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 32

KABUPATEN BARRU

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

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

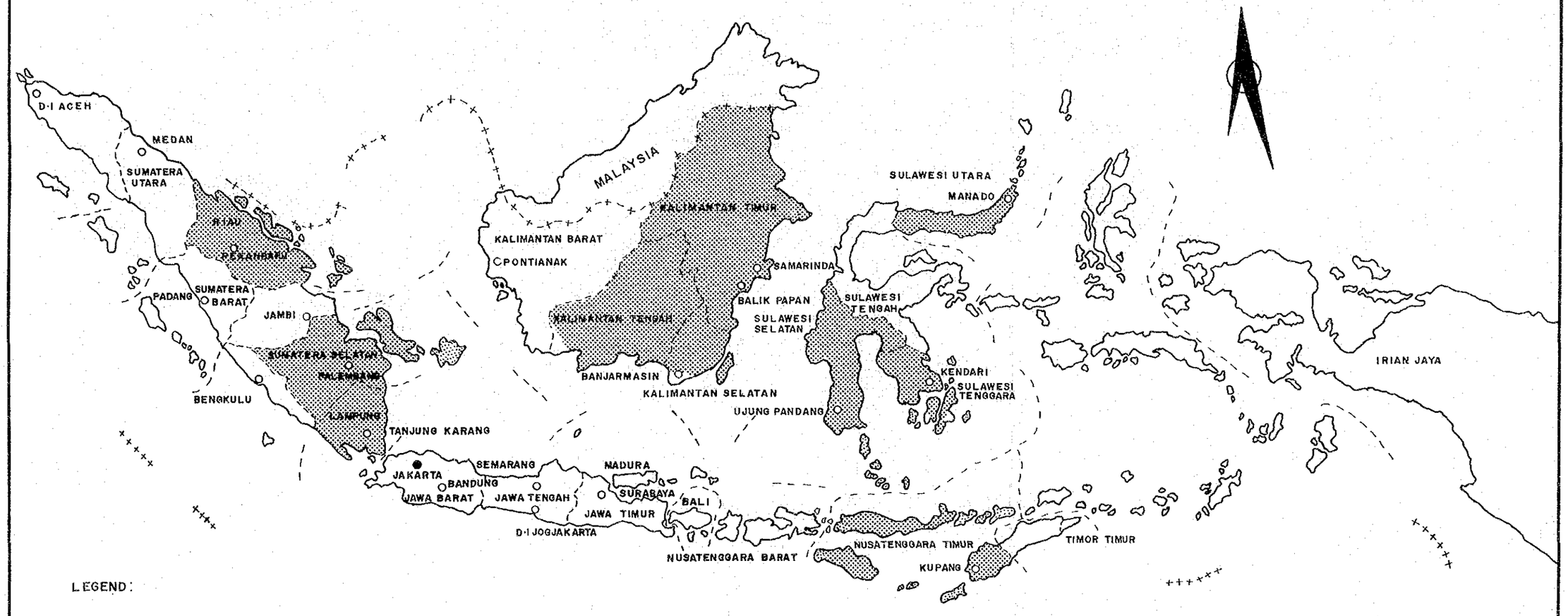
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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

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

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

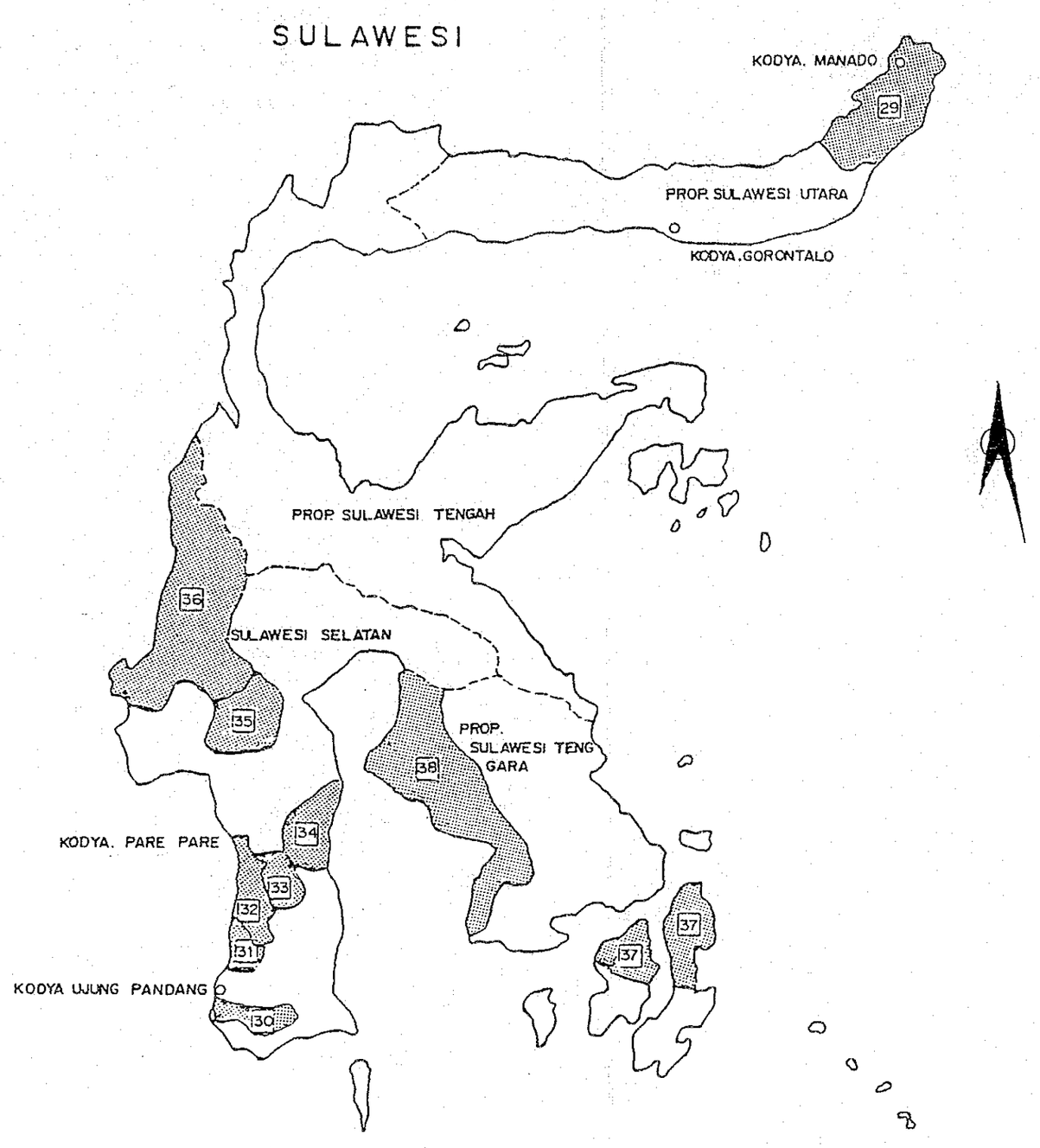
LOCATION MAP OF THE PROJECT AREAS



VIII · PROPINSI SULAWESI UTARA
29 · KAB · MINAHASA

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

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



LEGEND :

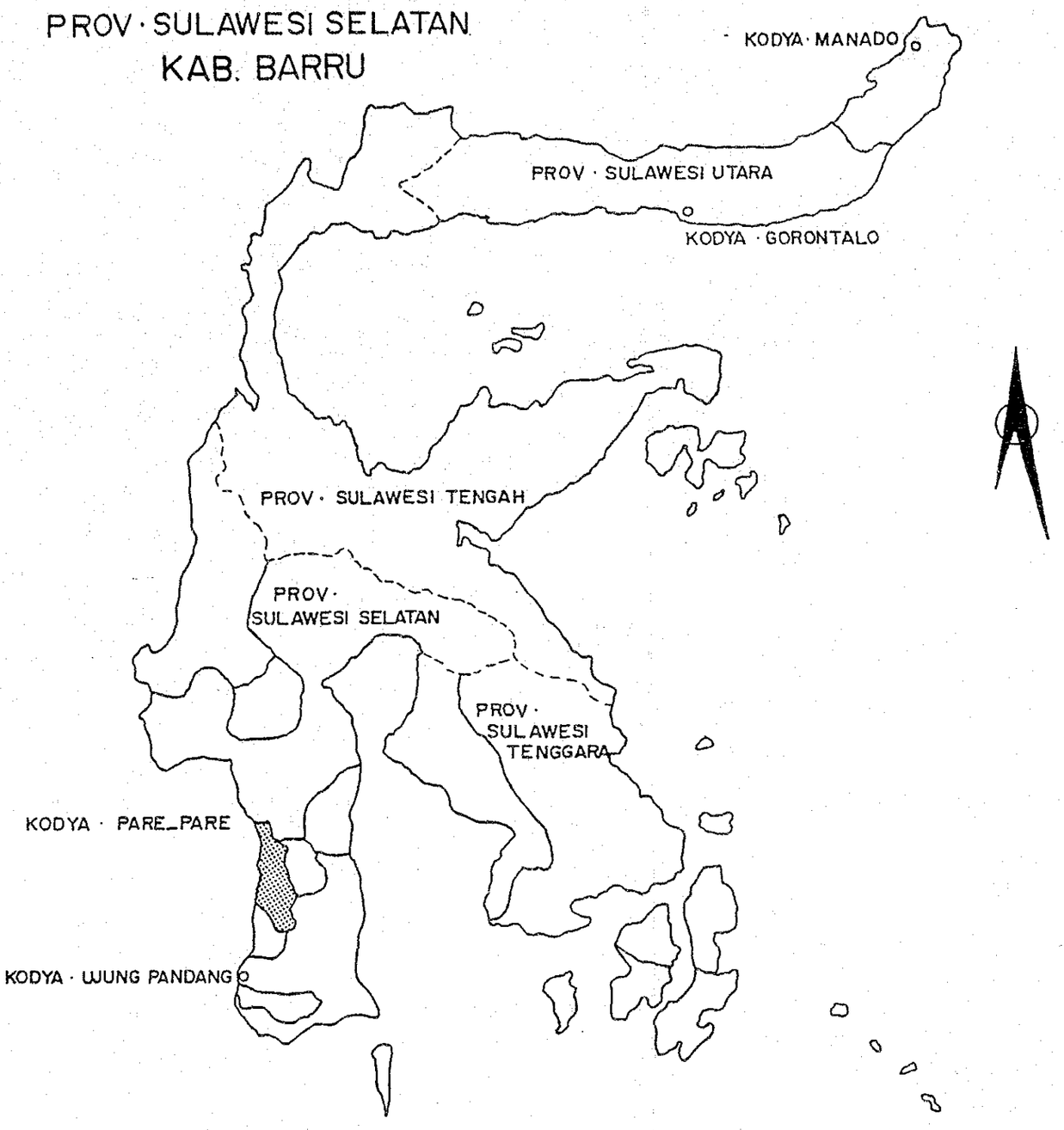
----- PROVINCIAL BOUDER

LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km

SULAWESI
PROV · SULAWESI SELATAN
KAB. BARRU



LEGEND :

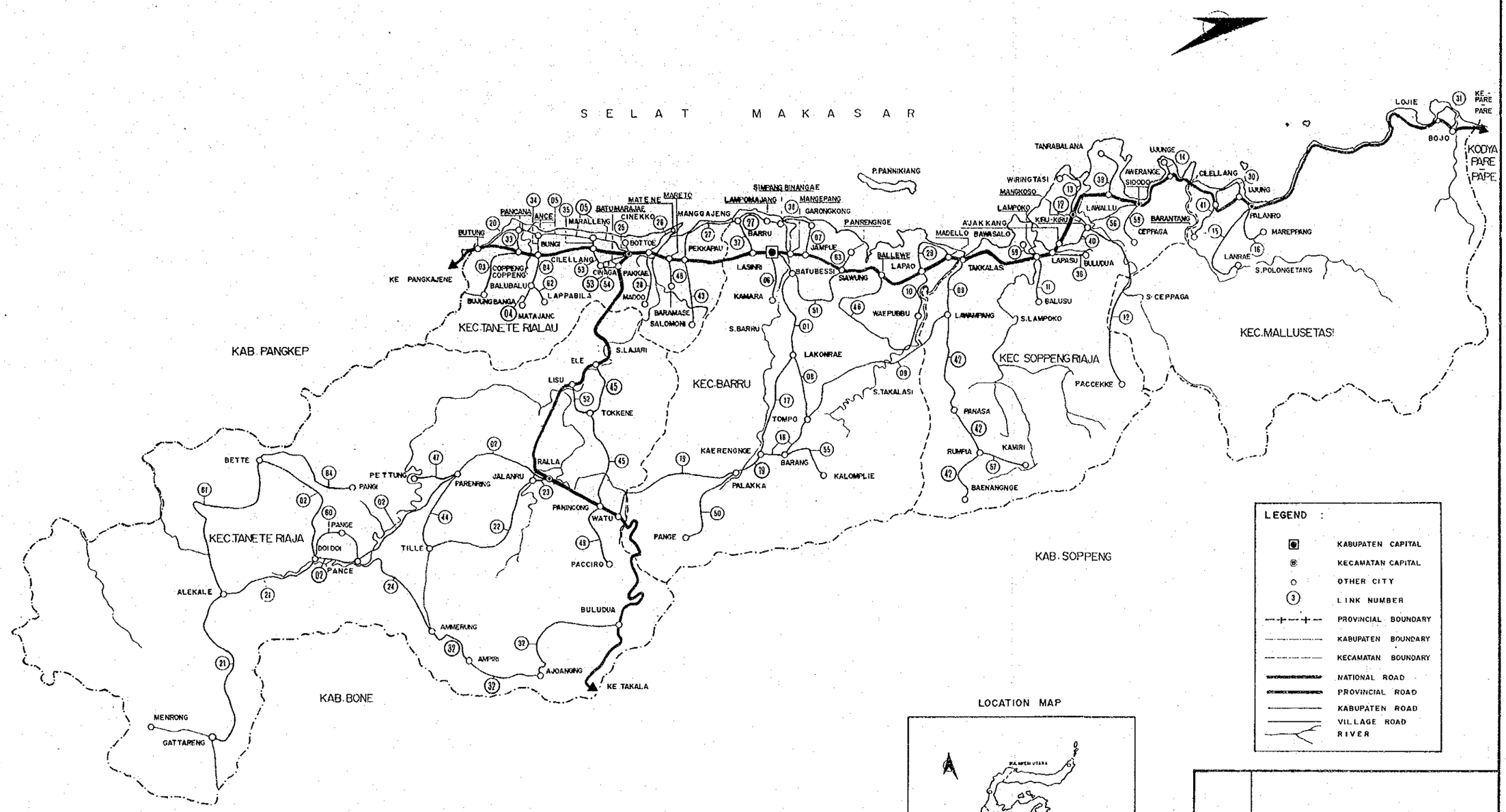
---- PROVINCIAL BOUNDARY

LOCATION OF THE PPOJECT AREA

SCALE :

0 92 184 276 460 Km

KAB. BARRU



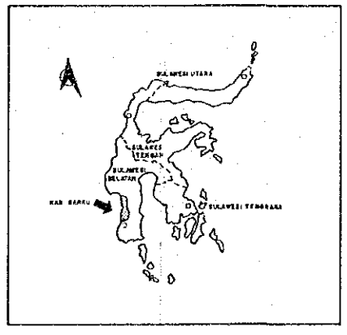
LEGEND :

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

SCALE :

0 2 5 8 Km

LOCATION MAP



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

TITLE :

SOURCE :	SCALE :	PROVINCE :
DIREKTORAT JENDERAL AGRARIA	AS SHOWN	SULAWESI SELATAN
		KABUPATEN BARRU

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 Barru has the geographical feature of being long in the north south direction. It faces the Makassar Strait on the west coast and borders against mountains on the east. It is bordered on the north by Kabupatens Pinrang and Sindereng Rappang, on the east by Kabupatens Soppeng and Bone, and on the south by Kabupatens Maros and Pangkajene Kepulauan.

There is a flat region on the west coast but it is narrow and changes into hills towards the inland. On the east boundary is the mountain range stretching in a north south direction.

The Kabupaten has an area of 1,175 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 Muna are 98 days and 1,474 mm respectively.

One year in the Kabupaten consists of a rainy season and a dry season. The dry season is from April 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 250 days using the following formula based upon the data shown in the table referred to above.

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

Where :

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

Table 1-1-1

METEOROLOGICAL CONDITIONS

PROVINCE : Sulawesi Selatan
KABUPATEN : Barru

STATION : Barru 408 A

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	15	471	19	314						
February	14	349	13	335						
March	12	366	14	267						
April	15	250	18	248						
May	9	184	12	176						
June	7	43	12	249						
July	0	0	4	18						
August	5	51	2	101						
September	1	33	2	5						
October	6	38	13	257						
November	13	207	19	405						
December	24	960	19	531						
Total	121	2,958	147	2,906	-	-	-	-	-	-

1.2 Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Barru in 1982 was 137,392 which was approximately 2.2% of the 6,278,200 total population of Sulawesi Selatan Province as shown in Table 1-2-1.

The population density was 1.17 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 :

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 SELATAN

KABUPATEN : BARRU

KECAMATAN	POPULATION	PROPORTION (%)
TANETE RIAJA	31,170	22.6
TANETE RILAU	27,841	20.3
BARRU	32,287	23.5
SOPPENG RIAJA	25,676	18.7
MALUSETASI	20,526	14.9
TOTAL	137,292	100

1.2.2 Land Use

In Kabupaten Barru, 21,785 ha of the current available land use area, which is approximately 19.1% of the 114,472 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 18,915 ha of agricultural harvest area and 2,870 ha of residential area which are 86.8% and 13.2% of the current available land use area respectively.

The agricultural harvest area consists of 12,653 ha of paddy field and 6,262 ha of other cultivated area which are 66.9% and 33.1% of the agricultural harvest area respectively.

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

Table 1-2-3

LAND USE

PROVINCE : SULAWESI SELATAN

(ha)

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

Notes :

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

1.2.3 Agriculture

The cultivated area and food crop production in Kabupaten Barru in 1982 were 18,249 ha and 83,497 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 12,749 ha and 79,316 ton respectively which are 69.9% and 95.0% of the total food crops. The yield rate of paddy production is 6.2 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 2.7% and 3.9% respectively indicate steady development of the paddy production. It is desirable that productivity of paddy becomes higher and this depends upon the future development of irrigation and the increase of double crop fields.

The population of the agricultural sector which is assumed from the employment in the Kabupaten is 64.8% 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 the development of uncultivated or hilly areas for food crops other than paddy.

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

KABUPATEN : BARRU

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	13,064	13,263	12,745	12,749	14,549	-	
OTHERS	2,590	4,914	5,479	-	-	-	
TOTAL	15,654	18,177	18,224	-	-	-	

PRODUCTION

(ton)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	70,635	71,528	73,933	79,316	-	-	
OTHERS	4,044	4,291	5,210	4,181	-	-	
TOTAL	74,679	75,819	79,143	83,497	-	-	

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR (%)
	1979	1980	1981	1982	1983	1984	
PADDY	5.4	5.4	5.8	6.2	-	-	

Notes :

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

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

PROVINCE : SULAWESI SELATAN

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

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : SULAWESI SELATAN

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
GOWA	226,000	368,552	61.3	0.05	1983
PANGKAJENE KEPULAUAN	146,000	224,630	64,8	2.0	1984
BARRU	89,000	137,392	64.8	1.0	1982
SOPPENG	166,000	293,335	69.4	0.25	1984
WAJO	243,000	379,948	63.8	4.0	1984
TANA TORAJA	260,000	340,015	76.4	3.0	1984
MAMUJU	101,000	124,315	81.5	6.0	1984

Notes :

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

1.2.4 Other Economic Activities

Kabupaten Barru appears to be a typical Kabupaten relying upon the agricultural sector. About 80% of the population of Kabupaten Barru is associated with the agricultural and the forest sectors.

With regard to other industries, it should be noted that according to Kabupaten statisties three hundred and sixty nine factories were operating in the fields of ceramics, timber and food, etc. in 1983. However, the population associated to the above light industrial activities formed only 3% of the total population of the Kabupaten and amounted to 1.497 persons employed in factories managed by an average of 4 employees.

(1982)

Item	No of Man Power (Person)	Share (%)	Remark
Agriculture	22,148	67.75	
Live Stock	436	1.27	79.47%
Fishery	4,602	13.45	
Industry	1,020	2.98	2 .98%
Commerce	3,009	8.80	
Service	2,989	8.75	17.55%
Total	34,204	100	

Coal, manganese and cobalt reserves have already been surveyed in the mountainous areas of the North-Eastern boundary of the Kabupaten and ensure its mining industry potential, which is expected to develop in the near future.

The industrial structure of south Sulawesi Province consists of about 50% agricultural and forest sectors which are the primary industry, about 5% mining and manufacturing sectors services sectors as the tertiary industry.

Accordingly, the primary industry employees about 50% of the workforce and is the industrial foundation of South Sulawesi Province.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Barru, there is a national road running through the Kabupaten along the coastal line from the northern boundary to the southern boundary. From its junction with the national road, a provincial roads runs to the east crossing a little to the south of the centre of the Kabupaten and connects with Kabupaten Bone. Most of the Kabupaten roads connect with one of the trunk roads mentioned above and serve the Desas as regional collector roads. The Kabupaten road between Barru and Watu serves in part as a regional trunk road in the inland region of the Kabupaten and connects the national road with the provincial road.

The Kabupaten road running from Ralla or Buludua to Kabupaten Bone via Doidoi and Gatareng is a regional trunk road in the southern inland part of the Kabupaten.

There are few links in the northern Kabupaten due to the geographical condition.

The Kabupaten road running from Takkalasi to Kabupaten Soppeng via Baenangnge is assumed to have potential to serve future social development.

Between the sea and the national road is a narrow and swampy area, therefore there are few links except one connecting Jampue with Pekkapao. This is an outer link of Barru.

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 Barru are confirmed as 64 links and 343 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 2.92 m per ha. This is distinctly higher than the national density of 0.48 m per ha and also higher than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Barru	343	117,472	2.92
Province : Sulawesi Selatan	2,730	2,104,377	1.30
Jawa Is.(Excluding DKI Jakarta)	27,715	13,159,700	2.11
Indonesia	92,038	191,944,300	0.48

Notes : 1. The value for the province is the total value for the Kabupatens included in the study.

2. The sources of data are as follows:
Kabupaten and Province : Bina Marga Inventory
Jawa and Indonesia : Statistical Yearbook of Indonesia 1984, published by the Central Statistics Bureau

(2) Kabupaten Road Surface Type

The type of surface on the Kabupaten roads in the Kabupaten is shown in Table 1-3-1.

The legend used in the table is as follows:

ASP : Asphalt
KRK : Gravel/Stone/Telford/Water Bound Macadam

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

PROV : SULAWESI SELATAN KAB : BARRU

(Km)

NO (?)	ASP	BTB	TNH	L.L	KRK	TOTAL
LINK 1	6	1				7
LINK 2		7	1			8
LINK 3			5			5
LINK 4		2	4			6
LINK 5		1	4	2		7
LINK 6		3	1			4
LINK 7	2					2
LINK 8			5	1		6
LINK 9		4			8	12
LINK 10		1				1
LINK 11		2				2
LINK 12	2		4	6		12
LINK 13	1	1	2	1	1	3
LINK 14			1			1
LINK 15	4		1		1	6
LINK 16		2	2			4
LINK 17		1			5	6
LINK 18				3		3
LINK 19					10	10
LINK 20			1	1		2
LINK 21			30	6		36
LINK 22	1	1	4	4	1	8
LINK 23			1	1		2
LINK 24			4	5		9
LINK 25	1					1
LINK 26		1	2		1	3
LINK 27	2		4			6
LINK 28		1	1	1		3
LINK 29			5			5
LINK 30	1	1	2	1		4
LINK 31	1	2	1	1		3
LINK 32			23			23
LINK 33		2				2
LINK 34		2				2
LINK 35		1				1
LINK 36	1	1				1
LINK 37			1			1
LINK 38	1		4			5
LINK 39			4			4
LINK 40					3	3
LINK 41			4			4
LINK 42			16			16
LINK 43			4			4
LINK 44			6			6
LINK 45			8	2		10
LINK 46			2	1		3
LINK 47			5			5
LINK 48			2			2
LINK 49			3	1		4
LINK 50			4			4
LINK 51			5	1		6
LINK 52			3			3
LINK 53			4			4
LINK 54			1			1
LINK 55			3			3
LINK 56			3			3
LINK 57			5			5
LINK 58		2	1			3
LINK 59			1	2		3
LINK 60			3			3
LINK 61			13	1		14
LINK 62			2			2
LINK 63			2			2
LINK 64			4			4
TOTAL	18	38	221	39	27	343
RATIO	5	11	64	11	8	(%)

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 : Barru	5.2	19.0	75.8
Province : Sulawesi Selatan	13.0	46.0	41.0
Jawa Is.(Excluding DKI Jakarta)	56.2	25.0	18.8
Indonesia	26 0	26 6	47 4

Thus, in the Kabupaten the proportion of Kabupaten roads with asphalt surface is much lower than either that of Indonesia or 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 : Barru	12.5	39.9	37.3	10.2
Province : Sulawesi Selatan	41.1	27.3	25.8	5.8
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

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

PROVINCE : SULAWESI SELATAN

KABUPATEN : BARRU

(1)

JO2	J1	ASP				BTB				INI				L.L				KRK			
JO2		BA	SD	RU	RB	BA	SB	RU	RB	BA	SB	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK	1	3	15	42	40		10	30	60	1											
LINK	2						49	41	10		15	50	5								
LINK	3									12	58	23	33								
LINK	4					75	25				51	30	16								
LINK	5					26	13	61		2	55	43			59	41					
LINK	6					10	11	13			70	10									
LINK	7	90	10																		
LINK	8									31	46	23		75	25						
LINK	9					26	60	11	3									16	58	23	3
LINK	10					80	20														
LINK	11					25	58	18													
LINK	12	8	55	38						15	58	28		16	48	29	7				
LINK	13					80	20				43	33	25								
LINK	14									2	53	45									
LINK	15	14	74	13						25	25	40	10					80	15	75	
LINK	16					28	23					91	9								
LINK	17					10	35	55										27	28	27	18
LINK	18													56	44						
LINK	19																	50	27	23	
LINK	20										75	25			25	45	30				
LINK	21										46	45	9		21	48	31				
LINK	22										30	52	18		5	65	30				
LINK	23										80	20			55	45					
LINK	24										11	70	19		20	59	22				
LINK	25		20	80																	
LINK	26					80		20		35	65										
LINK	27	55	40	5							58	65	2								
LINK	28						30	70			45	25	30	25	25						
LINK	29										55	38	7								
LINK	30						80	20		40	53	5			60	40					
LINK	31					60	15	25			80	20									
LINK	32										58	35	7								
LINK	33					90	5	5													
LINK	34					38	45	5	13												
LINK	35						25	75													
LINK	36					60	40														
LINK	37										15	60	25								
LINK	38		12	88							37	26	37								
LINK	39									14	33	54									
LINK	40																	43	43	13	
LINK	41									55	30	15									
LINK	42										4	52	43								
LINK	43									5	29	51	15								
LINK	44										16	47	8								
LINK	45										22	65	13		35	60	5				
LINK	46										48	45	8		65	30	5				
LINK	47										55	38	7								
LINK	48											30	70								
LINK	49										42	52	7		30	65	5				
LINK	50										55	38	8								
LINK	51										59	35	6		50	40	10				
LINK	52										37	7	57								
LINK	53										48	34	19								
LINK	54										45	55									
LINK	55									3	62	35									
LINK	56										18	25	57								
LINK	57										49	51									
LINK	58					70	25	5			40	60									
LINK	59										50	40	10		30	65	5				
LINK	60										47	47	7								
LINK	61										57	35	8		50	45	5				
LINK	62									8	30	40	23								
LINK	63										45	43	13								
LINK	64										49	41	10								
AVERAGE		24	32	38	6	40	33	23	4	5	43	40	12	13	38	40	9	29	34	32	4
LENGTH		18 Ka				38 Ka				221 Ka				39 Ka				27 Ka			
(Ka)		4	6	7	1	15	13	9	2	11	95	89	27	5	15	16	4	8	9	9	1

The surface condition level of the Kabupaten roads in the Kabupaten is lower than both that of Indonesia and Jawa Island. The proportion in good condition is relatively low. Therefore improvement of Kabupaten roads in 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 29.0% flat, 29.0% hilly, 42.0% mountainous.

1.3.3 Bridge Inventory

A bridge inventory showing the existing condition of bridges on the Kabupaten roads in Kabupaten Barru 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 112 bridges with a total length of 550 m of which 49 or 43.6% are timber, 33 or 29.5% are concrete and 15 or 13.4% are others. Steel bridges also account for 15 or 13.4% of the total. On the other hand, 93 bridges with a total length of 1,133 m are required to be newly constructed.

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

PROV : SULAWESI SELATAN KAB : BARRU

(Km)

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

(Km)

102 (3)	DT	BK	GN	TOTAL
LINK 33	2			2
LINK 34	2			2
LINK 35	1			1
LINK 36	1			1
LINK 37	1			1
LINK 38	5			5
LINK 39	1	3		4
LINK 40	3			3
LINK 41	1	3		4
LINK 42		1	15	16
LINK 43	1	3		4
LINK 44			6	6
LINK 45		9	1	10
LINK 46	3		1	3
LINK 47		5		5
LINK 48	2			2
LINK 49			4	4
LINK 50			4	4
LINK 51		6		6
LINK 52		3		3
LINK 53	2	2		4
LINK 54	1			1
LINK 55		2	1	3
LINK 56	2	1		3
LINK 57		2	3	5
LINK 58		3		3
LINK 59	1	2		3
LINK 60		3		3
LINK 61			14	14
LINK 62		2		2
LINK 63	2			2
LINK 64		4		4
TOTAL	100	100	143	343
RATIO	29	29	42	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SULAWESI SELATAN KAB : BARRU

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

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
1	2	6.00			2	6.00
2	6	25.50			6	25.50
3	2	7.40	1	10.00	3	17.40
4	2	13.50	2	15.00	4	28.50
5	4	11.75	1	60.00	5	71.75
7	2	11.75			2	11.75
8	2	9.00			2	9.00
9	12	54.00	1	26.00	13	80.00
12	1	4.00	2	18.00	3	22.00
13	1	2.00			1	2.00
15	3	11.00			3	11.00
16	3	8.60	1	5.00	4	13.00
17	10	42.10			10	42.10
18	2	14.00			2	14.00
19	8	75.00			8	75.00
21	26	141.30	15	131.00	41	272.30
22	4	17.70	1	40.00	5	57.70
24	6	28.50			6	28.50
27	2	6.00	1	55.00	3	61.00
28	2	9.00			2	9.00
29			2	12.00	2	12.00
30			2	11.00	2	11.00
31	1	5.00			1	5.00
32			5	74.00	5	74.00
37			1	40.00	1	40.00
38			1	4.00	1	4.00
40			1	3.00	1	3.00
41			1	6.00	1	6.00
42			9	51.00	9	51.00
43			4	14.00	4	14.00
44			2	19.00	2	19.00
45			6	132.00	6	132.00
47			3	34.00	3	34.00
48	2	4.00			2	4.00
49			2	13.00	2	13.00
50			2	32.00	2	32.00
51	2	7.00	4	20.00	6	27.00
52			2	60.00	2	60.00
53			4	15.00	4	15.00
55			2	16.00	2	16.00
56			1	36.00	1	36.00
57			6	43.00	6	43.00
59			1	5.00	1	5.00
60	1	3.50			1	3.50
61	5	27.50	3	103.00	8	130.50
62			2	20.00	2	20.00
64	1	5.00	2	10.00	3	15.00
TOTAL	112	549.50	93	1133.00	205	1682.50

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

PROV : SULAWESI SELATAN KAB : BARRU

	<<< BRIDGE >>>				(No)
	103 (1B)	BI	BJ	KY	LL	TOTAL
LINK 1	2					2
LINK 2	6					6
LINK 3			1	1		2
LINK 4			1	1		2
LINK 5	1		2	1		4
LINK 7	2					2
LINK 8				2		2
LINK 9	1		5	5	1	12
LINK 12					1	1
LINK 13					1	1
LINK 15			3			3
LINK 16	3					3
LINK 17	8		1	1		10
LINK 18	2					2
LINK 19	7		1			8
LINK 21				20	6	26
LINK 22				3	1	4
LINK 24				5	1	6
LINK 27	1				1	2
LINK 28				1	1	2
LINK 29						
LINK 30						
LINK 31				1		1
LINK 32						
LINK 37						
LINK 38						
LINK 40						
LINK 41						
LINK 42						
LINK 43						
LINK 44						
LINK 45						
LINK 47						
LINK 48				2		2
LINK 49						
LINK 50						
LINK 51			1	1		2
LINK 52						
LINK 53						
LINK 55						
LINK 56						
LINK 57						
LINK 59						
LINK 60					1	1
LINK 61				4	1	5
LINK 62						
LINK 64				1		1
TOTAL	33		15	49	15	112
RATIO	29		13	44	13	(%)

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

Bridge Type	Span Length (m)										
	⟨3	⟨5	⟨8	⟨10	⟨12	⟨14	⟨16	⟨18	⟨20	⟨99	Total
Timber	16	21	12	-	-	-	-	-	-	-	49
Concrete	11	16	6	-	-	-	-	-	-	-	33
Steel	6	4	4	1	-	-	-	-	-	-	15
Others	6	7	1	-	1	-	-	-	-	-	15
Total	39	48	23	1	1	-	-	-	-	-	112

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

1.3.4 Traffic

Inventories of the average daily traffic (ADT) on the Kabupaten roads in Kabupaten Barru 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	572	2,577	2,595	7,620	9,556
Proportion (%)	4.28	19.28	19.42	57.02	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	11·71	1.16	1.82	85.31	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 : BARRU

A)	Growth Rate of Population	:	0.50 (%)
B)	Growth Rate of Cultivated Area	:	7.90 (%)
C)	Growth Rate of Rice field	:	2.70 (%)
D)	Growth Rate of Rice yield rate	:	4.70 (%)
E)	Growth Rate of GDP / capita	:	6.60 (%)
a)	Geometrical Mean (A x B)	:	4.13 (%)
b)	Geometrical Mean (C x D)	:	3.70 (%)
c)	Geometrical Mean (a x b)	:	3.91 (%)
d)	Geometrical Mean (c x E)	:	5.25 (%)
	TRAFFIC GROWTH RATE	:	5.25 (%)

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 SELATAN KAB : BARRU

(SPD : 1/2)

	INVENTORY (1984)					RATE	AFTER 14 YEARS (1998)					CLASS
LINK NO	MBL	BUS	TRUK	SPD	TOTAL		MBL	BUS	TRUK	SPD	TOTAL	
1	16	120	60	520	456	5.3%	33	246	123	1064	933	IIIA
2	10	40	22	45	95	5.3%	20	82	45	92	194	IIIB-2
3	12	57	30	80	139	5.3%	25	117	61	164	285	IIIB-1
4	12	38	38	50	113	5.3%	25	78	78	102	231	IIIB-1
5	13	42	21	80	116	5.3%	27	86	43	164	237	IIIB-1
6	24	24	66	180	204	5.3%	49	49	135	368	418	IIIB-1
7	30	67	22	150	194	5.3%	61	137	45	307	397	IIIB-1
8	8	18	15	44	63	5.3%	16	37	31	90	129	IIIB-2
9	30	160	100	330	455	5.3%	61	328	205	675	931	IIIA
10	24	160	100	300	434	5.3%	49	328	205	614	888	IIIA
11	12	240	50	72	338	5.3%	25	491	102	147	692	IIIA
12	32	90	120	360	422	5.3%	66	184	246	737	864	IIIA
13	16	45	45	210	211	5.3%	33	92	92	430	432	IIIB-1
14	36	30	30	120	156	5.3%	74	61	61	246	319	IIIB-1
15	24	30	390	915	902	5.3%	49	61	798	1873	1846	IIIA
16	4	23	68	51	121	5.3%	8	47	139	104	248	IIIB-1
17	24	60	60	480	384	5.3%	49	123	123	983	786	IIIA
18	6	21	9	40	56	5.3%	12	43	18	82	115	IIIB-2
19	16	15	165	240	316	5.3%	33	31	338	491	647	IIIA
20	7	42	36	40	105	5.3%	14	86	74	82	215	IIIB-1
21	5	0	0	54	32	5.3%	10	0	0	111	66	IIIB-2
22	5	0	0	48	29	5.3%	10	0	0	98	59	IIIB-2
23	5	0	0	60	35	5.3%	10	0	0	123	72	IIIB-2
24	5	60	60	480	365	5.3%	10	123	123	983	747	IIIA
25	21	96	120	160	317	5.3%	43	197	246	328	649	IIIA
26	7	33	30	40	90	5.3%	14	68	61	82	184	IIIB-2
27	15	30	19	100	114	5.3%	31	61	39	205	233	IIIB-1
28	2	42	15	40	79	5.3%	4	86	31	82	162	IIIB-2
29	36	320	200	720	916	5.3%	74	655	409	1474	1875	IIIA
30	6	21	9	30	51	5.3%	12	43	18	61	104	IIIB-2
31	16	15	165	180	286	5.3%	33	31	338	368	585	IIIA
32	6	42	36	40	104	5.3%	12	86	74	82	213	IIIB-1
33	2	0	0	36	20	5.3%	4	0	0	74	41	IIIC
34	2	0	0	36	20	5.3%	4	0	0	74	41	IIIC
35	2	0	0	40	22	5.3%	4	0	0	82	45	IIIC
36	6	320	200	720	886	5.3%	12	655	409	1474	1814	IIIA
37	21	96	120	160	317	5.3%	43	197	246	328	649	IIIA
38	7	33	30	40	90	5.3%	14	68	61	82	184	IIIB-2
39	2	0	0	27	16	5.3%	4	0	0	55	33	IIIC
40	2	0	0	30	17	5.3%	4	0	0	61	35	IIIC
41	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
42	1	0	20	12	27	5.3%	2	0	41	25	55	IIIB-2
43	5	30	19	30	69	5.3%	10	61	39	61	141	IIIB-2
44	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
45	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
46	2	0	15	10	22	5.3%	4	0	31	20	45	IIIC
47	1	0	0	6	4	5.3%	2	0	0	12	8	IIIC
48	6	37	16	60	89	5.3%	12	76	33	123	182	IIIB-2
49	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
50	1	0	0	10	6	5.3%	2	0	0	20	12	IIIC

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

PROV : SULAWESI SELATAN KAB : BARRU

(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	5.3%	0	0	0	0	0	IIIC
52	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
53	6	23	38	30	82	5.3%	12	47	78	61	168	IIIB-2
54	2	6	3	20	21	5.3%	4	12	6	41	43	IIIC
55	2	12	9	30	38	5.3%	4	25	18	61	78	IIIB-2
56	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
57	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
58	8	6	9	18	32	5.3%	16	12	18	37	66	IIIB-2
59	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
60	1	0	0	6	4	5.3%	2	0	0	12	8	IIIC
61	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
62	8	33	15	40	76	5.3%	16	68	31	82	156	IIIB-2
63	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
64	0	0	0	0	0	5.3%	0	0	0	0	0	IIIC
PERCENT	4.28	19.28	19.42	57.02			4.28	19.28	19.42	57.02		

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 : BARRU

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
18	IIIC	KRK	1	5	5	16	19
21	IIIB-2	KRK	8	37	37	109	137
22	IIIC	KRK	2	9	9	28	34
23	IIIC	KRK	0	2	2	5	7
30	IIIC	KRK	3	12	12	34	44
33	IIIC	KRK	1	2	2	7	9
34	IIIC	KRK	0	2	2	7	8
35	IIIC	KRK	0	2	2	6	7
39	IIIC	KRK	1	4	4	12	15
40	IIIC	KRK	1	4	4	13	16
41	IIIC	KRK	3	12	12	34	44
42	IIIB-2	KRK	6	28	28	84	104
44	IIIC	KRK	2	10	10	30	37
45	IIIB-2	KRK	4	19	19	55	70
46	IIIC	KRK	1	5	5	15	19
47	IIIC	KRK	2	9	9	27	34
49	IIIC	KRK	2	7	7	20	26
50	IIIC	KRK	2	8	8	23	30
51	IIIB-2	KRK	3	14	14	41	52
52	IIIC	KRK	1	4	4	13	16
55	IIIC	KRK	1	5	5	16	19
56	IIIC	KRK	1	6	6	16	21
57	IIIC	KRK	2	9	9	26	33
58	IIIC	KRK	1	4	4	13	16
59	IIIC	KRK	1	5	5	15	19
60	IIIC	KRK	1	4	4	12	15
61	IIIB-2	KRK	4	20	20	59	74
64	IIIC	KRK	1	4	4	13	16

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 : BARRU

(1000Rupiah)

	LINK 1	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 8	LINK 9	LINK 11	LINK 12
	7 Km	8 Km	5 Km	6 Km	7 Km	4 Km	6 Km	12 Km	2 Km	12 Km
	IIIA	IIIB-2	IIIB-1	IIIB-1	IIIB-1	IIIB-1	IIIB-2	IIIA	IIIA	IIIA
YEAR	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC	VOC
1988	0	0	0	0	0	0	0	0	0	0
1989	65536	17426	29569	23797	25692	15749	9619	89975	12262	112866
1990	69115	18363	30987	25247	27261	16699	10165	94579	12892	118659
1991	72733	19125	32793	26325	28560	17383	10717	99589	13584	125446
1992	76398	20255	34418	27774	30129	18333	11433	104870	14274	131958
1993	80311	21365	36287	29247	31711	19386	12161	110380	15029	138859
1994	84670	22668	38119	30721	33281	20358	12551	116135	15815	145797
1995	89087	23798	40195	32613	35104	21433	13278	122364	16664	153691
1996	93957	24935	42077	34086	36957	22518	14014	128632	17514	161661
1997	98669	26258	44386	35978	38809	23779	14761	135144	18456	170000
1998	104044	27562	46901	38063	40898	24967	15501	142524	19431	179352
SUM	834520	221755	375732	303851	328402	200605	124200	1144192	155921	1438289
COST	465723	114717	202583	156203	166911	103032	61100	629334	84351	802865
/Km	66532	14340	40517	26034	23844	25758	10183	52445	42176	66905

Chapter 3 ENGINEERING

3.1 Design Criteria and Specification

3.1.1 Geometric Design Criteria

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

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

3.1.2 Loading Specification

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

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

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

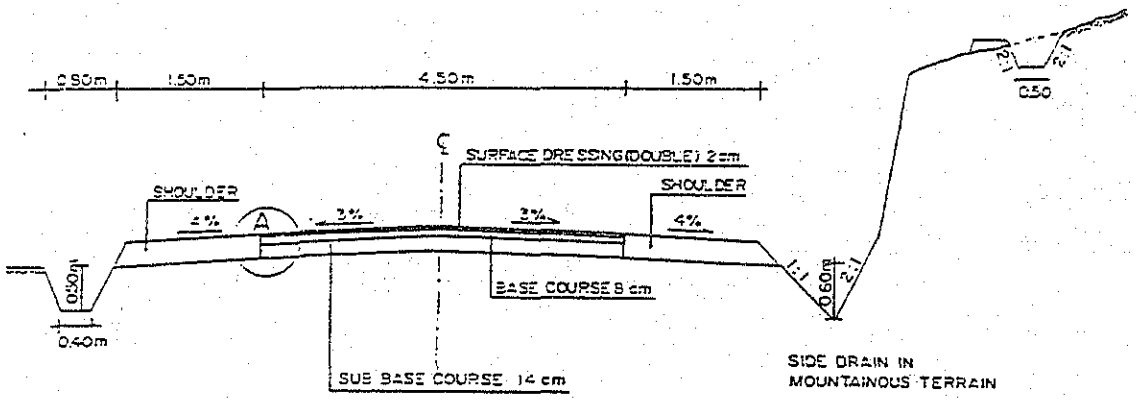
Table 3-1-1

DESIGN CRITERIA FOR KABUPATEN ROADS

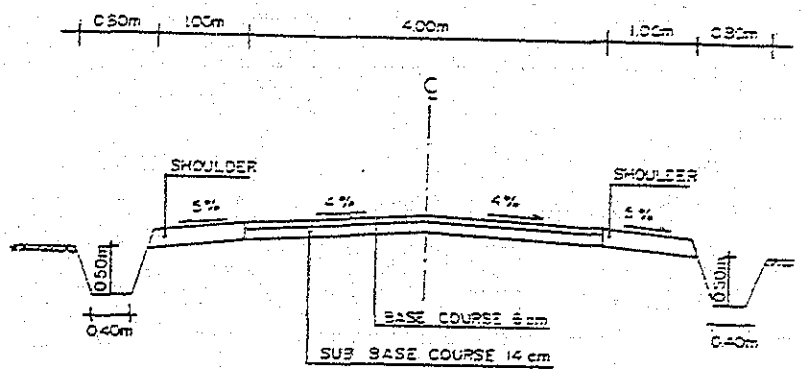
ROAD CLASSIFICATION		CLASS III A			CLASS III B-1			CLASS III B-2			CLASS III C		
SURFACE TYPE		ASPHALT SEAL (DOUBLE)			ASPHALT SEAL (SINGLE)			GRAVEL			GRAVEL		
TRAFFIC VOLUME : ADT (Forecast 10 th year average per day)		3000 - 500			500 - 200			200 - 50			50		
T E R R A I N		FLAT TO ROLLING	HILLY	MOUNT-AINOUS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

Fig. 3-1-1 STANDARD ROAD CROSS SECTIONS

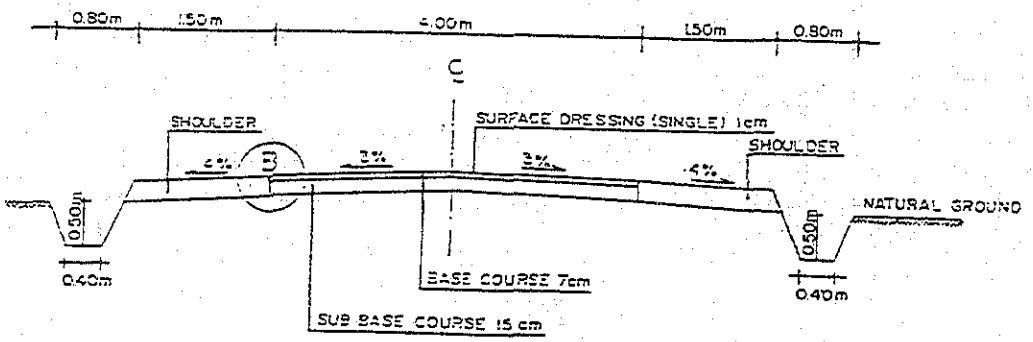
CLASS III A



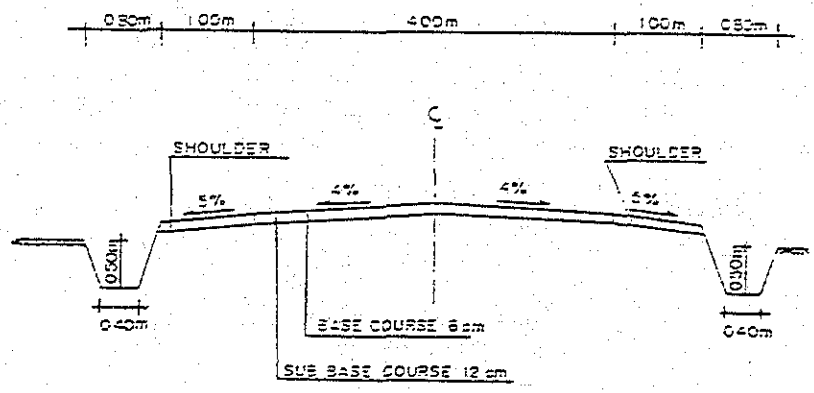
CLASS III B-2



CLASS III B-1



CLASS III C



3.2 Pavement Design

3.2.1 Design Conditions

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

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

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

1) Design Traffic Volume

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

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

2) Strength of Roadbed

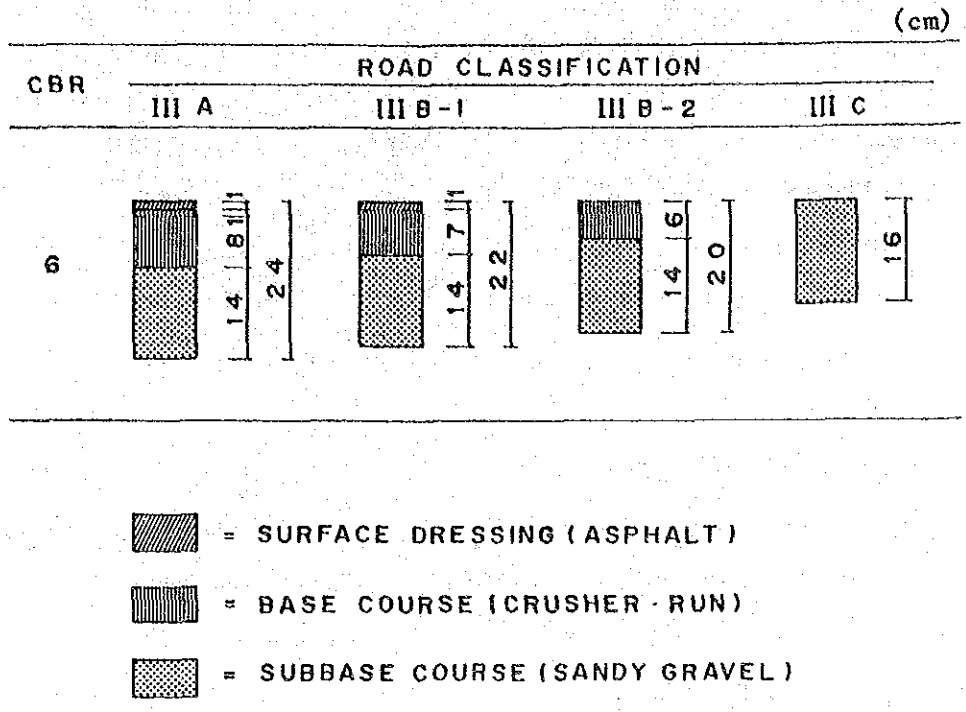
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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

3.2.2 Pavement Structure

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

Fig. 3-2-1 PAVEMENT STRUCTURE



3.3 Design of Bridges and Other Structures

3.3.1 Standard Bridge

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

(1) Bridge Type

1) Superstructure

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

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

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

2) Substructure

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

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

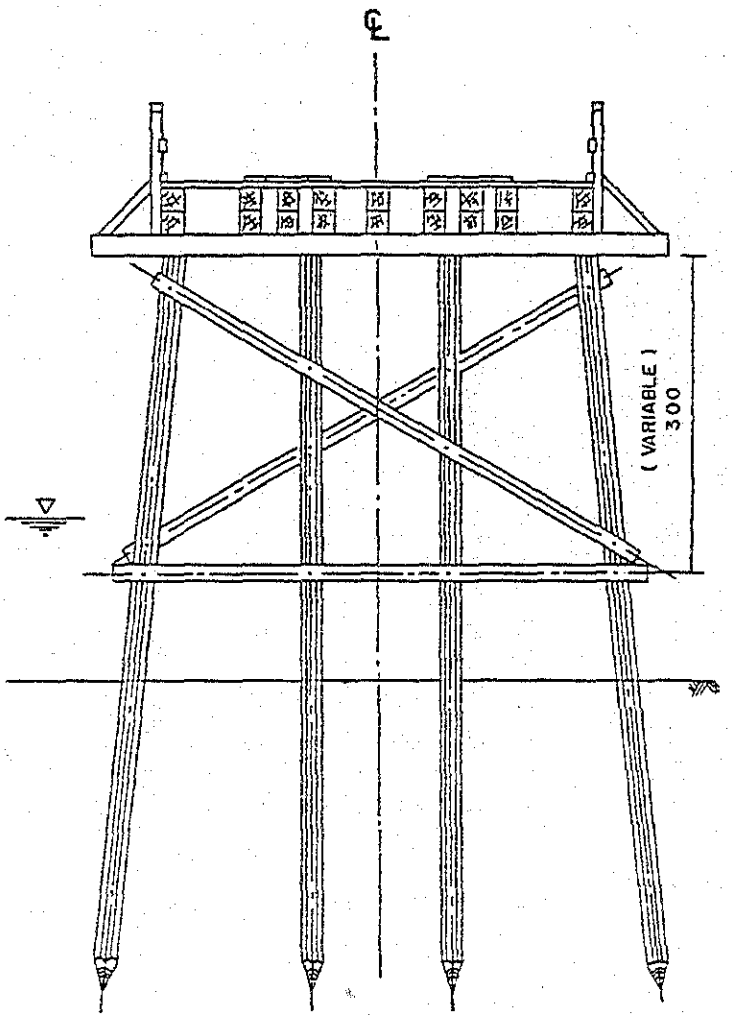
3) Foundation

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

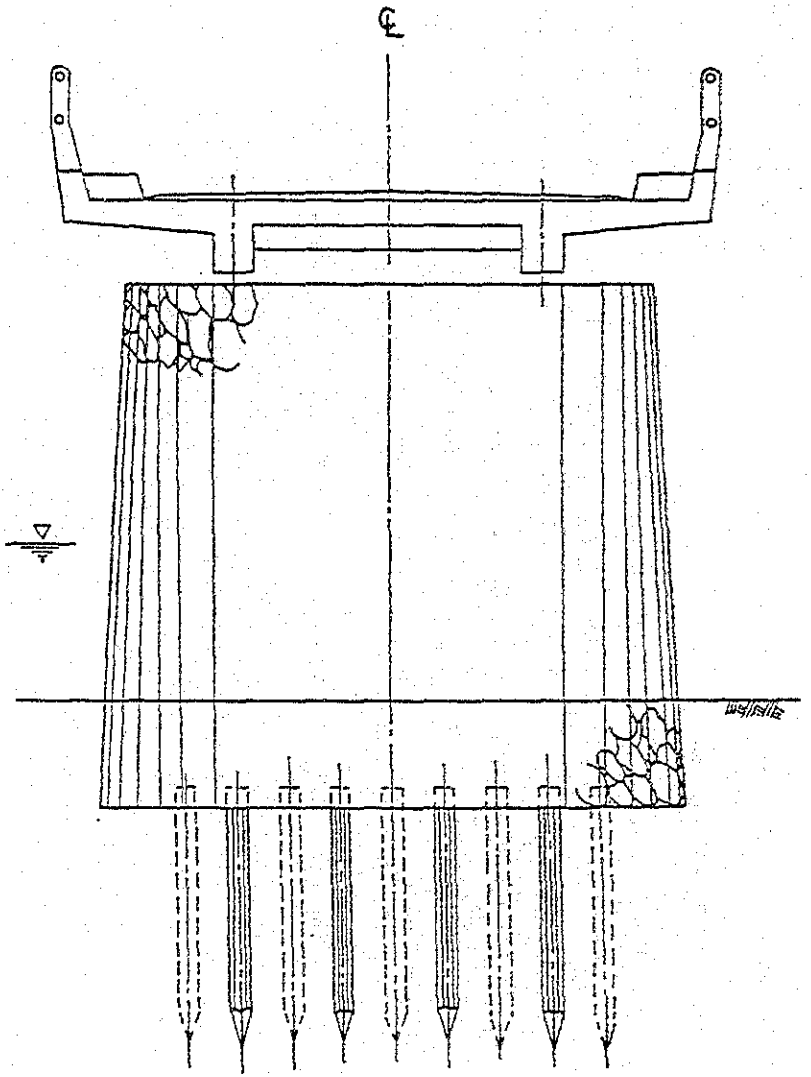
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

TIMBER BRIDGE



REINFORCED CONCRETE BRIDGE



(2) Bridge Width

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

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

(3) Span Length

The range of span lengths are determined as:

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

3.3.2 Other Structure

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

(1) Culvert

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

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

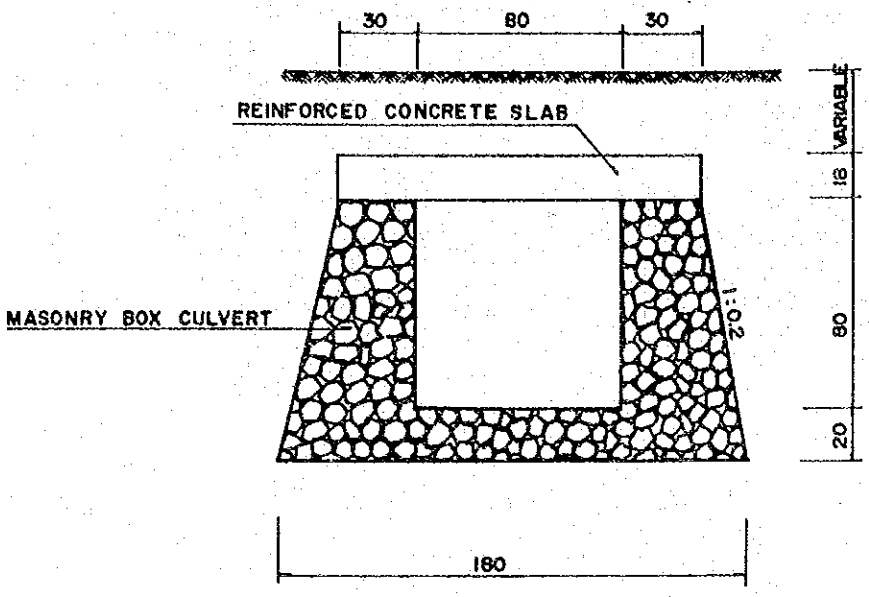
(2) Retaining Wall

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

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

Fig. 3-3-2 STANDARD CULVERTS

80 x 80 RUBBLE IN MORTAR BOX CULVERTS



Ø 80 RENFORCED CONCRETE PIPE CULVERT

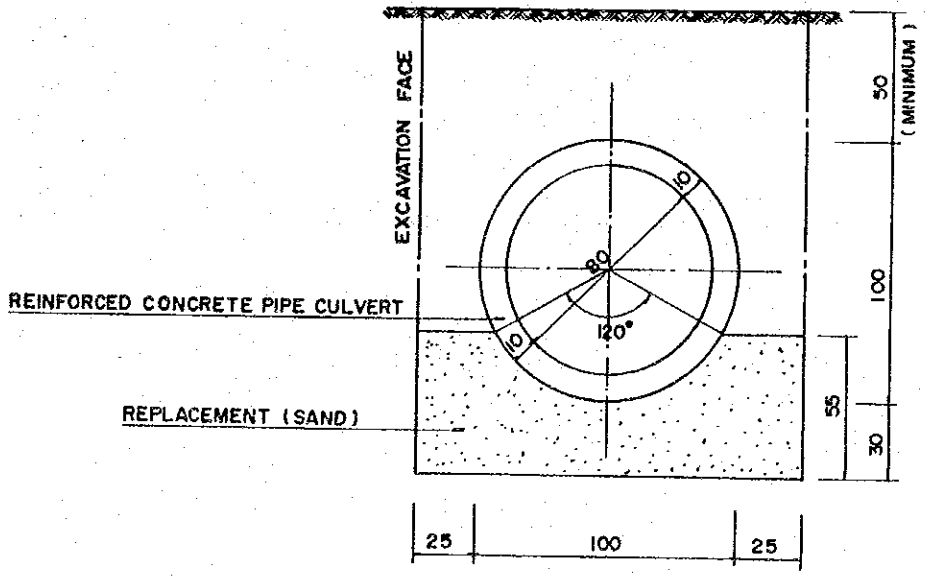
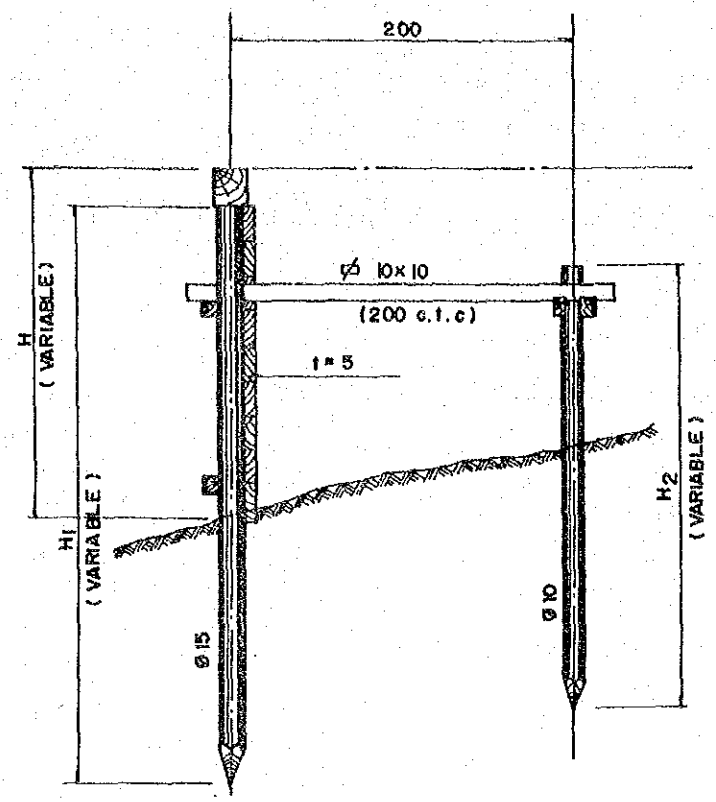
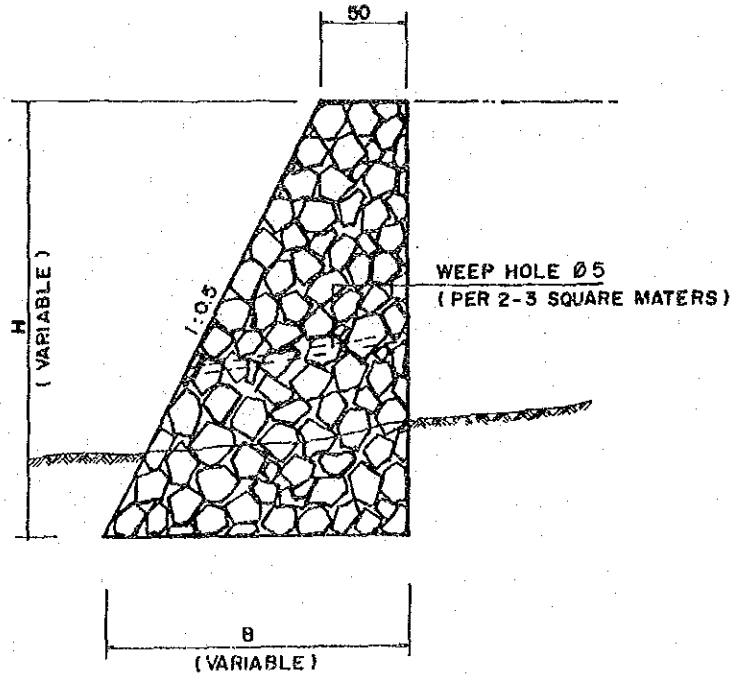


Fig. 3-3-3 STANDARD RETAINING WALLS

TIMBER RETAINING WALL



RUBBLE IN MORTAR WALL



3.4 Selection of Equipment Types

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

Table 3-4-1 CONSTRUCTION METHODS FOR MAJOR WORKS

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

3.4.1 Points to be Considered for the Selection

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

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

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

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

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

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

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

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

3.4.2 Combinations of Equipment for Major Works and Maintenance

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

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

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

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

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

3.5 Workshop and Laboratory

3.5.1 Policy of the Kabupaten Workshop

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

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

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

3.5.2 Workshop Equipment and Tools

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

Table 3-5-1 WORKSHOP EQUIPMENT AND TOOLS

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

continued

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

3.5.3 Laboratory

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

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

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

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

Table 3-5-2 LABORATORY TEST EQUIPMENT

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

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

Table 3-5-3 SURVEYING EQUIPMENT

DESCRIPTION	QUANTITY
Transit	1
Level	1
Staff	3

Chapter 4 CONSTRUCTION AND MAINTENANCE COST ESTIMATIONS

4.1 Unit Price

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

4.1.1 Unit Labour Price

The unit labour prices of Kabupaten Barru 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 Barru together with for other Kabupatens in Sulawesi Selatan Province.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

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

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

4.1.3 Hourly Equipment Cost

The hourly equipment cost for Kabupaten is shown in Table 4-1-3.

Table 4-1-3

HOURLY EQUIPMENT COST

PROVINCE : SULAWESI SELATAN
KABUPATEN : BARRU

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST OWERSHIP	LOCAL COST OPERATION	LOCAL COST SUB-TOTAL	FOREIGN COST OWERSHIP	FOREIGN COST OPERATION	FOREIGN COST SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	311	13,090	13,401	7,769	1,034	8,803	22,204
	Bulldozer/Ripper	120 HP	340	14,111	14,451	8,500	1,591	10,091	24,542
	Swamp Bulldozer	120 HP	356	14,355	14,711	8,879	1,662	10,541	25,252
	Bulldozer	90 HP	197	8,869	9,066	4,914	654	5,568	14,634
	Bulldozer/Ripper	90 HP	212	9,465	9,677	5,300	992	6,292	15,969
	Bulldozer	65 HP	140	6,445	6,585	3,500	465	3,965	10,550
	Bulldozer/Ripper	65 HP	153	6,898	7,051	3,819	714	4,533	11,584
	Swamp Bulldozer	90 HP	212	9,455	9,667	5,284	989	6,273	15,940
	Swamp Bulldozer	65 HP	162	6,787	6,949	4,050	758	4,808	11,757
	Motor Grader	110 HP	277	11,325	11,602	6,919	1,295	8,214	19,816
	Motor Grader	75 HP	192	7,762	7,954	4,779	894	5,673	13,627
	Motor Grader	65 HP	172	6,829	7,001	4,300	804	5,104	12,105
	Road Stabilizer	W=1850 mm	344	3,414	3,758	8,594	428	9,022	12,780
	Vibratory Roller	4 ton	116	3,399	3,515	2,900	385	3,285	6,800
	Hand-guide Vib. Roller	1000 Kg	102	617	719	850	30	880	1,599
	Tire Roller	8-15 ton	125	7,558	7,683	3,106	103	3,209	10,892
	Vibratory Roller (D&T)	4 ton	116	3,399	3,515	2,900	385	3,285	6,800
	Hand-guide Vib. Roller	600 Kg	72	422	494	600	21	621	1,115
	Rough Terrain Crane	10 ton	402	13,207	13,609	10,039	751	10,790	24,399
	Hydraulic Excavator; Wheel	0.3 m3	165	7,975	8,140	4,109	546	4,655	12,795
	Wheel Loader	1.2 m3	281	8,585	8,866	7,019	934	7,953	16,819
	Wheel Loader	0.3 m3	91	2,998	3,089	2,269	302	2,571	5,660
	Water Tank Truck	4000 ltr.	105	2,918	3,023	868	124	992	4,015
	Fuel Tank Truck	4000 ltr.	106	2,924	3,030	882	126	1,008	4,038
	Dump Truck	3.0 ton	177	3,654	3,831	1,469	210	1,679	5,510
	Flat Bed Truck with Crane	3.0 ton	69	3,155	3,224	1,717	128	1,845	5,069
	Dump Loader Truck	12 ton	154	19,454	19,608	3,838	127	3,965	23,573
	Dump Truck	5.0 ton	263	6,033	6,296	2,189	313	2,502	8,798
	Flat Bed Truck	3.0 ton	23	2,725	2,748	563	42	605	3,353
	Portable Crusher/Screening	30-40 t/h	752	22,091	22,843	18,800	2,502	21,302	44,145
	Concrete Mixer	0.5 m3	648	2,484	3,132	5,400	435	5,835	8,967
	Water Pump	200 l/min	23	270	293	188	6	194	487
	Concrete Vibrator	3.3 HP	9	232	241	73	2	75	316
	Asphalt Sprayer	850 ltr.	123	789	912	1,019	145	1,164	2,076

4.2 Unit Construction Cost by Work Type

4.2.1 All Works Except Bridges

The unit construction costs by work type, excluding bridge construction costs, have been estimated using the combination of equipment described in Clause 3.4 and the unit prices already listed. The results are summarized in Table 4-2-1.

Table 4-2-1 UNIT COST BY WORK TYPE EXCEPT BRIDGE WORK

PROV : SULAWESI SELATAN KAB : BARRU

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	166	91	257
Subgrade Preparation	m2	21	11	32
Normal Fill	m3	1,716	865	2,581
Fill in Swamp	m3	2,558	1,055	3,613
Normal Excavation to Spoil	m3	1,005	524	1,529
Sub Base Course	m3	3,249	1,351	4,600
Base Course	m3	4,448	2,303	6,751
Shoulder	m2	301	146	447
Asphalt Patching	m2	3,831	1,414	5,245
Surface Dressing (Single)	m2	628	638	1,266
Surface Dressing (Double)	m2	781	1,004	1,785
Earth Drain	m	930	119	1,049
Earth Drain in Swamp (by machine)	m3	1,216	475	1,691
Pipe Culvert D80cm	m	44,889	40,307	85,196
Masonry Culvert (80x80cm)	m	62,363	34,731	97,094
Retaining Wall and Wing Wall (Timber)	m2	16,520	246	16,766
Retaining Wall and Wing Wall (Masonry)	m3	44,398	11,421	55,819
Gabion Protection	m3	12,229	121	12,350
Manual routine maintenance of road	Km	150,976	7,260	158,236
Routine maintenance of earth road	Km	95,540	37,948	133,488
Routine maintenance of gravel road	Km	193,432	88,186	281,618
Routine maintenance of asphalt road	Km	383,100	141,400	524,500

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 : BARRU

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	58,101	3,541	61,642
Superstructure (Timber;Span 5m;10T)	m2	64,356	3,910	68,266
Superstructure (Timber;Span 8m;10T)	m2	85,243	5,137	90,380
Superstructure (Timber;Span 3m;BM50)	m2	72,043	4,379	76,422
Superstructure (Timber;Span 5m;BM50)	m2	78,652	4,745	83,397
Superstructure (Timber;Span 8m;BM50)	m2	99,752	6,007	105,759
Superstructure (Concrete;Span 3m;BM50)	m2	61,498	81,925	143,423
Superstructure (Concrete;Span 5m;BM50)	m2	62,917	91,542	154,459
Superstructure (Concrete;Span 8m;BM50)	m2	64,626	99,704	164,330
Superstructure (Concrete;Span10m;BM50)	m2	70,529	113,234	183,763
Superstructure (Concrete;Span15m;BM50)	m2	75,645	133,369	209,014
Substructure (Pier;for Timber;10T)	NO	506,055	32,863	538,918
Substructure (Abut;for Timber;10T)	NO	1,349,398	154,495	1,503,893
Substructure (Pier;for Timber;BM50)	NO	744,249	48,632	792,881
Substructure (Abut;for Timber;BM50)	NO	1,528,934	171,666	1,700,600
Substructure (Pier;for Concrete;BM50)	NO	1,795,557	452,906	2,248,463
Substructure (Abut;for Concrete;BM50)	NO	3,754,600	959,362	4,713,962
Demolition of Bridge (Timber->Timber)	m2	15,925	1,374	17,299
Demolition of Bridge (Timber->Concrete)	m2	15,925	1,374	17,299
Demolition of Bridge (Concrete)	m2	91,055	64,824	155,879
Maintenance of Timber Bridge (New)	m2	10,306	1,121	11,427
Maintenance of Concrete Bridge (New)	m2	2,129	2,456	4,585
Maintenance of Timber Bridge (Exist)	m2	8,977	2,405	11,382
Maintenance of Concrete Bridge (Exist)	m2	4,249	2,336	6,585

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 Barru are shown in Table 5-1-1.

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

KABUPATEN : BARRU

CRITERIA NO	ROAD LINK NO
(1)	11,14,36,48,54,62,63
(4)	07

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 : BARRU

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
29	5 Km	IIIA	156.481	VOC
1	7 Km	IIIA	89.582	VOC
15	6 Km	IIIA	75.561	VOC
31	3 Km	IIIA	50.991	VOC
25	1 Km	IIIA	44.772	VOC
17	6 Km	IIIA	43.599	VOC
12	12 Km	IIIA	41.830	VOC
6	4 Km	IIIB-1	32.100	VOC
24	9 Km	IIIA	31.128	VOC
19	10 Km	IIIA	30.409	VOC
38	5 Km	IIIB-2	28.902	VOC
9	12 Km	IIIA	26.786	VOC
3	5 Km	IIIB-1	26.397	VOC
32	23 Km	IIIB-1	22.943	VOC
37	1 Km	IIIA	21.386	VOC
10	1 Km	IIIA	20.733	VOC
2	8 Km	IIIB-2	19.473	VOC
53	4 Km	IIIB-2	18.237	VOC
16	4 Km	IIIB-1	17.640	VOC
13	3 Km	IIIB-1	12.280	VOC
4	6 Km	IIIB-1	11.861	VOC
42	16 Km	IIIB-2	10.265	Surplus
43	4 Km	IIIB-2	9.783	VOC
26	3 Km	IIIB-2	9.322	VOC
5	7 Km	IIIB-1	7.924	VOC
28	3 Km	IIIB-2	6.459	VOC
20	2 Km	IIIB-1	5.883	VOC
8	6 Km	IIIB-2	2.515	VOC
21	36 Km	IIIB-2	2.497	Surplus
27	6 Km	IIIB-1	2.011	VOC
34	2 Km	IIIC	0.078	Surplus
35	1 Km	IIIC	0.078	Surplus
23	2 Km	IIIC	0.078	Surplus
30	4 Km	IIIC	0.078	Surplus
39	4 Km	IIIC	0.078	Surplus
40	3 Km	IIIC	0.078	Surplus
41	4 Km	IIIC	0.078	Surplus
18	3 Km	IIIC	0.078	Surplus
22	8 Km	IIIC	0.078	Surplus
44	6 Km	IIIC	0.078	Surplus
45	10 Km	IIIB-2	0.078	Surplus
46	3 Km	IIIC	0.078	Surplus
47	5 Km	IIIC	0.078	Surplus
49	4 Km	IIIC	0.078	Surplus
50	4 Km	IIIC	0.078	Surplus
51	6 Km	IIIB-2	0.078	Surplus
52	3 Km	IIIC	0.078	Surplus
33	2 Km	IIIC	0.078	Surplus
55	3 Km	IIIC	0.078	Surplus
56	3 Km	IIIC	0.078	Surplus

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

PROVINCE : SULAWESI SELATAN KABUPATEN : BARRU

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
57	5 Km	IIIC	0.078	Surplus
58	3 Km	IIIC	0.078	Surplus
59	3 Km	IIIC	0.078	Surplus
60	3 Km	IIIC	0.078	Surplus
61	14 Km	IIIB-2	0.078	Surplus
64	4 Km	IIIC	0.078	Surplus

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SULAWESI SELATAN KABUPATEN : BARRU

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
26	3 Km	IIIC	11.159	VOC
43	4 Km	IIIC	11.114	VOC
5	7 Km	IIIB-2	9.443	VOC
28	3 Km	IIIC	7.485	VOC
20	2 Km	IIIB-2	6.532	VOC
21	36 Km	IIIC	4.763	Surplus
27	6 Km	IIIB-2	4.312	VOC
8	6 Km	IIIC	3.857	VOC

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SULAWESI SELATAN KABUPATEN : BARRU

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
29	5 Km	IIIA	1211628	9.863	156.481	VOC
12	12 Km	IIIA	538239	2.649	41.830	VOC
15	6 Km	IIIA	412022	4.400	75.561	VOC
1	7 Km	IIIA	390827	4.817	89.582	VOC
24	9 Km	IIIA	357207	2.099	31.128	VOC
9	12 Km	IIIA	317728	1.825	26.786	VOC
32	23 Km	IIIB-1	317157	1.577	22.943	VOC
17	6 Km	IIIA	171768	2.494	43.599	VOC
19	10 Km	IIIA	155983	1.842	30.409	VOC
31	3 Km	IIIA	111104	2.975	50.991	VOC
3	5 Km	IIIB-1	96929	1.751	26.397	VOC
38	5 Km	IIIB-2	68925	1.883	28.902	VOC
6	4 Km	IIIB-1	58557	1.948	32.100	VOC
37	1 Km	IIIA	53841	1.613	21.386	VOC
2	8 Km	IIIB-2	35971	1.373	19.473	VOC
53	4 Km	IIIB-2	30289	1.365	18.237	VOC
16	4 Km	IIIB-1	29260	1.320	17.640	VOC
25	1 Km	IIIA	24863	2.569	44.772	VOC
4	6 Km	IIIB-1	14034	1.080	11.861	VOC
13	3 Km	IIIB-1	12356	1.101	12.280	VOC
10	1 Km	IIIA	7604	1.441	20.733	VOC
43	4 Km	IIIC	4212	1.047	11.114	VOC
42	16 Km	IIIB-2	2831	1.011	10.265	Surplus
26	3 Km	IIIC	2129	1.047	11.159	VOC
SUM	158 Km		4425464			

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: Barru

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	822	1,365	2,187
MAINTENANCE	82	313	395
SUPPLEMENTATION	456	-	456
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	19	-	19
SURVEY EQUIPMENT	5	-	5
TOTAL	1,412	1,678	3,090

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

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

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CIVIL WORK	515	1,667	2,182
CONSTRUCTION & MAINTENANCE EQUIPMENT	801	-	801
SPARE PARTS	44	11	55
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	52	-	52
TOTAL	1,412	1,678	3,090

The cost for civil work is composed of the cost of labour and materials, operation cost excluding spare parts, indirect cost and transportation cost of equipment, and ownership cost for existing equipment.

6.1.2 Proposed Road Links

(1) Road Link to be Improved

The road links to be improved were generally selected taking into consideration the following criteria:

(1) Feasible road links
- Feasible road links from the primary evaluation
- Feasible road links from the secondary evaluation

(2) Road links selected from the engineering points of view

(3) Road links selected because of basic human needs.

The road links finally proposed to be improved in the Kabupaten are the 12 links with the total length of 114 km which is 33% of the 343 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 : BARRU

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	1,3,9,12,15,17,19,24,29,31,32,42
- Secondary	-
Engineering Point of View	-
Basic Human Needs	-

There are so many feasible road links that road links to be improved are sebected from the road links which form the local road networks.

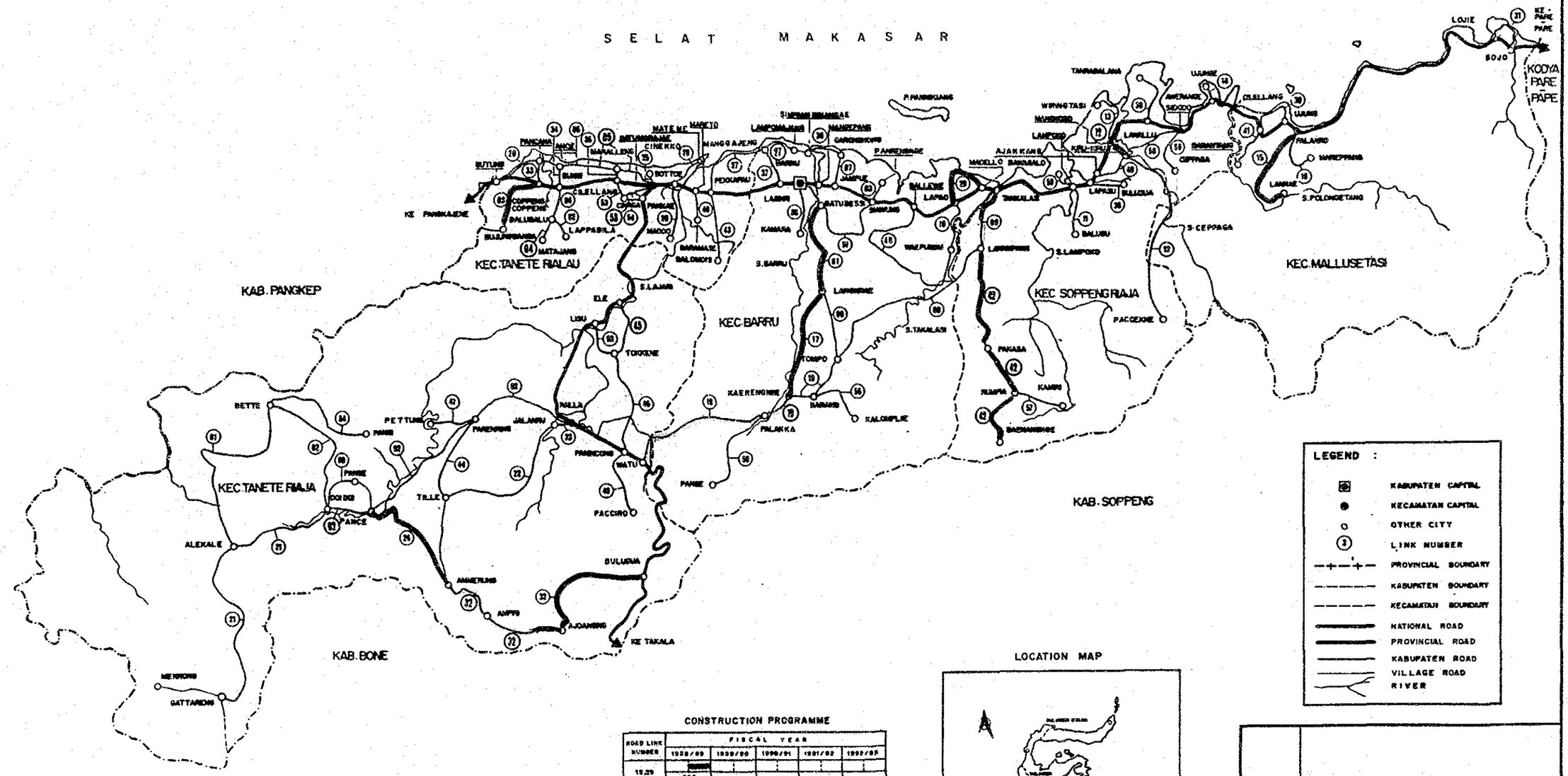
The order of proceeding with the improvement of the proposed road links are decided as shown in Table 6-1-4.

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

PROV : SULAWESI SELATAN KAB : BARRU

YEAR	LINK NO ( ) : rate
1988 :	15, 29
1989 :	1, 3, 12
1990 :	9 (40%), 17, 24
1991 :	9 (60%), 19, 31, 32 (40%)
1992 :	32 (60%), 42

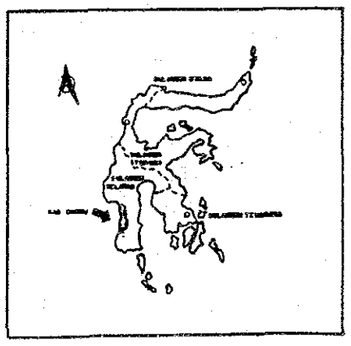
KAB. BARRU



CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR				
	1988/89	1989/90	1990/91	1991/92	1992/93
18,29	209				
01		452			
03,13					
09			901		
17,24					
05,19				940	
31,32					473
22,42					
TOTAL COST (10^6 Rp.)	209	452	901	940	473

LOCATION MAP



LEGEND :

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

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

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE: SULAWESI SELATAN
DIREKTORAT JENDERAL AGRARIA	AS SHOWN	KABUPATEN BARRU

(2) Road Links to Be Maintained

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

Table 6-1-5 ROAD LINKS TO BE MAINTAINED

PROV : SULAWESI SELATAN KAB : BARRU

(1000Rp)

LINK NO	LENGTH (Km)	BA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TN NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
3	5	12.0	54.0	22.6	11.4	0	0	5	1	15.75	1	22.00	324	1,467	315	1,782
4	6	25.0	44.2	20.0	10.8	0	2	4	0	0.00	2	63.70	419	1,946	521	2,467
5	7	4.7	50.1	45.1	0.0	0	3	4	1	7.50	3	35.75	321	2,239	569	2,808
6	4	7.5	75.0	17.5	0.0	0	3	1	0	0.00	0	0.00	0	1,280	332	1,612
7	2	90.0	10.0	0.0	0.0	2	0	0	0	0.00	2	47.00	309	1,268	407	1,675
8	6	38.3	42.3	19.3	0.0	0	1	5	1	20.00	1	16.00	333	1,825	407	2,232
9	12	19.3	58.6	19.2	2.9	0	12	0	7	128.00	5	69.50	1,915	5,577	1,616	7,193
10	1	80.0	20.0	0.0	0.0	0	1	0	0	0.00	0	0.00	0	344	95	439
11	2	25.0	57.5	17.5	0.0	0	2	0	0	0.00	0	0.00	0	689	191	880
12	12	14.2	52.5	30.0	3.3	2	6	4	0	0.00	1	16.00	105	4,189	1,088	5,277
13	3	26.7	35.0	21.7	16.7	0	1	2	1	8.00	0	0.00	91	909	205	1,114
14	1	2.0	53.0	45.0	0.0	0	0	1	0	0.00	0	0.00	0	247	45	292
15	6	15.0	55.8	27.5	1.7	1	1	1	0	0.00	3	44.00	290	2,914	838	3,752
17	6	24.2	29.2	31.7	15.0	0	6	0	1	14.00	9	154.40	1,176	2,848	967	3,815
18	3	55.7	44.3	0.0	0.0	0	3	0	0	0.00	2	56.00	369	1,271	417	1,688
19	10	49.5	27.0	22.5	1.0	0	10	0	0	0.00	8	300.00	1,976	4,719	1,655	6,374
23	2	0.0	67.5	32.5	0.0	0	1	1	0	0.00	0	0.00	0	591	141	732
26	3	50.0	43.3	6.7	0.0	0	1	2	0	0.00	0	0.00	0	837	186	1,023
27	6	18.3	49.2	31.3	1.2	2	0	4	0	0.00	2	22.80	150	2,151	531	2,682
28	3	25.0	33.3	31.7	10.0	0	2	1	1	6.80	1	20.00	209	1,091	299	1,390
29	5	0.0	55.0	38.0	7.0	0	0	5	0	0.00	0	0.00	0	1,233	226	1,459
30	4	20.0	62.5	17.5	0.0	0	2	2	0	0.00	0	0.00	0	1,182	281	1,463
31	3	40.0	13.3	46.7	0.0	0	2	1	1	15.00	0	0.00	171	1,070	272	1,342
32	23	0.0	58.0	34.8	7.2	0	0	23	0	0.00	0	0.00	0	5,670	1,040	6,710
33	2	90.0	5.0	5.0	0.0	0	2	0	0	0.00	0	0.00	0	689	191	880
34	2	37.5	45.0	5.0	12.5	0	2	0	0	0.00	0	0.00	0	689	191	880
36	1	60.0	40.0	0.0	0.0	0	1	0	0	0.00	0	0.00	0	344	95	439
40	3	43.3	43.3	13.3	0.0	0	3	0	0	0.00	0	0.00	0	1,033	286	1,319
41	4	55.0	30.0	15.0	0.0	0	0	4	0	0.00	0	0.00	0	986	181	1,167
46	3	0.0	53.3	40.0	6.7	0	1	2	0	0.00	0	0.00	0	837	186	1,023
47	5	0.0	55.0	38.0	7.0	0	0	5	0	0.00	0	0.00	0	1,233	226	1,459
50	4	0.0	55.0	37.5	7.5	0	0	4	0	0.00	0	0.00	0	986	181	1,167
51	6	0.0	57.5	35.8	6.7	0	1	5	1	12.00	1	16.00	242	1,753	388	2,141
55	3	3.3	61.7	35.0	0.0	0	0	3	0	0.00	0	0.00	0	740	136	876
58	3	46.7	30.0	23.3	0.0	0	2	1	0	0.00	0	0.00	0	935	236	1,171
61	14	0.0	56.4	36.1	7.5	0	1	13	5	106.85	0	0.00	1,216	4,508	940	5,448
SUM	185					10	72	103	20	333.90	41	883.15	9,616	62,280	15,881	78,161

6.1.3 Annual Construction and Maintenance Cost

The annual allocation of the total construction and maintenance cost in the five year programme for Kabupaten Barru is finally recommended as shown in Tables 6-1-6 (1), (2) and (3) for the construction, maintenance and total respectively.

The proposed construction cost is Rp 2,187 x 10^6 and maintenance cost is Rp 395 x 10^6 which is approximately 15% of the total expenditure.

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

PROV : SULAWESI SELATAN KAB : BARRU

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	129,845	260,681	299,106	329,949	337,095	1,364,676	(62.4%)
Ownership Cost	1,917	4,131	4,747	5,028	5,132	20,955	(1.5%)
Operation Cost	47,428	101,577	105,918	120,332	124,328	499,583	(36.6%)
Material Cost	36,575	63,952	73,250	85,017	73,100	331,894	(24.3%)
Labour Cost	26,989	63,976	76,177	76,535	90,566	334,243	(24.5%)
Contingency	16,936	35,045	39,014	43,037	43,969	178,001	(13.0%)
FOREIGN CURRENCY :	80,041	183,664	201,370	218,318	138,378	821,771	(37.6%)
Ownership Cost	26,301	55,918	62,084	68,247	68,182	280,732	(34.2%)
Operation Cost	3,435	7,362	7,688	8,799	9,420	36,704	(4.5%)
Material Cost	39,865	96,428	105,332	112,796	42,727	397,148	(48.3%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	10,440	23,956	26,266	28,476	18,049	107,187	(13.0%)
TOTAL COST :	209,887	452,346	500,475	548,267	475,473	2,186,448	
Ownership Cost	28,218	60,049	66,831	73,275	73,314	301,687	(13.8%)
Operation Cost	50,863	108,939	113,606	129,131	133,748	536,287	(24.5%)
Material Cost	76,440	160,380	178,582	197,813	115,827	729,042	(33.3%)
Labour Cost	26,989	63,976	76,177	76,535	90,566	334,243	(15.3%)
Contingency	27,377	59,002	65,279	71,513	62,018	285,189	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SULAWESI SELATAN KAB : BARRU

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	30,069	61,325	69,208	72,389	80,025	313,016	(79.3%)
Ownership Cost	325	695	856	931	1,098	3,905	(1.2%)
Operation Cost	14,478	29,142	31,527	31,899	34,366	141,412	(45.2%)
Material Cost	807	1,760	2,185	2,629	2,819	10,200	(3.3%)
Labour Cost	14,459	29,728	34,640	36,930	41,742	157,499	(50.3%)
FOREIGN CURRENCY :	7,665	15,849	18,090	18,946	21,391	81,941	(20.7%)
Ownership Cost	6,529	13,207	14,325	14,510	15,695	64,266	(78.4%)
Operation Cost	741	1,499	1,640	1,666	1,797	7,343	(9.0%)
Material Cost	395	1,143	2,125	2,770	3,899	10,332	(12.6%)
Labour Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :	37,734	77,174	87,298	91,335	101,416	394,957	
Ownership Cost	6,854	13,902	15,181	15,441	16,793	68,171	(17.3%)
Operation Cost	15,219	30,641	33,167	33,565	36,163	148,755	(37.7%)
Material Cost	1,202	2,903	4,310	5,399	6,718	20,532	(5.2%)
Labour Cost	14,459	29,728	34,640	36,930	41,742	157,499	(39.9%)

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

(TOTAL)

PROV : SULAWESI SELATAN KAB : BARRU

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	159,914	330,006	368,314	402,338	417,120	1,677,692	(65.0%)
Ownership Cost	2,242	4,826	5,603	5,959	6,230	24,860	(1.5%)
Operation Cost	61,906	130,719	137,445	152,231	158,694	640,995	(38.2%)
Material Cost	37,382	65,712	75,435	87,646	75,919	342,094	(20.4%)
Labour Cost	41,448	93,704	110,817	113,465	132,308	491,742	(29.3%)
Contingency	16,936	35,045	39,014	43,037	43,969	178,001	(10.6%)
FOREIGN CURRENCY :	87,706	199,513	219,460	237,264	159,769	903,712	(35.0%)
Ownership Cost	32,830	69,125	76,409	82,757	83,877	344,998	(38.2%)
Operation Cost	4,176	8,861	9,328	10,465	11,217	44,047	(4.9%)
Material Cost	40,260	97,571	107,457	115,566	46,626	407,480	(45.1%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	10,440	23,956	26,266	28,476	18,049	107,187	(11.9%)
TOTAL COST :	247,621	529,520	587,773	639,602	576,889	2,581,405	
Ownership Cost	35,072	73,951	82,012	88,716	90,107	369,858	(14.3%)
Operation Cost	66,082	139,580	146,773	162,696	169,911	685,042	(26.5%)
Material Cost	77,642	163,283	182,892	203,212	122,545	749,574	(29.0%)
Labour Cost	41,448	93,704	110,817	113,465	132,308	491,742	(19.0%)
Contingency	27,377	59,002	65,279	71,513	62,018	285,189	(11.0%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Barru are estimated from the annual proposed construction quantities as shown in Table 6-1-7.

The proposed numbers of equipment to be purchased are finally decided considering the following number of existing equipment in the Kabupaten which are available for the Project.

- 1-Dump Truck

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

a. Equipment for Road Maintenance

- 1-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 : BARRU

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer/Ripper	240	0	0.16	0.41	0.36	0.36	0.47
Swamp Bulldozer	240	0	0.04	0.01	0.02	0.01	0.00
Motor Grader	250	0	0.28	0.59	0.50	0.72	1.00
Hand-guide Vib. Roller	250	0	0.26	0.72	1.12	0.90	1.03
Tire Roller	240	0	0.31	0.73	0.65	0.84	0.32
Vibratory Roller (D&T)	250	0	0.25	0.46	0.40	0.55	0.81
Hydraulic Excavator; Wheel	240	0	0.18	0.09	0.22	0.15	0.00
Wheel Loader	250	0	0.47	1.02	0.99	1.20	1.37
Water Tank Truck	250	0	0.16	0.29	0.27	0.37	0.55
Dump Truck	250	1	3.69	8.54	8.18	9.57	11.62
Flat Bed Truck with Crane	250	0	0.28	0.48	1.33	0.85	0.63
Flat Bed Truck	250	0	0.57	1.02	1.13	1.27	0.69
Portable Crusher/Screening	250	0	0.10	0.24	0.25	0.33	0.22
Concrete Mixer	240	0	0.19	0.29	0.86	0.54	0.23
Water Pump	240	0	0.61	0.68	2.72	1.44	0.16
Concrete Vibrator	240	0	0.02	0.06	0.08	0.06	0.03
Asphalt Sprayer	240	0	0.31	0.73	0.65	0.84	0.32

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SULAWESI SELATAN KAB : BARRU

(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	1	47,800
Road Stabilizer	W=1850 mm	85,950	-	-
Hand-guide Vib. Roller	1000 Kg	8,500	2	17,000
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	-	-
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	10	147,000
Dump Loader Truck	12 ton	56,300	-	-
Flat Bed Truck with Crane	3.0 ton	25,190	2	50,380
Flat Bed Truck	3.0 ton	11,275	2	22,550
Portable Crusher/Screening	30-40 t/h	188,000	1	188,000
Concrete Mixer	0.5 m3	18,000	1	18,000
Water Pump	200 l/min	630	1	630
Concrete Vibrator	3.3 HP	740	1	740
Asphalt Sprayer	850 ltr.	10,200	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	800,920
OWNERSHIP COST (FOREIGN)	344,998
EQUIPMENT COST SUPPLEMENTED	455,922

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 : BARRU

I T E M	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	13500.00	42600.00	36000.00	32600.00	51400.00	176100.00
Subgrade Preparation	m2	45212.00	64500.00	33807.00	73316.00	192600.00	409435.00
Normal Fill	m3	0.00	1148.00	1230.00	750.00	0.00	3128.00
Fill in Swamp	m3	1544.40	270.00	633.82	398.28	0.00	2846.50
Normal Excavation to Spoil	m3	1778.00	2170.00	2378.00	1173.60	4311.40	11811.00
Sub Base Course	m3	3037.00	7457.50	6130.88	8873.92	16688.00	42987.30
Base Course	m3	2240.00	5720.00	6896.00	9040.00	7704.00	31400.00
Shoulder	m2	27000.00	62500.00	48600.00	68000.00	73400.00	279500.00
Asphalt Patching	m2	253.00	1952.00	0.00	0.00	0.00	2205.00
Surface Dressing (Single)	m2	16000.00	54000.00	0.00	36800.00	55200.00	162000.00
Surface Dressing (Double)	m2	28000.00	54000.00	83700.00	80800.00	0.00	246500.00
Earth Drain	m	4840.00	25480.00	18604.00	20344.00	36012.00	105280.00
Earth Drain in Swamp (by machine)	m3	3120.00	1200.00	2820.00	2160.00	0.00	9300.00
Pipe Culvert D80cm	m	6.00	168.00	168.00	90.00	234.00	666.00
Masonry Culvert (80x80cm)	m	18.00	90.00	8.40	9.60	0.00	126.00
Retaining Wall and Wing Wall (Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Masonry)	m3	1.50	70.70	102.56	292.64	466.80	934.20
Gabion Protection	m3	999.00	0.00	0.00	90.00	85.00	1174.00
Superstructure (Timber;Span 3m;10T)	m2	0.00	0.00	0.00	4.80	19.20	24.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	40.00	0.00	6.40	81.60	128.00
Superstructure (Timber;Span 8m;10T)	m2	0.00	0.00	0.00	107.20	280.80	388.00
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	13.50	32.85	12.15	0.00	58.50
Superstructure (Concrete;Span 5m;BM50)	m2	0.00	0.00	70.20	24.30	0.00	94.50
Superstructure (Concrete;Span 8m;BM50)	m2	54.00	0.00	21.60	32.40	0.00	108.00
Superstructure (Concrete;Span10m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span15m;BM50)	m2	0.00	67.50	96.30	70.20	0.00	234.00
Substructure (Pier;for Timber;10T)	NO	0.00	1.00	0.00	2.40	4.60	8.00
Substructure (Abut;for Timber;10T)	NO	0.00	2.00	0.00	4.00	24.00	30.00
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	0.40	0.60	0.00	1.00
Substructure (Abut;for Concrete;BM50)	NO	4.00	4.00	17.60	8.40	0.00	34.00
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	105.80	48.00	0.00	153.80
Demolition of Bridge (Concrete)	m2	0.00	0.00	6.40	9.60	0.00	16.00
Manual routine maintenance of road	Km	89.75	176.50	186.60	186.30	194.10	833.25
Routine maintenance of earth road	Km	50.00	92.50	88.00	82.90	80.10	393.50
Routine maintenance of gravel road	Km	35.75	68.00	59.60	49.40	35.00	247.75
Routine maintenance of asphalt road	Km	4.00	16.00	39.00	54.00	79.00	192.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	40.00	0.00	40.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	166.95	326.03	301.30	288.00	253.90	1336.18
Maintenance of Concrete Bridge (Exist)	m2	430.58	864.15	816.05	736.30	891.15	3738.23

6.2 Organization and Construction System

6.2.1 Organization

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

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

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

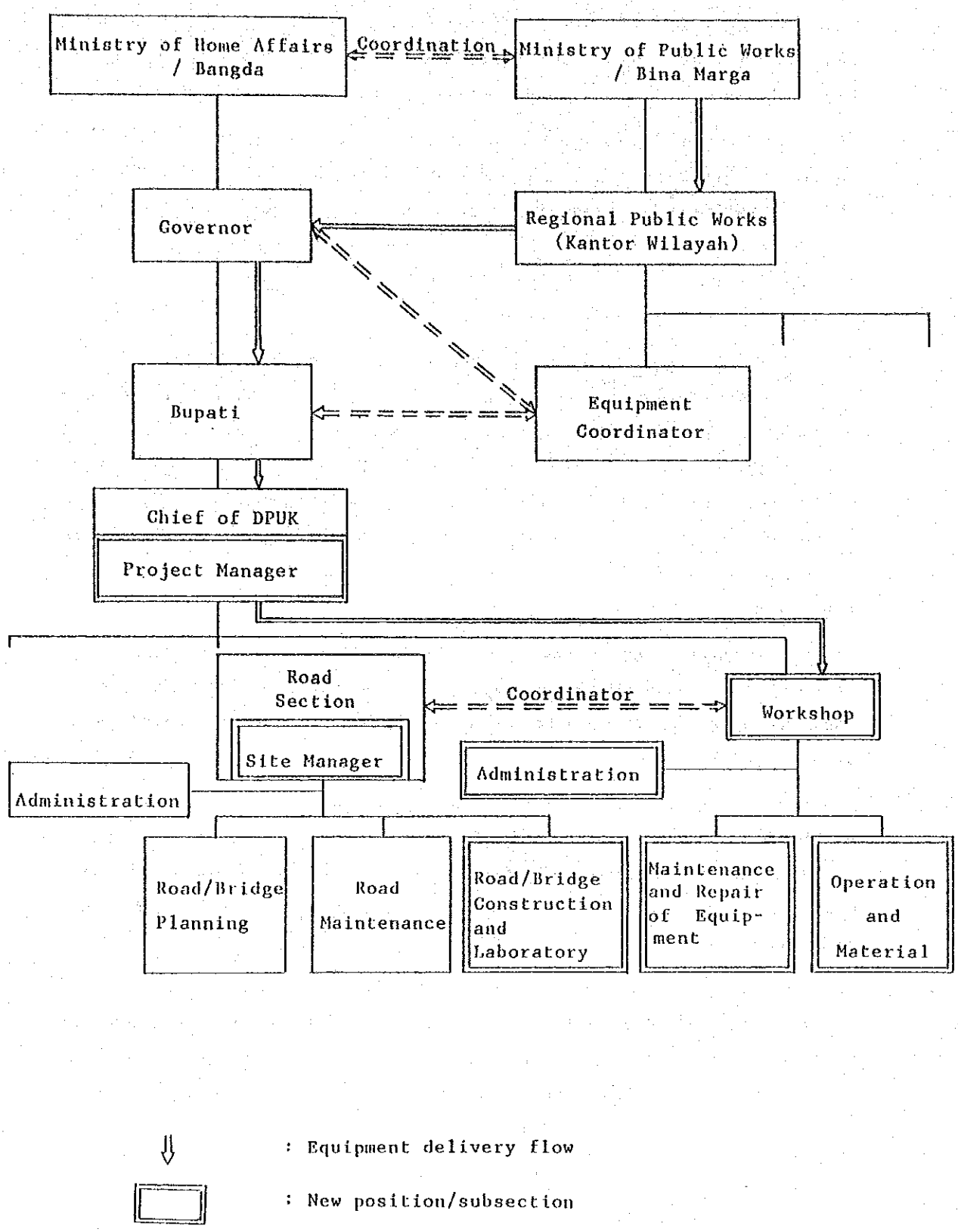
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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

6.2.2 Construction System

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

Fig. 6-2-1 PROPOSED ORGANIZATION



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

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

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

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

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

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

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

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