

MALAYSIA

FEASIBILITY STUDY

FOR

BELURU/LONG LAMA/LIMBANG

TRUNK ROAD CONSTRUCTION PROJECT

PROGRESS REPORT

(PHASE II)

MARCH 1979

JAPAN INTERNATIONAL COOPERATION AGENCY

113
61.4
SDR

SDF
198

1. Introduction

2. Methodology

3. Results and Discussion

4. Conclusion

5. References

6. Appendix

7. Acknowledgements

8. Contact Information

9. Author Biographies

MALAYSIA

FEASIBILITY STUDY

FOR

BELURU/LONG LAMA/LIMBANG

TRUNK ROAD CONSTRUCTION PROJECT

PROGRESS REPORT

(PHASE II)

21433

MARCH 1979

JICA LIBRARY



1079213(3)

JAPAN INTERNATIONAL COOPERATION AGENCY

小野田製粉

製粉 目録

第1

製粉 目録

製粉 目録



製粉 目録

製粉 目録

製粉 目録

製粉 目録

TABLE OF CONTENTS

1.	Introduction	1
2.	Engineering Study	3
	2.1 Outline of the Conducted Field Surveys	
	2.2 Design Criteria	
	2.3 Alignment Description	
3.	Economic/Transportation Study	23
	3.1 Outline of the Conducted Field Surveys	
	3.2 Development Policy of Feeder Roads	
	3.3 Development of Service Centres	
4.	Basic Policy and Work Schedules for Further Study	32
	4.1 General	
	4.2 Engineering Study	
	4.3 Economic/Transportation Study	
	4.4 Work Schedule	
Appendix A	Summary Record of Survey Activities	
Appendix B	Agencies Contacted	
Appendix C	List of Publication and Data Obtained	

1. Introduction

The Survey Team of Japan International Cooperation Agency (JICA) carried out the Phase II field survey of the Feasibility Study of the Beluru/Long Lama/ Limbang Trunk Road Construction Project based on the Scope of Work agreed by the Economic Planning Unit and JICA on July 21st 1978, and the review of Government of Malaysia and the approval of the Survey Team's recommendation in the Interim Report.

The purpose of this field survey is to make the detailed technical studies along the proposed route and supplementary investigation for economic studies to determine the optimum route.

The following items were performed:-

- Investigation of the geological and soil condition, geotechnical survey of the foundation at the bridge site, survey of the gravel quarries and tests of the aggregate
- Hydrological surveys on the river crossing
- Surveys on the cost of constructions and construction method
- Investigations of development potentials for Agricultural, Forestry and Tourism of Mulu National Park
- Investigation of case studies on the changes before and after construction of the road

The JICA Survey Team arrived at Malaysia on February 4th, and commenced the Phase II field survey immediately according to the scope of work.

The main purpose of the Progress Report is to present:-

- the works done by the Survey Team during the Phase II survey period, and
- the preliminary results obtained from the various field surveys conducted

We would like to express our sincere appreciation to the relevant officials of Economic Planning Unit, Public Works Department, State Planning Unit, Land and Survey Department and other Government Department and Agencies who kindly provide us the necessary assistance and cooperation in executing the Study throughout the survey period.

2. Engineering Study

2.1 Outline of the Conducted Field Survey

2.1.1 General

In the supplemented field survey of Phase II, the detailed technical studies were carried out along the proposed route, based on the topographical map in the scale of 1:10,000 which were made by the aerial photographic survey in Phase I.

2.1.2 Field Reconnaissance

The purpose of this field reconnaissance is to obtain the latest information along the proposed route and at the same time to gather the accurate data on the terrain condition, the minor water course, the soil condition, the swampy area's situations, and the logging roads to be crossed by the road.

The topographical maps in the scale of 1:10,000 and aerial photographs of scale 1:10,000 covering the project area were available. Since the topographical map is made of intervals of contour lines in 10 m, 50 m, and 5 m respectively for the principal, index and supplementary half interval contours, the detailed check for the terrain condition were conducted with satisfactory accuracy.

At first stage, the Survey Team had conducted field reconnaissance several times along the project route by chartered helicopter. And then, the team conducted the

detailed field reconnaissance along the proposed new route with surveyors of Land and Survey Department.

Based on the field reconnaissance, the descriptions of the alignment are indicated in section 2.3.

2.1.3 Soils and Materials Survey

1) Soils

The soil samples are taken out from the additional 3 (three) points to cover the Phase I study as shown in Figure 2-1. The soil tests described below based on British standard have been entrusted to the Central Mechanical Laboratory of the Sarawak PWD.

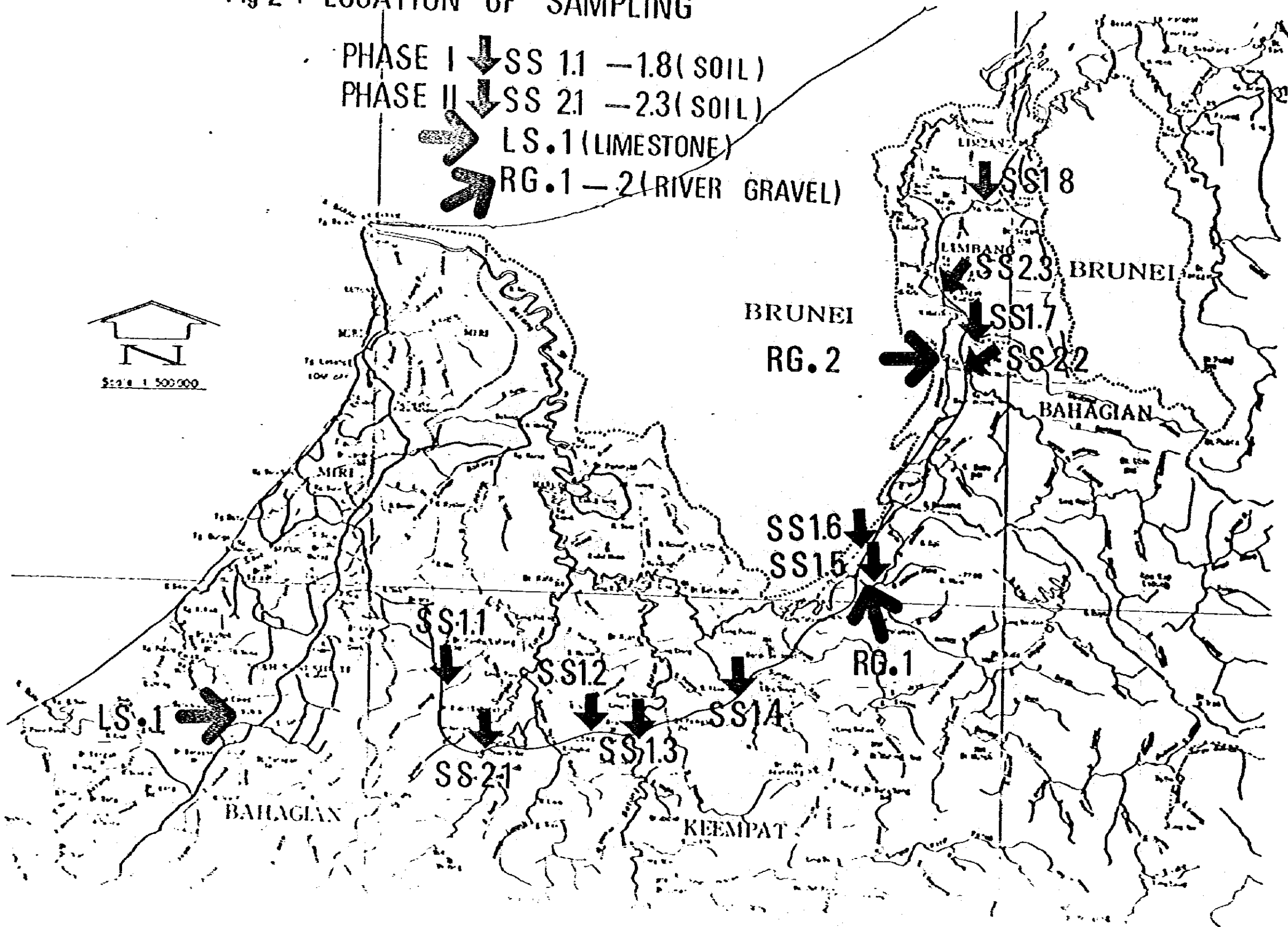
- i) Grain Size Analysis
- ii) Specific Gravity
- iii) Compaction Test
- iv) Atterberg Limit Test
- v) CBR Test

2) Construction Materials

Data collection of construction materials was carried out in Phase I. Not only supplemental data collection but the reconnaissance survey of potential quarry sites and gravel pits are also conducted in Phase II. The stone and gravel samples are taken from 3 (three) points as shown in Figure 2-1. The following material tests have been entrusted to the Central Mechanical Laboratory

Fig 2-1 LOCATION OF SAMPLING

- PHASE I ↓ SS 1.1 — 1.8 (SOIL)
- PHASE II ↓ SS 2.1 — 2.3 (SOIL)
- ↘ LS.1 (LIMESTONE)
- ↙ RG.1 — 2 (RIVER GRAVEL)



of Sarawak PWD.

- 1) Water absorption
- 11) Los Angeles abrasion
- 111) Aggregate Impact Value

3) Limestone Quarry

Although the rocks around the project area are geologically young, limestone of Batu Niah and Batu Gading (Holly Stone Quarry and Syarikat Betch Quarry) in 4th Division has good quality for road construction.

According to the potential amount of these quarries, the current production rate will be continuously kept for the coming 20 years, which is quite enough for this project. Selidong Limestone quarry in 5th Division was surveyed for reducing the construction cost. Based on the survey it is clear that the potential amount is not so much therefore the material for the project should be obtained from other quarries. Comparative study of aggregate for surface course concerning the transportation from Kuching or Batu Gading to the sections of 5th Division will be carried out.

4) Gravel Pits

The potential gravel pits in 4th Division are found only in the river bed deposit of S. Tutoh. The quantity of the deposit may be small and gravel cannot be found during the rainy season when the water level is high.

Existing gravel pits of Lubai Tengah and Ukong in Fifth Division have been exhausted. However, there are other pits nearby producing large quantity of gravel.

5) Investigation of Foundation Ground for Structures

The investigation for structure foundation is planned to be carried out as follows.

The following sub-surface investigations for the foundations of structure are being carried out:-

Site	Boring	Mackintosh
B. Baram	2 (right & left bank)	2
S. Apoh	1	2
S. Tutoh	1	2
S. Limbang	-	2
S. Medamit	1	2
Total.	5	10

6) Seismic Prospecting

Seismic Prospecting was carried out at 4 points to confirm the ripperability of the rocks.

This result will be reflected on the cost estimate of earthwork.

2.1.4 Hydrological and River Survey

Hydrological and River Surveys are aimed at establishing a design discharge for bridges and drainage structure on the proposed road.

The project area is located in the tropical monsoon zone. Therefore, these surveys are to be conducted to determine the lowest safe finished grade at the fill sections where the ground is inundated by flood water at the same times.

The data of the past 15 years for the project area were obtained for analysis through the State Drainage and Irrigation Department.

The rainfall observation stations in the project area are shown in Tables 2-1 and 2-2.

In addition to these data, the Survey Team conducted actual field survey to investigate the existing hydrological condition including the characteristics of the area and the conditions of major existing rivers.

On the field survey, the existing velocity of each river is observed to be less than 2.0 m/s. but the velocity will substantially increase when there is heavy rain storm.

The flood discharges of major rivers in the project area have been recorded at a few locations for several years. Therefore, the past records of the major rivers were collected from the local people.

The result of field investigation on major rivers are tabulated and presented on the pages 10, 11, 12 and 13.

Table 2-1 Rainfall and Evaporation Stations

Station No.	Station Name	Station No.	Station Name
4- 1	Lutong	4-51	Sg. Tangit
4- 3	Long Akah	4-19	Bk. Peninjau
4- 4	Marudi Airfield	4-54	Paya Selanyau
4- 5	Miri Airport	4-56	Subis
4- 6	Bekenu Sibuti	4-58	Sg. Sebiew
4- 7	Bario	4-59	Benawa
4- 9	Long Lama	4-60	D.I.D.
4-11	Lio Matu		Barrack
4-15	Long Moh	4-61	Cattle Area
4-16	Niah	5- 2	Sundar
4-17	Long Panai	5- 3	Lawas Estate
4-18	Long Pilah	5- 4	Ukong
4-20	Long Seridan	5- 6	Long Semadoh
4-21	Tubau	5- 7	Kubong
4-23	Sebauh	5- 8	Lawas
4-26	Long Anap		Reservoir
4-28	Long Leliang	5- 9	Lawas Airfield
4-32	Long Subing		
4-33	Long Jegah	5-10	Limbang P/House
4-34	Long Teru		
4-35	Long Atip	5-12	Ng. Medamit
4-36	Beluru	5-16	Long Belong
4-45	Sg. Niah	5-18	Lawas Depot
4-46	Sg. Sibuti	5-21	Herapok
4-47	Sarawak	5-22	Trusan
	Oil Palm	5-23	Pandaruan
4-48	Lambir	5-25	Lubai Tengah
4-50	Kpg. Wireless		
4-52	Landang III		

Table 2-2 Water Level and Discharge Stations

Station	Station Name	Type
4- 1	Kuala Baram	A.W.R.
4- 6	Marudi	A.W.R.
4- 8	Lio Hatu	S.G.
4- 9	Long Pilah	S.G.
4-10	Long Jegan	S.G.
4-11	Long Terawan	S.G.
4-12	Sg. Sehiew	S.G.
4-15	Sg. Niah	S.G.
4-17	Sg. Saeh (Merah)	S.G.
4-18	Sg. Saeh (Puteh)	S.G.
4-20	Sg. Dalam	S.G.
4-22	Sg. Liku	A.W.R.
5- 1	Ng. Medamit	S.G.
5- 2	Limbang	A.W.R.
5-10	Btg. Trusan	S.G.

Note:

A.W.R. - Automatic Weekly Recorder

S.G. - Stick Gauge

MAIN RIVER SURVEY DATA

No.	Name of River	Station	Nearest Village	Description of Site			Existing Structure
				Width of River	Width of Flood	Stream	
1.	Sg. Salu	1,000	R. Pong Barat	9.0 ^m	-	Muddy small stream	Wooden Br. $l = 12^m$ $b = 3.7$
2.	Sg. Toman	23,500	R. Kodis	11.5 ^m	50 ^m	Muddy stream	Temporary Timber Bridge New Bridge under construction
3.	Sg. Bakong	36,500	R. Jampi	23.6 ^m	-	Muddy stream Gravel on bed Driftwood	Temporary Timber Bridge New Bridge under construction
4.	Sg. Kelulit	44,000	-	11.8 ^m	-	Muddy stream	Temporary Timber Bridge New Bridge under planning
5.	Sg. Bok	45,500	R. Pagan	26.0 ^m	-	Muddy stream	Temporary Steel Bridge New Bridge under planning
6.	Sg. Tinjar	53,500	Long Tulungan	93.0 ^m	200 ^m	Muddy stream	New Bridge under planning by Australian Colombo Plan
7.	Sg. Tru (Teru)	12,500	R. Ingkot	15 ^m	45 ^m	Muddy stream Meandering flow	-

No.	Name of River	Station	Nearest Village	Description of Site			
				Width of River	Width of Flood	Stream	Existing Structure
8.	Selang Baram	25,000	Long Lama	150 ^m	250 ^m	Muddy stream	-
9.	Sg. Temala	33,500	-	50 ^m	60 ^m	Left bank, muddy stream Right bank, clear stream	-
10.	Sg. Apoh	49,500	R. Akan Ajang	25 ^m	75 ^m	Muddy stream	-
11.	Sg. Terawan	60,000	-	-	-	Muddy stream	-
12.	Sg. Tutoh	79,000	-	50 ^m	-	Clear stream Gravel on bed	-
13.	Sg. Montanal	99,500	-	-	-	-	-
14.	Sg. Medalam	108,000	-	20 ^m	-	Muddy stream Driftwood	-
15.	Sg. Limbang	122,000	R. Pakatom	70 ^m	-	Muddy stream	-

No.	Name of River	Station	Nearest Village	Description of Site			Existing Structure
				Width of River	Width of Flood	Stream	
16.	Sg. Medamit	129,000	R. Nanga Awang	15.0 ^m	45 ^m	Clear stream Gravel on bed	-
17.	Sg. Lubang	1,500	Ng. Medamit	6.0 ^m	400 ^m (Flood)	Muddy small stream	Steel Girder Br. Wooden Floor $l = 7.2$ $b = 3.7$
18.	Sg. Polub Merah	6,500	Kpg. Lubok Lasas	6.0 ^m	-	Gravel on bed Muddy stream	Steel Girder Br. Wooden Floor $l = 7.2$ $b = 3.7$
19.	Sg. Mengari	12,000	Kpg. Tanjung Liman	6.0 ^m	-	Muddy stream	Steel Girder Br. Wooden Floor $l = 7.2$ $b = 3.7$
20.	Sg. Palas	18,500	-	3.5 ^m	-	Gravel on bed small stream	Wooden Bridge $l = 3.9$ $b = 3.8$
21.	Sg. Berloras	21,000	-	2.5 ^m	-	Muddy very small stream	Wooden Bridge $l = 3.0m$ $b = 3.7$
22.	Sg. Lubai	23,000	-	33.0 ^m	-	Muddy stream	Steel Girder Br. (3 spans) Wooden Floor $l = 35.2$ $b = 3.7$

No.	Name of River	Station	Nearest Village	Description of Site			Existing Structure
				Width of River	Width of Flood	Stream	
23.	Sg. Melaban	24,000	-	15.0 ^m	-	Muddy stream	Steel Girder Br. Wooden Floor $l = 15.8$ $b = 3.7$
24.	Sg. Bakol	27,000	Kpg. Bakol	10.0 ^m	-	Bed Rock Gravel on bed	Steel Girder Br. Wooden Floor $l = 12.7$ $b = 3.8$
25.	Sg. Brangas	29,000	Kpg. Dakol	9.0 ^m	-	Muddy stream	Steel Girder Br. Wooden Floor $l = 9.9$ $b = 3.7$
26.	Sg. Borawan	30,500	Kpg. Borawan	15.0 ^m	-	Muddy stream	Steel Girder Br. Wooden Floor $l = 17.3$ $b = 3.7$
27.	Sg. China	34,500	Limbang	6.0 ^m	-	Muddy small stream	Wooden Br. $l = 9.0$
28.	Sg. Poyan	38,500	Limbang	12.0 ^m	-	Muddy stream	Temporary Bridge New Bridge under construction

2.1.5 Construction Cost Survey

To obtain the recent construction cost, additional survey and review of the cost in Phase I were conducted. Unit price of construction equipment, materials and labours including custom duties and taxes were surveyed separately from various sources. Latest unit price will be used for the cost estimates in the Final Report.

The lease fee of construction equipment and plants in Singapore were also surveyed for the alternative studies.

In order to decide the working days in a year, capability of earthwork in a month and so on and the monthly progress report on Beluru - Long Teru Road construction project were reviewed. The project area for the Beluru-Long Teru Road is very close and runs through similar terrains as the proposed road area.

2.2 Geometric Design Criteria

2.2.1 General

The Survey Team had recommended the Geometric design criteria for the Proposed Trunk Road in the Interim Report, which is based on the design criteria of P.W.D. Sarawak and P.W.D. Peninsula Malaysia, with reference to the AASHO and the Japanese standard.

The Survey Team reconsidered the several items of recommended geometric design criteria based on the physical conditions, the characteristics and volume of traffic in the study area.

The Survey Team also studied the optimum values of design criteria for Feeder Road as the future development of road network in the study area.

The optimum values of criteria of the Trunk Road and Feeder Road are strongly recommended because it is strongly believed that the optimum criteria would decrease the number of accidents reduce the construction cost and indirectly promote the development of the study area.

2.2.2 Trunk Road

The Survey Team had established the geometric design criteria as shown in Table 6-2 in the Interim Report, which is considered to be optimum for the topographical situation in the study area.

The design speed recommended in the Interim Report were based on the three terrains namely 80 KPH (50 MPH) for the flat, 64 KPH (40 MPH) for the rolling, and 40 KPH (30 MPH) for the mountainous terrains. It is considered that these values will satisfactorily provide the maximum services and will reduce the cost of construction considerably. The values of other elements were arrived at by these design speeds, but the width of pavement and shoulder, side clearances are generally not directly related to the design speed but to the road capacity.

In this phase, the Survey Team had corrected the values of the maximum gradient in the mountainous terrain, such as 9 per cent to 8 per cent. In the study area, there is a lot of logging activities which generate a great number of heavy vehicles. These heavy vehicles are not well maintained due to the insufficiency of mechanics and technical experiences. The 9 per cent gradient in the mountainous area limits the speed to 48 KPH (30 MPH) for passenger cars. The truck speed would be expected to be lower on the 9 per cent gradients. The Survey Team now recommend 8 per cent to be the maximum gradient in the mountainous area.

The typical cross-section of Trunk Road are shown in Fig. 6-1 in Interim Report (page 6-6).

2.2.3 Feeder Road

The Feeder road in the study area are necessary for the future social and economic development of the various villages scattered in the area.

Taking into consideration of the physical conditions of the area and the potential development in the various villages, the Survey Team had divided the area into flat, rolling and mountainous terrains. Subsequently the design criteria such as design speed, traffic lane width, maximum gradient, shoulder width, the sight distance, the minimum curve radius and the length of vertical curve for the three terrains are established as shown in the following Table 2-3.

2.3 Alignment Description

2.3.1 General

The description of the alignment based on the Phase I field reconnaissance was presented in the Interim Report. In this section, further findings from the Phase II field reconnaissance are presented.

2.3.2 Improvement Section

1) Miri/Bintulu Road-Beluru

As described in the Interim Report, there are no major problems with regards to the horizontal alignment but the improvement of inadequate sight distance is necessary for some sections.

2) Beluru - Sg. Tinjar

A part of this section is presently under construction. Since the design criteria of this section adopts the trunk road standard, there are no problems with regards to the horizontal and vertical alignment.

Table 2-3 Geometric Design Criteria of Feeder Road

1. Terrain	Flat	Rolling	Mountainous
2. Design speed	48 KMH (30 MPH)	48 (30)	32 (20)
3. Surface width	4.27 m (14 feet)	4.27 (14)	4.27 (14)
4. Shoulder width (min.)	1.22 m (4 feet)	1.22 (4)	1.00 (3)
5. Formation width	6.71 m (22 feet)	6.71 m (22)	6.27 (20)
6. Reserve width	20 m (66 feet)	20 (66)	20 (66)
7. Maximum Gradient (%)	7	7	10
8. Stopping Sight Distance	61 m (200 feet)	61 (200)	61 (200)
9. Minimum Radius	83 m (250 feet)	61 (200)	31 (100)
10. Widening	-	-	0.6 m (2 feet)
11. Superelevation	1:10	1:10	1:10
12. Chamber cross fall	1:30	1:25	1:25
13. Vertical curves			
Crest min.	9 m (28 feet)	9 (28)	9 (28)
Sag min.	11 m (35 feet)	11 (35)	10 (30)

Note: The figures in parenthesis show the values in feet.

3) Ng. Medamit - Limbang

Three portions in this section are inundated with water of about 3 feet deep during the flood period. The improvement for these portions is necessary in this aspect based on the hydrological study. With regards to the vertical alignment, two portions with more than 8% gradient are constructed and for the horizontal alignment four locations with less than 150 m radius are designed. These portions should be improved based on the recommended design standard.

2.3.3 New Construction Section

1) Sg. Tinjar - Long Lama

The detailed field reconnaissance along the proposed route was conducted by a three-day trip.

From Sg. Tinjar to the southern part of Loagan Bunut, the alignment should be selected to avoid the paddy field which are mostly cultivated on the wet ground. At the southern part of Loagan Bunut which is enclosed by swampy area the alignment should be selected to skirt the foot of the mountain.

From Loagan Bunut to the crossing point of Sg. Teru, the alignment runs in a tropical jungle in which no house and no cultivation exist. Along the Sg. Teru a belt of wet ground of about 1 Km wide exists. The alignment has to cross the wet ground and Sg. Teru. For this area the special construction method

should be considered. At the distance 1.5 Km from the right bank of Sg. Teru there is a swamp which is 300 m wide and is used as a wet paddy field. The alignment should avoid the swamp and be located in the hilly terrain. From this point to a distance of 3 Km, the alignment runs in the hilly forest. As far as Bātang Baram, the forestry roads are relatively well developed on the top of hills along the route, but the alignment avoids the forestry road and runs almost parallel to it.

2) Long Lama - Sg. Apoh

The section from Sg. Temala to Sg. Apoh is a jungle belt with hilly forestry roads. The alignment runs generally in the forest avoiding the top of hills. The crossing of Sg. Apoh is at the out-skirt of R. Akam Ajang. In spite of the existence of a belt of wet area of 1 Km wide along the Sg. Apoh, there are no difficulties anticipated in earthworks.

3) Sg. Apoh - Sg. Tutoh

This section runs through flat and rolling terrain with isolated hills of 200 m in height. Since the part of the flat area is swampy, care is taken to keep the alignment close to the skirt of hills.

4) Sg. Tutoh - Ng. Međanit

In the Mulu National Park, cares are taken to avoid excessive cuts and fills in order to preserve the originals as far as possible. The terrain conditions

of this section were reconfirmed by the Phase II survey that the route close to the border of Brunei exists in the mountainous area, while the route passing in the saddle 3 Kms off in the east of the former runs in the more gentle terrain. With regards to the vertical and horizontal alignment for the latter there are no difficulties to adopt the trunk road standard of the Sarawak Public Works Department.

3. Economic/Transportation Studies

3.1 Outline of the Conducted Field Surveys

1) General

Major activities performed during the Phase II field surveys comprise:-

- 1) Collecting additional data and information to refine the estimated figures with regard to population projection, forecast of agricultural production, traffic forecast, transportation cost estimate and cost-benefit analysis;
- 2) Holding further discussion with relevant Government Departments with regard to defining the development potentials in the Study Area more precisely; and
- 3) Collecting necessary information to carry out a preliminary study on the impact of road construction in the areas along the Miri-Bintulu Road.

Appendix A contains a summary record of activities while Appendix B and Appendix C show the list of agencies and officials contacted and that of data and information collected respectively.

2) Supplemental Data Collection

Additional data and information were collected by way of obtaining latest statistics and publications and

interviewing relevant officials. No additional traffic surveys were done during the period. Major data and information collected are:-

- latest statistics including population distribution and agriculture production in the Baram District.
 - up-to-dated cost figures of transport modes for both river and road.
 - series of road traffic census data covering the period of 1967 through 1978.
 - production cost data of major crops.
 - information of the sociological factors to be considered in the Study Area.
- 3) Scope of Preliminary Case Study on the Impacts due to the construction of Miri-Bintulu Road

In order to carry out a preliminary impact case study on the Miri-Bintulu Road, though this study is not included in the original scope of work of the project, the following data and information were collected:-

- historical record of Miri-Bintulu Road construction
- population distribution in the areas along the Miri-Bintulu Road for the year of 1968 and 1975 through 1977
- location of each kampong in the areas before and after the completion of the Miri-Bintulu Road

- vehicular traffic volume on the major points of the Road since 1967 through 1978
- agricultural statistics in the relevant Sub-districts in the areas for the years before and after the completion of the Road
- outline of the either completed or ongoing development schemes by SLDB (Sarawak Land Development Board)
- aerial photographs of the areas covering 10 kilometer along each side of the Road for the year of 1963 and the latest*

*these photographs have not been released by the time of writing of this report

- changes of sociological aspects by interviewing the relevant officials in the District Office.

Main objectives of this case study are:-

- to predict possible changes which might occur in the Influence Area of the Project Road due to its completion
- to know the sociological implication between the existing communities and the new settlements
- to have a basis for determining the most suitable type of development to be introduced.

3.2 Development of Feeder Roads and Service Centres in the Study Area

1) Agriculture Development Possibilities

Shifting cultivation is one of the biggest problems to be overcome not only because it will waste valuable timber resources and increase illegal occupation of State Land, but also because it will not be a long term solution in providing subsistence for the people themselves in the future. Under the current traditional cultivation method with low yield, long fallow period and increasing population, the only natural and inevitable outcome will be that more marginal land - both in quality and distance - and forest will be brought under cultivation. Besides upsetting delicate ecological balance, this will also mean that farmers will have to spend time travelling between widely scattered land.

Development in the pattern of settlement in the Study Area is largely dependent upon the availability of agricultural land and transport communication. In the Study Area, particularly the Baram area, where water up till now offers the only credible means of transportation, settlements have developed along the rivers. Notwithstanding this, transportation by river is not only time consuming but also very expensive. Exercise done in the Phase I Study, for example, indicates the following comparative costs of transportation by river and land:-

Passenger	- road (gravel, tangent)	. car	: 15 ¢/km/passenger
		. bus	: 3 ¢/km/passenger
	- river	. long boat	: 15-20 ¢/km/passenger
		. express launch	: 10 ¢/km/passenger
Goods	- road (gravel, tangent)	. 6 ton truck:	12 ¢/km/ton
		- river	. long boat : \$1.5-2.0/km/ton
		. 40 ton motor vessel	: 6 ¢/km/ton

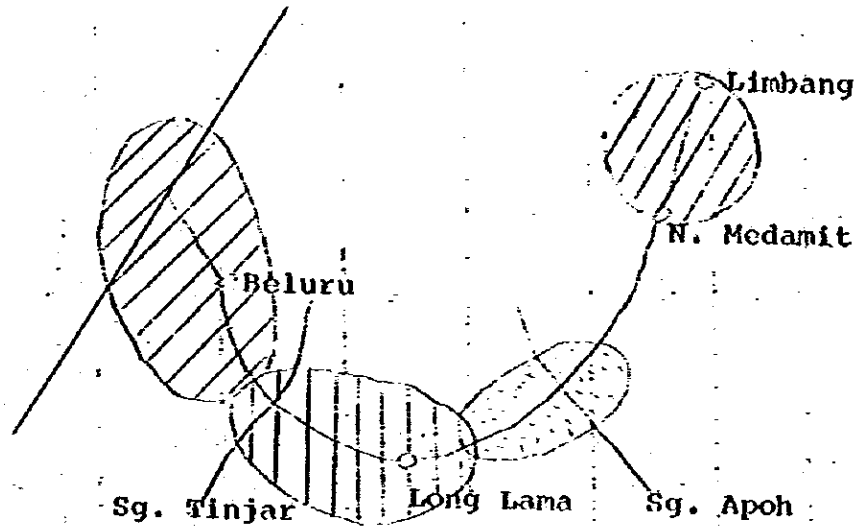
Although most of the people in the Baram areas cultivate rubber for their cash crop, the return they can obtain is relatively low due to the very high transportation cost by long boat and the fact that the market price is fixed by external factors.




Whether shifting cultivation could be changed to settled farming where in correct land use and more suitable cultivation practices could be developed and established is one of the crucial factors determining the regional development in these areas.

With the construction Project Road vast State Land along the Road could become available for various planned development. Customary Land which by and large spreads along the major rivers will not be a feature to hinder planned land development.

The basic agriculture development patterns with the Project Road can be roughly illustrated as follows:-

Miri-Bintulu Road



	Medium-large scale	(Estate Type)
	Small-medium scale	(Mainly Road Based Development)
	Small scale	(Road Based Development)

2) Development Policy of Feeder Roads

In order to maximize the benefits expected to arise from the construction of the Project Road, development of a number of feeder roads and creation of planned service centres will be inevitable. Strategic social and economic developments according to the potentials and regional characteristics in the areas must be integrated.

Objectives of constructing feeder roads will be:-

- to link major existing communities with the trunk road
- to provide land access to areas where relatively high development potentials of agriculture, forestry and tourism are expected
- to open up more land where road based agriculture development is expected

As is shown in Figure 3.1 the following feeder roads have been short listed for further study.

- (1) road to Long Telawan; approximate length 5.0 kms. (3.1 mls.)
- (2) road to Long Atip and possibly to Long Bedian; approximate length 23.0 kms. (14.26 mls.)
- (3) road to Lg. Buang; approximate length 1.5 kms. (0.9 mls.)
- (4) road to Long Laput; approximate length 1.0 kms. (0.6 mls.)
- (5) road to G. Mulu area; approximate length 8.0 kms. (5.0 mls.)

3) Development of Service Centres

Without the Project Road most of the Baram areas will be adversely affected by:-

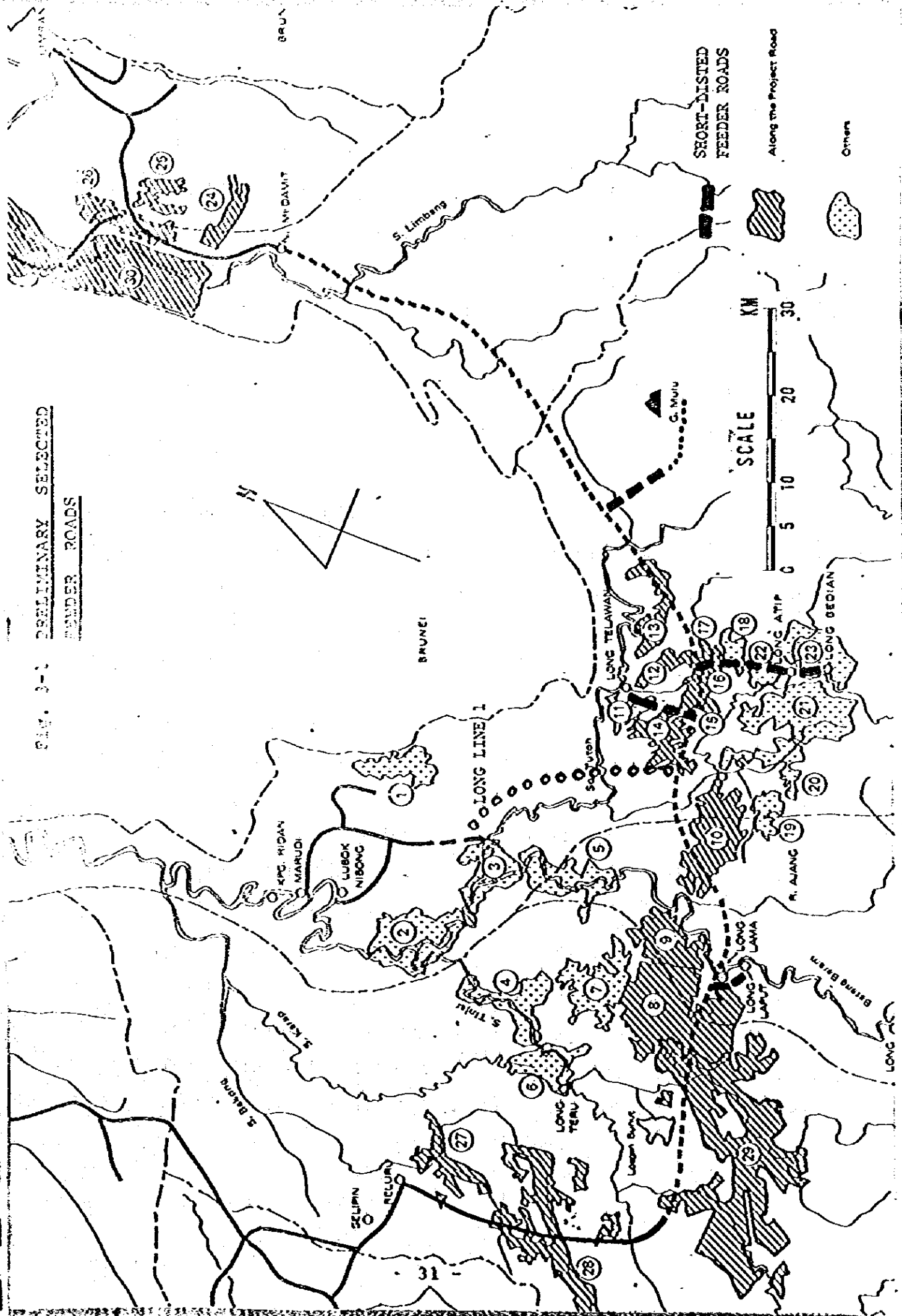
- constant outflow of population: Most of those who were sent for studies have not returned to their home place
- continuous expansion of shifting cultivation

- lack of proper service facilities due to the high cost of investment and scattered demand (Government administration, education, medical services, utilities etc.)

The construction of the roads will certainly contribute towards solving these problems, even though roads alone are not the solution particularly in these areas. As it is anticipated that agricultural development in the influence area of the Project Road is mainly small to medium scale and unlikely the estate type, and that most of the longhouses are located along the rivers, the concept and location of service centres will roughly be as follows:-

- a) Service centres will have comprehensive function to cater for such requirements as combining the services of agricultural extension, education and research; provision of marketing, processing and storage facilities; provision of credit; transport arrangements together with the building of schools, health clinics, shops, utilities etc.
- b) Service centres can be better located in the areas near the road and river crossings, since rivers form the common communication means for river basin groups of longhouse settlements.

FIG. 3-1 PRELIMINARY SELECTED FEEDER ROADS



4. Basic Policy and Work Schedule for Further Study

4.1 General

Based on the survey in Phase II, the detailed engineering study and economic/transportation study will be carried out in order to recommend the most adequate road development plan by a further analysis, final economic evaluation and a comprehensive appraisal of the project.

4.2 Engineering Study

4.2.1 Alternative Studies

In order to recommend the best alternatives, the alternative studies for alignment, pavement, bridge structure, ferry facility, stage construction, construction method and plan of feeder road will be conducted.

(1) Route Alignment

For the purpose of establishing the best route from the technical point of view, a detailed study of the topography, soil conditions, hydrological conditions, availability of construction materials, construction and maintenance costs will be carried out.

(2) Pavement

According to the volume and character of traffic, the cost and availability of materials and the climates of project area, the gravel road, the crushed rock road, the penetration macadam road and the hot-mixed asphalt road will be studied.

(3) Ferry Facilities

For the mode of crossing Eatang Earam, the comparative study concerning the bridge structure and ferry boat, will be carried out. Since the difference of water level between rainy season and dry season is big, the ferry facilities must be designed specially taking into consideration of this aspect.

4.2.2 Preliminary Engineering Design

Based on the engineering analysis, the preliminary engineering design will cover the following items:

- (1) Route alignment design
- (2) Pavement design
- (3) Design of major structures
- (4) Design of ferry facility
- (5) Feeder road plan.

4.2.3 Construction Cost Estimate

The project cost estimates will cover the following items:

- (1) Land acquisition and compensation cost
- (2) Construction cost
- (3) Maintenance cost
- (4) Foreign currency portion and local currency portion
- (5) Economic cost and financial cost

4.2.4 Construction Method

In order to recommend the best construction method in the swampy areas, the following alternatives will be studied in the Phase II:

- (i) Removal and replacement method
- (ii) Surcharge method (preload method)
- (iii) Vertical and drain method

4.2.5 Construction Schedule

(1) Implementation plan will cover the following items:

(a) Stage Construction

The stage construction will be studied and recommended in order to encourage the effect of the initial cost investment, taking into consideration and the factors such as physical conditions, priority of regional development and construction difficulties.

The study of the stage construction will be carried out both on the construction sections and component of cross section for road.

As for the construction section of the proposed road, the priority of construction section will be determined by considering the technical and economic viabilities, and the role of the trunk road.

From the view point of component of cross section for road, the following stage construction will be proposed:

- (i) Pavement
- (ii) Bridge structures

(b) Executive method

(c) Implementation plan and schedule

(2) Maintenance Plan

Maintenance work and managing system of the project road will be made clear and the maintenance plan will be proposed.

4.3 Economic/Transportation Study

Major work items to be analyzed in the Phase II Study will be the followings:

(1) Refinement of Traffic Forecast;

Whole process of traffic forecast will be refined based on the additional data obtained in the Field Survey Period.

(2) Detailed Evaluation of Agricultural Development Potentials;

(3) Preliminary Impact Study for the Case of Miri/Bintulu Road;

(4) Economic Evaluation of the Project;

The economic viability of the project will be tested and determined by comparing the costs with the benefits. Alternatives for economic evaluation will be identified including stage construction and introduction of ferry. The results will then be expressed in terms of internal rate of return, cost-benefit ratio and optimum investment timing.

Benefits will include those due to the reduction of transportation cost and travel time and net value added of any agricultural development. However as the intangible benefits due to the implementation of the Project is expected to be rather great, they will be analysed and described in details.

(5) Comprehensive Appraisal of the Project

The project will be appraised comprehensively from engineering, socio-economic and financial aspects and the followings will be recommended:

- (a) The most adequate road plan including all the details of geometric features and proposed development concepts regarding feeder roads, service centres, agriculture and other economic activities in the influence area;**
- (b) Implementation schedule including financial requirements by year;**
- (c) Construction/maintenance method;**
- (d) Scope of work for detailed engineering which will be a basis of drafting Terms of Reference for detailed engineering.**

4.4 Work Schedule

Work schedule of Phase II study is shown in the following Table.

Work Item	Year, Months	1979											
		2	3	4	5	6	7	8	9	10	11	12	
Field Reconnaissance and Survey		□											
Discussion of Progress Report			□										
Preliminary Engineering Design/Economic Analysis				□	□	□	□	□					
Alternative Study				□	□								
Preliminary Engineering Design				□	□	□							
Construction Cost Estimate						□	□	□					
Construction Schedule							□	□					
Refinement of Development Potentials and Traffic Forecast				□	□								
Calculation Benefit				□	□								
Economic Evaluation							□	□					
Comprehensive Appraisal of the Project								□					
Submission of Draft Final Report									▼				
Discussion of Draft Final Report										□			
Preparation of Final Report											□		
Submission of Final Report												▼	

Appendix A. Summary Record of Survey Activities

Date

Activities

- Feb. 4, Sun. - Arrival of Mr. Kataoka, Mr. Kaneko, Mr. H. Endo, Mr. Tomiyasu, Mr. M. Endo, Mr. Ohta at Kuala Lumpur from Tokyo
- 5, Mon. - Visit to the Embassy of Japan by Mr. Kataoka, Mr. Kaneko, Mr. H. Endo, Mr. Tomiyasu, Mr. M. Endo, Mr. Ohta.
- Meeting with Malaysian Government at BPU attended by the members mentioned hereabove and Mr. Ozawa
 - Visit to PWD Office in Kuala Lumpur
- 6, Tue. - Arrival of the Team at Kuching from Kuala Lumpur
- Visit to SPU, PWD, Land and Survey Dept. by the Team
- 7, Wed. - Visit to DID, Forest Dept., Agriculture Dept., PWD by the Team
- 8, Thu. - Visit to Agriculture Dept., SPU, CHL, Land and Survey Dept. by the Team
- 9, Fri. - Inspection of the Kuching Serian Trunk Road by the Team
- 10, Sat. - Arrival of the Team at Miri from Kuching
- Visit to PWD, Miri by the Team
 - Inspection of the Beluru Road by the Team

- 11, Sun. - Inspection of the Trunk Road from Miri to Kuala Baram and the ferry facilities in Kuala Baram by the Team
- 12, Mon. - Arrival of Mr. Kataoka and Mr. Kaneko at Singapore from Miri
- Visit to PWD, Miri, Land and Survey Dept., Miri by Mr. H. Endo and Mr. Ohta
 - Arrival of Mr. Tomiyasu at Marudi from K. Baram by express launch
- 13, Tue. - Visit to Agriculture Dept., Miri by Mr. H. Endo
- Arrival of Mr. Tomiyasu at Long Lama from Marudi by express launch
 - Cost survey of construction machinery at Tractor Malaysia Co., and United Motors Co., in Miri by Mr. H. Endo and Mr. T. Ohta
 - Visit to DID, Miri by Mr. Ohta
- 14, Wed. - Instruction of boring points by Mr. Tomiyasu in Long Lama
- Visit to Holly Stone Quarry and Betch Stone Quarry by Mr. Tomiyasu
 - Visit to MRCU-10 and Batu Niah Quarry by Mr. H. Endo and Mr. Ohta
 - Crushed stone sampling at Batu Niah Quarry by Mr. H. Endo

- 15, Thu. - General reconnaissance along the proposed road by helicopter by Mr. H. Endo, Mr. M. Endo, Mr. Ohta, Mr. Joseph Au (Agriculture Department, Miri)
- Arrival of Mr. Iwata at Kuala Lumpur from Tokyo
 - Soil sampling in Long Lama areas by Mr. Tomiyasu
- 16, Fri. - Field reconnaissance along the proposed road by helicopter by Mr. H. Endo, Mr. Tomiyasu, Mr. Ohta
- Visit to PWD Office by Mr. Kataoka and Mr. Iwata
 - Visit to the Embassy of Japan by Mr. Kataoka and Mr. Iwata
 - Instruction of boring points at both bridge sites of S. Apoh and S. Tutoh by Mr. Tomiyasu and Mr. M. Endo
 - Gravel sampling by helicopter in the area of S. Tutoh by Mr. Tomiyasu and Mr. M. Endo
- 17, Sat. - Field reconnaissance along the proposed road by helicopter by Mr. H. Endo, Mr. Tomiyasu, Mr. Ohta
- Arrival of Mr. Iwata at Kuching from Kuala Lumpur
 - Arrival of Mr. Kataoka at Miri from Kuala Lumpur
 - Reinstruction of boring points in Long Lama by helicopter by Mr. Tomiyasu
 - Investigation of the major rivers by speed boat by Mr. Ohta

- 18, Sun. - Preparation for field reconnaissance by Mr. H. Endo, Mr. Ohta
- 19, Mon. - Field reconnaissance from Sg. Tinjar to Loagan Bunut by Mr. H. Endo, Mr. Ohta with surveyors of Land and Survey Dept.
- Visit to PWD and SPU by Mr. Iwata
 - Arrival of Mr. Tomiyasu and Mr. M. Endo at Limbang from Miri by air
 - Courtesy call on PWD, Limbang by Mr. Tomiyasu and Mr. M. Endo
 - Soil sampling at Mile 24 of Ng. Medanit Road by Mr. Tomiyasu and Mr. M. Endo
- 20, Tue. - Field reconnaissance from Loagan Bunut to Sg. Teru by Mr. H. Endo, Mr. Ohta with surveyors
- Visit to SPU and PWD by Mr. Iwata
 - Discussion with Sarawak Airport Master Plan Study Team regarding the Limbang Airport development by Mr. Iwata
 - Instruction of boring points at the bridge sites of S. Medanit and S. Limbang by Mr. Tomiyasu and Mr. M. Endo
 - Soil sampling at R. Pakaton and gravel sampling at S. Limbang by Mr. Tomiyasu and M. Endo
- 21, Wed. - Field reconnaissance from Sg. Teru to Batam Baram by Mr. H. Endo, Mr. Ohta with surveyors
- Visit to SPU, Medical Dept. and Agriculture Dept. by Mr. Iwata

- Reconnaissance to Selidong limestone area by speed boat by Mr. Tomiyasu and Mr. M. Endo
- 22, Thu. - Field reconnaissance at Batan Baram crossing point by Mr. H. Endo, Mr. Ohta with surveyors
- Preparation of working papers by Mr. Iwata
 - Visit to timber camp of Limbang Trading Co., by Mr. Tomiyasu and Mr. M. Endo
 - Arrival of Mr. Tomiyasu and Mr. M. Endo at Miri by air from Limbang
- 23, Fri. - Field reconnaissance to Sg. Temala crossing point by long boat by Mr. Kataoka, Mr. H. Endo, Mr. Ohta with surveyors
- Visit to SPU and Land and Survey Dept. by Mr. Iwata
 - Arrival of Mr. Iwata at Miri from Kuching
 - Visit to PWD, Miri by Mr. Iwata
- 24, Sat. - Field reconnaissance to Sg. Apoh crossing point by long boat by Mr. Kataoka, Mr. H. Endo, Mr. Ohta with surveyors
- Arrival of Mr. Kataoka, Mr. H. Endo, Mr. Ohta at Marudi from Sg. Apoh
 - Arrival of Mr. Iwata and Mr. M. Endo at Marudi from Miri by air
- 25, Sun. - Arrival of Mr. Kataoka, Mr. H. Endo and Mr. M. Endo, Mr. Ohta at Miri from Marudi by river
- Visit to Dareo area by MAS flight by Mr. Iwata

- 26, Mon. - Arrival of Mr. Kataoka, Mr. H. Endo, Mr. Ohta to Limbang from Miri by air
- Visit to PWD, Limbang by Mr. Kataoka, Mr. H. Endo, Mr. Ohta
 - Visit to District Office and Agriculture Dept., Marudi by Mr. Iwata
 - Arrival of Mr. Iwata at Miri from Marudi by air
 - Visit to Betch Quarry Head Office in Miri by Mr. Tomiyasu
 - Cost survey on construction machinery of Tractor Malaysia Co., and United Motors Co., in Miri by Mr. H. Endo
 - Interview with PWD Miri regarding the operating ratio of construction equipments by Mr. H. Endo
- 27, Tue. - Field reconnaissance of Limbang - N. Medamit Road by Mr. Kataoka, Mr. H. Endo, Mr. Ohta
- Departure of Mr. Kataoka from Limbang to Miri
 - Visit to Land and Survey Dept. and PWD, Miri by Mr. Iwata
 - Soil sampling near the proposed bridge site at S. Tinjar by Mr. M. Endo
- 28, Wed. - River survey between Limbang - N. Medamit by Mr. H. Endo, Mr. Ohta
- Visit to Resident Office, Medical Dept. and Forest Dept., Miri by Mr. Iwata
 - Survey on taxation system at Customs Office, Miri by Mr. M. Endo

- March 1, Thu. - Arrival of Mr. H. Endo, Mr. Ohta from Limbang to Miri
- Visit to Niah District Office and Niah Cave by Mr. Iwata
 - Reconnaissance trip to Bintulu from Miri via land by Mr. Kataoka
 - Seismic prospecting test in the hill area near Miri by Mr. Tomiyasu and Mr. H. Endo and Mr. Ohta
- 2, Fri. - Visit to Land and Survey Dept. by Mr. H. Endo
- Arrival of Mr. H. Endo and Mr. M. Endo at Kota Kinabalu from Miri
 - Visit to Forest Dept. by Mr. Iwata
 - Reconnaissance trip to Bintulu along the Miri-Bintulu Trunk Road by chartered cessna by Mr. Iwata, Mr. Tomiyasu and Mr. Ohta
 - Reconnaissance trip to Miri from Bintulu via land by Mr. Kataoka
- 3, Sat. - Visit to trading companies of construction equipments in Kota Kinabalu by Mr. H. Endo and Mr. M. Endo
- Inspection of west coast new road under construction by Mr. H. Endo and Mr. M. Endo
 - Visit to Forest Dept. and Agriculture Dept., Miri by Mr. Iwata
 - Arrival of Mr. Iwata at Limbang from Miri

- 4, Sun. - Arrival of Mr. H. Endo, Mr. M. Endo from Kota Kinabalu to Miri
- Departure of Mr. Kataoka, Mr. M. Endo from Miri to Kuching
- Arrival of Mr. Iwata at Miri from Limbang
- 5, Mon. - Arrival of Mr. H. Endo, Mr. Iwata, Mr. Tomiyasu and Mr. Ohta from Miri to Kuching
- Visit to SLDB, Miri by Mr. Iwata
- 6, Tue. - Visit to SPU by Mr. Kataoka, Mr. H. Endo, Mr. Iwata, Mr. Tomiyasu, Mr. H. Endo, Mr. Ohta
- Visit to PWD by Mr. Iwata
- Visit to DID by Mr. Ohta
- 7, Wed. - Visit to PWD HQS. by Mr. Kataoka and Mr. H. Endo
- Visit to Agriculture Dept. HQS. by Mr. Iwata
- 8, Thu. - Preparation of Progress Report
- Visit to DID by Mr. Ohta
- 9, Fri. - Preparation of Progress Report
- Visit to Land and Survey Dept., Agriculture Dept. and Police by Mr. Iwata
- Visit to dealers of construction machines by Mr. M. Endo
- 10, Sat. - Preparation of Progress Report

Appendix B Agencies Contacted

Economic Planning Unit

- | | |
|-------------------------|----------------------------------------|
| Mr. Basha I. bin Nordin | - Director (Infrastructure) |
| Miss Leong So Seh | - Assistant Secretary (Infrastructure) |
| Mr. Ismail | |

Highway Planning and Public Transport Unit

- | | |
|-----------------------|------------|
| Mr. Zaidan Hj. Othman | - Director |
|-----------------------|------------|

State Planning Unit

- | | |
|---------------------------|---------------------------------|
| Mr. Amiruddin bin Hussain | - Director |
| Mr. Teo Tien Hiong | - Principal Assistant Secretary |

Public Works Department, Headquarters

- | | |
|--------------------------|--------------------------------|
| Mr. Chai Bun Poh | - Director |
| Mr. Fung Chee Ping | - Deputy Director |
| Mr. Michael Parker | - Assistant Director |
| Mr. Victor Voon Teck Ann | - Chief Road Engineer |
| Mr. Wong Chin Hook | - Executive Engineer (Roads) |
| Mr. Fong Lee Chee | - Works Superintendent (Roads) |
| Mr. Dennis Chua | - Chief CML |

P.W.D., Stabar Quarry

- | | |
|---------------------------|------------|
| Mr. Othman bin Abg. Jajol | - Overseer |
|---------------------------|------------|

P.W.D., Miri

- | | |
|----------------------|---------------------------------|
| Mr. Chung Sie Hyuang | - Divisional Engineer |
| Mr. Chen Chee Nay | - Executive Engineer (Civil) |
| Mr. Tan Seng Wee | - Assistant Divisional Engineer |
| Mr. Lee Chim Lee | - Mechanical Section |

P.W.D., Limbang

- | | |
|---------------|---------------------------------|
| Mr. Tan | |
| Mr. Sap Ambau | - Assistant Divisional Engineer |

P.W.D., Marudi

- | | |
|--------------------------|-----------------------------|
| Mr. Jack Chan Ching Fong | - Officer-In-Charge, Marudi |
| Mr. Woo Chun Seng | - Storekeeper |

P.W.D., Bintulu

- | | |
|-------------------|----------------------|
| Mr. Mohidin Ishak | - Engineer-In-Charge |
|-------------------|----------------------|

P.W.D., Central Material Laboratory

- | | |
|------------------|------------------------------------|
| Mr. Dennis Chua | - Sg Exc. Engineer (Materials) |
| Mr. Foong Ka Cha | - Works Superintendent (Materials) |

P.W.D., MRCU10

- | | |
|--------------------------|------------------------|
| Mr. Kong Bun Hin | - Resident Engineer |
| Mr. Vincent Yong Hock Oi | - Engineering Surveyor |

P.W.D., MRCU12

- | | |
|-------------------|---------------------|
| Mr. Then Joon Hua | - Resident Engineer |
|-------------------|---------------------|

P.W.D., Niah Quarry Site

- | | |
|----------------------------------|--------------------------|
| Abg. Dawi bin Abg. Hj. Kushiari- | Assistant Quarry Manager |
|----------------------------------|--------------------------|

Agriculture Department, Headquarters

- Mr. Joseph Kong - Director
- Mr. Johanes Dian Anyie - Agricultural Economist

Agriculture Department, Soil Laboratory

- Mr. Lia Chin Pang - Senior Soil Surveyor

Agriculture Department, Miri

- Mr. Wong Leong Do - Divisional Agricultural Officer

Agriculture Department, Marudi

- Mr. Danson Bura - Assistant Agricultural Officer

Forest Department, Headquarters

- Mr. Joseph Yong - Director
- Mr. Abang Nuas - Deputy Director
- Mr. Paul P.K. Chai - Forest Botanist

Forest Department, Miri

- Mr. Haji Sulaiman - Section Forest Officer
- Mr. Joseph Au

Drainage & Irrigation Department, Headquarters

- Mr. Foong Ka Nim - Director
- Mr. Yasuzaga Kolori - Specialist (Colombo Plan)
- Mr. Tserng Geong Farn - Hydrologist

Land and Survey Department, Headquarters

Mr. Haji Borhan Sablo Mohamad .. Director
Mr. Ambrose Foo .. Deputy Director
Mr. Sim Teck Chian .. Assistant Director
Mr. Chia Pit Chung .. Planning Officer

Land and Survey Department, Miri

Mr. Chai Sin Fatt .. Chief Surveyor
Mr. Edward Ngui - Planning Officer

Geological Survey Department

Mr. Chen Shick Pen - Geologist

Medical Department, Kuching

Dr. P.K. Roy

Medical Department, Miri

Mr. Bujang Mohd. Nens

SLDB, Miri

Mr. Mazlan Ahmad - Resident Manager
Mr. Robert Ho

Resident Office, Miri

Mr. Anthony Druce .. A.O./P.D.

District Office, Niah

Mr. George Guan Guri - District Officer

District Office, Marudi

Mr. Daniel Law

S.A.O. Office, Long Lama

Mr. Ding Ibau

- S.A.O.

S.A.O. Office, Ng. Medamit

Mr. Simón Awang S.

Sarawak Airport Development Study Team

Mr. Patrice Hardel

- Manager, Planning and Environment, Aeroport de Paris

Miss Wong Sok Kim

- Senior Management Consultant, MIDF Industrial Consultants Sdn. Bhd.

Appendix C List of Publication and Data Obtained

Economy

1. Agricultural Statistics of Sarawak, 1977
- Department of Agriculture -
2. Production Data for Sarawak Agriculture, Part I Major Crops, 1971
- Department of Agriculture -
3. A Social and Economic Survey of the Engkilili Extension Region,
1979
- Department of Agriculture -
4. Annual Report, 1978
- Department of Agriculture, Baram District -
5. Soils and Soil Suitability of the Limbang Valley, Sarawak
- M + R International -
6. Annual Report of the Research Branch, 1976
- Department of Agriculture -
7. Fish Culture
- Borneo Literature Bureau -
8. Pepper Cultivation and Improvement
- Department of Agriculture -

9. Extension/Seed Project, 1976
- Government of Malaysia -
10. Seminar on Water Management for Agricultural Development,
1977 (Draft Report)
- Ministry of Agriculture and Community Development,
Sarawak -
11. The Social Organisation of the Baluy Kayan, 1973
- St. Catherine's College -

Engineering

12. Soils of Gunung Mulu National Park
- Agriculture Department -
13. Test Report on Syarikat Betch Quarry
- Syarikat Betch Quarry Sdn. Bhd. -
14. Testing of Gravel
- P.W.D., 5th Division -
15. Hydrological Year Book 1969 and 1975
- Drainage and Irrigation Department -
16. Term Construction for shipping of general cargo from Kuala
Baram - Marudi and Marudi to Kuala Baram
- J.K.R., Miri -

17. Term contract for shipping of general cargo from Miri to Bintulu and Bintulu to Miri
- J.K.R., Miri -
18. Schedule of Tender R.C. Pipe
- J.K.R., Miri -
19. Circular Memorandum
- J.K.R., Miri -
20. Average Monthly wholesale prices for steel and cement, January 1978
- J.K.R., Miri -
21. Price table of Armco Culvert
- J.K.R., Miri -
22. List of standard rate for cultivation in all five Divisions
- J.K.R., Miri -
23. The table of Heavy Earth Moving Equipments in Fourth Division
- J.K.R., Miri -
24. Monthly Standard Tax Deductions
- J.K.R., Miri -
25. Mechanical Road Construction unit for State
- J.K.R., Kuching -

