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 38

KABUPATEN KOLAKA

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 Kolaka 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.

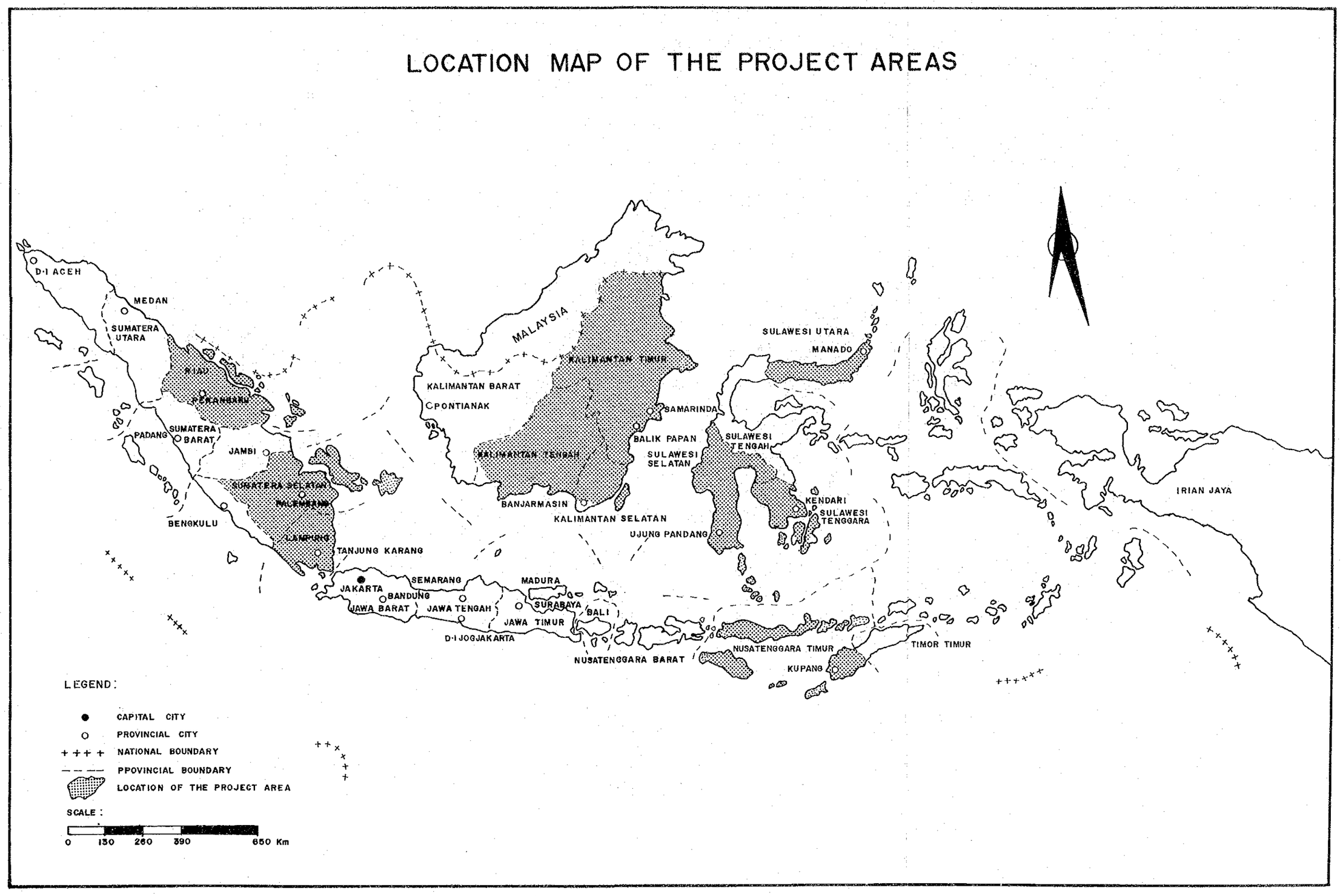
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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.

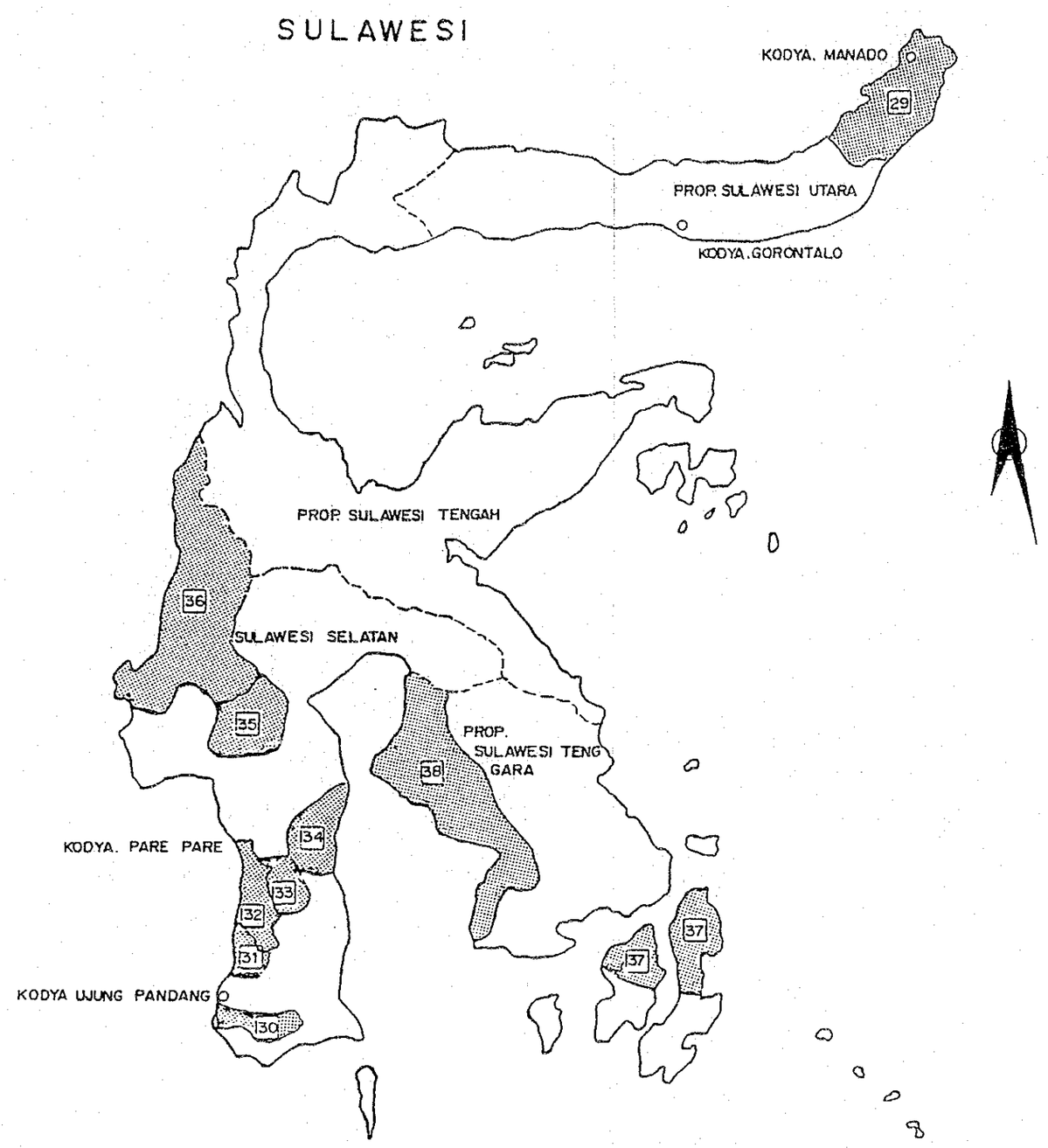
LOCATION MAP OF THE PROJECT AREAS



VIII · PROPINSI SULAWESI UTARA
29 · KAB · MINÁHASA

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



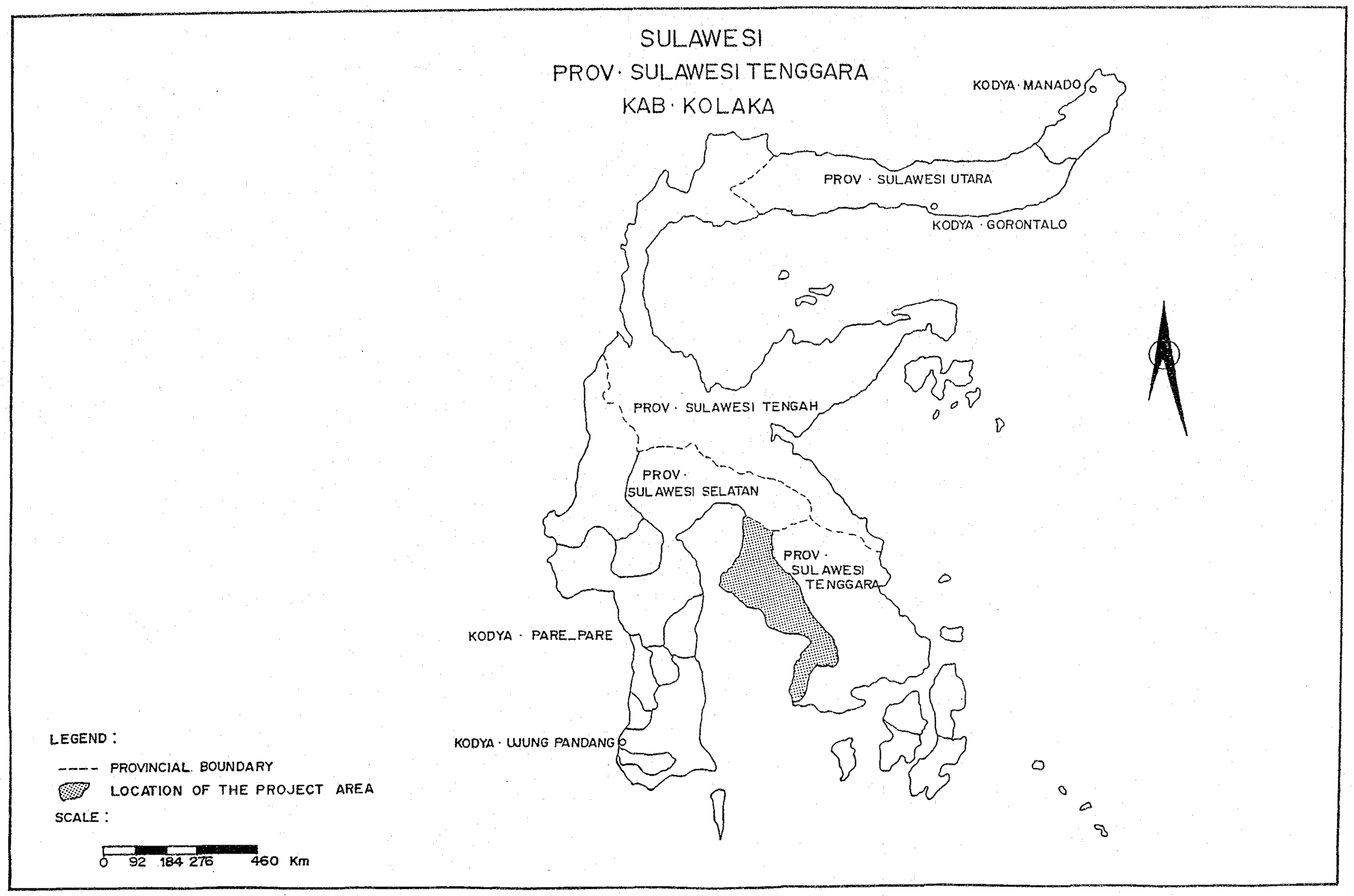
LEGEND :

---- PROVINCIAL BOUDER

LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km


SULAWESI
PROV· SULAWESI TENGGARA
KAB· KOLAKA
KODYA· MANADO
PROV · SULAWESI UTARA
KODYA · GORONTALO
PROV · SULAWESI TENGAH
PROV · SULAWESI SELATAN
PROV · SULAWESI TENGGARA
KODYA · PARE_PARE
KODYA · UJUNG PANDANG
LEGEND :
---- PROVINCIAL BOUNDARY
LOCATION OF THE PROJECT AREA
SCALE :
0 92 184 276 460 Km

KAB. KOLAKA

KEC LASUSUA
KEC PAKUE
KEC MOWEWE
KEC KOLAKA
KEC WUNDULAKO
KEC TIRAWUTA
KAB. KENDARI
KAB. BUTON
TELUK BONE
TELUK KOLAKA
P. PADAMARANG
PROPINSI SULAWESI SELATAN
KE KENDARI

KATO, AWO, LASUSUA, PITULUA, LAMBAI, MALAMALA, KAROOHA, KAMISI, TIU, WATUNOHU, TOAHA, KOSALI, LAHASARU, LAPAI, RANTEANGIN, WAWO, WALASIHO, WOIMENDA, WOLO, ULUWOLO, TAMBOLI, ULULA-PARAO, TOLOWE, TOSIBA, PUATAU, ANGGUAME, TONGAUNA, ALAAHA, AHELULU, UESI, PORABUA, SANGGONA, TAWANGA, MANGOLO, ULENGGOLAKA, KOLAKA, LAMOKATO, DAWI DAWI, TOWUA, SP.JL. PROPINSI, BAULA, LAMEKONGGA, HORODOPI, MOWEWE, NILOMBU, WATU PUTE, TINONDO, TALODO, SOLEWATU, LOEA, RATERATE, WOIHA, POLIPOLIA, LAMBANDIA, TOARI, LAMUNDE, SP.2 TOARI, OLOOLOHO, PAKUE, LAMPI, LAMPA, ILOTAWU, MASIKU, PUUNOOHO, MOJOPAHIT, LELEWAWO, TOLALA, LAMPIA, POREHU, LARUI

LEGEND :

- KABUPATEN CAPITAL
- KECAMATAN CAPITAL
- OTHER CITY
- 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 TENGGARA
DIREKTORAT JENDERAL AGRARIA	AS SHOWN	KABUPATEN: KOLAKA

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 Kolaka is located in the northwestern part of Sulawesi Tenggara Province, and appears geographically as a long and slender shape which lies along Bone Bay.

Kabuapten Kolaka is surrounded by mountains and is itself almost entirely mountainous, i.e the northern mountain Mengkoka of 2,790 meter, the central mountain Batuwila of 2,000 meter and the southern mountain Mendoka of 981 meter above sea level. Accordingly the height above sea level of the northern area is greater than that of the southern area. Kecamatan Pakue Lasusua is located in the northern part of the Kabuapten and has few flat areas because it is almost all mountainous. Kecamatan Mowewe has the same conditions as Kecamatan Pakue, however the Kanaweha River rising in the north of the Kabupaten flows southwards for a while and turns into the neigboring Kabupaten Kendari, where narrow lowlands lie along the river. Kecamatan Kolaka which is located in the middle of the Kabupaten includes Kolaka city, the capital of the Kabuapten, which has a narrow flat area around it. Kecamatan Wundulako, which is located in the southern part of the Kabupaten is also mostly covered by mountains, while a few hills, are found in the southern coastal area. Kecamatan Tirauta, which is located in the middle southeastern part of the Kabupaten is flat. This is formed by part of the low swampy area which ectends from the neighboring Kabupaten Kendari, the central area of Sulawesi Tenggara Province.

The Kabupaten has an area of 8,855 square kilometers, approximately 32 percent of the total of the province. It consists administratively of 6 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Kolaka are 128 days and 1,680 mm respectively.

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

The number of working days per year, 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.

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

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 Tenggara
KABUPATEN : Kolaka

STATION : Kolaka

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	9	295	7	147	13	170				
February	11	178	13	207	16	152				
March	9	148	16	183	26	372				
April	18	339	11	215	22	260				
May	11	167	16	254	14	192				
June	12	126	11	127	10	95				
July	6	43	23	271	1	1				
August	11	60	4	15	3	6				
September	-	-	9	70	3	41				
October	5	44	9	127	2	10				
November	8	82	16	195	4	16				
December	15	229	14	148	6	55				
Total	115	1,711	149	1,959	120	1,370	-	-	-	-

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Kolaka in 1982 was 159,790 which was approximately 15.9% of the 1,002,100 total population of Sulawesi Tenggara Province as shown in Table 1-2-1.

The population density was 0.18 persons per ha which was lower than the provincial density of 0.38.

The recent annual average growth rate of population of the Kabupaten is 5.7% which is higher than both the provincial rate of 3.1% and the national rate of 2.2%. This may be a result of the on-going transmigration programme.

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:					
MUNA	187,653	3.0	488,725	0.38	1984
KOLAKA	159,790	5.7	885,495	0.18	1982
PROVINCE:					
SULWESI TENGGARA	1,002,100		2,768,600		1982
	1,031,200	3.1	2,768,600	0.37	1983
	1,061,200		2,768,600		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 : 1982

PROVINCE : SULAWESI TENGGARA

KABUPATEN : KOLAKA

KECAMATAN	POPULATION	PROPORTION (%)
WUNDULAKO	48,370	30.3
TIRAUTA	25,052	15.7
MOWEWE	8,545	5.3
KOLAKA	39,989	25.0
LASUSUA	19,920	12.5
PAKUE	17,914	11.2
TOTAL	159,790	100

1.2.2 Land Use

In Kabupaten Kolaka, 32,199 ha of the current available land use area, which is approximately 3.6% of the 885,495 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 28,179 ha of agricultural harvest area and 4,020 ha of residential area which are 87.5% and 12.5% of the current available land use area respectively.

The agricultural harvest area consists of 12,178 ha of paddy field, 7,012 ha of plantation and 8,989 ha of other cultivated area which are 43.2%, 24.9% and 31.9% 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 TENGGARA

(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
MUNA	12 (0.1)	3,367 (0.7)	53,999 (11.0)	26,322 (5.4)	4,260 (0.9)	142,000 (29.1)	1,062 (0.2)	221,440 (45.3)	36,278 (7.4)	488,725 (100)	1984
KOLAKA	12,178 (1.4)	-	8,989 (1.0)	7,012 (0.8)	4,020 (0.5)	-	-	773,286 (87.3)	80,000 (9.0)	885,495 (100)	1982

Notes :

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

1.2.3 Agriculture

The cultivated area and food crop production in Kabupaten Kolaka in 1982 were 10,429 ha and 31,441 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 7,554 ha and 29,818 ton respectively which are 72.4% and 94.8% of the total food crops. The yield rate of paddy production is 3.95 ton per ha. Thus, paddy is the most predominant agricultural crop of the Kabupaten.

As the table shows, average annual growth rates of area and production of paddy in 1979 through 1982 were -4.0% and 24.6% respectively which indicate favorable increase of the paddy productivity although the area is decreasing. This is because the portion of wet paddy field has increased. It is desirable that productivity of paddy increases further and this depends upon the future development of irrigation.

The population of the agricultural sector which is assumed from the employment in the Kabupaten is 87.4% 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 is to further progress paddy cultivation by proceeding with the transmigration programme. In addition, increase in cultivation and improvement of productivity of other food crops are essential.

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

KABUPATEN : KOLAKA

CULTIVATED AREA

(ha)

ITEM	YEAR 1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	8,549	8,036	7,213	7,554	-	-	
OTHERS	3,183	4,689	3,503	2,875	-	-	
TOTAL	11,732	12,725	10,716	10,429	-	-	

PRODUCTION

(ton)

ITEM	YEAR 1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	15,404	26,365	22,129	29,818	-	-	
OTHERS	844	1,023	1,026	1,623	-	-	
TOTAL	16,248	27,388	23,155	31,441	-	-	

YIELD RATE

(ton/ha)

ITEM	YEAR 1979	1980	1981	1982	1983	1984	AAGR (%)
PADDY	1.8	3.28	3.07	3.95	-	-	

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 TENGGARA

KABUPATEN	AREA	PRODUCTION	AAGR (%) AREA	AAGR (%) PRODUCTION
MUNA	22,244	57,038	30.9	25.7
KOLAKA	-	-	-	-

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : SULAWESI TENGGARA

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
MUNA	119,000	187,653	63.6	0.7	1984
KOLAKA	140,000	159,790	87.4	4.0	1982

Notes :

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

1.2.4 Other Economic Activities

According to the distribution of employees by industry in Kabupaten Kolaka, the primary industry consists mainly of the agricultural and forest sectors employing about 88% of the workforce.

The other sectors employ 4% in the mining and manufacturing sectors which are the secondary industry and 8% in the commercial and services sectors which are the tertiary industry.

Item	No of Man Power (Person)	Share(%)	(1982) Remark
Agriculture	119,570	87.43	
Live Stock	-	-	88.36%
Fishery	1,265	0.93	
Industry	1,380	1.01	
Mining	4,321	3.16	4.17%
Commerce	2,363	1.73	
Service	5,368	3.93	7.47%
Others	2,472	1.81	
Total	136,739	100	

The manufacturing industry as one of the secondary industries is mainly composed of processing industries using the materials of timber and various kinds of food. However, they are mainly small-scale domestic-cottage industries and therefore there is little possibility of future rapid development. The mining industry also shows current stagnation because nickel production has declined recently.

In Central Sulawesi Province the agricultural sector is a major industry and recently production volume per ha. Has been increased as a result of promoting the use of modern agricultural techniques to an intensive agricultural sector.

Furthermore, sice production of nickel descresed sharply, the agricultural sector's ratio in increasing in Central Sulawesi Province. It seems that this is no a little related to the influence of the transmigration programmes.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Kolaka there is a provincial road which connects the provincial capital Kendari and the Kabupaten capital Kolaka crossing the Kabupaten from east to west. It is a trunk road connecting two road links running from north to south on both the east and west sides of the mountain range.

The Kabupaten road which runs from the northern boundary with South Sulawesi Province to the southern boundary with Kabupaten Buton along the west coastline of the Kabupaten forms a trunk road in the region west of the mountain range. Most of the Desas in Kecamatan Pakue, Lasusua, Kolaka and Wundulaka are on this Kabupaten road.

The inland areas which have potential for development, i.e. near Pakue, Lapai, Tosiba, Ulunggolaka, Baula and Lamunde, have small road networks connecting to the north-south trunk road. The Kabupaten roads on the east side of the mountain range are formed by the following links:

- A link starting from Puurau or Tongauna of Kecamatan Mowewe, connecting to the provincial road at Talodo via Porabua and Solewatu.
- A link leaving the provincial road at Reterate, running to Lambandia in the southern area of the Kabupaten via Polipolia.

Since the southern area of the Kabupaten has the highest potential for agricultural development, the Solewatu-Talodo section of the above first link and all of the above second link are an important part of the development strategy.
The Kabupaten road connecting to Solewatu and the provincial road via Mowewe have similar characteristics.

There are two more roads which connect to regional trunk roads on both sides of the mountain range, i.e Porabua to Uluwolo in the central part of the Kabupaten and Polipolia to Baula in the southern part of the Kabupaten.

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 Kolaka are confirmed as 63 links and 754 Km respectively. These figures exclude Kabupaten roads with no data.

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

(1) Density of Kabupaten Roads

The density of the Kabupaten roads is 0.85 m per ha. This is higher than the national density of 0.48 m per ha but distinctly lower than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Kolaka	754	885,495	0.85
Province : Sulawesi Tenggara	1,268	1,374,220	0.92
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

KRK : Gravel/Stone/Telford/Water Bound Macadam

Table 1-3-1 EXISTING ROAD LENGTH BY SURFACE TYPE

PROV : SULAWESI TENGGARA KAB : KOLAKA

(Km)

NO (%)	ASP	KRK	TNH	BTB	L.L	TOTAL
LINK 1	6	10	6			22
LINK 2			6			6
LINK 3		6				6
LINK 4	40		30	10		80
LINK 5		8	34			42
LINK 6			38		1	39
LINK 7		5			2	7
LINK 8		3	2		3	8
LINK 9			5			5
LINK 10			10			10
LINK 11			34		1	35
LINK 12			7			7
LINK 13			9			9
LINK 14			14			14
LINK 15			6			6
LINK 16			8			8
LINK 17			5			5
LINK 18			6			6
LINK 19			6			6
LINK 20			1		63	64
LINK 21		3				3
LINK 22		13				13
LINK 23		2	1		6	9
LINK 24					18	18
LINK 25		3			8	11
LINK 26		5	1			6
LINK 27		1			3	4
LINK 28		4	7		5	16
LINK 29			5			5
LINK 30		2	10		8	20
LINK 31		5	2		1	8
LINK 32		4				4

(Km)

NO (%)	ASP	KRK	TNH	BTB	L.L	TOTAL
LINK 33		3				3
LINK 34		2				2
LINK 35		3				3
LINK 36		3	1			4
LINK 37		3			1	4
LINK 38			2			2
LINK 39			9			9
LINK 40			3			3
LINK 41			4		4	8
LINK 42			3		3	6
LINK 43			2			2
LINK 44			4		1	5
LINK 45			2		5	7
LINK 46					7	7
LINK 47			4			4
LINK 48			4		2	6
LINK 49			2		2	4
LINK 50			3			3
LINK 51			10			10
LINK 52			5		1	6
LINK 53		1	19		1	20
LINK 54			3		42	45
LINK 55					7	7
LINK 56					9	9
LINK 57					9	9
LINK 58			15			15
LINK 59			5			5
LINK 60			16			16
LINK 61			6			6
LINK 62			11			11
LINK 63			11			11
TOTAL	46	88	397	10	213	754
RATIO	6	12	53	1	28	(%)

TNH : Earth

LL : Others

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

	ASP	KRK	TNH/LL
Kabupaten : Kolaka	6.1	13.0	80.9
Province : Sulawesi Tenggara	4.3	25.9	69.8
Jawa Is.(Excluding DKI Jakarta)	56.2	25.0	18.8
Indonesia	26.0	26.6	47.4

Thus, in the Kabupaten the proportion of Kabupaten roads with asphalt surface is much lower than either that of Indonesia or of Jawa Island. The proportion of low grade roads such as earth roads and others is distinctly high. This means that the road classification in the Kabupaten is low.

(3) Surface Condition of Kabupaten Roads

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

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

	Good	Fair	Poor	Bad
Kabupaten : Kolaka	34.7	29.1	26.8	9.4
Province : Sulawesi Tenggara	30.6	21.5	36.8	11.1
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

The surface condition level of the Kabupaten roads in the Kabupaten is lower than both that of Indonesia and of Jawa Island. The proportion in good condition is relatively low.

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

PROVINCE : SULAWESI TENGGARA

KABUPATEN : KOLAKA

(%)

102	71	ASP				KRK				INH				BTB				L.L			
102		BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK	1	46	31	11	12	40	31	16	14	30	54	14	2								
LINK	2									15	85										
LINK	3					42	58														
LINK	4	93	2	5						76	24			97	2	1					
LINK	5					92	3	5		79	21										
LINK	6									1	17	68	14							95	5
LINK	7					87	10	3										88	9	4	
LINK	8					90	4	6		60	14	6						90	8	2	
LINK	9									3	7	90									
LINK	10										5	95									
LINK	11									1	19	75	6							95	5
LINK	12											10	90								
LINK	13											93	7								
LINK	14											95	5								
LINK	15											95	5								
LINK	16											95	5								
LINK	17											95	5								
LINK	18											95	5								
LINK	19											95	5								
LINK	20											60	40							60	40
LINK	21					81	1	18													
LINK	22					64	11	26													
LINK	23					50	50			50	50							50	49	1	
LINK	24																	37	23	36	5
LINK	25					97	1	2										49	26	25	1
LINK	26					84	12	4		99	1										
LINK	27					99	1											17	17	66	1
LINK	28					88	12			27	70	3						93	7		
LINK	29									79	21										
LINK	30					99	1			71	23	6						12	10	3	74
LINK	31					76	24			99	1							99	1		
LINK	32					91	9														
LINK	33					66	34														
LINK	34					66	34														
LINK	35					66	34														
LINK	36					48	52			67	33										
LINK	37						93		7										1	1	99
LINK	38										35	65									
LINK	39										41	59									
LINK	40									32	55	13									
LINK	41										58	24	18						13	50	38
LINK	42										58	42							17	50	33
LINK	43											50	50								
LINK	44										41	58	1							99	1
LINK	45											99	1					10	50	40	
LINK	46																	13	20	34	33
LINK	47									5	48	48									
LINK	48										49	49							55	45	
LINK	49										68	33						50	50		
LINK	50											99	1								
LINK	51											99	1								
LINK	52											99	1							99	1
LINK	53											99	1							99	1
LINK	54									17	47	30	7					2	36	40	22
LINK	55																	76	19	6	
LINK	56																	73	18	8	
LINK	57																	69	18	13	
LINK	58									3	6	91									
LINK	59									3	6	91									
LINK	60									4	6	91									
LINK	61									4	5	91									
LINK	62									4	5	91									
LINK	63									4	6	91									
AVERAGE		70	17	8	6	71	24	4	1	18	21	56	6	97	2	1	0	32	17	37	14
LENGTH		16 Km				88 Km				397 Km				10 Km				213 Km			
(Km)		32	8	4	3	62	21	4	1	71	83	222	24	10	0	0	0	68	36	79	30

Therefore besides improvement for poor roads in or bad condition it is desirable that the asphalted portion is increased.

(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 41.0% flat, 20.0% hilly, 36.0% mountainous and 3.0% swampy. Road construction is anticipated to be rather difficult because of the relatively large proportions of hilly and mountainous areas.

1.3.3 Bridge Inventory

A bridge inventory showing the existing condition of bridges on the Kabupaten roads in Kabupaten Kolaka 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 52 bridges with a total length of 437 m of which 42 or 80.8% are timber, 1 or 1.9% are concrete and 19 or 17.3% are others. However 167 bridges with a total length of 2028 m are required to be newly constructed.

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

Bridge Type	<3	<5	<8	<10	<12	<14	<16	<18	<20	<99	Total
Timber	-	10	20	5	2	-	4	1	-	-	42
Concrete	-	1	-	-	-	-	-	-	-	-	1
Steel	-	-	-	-	-	-	-	-	-	-	-
Others	-	2	5	-	1	-	-	1	-	-	9
Total	-	13	25	5	3	-	4	2	-	-	52

Thus, most of the existing bridges on the Kabupaten roads are timber and the majority of spanlengths is within the range of 5 m to 8 m.

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

PROV : SULAWESI TENGGARA KAB : KOLAKA

(Ka)

102 (3)	BK	GN	DT	RW	TOTAL
LINK 1	15	7			22
LINK 2	1	5			6
LINK 3	5	1			6
LINK 4	59	21			80
LINK 5	15	21	6		42
LINK 6	6	20	13		39
LINK 7		3	3	1	7
LINK 8	1	1	6		8
LINK 9	3		2		5
LINK 10		5	5		10
LINK 11	5	17	13		35
LINK 12		6	1		7
LINK 13		9			9
LINK 14		14			14
LINK 15		1	5		6
LINK 16			8		8
LINK 17			5		5
LINK 18		6			6
LINK 19			6		6
LINK 20	3	52	9		64
LINK 21			3		3
LINK 22	4	2	7		13
LINK 23	1		8		9
LINK 24	3	2	13		18
LINK 25	4	4	3		11
LINK 26	3		3		6
LINK 27		2	2		4
LINK 28	2	1	13		16
LINK 29	2	3			5
LINK 30	3	7	6	4	20
LINK 31	1	2	5		8
LINK 32			4		4
LINK 33			3		3
LINK 34			2		2
LINK 35			3		3
LINK 36		1	3		4
LINK 37			1	3	4
LINK 38			2		2
LINK 39			6	3	9
LINK 40			3		3
LINK 41	1		5	2	8
LINK 42	1		4	1	6
LINK 43			1	1	2
LINK 44	3		2		5
LINK 45	2		5		7
LINK 46			3	4	7
LINK 47			2	2	4
LINK 48	1		4	1	6
LINK 49	1	1	2		4
LINK 50		3			3
LINK 51		10			10
LINK 52	1	3	2		6
LINK 53		20			20
LINK 54	1	11	33		45
LINK 55	1	1	5		7
LINK 56	1	4	4		9
LINK 57	1	4	4		9
LINK 58			15		15
LINK 59			5		5
LINK 60			16		16
LINK 61			6		6
LINK 62			11		11
LINK 63			11		11
TOTAL	150	270	312	22	754
RATIO	20	36	41	3	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SULAWESI TENGGARA KAB : KOLAKA

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

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
7			6	42.00	6	42.00
8			1	10.00	1	10.00
9			3	21.00	3	21.00
11			23	227.00	23	227.00
12			2	36.00	2	36.00
13			3	36.00	3	36.00
14			13	123.00	13	123.00
15			1	20.00	1	20.00
16			4	58.00	4	58.00
18			1	40.00	1	40.00
19			1	15.00	1	15.00
20			10	110.00	10	110.00
21	1	11.00			1	11.00
22	6	75.50	1	14.00	7	89.50
23	10	88.00			10	88.00
24	16	142.00	1	20.00	17	162.00
26	3	20.60	1	40.00	4	60.60
27	1	5.00			1	5.00
28	6	37.00	2	57.00	8	94.00
30	1	6.00	8	188.00	9	194.00
31	2	14.60			2	14.60
32	4	20.00			4	20.00
35	2	17.40			2	17.40
36			1	40.00	1	40.00
37			3	94.00	3	94.00
38			1	6.00	1	6.00
39			11	75.00	11	75.00
40			4	48.00	4	48.00
41			4	38.00	4	38.00
42			3	35.00	3	35.00
43			1	30.00	1	30.00
44			5	53.00	5	53.00
46			3	24.00	3	24.00
47			4	31.00	4	31.00
48			3	49.00	3	49.00
49			6	72.00	6	72.00
50			3	13.00	3	13.00
51			4	61.00	4	61.00
52			1	7.00	1	7.00
53			14	102.00	14	102.00
54			11	111.00	11	111.00
57			3	76.00	3	76.00
59			1	6.00	1	6.00
TOTAL	52	437.10	167	2028.00	219	2465.10

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

PROV : SULAWESI TENGGARA KAB : KOLAKA

	<<< BRIDGE >>>			(No)
103 (18)	LL	KY	BI	TOTAL
LINK 7				
LINK 8				
LINK 9				
LINK 11				
LINK 12				
LINK 13				
LINK 14				
LINK 15				
LINK 16				
LINK 18				
LINK 19				
LINK 20				
LINK 21	1			1
LINK 22	2	4		6
LINK 23	2	7	1	10
LINK 24	2	14		16
LINK 26		3		3
LINK 27	1			1
LINK 28	1	5		6
LINK 30		1		1
LINK 31		2		2
LINK 32		4		4
LINK 35		2		2
LINK 36				
LINK 37				
LINK 38				
LINK 39				
LINK 40				
LINK 41				
LINK 42				
LINK 43				
LINK 44				
LINK 46				
LINK 47				
LINK 48				
LINK 49				
LINK 50				
LINK 51				
LINK 52				
LINK 53				
LINK 54				
LINK 57				
LINK 59				
TOTAL	9	42	1	52
RATIO	17	81	2	(%)

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Kolaka 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 1984 are summarized as follows:

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Total Trips	166	234	482	1,790	1,782
Proportion (%)	6.21	8.76	18.04	66.99	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	8.60	3.96	3.78	83.66	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 TENGGARA KAB : KOLAKA

A)	Growth Rate of Population	:	5.70 (%)
B)	Growth Rate of Cultivated Area	:	0.00 (%)
C)	Growth Rate of Rice field	:	0.00 (%)
D)	Growth Rate of Rice yield rate	:	20.50 (%)
E)	Growth Rate of GDP / capita	:	5.70 (%)
a)	Geometrical Mean (A x B)	:	2.81 (%)
b)	Geometrical Mean (C x D)	:	9.77 (%)
c)	Geometrical Mean (a x b)	:	6.23 (%)
d)	Geometrical Mean (c x E)	:	5.97 (%)
	TRAFFIC GROWTH RATE	:	5.97 (%)

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 1984

r : Traffic growth rate

The results are shown in Table 2-1-2 together with the traffic volume in 1984.

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

PROV : SULAWESI TENGGARA KAB : KOLAKA

(SPD : 1/2)

	INVENTORY (1984)					RATE	AFTER 14 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	4	16	31	400	251	6.0%	9	36	70	901	565	IIIA
2	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
3	50	150	50	200	350	6.0%	113	338	113	450	788	IIIA
4	50	50	250	750	725	6.0%	113	113	563	1689	1633	IIIA
5	10	9	45	90	109	6.0%	23	20	101	203	245	IIIB-1
6	3	0	8	15	19	6.0%	7	0	18	34	43	IIIC
7	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
8	0	0	2	5	5	6.0%	0	0	5	11	11	IIIC
9	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
10	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
11	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
12	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
13	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
14	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
15	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
16	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
17	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
18	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
19	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
20	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
21	3	0	4	10	12	6.0%	7	0	9	23	27	IIIC
22	6	0	15	45	44	6.0%	14	0	34	101	99	IIIB-2
23	4	0	6	24	22	6.0%	9	0	14	54	50	IIIC
24	2	1	3	10	11	6.0%	5	2	7	23	25	IIIC
25	10	0	5	20	25	6.0%	23	0	11	45	56	IIIB-2
26	0	0	0	5	3	6.0%	0	0	0	11	7	IIIC
27	0	0	2	5	5	6.0%	0	0	5	11	11	IIIC
28	0	0	8	7	12	6.0%	0	0	18	16	27	IIIC
29	0	0	10	0	10	6.0%	0	0	23	0	23	IIIC
30	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
31	1	0	0	10	6	6.0%	2	0	0	23	14	IIIC
32	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
33	0	0	0	15	8	6.0%	0	0	0	34	18	IIIC
34	0	0	0	8	4	6.0%	0	0	0	18	9	IIIC
35	0	0	0	15	8	6.0%	0	0	0	34	18	IIIC
36	5	0	7	10	17	6.0%	11	0	16	23	38	IIIC
37	0	0	0	10	5	6.0%	0	0	0	23	11	IIIC
38	0	0	0	2	1	6.0%	0	0	0	5	2	IIIC
39	0	0	0	5	3	6.0%	0	0	0	11	7	IIIC
40	0	0	0	2	1	6.0%	0	0	0	5	2	IIIC
41	0	0	0	4	2	6.0%	0	0	0	9	5	IIIC
42	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
43	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
44	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
45	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
46	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
47	0	0	0	6	3	6.0%	0	0	0	14	7	IIIC
48	0	0	0	2	1	6.0%	0	0	0	5	2	IIIC
49	0	0	0	2	1	6.0%	0	0	0	5	2	IIIC
50	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC

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

PROV : SULAWESI TENGGARA KAB : KOLAKA

(SPD : 1/2)

	INVENTORY (1984)					RATE	AFTER 14 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
51	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
52	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
53	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
54	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
55	0	0	0	4	2	6.0%	0	0	0	9	5	IIIC
56	2	8	15	4	27	6.0%	5	18	34	9	61	IIIB-2
57	4	0	3	45	30	6.0%	9	0	7	101	68	IIIB-2
58	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
59	0	0	0	6	3	6.0%	0	0	0	14	7	IIIC
60	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
61	10	0	15	36	43	6.0%	23	0	34	81	97	IIIB-2
62	0	0	0	0	0	6.0%	0	0	0	0	0	IIIC
63	2	0	3	18	14	6.0%	5	0	7	41	32	IIIC
PERCENT	6.21	8.76	18.04	66.99			6.21	8.76	18.04	66.99		

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 TENGGARA KAB : KOLAKA

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
2	IIIC	KRK	3	4	8	29	30
6	IIIB-1	ASP	25	36	73	273	271
7	IIIC	KRK	0	0	1	3	3
8	IIIC	KRK	0	0	1	4	3
9	IIIC	KRK	0	0	1	2	2
10	IIIB-2	KRK	5	8	16	59	59
11	IIIC	KRK	1	2	4	16	15
12	IIIC	KRK	0	0	1	3	3
13	IIIC	KRK	0	1	1	4	4
14	IIIC	KRK	1	1	2	6	7
15	IIIC	KRK	0	0	1	3	3
16	IIIC	KRK	0	0	1	4	3
17	IIIC	KRK	0	0	1	2	2
18	IIIC	KRK	0	0	1	3	3
19	IIIC	KRK	0	0	1	3	3
20	IIIB-2	KRK	10	14	29	109	108
21	IIIC	KRK	0	1	1	4	4
22	IIIC	KRK	4	5	10	39	39
23	IIIC	KRK	2	4	7	27	27
24	IIIB-2	KRK	5	7	14	53	53
25	IIIC	KRK	3	5	10	37	37
26	IIIC	KRK	2	3	5	19	20
27	IIIC	KRK	1	2	3	13	13
28	IIIB-2	KRK	5	7	14	51	52
29	IIIC	KRK	1	2	4	16	15
30	IIIC	KRK	2	3	6	22	22
31	IIIC	KRK	2	3	7	25	25
32	IIIC	KRK	1	2	4	16	15
33	IIIC	KRK	1	1	3	10	10
34	IIIC	KRK	1	1	2	6	7
35	IIIC	KRK	1	1	3	10	10
36	IIIC	KRK	1	2	3	13	13
37	IIIC	KRK	1	1	3	10	10
38	IIIC	KRK	1	1	2	6	7
39	IIIC	KRK	3	4	9	33	33
40	IIIC	KRK	1	2	3	13	13
41	IIIC	KRK	3	4	9	34	33
42	IIIC	KRK	2	3	7	25	25
43	IIIC	KRK	1	1	2	8	8
44	IIIC	KRK	2	3	6	21	22
45	IIIC	KRK	3	4	8	29	30
46	IIIC	KRK	3	4	8	29	30
47	IIIC	KRK	2	2	5	17	18
48	IIIC	KRK	2	3	7	25	25
49	IIIC	KRK	2	2	5	17	18
50	IIIC	KRK	1	2	3	13	13
51	IIIC	KRK	4	6	11	42	42
52	IIIC	KRK	2	3	7	25	25
53	IIIB-2	KRK	8	11	23	84	84
54	IIIB-2	KRK	17	25	51	189	188
55	IIIC	KRK	3	4	8	29	30
56	IIIB-2	KRK	9	13	26	97	97
57	IIIC	KRK	2	4	7	27	27
58	IIIC	KRK	4	6	12	44	44
59	IIIC	KRK	0	0	1	2	2
60	IIIC	KRK	3	4	7	27	28
61	IIIC	KRK	1	1	2	8	8
62	IIIB-2	KRK	11	16	32	119	119
63	IIIC	KRK	3	4	9	33	33

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 : KOLAKA

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 8	LINK 9	LINK 10
	22 Km	6 Km	6 Km	80 Km	42 Km	39 Km	7 Km	8 Km	5 Km	10 Km
	IIIA	IIIC	IIIA	IIIA	IIIB-1	IIIB-1	IIIC	IIIC	IIIC	IIIB-2
YEAR	VOC	Surplus	VOC	VOC	VOC	Surplus	Surplus	Surplus	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	63304	1282	24219	705476	128354	124635	1	8	24	5792
1990	67978	1324	25670	747692	137167	141159	1	8	24	6330
1991	71885	1526	27191	791555	146138	153578	1	16	24	7306
1992	75424	1567	28924	840884	153889	172644	3	89	24	7940
1993	80509	1936	30526	888337	163020	191608	3	89	24	8526
1994	85226	2149	32339	941107	172150	215227	15	89	24	9992
1995	90830	2372	34362	999344	182581	237178	15	97	47	11093
1996	95641	2414	36327	1057200	193170	263459	17	97	47	12170
1997	101797	2657	38502	1120530	205219	290185	17	97	264	13731
1998	107644	3239	40888	1189320	217405	321240	17	105	264	15323
SUM	840038	20466	318948	9281440	1699093	2110913	90	695	766	98203
COST	373649	-9994	154707	5016340	769872	983426	-25161	-28437	-17639	19437
/Km	16984	-1666	25785	62704	18330	25216	-3594	-3555	-3528	1944

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.

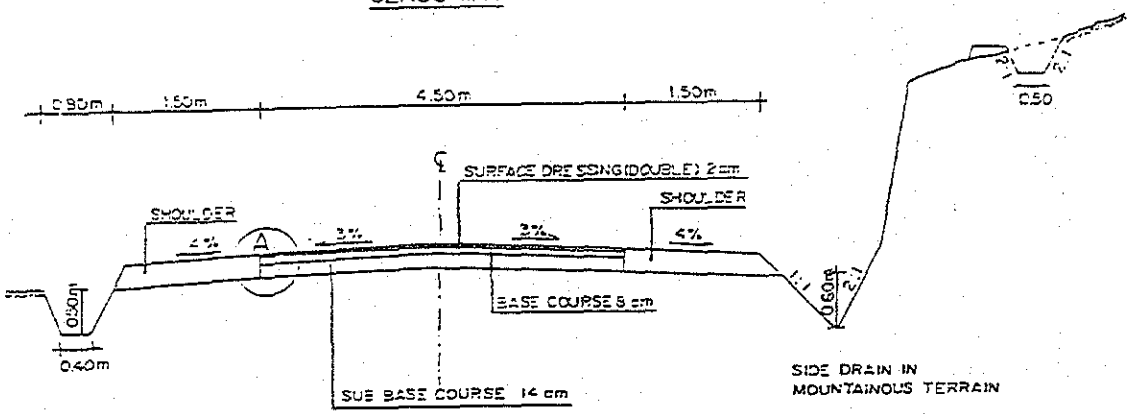
Table 3-1-1 DESIGN CRITERIA FOR KABUPATEN ROADS

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		
TERRAIN		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		

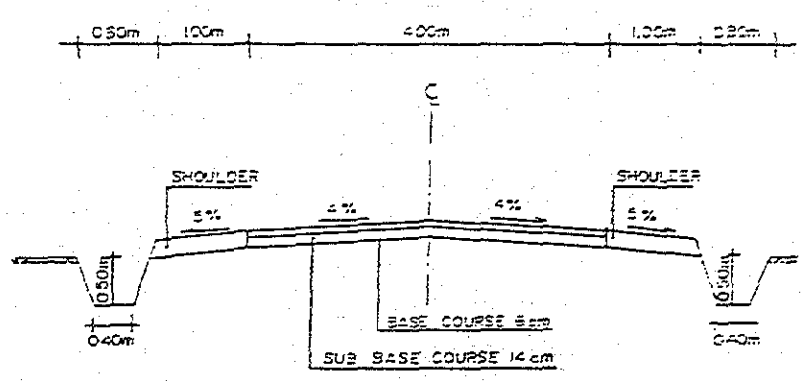
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

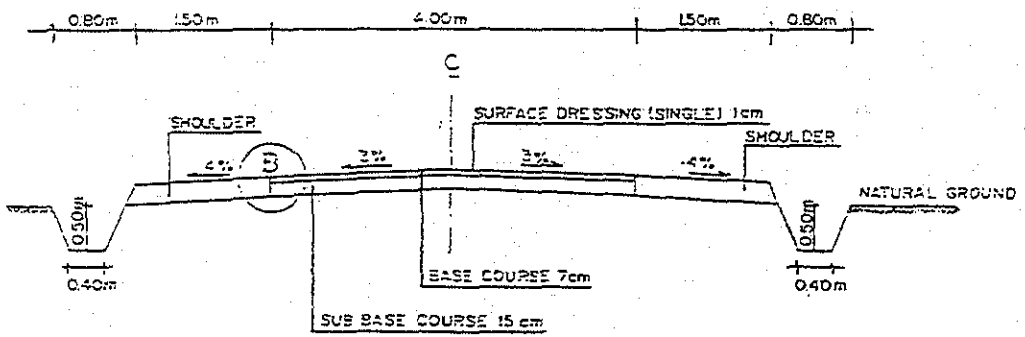
CLASS III A



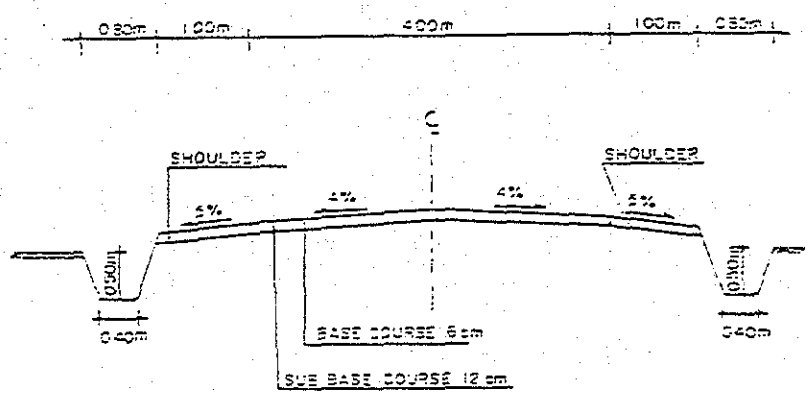
CLASS III B-2



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

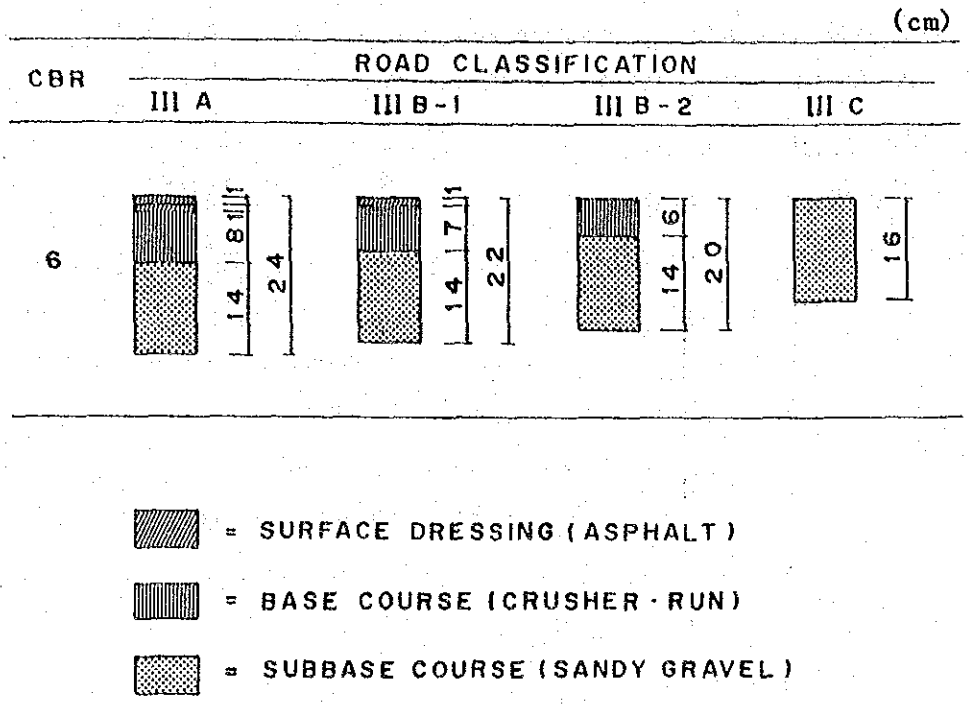
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

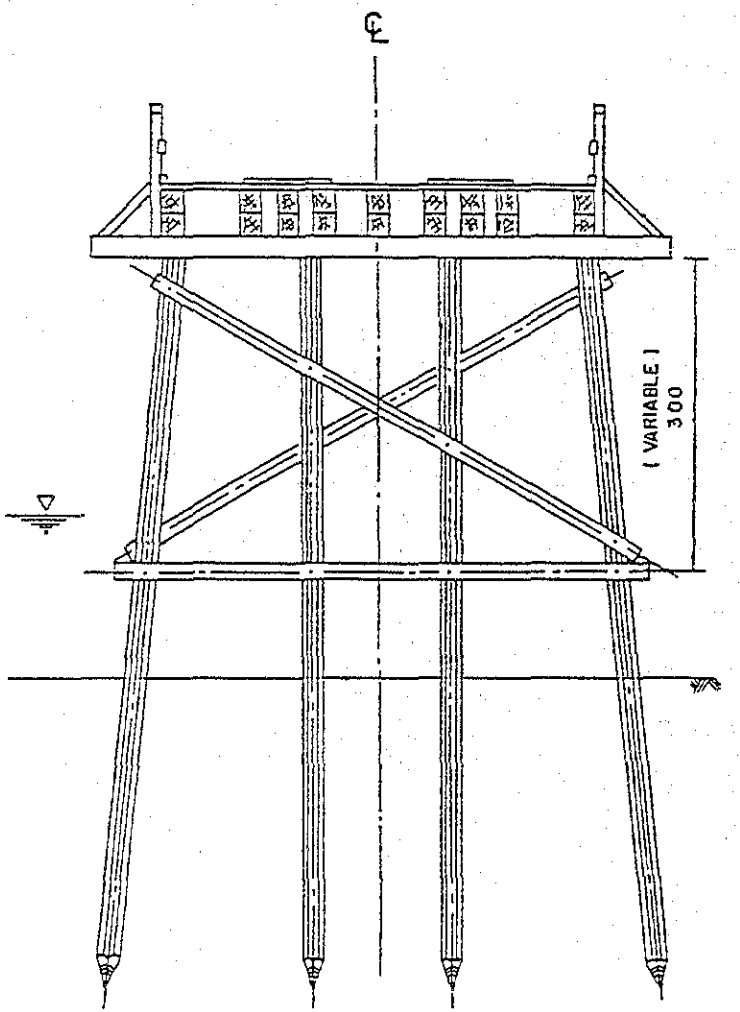
3) Foundation

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.

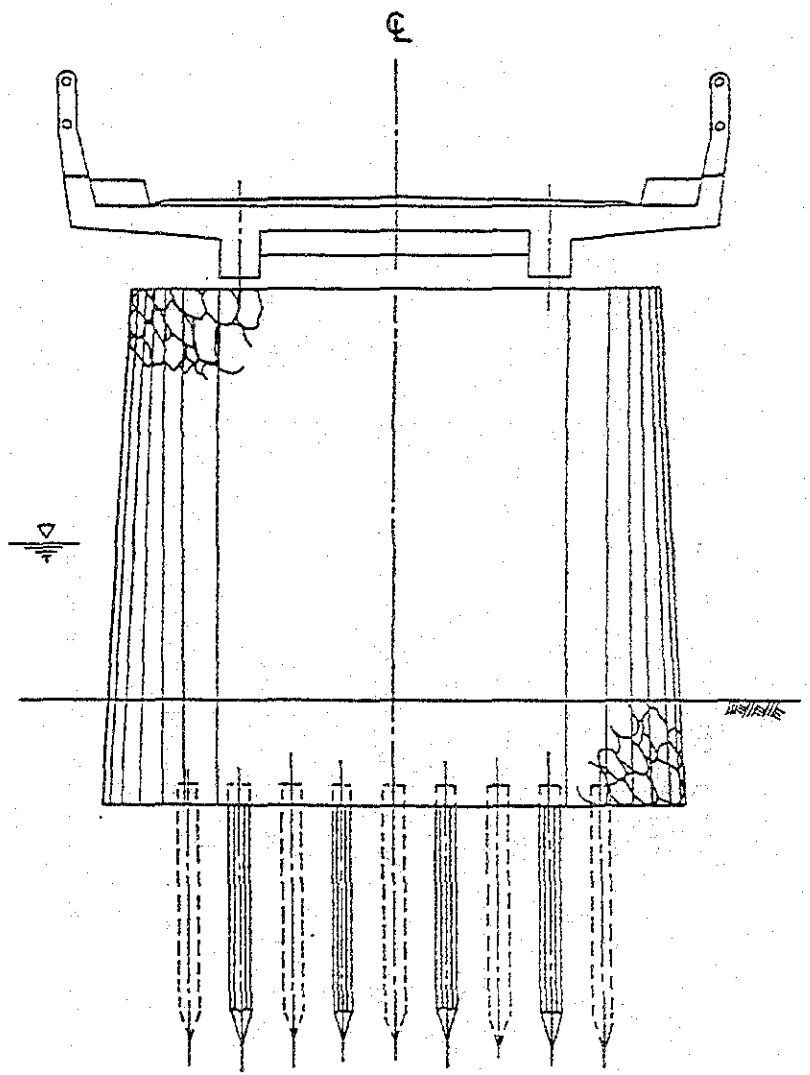
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

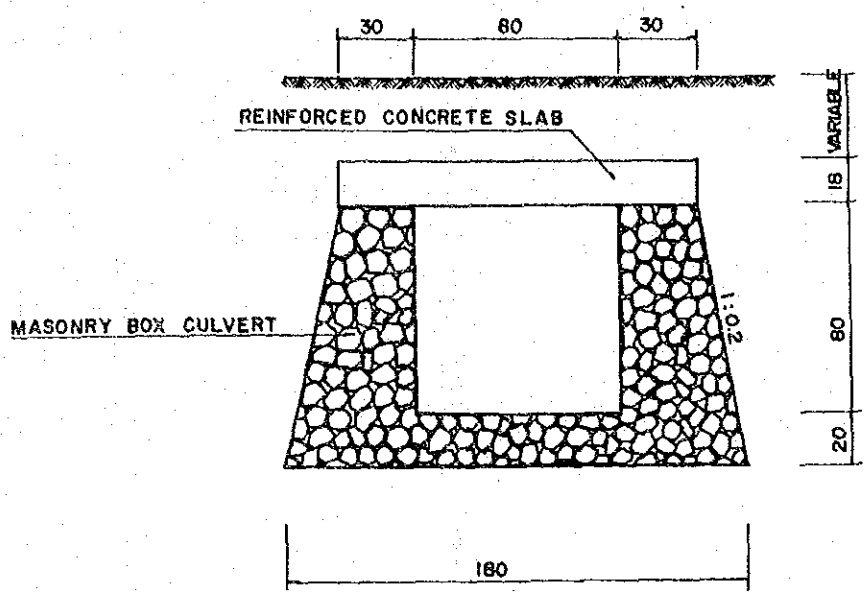
(2) Retaining Wall

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

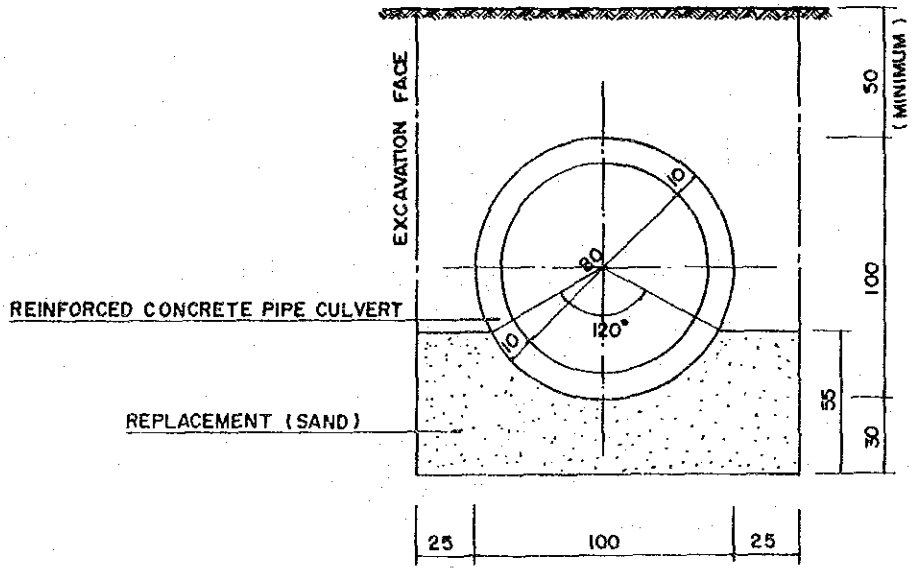
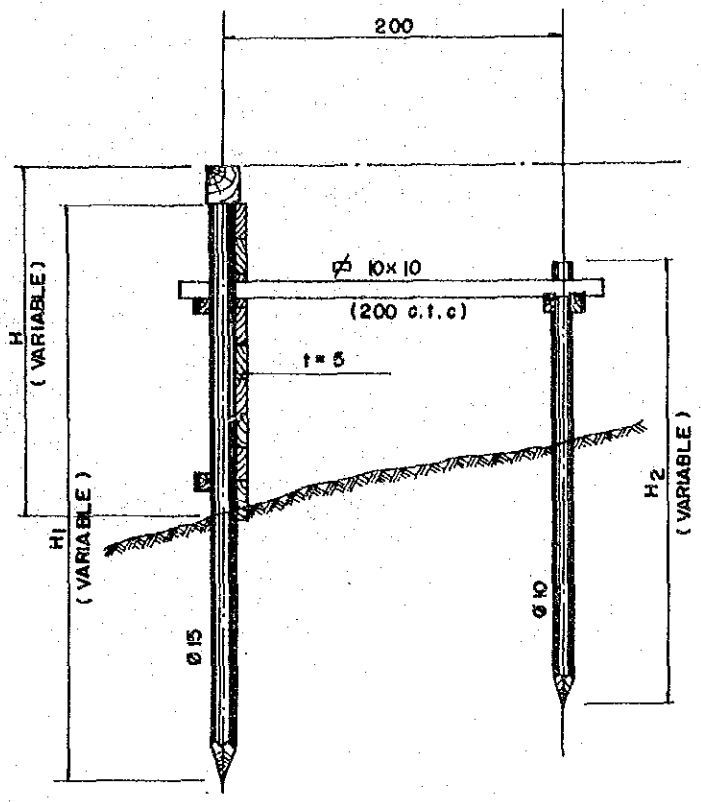
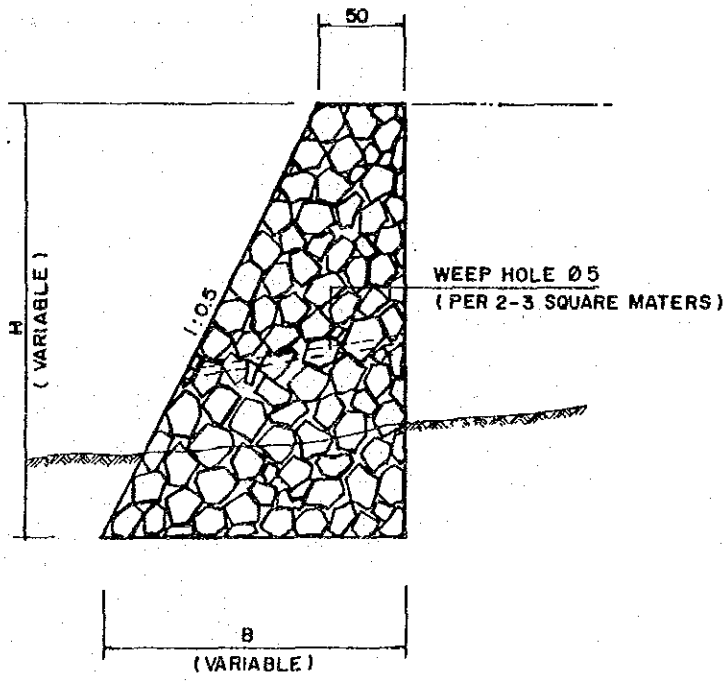


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Kolaka and other Kabupatens in Sulawesi Tenggara 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
Muna	2,500	2,250	3,000	3,000	1,750	2,000	2,500
Kolaka	3,300	3,000	3,500	3,500	2,200	3,000	4,000
Average	2,900	2,625	3,250	3,250	1,975	2,500	3,250

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 Kolaka together with for other Kabupatens in Sulawesi Tenggara Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	MUNA	KOLAKA	AVERAGE
Bitumen	L	300	400	350
Asphalt oil	L	800	850	825
Gasoline	L	250	250	250
Sand	M^3	7,500	4,000	5,750
Cement	bag	5,000	4,750	4,875
River Stone	M^3	3,500	5,000	4,250
Steel moulds	Set	8,500	8,500	8,500
Timber	M^3	125,000	110,000	117,500
Paint	L	3,000	3,000	3,000
Reinforcing Steel	Kg	750	800	775
Tying Wire	Kg	1,200	1,200	1,200
Equivalent Royalty	M^3	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 TENGGARA
KABUPATEN : KOLAKA

(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	428	12,641	13,069	7,769	1,048	8,817	21,886
	Bulldozer/Ripper	120 HP	468	13,676	14,144	8,499	1,613	10,112	24,256
	Swamp Bulldozer	120 HP	489	13,925	14,414	8,879	1,686	10,565	24,979
	Bulldozer	90 HP	271	8,591	8,862	4,914	663	5,577	14,439
	Bulldozer/Ripper	90 HP	292	9,195	9,487	5,299	1,006	6,305	15,792
	Bulldozer	65 HP	193	6,238	6,431	3,499	472	3,971	10,402
	Bulldozer/Ripper	65 HP	211	6,700	6,911	3,819	725	4,544	11,455
	Swamp Bulldozer	90 HP	291	9,185	9,476	5,284	1,003	6,287	15,763
	Swamp Bulldozer	65 HP	223	6,577	6,800	4,049	768	4,817	11,617
	Motor Grader	110 HP	381	11,020	11,401	6,919	1,314	8,233	19,634
	Motor Grader	75 HP	263	7,554	7,817	4,779	907	5,686	13,503
	Motor Grader	65 HP	237	6,650	6,887	4,299	816	5,115	12,002
	Road Stabilizer	W=1850 mm	473	3,463	3,936	8,594	435	9,029	12,965
	Vibratory Roller	4 ton	160	3,301	3,461	2,899	391	3,290	6,751
	Hand-guide Vib. Roller	1000 Kg	128	605	733	849	31	880	1,613
	Tire Roller	8-15 ton	171	7,241	7,412	3,106	104	3,210	10,622
	Vibratory Roller (D&T)	4 ton	160	3,301	3,461	2,899	391	3,290	6,751
	Hand-guide Vib. Roller	600 Kg	90	414	504	600	22	622	1,126
	Rough Terrain Crane	10 ton	553	12,844	13,397	10,039	762	10,801	24,198
	Hydraulic Excavator; Wheel	0.3 m3	227	7,707	7,934	4,109	554	4,663	12,597
	Wheel Loader	1.2 m3	387	8,397	8,784	7,019	947	7,966	16,750
	Wheel Loader	0.3 m3	125	2,925	3,050	2,269	306	2,575	5,625
	Water Tank Truck	4000 ltr.	131	2,792	2,923	868	127	995	3,918
	Fuel Tank Truck	4000 ltr.	133	2,799	2,932	882	129	1,011	3,943
	Dump Truck	3.0 ton	221	3,530	3,751	1,469	216	1,685	5,436
	Flat Bed Truck with Crane	3.0 ton	95	3,028	3,123	1,716	130	1,846	4,969
	Dump Loader Truck	12 ton	212	18,484	18,696	3,837	129	3,966	22,662
	Dump Truck	5.0 ton	329	5,818	6,147	2,189	322	2,511	8,658
	Flat Bed Truck	3.0 ton	31	2,593	2,624	563	42	605	3,229
	Portable Crusher/Screening	30-40 t/h	1,034	21,372	22,406	19,800	2,538	21,338	43,744
	Concrete Mixer	0.5 m3	810	2,522	3,332	5,400	447	5,847	9,179
	Water Pump	200 l/min	29	259	288	188	6	194	482
	Concrete Vibrator	3.3 HP	12	222	234	73	2	75	309
	Asphalt Sprayer	850 ltr.	153	782	935	1,020	150	1,170	2,105

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 TENGGARA KAB : KOLAKA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	166	91	257
Subgrade Preparation	m2	21	11	32
Normal Fill	m3	1,712	866	2,578
Fill in Swamp	m3	2,581	1,038	3,619
Normal Excavation to Spoil	m3	1,002	525	1,527
Sub Base Course	m3	3,240	1,355	4,595
Base Course	m3	4,441	2,310	6,751
Shoulder	m2	302	146	448
Asphalt Patching	m2	3,941	1,518	5,459
Surface Dressing (Single)	m2	656	766	1,422
Surface Dressing (Double)	m2	813	1,207	2,020
Earth Drain	m	986	120	1,106
Earth Drain in Swamp (by machine)	m3	1,225	476	1,701
Pipe Culvert D80cm	m	46,535	44,416	90,951
Masonry Culvert (80x80cm)	m	62,846	38,045	100,891
Retaining Wall and Wing Wall (Timber)	m2	12,810	246	13,056
Retaining Wall and Wing Wall (Masonry)	m3	45,070	11,820	56,890
Gabion Protection	m3	10,908	121	11,029
Manual routine maintenance of road	Km	160,688	7,260	167,948
Routine maintenance of earth road	Km	95,612	38,004	133,616
Routine maintenance of gravel road	Km	193,041	88,384	281,425
Routine maintenance of asphalt road	Km	394,100	151,800	545,900

4.2.2 Bridges

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

Table 4-2-2 BRIDGE COST

PROV : SULAWESI TENGGARA KAB : KOLAKA

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	47,921	4,084	52,005
Superstructure (Timber;Span 5m;10T)	m2	53,080	4,509	57,589
Superstructure (Timber;Span 8m;10T)	m2	70,304	5,922	76,226
Superstructure (Timber;Span 3m;BM50)	m2	59,420	5,049	64,469
Superstructure (Timber;Span 5m;BM50)	m2	64,869	5,471	70,340
Superstructure (Timber;Span 8m;BM50)	m2	82,270	6,925	89,195
Superstructure (Concrete;Span 3m;BM50)	m2	54,424	90,442	144,866
Superstructure (Concrete;Span 5m;BM50)	m2	55,920	100,977	156,897
Superstructure (Concrete;Span 8m;BM50)	m2	57,623	109,933	167,556
Superstructure (Concrete;Span10m;BM50)	m2	63,078	124,768	187,846
Superstructure (Concrete;Span15m;BM50)	m2	68,035	146,857	214,892
Substructure (Pier;for Timber;10T)	NO	417,519	37,996	455,515
Substructure (Abut;for Timber;10T)	NO	1,154,109	172,146	1,326,255
Substructure (Pier;for Timber;BM50)	NO	614,060	56,242	670,302
Substructure (Abut;for Timber;BM50)	NO	1,302,584	192,243	1,494,827
Substructure (Pier;for Concrete;BM50)	NO	1,698,484	473,575	2,172,059
Substructure (Abut;for Concrete;BM50)	NO	3,598,490	994,280	4,592,770
Demolition of Bridge (Timber->Timber)	m2	13,359	1,552	14,911
Demolition of Bridge (Timber->Concrete)	m2	13,359	1,552	14,911
Demolition of Bridge (Concrete)	m2	84,969	70,510	155,479
Maintenance of Timber Bridge (New)	m2	8,658	1,233	9,891
Maintenance of Concrete Bridge (New)	m2	1,961	2,793	4,754
Maintenance of Timber Bridge (Exist)	m2	8,052	2,462	10,514
Maintenance of Concrete Bridge (Exist)	m2	4,115	2,404	6,519

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 Kolaka are shown in Table 5-1-1.

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

KABUPATEN : KOLAKA

CRITERIA NO	ROAD LINK NO
-	-

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 TENGGARA KABUPATEN : KOLAKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
4	80 Km	IIIA	52.901	VOC
3	6 Km	IIIA	16.837	VOC
6	39 Km	IIIB-1	15.999	Surplus
5	42 Km	IIIB-1	14.900	VOC
1	22 Km	IIIA	7.131	VOC
62	11 Km	IIIB-2	5.123	Surplus
7	7 Km	IIIC	0.078	Surplus
8	8 Km	IIIC	0.078	Surplus
9	5 Km	IIIC	0.078	Surplus
10	10 Km	IIIB-2	0.078	Surplus
11	35 Km	IIIC	0.078	Surplus
12	7 Km	IIIC	0.078	Surplus
13	9 Km	IIIC	0.078	Surplus
14	14 Km	IIIC	0.078	Surplus
15	6 Km	IIIC	0.078	Surplus
16	8 Km	IIIC	0.078	Surplus
17	5 Km	IIIC	0.078	Surplus
18	6 Km	IIIC	0.078	Surplus
19	6 Km	IIIC	0.078	Surplus
20	64 Km	IIIB-2	0.078	Surplus
21	3 Km	IIIC	0.078	Surplus
22	13 Km	IIIC	0.078	Surplus
23	9 Km	IIIC	0.078	Surplus
24	18 Km	IIIB-2	0.078	Surplus
25	11 Km	IIIC	0.078	Surplus
26	6 Km	IIIC	0.078	Surplus
27	4 Km	IIIC	0.078	Surplus
28	16 Km	IIIB-2	0.078	Surplus
29	5 Km	IIIC	0.078	Surplus
30	20 Km	IIIC	0.078	Surplus
31	8 Km	IIIC	0.078	Surplus
32	4 Km	IIIC	0.078	Surplus
33	3 Km	IIIC	0.078	Surplus
34	2 Km	IIIC	0.078	Surplus
35	3 Km	IIIC	0.078	Surplus
36	4 Km	IIIC	0.078	Surplus
37	4 Km	IIIC	0.078	Surplus
38	2 Km	IIIC	0.078	Surplus
39	9 Km	IIIC	0.078	Surplus
40	3 Km	IIIC	0.078	Surplus
41	8 Km	IIIC	0.078	Surplus
42	6 Km	IIIC	0.078	Surplus
43	2 Km	IIIC	0.078	Surplus
44	5 Km	IIIC	0.078	Surplus
45	7 Km	IIIC	0.078	Surplus
46	7 Km	IIIC	0.078	Surplus
47	4 Km	IIIC	0.078	Surplus
48	6 Km	IIIC	0.078	Surplus
49	4 Km	IIIC	0.078	Surplus
50	3 Km	IIIC	0.078	Surplus

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

PROVINCE : SULAWESI TENGGARA KABUPATEN : KOLAKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
51	10 Km	IIIC	0.078	Surplus
52	6 Km	IIIC	0.078	Surplus
53	20 Km	IIIB-2	0.078	Surplus
54	45 Km	IIIB-2	0.078	Surplus
55	7 Km	IIIC	0.078	Surplus
56	9 Km	IIIB-2	0.078	Surplus
57	9 Km	IIIC	0.078	Surplus
58	15 Km	IIIC	0.078	Surplus
59	5 Km	IIIC	0.078	Surplus
60	16 Km	IIIC	0.078	Surplus
61	6 Km	IIIC	0.078	Surplus
2	6 Km	IIIC	0.078	Surplus
63	11 Km	IIIC	0.078	Surplus

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SULAWESI TENGGARA KABUPATEN : KOLAKA

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
1	22 Km	IIIB-1	10.580	VOC
62	11 Km	IIIC	7.121	Surplus

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SULAWESI TENGGARA KABUPATEN : KOLAKA

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
4	80 Km	IIIA	3775622	3.208	52.901	VOC
6	39 Km	IIIB-1	273149	1.286	15.999	Surplus
5	42 Km	IIIB-1	172291	1.202	14.900	VOC
3	6 Km	IIIA	43934	1.298	16.837	VOC
1	22 Km	IIIB-1	11479	1.023	10.580	VOC
SUM	189 Km		4276475			