5
LINK 71	3	2			5
LINK 72	3				3
LINK 73	1	1			2
LINK 74	4				4
TOTAL	137	224	6	32	399
RATIO	34	56	2	8	(%)

The legend used in the table is as follows:

ASP : Asphalt

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 : Soppeng	27.6	51.4	21.0
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 not lower either than that of Indonesia but is distinctly lower for that of Jawa Island. The proportion of low grade roads such as earth roads and others is fairly high. This means that the road classification in the Kabupaten is still considered as 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 : Soppeng	52.8	22.5	22.0	2.7
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 LENGTH BY SURFACE TYPE

PROV : SULAWESI SELATAN KAB : SOPPENG

(Km)

ID2 (7)	KRK	ASP	L.L	TNH	BTD	TOTAL
LINK 1	7					7
LINK 2		3				3
LINK 3	5					5
LINK 4		7				7
LINK 5		5				5
LINK 6	3					3
LINK 7	9					9
LINK 8	8					8
LINK 9		16	1	4		21
LINK 10	2	11				13
LINK 11		2				2
LINK 12	8	5				13
LINK 13		2				2
LINK 14	5					5
LINK 15		7				7
LINK 16		7				7
LINK 17		3				3
LINK 18		5				5
LINK 19	6					6
LINK 20		7				7
LINK 21		3				3
LINK 22		4				4
LINK 23		2				2
LINK 24	3					3
LINK 25	3					3
LINK 26	3			1		4
LINK 27				3		3
LINK 28	4					4
LINK 29	9					9
LINK 30				2		2
LINK 31	13					13
LINK 32				8		8
LINK 33	5					5
LINK 34	20					20
LINK 35	5					5
LINK 36				3		3
LINK 37			1	1		2
LINK 38				3		3
LINK 39	10					10
LINK 40	5					5
LINK 41	4				2	6
LINK 42				3		3
LINK 43				3		3
LINK 44	4					4
LINK 45		14				14
LINK 46	8					8
LINK 47	3					3
LINK 48	5			3		8
LINK 49	5			4		9
LINK 50	5			4		9
LINK 51	8			4		12
LINK 52		3				3
LINK 53	5					5
LINK 54	2					2
LINK 55				2		2
LINK 56	2					2
LINK 57	3					3
LINK 58	3					3
LINK 59		2				2
LINK 60					3	3
LINK 61				5		5
LINK 62				3		3
LINK 63		2				2
LINK 64	6					6
LINK 65	2					2
LINK 66	1					1
LINK 67				4		4
LINK 68	1					1
LINK 69				3		3
LINK 70				5		5
LINK 71				5		5
LINK 72				3		3
LINK 73				2		2
LINK 74				4		4
TOTAL	200	110	2	82	5	399
RATIO	50	28	1	21	1	(%)

The surface condition level of the Kabupaten roads in the Kabupaten is at the same level as both that of Indonesia and Jawa Island. The proportion in good condition is relatively 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 56.0% flat, 34.0% hilly, 8.0% mountainous and 2.0% swampy.

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

PROVINCE : SULAWESI SELATAN

KABUPATEN: SOPPENG

(1)

NO	KRK				ASP				L.A.				TNH				BTO			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 1	76	24																		
LINK 2					40	60														
LINK 3		99	1																	
LINK 4					99	1														
LINK 5					99	1														
LINK 6	99	1																		
LINK 7	78	22																		
LINK 8	86	14																		
LINK 9					84	14	1			5	95		3	26	71					
LINK 10	25	25	50		50	40	10													
LINK 11					90	10														
LINK 12	93	7			75	25														
LINK 13					85	15														
LINK 14	91	9																		
LINK 15					68	32														
LINK 16					74	17	9													
LINK 17					95	5														
LINK 18					86	14														
LINK 19	30	20	50																	
LINK 20					50	30	20													
LINK 21					90	10														
LINK 22					90	10														
LINK 23					95	5														
LINK 24		40	60																	
LINK 25	70	30																		
LINK 26	50	50												75		75				
LINK 27														5	95					
LINK 28	75	25																		
LINK 29	84	16																		
LINK 30															99	1				
LINK 31	53	27	20																	
LINK 32															99	1				
LINK 33		83	17																	
LINK 34	87	13																		
LINK 35	13	87																		
LINK 36															99	1				
LINK 37									50	50			50	50						
LINK 38															95	5				
LINK 39	76	24																		
LINK 40	78	15	7																	
LINK 41	50	42	8														75	26		
LINK 42														5	95					
LINK 43													2	35	63					
LINK 44	50	50																		
LINK 45					84	15	1													
LINK 46	95	5																		
LINK 47	87	13																		
LINK 48	91	9													95	5				
LINK 49	46	36	18										50	30	20					
LINK 50	99	1													99	1				
LINK 51	50	30	20												95	5				

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

PROVINCE : SULAWESI SELATAN

KABUPATEN : SOPPENG

(II)

ID2 (3)	KRK				ASP				L.L				TNH				BID			
ID2	BA	SD	RU	RD	BA	SD	RU	RD	BA	SD	RU	RD	BA	SD	RU	RD	BA	SD	RU	RD
LINK 52						50	50													
LINK 53	74	26																		
LINK 54	95	5																		
LINK 55															95	5				
LINK 56	95	4	1																	
LINK 57	91	9																		
LINK 58	33	50	17																	
LINK 59					95	6														
LINK 60																	20	25	55	
LINK 61														5	95					
LINK 62														47	53					
LINK 63					90	10														
LINK 64	90	10																		
LINK 65		95	5																	
LINK 66		50	50																	
LINK 67														1	99					
LINK 68		50	50																	
LINK 69														1	99					
LINK 70															95	5				
LINK 71															5	95				
LINK 72															10	90				
LINK 73														5	95					
LINK 74														5	95					
AVERAGE	60	30	10	0	77	19	5	0	25	28	40	6	4	10	74	12	48	26	28	0
LENGTH	200 Km				110 Km				2 Km				82 Km				5 Km			
(Km)	120	60	20	0	85	21	6	0	1	1	1	0	3	8	61	10	2	1	1	0

1.3.3 Bridge Inventory

The bridge inventories showing the existing condition of bridges on the Kabupaten roads in Kabupaten Soppeng were 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 inventories shown in Table 1-3-4 and Table 1-3-5 indicate a tota of 62 bridges with a total length of 511 m of which 27 or 27.4% are timber, 55 or 54.8% are concrete and 16 or 16.1% are others. Steel bridges account for only 2 or 1.6% of the total. On the other hand, 7 bridges with a total length of 93 m are required to be newly constructed.

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

	Span Length (m)										
Bridge Type	<3	<5	<8	<10	<12	<14	<16	<18	<20	<99	Total
Timber	10	4	2	-	1	-	-	-	-	-	17
Concrete	7	6	4	7	6	1	2	-	-	1	34
Steel	-	1	-	-	-	-	-	-	-	-	1
Others	3	1	1	4	-	-	-	-	-	1	10
Total	20	12	7	11	7	1	2	-	-	2	62

Thus, most of the existing bridges on the Kabupaten roads are timber and the majority of spanlengths is within the range of 0 m to 3 m.

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SULAWESI SELATAN KAB : SOPPENG

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

LINK NO	EXISTING NO.	EXISTING LENGTH	NOT EXIST NO.	NOT EXIST LENGTH	TOTAL NO.	TOTAL LENGTH
1	1	4.00			1	4.00
2			1	20.00	1	20.00
3	1	12.00			1	12.00
4	6	70.00			6	70.00
5	2	20.00			2	20.00
6			1	25.00	1	25.00
7	3	9.00			3	9.00
8	1	3.00			1	3.00
9	6	23.00			6	23.00
10	2	31.00			2	31.00
11	1	27.00			1	27.00
12	1	8.00			1	8.00
14	1	9.50			1	9.50
15	3	14.50			3	14.50
16	1	25.00			1	25.00
17	1	25.00			1	25.00
18	1	23.50			1	23.50
20	3	23.00			3	23.00
22	1	10.00			1	10.00
26	1	9.00			1	9.00
28	1	5.00			1	5.00
29	2	24.00			2	24.00
31	2	17.00			2	17.00
32			1	16.00	1	16.00
33	2	7.50			2	7.50
35	1	10.00			1	10.00
39	2	6.00			2	6.00
41	2	6.00			2	6.00
42	1	3.00			1	3.00
45	3	26.00			3	26.00
49	3	12.00			3	12.00
50			1	15.00	1	15.00
52	1	17.00			1	17.00
53	1	8.00			1	8.00
61	1	4.00			1	4.00
65	2	12.00			2	12.00
66	2	7.00			2	7.00
67			1	15.00	1	15.00
72			1	1.00	1	1.00
73			1	1.00	1	1.00
TOTAL	62	511.00	7	93.00	69	604.00

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

PROV : SULAWESI SELATAN　　KAB : BOPPENO

<<< BRIDGE >>>　　(No)

103 (18)	BT	KY	LL	BJ	TOTAL
LINK 1	1				1
LINK 2					
LINK 3	1				1
LINK 4	6				6
LINK 5	2				2
LINK 6					
LINK 7		3			3
LINK 8	1				1
LINK 9	6				6
LINK 10	2				2
LINK 11			1		1
LINK 12			1		1
LINK 14	1				1
LINK 15	1		2		3
LINK 16	1				1
LINK 17		1			1
LINK 18		1			1
LINK 20	3				3
LINK 22			1		1
LINK 26	1				1
LINK 28			1		1
LINK 29	2				2
LINK 31			2		2
LINK 32					
LINK 33		2			2
LINK 35	1				1
LINK 39		2			2
LINK 41		2			2
LINK 42			1		1
LINK 45	2		1		3
LINK 49		2		1	3
LINK 50					
LINK 52	1				1
LINK 53		1			1
LINK 61		1			1
LINK 65		2			2
LINK 66	2				2
LINK 67					
LINK 72					
LINK 73					
TOTAL	34	17	10	1	62
RATIO	55	27	16	2	(%)

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Soppeng 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	3,632	818	748	4,010	7,215
Proportion (%)	39.44	8.88	8.12	43.55	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	13.90	0.74	4.21	81.15	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 : SOPPENG

A)	Growth Rate of Population	:	0.50 (%)
B)	Growth Rate of Cultivated Area	:	10.40 (%)
C)	Growth Rate of Rice field	:	4.30 (%)
D)	Growth Rate of Rice yield rate	:	4.00 (%)
E)	Growth Rate of GDP / capita	:	6.60 (%)

a)	Geometrical Mean (A x B)	:	5.33 (%)
b)	Geometrical Mean (C x D)	:	4.15 (%)
c)	Geometrical Mean (a x b)	:	4.74 (%)
d)	Geometrical Mean (c x E)	:	5.67 (%)

TRAFFIC GROWTH RATE : 5.67 (%)

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 : SOPPENG

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	10	0	2	3	14	5.7%	20	0	4	6	29	IIIC
2	50	5	20	50	100	5.7%	102	10	41	102	205	IIIB-1
3	100	10	40	50	175	5.7%	205	20	82	102	358	IIIB-1
4	750	200	50	100	1050	5.7%	1536	410	102	205	2151	IIIA
5	750	200	50	100	1050	5.7%	1536	410	102	205	2151	IIIA
6	25	5	10	40	60	5.7%	51	10	20	82	123	IIIB-2
7	10	0	5	10	20	5.7%	20	0	10	20	41	IIIC
8	30	0	0	50	55	5.7%	61	0	0	102	113	IIIB-2
9	25	25	10	20	70	5.7%	51	51	20	41	143	IIIB-2
10	25	10	10	10	50	5.7%	51	20	20	20	102	IIIB-2
11	50	5	10	100	115	5.7%	102	10	20	205	236	IIIB-1
12	50	2	10	75	100	5.7%	102	4	20	154	205	IIIB-1
13	75	5	5	100	135	5.7%	154	10	10	205	277	IIIB-1
14	10	0	2	30	27	5.7%	20	0	4	61	55	IIIB-2
15	50	5	5	100	110	5.7%	102	10	10	205	225	IIIB-1
16	50	5	10	100	115	5.7%	102	10	20	205	236	IIIB-1
17	10	2	7	50	44	5.7%	20	4	14	102	90	IIIB-2
18	10	2	5	30	32	5.7%	20	4	10	61	66	IIIB-2
19	10	0	5	5	18	5.7%	20	0	10	10	37	IIIC
20	30	2	5	75	75	5.7%	61	4	10	154	154	IIIB-2
21	75	5	5	100	135	5.7%	154	10	10	205	277	IIIB-1
22	35	10	5	50	75	5.7%	72	20	10	102	154	IIIB-2
23	100	75	25	75	238	5.7%	205	154	51	154	487	IIIB-1
24	25	25	25	40	95	5.7%	51	51	51	82	195	IIIB-2
25	40	5	5	50	75	5.7%	82	10	10	102	154	IIIB-2
26	40	10	0	25	63	5.7%	82	20	0	51	129	IIIB-2
27	10	0	5	20	25	5.7%	20	0	10	41	51	IIIB-2
28	10	0	2	10	17	5.7%	20	0	4	20	35	IIIC
29	15	0	2	10	22	5.7%	31	0	4	20	45	IIIC
30	0	0	0	5	3	5.7%	0	0	0	10	6	IIIC
31	25	0	5	50	55	5.7%	51	0	10	102	113	IIIB-2
32	0	0	0	25	13	5.7%	0	0	0	51	27	IIIC
33	35	5	10	30	65	5.7%	72	10	20	61	133	IIIB-2
34	40	0	10	100	100	5.7%	82	0	20	205	205	IIIB-1
35	40	0	10	75	88	5.7%	82	0	20	154	180	IIIB-2
36	0	0	0	0	0	5.7%	0	0	0	0	0	IIIC
37	20	0	0	20	30	5.7%	41	0	0	41	61	IIIB-2
38	0	0	0	10	5	5.7%	0	0	0	20	10	IIIC
39	20	2	5	50	52	5.7%	41	4	10	102	107	IIIB-2
40	25	0	10	20	45	5.7%	51	0	20	41	92	IIIB-2
41	10	0	5	5	18	5.7%	20	0	10	10	37	IIIC
42	5	0	0	6	8	5.7%	10	0	0	12	16	IIIC
43	10	0	0	4	12	5.7%	20	0	0	8	25	IIIC
44	1	0	5	10	11	5.7%	2	0	10	20	23	IIIC
45	250	100	150	1000	1000	5.7%	512	205	307	2048	2048	IIIA
46	10	0	0	5	13	5.7%	20	0	0	10	27	IIIC
47	40	5	5	40	70	5.7%	82	10	10	82	143	IIIB-2
48	5	0	2	15	15	5.7%	10	0	4	31	31	IIIC
49	15	0	10	4	27	5.7%	31	0	20	8	55	IIIB-2
50	50	5	45	75	138	5.7%	102	10	92	154	283	IIIB-1

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

PROV : SULAWESI SELATAN KAB : SOPPENG

(SPD : 1/2)

LINK NO	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
	HBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	10	0	6	25	29	5.7%	20	0	12	51	59	IIIB-2
52	200	50	50	400	500	5.7%	410	102	102	819	1024	IIIA
53	3	0	1	25	17	5.7%	6	0	2	51	35	IIIC
54	30	2	5	50	62	5.7%	61	4	10	102	127	IIIB-2
55	5	0	2	30	22	5.7%	10	0	4	61	45	IIIC
56	7	1	2	10	15	5.7%	14	2	4	20	31	IIIC
57	30	0	0	50	55	5.7%	61	0	0	102	113	IIIB-2
58	40	5	5	75	88	5.7%	82	10	10	154	180	IIIB-2
59	70	10	20	60	130	5.7%	143	20	41	123	266	IIIB-1
60	10	0	0	5	13	5.7%	20	0	0	10	27	IIIC
61	1	0	0	0	1	5.7%	2	0	0	0	2	IIIC
62	20	0	5	15	33	5.7%	41	0	10	31	68	IIIB-2
63	50	10	15	100	125	5.7%	102	20	31	205	256	IIIB-1
64	20	0	5	15	33	5.7%	41	0	10	31	68	IIIB-2
65	15	0	10	10	30	5.7%	31	0	20	20	61	IIIB-2
66	10	0	2	20	22	5.7%	20	0	4	41	45	IIIC
67	2	0	2	5	7	5.7%	4	0	4	10	14	IIIC
68	20	5	5	40	50	5.7%	41	10	10	82	102	IIIB-2
69	5	5	0	15	18	5.7%	10	10	0	31	37	IIIC
70	0	0	0	0	0	5.7%	0	0	0	0	0	IIIC
71	10	0	2	20	22	5.7%	20	0	4	41	45	IIIC
72	0	0	4	5	7	5.7%	0	0	8	10	14	IIIC
73	2	0	0	5	5	5.7%	4	0	0	10	10	IIIC
74	1	0	0	3	3	5.7%	2	0	0	6	6	IIIC
PERCENT	39.44	8.88	8.12	43.55			39.44	8.88	8.12	43.55		

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 : SOPPENG

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
1	IIIB-1	ASP	227	51	47	250	450
7	IIIB-2	KRK	68	15	14	76	135
8	IIIB-2	KRK	68	15	14	76	135
10	IIIB-2	KRK	79	18	16	87	157
14	IIIB-1	ASP	169	38	35	187	336
17	IIIB-1	ASP	123	28	25	136	244
18	IIIB-1	ASP	205	46	42	226	406
19	IIIB-2	KRK	58	13	12	64	115
27	IIIB-1	ASP	106	24	22	117	211
28	IIIB-2	KRK	86	19	18	95	171
29	IIIB-1	ASP	142	32	29	157	282
30	IIIB-2	KRK	33	7	7	36	65
31	IIIB-2	KRK	79	18	16	87	157
32	IIIB-2	KRK	48	11	10	53	96
36	IIIB-2	KRK	30	7	6	33	60
37	IIIC	KRK	12	3	2	13	24
38	IIIB-1	ASP	106	24	22	117	211
39	IIIA	ASP	324	73	67	357	643
40	IIIB-1	ASP	205	46	42	226	406
41	IIIB-2	KRK	53	12	11	59	106
42	IIIC	KRK	23	5	5	25	46
43	IIIC	KRK	23	5	5	25	46
44	IIIB-1	ASP	129	29	27	143	257
46	IIIA	ASP	259	58	53	286	513
48	IIIB-2	KRK	61	14	13	67	122
49	IIIB-2	KRK	76	17	16	84	151
51	IIIB-2	KRK	73	16	15	80	144
53	IIIB-1	ASP	205	46	42	226	406
55	IIIB-2	KRK	82	18	17	90	162
56	IIIB-2	KRK	82	18	17	90	162
57	IIIC	KRK	23	5	5	25	46
60	IIIC	KRK	23	5	5	25	46
61	IIIB-2	KRK	59	13	12	66	117
62	IIIB-2	KRK	97	22	20	107	193
64	IIIB-1	ASP	212	48	44	234	421
65	IIIB-1	ASP	123	28	25	136	244
66	IIIB-2	KRK	97	22	20	107	193
67	IIIB-1	ASP	129	29	27	143	257
68	IIIB-2	KRK	32	7	7	36	64
69	IIIC	KRK	18	4	4	20	36
70	IIIB-1	ASP	162	36	33	179	321
71	IIIB-1	ASP	205	46	42	226	406
72	IIIC	KRK	23	5	5	25	46
73	IIIB-2	KRK	65	15	13	71	129
74	IIIB-1	ASP	129	29	27	143	257

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 : SOPPENG

(1000Rupiah)

	LINK 11	LINK 12	LINK 13	LINK 14	LINK 15	LINK 16	LINK 17	LINK 18	LINK 19	LINK 20
	2 Km	13 Km	2 Km	5 Km	7 Km	7 Km	3 Km	5 Km	6 Km	7 Km
	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-2	IIIB-2
YEAR	VOC	VOC	VOC	Surplus	VOC	VOC	Surplus	Surplus	Surplus	VOC
1988	0	0	0	0	0	0	0	0	0	0
1989	133	6331	264	6283	1430	1995	119	925	4765	2504
1990	142	6792	280	6630	1534	2136	125	972	5145	2742
1991	150	7197	293	7048	1616	2259	133	1030	5441	2861
1992	158	7611	309	7447	1699	2385	141	1092	5639	2986
1993	168	8035	330	7872	1805	2528	149	1160	6029	3198
1994	175	8389	345	8306	1891	2639	157	1227	6325	3323
1995	187	8887	367	8783	2017	2809	166	1295	6804	3535
1996	197	9450	387	9295	2120	2959	177	1369	7282	3753
1997	208	9948	409	9854	2248	3132	186	1446	7579	3966
1998	218	10465	432	10412	2355	3288	197	1531	8068	4152
SUM	1736	83105	3416	81930	18715	26130	1550	12047	63077	33020
COST	-6683	-1163	-5694	28923	-15953	-11586	-10646	-12180	24921	5290
/Km	-3342	-89	-2847	5785	-2279	-1655	-3549	-2436	4154	756

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.

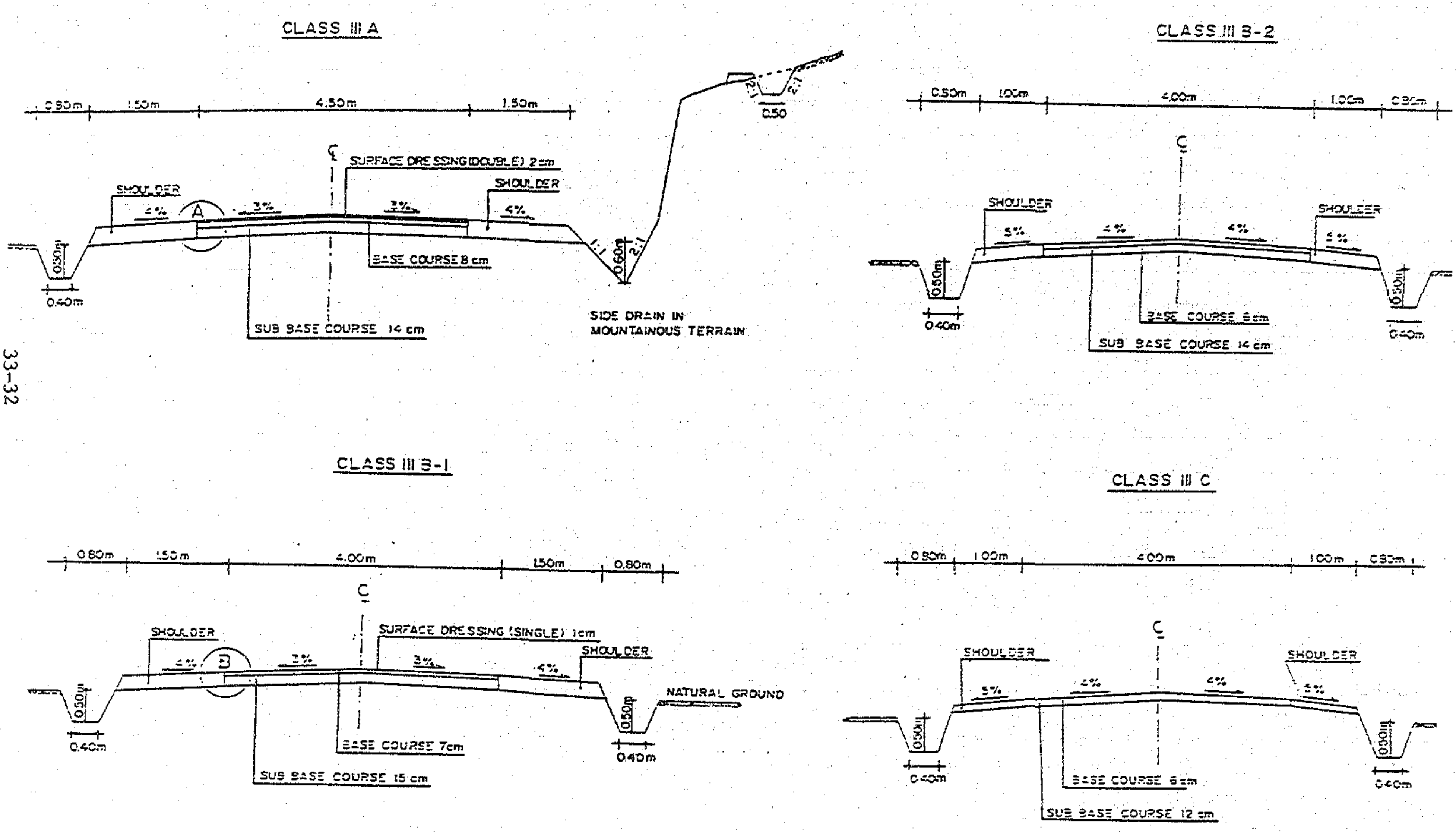
b. 10-ton truck load is applied for timber bridges on roads of III B-1, III B-2 and III C classification.

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 PRACTICABLE
	MINIMUM	30	30	30	30	30	AS PRACTICABLE	30	30	AS PRACTICABLE	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



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

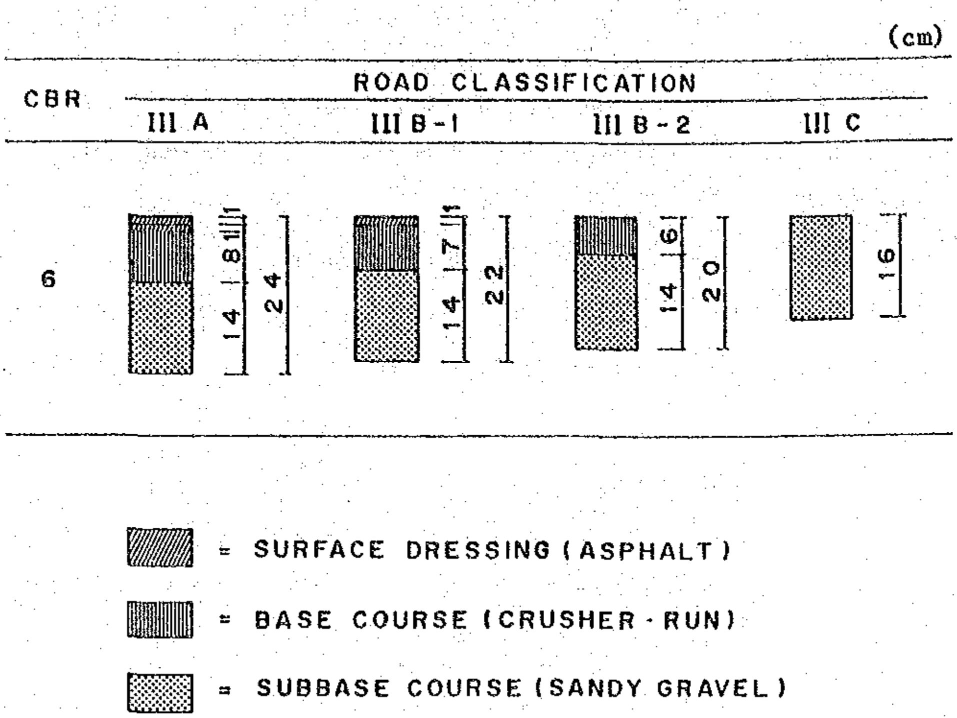
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

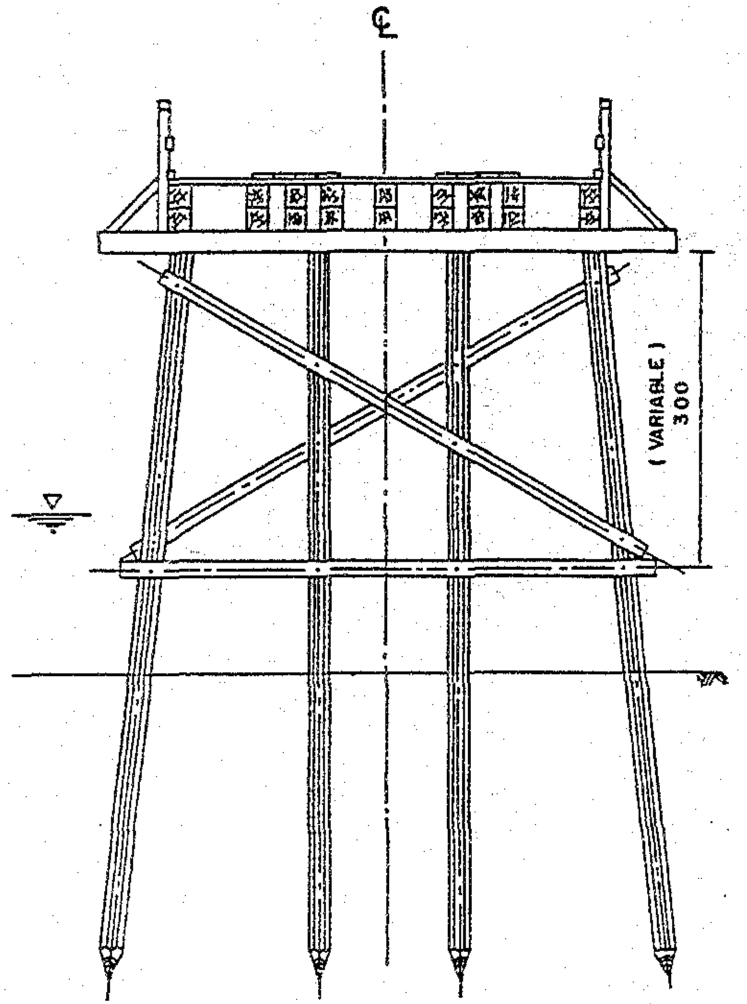
3) Foundation

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.

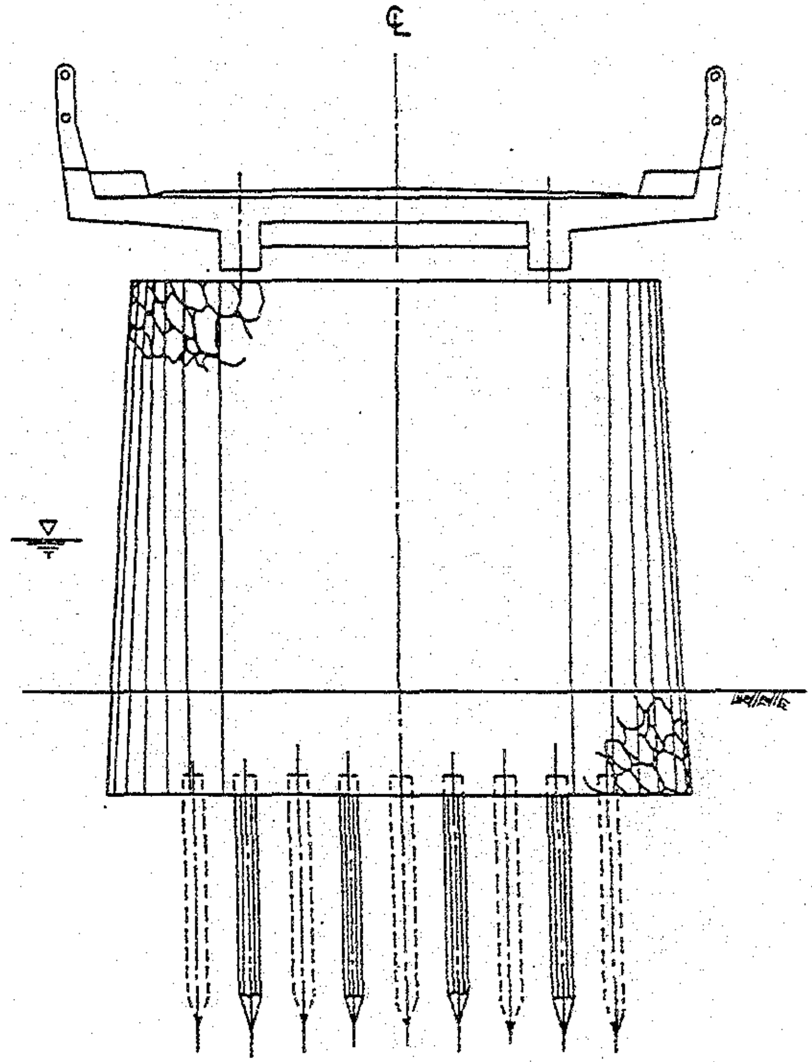
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

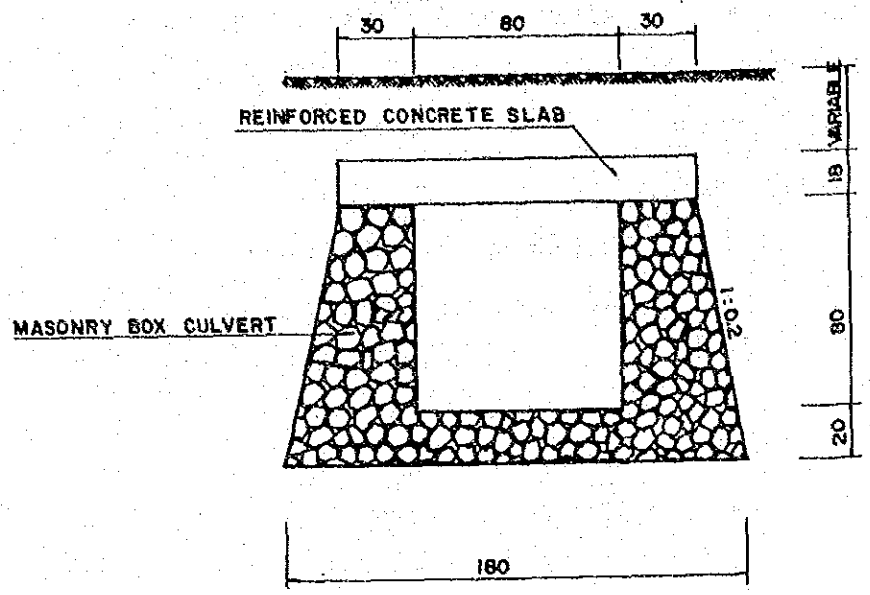
(2) Retaining Wall

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

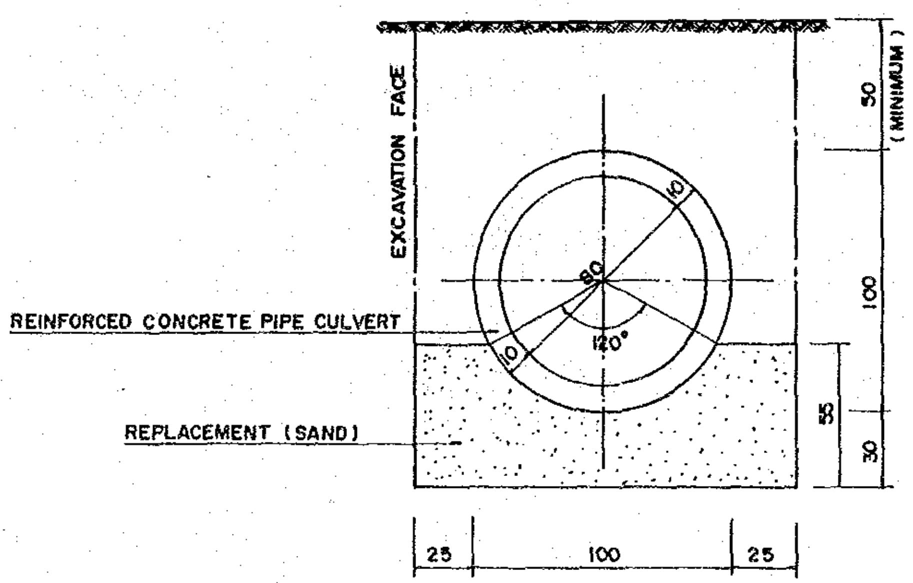
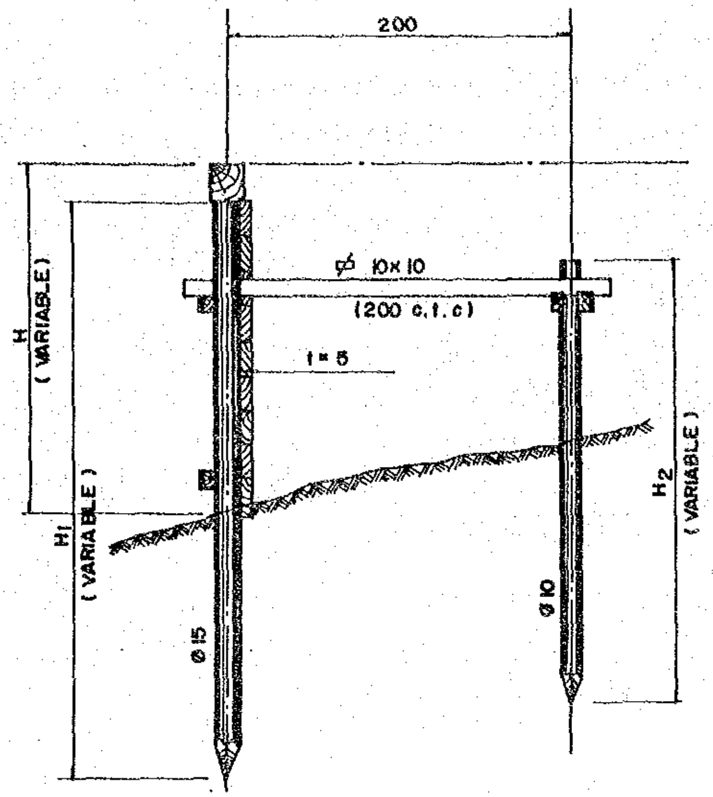
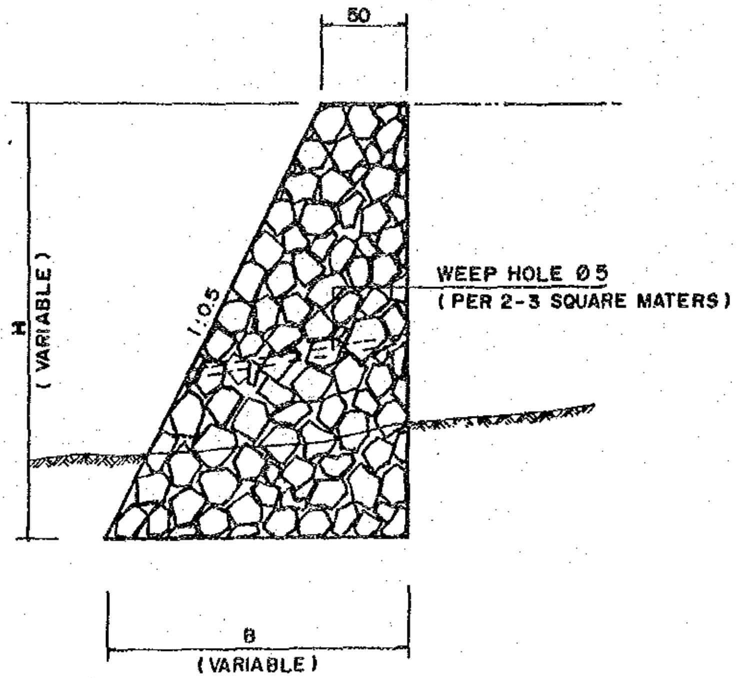


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Soppeng 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 together with for other Kabupatens in 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

(Rp)

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	M^3	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 : SOPPENG

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	<<<<< LOCAL COST >>>>> OWERSHIP	OPERATION	SUB-TOTAL	<<<<< FOREIGN COST >>>>> OWERSHIP	OPERATION	SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	311	13,023	13,334	7,769	1,034	8,803	22,137
	Bulldozer/Ripper	120 HP	340	14,044	14,384	8,500	1,591	10,091	24,475
	Swamp Bulldozer	120 HP	356	14,288	14,644	8,879	1,662	10,541	25,185
	Bulldozer	90 HP	197	8,765	8,962	4,914	654	5,568	14,530
	Bulldozer/Ripper	90 HP	212	9,362	9,574	5,300	992	6,292	15,866
	Bulldozer	65 HP	140	6,369	6,509	3,500	465	3,965	10,474
	Bulldozer/Ripper	65 HP	153	6,823	6,976	3,819	714	4,533	11,509
	Swamp Bulldozer	90 HP	212	9,352	9,564	5,284	989	6,273	15,837
	Swamp Bulldozer	65 HP	162	6,755	6,917	4,050	758	4,808	11,725
	Motor Grader	110 HP	277	11,220	11,497	6,919	1,295	8,214	19,711
	Motor Grader	75 HP	192	7,690	7,882	4,779	894	5,673	13,555
	Motor Grader	65 HP	172	6,767	6,939	4,300	804	5,104	12,043
	Road Stabilizer	W=1850 mm	344	3,414	3,758	8,594	428	9,022	12,780
	Vibratory Roller	4 ton	116	3,361	3,477	2,900	385	3,285	6,762
	Hand-guide Vib. Roller	1000 Kg	102	611	713	850	30	880	1,593
	Tire Roller	8-15 ton	125	7,462	7,587	3,106	103	3,209	10,796
	Vibratory Roller (D&T)	4 ton	116	3,361	3,477	2,900	385	3,285	6,762
	Hand-guide Vib. Roller	600 Kg	72	418	490	600	21	621	1,111
	Rough Terrain Crane	10 ton	402	13,082	13,484	10,039	751	10,790	24,274
	Hydraulic Excavator; Wheel	0.3 m3	165	7,889	8,054	4,109	546	4,655	12,709
	Wheel Loader	1.2 m3	281	8,514	8,795	7,019	934	7,953	16,748
	Wheel Loader	0.3 m3	91	2,973	3,064	2,269	302	2,571	5,635
	Water Tank Truck	4000 ltr.	105	2,878	2,983	868	124	992	3,975
	Fuel Tank Truck	4000 ltr.	106	2,884	2,990	882	126	1,008	3,998
	Dump Truck	3.0 ton	177	3,611	3,788	1,469	210	1,679	5,467
	Flat Bed Truck with Crane	3.0 ton	69	3,116	3,185	1,717	128	1,845	5,030
	Dump Loader Truck	12 ton	154	19,172	19,326	3,838	127	3,965	23,291
	Dump Truck	5.0 ton	263	5,961	6,224	2,189	313	2,502	8,726
	Flat Bed Truck	3.0 ton	23	2,686	2,709	563	42	605	3,314
	Portable Crusher/Screening	30-40 t/h	752	21,982	22,734	18,800	2,502	21,302	44,036
	Concrete Mixer	0.5 m3	648	2,480	3,128	5,400	435	5,835	8,963
	Water Pump	200 l/min	23	269	292	188	6	194	486
	Concrete Vibrator	3.3 HP	9	231	240	73	2	75	315
	Asphalt Sprayer	850 ltr.	123	786	909	1,019	145	1,164	2,073

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 : SOPPENG

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	161	91	252
Subgrade Preparation	m2	20	11	31
Normal Fill	m3	1,661	865	2,526
Fill in Swamp	m3	2,474	1,055	3,529
Normal Excavation to Spoil	m3	974	524	1,498
Sub Base Course	m3	3,152	1,351	4,503
Base Course	m3	4,319	2,303	6,622
Shoulder	m2	290	146	436
Asphalt Patching	m2	3,523	1,312	4,835
Surface Dressing (Single)	m2	594	509	1,103
Surface Dressing (Double)	m2	741	800	1,541
Earth Drain	m	827	119	946
Earth Drain in Swamp (by machine)	m3	1,158	475	1,633
Pipe Culvert D80cm	m	41,020	49,532	90,552
Masonry Culvert (80x80cm)	m	57,443	39,676	97,119
Retaining Wall and Wing Wall (Timber)	m2	18,913	246	19,159
Retaining Wall and Wing Wall (Masonry)	m3	40,295	11,611	51,906
Gabion Protection	m3	11,079	121	11,200
Manual routine maintenance of road	Km	132,008	7,260	139,268
Routine maintenance of earth road	Km	91,378	37,948	129,326
Routine maintenance of gravel road	Km	186,658	88,186	274,844
Routine maintenance of asphalt road	Km	352,300	131,200	483,500

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 : SOPPENG

(Rp)

I T E M	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	64,767	3,541	68,308
Superstructure (Timber;Span 5m;10T)	m2	71,740	3,910	75,650
Superstructure (Timber;Span 8m;10T)	m2	95,025	5,137	100,162
Superstructure (Timber;Span 3m;BM50)	m2	80,309	4,379	84,688
Superstructure (Timber;Span 5m;BM50)	m2	87,677	4,745	92,422
Superstructure (Timber;Span 8m;BM50)	m2	111,198	6,007	117,205
Superstructure (Concrete;Span 3m;BM50)	m2	64,900	104,672	169,572
Superstructure (Concrete;Span 5m;BM50)	m2	66,140	117,107	183,247
Superstructure (Concrete;Span 8m;BM50)	m2	67,742	127,638	195,380
Superstructure (Concrete;Span10m;BM50)	m2	73,759	145,092	218,851
Superstructure (Concrete;Span15m;BM50)	m2	78,703	171,071	249,774
Substructure (Pier;for Timber;10T)	NO	564,031	32,863	596,894
Substructure (Abut;for Timber;10T)	NO	1,466,984	154,495	1,621,479
Substructure (Pier;for Timber;BM50)	NO	829,502	48,632	878,134
Substructure (Abut;for Timber;BM50)	NO	1,666,871	171,666	1,838,537
Substructure (Pier;for Concrete;BM50)	NO	1,723,460	462,948	2,186,408
Substructure (Abut;for Concrete;BM50)	NO	3,594,081	976,181	4,570,262
Demolition of Bridge (Timber->Timber)	m2	17,549	1,374	18,923
Demolition of Bridge (Timber->Concrete)	m2	17,549	1,374	18,923
Demolition of Bridge (Concrete)	m2	90,131	79,067	169,198
Maintenance of Timber Bridge (New)	m2	11,342	1,121	12,463
Maintenance of Concrete Bridge (New)	m2	2,160	2,934	5,094
Maintenance of Timber Bridge (Exist)	m2	9,406	2,405	11,811
Maintenance of Concrete Bridge (Exist)	m2	4,167	2,431	6,598

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) Roads 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 Soppeng are shown in Table 5-1-1.

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

KABUPATEN : Soppeng

CRITERIA NO	ROAD LINK NO
(1)	66,68
(6)	45,59,63

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 : SOPPENG

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
71	5 Km	IIIB-1	78.259	Surplus
52	3 Km	IIIA	72.773	VOC
70	5 Km	IIIB-1	50.655	Surplus
74	4 Km	IIIB-1	47.101	Surplus
38	3 Km	IIIB-1	41.912	Surplus
62	3 Km	IIIB-2	41.549	Surplus
27	3 Km	IIIB-1	41.360	Surplus
24	3 Km	IIIB-2	39.892	VOC
67	4 Km	IIIB-1	35.970	Surplus
55	2 Km	IIIB-2	32.283	Surplus
61	5 Km	IIIB-2	29.334	Surplus
73	2 Km	IIIB-2	29.176	Surplus
50	9 Km	IIIB-1	22.873	VOC
3	5 Km	IIIB-1	22.081	VOC
51	12 Km	IIIB-2	21.558	Surplus
49	9 Km	IIIB-2	19.260	Surplus
39	10 Km	IIIA	16.986	Surplus
1	7 Km	IIIB-1	14.923	Surplus
40	5 Km	IIIB-1	13.291	Surplus
9	21 Km	IIIB-2	12.984	VOC
53	5 Km	IIIB-1	11.538	Surplus
19	6 Km	IIIB-2	10.399	Surplus
64	6 Km	IIIB-1	9.592	Surplus
65	2 Km	IIIB-1	9.362	Surplus
72	3 Km	IIIC	9.285	Surplus
46	8 Km	IIIA	9.212	Surplus
30	2 Km	IIIB-2	9.113	Surplus
42	3 Km	IIIC	8.211	Surplus
32	8 Km	IIIB-2	7.851	Surplus
26	4 Km	IIIB-2	7.725	VOC
48	8 Km	IIIB-2	6.407	Surplus
44	4 Km	IIIB-1	4.907	Surplus
43	3 Km	IIIC	4.532	Surplus
36	3 Km	IIIB-2	4.059	Surplus
14	5 Km	IIIB-1	1.490	Surplus
11	2 Km	IIIB-1	0.078	VOC
37	2 Km	IIIC	0.078	Surplus
12	13 Km	IIIB-1	0.078	VOC
13	2 Km	IIIB-1	0.078	VOC
4	7 Km	IIIA	0.078	VOC
41	6 Km	IIIB-2	0.078	Surplus
15	7 Km	IIIB-1	0.078	VOC
16	7 Km	IIIB-1	0.078	VOC
17	3 Km	IIIB-1	0.078	Surplus
18	5 Km	IIIB-1	0.078	Surplus
47	3 Km	IIIB-2	0.078	VOC
5	5 Km	IIIA	0.078	VOC
20	7 Km	IIIB-2	0.078	VOC
21	3 Km	IIIB-1	0.078	VOC
22	4 Km	IIIB-2	0.078	VOC

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

PROVINCE : SULAWESI SELATAN KABUPATEN : SOPPENG

LINK NO	LENGTH	CLASS	IRR (%)	REMARK
23	2 Km	IIIB-1	0.078	VOC
6	3 Km	IIIB-2	0.078	VOC
54	2 Km	IIIB-2	0.078	VOC
25	3 Km	IIIB-2	0.078	VOC
56	2 Km	IIIB-2	0.078	Surplus
57	3 Km	IIIC	0.078	Surplus
58	3 Km	IIIB-2	0.078	VOC
60	3 Km	IIIC	0.078	Surplus
7	9 Km	IIIB-2	0.078	Surplus
8	8 Km	IIIB-2	0.078	Surplus
28	4 Km	IIIB-2	0.078	Surplus
29	9 Km	IIIB-1	0.078	Surplus
2	3 Km	IIIB-1	0.078	VOC
69	3 Km	IIIC	0.078	Surplus
31	13 Km	IIIB-2	0.078	Surplus
10	13 Km	IIIB-2	0.078	Surplus
33	5 Km	IIIB-2	0.078	VOC
34	20 Km	IIIB-1	0.078	VOC
35	5 Km	IIIB-2	0.078	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SULAWESI SELATAN KABUPATEN : SOPPENG

LINK NO	LENGTH	CLASS	IRR (%)	REMARK
46	8 Km	IIIB-1	13.898	Surplus
30	2 Km	IIIC	12.713	Surplus
26	4 Km	IIIC	10.663	VOC
32	8 Km	IIIC	10.566	Surplus
48	8 Km	IIIC	10.431	Surplus
72	3 Km	IIIC	9.285	Surplus
65	2 Km	IIIB-2	8.826	Surplus
42	3 Km	IIIC	8.211	Surplus
36	3 Km	IIIC	6.594	Surplus
43	3 Km	IIIC	4.532	Surplus
64	6 Km	IIIB-2	0.078	Surplus
14	5 Km	IIIB-2	0.078	Surplus
44	4 Km	IIIB-2	0.078	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SULAWESI SELATAN KABUPATEN : SOPPENG

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
71	5 Km	IIIB-1	362082	4.757	78.259	Surplus
70	5 Km	IIIB-1	201911	3.100	50.655	Surplus
74	4 Km	IIIB-1	120275	2.826	47.101	Surplus
67	4 Km	IIIB-1	104422	2.246	35.970	Surplus
52	3 Km	IIIA	99286	3.658	72.773	VOC
50	9 Km	IIIB-1	89292	1.554	22.873	VOC
38	3 Km	IIIB-1	71276	2.522	41.912	Surplus
27	3 Km	IIIB-1	68804	2.488	41.360	Surplus
39	10 Km	IIIA	47276	1.283	16.986	Surplus
62	3 Km	IIIB-2	46156	2.492	41.549	Surplus
61	5 Km	IIIB-2	41800	1.833	29.334	Surplus
51	12 Km	IIIB-2	37516	1.429	21.558	Surplus
3	5 Km	IIIB-1	37028	1.485	22.081	VOC
55	2 Km	IIIB-2	26636	2.060	32.283	Surplus
24	3 Km	IIIB-2	23967	2.170	39.892	VOC
49	9 Km	IIIB-2	22210	1.324	19.260	Surplus
73	2 Km	IIIB-2	18507	1.858	29.176	Surplus
1	7 Km	IIIB-1	16160	1.180	14.923	Surplus
46	8 Km	IIIB-1	14410	1.142	13.898	Surplus
9	21 Km	IIIB-2	8620	1.078	12.984	VOC
40	5 Km	IIIB-1	8420	1.123	13.291	Surplus
53	5 Km	IIIB-1	3509	1.053	11.538	Surplus
32	8 Km	IIIC	2731	1.023	10.566	Surplus
30	2 Km	IIIC	1995	1.105	12.713	Surplus
48	8 Km	IIIC	831	1.014	10.431	Surplus
26	4 Km	IIIC	584	1.020	10.663	VOC
19	6 Km	IIIB-2	462	1.012	10.399	Surplus
SUM	161 Km		1476166			

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: Soppeng

($Rp \times 10^6$)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	552	971	1,523
MAINTENANCE	175	573	748
SUPPLEMENTATION	454	-	454
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	1,226	1,544	2,770

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

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

($Rp \times 10^6$)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CIVIL WORK	305	1,531	1,836
CONSTRUCTION & MAINTENANCE EQUIPMENT	822	-	822
SPARE PARTS	54	13	67
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	1,226	1,544	2,770

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 Links 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 30 links with the total length of 194 km which is 49% of the 399 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 : Soppeng

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	1,3,9,19,24,27,38,39,40,49,50,51, 52,53,55,61,62,67,70,71,73,74
- Secondary	26,30,32,46,48
Engineering Point of View	10,15,31
Basic Human Needs	-

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

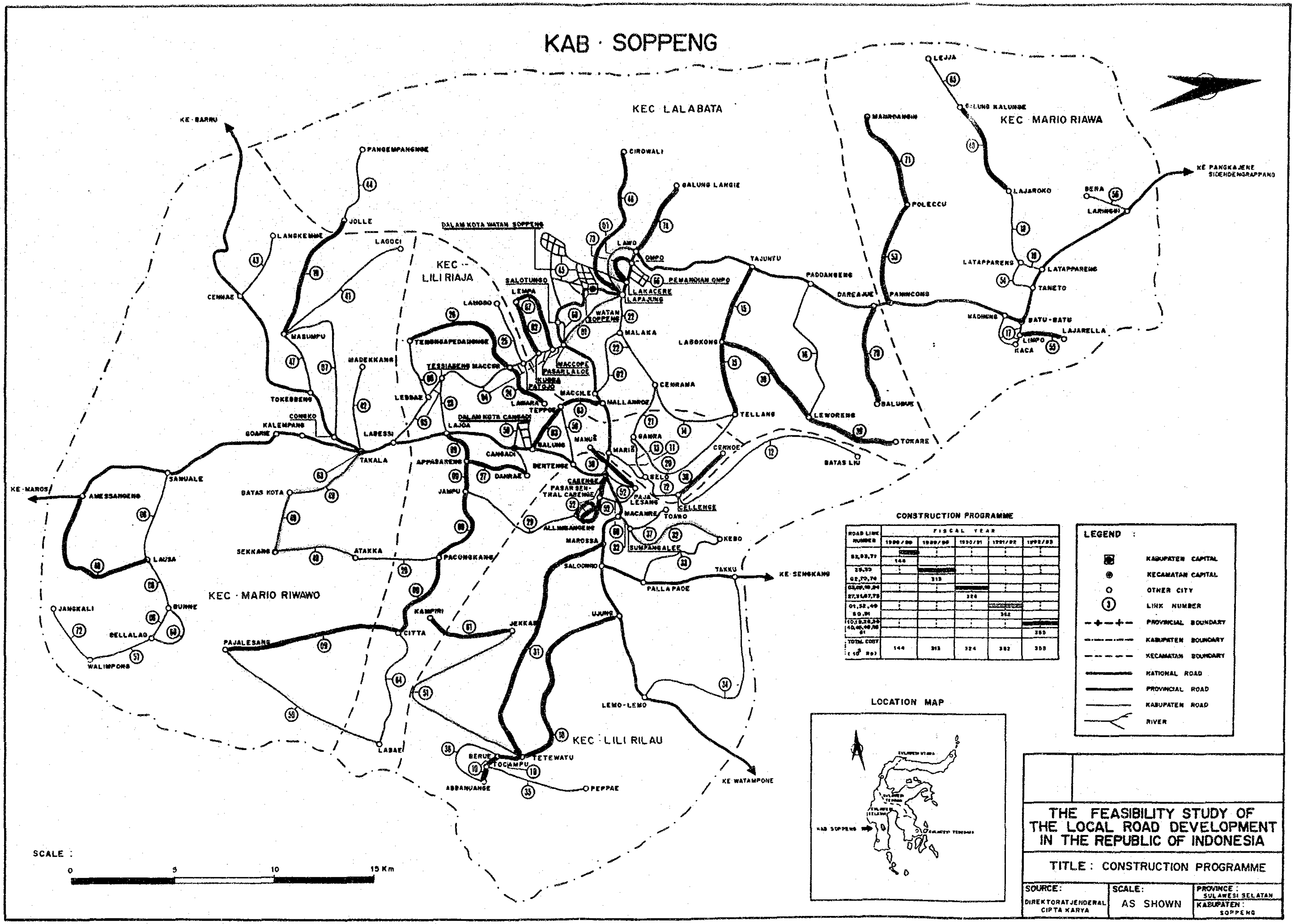
Three key road links which are located at the strategic point to complete the rocal road network consisting of feasible road links are selected from the engineering point of view.

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 : SOPPENG

YEAR		LINK NO ( ) : rate
1988	:	52, 53, 71
1989	:	38, 39, 62, 70, 74
1990	:	3, 9, 15, 24, 27, 31, 67, 73
1991	:	1, 32, 49, 50, 51
1992	:	10, 19, 26, 30, 40, 46, 48, 55, 61



CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1988/89	1989/90	1990/91	1991/92	1992/93
52,53,77	144				
29,33 62,70,74		313			
03,09,18,24 27,31,67,73			324		
01,32,40 50,91				352	
10,19,28,29 40,46,48,58 61					353
TOTAL COST (10^6 Rp)	144	313	324	352	353

(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 : SOPPENG

(1000Rp)

LINK NO	LENGTH (Km)	GA (%)	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
3	5	0.0	99.0	1.0	0.0	0	5	0	0	0.00	1	48.00	317	1,793	594	2,387
4	7	99.0	1.0	0.0	0.0	7	0	0	0	0.00	6	317.00	2,092	4,711	1,740	6,451
5	5	99.0	1.0	0.0	0.0	5	0	0	0	0.00	2	100.00	660	2,838	935	3,773
7	9	77.8	22.2	0.0	0.0	0	9	0	3	36.00	0	0.00	425	3,207	946	4,153
8	8	86.0	14.0	0.0	0.0	0	8	0	0	0.00	1	18.00	119	2,624	807	3,431
9	21	64.8	16.2	19.0	0.0	16	1	4	0	0.00	6	103.00	680	9,390	2,742	12,132
10	13	46.2	37.7	16.2	0.0	11	2	0	0	0.00	2	155.00	1,023	6,611	2,091	8,702
11	2	90.0	10.0	0.0	0.0	2	0	0	0	0.00	1	108.00	713	1,419	539	1,958
12	13	86.2	13.8	0.0	0.0	5	8	0	0	0.00	1	40.00	264	5,138	1,553	6,691
13	2	85.0	15.0	0.0	0.0	2	0	0	0	0.00	0	0.00	0	969	277	1,246
14	5	91.0	9.0	0.0	0.0	0	5	0	0	0.00	1	47.50	313	1,791	593	2,384
15	7	67.9	32.1	0.0	0.0	7	0	0	0	0.00	3	66.50	439	3,667	1,131	4,798
16	7	74.3	17.1	8.6	0.0	7	0	0	0	0.00	1	100.00	660	3,807	1,212	5,019
17	3	95.0	5.0	0.0	0.0	3	0	0	1	75.00	0	0.00	886	2,158	596	2,754
18	5	86.0	14.0	0.0	0.0	5	0	0	0	0.00	1	70.50	465	2,715	864	3,579
20	7	50.0	30.0	20.0	0.0	7	0	0	0	0.00	3	138.00	911	3,965	1,305	5,270
21	3	90.0	10.0	0.0	0.0	3	0	0	0	0.00	0	0.00	0	1,453	415	1,868
22	4	90.0	10.0	0.0	0.0	4	0	0	0	0.00	1	50.00	330	2,146	675	2,821
23	2	95.0	5.0	0.0	0.0	2	0	0	0	0.00	0	0.00	0	969	277	1,246
25	3	70.0	30.0	0.0	0.0	0	3	0	0	0.00	0	0.00	0	956	286	1,242
26	4	37.5	43.8	0.0	18.8	0	3	1	0	0.00	1	45.00	297	1,367	441	1,808
28	4	75.0	25.0	0.0	0.0	0	4	0	1	20.00	0	0.00	236	1,463	430	1,893
29	9	84.1	15.9	0.0	0.0	0	9	0	0	0.00	2	120.00	792	3,368	1,151	4,519
31	13	53.1	26.9	20.0	0.0	0	13	0	0	0.00	2	85.00	561	4,497	1,447	5,944

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

PROV : SULAWESI SELATAN KAB : SOPPENG

(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
33	5	0.0	83.0	17.0	0.0	0	5	0	2	30.00	0	0.00	354	1,876	549	2,425
34	20	86.9	12.9	0.3	0.0	0	20	0	0	0.00	0	0.00	0	6,373	1,909	8,282
35	5	13.0	87.0	0.0	0.0	0	5	0	0	0.00	1	55.00	363	1,823	611	2,434
37	2	50.0	50.0	0.0	0.0	0	1	1	0	0.00	0	0.00	0	542	141	683
39	10	76.5	23.5	0.0	0.0	0	10	0	2	24.00	0	0.00	283	3,412	1,012	4,424
40	5	78.0	15.0	7.0	0.0	0	5	0	0	0.00	0	0.00	0	1,593	477	2,070
41	6	58.2	36.8	5.0	0.0	0	6	0	2	24.00	0	0.00	283	2,138	630	2,768
45	14	84.3	15.0	0.7	0.0	14	0	0	0	0.00	3	120.00	792	7,280	2,230	9,510
47	3	86.7	13.3	0.0	0.0	0	3	0	0	0.00	0	0.00	0	956	286	1,242
48	8	56.9	5.6	35.6	1.9	0	5	3	0	0.00	0	0.00	0	2,263	613	2,876
49	9	47.8	33.3	18.9	0.0	0	5	4	3	48.00	0	0.00	567	2,938	774	3,712
51	12	33.3	20.0	45.0	1.7	0	8	4	0	0.00	0	0.00	0	3,443	944	4,387
53	5	74.0	26.0	0.0	0.0	0	5	0	1	32.00	0	0.00	378	1,894	554	2,448
54	2	95.0	5.0	0.0	0.0	0	2	0	0	0.00	0	0.00	0	637	191	828
56	2	95.0	4.0	1.0	0.0	0	2	0	0	0.00	0	0.00	0	637	191	828
57	3	91.3	8.7	0.0	0.0	0	3	0	0	0.00	0	0.00	0	956	286	1,242
58	3	33.3	50.0	16.7	0.0	0	3	0	0	0.00	0	0.00	0	956	286	1,242
59	2	94.5	5.5	0.0	0.0	2	0	0	0	0.00	0	0.00	0	969	277	1,246
63	2	90.0	10.0	0.0	0.0	2	0	0	0	0.00	0	0.00	0	969	277	1,246
64	6	90.0	10.0	0.0	0.0	0	6	0	0	0.00	0	0.00	0	1,912	573	2,485
65	2	0.0	95.0	5.0	0.0	0	2	0	2	48.00	0	0.00	567	1,089	306	1,395
SUM	287					104	166	17	17	337.00	39	1786.50	15,768	117,678	36,164	153,842

6.1.3 Annual Construction and Maintenance Cost

The annual allocation of the total construction and maintenance cost in the five years programme for the Kabupaten 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 1,523 x 10^6 and maintenance cost is Rp 748 x 10^6 which is approximately 33% of the total expenditure.

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

(CONSTRUCTION)

PROV : SULAWESI SELATAN KAB : SOPPENG

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	90,720	191,236	210,117	255,525	223,766	971,364	(63.8%)
Ownership Cost	1,542	3,574	4,017	5,065	4,284	18,482	(1.9%)
Operation Cost	40,378	94,033	104,339	131,831	111,344	481,921	(49.6%)
Material Cost	21,160	39,833	41,203	44,374	44,409	190,983	(19.7%)
Labour Cost	15,799	28,852	33,155	40,926	34,546	153,278	(15.8%)
Contingency	11,833	24,944	27,407	33,329	29,187	126,700	(13.0%)
FOREIGN CURRENCY :	54,487	122,499	114,504	127,574	132,069	551,213	(36.2%)
Ownership Cost	21,998	51,718	58,101	72,367	61,563	265,747	(48.2%)
Operation Cost	3,048	7,220	8,304	10,345	8,697	37,614	(6.8%)
Material Cost	22,334	47,583	33,233	28,222	44,583	175,955	(31.9%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	7,107	15,979	14,946	16,640	17,226	71,897	(13.0%)
TOTAL COST :	145,207	313,735	324,700	383,100	355,835	1,522,577	
Ownership Cost	23,540	55,292	62,118	77,432	65,847	284,229	(18.7%)
Operation Cost	43,426	101,253	112,639	142,176	120,041	519,535	(34.1%)
Material Cost	43,502	87,416	74,436	72,596	88,988	366,938	(24.1%)
Labour Cost	15,799	28,852	33,155	40,926	34,546	153,278	(10.1%)
Contingency	18,940	40,922	42,352	49,970	46,413	198,597	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SULAWESI SELATAN KAB : SOPPENG

(UNIT : 1000Rp)

ITEM		(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :		58,338	120,900	121,359	131,383	140,526	572,506	(76.5%)
	Ownership Cost	940	1,967	1,997	2,170	2,321	9,395	(1.6%)
	Operation Cost	29,181	59,838	59,221	64,583	68,585	281,408	(49.2%)
	Material Cost	2,247	4,749	4,925	5,147	5,990	23,058	(4.0%)
	Labour Cost	25,970	54,346	55,216	59,483	63,630	258,645	(45.2%)
FOREIGN CURRENCY :		17,943	37,151	37,079	40,356	42,893	175,422	(23.5%)
	Ownership Cost	14,053	28,820	28,497	31,132	33,069	135,571	(77.3%)
	Operation Cost	1,642	3,363	3,332	3,651	3,897	15,885	(9.1%)
	Material Cost	2,248	4,968	5,250	5,573	5,927	23,966	(13.7%)
	Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :		76,281	158,051	158,438	171,739	183,419	747,928	
	Ownership Cost	14,993	30,787	30,494	33,302	35,390	144,966	(19.4%)
	Operation Cost	30,823	63,201	62,553	68,234	72,482	297,293	(39.7%)
	Material Cost	4,495	9,717	10,175	10,720	11,917	47,024	(6.3%)
	Labour Cost	25,970	54,346	55,216	59,483	63,630	258,645	(34.6%)

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

(TOTAL)

PROV : SULAWESI SELATAN KAB : SOPPENG

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	149,038	312,136	331,476	386,908	364,292	1,543,870	(68.0%)
Ownership Cost	2,482	5,541	6,014	7,235	6,605	27,877	(1.8%)
Operation Cost	69,559	153,871	163,556	196,414	179,929	763,329	(49.4%)
Material Cost	23,415	44,582	46,128	49,521	50,395	214,041	(13.9%)
Labour Cost	41,769	83,198	88,371	100,409	98,176	411,923	(26.7%)
Contingency	11,833	24,944	27,407	33,329	29,187	126,700	(8.2%)
FOREIGN CURRENCY :	72,430	159,650	151,663	167,930	174,962	726,635	(32.0%)
Ownership Cost	36,051	80,538	86,598	103,499	94,632	401,318	(55.2%)
Operation Cost	4,690	10,583	11,636	13,996	12,594	53,499	(7.4%)
Material Cost	24,582	52,551	38,483	33,795	50,510	199,921	(27.5%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	7,107	15,978	14,946	16,640	17,226	71,897	(9.9%)
TOTAL COST :	221,488	471,786	483,138	554,839	539,254	2,270,505	
Ownership Cost	38,533	86,079	92,612	110,734	101,237	429,195	(18.9%)
Operation Cost	74,249	164,454	175,192	210,410	192,523	816,828	(36.0%)
Material Cost	47,997	97,133	84,611	83,316	100,905	413,962	(18.2%)
Labour Cost	41,769	83,198	88,371	100,409	98,176	411,923	(18.1%)
Contingency	18,940	40,922	42,352	49,970	46,413	198,597	(8.7%)

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

b. Equipment for Bridge Maintenance

- 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

The proposed construction and maintenance equipment and their purchase costs are shown in Table 6-1-8. In the Project the supplementation cost or equipment cost supplemented is the difference between the purchase cost for newly supplied equipment and the depreciated value.
This comes about because full depreciation of the supplied equipment would not be completed within the Project Period of 5 years.

Table 6-1-7 REQUIRED NUMBER OF EQUIPMENT

PROV : SULAWESI SELATAN KAB : SOPPENG

EQUIPMENT NAME	WORKABLE	EXISTING	< 1988 >	< 1989 >	< 1990 >	< 1991 >	< 1992 >
Bulldozer/Ripper	240	0	0.19	0.36	0.54	0.49	0.51
Swamp Bulldozer	240	0	0.00	0.02	0.00	0.12	0.00
Motor Grader	250	0	0.31	0.78	1.02	1.11	1.00
Hand-guide Vib. Roller	250	0	0.04	0.00	0.11	0.07	0.05
Tire Roller	240	0	0.31	0.59	0.44	0.38	0.61
Vibratory Roller (D&T)	250	0	0.23	0.60	0.71	0.92	0.72
Hydraulic Excavator; Wheel	240	0	0.00	0.16	0.00	0.63	0.00
Wheel Loader	250	0	0.46	1.07	1.24	1.52	1.31
Water Tank Truck	250	0	0.13	0.38	0.36	0.59	0.41
Dump Truck	250	0	3.44	7.86	8.96	11.58	9.58
Flat Bed Truck with Crane	250	0	0.00	0.00	0.06	0.09	0.00
Flat Bed Truck	250	0	0.35	0.68	0.53	0.45	0.70
Portable Crusher/Screening	250	0	0.10	0.25	0.26	0.27	0.29
Concrete Mixer	240	0	0.00	0.00	0.00	0.00	0.00
Water Pump	240	0	0.00	0.00	0.00	0.00	0.00
Concrete Vibrator	240	0	0.00	0.00	0.00	0.00	0.00
Asphalt Sprayer	240	0	0.31	0.59	0.44	0.38	0.61

NOTE WORKABLE : workable days in a year

EXISTING : number of existing equipment

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SULAWESI SELATAN KAB : SOPPENG

(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	1	8,500
Tire Roller	8-15 ton	31,070	1	31,070
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	9	132,300
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	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	1	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	822,060
OWNERSHIP COST (FOREIGN)	368,107
EQUIPMENT COST SUPPLEMENTED	453,953

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Dump Truck	33,211

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 : SOPPENG

ITEM	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance In Light Bush	m2	20000.00	28000.00	15000.00	28000.00	27000.00	118000.00
Subgrade Preparation	m2	35000.00	112050.00	78000.00	132000.00	90000.00	447050.00
Normal Fill	m3	0.00	0.00	0.00	0.00	0.00	0.00
Fill in Swamp	m3	0.00	675.00	0.00	4800.00	0.00	5475.00
Normal Excavation to Spoil	m3	740.00	1927.00	1813.00	2628.00	1680.00	8788.00
Sub Base Course	m3	3452.00	9974.00	8920.50	15278.00	10820.00	48444.50
Base Course	m3	2800.00	7280.00	8730.00	9520.00	9240.00	37570.00
Shoulder	m2	37000.00	78000.00	156500.00	117000.00	131000.00	519500.00
Asphalt Patching	m2	375.00	0.00	450.00	0.00	495.00	1320.00
Surface Dressing (Single)	m2	52000.00	48000.00	76000.00	64000.00	104000.00	344000.00
Surface Dressing (Double)	m2	0.00	40000.00	0.00	0.00	0.00	40000.00
Earth Drain	m	10000.00	10500.00	7920.00	7920.00	13420.00	49760.00
Earth Drain In Swamp (by machine)	m3	0.00	3000.00	0.00	12000.00	0.00	15000.00
Pipe Culvert D80cm	m	0.00	0.00	0.00	0.00	0.00	0.00
Masonry Culvert (80x80cm)	m	0.00	0.00	0.00	0.00	0.00	0.00
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	0.00	0.00	0.00	0.00	0.00	0.00
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	4.00	0.00	0.00	4.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;10T)	m2	0.00	0.00	60.00	124.00	0.00	184.00
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	1.00	2.00	0.00	3.00
Substructure (Abut;for Timber;10T)	NO	0.00	0.00	4.00	4.00	0.00	8.00
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	142.25	290.00	287.00	311.50	331.00	1361.75
Routine maintenance of earth road	Km	8.50	17.00	15.00	9.00	3.00	52.50
Routine maintenance of gravel road	Km	81.75	156.00	144.50	167.50	182.50	732.25
Routine maintenance of asphalt road	Km	52.00	117.00	127.50	135.00	145.50	577.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	0.00	64.00	64.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	160.50	325.00	337.00	313.00	337.00	1472.50
Maintenance of Concrete Bridge (Exist)	m2	893.25	1849.40	1698.15	1849.40	1765.40	8055.60

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.

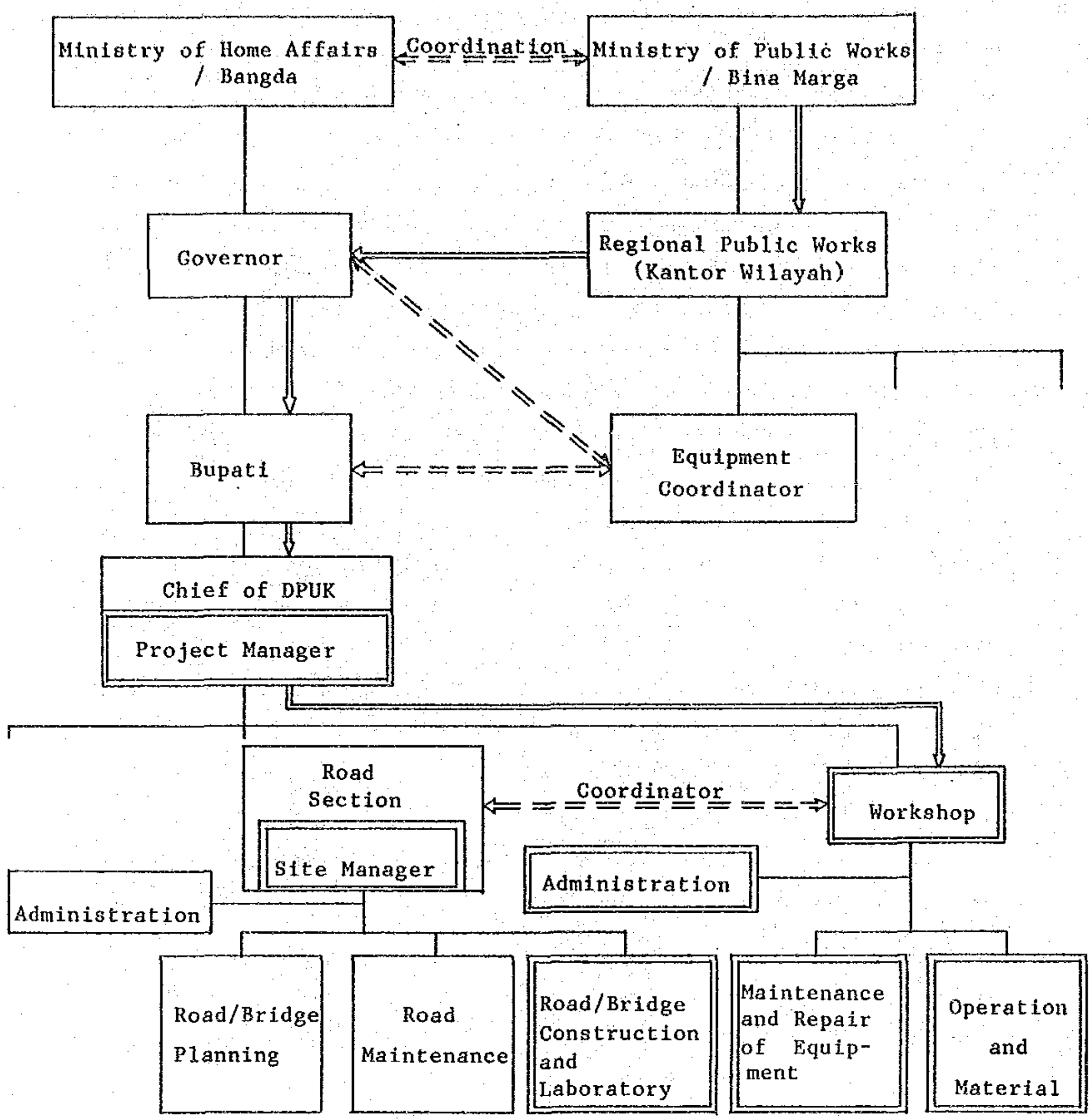
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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



⇓ : Equipment delivery flow

▭ : New position/subsection

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

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

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

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

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

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

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

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