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 5

KABUPATEN MUSI BANYUASIN

MARCH 1986

JAPAN INTERNATIONAL COOPERATION AGENCY

REPUBLIC OF INDONESIA
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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 Musi Banyuasin in Sumatra 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.

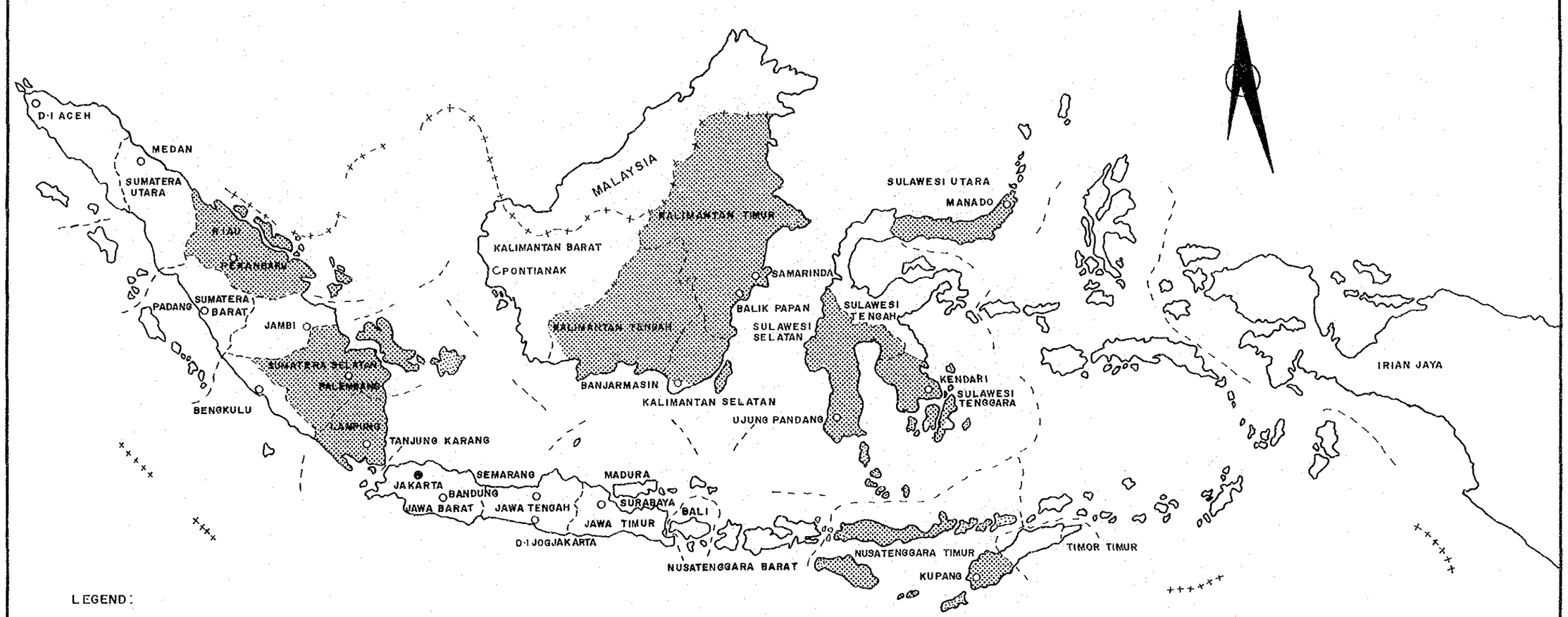
Since the study period was limited, without cooperation of Bina Marga, Bangda and local governments of both province and Kabupaten in collecting the data, the study would not have been completed within the period.

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



I · PROPINSI RIAU
- 01 · KAB · INDRAGIRI HULU
- 02 · KAB · INDRAGIRI HILIR
- 03 · KAB · BENGKALIS

II · PROPINSI SUMATERA SELATAN
- 04 · KAB · MUSI RAWAS
- 05 · KAB · MUSI BANYUASIN
- 06 · KAB · BANGKA
- 07 · KAB · BELITUG

III PROPINSI LAMPUNG
- 08 · KAB · LAMPUNG TENGAH

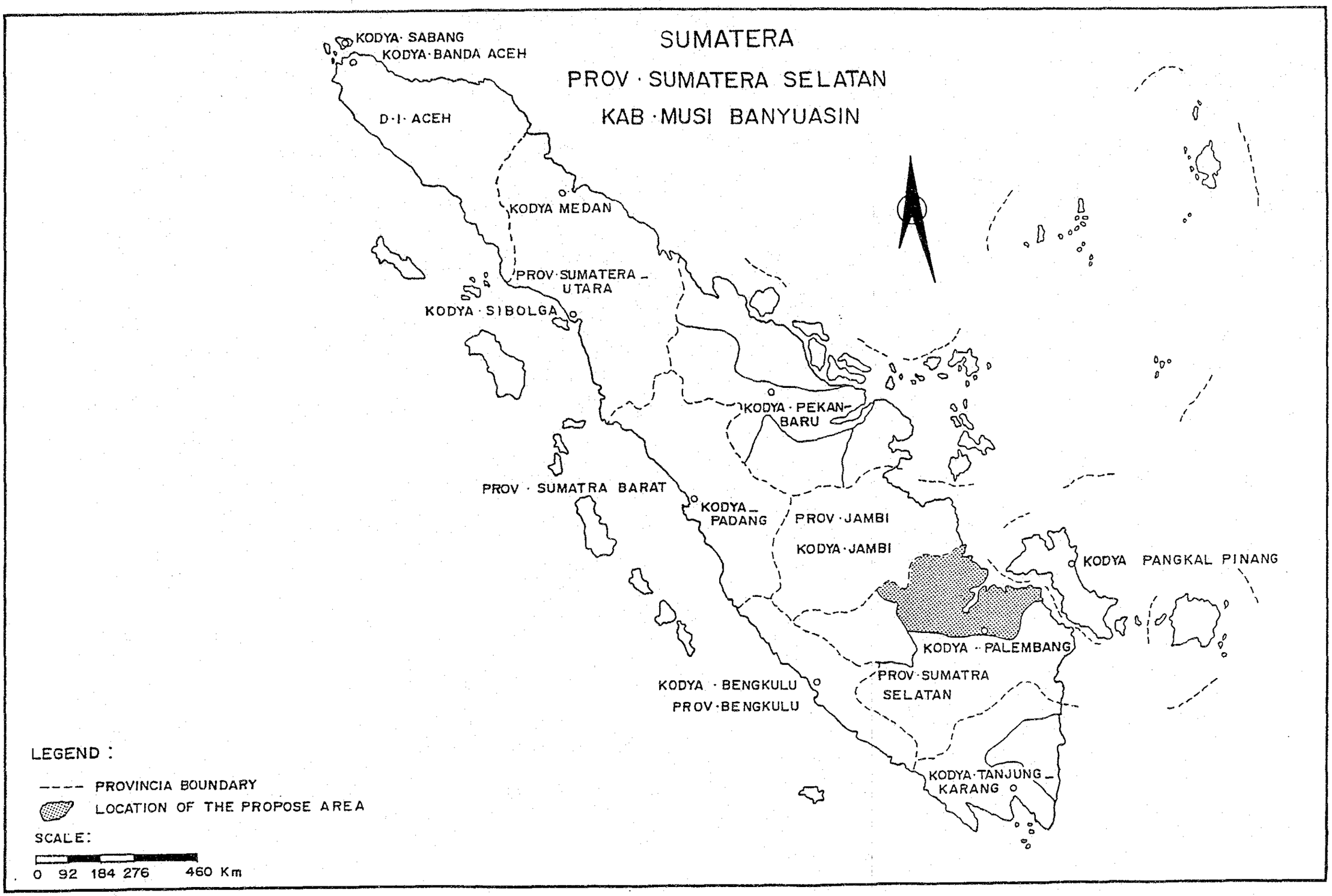
LEGEND :

---- PROVINCIAL BOUNDARY

LOCATION OF THE PROPOSED AREA

SCALE :

0 92 184 276 460 Km

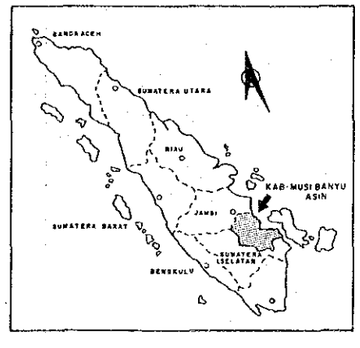

SUMATERA
PROV · SUMATERA SELATAN
KAB · MUSI BANYUASIN
KODYA · SABANG
KODYA · BANDA ACEH
D · I · ACEH
KODYA MEDAN
PROV · SUMATERA UTARA
KODYA · SIBOLGA
KODYA · PEKAN-BARU
PROV · SUMATRA BARAT
KODYA - PADANG
PROV · JAMBI
KODYA · JAMBI
KODYA PANGKAL PINANG
KODYA · PALEMBANG
PROV · SUMATRA SELATAN
KODYA · BENGKULU
PROV · BENGKULU
KODYA · TANJUNG - KARANG
LEGEND :
---- PROVINCIA BOUNDARY
LOCATION OF THE PROPOSE AREA
SCALE:
0 92 184 276 460 Km

KAB · MUSI BANYUASIN

KE · JAMBI
BAYUNG LENCIR
SIMPANG BAYAT
DESA BAYAT
KEC · BAYUNG LENCIR
KEC · SUNGAI LILIN
KEC · BANYU - ASIN III
KEC · TALANG KELAPA
KUALA PUNTIAN
KEC · BANYUASIN II
CINTA MANIS
KEC · BANYU - ASIN I
PRAJEN
SAKO TIGO
MARIANA
KEBON SAHANG
PANGKALAN BENTENG
TL BETUTU
SUKAJADI
MATAMERAH
SP GELEBAK DALAM
GELEBAK DALAM
TL-KELAPA
SIMP. TL-KELAPA
BALAI MAKMUR
SIMPANG ALANG - ALANG LEBAR
DS ALANG LEBAR
AIRBATU
TL-SUAK LUAR
SEI RENGIT
SIMPANG LIMAU
DESA LIMAU
RIMBA BALAI
SRI BANDUNG
PANGKALAN BALAI
BOM BERLIAN
SEDANG
SATRIO
DESA PULAU
TL-RAJAK
DESA TE. RENTANG
KM-31
SIMPANG PULAU
DESA LANGKAN
SIMPANG LANGKAN
SIMPANG PKL PANJI
PANGKALAN PANJI
SERONG
SUKA MAKMUR
SEMUNTUL
SUNGAI DUA
PALEMBANG
MENTEN
TANJUNG KERANG
SIMPANG RAMBUTAN
KE KAYU AGUNG
DAWAS
SUNGAI LILIN
SIMP GAJAH MATI
DESA GAJAH MATI
SIMP BUKIT
DESA BUKIT
SIMP SUKARAJA
SIMPANG BIUKU
DESA BIUKU
SIMPANG BERLIAN
SUKARAJA
REBAN GAJAH
DALAM DESA PANGKALA BALAI
DESA TANGGARO
SIMP TANGGARO
DESA LANGKAP
DS B BANYU ASIN
SP KM 108
SP LANGKAP
SP B BANYU ASIN
SIMP U TANJUNG
BETUNG
PETALING
LEBONG
DESA UJUNG TANJUNG
TEBING ABANG
TELUK SAUT
KELUANG
SP DALAM SUPAT
BABAT B ASIN
SUPAT
KEC · BABAT TOMAN
TANAH ABANG
BANDAR JAYA
DESA LAIS
DESA EPIL
SIMPANG TELUK KIJING
PINGGAP
DESA TELADAN
SIMPANG EPIL
SP MUARA TELADAN
SP DANAU CALA
DESA PETALING
SIMPANG PETALING
DS T KIJING
DALAM PERKEBUNAN NES I
SEI ANGIT
SIMPANG SARI
DS DANAU CALA
BABAT TOMAN
KASMARAN
SUKARAMI
PENUGUAN
PULAU SEKAYU
ULAK TEBERAU
KR RINGIN
SIMPANG KR RINGIN
PENGADANG
SIMP KM-11
KEC · KOTA SEKAYU
TL · PIASE
TELUKNGUNANG
SIMP · NGUNANG
TEBING BULANG
KERTA JAYA
JARAK KM - 11
KE · LUBUK LINGGAU
KE MUARA ENIM

SCALE:
0 5 10 15 Km

LOCATION MAP



LEGEND :

- KABUPATEN CAPITAL / KOTAMADYA
- 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 :

SOURCE:	SCALE:	PROVINCE : SUMATRA SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN: MUSI BANYUASIN

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 Musi Banyuasin is located in the northeast part of Sumatera Selatan Province. On the north it is bordered by Jambi Province, and on the east it fronts the Bangka Strait where Bangka Island lies off shore in the Natuna Sea. The south of the Kabupaten is bordered by Kabupatens Ogan Komering Ilir and Lematang Ilir Ogan Tengah.

Palembang City the capital of the Kabupaten is also the capital of the province and is governed as a Kotamadya.

The features of the Kabupaten present an entirely flat topography. The area extending from the northwest to the south is covered with rich granaries but the remaining coastal area from the northeast to the east is widely covered with swamps formed in the lower reaches of the Upan, the Banyuasin and the Musi Rivers.

The area of the Kabupaten is about 26,190 square kilometers, approximately 25 percent of the total of Sumatera Selatan Province and occupying the largest part of the province. It administers 8 Kecamatans.

1.1.2 Meteorological Conditions

The average number of rainy days and the average amount of yearly rainfall in Kabupaten Musi Banyuasin are 160 days and 2,625 mm respectively.

One year in the Kabupaten consists of a rainy season and a dry season. The dry season is from June through September 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 210 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 : Sumatera Selatan
KABUPATEN : Musi Banyuasin STATION : Sekayu

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	14	243	18	222	20	164	20	184	19	313
February	21	190	17	422	18	276	14	188	9	134
March	23	336	22	184	21	697	11	291	19	279
April	18	386	19	423	19	265	12	353	14	237
May	14	363	16	142	14	360	11	108	15	229
June	10	46	8	132	8	114	7	192	7	88
July	11	117	11	132	3	49	7	74	8	100
August	14	269	4	19	5	33	7	90	6	68
September	11	589	14	216	5	24	6	71	6	99
October	13	246	13	151	12	146	23	239	9	141
November	20	503	18	194	13	130	17	576	5	185
December	20	261	19	281	18	333	11	174	3	55
Total	189	3,549	189	2,518	156	2,592	146	2,540	120	1,928

1.2. Socio-Economic Conditions

1.2.1 Population

The population of Kabupaten Musi Banyuasin in 1984 was 860,597 which was approximately 16.4% of the 5,259,200 total population of Sumatera Selatan Province as shown in Table 1-2-1.

The population density was 0.33 persons per ha which was lower than the provincial density of 0.49.

The recent annual average growth rate of population of the Kabupaten is 4.5% which is higher than both the provincial rate of 3.3% 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:					
MUSI RAWAS	397,143	3.1	1,520,000	0.26	1982
MUSI BANYUASIN	860,597	4.5	2,619,125	0.33	1984
BANGKA	436,687	2.7	1,159,184	0.38	1984
BELITUNG	173,379	1.8	462,305	0.38	1984
PROVINCE:					
SUMATRA SELATAN	4,944,300		10,368,800		1982
	5,099,700	3.3	10,368,800	0.49	1983
	5,259,200		10,368,800		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 sand Indonesia;

   Statistical yearbook of Indonesia 1984, published by the Central Statistics Bureau.

2. AAGR : Average Annual Growth Rate.

Table 1-2-2 POPULATION BY KECAMATAN

Year : 1984

PROVINCE : SUMATERA SELATAN

KABUPATEN : MUSI BANYUASIN

KECAMATAN	POPULATION	PROPORTION (%)
KOTA SEKAYU	124,243	14.6
BABAT TOMAN	129,683	15.3
SUNGAI LILIN	73,930	8·7
BAYUNG LENCIR	30,442	3.7
BANYUASIN I	148,867	17.5
TALANG KELAPA	92,307	10.8
BANYUASIN II	126,818	14.8
BANYUASIN III	124,307	14.6
TOTAL	860,597	100

1.2.2 Land Use

In Kabupaten Musi Banyuasin, 519,879 ha of the current available land use area, which is approximately 19.8% of the 2,619,125 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 459,212 ha of agricultural harvest area and 60,667 ha of residential area which are 88.3% and 11.7% of the current available land use area respectively.

The agricultural harvest area consists of 209,941 ha of paddy field and 249,271 ha of plantation area which are 45.7% and 54.3% of the agricultural harvest area respectively. .

It can be realized from the land use that paddy cultivation and plantations are of similar proportions.

Table 1-2-3

LAND USE

PROVINCE : SUMATRA 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
MUSI RAWAS	32,554 (2.1)	-	6,639 (0.4)	112,803 (7.4)	21,000 (1.4)	-	10,264 (0.7)	1,203,055 (79.1)	134,685 (8.9)	1,520,000 (100)	1982
MUSI BANYUASIN	131,486 (5.0)	78,455 (3.0)	-	249,271 (9.5)	60,667 (2.3)	-	77,121 (2.9)	265,181 (10.1)	1,756,944 (67.1)	2,619,125 (100)	1983
BANGKA	68 (0.01)	7,938 (0.7)	467,252 (40.3)	77,553 (6.7)	5,631 (0.5)	6,870 (0.6)	16,611 (1.4)	347,741 (30.0)	229,520 (19.8)	1,59 ,184 (100)	1984
BELITUNG	488 (0.1)	1,889 (0.4)	-	20,142 (4.4)	5,336 (1.2)	-	-	404,352 (87.5)	30,098 (6.5)	462,305 (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 Musi Banyuasin in 1984 were 195,817 ha and 469,216 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 151,806 ha and 329,156 ton respectively which are 77.5% and 70.2% of the total food crops. The yield rate of paddy production is 2.17 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 1984 were 10.0% and 9.1% respectively which show a favorable development of paddy production. Approximately 87% of the paddy production is yielded in the wet paddy field. It is desirable that productivity of paddy becomes higher and this depends upon the future development of irrigation.

The commodity crops, of which rubber is major, are produced in the plantations. The area and production of plantation crops in 1983 were 140,989 ha and 40,076 ton respectively with current growth rates being 5.1% and 3.5% respectively. Thus the plantation crop which is an export product is important agriculturally. Some changes are expected considering the international balance of supply and demand.

The population of the agricultural sector which is assumed from the employment in the Kabupaten is 54.2% of the total population as shown in Table 1-2-6. Thus the Kabupaten is an agricultural Kabupaten.

As can be seen from the current trends, future agricultural development of the Kabupaten depends upon the result of developing various plantation crops as a food supply for the large market of Palembang, the capital of the Province, located in the neighbouring Kabupaten.

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

KABUPATEN : MUSI BANYUASIN

CULTIVATED AREA

(ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	93,244	100,283	99,996	89,157	136,261	151,806	10.1
OTHERS	8,837	6,186	7,881	9,408	15,111	44,011	37.9
TOTAL	102,081	106,469	107,877	98,565	151,372	195,817	13.9

PRODUCTION

(ton)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	212,611	226,304	245,640	188,218	279,489	329,156	9.1
OTHERS	63,040	45,631	46,675	66,215	80,360	140,060	17.3
TOTAL	275,651	271,935	292,315	254,433	359,849	469,216	11.2

YIELD RATE

(ton/ha)

ITEM	YEAR						AAGR
	1979	1980	1981	1982	1983	1984	(%)
PADDY	2.28	2.26	2.46	2.11	2.05	2.17	1.4

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 : SUMATRA SELATAN

KABUPATEN	AREA (ha)	PRODUCTION (ton)	AAGR (%) AREA	AAGR (%) PRODUCTION
MUSI RAWAS	112,803	35,421	1.2	14.4
MUSI BANYUASIN	140,989	40,076	5.1	3.5
BANGKA	77,636	28,227	3.4	5.7
BELITUNG	9,105	3,187	6.8	11.8

Table 1-2-6 POPULATION OF AGRICULTURAL SECTOR

PROVINCE : SUMATRA SELATAN

KABUPATEN	AGRICULTURAL SECTOR	TOTAL POPULATION	PROPORTION (%)	AAGR (%)	SURVEY YEAR
MUSI RAWAS	346,000	397,143	87.1	3.5	1982
MUSI BANYUASIN	466,000	860,597	54.2	4.6	1984
BANGKA	224,100	436,687	51.3	2.1	1984
BELITUNG	-	173,379	-	-	1984

Notes :

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

1.2.4 Other Economic Activities

Notable economic activities excluding agriculture in Kabupaten Musi Banyuasin are the forestry and fishery sectors.

The following figures show the current decline of forestry production.

	1980	1984	AAGR (%)
Production (m^3)	773,855	756,907	- 0.6

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

In this Kabupaten the forestry sector is a major industry. However this industrial activity does not influence the whole of the industrial activities in the Kabupaten because the returns from the forestry activity are invested outside the Kabupaten. Furthermore production shows stagnation recently because of government policy which prohibits exporting green wood.

The following shows the current growth of fishery production.

	1980	1984	AAGR (%)
Catch (ton)	13,112	14,062	1.8

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

Judging from the present conditions approximately 1,000 tons are exported out of the Kabupaten yearly and the catch is tending to increase.

1.3 Present Status of Kabupaten Roads

1.3.1 Outline of Road Networks

In Kabupaten Musi Banyuasin there is a provincial road which runs across the Kabupaten from east to west leading to the neighbouring Kabupaten Musi Rawas from Palembang, the capital of the province. Two Provincial roads separate from this provincial road at Belitung and Sekayu and these roads run towards the neighbouring Province Jambi and Kabupaten Lematan Ogan Tengah respectively.

These provincial roads are the regional trunk roads of the Kabupaten, however it is necessary to take appropriate and prompt measures for consolidation of the roads due to the unsatisfactory road conditions. Because of the poor road conditions the Musi river which runs across the Kabupaten, mostly beside the east-west provincial road, also has at present an important role in the trasportation system of the Kabupaten.

The Kabupaten roads form their own different networks depending upon the regional geographical conditions. For instance, the Kabupaten roads in the northeastern areas along the provincial road which leads to the neighbouring Province Jambi from Palembang via Betung can only extend their networks within the limits of five or ten km on average from the provincial road because the areas downstream of the Musi river are mostly covered by swamp. The Kabupaten roads in the northern region of Sukayu develop a road network connecting with the provincial roads within a center of rice production in 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 Musi Banyuasin are confirmed as 82 links and 578 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 0.22 m per ha. This is lower than the national density of 0.48 m per ha and distinctly lower than 2.11 m per ha which is the density in Jawa Island, excluding DKI Jakarta, as shown in the following table. Thus, the Kabupaten lags behind in density of Kabupaten roads.

	Total Length (km)	Area (ha)	Density (m/ha)
Kabupaten : Musi Banyuasin	578	2,619,125	0.22
Province : Sumatera Selatan	2,905	5,760,614	0.50
Jawa Is.(Excluding DKI Jakarta)	27,715	13,159,700	2.11
Indonesia	92,038	191,944,300	0.48

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

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

(2) Kabupaten Road Surface Type

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

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(Km)

NO (7)	TNH	KRK	ASP	TOTAL
LINK 1				
LINK 2	9			9
LINK 3	9			9
LINK 4	9			9
LINK 5		8		8
LINK 6	29			29
LINK 7	24			24
LINK 8				
LINK 9	6			6
LINK 10	18			18
LINK 11		12		12
LINK 12				
LINK 13		3		3
LINK 14		13		13
LINK 15			8	8
LINK 16	4			4
LINK 17				
LINK 18	5			5
LINK 19				
LINK 20	1	13		14
LINK 21	3			3
LINK 22				
LINK 23	5			5
LINK 24	12			12
LINK 25	11			11
LINK 26	9	10		19
LINK 27	1	2		3
LINK 28	10			10
LINK 29		6		6
LINK 30	2			2
LINK 31	2		1	3
LINK 32	9			9
LINK 33	7	2		9
LINK 34			3	3
LINK 35	13			13
LINK 36			8	8
LINK 37	5			5
LINK 38	2			2
LINK 39	5			5
LINK 40	6			6
LINK 41	4			4
LINK 42	2			2
LINK 43	3			3
LINK 44	3			3
LINK 45	3			3
LINK 46	7			7
LINK 47			11	11
LINK 48		14		14
LINK 49				
LINK 50	4			4
LINK 51	1		9	10
LINK 52	15			15
LINK 53	3			3
LINK 54	26		21	47
LINK 55	17			17
LINK 56	7			7
LINK 57	13			13
LINK 58				
LINK 59				
LINK 60				
LINK 61	3			3
LINK 62				
LINK 63				
LINK 64				
LINK 65	6	3		9
LINK 66	8			8
LINK 67	17			17
LINK 68		6		6
LINK 69	8			8
LINK 70				
LINK 71	3			3
LINK 72	17			17
LINK 73				
LINK 74				
LINK 75	5			5
LINK 76	3			3
LINK 77				
LINK 78				
LINK 79				
LINK 80		4		4
LINK 81	9			9
LINK 82	9		9	18
TOTAL	412	96	70	578
RATIO	71	17	12	(%)

The legend used in the table is as follows:

ASP : Asphalt

KRK : Gravel/Stone/Telford/Water Bound Macadam

TNH : Earth

LL : Others

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

	ASP	KRK	TNH/LL
Kabupaten : Musi Banyuasin	12.1	16.6	71.3
Province : Sumatera Selatan	13.7	10.7	75.6
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 : Musi Banyuasin	52.6	28.7	15.7	2.9
Province : Sumatera Selatan	43.3	31.7	17.3	7.7
Jawa Is.(Excluding DKI Jakarta)	45.6	29.8	19.6	5.0
Indonesia	43.5	21.8	21.1	13.6

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

PROVINCE : SUMATERA SELATAN

KABUPATEN : MUSI BANYUASIN

(%)

NO	KM					KAK				ASP			
NO		BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
1	LINK 1												
2	LINK 2	55	15	11	19								
3	LINK 3	87	13	0									
4	LINK 4	93	7										
5	LINK 5					3	38	55	4				
6	LINK 6	35	52	12	1								
7	LINK 7	17	50	27	6								
8	LINK 8												
9	LINK 9	62	15	23									
10	LINK 10	80	18	2									
11	LINK 11						2	63	35				
12	LINK 12												
13	LINK 13						45	52	3				
14	LINK 14					39	37	25					
15	LINK 15									87	13		
16	LINK 16	90	10										
17	LINK 17												
18	LINK 18	51	21	28									
19	LINK 19												
20	LINK 20	40	60			9	42	49					
21	LINK 21	3	52	33	12								
22	LINK 22												
23	LINK 23	44	42	14									
24	LINK 24	96	4										
25	LINK 25		50	42	8								
26	LINK 26	19	61	20			55	36	10				
27	LINK 27	80	20			88	13						
28	LINK 28	3	57	39									
29	LINK 29					93	7						
30	LINK 30	88	13										
31	LINK 31	75	25							80	10	10	
32	LINK 32	82	17	1									
33	LINK 33	84	16			93	6						
34	LINK 34									92	8		
35	LINK 35	35	29	25	11								
36	LINK 36									50	31	19	
37	LINK 37	77	21	2									
38	LINK 38	83	18										
39	LINK 39	91	9										
40	LINK 40	87	13										
41	LINK 41	36	49	15									
42	LINK 42		75	25									
43	LINK 43		13	77	10								
44	LINK 44		78	22									
45	LINK 45	78	22										
46	LINK 46	85	15										
47	LINK 47									16	55	28	6
48	LINK 48	5				61	15						
49	LINK 49												
50	LINK 50	1	78	23									
51	LINK 51	1	95	5							26	62	12

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

PROVINCE : SUMATERA SELATAN

KABUPATEN : MUSI BANYUASIN

(%)

NO	[illegible]				KRK				ASP			
NO	BA	SD	RU	RB	BA	SD	RU	RB	BA	SD	RU	RB
LINK 52	26	62	11	1								
LINK 53		10	70	20								
LINK 54	77	10	9						83	17		
LINK 55	84	16										
LINK 56	71	28	1									
LINK 57	82	15	3									
LINK 58												
LINK 59												
LINK 60												
LINK 61	78	22										
LINK 62												
LINK 63												
LINK 64												
LINK 65	5	77	17	1		73	23	3				
LINK 66	71	19	10									
LINK 67		7	63	36								
LINK 68					93	17						
LINK 69		14	75	11								
LINK 70												
LINK 71		80	20									
LINK 72	97	3										
LINK 73												
LINK 74												
LINK 75	85	15										
LINK 76	92	8										
LINK 77												
LINK 78												
LINK 79												
LINK 80					91	9						
LINK 81	84	15	1									
LINK 82	86	12	2						86	11	2	
AVERAGE	53	36	11	3	15	38	23	4	61	22	15	2
LENGTH	412 Km				96 Km				20 Km			
(Km)	218	171	50	12	43	37	22	4	13	15	31	1

The surface condition level of the Kabupaten roads in the Kabupaten surpasses both that of Indonesia and of Jawa Island. The proportion in good condition is comparatively high.
This situation seems to be explained by the diligent road maintenance carried out by the Kabupaten.

(4) Terrain Conditions of Kabupaten Roads

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

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

The proportions of terrain conditions in the Kabupaten are 64.0% flat and 36.0% hilly. As there are no mountainous or swampy areas in the Kabupaten road construction is anticipated to be not so difficult.

1.3.3 Bridge Inventory

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

The bridges 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 1-3-5 indicates a total of 172 bridges with a total length of 1257 m of which 150 or 87.2% are timber, 9 or 5.2% are concrete and 11 or 6.4% are others. Steel bridges account for only 2 or 1.2% of the total. One bridge with a length of 110 m is required to be newly constructed.

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(Km)

102 (3)	DI	BK	TOTAL
LINK 1			
LINK 2	9		9
LINK 3	9		9
LINK 4	9		9
LINK 5	7	1	8
LINK 6		29	29
LINK 7		24	24
LINK 8			
LINK 9	6		6
LINK 10	17	1	18
LINK 11		12	12
LINK 12			
LINK 13	3		3
LINK 14	13		13
LINK 15	8		8
LINK 16	4		4
LINK 17			
LINK 18	5		5
LINK 19			
LINK 20	14		14
LINK 21	3		3
LINK 22			
LINK 23	5		5
LINK 24	12		12
LINK 25	11		11
LINK 26		19	19
LINK 27	3		3
LINK 28		10	10
LINK 29	6		6
LINK 30	2		2
LINK 31	3		3
LINK 32	9		9
LINK 33	9		9
LINK 34	3		3
LINK 35	13		13
LINK 36	8		8
LINK 37	5		5
LINK 38	2		2
LINK 39	5		5
LINK 40	6		6
LINK 41	4		4

(Km)

102 (3)	DI	BK	TOTAL
LINK 42	2		2
LINK 43		3	3
LINK 44	3		3
LINK 45	3		3
LINK 46	7		7
LINK 47		11	11
LINK 48	14		14
LINK 49			
LINK 50	4		4
LINK 51	10		10
LINK 52		15	15
LINK 53	3		3
LINK 54		47	47
LINK 55	17		17
LINK 56	7		7
LINK 57	13		13
LINK 58			
LINK 59			
LINK 60			
LINK 61	3		3
LINK 62			
LINK 63			
LINK 64			
LINK 65		9	9
LINK 66	8		8
LINK 67		17	17
LINK 68	6		6
LINK 69		8	8
LINK 70			
LINK 71	3		3
LINK 72	17		17
LINK 73			
LINK 74			
LINK 75	5		5
LINK 76	3		3
LINK 77			
LINK 78			
LINK 79			
LINK 80	4		4
LINK 81	9		9
LINK 82	18		18
TOTAL	372	206	578
RATIO	64	36	(%)

Table 1-3-4 NUMBER AND LENGTH OF BRIDGES

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

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

	EXISTING		NOT EXIST		TOTAL	
LINK NO	NO.	LENGTH	NO.	LENGTH	NO.	LENGTH
2	5	96.50			5	96.50
3	4	20.00			4	20.00
4	6	32.00			6	32.00
5	3	28.00			3	28.00
6	8	67.00			8	67.00
7	2	13.00			2	13.00
10	2	7.00			2	7.00
11	2	8.00			2	8.00
14	8	31.00			8	31.00
15	2	11.00			2	11.00
18	4	21.00			4	21.00
20	4	32.00			4	32.00
23	3	20.00			3	20.00
25	7	28.00			7	28.00
26	3	33.00			3	33.00
28	4	31.00			4	31.00
32	6	33.00			6	33.00
33	4	23.00			4	23.00
34	1	35.00			1	35.00
35	12	78.00			12	78.00
36	3	43.00			3	43.00
37	2	13.00			2	13.00
38	1	3.00			1	3.00
40	1	5.00			1	5.00
41	3	15.00			3	15.00
42	1	8.00			1	8.00
44	1	4.00			1	4.00
45	4	60.00			4	60.00
47	1	3.00			1	3.00
52	7	69.00			7	69.00
53	2	11.00			2	11.00
54	3	23.00			3	23.00
55	11	56.00	1	110.00	12	166.00
57	3	15.00			3	15.00
61	2	25.00			2	25.00
65	2	12.00			2	12.00
66	1	10.00			1	10.00
67	7	32.00			7	32.00
69	9	98.00			9	98.00
71	2	8.00			2	8.00
72	2	15.00			2	15.00
75	3	13.00			3	13.00
80	1	5.00			1	5.00
82	10	63.50			10	63.50
TOTAL	172	1257.00	1	110.00	173	1367.00

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

	<<< BRIDGE >>>				(No)
103 (10)	KY	BT	LL	BJ	TOTAL
LINK 2	5		1		5
LINK 3	4		1	1	4
LINK 4	6		1	1	6
LINK 5	2	1	1	1	3
LINK 6	2	3	3	1	8
LINK 7	1	1	1	1	2
LINK 10	2	1	1	1	2
LINK 11	2	1	1	1	2
LINK 14	8	1	1	1	8
LINK 15	1	2	1	1	2
LINK 18	4	1	1	1	4
LINK 20	3	1	1	1	4
LINK 23	3	1	1	1	3
LINK 25	7	1	1	1	7
LINK 26	1	1	2	1	3
LINK 28	4	1	1	1	4
LINK 32	6	1	1	1	6
LINK 33	4	1	1	1	4
LINK 34	1	1	1	1	1
LINK 35	12	1	1	1	12
LINK 36	1	1	1	2	3
LINK 37	2	1	1	1	2
LINK 38	1	1	1	1	1
LINK 40	1	1	1	1	1
LINK 41	3	1	1	1	3
LINK 42	1	1	1	1	1
LINK 44	1	1	1	1	1
LINK 45	4	1	1	1	4
LINK 47	1	1	1	1	1
LINK 52	7	1	1	1	7
LINK 53	1	1	1	1	2
LINK 54	3	1	1	1	3
LINK 55	11	1	1	1	11
LINK 57	1	1	2	1	3
LINK 61	2	1	1	1	2
LINK 65	1	1	2	1	2
LINK 66	1	1	1	1	1
LINK 67	7	1	1	1	7
LINK 69	9	1	1	1	9
LINK 71	2	1	1	1	2
LINK 72	2	1	1	1	2
LINK 75	2	1	1	1	3
LINK 80	1	1	1	1	1
LINK 82	9	1	1	1	10
TOTAL	150	9	11	2	172
RATIO	87	5	6	1	(%)

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

Bridges Type	Span Length (m)										
	⟨3	⟨5	⟨8	⟨10	⟨12	⟨14	⟨16	⟨18	⟨20	⟨99	Total
Timber	42	104	4	-	-	-	-	-	-	-	150
Concrete	2	4	3	-	-	-	-	-	-	-	9
Steel	-	2	-	-	-	-	-	-	-	-	2
Others	1	3	5	-	-	-	1	1	-	-	11
Total	45	113	12	-	-	-	11	-	-	-	172

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 Musi Banyuasin were prepared by the Kabupaten and are shown in Chapter 2.

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Total Trips	908	54	957	3,411	3,637
Proportion (%)	17.04	1.01	17.95	64.00	100.00

Source : Bina Marga Inventory

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

	SEDAN	BUS	TRUCK	MOTOR-CYCLE	TOTAL
Proportion (%)	2.17	6.26	5.24	86.33	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 : SUMATERA SELATAN KAB : MUSI BANYUASIN

A)	Growth Rate of Population	:	4.50 (%)
B)	Growth Rate of Cultivated Area	:	8.50 (%)
C)	Growth Rate of Rice field	:	10.00 (%)
D)	Growth Rate of Rice yield rate	:	1.40 (%)
E)	Growth Rate of GDP / capita	:	6.70 (%)
a)	Geometrical Mean (A x B)	:	6.48 (%)
b)	Geometrical Mean (C x D)	:	5.61 (%)
c)	Geometrical Mean (a x b)	:	6.05 (%)
d)	Geometrical Mean (c x E)	:	6.37 (%)
	TRAFFIC GROWTH RATE	:	6.37 (%)

2.1.2 Present and Future Traffic Volume

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

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

Where :

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

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

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	HBL	BUS	TRUK	SPD	TOTAL		HBL	BUS	TRUK	SPD	TOTAL	
1	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
2	20	0	5	25	38	6.4%	45	0	11	56	85	IIIB-2
3	10	0	5	18	24	6.4%	22	0	11	40	54	IIIB-2
4	8	0	5	25	26	6.4%	18	0	11	56	58	IIIB-2
5	5	0	10	40	35	6.4%	11	0	22	89	78	IIIB-2
6	50	2	95	135	215	6.4%	112	4	212	301	480	IIIB-1
7	5	0	16	70	56	6.4%	11	0	36	156	125	IIIB-2
8	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
9	15	0	10	40	45	6.4%	33	0	22	89	100	IIIB-2
10	3	0	0	10	8	6.4%	7	0	0	22	18	IIIC
11	0	0	7	50	32	6.4%	0	0	16	112	71	IIIB-2
12	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
13	0	0	0	35	18	6.4%	0	0	0	78	40	IIIC
14	3	0	6	20	19	6.4%	7	0	13	45	42	IIIC
15	120	0	30	80	190	6.4%	268	0	67	179	424	IIIB-1
16	30	0	20	100	100	6.4%	67	0	45	223	223	IIIB-1
17	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
18	15	0	10	125	88	6.4%	33	0	22	279	196	IIIB-2
19	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
20	50	0	25	60	105	6.4%	112	0	56	134	234	IIIB-1
21	0	5	15	175	108	6.4%	0	11	33	391	241	IIIB-1
22	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
23	45	0	15	125	123	6.4%	100	0	33	279	275	IIIB-1
24	10	0	5	25	28	6.4%	22	0	11	56	62	IIIB-2
25	0	0	0	35	18	6.4%	0	0	0	78	40	IIIC
26	7	0	15	100	72	6.4%	16	0	33	223	161	IIIB-2
27	25	0	10	30	50	6.4%	56	0	22	67	112	IIIB-2
28	5	0	18	79	63	6.4%	11	0	40	176	141	IIIB-2
29	3	0	10	15	21	6.4%	7	0	22	33	47	IIIC
30	4	0	15	30	34	6.4%	9	0	33	67	76	IIIB-2
31	10	0	16	50	51	6.4%	22	0	36	112	114	IIIB-2
32	0	0	2	0	2	6.4%	0	0	4	0	4	IIIC
33	40	0	20	35	78	6.4%	89	0	45	78	174	IIIB-2
34	30	0	20	150	125	6.4%	67	0	45	335	279	IIIB-1
35	3	0	5	10	13	6.4%	7	0	11	22	29	IIIC
36	60	0	40	40	120	6.4%	134	0	89	89	268	IIIB-1
37	5	0	7	13	19	6.4%	11	0	16	29	42	IIIC
38	5	0	10	50	40	6.4%	11	0	22	112	89	IIIB-2
39	20	0	30	40	70	6.4%	45	0	67	89	156	IIIB-2
40	20	0	15	110	90	6.4%	45	0	33	245	201	IIIB-1
41	20	0	20	50	65	6.4%	45	0	45	112	145	IIIB-2
42	10	30	40	95	128	6.4%	22	67	89	212	286	IIIB-1
43	5	15	20	120	100	6.4%	11	33	45	268	223	IIIB-1
44	0	0	15	30	30	6.4%	0	0	33	67	67	IIIB-2
45	0	0	4	10	9	6.4%	0	0	9	22	20	IIIC
46	10	0	15	18	34	6.4%	22	0	33	40	76	IIIB-2
47	9	0	25	120	94	6.4%	20	0	56	268	210	IIIB-1
48	6	0	10	30	31	6.4%	13	0	22	67	69	IIIB-2
49	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
50	0	0	10	65	43	6.4%	0	0	22	145	96	IIIB-2

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(SPD : 1/2)

	INVENTORY (1985)					RATE	AFTER 13 YEARS (1998)					CLASS
LINK NO	HBL	BUS	TRUK	SPD	TOTAL		HBL	BUS	TRUK	SPD	TOTAL	
51	4	0	21	75	63	6.4%	9	0	47	167	141	IIIB-2
52	0	0	15	80	55	6.4%	0	0	33	179	123	IIIB-2
53	0	0	15	90	60	6.4%	0	0	33	201	134	IIIB-2
54	65	2	85	120	212	6.4%	145	4	190	268	473	IIIB-1
55	8	0	5	25	26	6.4%	18	0	11	56	58	IIIB-2
56	20	0	15	30	50	6.4%	45	0	33	67	112	IIIB-2
57	6	0	10	25	29	6.4%	13	0	22	56	65	IIIB-2
58	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
59	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
60	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
61	4	0	7	15	19	6.4%	9	0	16	33	42	IIIC
62	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
63	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
64	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
65	5	0	19	78	63	6.4%	11	0	42	174	141	IIIB-2
66	0	0	6	20	16	6.4%	0	0	13	45	36	IIIC
67	0	0	0	40	20	6.4%	0	0	0	89	45	IIIC
68	30	0	10	50	65	6.4%	67	0	22	112	145	IIIB-2
69	0	0	5	25	18	6.4%	0	0	11	56	40	IIIC
70	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
71	0	0	15	70	50	6.4%	0	0	33	156	112	IIIB-2
72	13	0	10	35	41	6.4%	29	0	22	78	92	IIIB-2
73	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
74	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
75	20	0	15	25	48	6.4%	45	0	33	56	107	IIIB-2
76	7	0	2	25	22	6.4%	16	0	4	56	49	IIIC
77	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
78	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
79	0	0	0	0	0	6.4%	0	0	0	0	0	IIIC
80	12	0	3	25	28	6.4%	27	0	7	56	62	IIIB-2
81	8	0	13	25	34	6.4%	18	0	29	56	76	IIIB-2
82	20	0	15	50	60	6.4%	45	0	33	112	134	IIIB-2
PERCENT	17.04	1.01	17.95	64.00			17.04	1.01	17.95	64.00		

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 : SUMATERA SELATAN KAB : MUSI BANYUASIN

(1998)

LINK NO	CLASS	SURFACE	MOBIL	BUS	TRUCK	SEPEDA	TOTAL
2	IIIB-2	KRK	18	1	18	68	71
3	IIIB-2	KRK	22	1	23	86	89
4	IIIB-2	KRK	18	1	18	68	71
5	IIIB-2	KRK	17	1	17	64	67
7	IIIB-1	ASP	64	4	65	245	256
9	IIIC	KRK	7	0	8	28	29
10	IIIA	ASP	275	16	281	1057	1101
11	IIIB-2	KRK	24	1	24	91	95
13	IIIC	KRK	5	0	5	19	20
14	IIIB-1	ASP	55	3	56	210	219
24	IIIB-2	KRK	29	2	30	113	118
25	IIIB-2	KRK	21	1	21	80	83
27	IIIC	KRK	1	0	1	4	4
29	IIIB-2	KRK	27	2	28	104	109
30	IIIC	KRK	9	1	9	34	36
31	IIIB-2	KRK	13	1	13	50	52
32	IIIB-2	KRK	39	2	40	151	157
35	IIIB-1	ASP	55	3	56	210	219
37	IIIC	KRK	2	0	2	6	7
38	IIIC	KRK	9	1	9	34	36
44	IIIC	KRK	5	0	5	18	19
45	IIIB-2	KRK	13	1	13	50	52
46	IIIC	KRK	2	0	2	9	9
48	IIIB-1	ASP	61	4	62	235	245
50	IIIC	KRK	7	0	7	27	28
52	IIIB-2	KRK	30	2	30	114	119
55	IIIA	ASP	456	26	466	1750	1823
56	IIIB-2	KRK	31	2	31	117	123
57	IIIB-1	ASP	57	3	58	218	227
61	IIIB-1	ASP	81	5	83	312	325
66	IIIB-2	KRK	35	2	36	134	140
67	IIIB-2	KRK	44	3	45	169	177
69	IIIB-2	KRK	16	1	16	61	64
71	IIIC	KRK	6	0	6	23	24
72	IIIC	KRK	6	0	6	22	23
75	IIIC	KRK	2	0	2	6	7
76	IIIC	KRK	6	0	6	22	23
80	IIIB-2	KRK	16	1	17	62	65
81	IIIA	ASP	141	8	144	540	563

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 : MUSI BANYUASIN

(1000Rupiah)

	LINK 2	LINK 3	LINK 4	LINK 5	LINK 6	LINK 7	LINK 9	LINK 10	LINK 11	LINK 13
	9 Km	9 Km	9 Km	8 Km	29 Km	24 Km	6 Km	18 Km	12 Km	3 Km
	IIIB-2	IIIB-2	IIIB-2	IIIB-2	IIIB-1	IIIB-1	IIIC	IIIA	IIIB-2	IIIC
YEAR	Surplus	Surplus	Surplus	Surplus	VOC	Surplus	Surplus	Surplus	Surplus	Surplus
1988	0	0	0	0	0	0	0	0	0	0
1989	8170	8011	6626	3646	231597	86504	2419	221456	12873	411
1990	8244	8628	6689	4020	245203	92541	2621	239088	13843	417
1991	9002	9245	7304	4056	261173	98624	2621	259869	14769	424
1992	9760	9894	7918	4430	277110	105800	2621	281373	15739	424
1993	10518	10543	8533	4803	295412	114179	2830	304582	16709	490
1994	11011	11191	8930	5177	313846	121474	2853	330881	17724	552
1995	11769	11840	9545	5397	334547	129127	2875	359545	19148	559
1996	12564	12823	10191	5789	355447	138775	3286	389173	20546	565
1997	13698	13754	11118	6181	377596	148661	3332	422712	22014	693
1998	14493	14738	11764	6744	402076	161744	3556	457294	23456	700
SUM	109229	110667	88618	50243	3094007	1197429	29014	3265973	176821	5235
COST	31307	32147	19283	500	1654400	566991	-4320	1786100	59951	-7746
/Km	3479	3572	2143	63	57048	23625	-720	99228	4996	-2582

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		

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

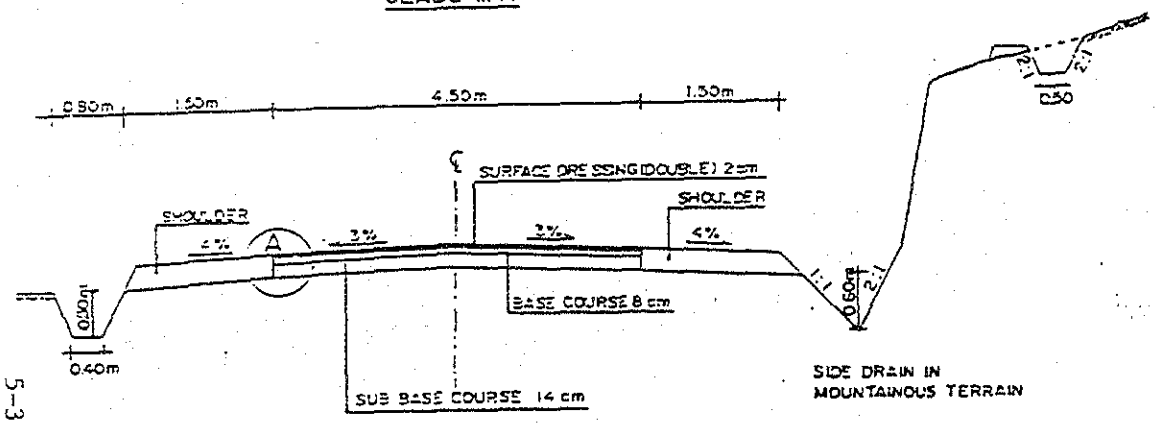
The CBR value of the existing roadbed is a very important factor for the pavement design but no results are available from CBR tests on the Kabupaten roads.

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.

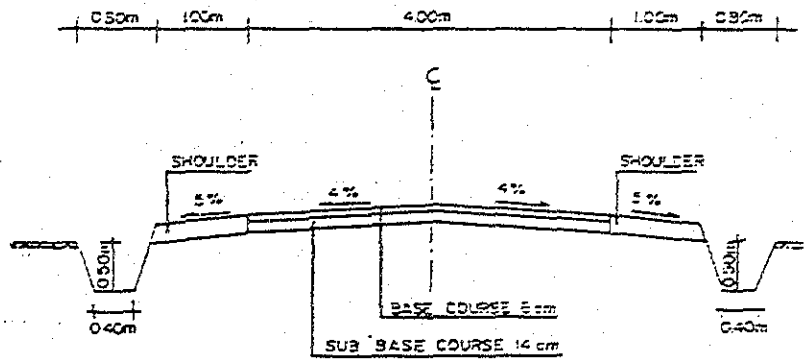
Fig. 3-1-1

STANDARD ROAD CROSS SECTIONS

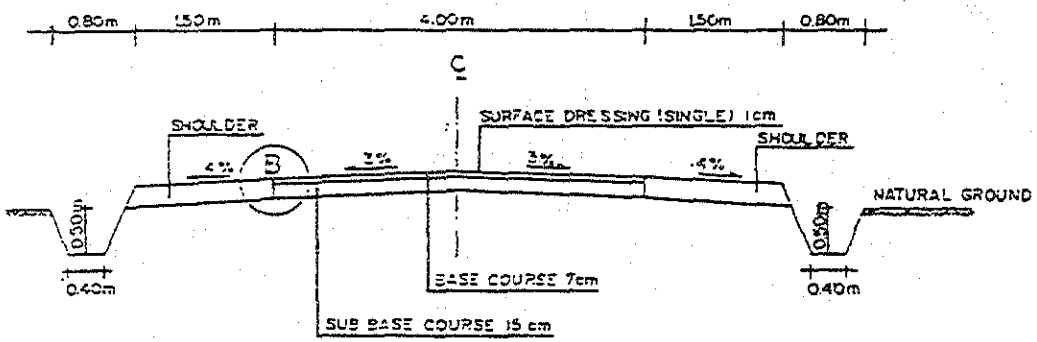
CLASS III A



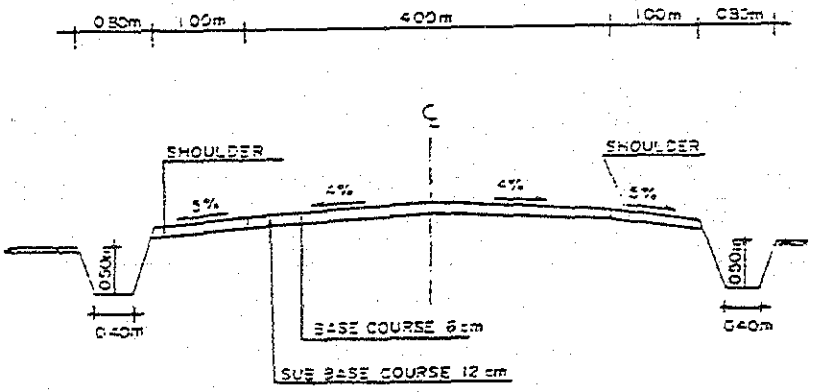
CLASS III B-2



CLASS III B-1



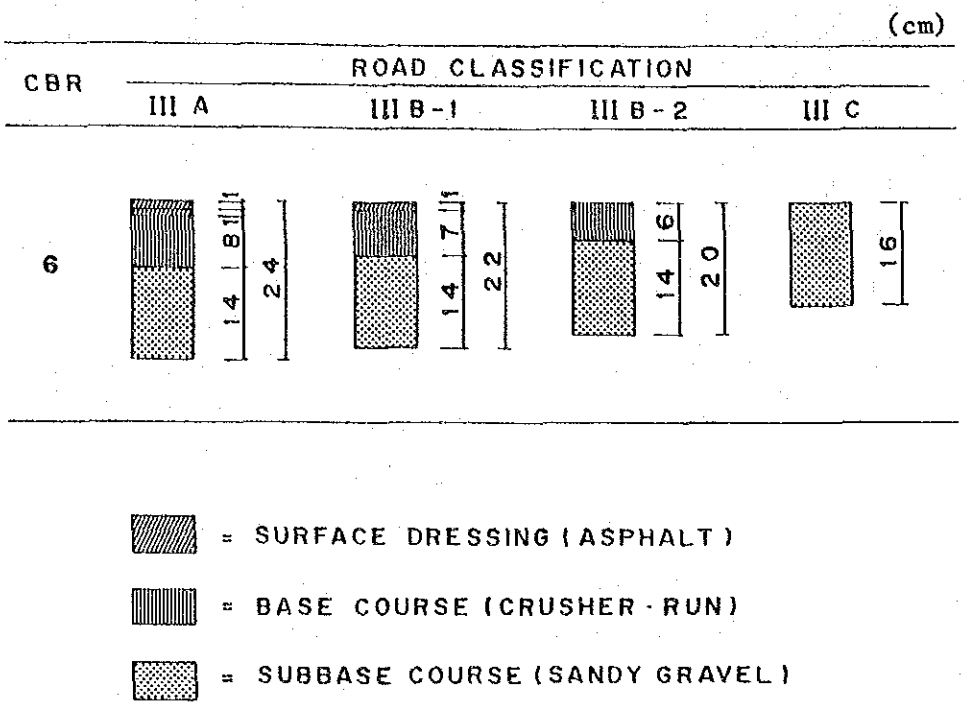
CLASS III C



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

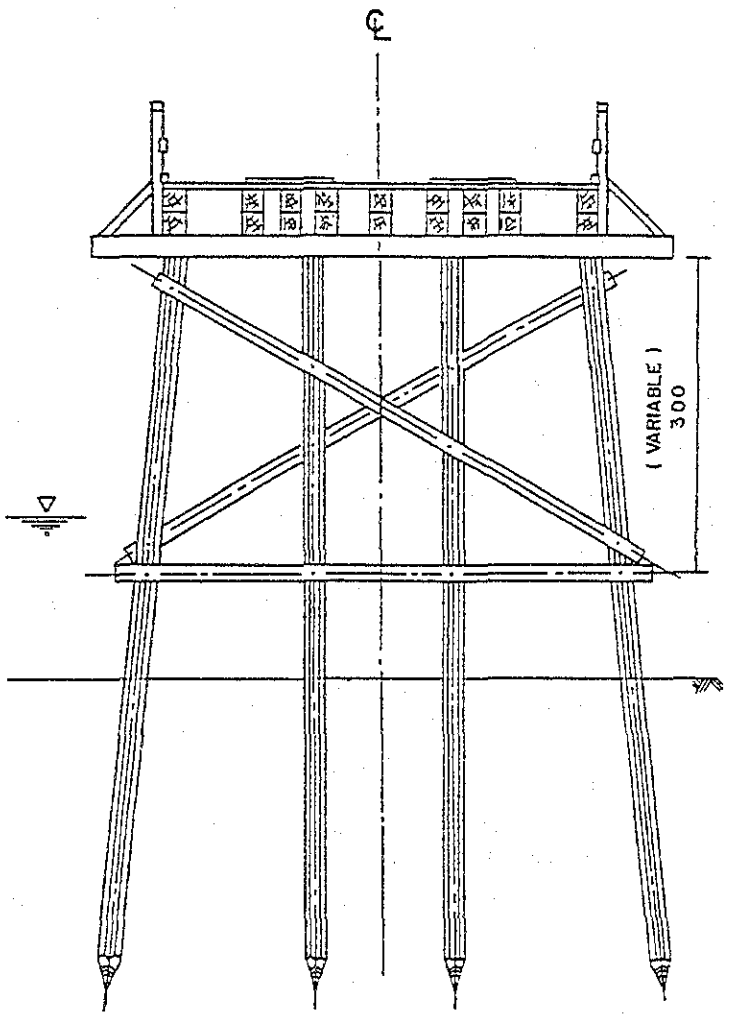
3) Foundation

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.

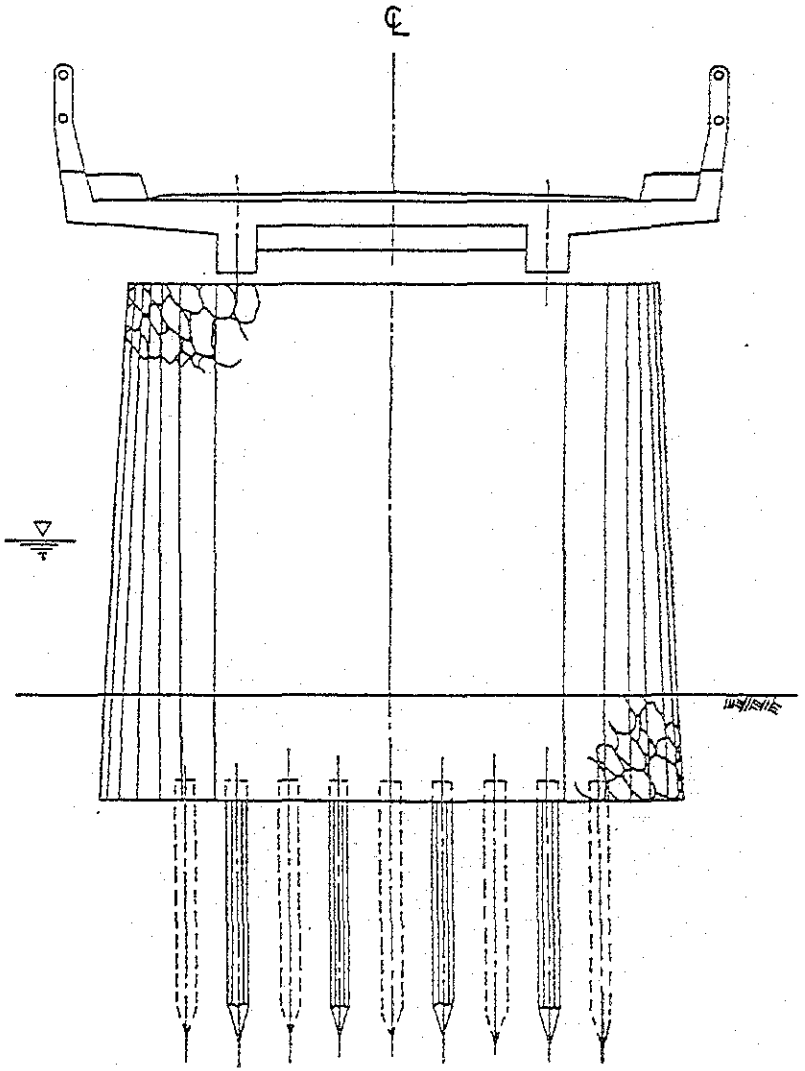
The pile length is suggested to be a minimum of 3 meters under the bottom of the foundation. The length and number of piles should be decided in order to be adequate for the condition of the foundation materials.

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

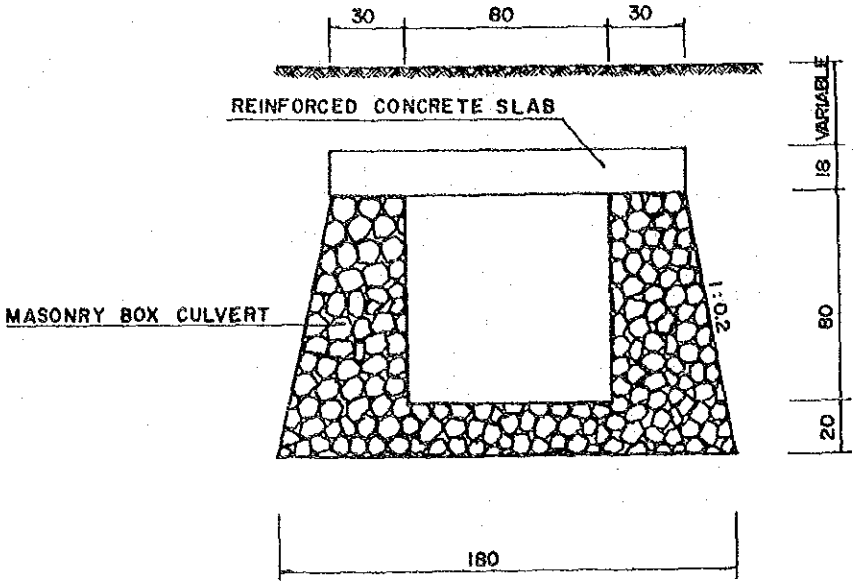
(2) Retaining Wall

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

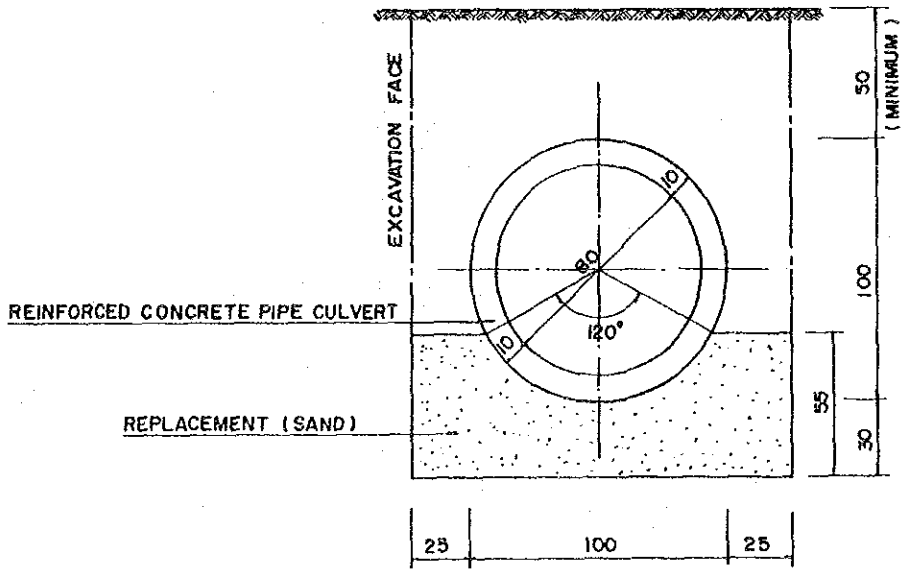
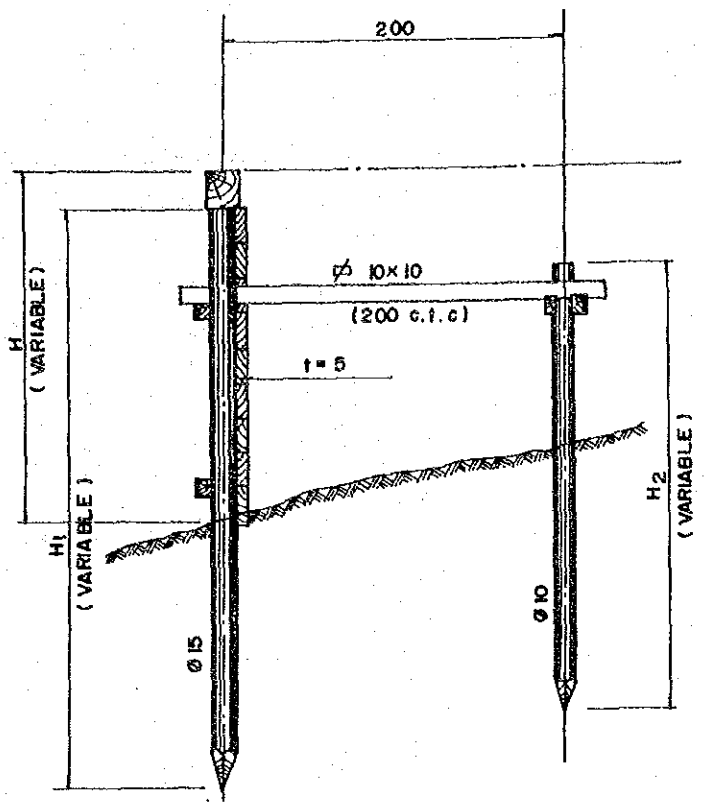
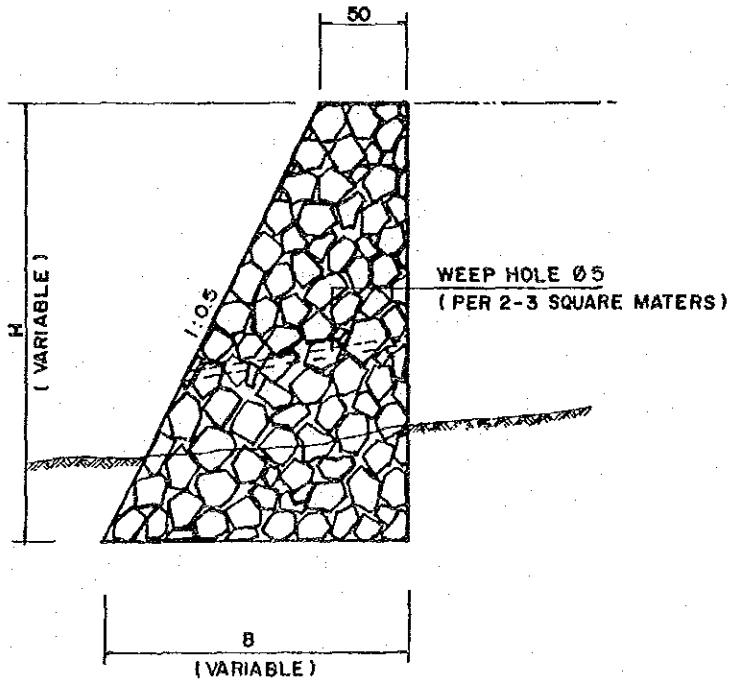


Fig. 3-3-3 STANDARD RETAINING WALLS

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 Musi Banyuasin and other Kabupatens in Sumatera 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
Musi Rawas	2,750	2,200	3,850	3,850	1,650	3,500	5,000
Musi Banyuasin	2,500	2,500	3,000	3,000	2,000	2,500	3,000
Bangka	3,000	2,750	3,500	3,500	2,250	3,000	3,500
Belitung	3,000	2,750	5,000	3,750	2,250	4,000	3,000
Average	2,813	2,250	3,838	3,525	2,025	3,250	3,625

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 Musi Banyuasin together with for other Kabupatens in Sumatera Selatan Province.

The unit price of river stone in the Kabupaten which has direct effects upon construction costs is significantly high.
Stone and sand are not produced in the Kabupaten. Therefore unit prices of these materials include the shipping cost from the producing Kabupaten.

Table 4-1-2 UNIT PRICE OF MATERIALS

(Rp)

MATERIAL	UNIT	MUSI RAWAS	MUSI BANYUASIN	BANGKA	BELITUNG	AVERAGE
Bitumen	L	380	365	300	280	330
Asphalt oil	L	800	300	850	850	700
Gasoline	L	250	250	250	250	250
Sand	M^3	7,000	6,000	5,500	4,000	5,625
Cement	bag	4,000	4,000	4,800	4,000	4,200
River Stone	M^3	8,000	25,000	7,500	6,000	11,625
Steel moulds	Set	7,000	7,000	7,000	7,000	7,000
Timber	M^3	90,000	120,000	155,000	150,000	128,750
Paint	L	3,500	2,500	3,500	3,000	3,125
Reinforcing Steel	Kg	800	1,000	800	900	875
Tying Wire	Kg	1,200	1,500	1,100	1,100	1,225
Equivalent Royalty	M^3	250	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 : SUMATERA SELATAN
KABUPATEN : MUSI BANYUASIN

(UNIT : Rp) (6'85)

CODE NO	EQUIPMENT NAME	CLASS	LOCAL COST OWNERSHIP	LOCAL COST OPERATION	LOCAL COST SUB-TOTAL	FOREIGN COST OWNERSHIP	FOREIGN COST OPERATION	FOREIGN COST SUB-TOTAL	TOTAL COST
	Bulldozer	120 HP	156	12,715	12,871	7,769	1,014	8,783	21,654
	Bulldozer/Ripper	120 HP	170	13,716	13,886	8,500	1,560	10,060	23,946
	Swamp Bulldozer	120 HP	178	13,955	14,133	8,879	1,630	10,509	24,642
	Bulldozer	90 HP	99	8,604	8,703	4,914	641	5,555	14,258
	Bulldozer/Ripper	90 HP	106	9,188	9,294	5,300	973	6,273	15,567
	Bulldozer	65 HP	70	6,252	6,322	3,500	456	3,956	10,278
	Bulldozer/Ripper	65 HP	77	6,696	6,773	3,819	701	4,520	11,293
	Swamp Bulldozer	90 HP	106	9,178	9,284	5,284	970	6,254	15,538
	Swamp Bulldozer	65 HP	81	6,596	6,677	4,050	743	4,793	11,470
	Motor Grader	110 HP	139	11,002	11,141	6,919	1,270	8,189	19,330
	Motor Grader	75 HP	96	7,540	7,636	4,779	877	5,656	13,292
	Motor Grader	65 HP	86	6,635	6,721	4,300	789	5,089	11,810
	Road Stabilizer	W=1850 mm	172	3,348	3,520	8,594	420	9,014	12,534
	Vibratory Roller	4 ton	58	3,299	3,357	2,900	378	3,278	6,635
	Hand-guide Vib. Roller	1000 Kg	34	585	619	850	28	878	1,497
	Tire Roller	8-15 ton	63	7,316	7,379	3,106	101	3,207	10,586
	Vibratory Roller (D&T)	4 ton	58	3,299	3,357	2,900	378	3,278	6,635
	Hand-guide Vib. Roller	600 Kg	24	399	423	600	19	619	1,042
	Rough Terrain Crane	10 ton	201	12,828	13,029	10,039	737	10,776	23,805
	Hydraulic Excavator; Wheel	0.3 m3	83	7,735	7,818	4,109	536	4,645	12,463
	Wheel Loader	1.2 m3	141	8,349	8,490	7,019	916	7,935	16,425
	Wheel Loader	0.3 m3	46	2,915	2,961	2,269	296	2,565	5,526
	Water Tank Truck	4000 ltr.	35	2,801	2,836	869	115	984	3,820
	Fuel Tank Truck	4000 ltr.	36	2,807	2,843	882	117	999	3,842
	Dump Truck	3.0 ton	59	3,493	3,552	1,469	195	1,664	5,216
	Flat Bed Truck with Crane	3.0 ton	35	3,055	3,090	1,716	126	1,842	4,932
	Dump Loader Truck	12 ton	77	18,798	18,875	3,838	125	3,963	22,838
	Dump Truck	5.0 ton	89	5,774	5,862	2,189	291	2,480	8,342
	Flat Bed Truck	3.0 ton	12	2,634	2,646	563	41	604	3,250
	Portable Crusher/Screening	30-40 t/h	376	21,464	21,840	18,800	2,454	21,254	43,094
	Concrete Mixer	0.5 m3	216	2,318	2,534	5,400	404	5,804	8,338
	Water Pump	200 l/min	8	258	266	188	6	194	460
	Concrete Vibrator	3.3 HP	3	224	227	73	2	75	302
	Asphalt Sprayer	850 ltr.	41	745	786	1,019	135	1,154	1,940

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 : SUMATERA SELATAN KAB : MUSI BANYUASIN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Site Clearance in Light Bush	m2	157	91	248
Subgrade Preparation	m2	20	11	31
Normal Fill	m3	1,610	860	2,470
Fill in Swamp	m3	6,575	266	6,841
Normal Excavation to Spoil	m3	943	521	1,464
Cement Stabilizing	m3	10,621	10,436	21,057
Cement Stabilizing	m3	10,621	10,436	21,057
Shoulder	m2	282	145	427
Asphalt Patching	m2	8,505	1,123	9,628
Surface Dressing (Single)	m2	962	665	1,627
Surface Dressing (Double)	m2	1,432	1,044	2,476
Earth Drain	m	896	118	1,014
Earth Drain in Swamp (by machine)	m3	1,152	473	1,625
Pipe Culvert D80cm	m	55,663	47,456	103,119
Masonry Culvert (80x80cm)	m	94,551	36,480	131,031
Retaining Wall and Wing Wall (Timber)	m2	12,601	245	12,846
Retaining Wall and Wing Wall (Masonry)	m3	68,781	10,055	78,836
Gabion Protection	m3	31,129	120	31,249
Manual routine maintenance of road	Km	146,752	7,248	154,000
Routine maintenance of earth road	Km	91,310	37,868	129,178
Routine maintenance of gravel road	Km	845,224	42,601	887,825
Routine maintenance of asphalt road	Km	850,500	112,300	962,800

4.2.2 Bridges

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

Table 4-2-2 BRIDGE COST

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(Rp)

ITEM	UNIT	LOCAL	FOREIGN	TOTAL
Superstructure (Timber;Span 3m;10T)	m2	46,000	3,540	49,540
Superstructure (Timber;Span 5m;10T)	m2	50,952	3,909	54,861
Superstructure (Timber;Span 8m;10T)	m2	67,487	5,135	72,622
Superstructure (Timber;Span 3m;BM50)	m2	57,038	4,377	61,415
Superstructure (Timber;Span 5m;BM50)	m2	62,269	4,743	67,012
Superstructure (Timber;Span 8m;BM50)	m2	78,973	6,005	84,978
Superstructure (Concrete;Span 3m;BM50)	m2	66,708	102,342	169,050
Superstructure (Concrete;Span 5m;BM50)	m2	69,448	114,569	184,017
Superstructure (Concrete;Span 8m;BM50)	m2	72,254	124,913	197,167
Superstructure (Concrete;Span10m;BM50)	m2	79,357	142,061	221,418
Superstructure (Concrete;Span15m;BM50)	m2	86,990	167,579	254,569
Substructure (Pier;for Timber;10T)	NO	400,726	32,851	433,577
Substructure (Abut;for Timber;10T)	NO	1,225,419	129,741	1,355,160
Substructure (Pier;for Timber;BM50)	NO	589,354	48,615	637,969
Substructure (Abut;for Timber;BM50)	NO	1,367,780	146,908	1,514,688
Substructure (Pier;for Concrete;BM50)	NO	2,651,987	456,252	3,108,239
Substructure (Abut;for Concrete;BM50)	NO	5,546,808	885,074	6,431,882
Demolition of Bridge (Timber->Timber)	m2	13,462	1,239	14,701
Demolition of Bridge (Timber->Concrete)	m2	13,462	1,239	14,701
Demolition of Bridge (Concrete)	m2	122,904	76,512	199,416
Maintenance of Timber Bridge (New)	m2	8,299	1,120	9,419
Maintenance of Concrete Bridge (New)	m2	2,787	2,792	5,579
Maintenance of Timber Bridge (Exist)	m2	7,739	2,402	10,141
Maintenance of Concrete Bridge (Exist)	m2	4,147	2,400	6,547

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 Musi Banyuasin are shown in Table 5-1-1.

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

KABUPATEN : MUSI BANYUASIN

CRITERIA NO	ROAD LINK NO
(8)	01,08,12,17,19,22,49,58,59,60,62,63,64,70, 73,74,77,78,79,82

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 : SUMATERA SELATAN KABUPATEN : MUSI BANYUASIN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
10	18 Km	IIIA	39.361	Surplus
55	17 Km	IIIA	35.472	Surplus
6	29 Km	IIIB-1	25.344	VOC
54	47 Km	IIIB-1	18.055	VOC
42	2 Km	IIIB-1	11.229	VOC
81	9 Km	IIIA	10.352	Surplus
61	3 Km	IIIB-1	7.511	Surplus
7	24 Km	IIIB-1	6.899	Surplus
43	3 Km	IIIB-1	5.459	VOC
67	17 Km	IIIB-2	5.193	Surplus
20	14 Km	IIIB-1	3.815	VOC
35	13 Km	IIIB-1	3.519	Surplus
16	4 Km	IIIB-1	1.914	VOC
23	5 Km	IIIB-1	1.869	VOC
57	13 Km	IIIB-1	1.754	Surplus
39	5 Km	IIIB-2	1.210	VOC
3	9 Km	IIIB-2	0.078	Surplus
24	12 Km	IIIB-2	0.078	Surplus
25	11 Km	IIIB-2	0.078	Surplus
26	19 Km	IIIB-2	0.078	VOC
27	3 Km	IIIC	0.078	Surplus
28	10 Km	IIIB-2	0.078	VOC
29	6 Km	IIIB-2	0.078	Surplus
30	2 Km	IIIC	0.078	Surplus
31	3 Km	IIIB-2	0.078	Surplus
32	9 Km	IIIB-2	0.078	Surplus
33	9 Km	IIIB-2	0.078	VOC
34	3 Km	IIIB-1	0.078	VOC
9	6 Km	IIIC	0.078	Surplus
36	8 Km	IIIB-1	0.078	VOC
37	5 Km	IIIC	0.078	Surplus
38	2 Km	IIIC	0.078	Surplus
4	9 Km	IIIB-2	0.078	Surplus
40	6 Km	IIIB-1	0.078	VOC
41	4 Km	IIIB-2	0.078	VOC
11	12 Km	IIIB-2	0.078	Surplus
13	3 Km	IIIC	0.078	Surplus
44	3 Km	IIIC	0.078	Surplus
45	3 Km	IIIB-2	0.078	Surplus
46	7 Km	IIIC	0.078	Surplus
47	11 Km	IIIB-1	0.078	VOC
48	14 Km	IIIB-1	0.078	Surplus
50	4 Km	IIIC	0.078	Surplus
51	10 Km	IIIB-2	0.078	VOC
52	15 Km	IIIB-2	0.078	Surplus
53	3 Km	IIIB-2	0.078	VOC
14	13 Km	IIIB-1	0.078	Surplus
15	8 Km	IIIB-1	0.078	VOC
56	7 Km	IIIB-2	0.078	Surplus
5	8 Km	IIIB-2	0.078	Surplus

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

PROVINCE : SUMATERA SELATAN KABUPATEN : MUSI BANYUASIN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
18	5 Km	IIIB-2	0.078	VOC
65	9 Km	IIIB-2	0.078	VOC
66	8 Km	IIIB-2	0.078	Surplus
2	9 Km	IIIB-2	0.078	Surplus
68	6 Km	IIIB-2	0.078	VOC
69	8 Km	IIIB-2	0.078	Surplus
71	3 Km	IIIC	0.078	Surplus
72	17 Km	IIIC	0.078	Surplus
75	5 Km	IIIC	0.078	Surplus
76	3 Km	IIIC	0.078	Surplus
80	4 Km	IIIB-2	0.078	Surplus
21	3 Km	IIIB-1	0.078	VOC

Table 5-2-2 RESULTS OF SECONDARY ANALYSIS

PROVINCE : SUMATERA SELATAN KABUPATEN : MUSI BANYUASIN

LINK NO	LENGTH	CLASS	NPV (1000Rp)	B/C	IRR (%)	REMARK
55	17 Km	IIIA	1824376	2.509	35.472	Surplus
10	18 Km	IIIA	1222277	2.655	39.361	Surplus
6	29 Km	IIIB-1	818231	1.744	25.344	VOC
54	47 Km	IIIB-1	440999	1.342	18.055	VOC
81	9 Km	IIIA	9046	1.017	10.352	Surplus
42	2 Km	IIIB-1	3990	1.053	11.229	VOC
SUM	122 Km		4318919			

Table 5-2-3 RANKING OF FEASIBILITY ROAD LINKS

PROVINCE : SUMATERA SELATAN KABUPATEN : MUSI BANYUASIN

LINK NO	LENGTH	CLASS	IRR(%)	REMARK
67	17 Km	IIIC	7.993	Surplus
7	24 Km	IIIB-2	7.933	Surplus
61	3 Km	IIIB-2	7.892	Surplus
43	3 Km	IIIB-2	7.171	VOC
35	13 Km	IIIB-2	4.132	Surplus
39	5 Km	IIIC	3.884	VOC
20	14 Km	IIIB-2	3.097	VOC
57	13 Km	IIIB-2	1.511	Surplus
16	4 Km	IIIB-2	1.479	VOC
23	5 Km	IIIB-2	0.701	VOC

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: Musi Banyuasin

(Rpx10^6)

COST	FOREIGN CURRENCY	LOCAL CURRENCY	TOTAL
CONSTRUCTION	1,595	2,073	3,668
MAINTENANCE	137	1,055	1,192
SUPPLEMENTATION	397	-	397
WORKSHOP EQUIPMENT & TOOLS	28	-	28
LABORATORY EQUIPMENT	12	-	12
SURVEY EQUIPMENT	5	-	5
TOTAL	2,174	3,128	5,302

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	1,292	3,115	4,407
CONSTRUCTION & MAINTENANCE EQUIPMENT	785	-	785
SPARE PARTS	52	13	65
WORKSHOP/LABORATORY/SURVEY EQUIPMENT	45	-	45
TOTAL	2,174	3,128	5,302

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 final proposal for road links to be improved in the Kabupaten development plan are the 9 links with the total length of 159 km which is 28% of the 578 km total length of Kabupaten roads studied. Since Road Links No 10 and No 81 do not form road networks without improvement of Desa roads, these road links are not selected. Road link No 42 is a short road and does not form a road network, therefore this road link is not selected. The proposed road links are shown in Table 6-1-3.

Table 6-1-3 ROAD LINKS TO BE IMPROVED

KABUPATEN : MUSI BANYUASIN

REASON FOR SELECTION	ROAD LINK NO
Feasible	
- Primary	6,54,55
- Secondary	-
Engineering Point of View	2,4,24,47,51,52
Basic Human Needs	-

As the table shows three feasible road links out of six are proposed to be improved.

Since Road Links No 2, No 4, No 24, No 47, No 51 and No 52 are key road links which are located at the strategic point to complete the local road network near Sekayu, the Kabupaten capital, these road links are selected from the engineering points of view.

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

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

YEAR		LINK NO ( ) : rate
1988	:	2, 55 (30%)
1989	:	4, 54 (20%), 55 (70%)
1990	:	6 (20%), 24, 51, 54 (30%)
1991	:	6 (25%), 52 (50%), 54 (50%)
1992	:	6 (55%), 47, 52 (50%)

KAB · MUSI BANYUASIN

KE JAMBI
BAYUNG LENCIN
SIMPANG BAYAT
DESA BAYAT
KEC · BAYUNG LENCIR
KEC · SUNGAILILIN
KEC · BANYU - ASIN III
KEC · TALANG KELAPA
KUALA PUNTIAN
KEC · BANYUASIN II
CINTA MANIS
KEC · BANYU - ASIN I
PRAJEN
BAKO TIBO
MARIANA
KERON SAHANG
MATAMERAH
SP GELEBAK DALAM
GELEBAK DALAM
MENTEN
TANJUNG KERANG
SIMPANG BANGUNAN
KE KAYU AGUNG
SUNGAI DUA
PALEMBANG
PANGKALAN BENTENG
TL SETUTU
SUKAJADI
TL KELAPA
SIMP. TL KELAPA
BALAI MAKMUR
SIMPANG ALANG-ALANG LEBAR
DS ALANG LEBAR
AIR BATU
TL SUAK LUAR
SEI REMBIT
SIMPANG LIMAU
DESA LIMAU
RIMBA BALAI
SRI BANDUNG
PANGKALAN BALAI
DESA PULAU TL RAJAK
DESA TL RENTANG
SEDAMS
SATRIO
SEMBUTUL
DESA LANGKAP
SIMPANG PULAU
SIMPANG LANGKAP
PANGKALAN PINAU
REBAN BAJAH
DALAM DESA PANGKALA BALAI
SUKARAJA
SIMPANG TANJUNG
DESA AJUNG TANJUNG
KEBON
PETALING
TEBING ABANG
DALAM PERKEBUNAN KESI
DESA BUKIT
SIMP SUKARAJA
SIMPANG PERJUAN
SIMPANG BUKIT
DESA BUKU
SIMPANG BUKU
SUNGAI LILIN
DESA GAJAH MATI
SIMP GAJAH MATI
DESA TAMBARO
SIMP TAMBARO
DAMAS
TELUK SAUT
KELUANG
SP KM 105
SP DALAM SUKAT
SP LANGKAP
SP B BANYU ASIN
DS B BANYU ASIN
BABAT B ASIN
SUKAT
KEC · BABAT TOMAN
DESA LAIT
DESA EPIL
SIMPANG TELUK KIJING
SIMPANG EPIL
DESA PETALING
SIMPANG PETALING
DAT KIMIS
DESA TELADAN
SP SUARA TELADAN
SP DANAU CALA
DS DANAU CALA
SUNGAI BANYU ASIN
PINGGAP
SEI ANGIT
SIMPANG SAIK
BASAR TOMAN
KASMARAN
SUKARAJA
PENGUSUAN
PULAU TEBERAU
KR RINGIN
SIMPANG KR RINGIN
PULAU SEKAYU
SIMP KM-11
KEC · KOTA SEKAYU
TL · PIASE
PENGADANG
TELUK NGUNANG
SIMP · NGUNANG
TEBING SULANG
KERTA JAYA
JARAK KM-11
KE LUBUK LINGGAU
KE MUARA ENIM

SCALE:
0 5 10 15 Km

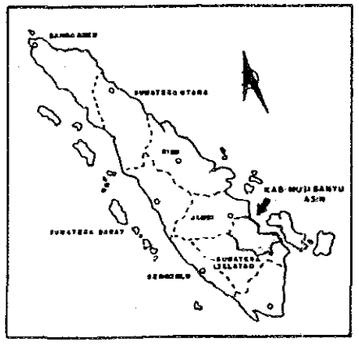
CONSTRUCTION PROGRAMME

ROAD LINK NUMBER	FISCAL YEAR 1990/91	1991/92	1992/93	1993/94	1994/95
02,88	229				
04,86,98		732			
08,24			640		
31,84				933	
00,52,84					834
08,67,98					
TOTAL COST (10^6 Rp.)	229	732	640	933	834

LEGEND :

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

LOCATION MAP



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

TITLE : CONSTRUCTION PROGRAMME

SOURCE:	SCALE:	PROVINCE: SUMATRA SELATAN
DIREKTORAT JENDERAL CIPTA KARYA	AS SHOWN	KABUPATEN: MUSI BANYUASIN

(2) Road Links to Be Maintained

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

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(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
2	9	55.1	15.4	11.1	18.3	0	0	9	5	374.25	0	0.00	3,795	5,039	1,305	6,344
3	9	88.7	10.6	0.8	0.0	0	0	9	4	80.00	0	0.00	811	2,762	598	3,360
4	9	93.4	6.6	0.0	0.0	0	0	9	6	128.00	0	0.00	1,298	3,133	714	3,847
6	29	34.8	52.2	12.2	0.7	0	0	29	0	0.00	8	310.00	2,030	8,189	2,052	10,241
7	24	16.7	50.4	26.9	6.0	0	0	24	2	52.00	0	0.00	527	6,116	1,208	7,324
9	6	61.7	15.0	23.3	0.0	0	0	6	0	0.00	0	0.00	0	1,428	271	1,699
14	13	38.8	36.5	24.6	0.0	0	13	0	8	124.00	0	0.00	1,257	13,855	946	14,801
15	8	86.9	13.1	0.0	0.0	8	0	0	0	0.00	2	66.00	432	8,252	1,115	9,367
16	4	89.5	10.5	0.0	0.0	0	0	4	0	0.00	0	0.00	0	952	180	1,132
18	5	51.0	21.0	28.0	0.0	0	0	5	4	84.00	0	0.00	852	1,840	427	2,267
20	14	11.4	43.2	45.4	0.0	0	13	1	4	128.00	0	0.00	1,298	14,124	1,001	15,125
21	3	3.3	51.7	33.3	11.7	0	0	3	0	0.00	0	0.00	0	714	135	849
23	5	44.0	42.0	14.0	0.0	0	0	5	3	80.00	0	0.00	811	1,809	418	2,227
24	12	95.6	4.4	0.0	0.0	0	0	12	0	0.00	0	0.00	0	2,857	541	3,398
26	19	8.4	57.6	28.4	5.5	0	10	9	1	16.00	2	121.00	954	12,688	1,233	13,921
27	3	85.0	15.0	0.0	0.0	0	2	1	0	0.00	0	0.00	0	2,222	145	2,367
28	10	3.0	56.8	39.2	1.0	0	0	10	4	120.00	0	0.00	1,217	3,309	739	4,048
29	6	93.0	7.0	0.0	0.0	0	6	0	0	0.00	0	0.00	0	5,952	299	6,251
30	2	87.5	12.5	0.0	0.0	0	0	2	0	0.00	0	0.00	0	476	90	566
31	3	76.7	20.0	3.3	0.0	1	0	2	0	0.00	0	0.00	0	1,473	210	1,683
33	9	86.1	13.9	0.0	0.0	0	2	7	4	138.00	0	0.00	1,399	4,718	747	5,465
34	3	91.7	8.3	0.0	0.0	3	0	0	1	105.00	0	0.00	1,065	3,804	611	4,415
37	5	77.0	21.0	2.0	0.0	0	0	5	2	52.00	0	0.00	527	1,593	350	1,943
38	2	82.5	17.5	0.0	0.0	0	0	2	1	12.00	0	0.00	122	569	119	688
39	5	91.0	9.0	0.0	0.0	0	0	5	0	0.00	0	0.00	0	1,190	226	1,416
40	6	86.7	13.3	0.0	0.0	0	0	6	1	20.00	0	0.00	203	1,583	319	1,902

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(1000Rp)

LINK NO	LENGTH (Km)	DA (%)	SD (%)	RU (%)	RB (%)	ASPHAL (Km)	GRAVEL (Km)	EARTH (Km)	TH NO	AREA (m2)	RC NO	AREA (m2)	BRIDGE COST	LOCAL COST	FOREIGN COST	TOTAL COST
41	4	36.3	48.8	15.0	0.0	0	0	4	3	60.00	0	0.00	608	1,417	325	1,742
42	2	0.0	75.0	25.0	0.0	0	0	2	1	32.00	0	0.00	325	724	167	891
44	3	0.0	78.3	21.7	0.0	0	0	3	1	16.00	0	0.00	162	838	174	1,012
46	7	85.0	15.0	0.0	0.0	0	0	7	0	0.00	0	0.00	0	1,666	316	1,982
47	11	10.0	55.5	28.2	6.4	11	0	0	1	12.00	0	0.00	122	11,063	1,344	12,407
48	14	84.3	15.0	0.7	0.0	0	14	0	0	0.00	0	0.00	0	13,888	698	14,586
50	4	0.0	77.5	22.5	0.0	0	0	4	0	0.00	0	0.00	0	952	180	1,132
52	15	26.3	61.7	11.0	1.0	0	0	15	7	276.00	0	0.00	2,799	5,707	1,340	7,047
54	47	79.8	17.2	3.0	0.0	21	0	26	3	92.00	0	0.00	933	27,844	3,905	31,749
56	7	71.1	24.3	4.3	0.0	0	0	7	0	0.00	0	0.00	0	1,666	316	1,982
57	13	81.9	15.0	3.1	0.0	0	0	13	3	60.00	0	0.00	608	3,559	731	4,290
65	9	3.3	75.6	18.9	2.2	0	3	6	2	48.00	0	0.00	487	4,776	536	5,312
66	8	70.6	19.4	10.0	0.0	0	0	8	1	40.00	0	0.00	406	2,214	457	2,671
68	6	83.3	16.7	0.0	0.0	0	6	0	0	0.00	0	0.00	0	5,952	299	6,251
71	3	0.0	80.0	20.0	0.0	0	0	3	2	32.00	0	0.00	325	962	212	1,174
72	17	96.9	3.1	0.0	0.0	0	0	17	2	60.00	0	0.00	608	4,511	911	5,422
75	5	85.0	15.0	0.0	0.0	0	0	5	2	40.00	1	12.00	484	1,550	350	1,900
76	3	91.7	8.3	0.0	0.0	0	0	3	0	0.00	0	0.00	0	714	135	849
80	4	91.3	8.8	0.0	0.0	0	4	0	1	20.00	0	0.00	203	4,123	247	4,370
SUM	405					44	73	288	79	2301.25	13	509.00	26,669	204,773	28,642	233,415

6.1.3 Annual Construction and Maintenance Cost

The annual allocation of the total construction and maintenance cost in the five years programme for Kabupaten Musi Banyuasin 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 3,668 x 10^6 and maintenance cost is Rp 1,192 x 10^6 which is approximately 25% of the total expenditure.

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

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	181,813	406,454	464,054	510,968	464,636	2,027,925	(55.3%)
Ownership Cost	820	1,642	1,965	2,040	1,891	8,358	(0.4%)
Operation Cost	51,524	104,624	125,743	131,975	122,525	536,391	(26.5%)
Material Cost	83,109	203,730	235,542	267,754	238,844	1,028,979	(50.7%)
Labour Cost	22,645	43,442	40,275	42,551	40,771	189,684	(9.4%)
Contingency	23,715	53,016	60,529	66,648	60,605	264,513	(13.0%)
FOREIGN CURRENCY :	146,871	325,971	375,832	422,211	369,878	1,640,763	(44.7%)
Ownership Cost	31,939	64,443	76,337	79,981	73,610	326,310	(19.9%)
Operation Cost	4,037	8,020	9,603	9,907	9,231	40,798	(2.5%)
Material Cost	91,738	210,990	240,870	277,252	238,792	1,059,642	(64.6%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	19,157	42,518	49,022	55,071	48,245	214,013	(13.0%)
TOTAL COST :	328,684	732,425	839,885	933,179	834,514	3,668,687	
Ownership Cost	32,759	66,085	78,302	82,021	75,501	334,668	(9.1%)
Operation Cost	55,561	112,644	135,346	141,882	131,756	577,189	(15.7%)
Material Cost	174,847	414,720	476,412	545,006	477,636	2,088,621	(56.9%)
Labour Cost	22,645	43,442	40,275	42,551	40,771	189,684	(5.2%)
Contingency	42,872	95,534	109,550	121,719	108,850	478,525	(13.0%)

(Contingency : 15%)

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

(MAINTENANCE)

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(UNIT : 1000Rp)

ITEM		(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :		101,108	207,202	230,594	250,264	266,557	1,055,725	(88.5%)
Ownership	Cost	256	509	555	576	613	2,509	(0.2%)
Operation	Cost	26,138	52,194	54,907	56,160	56,977	246,376	(23.3%)
Material	Cost	41,571	88,874	105,081	119,940	132,852	488,318	(46.3%)
Labour	Cost	33,143	65,625	70,051	73,588	76,115	318,522	(30.2%)
FOREIGN CURRENCY :		13,994	27,936	30,235	31,475	32,915	136,555	(11.5%)
Ownership	Cost	11,325	22,672	23,999	24,571	24,961	107,528	(78.7%)
Operation	Cost	1,167	2,331	2,455	2,515	2,559	11,027	(8.1%)
Material	Cost	1,502	2,933	3,781	4,389	5,395	18,000	(13.2%)
Labour	Cost	0	0	0	0	0	0	(0.0%)
TOTAL COST :		115,102	235,138	260,829	281,739	299,472	1,192,280	
Ownership	Cost	11,581	23,181	24,554	25,147	25,574	110,037	(9.2%)
Operation	Cost	27,305	54,525	57,362	58,675	59,536	257,403	(21.6%)
Material	Cost	43,073	91,807	108,862	124,329	138,247	506,318	(42.5%)
Labour	Cost	33,143	65,625	70,051	73,588	76,115	318,522	(26.7%)

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

(TOTAL)

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(UNIT : 1000Rp)

ITEM	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)	
LOCAL CURRENCY :	282,921	613,656	694,648	761,232	731,193	3,083,650	(63.4%)
Ownership Cost	1,076	2,151	2,520	2,616	2,504	10,867	(0.4%)
Operation Cost	77,662	156,818	180,850	188,135	179,502	782,767	(25.4%)
Material Cost	124,680	292,604	340,623	387,694	371,696	1,517,297	(49.2%)
Labour Cost	55,788	109,067	110,326	116,139	116,886	508,206	(16.5%)
Contingency	23,715	53,016	60,529	66,648	60,605	264,513	(8.6%)
FOREIGN CURRENCY :	160,865	353,907	406,067	453,686	402,793	1,777,318	(36.6%)
Ownership Cost	43,264	87,115	100,336	104,552	98,571	433,838	(24.4%)
Operation Cost	5,204	10,351	12,058	12,422	11,790	51,825	(2.9%)
Material Cost	93,240	213,923	244,651	281,641	244,187	1,077,642	(60.6%)
Labour Cost	0	0	0	0	0	0	(0.0%)
Contingency	19,157	42,518	49,022	55,071	48,245	214,013	(12.0%)
TOTAL COST :	443,786	967,563	1,100,714	1,214,918	1,133,986	4,860,967	
Ownership Cost	44,340	89,266	102,856	107,168	101,075	444,705	(9.1%)
Operation Cost	82,866	167,169	192,708	200,557	191,292	834,592	(17.2%)
Material Cost	217,920	506,527	585,274	669,335	615,883	2,594,939	(53.4%)
Labour Cost	55,788	109,067	110,326	116,139	116,886	508,206	(10.5%)
Contingency	42,872	95,534	109,550	121,719	108,850	478,525	(9.8%)

(Contingency : 15%)

6.1.4 Construction and Maintenance Equipment Cost

(1) Required Number of Equipment

The required numbers of construction equipment for Kabupaten Musi Banyuasin 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-Motor Grader
- 1-Tire Roller
- 1-Asphalt Sprayer

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

a. Equipment for Road Maintenance

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

b. Equipment for Bridge Maintenance

- 1-Flat Bed Truck with Grane 3 Ton

(2) Equipment Cost

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

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

Table 6-1-7 REQUIRED NUMBER OF EQUIPMENT

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

EQUIPMENT NAME	WORKABLE	EXISTING	(1988)	(1989)	(1990)	(1991)	(1992)
Bulldozer	210	0	0.40	0.80	0.85	0.93	0.79
Bulldozer/Ripper	210	0	0.15	0.24	0.44	0.36	0.43
Swamp Bulldozer	210	0	0.00	0.00	0.00	0.02	0.02
Motor Grader	230	1	0.73	1.50	1.77	1.80	1.67
Road Stabilizer	210	0	0.40	0.80	0.85	0.93	0.79
Hand-guide Vib. Roller	230	0	0.03	0.06	0.25	0.06	0.16
Tire Roller	210	1	0.14	0.57	0.80	1.02	0.92
Vibratory Roller (D&T)	230	0	0.69	1.40	1.59	1.66	1.51
Hydraulic Excavator; Wheel	210	0	0.00	0.00	0.00	0.11	0.11
Wheel Loader	230	0	0.68	1.31	1.55	1.59	1.46
Water Tank Truck	230	0	0.60	1.19	1.26	1.38	1.18
Dump Truck	230	0	3.90	7.34	9.13	9.10	8.77
Flat Bed Truck with Crane	230	0	0.10	0.21	0.04	0.04	0.01
Flat Bed Truck	230	0	0.71	1.73	2.04	2.40	2.08
Concrete Mixer	210	0	0.01	0.01	0.02	0.02	0.01
Water Pump	210	0	0.01	0.01	0.02	0.02	0.01
Concrete Vibrator	210	0	0.01	0.01	0.01	0.01	0.01
Asphalt Sprayer	210	1	0.14	0.57	0.80	1.02	0.92

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

Table 6-1-8 EQUIPMENT PURCHASE COST

PROV : SUMATERA SELATAN KAB : MUSI BANYUASIN

(1000 Rp)

EQUIPMENT NAME	CLASS	CIF (JAKARTA)	PURCHASE NO.	PURCHASE COST
Bulldozer	90 HP	49,150	1	49,150
Bulldozer/Ripper	90 HP	53,000	1	53,000
Swamp Bulldozer	90 HP	52,850	-	-
Swamp Bulldozer	65 HP	40,500	-	-
Motor Grader	75 HP	47,800	2	95,600
Road Stabilizer	W=1850 mm	85,950	1	85,950
Hand-guide Vib. Roller	1000 Kg	8,500	1	8,500
Tire Roller	8-15 ton	31,070	1	31,070
Vibratory Roller (D&T)	4 ton	29,000	2	58,000
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	1	25,190
Flat Bed Truck	3.0 ton	11,275	3	33,825
Portable Crusher/Screening	30-40 t/h	188,000	-	-
Concrete Mixer	0.5 m3	18,000	-	-
Water Pump	200 l/min	630	-	-
Concrete Vibrator	3.3 HP	740	-	-
Asphalt Sprayer	850 ltr.	10,200	1	10,200
Service Car	3 ton	11,600	1	11,600
4 Wheel Drive Vehicle	70 HP	17,500	1	17,500
Motorcycle	100 cc	1,100	5	5,500

PURCHASE COST TOTAL	785,235
OWNERSHIP COST (FOREIGN)	388,708
EQUIPMENT COST SUPPLEMENTED	396,527

NOTE : OWNERSHIP COST (FOREIGN) for Existing Equipment

Motor Grader	26,307
Tire Roller	16,633
Asphalt Sprayer	2,190
TOTAL	45,130

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 : SUMATERA SELATAN KAB : MUSI BANYUASIN

I T E M	UNIT	(1988)	(1989)	(1990)	(1991)	(1992)	(TOTAL)
Site Clearance in Light Bush	m2	9000.00	0.00	0.00	0.00	0.00	9000.00
Subgrade Preparation	m2	84600.00	165600.00	195200.00	188500.00	180100.00	814000.00
Moreal Fill	m3	0.00	0.00	0.00	0.00	0.00	0.00
Fill in Swamp	m3	0.00	0.00	0.00	405.00	405.00	810.00
Normal Excavation to Spoil	m3	665.20	321.20	1923.60	1268.00	1518.00	5696.00
Cement Stabilizing	m3	8616.00	15336.00	17116.00	15540.00	13132.00	69740.00
Cement Stabilizing	m3	1428.00	4788.00	4088.00	7770.00	6566.00	24640.00
Shoulder	m2	28200.00	69600.00	119400.00	98500.00	119300.00	435000.00
Asphalt Patching	m2	0.00	70.00	1882.00	175.00	1286.00	3413.00
Surface Dressing (Single)	m2	20400.00	85200.00	119600.00	153000.00	137800.00	516000.00
Surface Dressing (Double)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Earth Drain	m	8150.00	6330.00	4470.00	7445.00	7385.00	33780.00
Earth Drain in Swamp (by machine)	m3	0.00	0.00	0.00	1800.00	1800.00	3600.00
Pipe Culvert D80cm	m	24.00	31.20	49.60	54.00	13.20	172.00
Masonry Culvert (80x80cm)	m	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Retaining Wall and Wing Wall (Masonry)	m3	3.20	3.20	13.12	10.40	5.28	35.20
Gabion Protection	m3	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 3m;10T)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;10T)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;10T)	m2	132.00	308.00	0.00	0.00	0.00	440.00
Superstructure (Timber;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Timber;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 3m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 5m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span 8m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span10m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Superstructure (Concrete;Span15m;BM50)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Timber;10T)	NO	3.90	9.10	0.00	0.00	0.00	13.00
Substructure (Abut;for Timber;10T)	NO	0.60	1.40	0.00	0.00	0.00	2.00
Substructure (Pier;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Timber;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Pier;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Substructure (Abut;for Concrete;BM50)	NO	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Timber)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Timber->Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Demolition of Bridge (Concrete)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Manual routine maintenance of road	Km	200.25	395.80	406.05	412.88	414.78	1829.75
Routine maintenance of earth road	Km	141.75	271.90	257.20	244.13	220.28	1135.25
Routine maintenance of gravel road	Km	36.50	82.00	91.00	103.00	103.00	415.50
Routine maintenance of asphalt road	Km	22.00	41.90	57.85	65.75	91.50	279.00
Maintenance of Timber Bridge (New)	m2	0.00	0.00	0.00	440.00	0.00	440.00
Maintenance of Concrete Bridge (New)	m2	0.00	0.00	0.00	0.00	0.00	0.00
Maintenance of Timber Bridge (Exist)	m2	1057.06	2228.05	2511.45	2433.25	2450.25	10680.06
Maintenance of Concrete Bridge (Exist)	m2	254.50	509.00	478.00	470.25	423.75	2135.50

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.

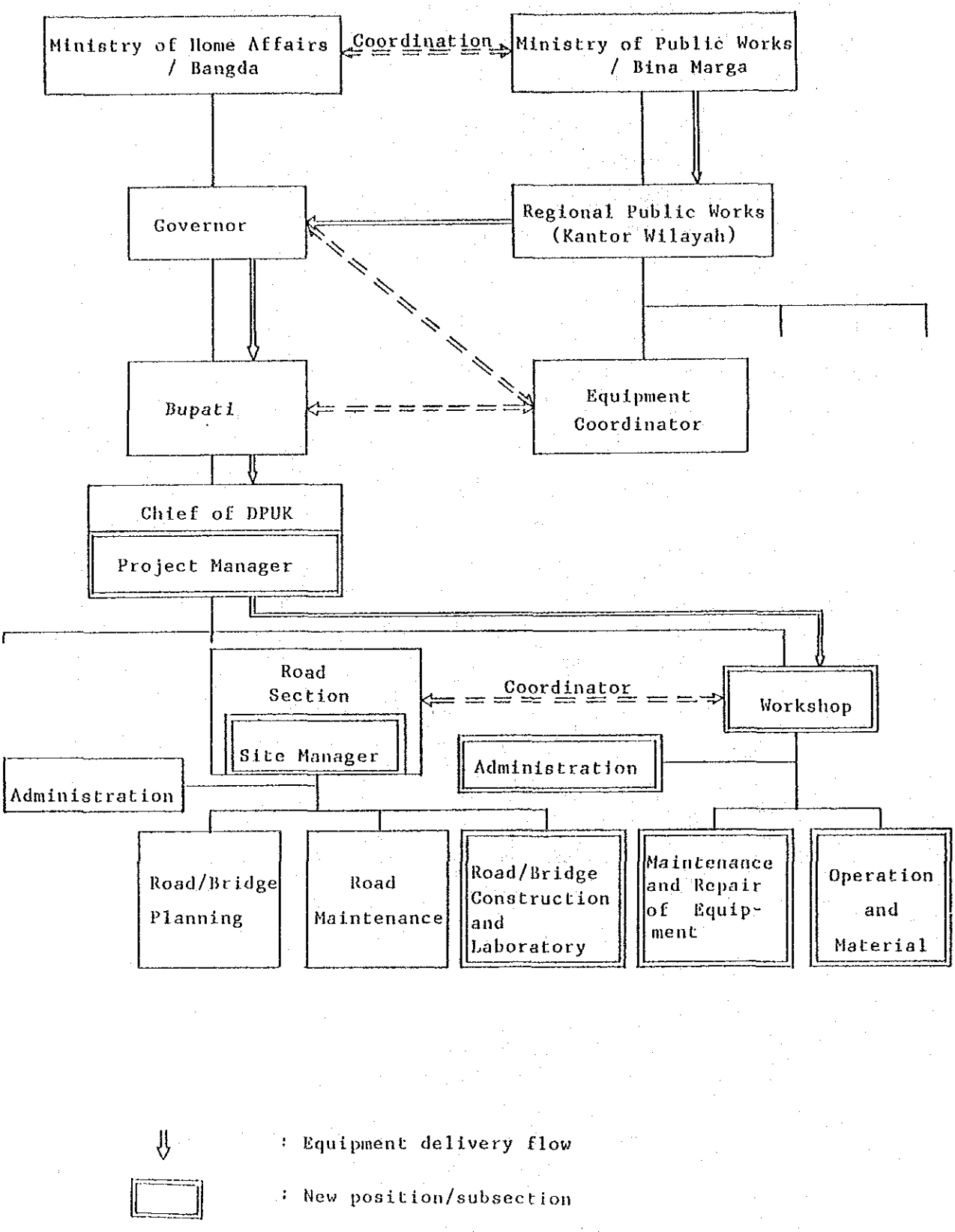
It is recommended that the workshop is newly organized to consist of three sub-sections, i.e. maintenance and repair of equipment, operation and materials, and administration to execute the main tasks described in Clause 3.5.

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