MALAYSIA

FEASIBILITY STUDY FOR BELURU/LONG LAMA/LIMBANG TRUNK ROAD CONSTRUCTION PROJECT

PROGRESS REPORT (PHASE 1)

AUGUST 1978

JAPAN INTERNATIONAL COOPERATION AGENCY

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TABLE OF CONTENTS

1. Introduction

The Feasibility Study on the Beluru/Long Lama/Limbang Road Construction Project is being carried out by the Survey Team of Japan International Cooperation Agency (JICA) for the Government of Malaysia on behalf of the Japanese Government based on the Scope of Work agreed by the Economic Planning Unit and JICA on the date of July 21st. 1978.

The purpose of this Study is to determine the engineering and economic feasibility of constructing a part of the Second Trunk Road System as outlined below:

(1) Improvement, especially with regard to bitumen-surfacing of the section from the junction of Miri/Bintulu Road to the Sg. Tinjar via Beluru now under construction; 33.2 miles (53.5 kms.)

(2) New construction of the section between the Sg. Tinjar and Nanga Medamit via Long Lama; 86 miles (137 kms.)

(3) Upgrading of the existing Limbang - N. Medamit Road; 25.5 miles (41 kms.)

(4) Provision of bridges and/or ferries where necessary

The JICA Survey Team arrived at Malaysia on July 9th and submitted the Inception Reports for presentation and discussion to the Steering Committee held on July 12th. The Survey Team then commenced the Phase I Field Survey according to the scope of consulting services explained in the Inception Report.

The main purpose of the Progress Report is to present

(1) the works done by the Survey Team during the Phase I survey period,

(2) the major findings and the preliminary results obtained from the various field surveys conducted, and

(3) the preliminary results of selecting most likely alignments of the proposed road for the purpose of aerial photographing with 1:10,000 scale which must be completed before rainy season starts.

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 Departments and Agencies who kindly provided us necessary assistance and cooperation in executing the Study throughout the survey period.

2. Outline of the Conducted Field Surveys

2.1 Socio-economic Survey

2.1.1 General

Socio-economic survey has been carried out by way of:

(a) interviewing with relevant Government departments and agencies as well as private organizations;

(b) collecting existing publication, reports and data;

(c) conducting field reconnaissance to the areas where relevant activities are ongoing or major projects are currently being proposed;

(d) conducting necessary field surveys when and where information required do not exist.

Activities done by the Survey Team are outlined in Appendix A.

2.1.2 The Areas Visited

The following areas were visited by the Survey Team during the survey period in the Study Area:

(a) Miri-Beluru-Bekenu-K.Baram areas by road where the roads exist or under construction;

(b) Limbang-N.Medamit areas by road;

(c) K.Baram-Marudi-Long Lama-Long Laput areas by expross/ longboats;

(d) the areas along the proposed road by chartered aircraft;

(e) G.Mulu, Logun Bunut and Long Lama areas by chartered helicopter.

2.1.3 Contacted Agencies

The Survey Team visited various Government agencies and private organization to collect necessary information and data and to hold discussion to have their opinions regarding the impacts due to the implementation of the proposed road. The names of the agencies together with persons contacted by the Survey Team are contained in Appendix B.

2.1.4 Collected Data and Information

Data and information collected regarding the socio-economic activities in the Study Area being listed in Appendix C are as follows in main;

1) Overall national and State's economic indicators;

   These were mainly obtained from Department of Statistics and SPU.

2) Population; Apart from overall population figures efforts were taken to know the population distribution in the Study Area. Estimated figures or basis for estimate of population for each town/kampong were obtained from various Government departments such as District Offices, Medical Departments, Police Office and Information Offices, although the figures show some discrepancies and yet to be elaborated.

3) Imports and Exports; Unpublished statistics of volume/tonnage of major import and export commodities for each port of Miri, Limbang and Marudi were obtained from Department of Statistics, Customs Offices and Marine Departments.

4) Tourism; Reliable and comprehensive data regarding the tourism activities in the Study Area are scarce. Preliminary visitor survey on Niah National Park is now underway by National Park Section of Forest Department, Miri. Information on the tourism in the Baram River areas was obtained to some extent by interviewing with a travel agent based in Marudi and Long Lama. A large-scale scientific survey on G.Mulu National Park is being carried out by the British Survey Team and Forest Department whom the Survey Team visited at their camp to hold discussion particularly with regard to the possible and proper alignment of the proposed road section passing through the National Park. Information on Logun Bunut was hardly obtained during the survey period. Discussion with the consultants to be selected soon to carry out the proposed Tourism Master Plan Study for Sarawak will have to be hold during the Phase II Field Survey.

5) Agriculture; Information and data of agricultural activities in the Study Area were obtained by way of extensive interview with relevant Government departments and agencies and collecting the available statistics and records. Besides the areas visited by the Survey Team for field survey to have on-the-spot information are as follows: Beluru, Marudi, Long Lama, Long Laput, N.Medamit, Kpg. Ukong and other areas in Limbang Valley.

Agricultural statistics are generally available but the figures of production, cultivated area, harvested area etc. are only those of Districts and are not broken down into those of more detailed area. Therefore the distribution of the agricultural activities will have to be estimated by the Survey Team.

Feasibility Study on the Limbang Valley Development has just started by the Belgium Survey Team, requiring about two years before its completion. Although any detail information on the said project is not available, it can be said the Limbang Valley is the only large area with suitable flat land for padi cultivation and this area would also be suitable for swamp rice production.

6) Forestry; Statistics regarding the production of logging activities in the Study Area are better prepared by Forest Department. Two timber camps being operated by Limbang Trading and Sarawak Plywood in Lubok Lalang and in Sg. Temala respectively were visited and interviewed by the Survey Team to obtain the detailed information of their present timber activities and possible impacts on their future activities due to the completion of the proposed road.

7) Other Industries; Information on the present activities of fishery, animal husbandary, mining, processing industry was also obtained to some extent from relevant Government Departments.

8) Town Development; Preliminary discussion was hold with Land and Survey Department regarding the development of Long Lama and new communities along the proposed road in connection with the construction of the proposed road. Field reconnaissance was made in Long Lama area to find the availability of flat land for possible expansion. Preliminary investigation was also made to other potential areas good for developing new settlements particularly to the areas where the proposed road will cross the major rivers.

9) Interview Survey on the Proposed Road: This survey aims at obtaining the opinions of people living in Limbang, Long Lama or Miri area regarding the construction of the proposed road. On the supposition that the proposed road had been constructed, the following items were asked:

- whether or not the development/economic activities will be accelerated, (Ans. Not at all/to some extent/significant):
- places they would like to visit, (Miri, Long Lama, Beluru, Logun Bunut, Bintulu, Niah, G. Mulu, Limbang);
- for what purpose and by what mode of transport;
- characteristics of interviewee; (sex, age, occupation, race, marital status, vehicle/boat ownership).

The survey was carried out in Limbang, Long Lama and Miri including Beluru and samples obtained were 50, 65 and 65 respectively.

2.2. Transport Surveys

Transport surveys conducted during the Phase I field survey covered the modes of road and river in main and those of air and coastal shipping to a lesser extent.

2.2.1. Road Transport Survey

The following surveys regarding the road transport in the Study Area were carried out:

- traffic count survey
- road-side interview survey including O-D survey
- interview survey with bus/truck operating companies
- transportation cost survey

1) Road Traffic Survey: PWD has conducted traffic count survey on major road sections twice a year since 1970. This survey covers 24 hours over a whole week which would provide reliable basis of estimating ADT, hourly variation and weekly variation of the traffic as well as vehicle composition for each year. The latest survey was made for the first half of 1978. In order therefore mainly to know the characteristics of the existing road traffic on the proposed road, the following three survey stations of which locations are shown in Figure 2.1 were selected for traffic count and road-side interview.

Station No.	Name of Station	Survey Period
1.	Junction of Miri/Bintulu Road and Bekenu Road	July 27(Thu.), 28(Fri.) 7.00a.m. - 5.00p.m.
2.	Junction of Baluru Road and Bukit Peninjau Road	July 27(Thu.), 28(Fri.) 7.00a.m. - 5.00p.m.
3.	Junction of Limbang/ N. Medamit Road and Kubong	Aug. 1(Tue.), 2(Wed.) 7.00a.m. - 5.00p.m.

In these surveys the vehicle types were divided into nine: passenger car, taxi, van/pick-up, medium truck, heavy truck, truck trailer, bus, motor cycle and bicycle.

In road-side interview survey the following items were asked to the drivers by way of stopping the vehicles.

- vehicle type
- vehicle model
- vehicle age
- origin of trip
- destination of trip
- trip purpose
- capacity
- number of passengers } for passenger vehicle
- loading capacity
- type and weight of commodities } for truck
- average travel time

Number of sample obtained during the survey period were 405 at survey station 1 and 216 at survey station 2 with respective sample rate of 52.5 percent and 88.2 percent. At survey station 3, 390 samples were obtained with a sample rate of 96.3 percent.

2) Interview Survey with Bus/Truck Operating Compaines: Interview was also made with major bus/truck operating companies to supplement the results of the road traffic survey mentioned hereabove.

3) Transportation Cost Survey: Necessary data and information were obtained to estimate the operating cost of various types of vehicles by way of interviewing with agents, garages, transport compaines, insurance companies etc. Cost data of truck trailer of which capacity exceeds

20 tons is yet to be obtained because such trucks for the purpose of transporting logs do not exist in Sarawak at present moment but only in Sabah.

2.2.2. River Transport Survey

Any comprehensive survey on river transport in the Study Area has not been carried out, although the river transport has been playing an important role since years. River transport survey conducted covers the followings:

- passenger traffic survey moving by express launch between K. Baram and Marudi and between Marudi and Long Lama
- interview survey for other vessel/longboat operators
- transportation cost survey.

1) Passenger Traffic Survey Moving by Express Launch:

The express launches being operated twice and once a day for each direction between K. Baram and Marudi and between Marudi and Long Lama respectively are the only mode of mass-transit in the areas along the Baram River. All the passengers of seven launches between K. Baram and Marudi were interviewed during the period of August 5 (Saturday) through August 8 (Tuesday) and those of 11 launches between Marudi and Long Lama during the period of August 6 (Sunday) through August 12 (Saturday) were interviewed on the express boat by asking them the following items:

- origin and destination of trip
- trip purpose
- transportation means before boading and after leaving a ship
- average travel time
- passenger characteristics ... sex, age, occupation, race.

Figure 2.1 shows location of survey station. Samples obtained from this survey were roughly 350 and 400 for survey station 4 (K. Baram – Marudi) and survey station 5 (Marudi – Long Lama) respectively with approximate sample rate of 70 to 80 percent.

As of the number of passengers travelling by express launch, an additional survey was carried out by counting the tickets sold at the relevant shipping companies to know the level of ADT, weekly and monthly variation of the passenger traffic.

2) Interview Survey for Other Vessel/Longboat Operators:

As it was observed that considerable number of different types of ships are using the Baram River, interview was also made at the wharfs of both Marudi and Long Lama for the drivers/operators of other type of ships than express launch. Survey was carried out for a week from August 6 (Sunday) till August 12 (Saturday) in Marudi and 4 days from August 7 (Monday) till August 10 (Thursday) in Long Lama in which the following items were asked:

- type of ship
- origin and destination
- trip purpose
- number of passengers
- type of commodity carried
- average travel time

Samples obtained were 115 at Marudi and 65 at Long Lama with approximate sample rate of 80 to 90 percent.

3) Transportation Cost Survey: Necessary cost data to estimate operating cost of various types of vessels was obtained by interviewing with shipping companies, drivers/operators of vessels/long boats, agents of equipments etc.

2.2.3. Interview Survey for Passengers Moving by Speed Boat between Limbang and Brunei

Interview survey was carried out at the customs wharf in Limbang for the passengers moving by speed boat between Limbang and Brunei, in order partly to know the level and features of passenger movement between the two places and partly to know the approximate volume of pasenger traffic between Limbang and Miri area via Brunei. The survey was conducted for two days from 7.00 a.m. to 5.00 p.m. of August 1 (Tuesday) and August 2 (Wednesday). The following items were asked:

- origin and destination of the trip
- trip purpose
- transportation means before boarding and after leaving a ship
- average travel time
- passenger characteristics ... sex, age, occupation, race and nationality

Number of samples obtained was 1113 with a sample rate of 80 percent.

Similar type of survey was also carried out for the passengers moving between Limbang and Lawas, though the number is rather limited.

As of the passenger traffic between Limbang and Brunei, reliable statistics were also obtained from Immigration Office.

2.2.4. Coastal Shipping

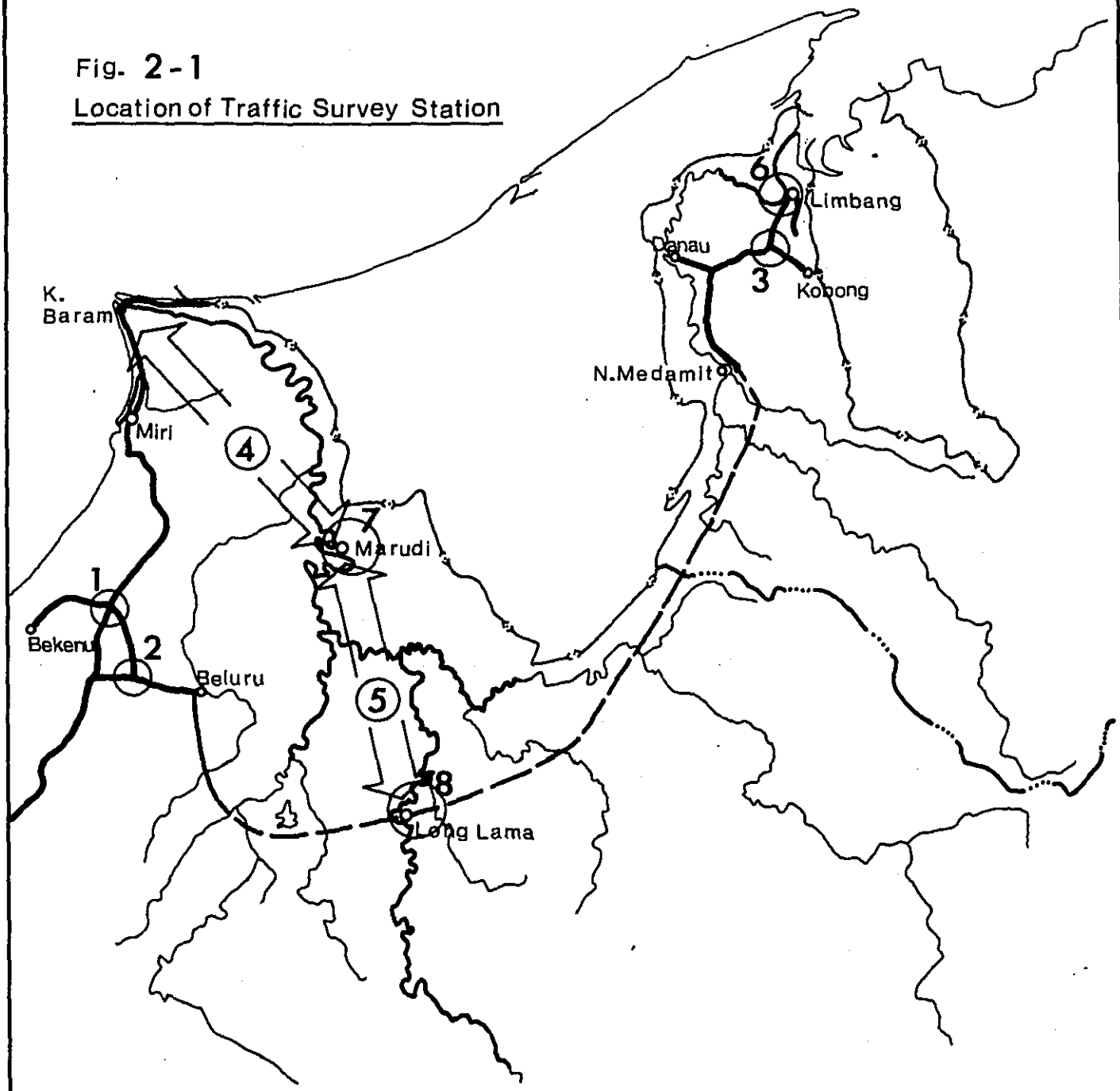
Interview was made with Customs Office, Marine Department and Vessels at the wharf in Marudi. Records and statistics were obtained from the said Government agencies, while the data of vessel operating characteristics from the vessel operators.

2.2.5. Air Transport

Reliable statistics of air passengers were obtained from Civil Aviation Department and MAS Offices in Miri, Limbang and Marudi.

Fig. 2-1

Location of Traffic Survey Station



LEGEND

1 , 2 , 3	.....	Road traffic count and road-side interview
4 , 5	.....	Interview for express launch passengers
6	.....	Interview for passengers moving between Limbang and Brunei
7 , 8	.....	Interview for long boats/motor launch

2.3 Engineering Surveys

During the stay in Sarawak, the Survey Team conducted various engineering surveys at site with the Government's counterparts. The main activities conducted are introduced as follows:

2.3.1 Study on the Possibility of Mapping from the Existing Aerial Photography

The project area is covered by the topographical map of S = 1:50,000 and the aerial photography of S = 1:10,000 & 20,000 in Limbang area and the other area of them of S = 1:25,000. The Survey Team discussed with the Government of Malaysia on the necessity of the topographical map of S = 1:10,000 for the feasibility study at the first meeting. As a result, the topographical map of S = 1:10,000 should be mapped by the survey team. At first, the survey team studied the possibility of mapping from the existing aerial photography, but the survey team concluded that it had better not to use the existing aerial photography because of the following reasons.

a) Course Direction

The existing aerial photography was taken in East & West direction, but the direction of the project road is North & South and S.W. & N.E. This involves the Survey Team to increase the quantity of work i.e. cost and time. For example, more than 300 existing photos with 30 strips are necessary to cover the area against 90 photos with 5 strips in case of the new photography. In case the Survey Team use the existing ones, the works like "Photoprocessing" to print contact prints and positive films, "Aerial Triangulation" and "Orientation" for Plotting shall be three times. Besides the Survey Team have to carry out "Pricking" so many control points on the photos and "Ground Survey" for new control points. It is obvious

that these extra cost and time are higher than the cost for the new aerial photograph.

b) Existing photos do not cover the necessary area

The existing aerial photographies taken in 1976 do not cover the necessary area as Stereo Model, because of the gap between adjacent strips and the less side-lap or lateral overlap.

c) New Logging Road

New logging roads in forest which are significant for this study have been constructed after 1976 when the existing photos were taken.

d) Clouds in some Photos

2.3.2 Preliminary Field Survey

The purpose of this survey is to obtain the latest information along the project route and at the same time to examine the accurate data on the water courses and logging roads to be crossed by the project road.

The topographical map of scale 1:50,000 and aerial photography of scale 1:25,000 provided are covering the project area. For the existing road sections, the Beluru Road, the Beluru/Longan Bunut Road and the Limbang/Ng. Medamit Road, the drawings of plan and profile of scale 1:1,200 are provided.

Under these conditions, the Survey Team conducted five times of preliminary field reconnaissance survey along the project route by chartered aircraft and helicopter. For the existing road sections, the Survey Team conducted the detailed field reconnaissance survey.

The following items were made clear by the survey.

(1) Beluru Road

Total Length : 19 Km (11.8M)

(Miri/Bintulu Road - Intersection of Beluru/Longan Bunut Road : 18 Km (11.2M)

Design Standard : Feeder Road

Surface Condition : Gravel Road (Crusher-run from Niah Quarry Site)

Design and Construction : 1968 - 69

Improvement Plan : Since 1981
Upgrading from Feeder to Trunk Road, Gravel Road.

(2) Beluru/Loagan Bunut Road (Sg. Tinjar)

Total Length : 35.5 Km (22.1M)

Design Standard : Feeder Road (Beluru Intersection - + 9.65 Km (6.0M)
Trunk Road (+ 9.65 Km - + 35.5 Km)

Surface Condition : Gravel Road
(Crusher-run from Niah Quarry Site)

Design and Construction : 1975 - 1980
under construction
+ 0 - + 29 Km (18M) Completed Formation
+ 29 - + 33 Km (20.5M) Earthwork
+ 33 - + 35.5 Km (22.1M) Completed clearing and grubbing

All bridges in this road are designed with permanent bridges, and Sg. Tinjar bridge is preparing to design and construct by the Australia Colombo Plan.

Accordingly, the construction of bridges in this road should be excluded for the study.

(3) Sg. Tinjar/Ng. Medamit Section

This section is new construction one.

Approximate Total Length : 137 Km (85.1M)

Based on the survey results, the appropriate alternative alignments are selected as shown on the Fig.3-3. The detailed description of alternative alignments are indicated in the next chapter. In the topographical map, recent houses, structures and logging roads are not shown. In order to conduct the phase II survey the more detailed topographical map should be provided.

(4) Ng. Medamit/Limbang Road

Total Length : 41.0 Km (25.5M)

Design Standard : Feeder Road

Surface Condition : Gravel Road

Design and Construction : Before 1966

There are 12 bridges of 3.7M width in the road. All bridges except one, Sg. Poyan Bridge which is under construction, are not permanent bridge, but the improvement plan doesn't exist.

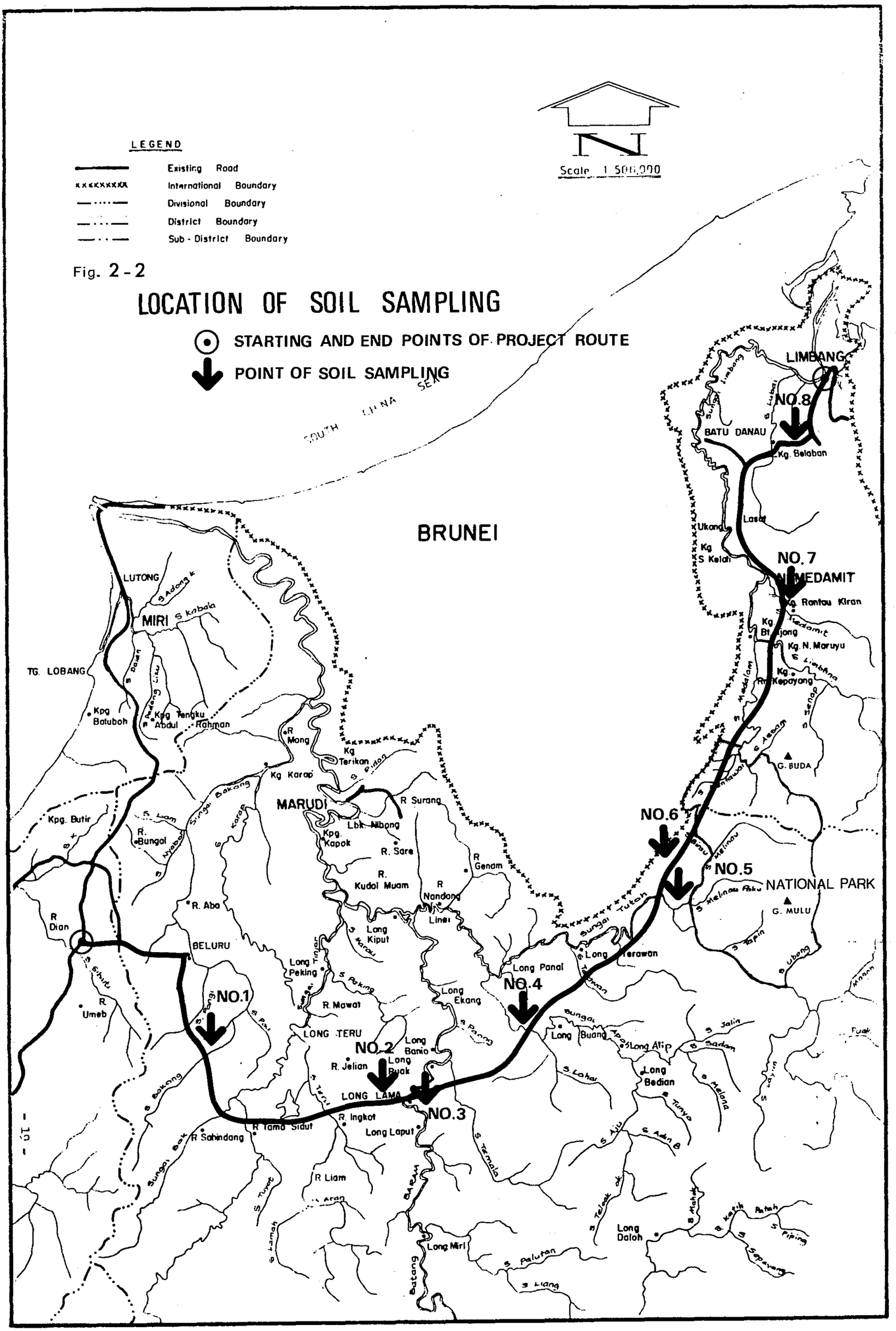

LEGEND
Existing Road
International Boundary
Divisional Boundary
District Boundary
Sub - District Boundary
N
Scale 1:500,000
LOCATION OF SOIL SAMPLING
STARTING AND END POINTS OF PROJECT ROUTE
POINT OF SOIL SAMPLING
SOUTH CHINA SEA
BRUNEI
LIMBANG
NO.8
BATU DANAU
Kg. Belaban
NO.7
MEDAMIT
Kg. Rantau Kiran
Kg. N. Maruyu
LUTONG
MIRI
TG. LOBANG
Kpg Batuboh
Kpg Tengku Abdul Rahman
MARUDI
Kg Karap
Kg Terikan
R Surang
Kpg. Kapok
Kpg. Butir
R. Bungal
R. Aba
R Dian
R Umeb
BELURU
NO.1
LONG TERU
NO.2
LONG LAMA
NO.3
R. Jelian
R. Ingkot
Long Laput
R Sahindang
R Liam
Long Miri
NO.6
NO.5
NATIONAL PARK
G. BUDA
G. MULU
R Genam
R. Sare
R Nandong
R. Kudol Muam
Long Kiput
Long Peking
R. Mawat
Long Ekang
Long Panai
NO.4
Long Terawan
Long Buang
Long Alip
Long Bedian
Long Daloh
Ukong
Kg S Kelai
Lasar

Fig. 2-2

2.3.3 Soils and Material Survey

The Survey Team conducted preliminary field reconnaissance in the project area and selected eight stations to collect soil samples. The soil samplings were accomplished by using a means of Jeep, Helicopter and Long Boat, and sent to the Central Material Laboratory in Kuching for testing.

Physical tests and C.B.R. Test will be informed to the Survey Team by the end of September. The eight stations selected are shown on the fig.2-2.

In selecting the possible material site for the project, the Survey Team visited the Geological Survey Department in Kuching for collecting informations. Moreover, the Survey Team paid an inspection visit to the existing quarry site (Stabar Quarry, Niah Quarry and Batu Gading) and material site in order to know the collecting method and machineries used.

2.3.4 Hydrological and River Survey

Hydrological and river surveys are aimed at establishing a design criteria for bridges and drainage structures on the project road. At the same time, 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.

Since the project area has a typical equatorial heavy rainfall, the special attention should be paid to the frequent short-duration and high-intensity storms.

The rainfall data of past 15 years in the project area were obtained for analysis through the Drainage and Irrigation Department. In addition to these data, the Survey Team conducted actual field survey to investigate the existing hydrological condition, the characteristics of the area effected and the conditions of major existing rivers.

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

The results of field investigation on major rivers are tabulated and presented in next page.

MAIN RIVER SURVEY DATA

No.	Name of River	Station	Nearest Village	Description of Site			
				Width of River	Width of Flood	Stream	Existing Structure
1.	Sg. Salu	*1) +1,000 (0.7M)	R. Peng Barat	9.0m	-	Muddy small stream	Wooden Br. ℓ = 12m b = 3.7
2.	Sg. Teman	*2) +23,500 (14.6M)	R. Kodis	11.8m	50m	Muddy stream	Temporary Timber Bridge New Bridge under construction
3.	Sg. Bakong	*2)+36,000 (22.4M)	R. Jampi	23.6m	-	Muddy stream Gravel on bed Driftwood	Temporary Timber Bridge New Bridge under construction
4.	Sg. Kelulit	*2)+44,000 (27.3M)	-	11.8m	-	Muddy stream	Temporary Timber Bridge New Bridge under planning
5.	Sg. Bok	*2)+49,000 (30.5M)	R. Pagan	26.0m	-	Muddy stream	Temporary Steel Bridge New Bridge under planning
6.	Sg. Tinjar	*2)+53,500 (33.3M)	Long Tulungan	93.0m	200m	Muddy stream	New Bridge under planning by Australian Colombo Plan
7.	Sg. Tru (Teru)	+66,000 (41.0M)	R. Ingkot	15m	45m	Muddy stream Meandering flow	-

*1) 1st Trunk~Beluru (18 Km)

*2) Beluru~S. Tinjar (35.5 Km)

No.	Name of River	Station	Nearest Village	Description of Site			
				Width of River	Width of Flood	Stream	Exising Structure
8.	Batang Baram	+78,500 (48.8M)	Long Lama	150m	250m	Muddy stream	-
9.	Sg. Apoh	+103,500 (64.3M)	R. Akan Ajang	25m	75m	Muddy stream	-
10.	Sg. Tutoh	+133,000 (82.7M)	-	50m	-	Clear stream Gravel on bed	-
11.	Sg. Medalam	+163,500 (101.6M)	-	20m	-	Muddy stream Driftwood	-
12.	Sg. Limbang	+177,500 (110.3M)	R. Pakatom	70m	-	Muddy stream	-
13.	Sg. Medamit	+185.5 (115.3M)	R. Nanga Awang	15.0m	45m	Clear stream Gravel on bed	-
14.	Sg. Lubang	+192,400 (119.6M)	Ng. Medamit	6.0m	400m	Muddy small stream	Steel Girder Br. Wooden floor ℓ = 7.2 b = 3.7
15.	Sg. Polub Merah	+197,500 (122.7M)	Kpg. Lubok Lasas	6.0m	-	Gravel on bed Muddy stream	Steel Girder Br. Wooden floor ℓ = 7.2 b = 3.7
16.	Sg. Mengari	+202,500 (125.9M)	Kpg. Tanjong Liman	6.0m	-	Muddy stream	Steel Girder Br. Wooden floor ℓ = 7.2 b = 3.7

No.	Name of River	Station	Nearest Village	Description of Site			
				Width of River	Width of Flood	Stream	Existing Structure
17.	Sg. Palas	+209,300 (130.1M)	–	3.5m	–	Gravel on bed small stream	Wooden Bridge ℓ= 3.9 b = 3.8
18.	Sg. Berleras	+212,500 (132.1M)	–	2.5m	–	Muddy very small stream	Wooden Bridge ℓ= 3.0m b = 3.7
19.	Sg. Lubai	+213,800 (132.9M)	–	33.0m	–	Muddy stream	Steel Girder Br. (3 spans) Wooden Floor ℓ= 35.2 b = 3.7
20.	Sg. Melaban	+215,750 (134.1M)	–	15.0m	–	Muddy stream	Steel Girder Br. Wooden Floor ℓ= 15.8 b = 3.7
21.	Sg. Bakol	+218,300 (135.7M)	Kpg. Bakol	10.0m	–	Bed Rock Gravel on bed	Steel Girder Br. Wooden Floor ℓ= 12.7 b = 3.8
22.	Sg. Brangas	+219,000 (136.0M)	Kpg. Bakol	9.0m	–	Muddy stream	Steel Girder Br. Wooden Floor ℓ= 9.9 b = 3.7
23.	Sg. Berawan	+220,900 (137.3M)	Kpg. Berawan	15.0m	–	Muddy stream	Steel Girder Br. Wooden Floor ℓ= 17.3 b = 3.7
24.	Sg. China	+225,250 (134.0M)	Limbang	6.0m	–	Muddy small stream	Wooden Br. ℓ= 9.0
25.	Sg. Poyan	+229,000 (142.3M)	Limbang	12.0m	–	Muddy stream	Temporary Bridge New Bridge under construction

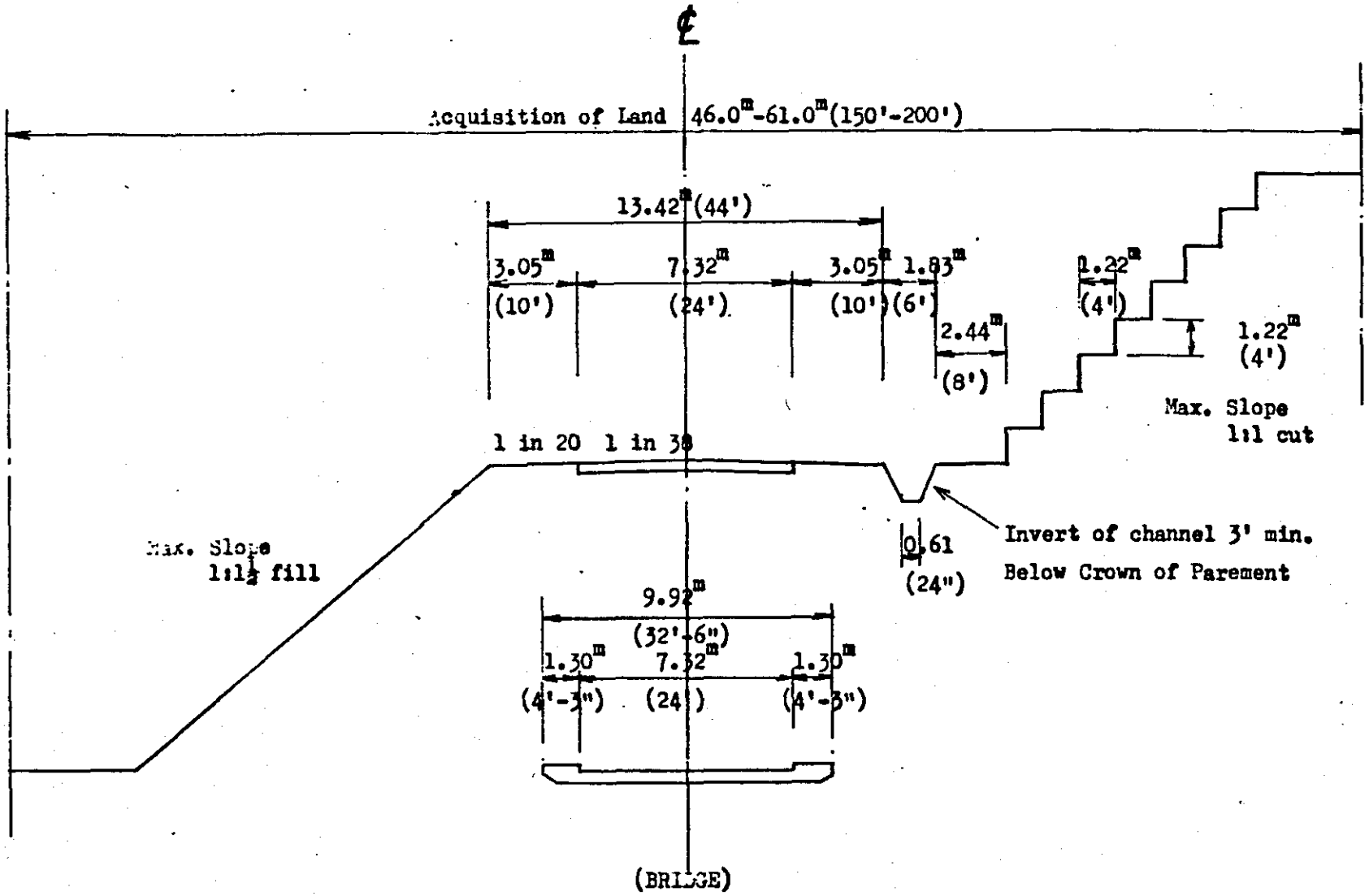
2.3.5. Inventories of Existing Structure and Road

In order to make clear figures of theexisting bridges and roads, the field survey was conducted along the Beluru Road, the Beluru/Longan Bunut Road and the Limbang/Kg. Medamit Road. The design criteria of the existing Beluru Road and Limbang/Kg. Medamit Road are based on the Feeder Road Standard, while that of the Beluru/Longan Bunut Road is based on the Trunk Road Standard. The typical cross section of Trunk Road shows on the following page.

2.3.6. Construction Cost Survey

To obtain the most realistic estimate of construction cost, the recent construction cost survey was conducted. Cost of construction equipment, construction materials and labour cost are separately collected from various sources.

Moreover, land acquisition and compensation cost are collected from Lands and Surveys Department.



TYPICAL CROSS SECTION

3. Preliminary Selection of Alternative Alignments

3.1. Outline of Regional Characteristics

3.1.1. Geological Condition

The Study Area comprizing a part of Miri District and Baram District in 4th Division and Limbang District in 5th Division covers an area of about 10,800 sq. miles. The Study Area can be divided into the following broad physiographic units:-

(a) Alluvial flats and terraces: these areas provide the only significant areas of flat or very gently sloping land, the major areas occuring in the lower Baram-Tinjar river system and in the lower Limbang river. Terraces occupy only small areas, and are generally rather eroded, so that actual areas of flat or very gently sloping land are limited.

(b) The lowlands: these are areas of land between sea level and 300 feet, associated with the more mature topography. Slopes are short and moderately steep and the terrain is generally undulating to rolling. This unit contains a high percentage of the land with agricultural potential.

(c) The uplands: lying between 300 and 600 feet, this unit is more highly dissected, with steep slopes of greater length. River valleys are generally very narrow and often incised and the terrain is hilly. Only very limited areas of land with agricultural potential exist.

(d) Highlands: ranging from 600 feet to a maximum of over 7000 feet in the Tamabu range. This unit is characterised by intense dissection with long very steep slopes, and

deeply incised drainage. The terrain is very hilly to mountainous, and contains virtually no land with agricultural potential with an exception of Baree areas.

There are two major river systems, the Limbang in the north and the Baram in the south and a number of smaller rivers. Most rivers are subject to flash flooding, particularly in their middle and upper reaches which poses problems for the development of their associated alluvium.

The Study Area has a tropical rainy climate which is characterised by constant temperature, humidity and high rainfall. The range of mean annual rainfall over the Study Area is considerable; from about 100 to 250 inches. The area of lowest rain annual rainfall appears to extend in the coastal belt, while the area of highest rainfall lies in the highlands. The annual rainfall in the area along the proposed road range between 100 and 160 inches generally.

In the study area Red-Yellow Podzolic Soils in gently sloping to steep land, Gley Soils in flood plain areas and Peat Soils in present flood plains are observed broadly.

3.1.2. Population and Its Distribution

Population of the Study Area as a whole in 1970 was about 107,000 or about 11.0 percent of Sarawak's total population, while the area is about 10,800 sq. miles or about 22.5 percent of Sarawak's total land.

As is shown in Table 3.1 Miri, Sibuti and Limbang Sub-districts are relatively densely inhabited while for the rest of the areas population density is only about 5 persons per sq. mile.

Table 3.1 Population* of the Study Area, 1970

Sub-district	Area (sq. mls.)	Population	Population Density (Persons/sq. ml.)
Miri	371	35,975	97.0
Sibuti	385	10,483	27.2
Baram	1,881	14,243	7.6
Bakong	2,120	13,036	6.1
Baram Tengah	1,876	7,538	4.0
Baram Ulu	2,638	6,053	2.3
Limbang	381	14,500	38.1
N. Medamit	1,155	5,300	4.6
Total	10,807	107,128	9.9
excluding Miri, Sibuti, Limbang and Baram Ulu	7,032	40,117	5.7
Sarawak	48,050	975,918	20.3

* Preliminary figures only
Source: Annual report and data obtained from District Offices

Table 3.2 shows population of major communities estimated on the basis of various data and information collected during the survey period. Among them Miri is the only town which has been growing at considerably high rate, while the other towns or communities have been growing slightly or stagnating.

Table 3.2 Population* of Major Towns/Communities in the Study Area, 1977-78

Town/Community	Population	Remark
Miri	41,000	-
Limbang	8,000	within the area of 3 mile radius
Marudi	5,000	1,400 of secondary school students included
Long Lama	1,600	770 of secondary school students included
Beluru	600	-
N. Medamit	500	250 of secondary school students included

* Preliminary estimate made by Consultant

Table 3.3 shows population distribution by major river basin. Each river basin was divided into upper area and lower area of the respective river. Upper area covers the upstream areas of the proposed road while lower area covers the downstreams areas. Figure 3.1 illustrates each area together with the location of kampongs. These table and figure indicate roughly 30 percent of the population of Baram and Limbang Districts or 19,000 inhabitants will be more directly benefited due to the completion of the proposed road while the rest will be benefited to a lesser extent.

Fig. 3-1

Major River Basin and Location of Kampong

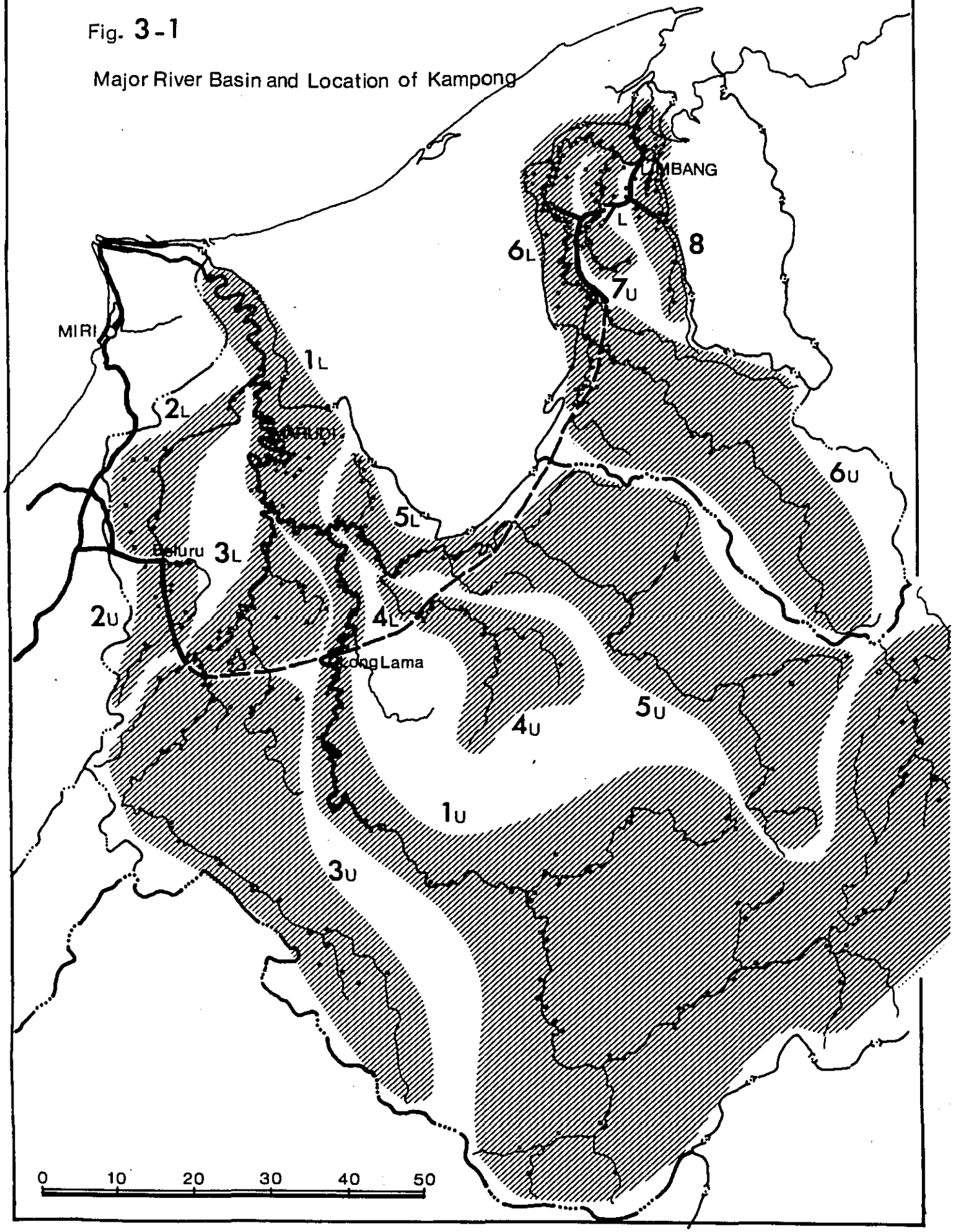


Table 3.3 Population by Major River Basin*

Code No. in Map	River Basin	1970 Lower Area	1970 Upper Area	1970 Total	1977 Lower Area	1977 Upper Area	1977 Total
1.	Batang Baram	8,040	13,570	21,610	9,240	12,230	21,470
2.	Sg. Bakong	2,700	2,280	4,980	2,870	2,440	5,310
3.	Sg. Tinjar	3,150	4,550	7,700	3,670	6,360	10,030
4.	Sg. Apoh	30	3,060	3,090	30	3,260	3,290
5.	Sg. Tutoh	1,950	170	2,120	2,720	180	2,900
6.	Sg. Limbang	15,480	1,280	16,760	14,820	1,650	16,470
7.	Sg. Lubai	1,360	1,050	2,410	1,660	870	2,530
8.	Sg. Pandaruan	--	630	630	-	1,000	1,000
	Total	32,710	26,590	59,300	35,010	27,990	63,000

* Preliminary estimates only

Source: Worked out by the consultants based on the population data obtained from Medical Department District Office, Statistic Department etc.

3.1.3. Transport Network and Activities

Transport network in the Study Area comprizes modes of road, river, air and sea as is shown in Figure 3.2.

1) Road Transport

Availability of road transport is limited to Miri-Beluru and Limbang areas with an exception of Marudi area where the roads however serve very locally. Table 3.4 showing the traffic volume on the major road sections indicate that the increase rate of the road traffic is significant.

Fig. 3-2

Transport Network of Study Area

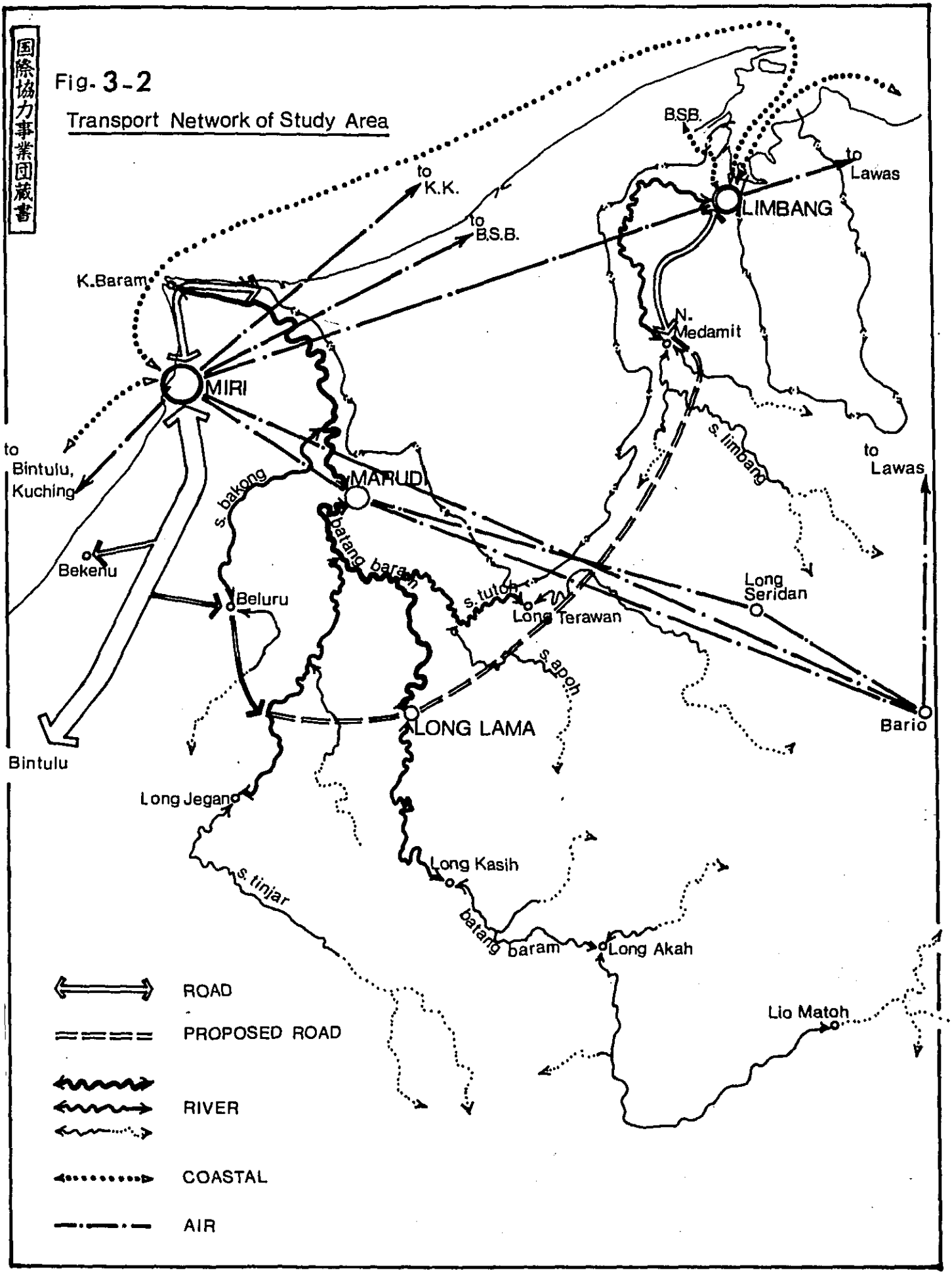


Table 3.4 Traffic Volume* on Major Road Sections in the Study Area

Road Section	Average Daily Traffic 1974 1st half	1978 1st half	Annual Growth Rate (%)
Miri/Bintulu Road			
– Mile 1.8	1,791	5,363	31.5
– near the junction with Bekenu Road	226	649	30.2
Limbang/N. Medamit Road			
– Mile 1.0	1,078	1,454	7.8
– near the junction with Kubong Road	91	227	25.7

* 12 hour traffic volume for both direction excluding motorcycles

Source: PWD traffic census

Table 3.5 showing a number of motor vehicles in 4th and 5th Divisions, also indicate a high growth rate of motor vehicles.

Table 3.5 Number of Motor Vehicles in 4th and 5th Division

Division	1973 (1)*1)	1973 (2)*2)	1977 (1)	1977 (2)	Average Annual Growth Rate (%) (1)	(2)
Fourth	4,218	3,439	7,890	3,424	16.9	0
Fifth	391	443	555	669	9.2	10.9

*1) Motor vehicles excluding motorcycles

*2) Motorcycles only

Source: Annual Report, Land Transport Department

Buses are regularly operated on major road sections both in Miri–Beluru area and in Limbang–N. Medamit area.

2) River Transport

The rivers in the Study Area are important as they have been the traditional transport lines and still carry a considerable human and goods traffic. The Baram, which is second in size in Sarawak to the Batang Rajang, forms a main corridor of transport in the Study Area. The section between K. Baram and Long Lama via Marudi provides good transport channels for inter-regional coastal shipping vessels with loading capacity of 150 to 400 tons throughout the year. In the upper and middle courses of the Baram however there are numerous rapids and gorges, making navigation difficult and reduce its value as a means of communication. Other rivers are also navigable but mostly for smaller boats like long boats with outboard engines, speed boats etc. A part of Sg. Tinjar, Sg. Tutoh and Sg. Limbang can be accessed by 30 to 50 ton motor vessels.

Daily express-launch services have been opened since 1972 between K. Baram and Marudi and between Marudi and Long Lama. Table 3.5 shows the present operation of express-launches. The number of passengers travelling by express-launch has been doubled since last two years.

Table 3.6 River Transport by Express Passenger Launch, 1978

Route	Statute Mile	Frequency of Services	Passenger Capacity	Fare	Average Travel Time	Average No. of Passengers
		Daily	Seats	M$	Hrs.	Persons/day
K. Baram-Marudi	65	4 both direction	60-80	10	3	160
Marudi-Long Lama	67	2	50-70	9	5	70

Marudi is an important terminal or a trans-shipment point for external goods transport. Regular coastal shipping services are available between Marudi and Kuching, Sibu, Kuala Baram, Labuan and Brunei. Long Lama also plays a role of distribution center but only to a lesser extent, and covering the limited areas. Internal transport of goods and passengers is done mostly by popular longboats and partly by 30 to 50 ton motor vessel and other small vessels.

The river system in the Study Area also provides a very important channel for logs and timbers nearly all of which are transported by rafting or barge to the export points of K. Baram or Limbang. Approximately 0.8 to 1.0 million h. tons of logs in 1977 was transported partly or totally by rivers.

3) Air Transport

There are at present five airports at Miri, Limbang, Marudi, Long Seridan and Bario. Miri airport serve aircraft of Boeing 737 while other airports can only take smaller aircraft such as the BN2 presently used by MAS. Beside these airports served by MAS regularly, there are several airfields scattered in the internal areas which can only serve small chartered aircrafts.

Therefore the capacity of air transport in the Study Area is quite limited and the aircrafts are mostly fully occupied.

Table 3.7 Air Passenger Traffic*1) at Marudi and Limbang Airport between Miri

Airport	1973	1977	Average Annual Growth Rate (%)
	persons		
Limbang	3,600	9,200	26.4
Marudi	4,600*2)	6,100	9.9

*1) Preliminary figures only, figures include both direction between Miri

*2) figure is that of 1974

3.1.3. Economic Development Activities

Agriculture and forestry are the two major economic activities in the Study Area as a whole. With the exception of the oil palm cultivation in Danau and in Bukit Peninjau and the rubber cultivation in Lubai Tengah, agricultural activities in the Study Area are, for the moment, by and large restricted to small scale farming. Shifting cultivation prevails throughout the area particularly along the roads and major rivers. Table 3.8shows production of major crops.

Table 3.8 Production of Major Crops, 1977

Crop	Miri District		Baram District		Limbang District	
	Area Planted / Area Harvested	Production	Area Planted / Area Harvested	Production	Area Planted / Area Harvested	Production
	(acres)	(tons)	(acres)	(tons)	(acres)	(tons)
Wet Paddy	5,880		10,280		5,400	
	5,750	5,569	10,130	10,501	4,714	4,489
Hill Paddy	7,590		15,015		5,000	
	7,430	4,716	15,015	5,429	5,000	2,976
Rubber	22,837		16,932		n.a.	
	n.a.	n.a.	13,892	2,450	n.a.	708
Popper	1,345		581		242	
	n.a.	1,285	333	565	124	59

Source: District Annual Report 1977, Department of Agriculture

Except Limbang valley Development Scheme of which feasibility study has been just commenced, there are no large scale agricultural development projects in the Study Area.

Forestry as an industry is currently the most important economic activity in the Study Area. Roughly thirty licencee are engaged in timber activities in the 4th and 5th Division. The potential timber resources of the Study Area are large enough to be tapped over the comming decades. Although the completion of the proposed road would little benefit timber companies in transporting logs to the ports for export, it would certainly benefit them in locating their sawmills and other processing factories near the production area from where processed timber can probably transported by vehicle at reasonable cost.

Table 3.9 Timber Production of 4th and 5th Divisions 1977

Type		Production (M/T)	Export (M/T)
Hill Timber,	4th Div.	629,900	
	5th Div.	97,800	
Swamp Timber,	4th Div.	487,500	
	5th Div.	9,100	
Total		1,224,300	969,000
Sawn Timber,	4th & 5th Div.	46,600	4,400

Source: Annual Report 1977. Forest Department

3.2. Preliminary Selection of the Alignment of the Proposed Road

3.2.1. Identification of Alternative Alignments

Initially possible alternative alignments of the proposed road for its new construction section between Sg. Tinjar and N. Medamit were extensively developed based on the general reconnaissance made by chartered aircraft and the available 1:50,000 scale topographic maps both from engineering and socio-economic point of view.

In identifying the alternative alignments, the following factors were taken into consideration.

Engineering factor:

- topographic condition
- hydrological condition
- soil condition

Socio-economic factor:

- accessibility to major communities
- accessibility to potential resource areas
- impact on natural asset to be preserved

Those alternatives initially identified were reviewed after the more detailed field surveys including further field reconnaissance, discussion with Government departments and preliminary analysis of the data collected had been carried out.

The whole new construction section of the proposed road was divided into three sections for the purpose of preliminary analysis as is explained in the following paragraphs.

3.2.2. Sg. Tinjar/Long Lama Section

Road Length: 25 kilometers or 15.5 miles (Km 53.5 - Km 78.5)
This section, providing a direct link between Long Lama and the existing Beluru Road, lies in the area of rolling terrain studded with a number of swamp areas, large and small, around the Loagun Bunut Lake. Red-yellow podzolic soil is broadly observed in the forest area while gley soil in the area along the Sg. Teru. Timber roads have been constructed between the Sg. Teru and the Batang Baram.

This section starting from the end of the Beluru Road at the Sg. Tinjar passes along the skirts of small mountains with an approximate height of 50 to 70 meters to avoid Swamp area. After crossing the Sg. Teru the proposed road passes through the forest in parallel with the timber road as far as to the Batang Baram.

The crossing point of the Batang Baram is about 200m upstream from timber camp on the left side bank. According to the observation the soil condition of left side bank of the river seems to be good for foundation of bridge.

The terrain condition in this section is not so difficult and the alignment to meet the required geometric design criteria, will be determined without any difficulties.

3.2.3. Long Lama/Sg. Tutoh

Road Length: 55 Kilometer or 34.2 miles (Km 78.5 - Km 133.5)

This section is formed the rolling terrain.

In the watershed of Sg. Apoh and Sg. Terawan many big swamp areas exist. Soil condition around these swamp areas is not so good and Peat Soil of more than 3m depth is observed.

After crossing Batang Baram the proposed route passes through the south side of a schoolhouse.

In early 1960's, Long Lama Area was submerged by the big flood. At that time one meter height of flood water level on ground was observed at the school side. The analysis of this flood should be done moreover survey the detailed site survey should be conducted. After these studies the Survey Team should decide the adoption of low bank road from Batang Baram to approximate 2 Km (1.25M) distance point. Also, the opening of Sg. Tabi and Sg. Bake Bridge should be considered the big flood situation.

After passing the Sg. Temala, the route is separated to two alternatives of A route and B route.

Alternative A route goes almost straight to the N.E. direction as far as the crossing point of Sg. Tutoh, about 3 Km distance downstream from the confluence of Sg. Melinau. Terrain is almost flat and rolling in this area, and along Sg. Apoh and Sg. Terawan the swamps are scattered. The proposed route passes twisting through the swamps. The crossing point of Sg. Apoh is near the R. Akan Ajang.

Alternative B route goes to the east direction and through the neighbourhood of Long Atip and then bends to the north direction along the skirt of mountainous area. Terrain of this route is almost rolling and Red-Yellow Podzolic Soil is observed in the forest. The Length of B route is about 10 Km longer than A route.

These alternatives should be selected after phase II studies.

3.2.4. Sg. Tutoh - Ng. Medamit Section

Road Length: 57 kilometer or 35.4 miles (Km 133.5 - Km 190.5)
This section lies in the area of rolling or mountainous terrain covered by thick topical jungle. The area, consisting the upper reaches of the Sg. Tutoh and its tributaries in the south and those of the Sg. Limbang and its tributaries in the north, is scarcely inhabited with the exception of the area alongside the Sg. Limbang.

Major point at issue for this section was placed on the identification of the alignments in the G. Mulu National Park and its neighbouring areas. Three alternative alignments were developed for comparison of which engineering features are summarized in Table 3-10 hereafter.

1) Alternative A: The proposed road passes from south to north through the flat land sandwiched in between the high and steep range of G. Mulu and G. Api in the east and the low range of mountains in the west. Most of this area, being the river basin of the Sg. Assam and the Sg. Mentakong, is frequently flooded every year. The G. Mulu Survey Team pointed out that this area is characterized by rich flora and fauna that can not be found elsewhere in Sarawak. It was feared that the academic value of the area designated as the National Park might be detracted due to the construction of the proposed road. Both from engineering as well as socio-economic view point this alternative has been omited from further analysis.

2) Alternative B and C: Both alignments lie from south to north in the area of partly flat and mostly hilly terrain sandwiched in between the low range of maintains in the east and the Brunei Border in the west. Both alignments can avoid the area prone to be flooded and would hardly affect the ecology of the National Park. Further analysis will be made for these two alternatives with due consideration of the following factors:

   - geometric design standard required,
   - development of access roads to the G. Mulu National Park,
   - comparison of cost and benefit.

Table 3-10 Comparison of Engineering Features of the Alternative Alignments in the G. Mulu National Park Area

Major Engineering Items		Alternative Alignment A	Alternative Alignment B	Alternative Alignment C
(1) Length of the Road Section	kms (mls.)	51.2 (32.0)	50.0 (31.3)	50.7 (31.7)
(2) Max. Gradient	%	3.0	4.0	4.0
(3) Length of Max Gradient Section	ms. (mls.)	1,200 (0.75)	1,000 (0.63)	3,000 (1.88)
(4) Min. Radius	ms. (ft.)	300 (1,000)	300 (1,000)	150 (500)
(5) Height of Biggest Cut	ms. (ft.)	15 (50)	15 (50)	30 (100)
(6) Height of Biggest Embankment		7 (23.3)	9 (30.0)	15 (50.0)
(7) Number of Bridges :				
100 ms.(333 ft.) and over		2	2	2
50 ms.(167 ft.) – 100 ms.		–	1	3
30 ms. (100 ft.) – 50 ms.		2	–	3
10 ms. (34 ft.) – 30 ms.		15	12	7
(8) Number of Drainage Structures :				
Box Culvert		15	10	15
Pipe Culvert		20	25	40

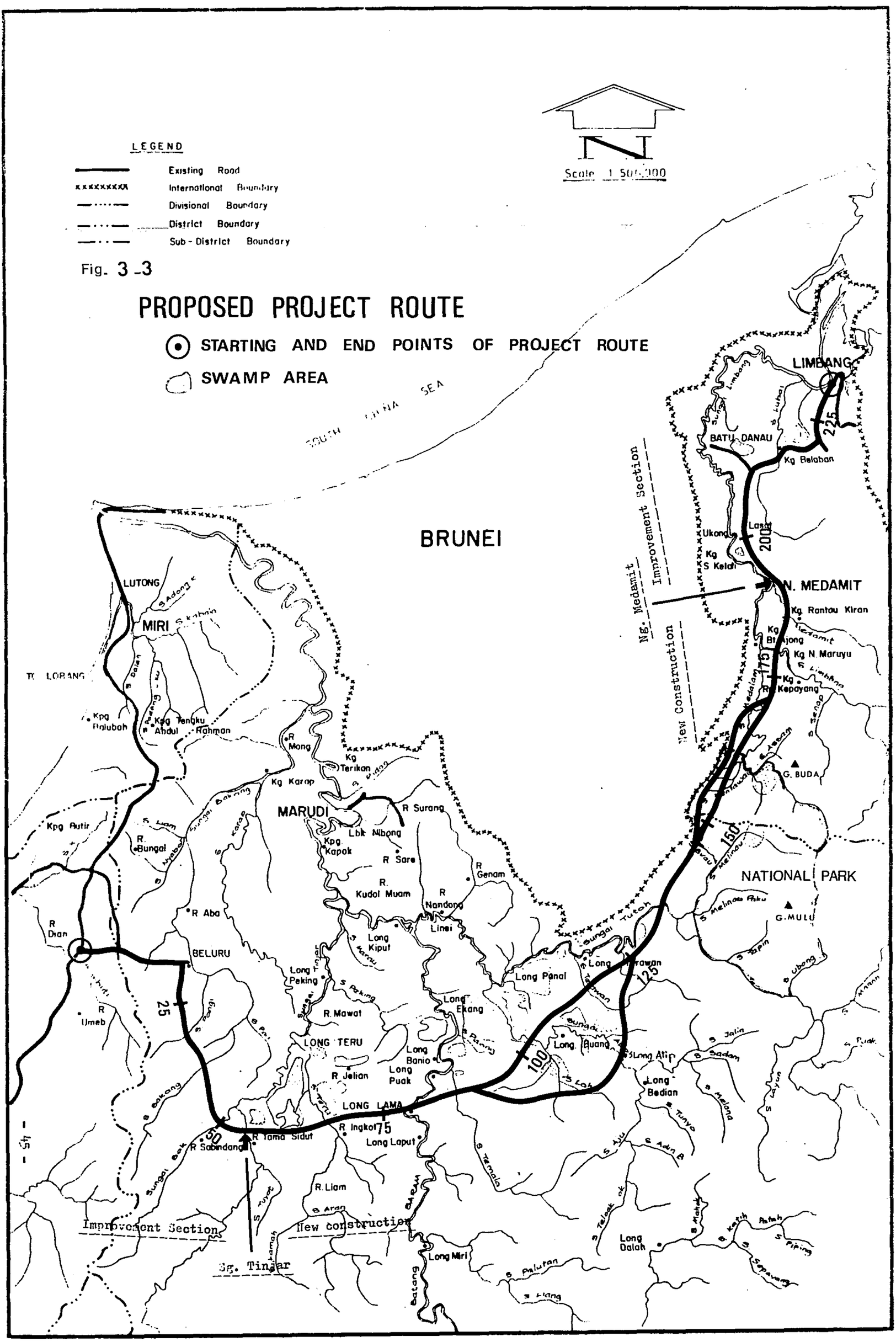

LEGEND
Existing Road
International Boundary
Divisional Boundary
District Boundary
Sub - District Boundary
N
Scale 1:500,000
PROPOSED PROJECT ROUTE
STARTING AND END POINTS OF PROJECT ROUTE
SWAMP AREA
SOUTH CHINA SEA
BRUNEI
LIMBANG
BATU DANAU
Kg Belaban
Ukong
Kg S Kelai
N. MEDAMIT
Kg Rantau Kiran
Kg Batu Ajong
Kg N. Maruyu
Kg Kepayang
Ng. Medamit
Improvement Section
New Construction
LUTONG
MIRI
TG LOBANG
Kpg Pujubah
Kpg Tengku Abdul Rahman
R Mong
Kg Terikan
Kg Karap
MARUDI
R Surang
Lbk Nibong
Kpg Kapok
R Sare
R Genam
R Kudol Muam
R Nandong
Linei
Kpg Batir
R Bungal
R Aba
R Dian
BELURU
Long Kiput
Long Peking
R Umeb
R Mawat
LONG TERU
Long Banio
Long Puak
R Jelian
Long Panal
Long Ekang
Long Buang
Long Alip
Long Bedian
LONG LAMA
R Ingkot
Long Laput
R Tama Sidut
R Sabandang
R Liam
Improvement Section
New construction
Sg. Tingar
Long Miri
Long Dalah
NATIONAL PARK
G. BUDA
G. MULU
25
50
75
100
125
150
175
200
225

Fig. 3-3

4. Basic Policy for Further Study

4.1. Engineering Study

4.1.1. Mapping Work of Scale 1 : 10,000 Topographical Map

For the course of the preliminary design and the detailed route survey of phase II, the topographical map of scale 1 : 10,000 which is covered from Beluru to Limbang, the total length 230 km with its width 1 km, will be prepared by the Survey Team.

The field survey for mapping work will start at the end of August and the mapping work in Japan will be completed by the end of December, 1978.

4.1.2. Identification of Alternatives and Preliminary Engineering Study

Alternatives for the engineering point of view will be studies taking into consideration the following items.

a) route alignment
b) design criteria
c) construction method including stage construction
d) adoption of bridge or ferry for major river
e) improvement method for existing roads

c) and d) will be studied in detail at Phase II.

1) Route Alignment

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

2) Design Criteria

The project road consists of four section as follows:

Beluru Road

Beluru/Loagan Bunut Road (Sg. Tinjar)

Sg. Tinjar/Ng. Medamit New Road

Limbang/Ng. Medamit

The design criteria of the Beluru Road and Limbang/Ng. Medamit Road are based on the Feeder Road Standard, while that of the Beluru/Loagan Bunut Road are based on the Feeder Road Standard (between Beluru and + 6.0 M) and the Trunk Road Standard (between + 6.0 M and Sg. Tinjar).

The geometric design criteria to be applicable affect the construction cost. According to the topographical conditions, the proposed project road cannot be avoided to pass the rolling and mountainous terrain. Taking the above consideration in mind, the Survey Team will study the criteria in detail and prepare the recommended design criteria for the project road. They should be all conformed to the Trunk Road Standard, Sarawak except some items for rolling and mountainous terrain. The Survey Team will conduct the comparative study about the Trunk Road Standard, Sarawak and the recommended design criteria.

3) Improvement Method for Existing Roads

Improvement methods for existing roads will be involved as follows:

a) upgrading the design standard from Feeder Road to Trunk Road

b) upgrading the surface condition from gravel to asphalt

c) upgrading the bridges from one lane width to two lane width

4.1.3. Preliminary Cost Estimate

For each alternative, preliminary project cost will be estimated by construction cost, maintenance and repair costs per Km based on the data collected.

4.2. Traffic/Socio-economic Study

Although the further analysis will be made basically according to the method and procedure explained in the Inception Report, the following points will be duly taken into account at the same time.

1) Identification of the development potentials in the project influence area: Although a number of projects, at present, are being promoted or planned in the area to be directly affected by the construction of the proposed road, the detailed information are scarcely available for the moment, because some are under study and the others are still at schematic plan stage. Therefore the development potentials of the influence area will be determined both quantitatively and qualitatively based on the alternative scenario writing. Development of agriculture, forestry, tourism and town/community will be the main issue.

2) Comparison of advantage and disadvantage in transporting goods and passengers by different transport mode each other with regard to the development of the proposed road: particularly the comparative study will be carefully made between the modes of river and road.

3) Development policy of feeder roads: as the resources and communities are widely scattered over the project influence area, the policy on the feeder road developments will be carefully studied to maximize the benefit due to the implementation of the project.

Appendix A. Summary Record of Survey Activities

Date	Activities
July 9, Sun.	- Arrival of Mr. Kataoka, Mr. Takahashi, Mr. Iwata and Mr. Saito at Kuala Lumpur from Tokyo
10, Mon.	- Visit to JICA Office in Kuala Lumpur
11, Tue.	- Visit to the Embassy of Japan by Mr. Kataoka, Mr. Iwata, Mr. Takahashi and Mr. Saito
	- Visit to P.W.D. in Kuala Lumpur by the members mentioned hereabove and Mr. Ozawa
12, Wed.	- Submission and presentation of Inception Reports to the Steering Committee in Kuala Lumpur attended by Mr. Kataoka, Mr. Iwata, Mr. Ozawa, Mr. Takahashi and Mr. Saito
	- Arrival of Mr. Endo, Mr. Tomiyasu, Mr. Hibii, Mr. Ohtsu and Dr. Takeda at Kuala Lumpur from Tokyo
13, Thu.	- Visit to EPU by the Whole Team
	- Visit to the Embassy of Japan and JICA Office
	- Arrival of the Team at Kuching from Kuala Lumpur
14, Fri.	- Visit to P.W.D., Land and Survey, Forest Department and Agriculture Department by Mr. Kataoka, Mr. Endo, Mr. Tomiyasu, Mr. Hibii and Others
	- Visit to Forest Department and Agriculture Department by Dr. Takeda
	- Meeting with Sarawak Government at SPU attended by all members
15, Sat.	- Meeting with P.W.D. and visit to DID and CML by Mr. Endo and Mr. Tomiyasu

- Visit to Agriculture Department and Forest Department by Dr. Takeda

- Visit to P.W.D. and S.P.U. by Mr. Iwata

16, Sun. - Reconnaissance trip to Bau by the Team

17, Mon. - Meeting with P.W.D. by Mr. Kataoka, Mr. Endo and Mr. Tomiyasu

- Visit to Geological Department by Mr. Tomiyasu and Mr. Endo

- Visit to Agriculture Department by Dr. Takeda and Mr. Ohtsu

18, Tue. - Visit to MRCU3 and Government quarry site (STADAR) by Mr. Endo and Mr. Tomiyasu

- Visit to Statistic Department and Land Transport by Mr. Iwata and Mr. Ohtsu

- Visit to STIDC and SLDB by Dr. Takeda

- Arrival of Mr. Kataoka, Mr. Takahashi, Mr. Hibii and Mr. Saito at Miri from Kuching, and visit to PWD by them

19, Wed. - Visit to Forest Dept., SPU and DID by Dr. Takeda in Kuching

- Interview with private shipping companies by Mr. Iwata and Mr. Ohtsu in Kuching

- General reconnaissance by Chartered cessna along the proposed road by Mr. Kataoka, Mr. Takahashi, Mr. Hibii and Mr. Saito

- Visit to PWD Limbang by the members mentioned hereabove

20, Thu. - Visit to Land and Survey Department in Miri by Mr. Kataoka and Mr. Hibii

- Visit to DID by Dr. Takeda in Kuching

21, Fri. - Visit to Forest Department and Agriculture Department by Mr. Endo and Mr. Tomiyasu in Kuching

- Visit to Land and Survey Department and Statistic Department by Mr. Iwata in Kuching

- Arrival of Dr. Takeda at Miri from Kuching

- Interview with private timber companies by Dr. Takeda in Miri

- Arrival of Mr. Kataoka and Mr. Hibii at Marudi from Miri

22, Sat. - Visit to the ferry facilities in Lundu by Mr. Endo and Mr. Ohtsu

- Visit to Land and Survey Department by Mr. Iwata

- Visit to Agriculture Department and private timber companies by Dr. Takeda in Miri

- Visit to PWD by Mr. Kataoka and Mr. Hibii in Marudi

- Arrival of Mr. Kataoka and Mr. Hibii at Miri from Marudi

23, Sun. - Arrival of Mr. Endo, Mr. Tomiyasu, Mr. Iwata and Mr. Ohtsu at Miri from Kuching

- Reconnaissance trip to K. Baram by the members mentioned hereabove

24, Mon. - Visit to Land and Survey Department by Mr. Hibii in Miri

- Visit to PWD Miri by Mr. Kataoka and the rest of the members

- Visit to Agriculture Department by Dr. Takeda in Miri
- Preparation for traffic survey by Mr. Iwata and Mr. Ohtsu in Miri

25, Tue.
- General reconnaissance by chartered cessna along the proposed road by Mr. Kataoka, Mr. Endo, Mr. Tomiyasu, Mr. Iwata and Dr. Takeda
- Visit to PWD Limbang by the members mentioned hereabove
- Interview with timber company by Dr. Takeda

26, Wed.
- Reconnaissance trip to a timber camp of Limbang Trading and interview with camp manager by Dr. Takeda in Limbang
- Reconnaissance trip to Beluru area by Mr. Iwata and Mr. Ohtsu
- Briefing of traffic survey by Mr. Iwata and Mr. Ohtsu in Miri
- Departure of Mr. Hibii from Miri to Kuching

27, Thu.
- Reconnaissance trip to Beluru road and visit to MERCU10 by Mr. Kataoka, Mr. Endo and Mr. Tomiyasu
- Conducting traffic survey on Miri/Bintulu and Beluru roads by Mr. Ohtsu and Mr. Iwata
- Visit to Agriculture and Forest Departments by Dr. Takeda in Limbang
- Reconnaissance trip to Danau Area by Dr. Takeda
- Meeting with Land and Survey Department Kuching by Mr. Hibii
- Departure of Mr. Hibii from Kuching to Kuala Lumpur

28, Fri. - Visit to Land and Survey Department by Mr. Kataoka, Mr. Endo, Mr. Tomiyasu and Mr. Iwata in Miri

- Visit to Resident of 4th Division by Mr. Endo and Mr. Iwata

- Departure of Mr. Kataoka from Miri to Kuching

- Conducting traffic survey by Mr. Ohtsu

- Visit to Pady Test Station by Dr. Takeda in Limbang

- Departure of Dr. Takeda from Limbang to Miri

29, Sat. - Visit to Statistic Department by Mr. Iwata in Miri

- Visit to Niah quarry site by Mr. Endo

- Visit to Agriculture Department by Dr. Takeda

30, Sun. - Arrival of Mr. Endo, Mr. Tomiyasu, Mr. Iwata and Mr. Ohtsu at Limbang from Miri

- Reconnaissance trip to N. Medamit by road by the members mentioned hereabove

31, Mon. - Visit to PWD Limbang by Mr. Endo, Mr. Tomiyasu, Mr. Iwata and Mr. Ohtsu

- Field reconnaissance of Limbang - N. Medamit road by Mr. Endo and Mr. Tomiyasu

- Visit to District Office, Immigration Office, Medical Department and Land and Survey Department by Mr. Iwata and Mr. Ohtsu in Limbang

- Briefing of traffic survey by Mr. Iwata and Mr. Ohtsu in Limbang

- Visit to Bakong Agriculture Station by Dr. Takeda

- Arrival of Mr. Kataoka from Kuching to Miri

- Departure of Mr. Hibii from Kuala Lumpur to Tokyo

Aug. 1, Tue. - Field reconnaissance to N. Medamit and Sg. Medalam area by long boat by Mr. Endo and Mr. Tomiyasu

- Conducting traffic survey on Limbang - N. Medamit road by Mr. Ohtsu and Mr. Iwata

- Interview with MAS and Chamber of Commerce by Mr. Iwata in Limbang

- Arrival of Dr. Takeda at Marudi from Miri

2, Wed. - Field reconnaissance to N. Medamit - Sg. Limbang area by longboat by Mr. Endo and Mr. Tomiyasu

- Visit to Agriculture Department and Forest Department field survey on farmers in Marudi by Dr. Takeda

- Conducting traffic and interview surveys in Limbang by Mr. Iwata and Mr. Ohtsu

3, Thu. - Conducting interview survey by Mr. Ohtsu and Mr. Iwata in Limbang

- Reconnaissance trip to N. Medamit and Danau area by Mr. Iwata

- Departure of Mr. Endo and Mr. Tomiyasu from Limbang to Miri

- Visit to Agriculture Department and Forest Department and interview with farmers in Long Lama by Dr. Takeda

4, Fri. - Visit to Forest Department by Mr. Endo and Mr. Tomiyasu in Miri

- Departure of Mr. Iwata and Mr. Ohtsu from Limbang to Miri

- Visit to Long Laput for interview with long house people on their agricultural activities by Dr. Takeda

- Visit to timber camp of Sarawak Plywood in Temala by Dr. Takeda

5, Sat. - Field reconnaissance and soil sampling in the areas along the proposed road by helicopter by Mr. Endo and Mr. Tomiyasu

- Arrival of Mr. Iwata and Mr. Ohtsu at Marudi from Miri

- Visit to PWD and briefing of traffic survey by Mr. Iwata and Mr. Ohtsu

- Arrival of Dr. Takeda at Miri from Temala via Marudi

6, Sun. - Conducting river traffic survey in Marudi-Long Lama-K. Baram area by Mr. Ohtsu and Mr. Iwata

- Arrival of Mr. Endo and Mr. Tomiyasu at Marudi from Miri

- Departure of Mr. Iwata at Miri from Marudi for internal discussion

7, Mon. - Visit to PWD and field reconnaissance to Long Lama by long boat and soil sampling by Mr. Endo and Mr. Tomiyasu

- Arrival of Mr. Iwata at Marudi from Miri

- Conducting the same river traffic survey as of August 6 by Mr. Ohtsu and Mr. Iwata

- Visit to District Office and Medical Department in Marudi by Mr. Iwata and Mr. Ohtsu

- Visit to Agriculture and Forest Departments in Miri by Dr. Takeda

8, Tue. - Field reconnaissance to R. Ajang (Sg. Apoh) by long boat by Mr. Endo and Mr. Tomiyasu

- Visit to Education Department, Marine Department, Civil Aviation Department, Agriculture Department and PWD by Mr. Iwata in Marudi

- Departure of Mr. Ohtsu to Long Lama from Marudi
- Conducting the same river traffic survey as of August 6 by Mr. Ohtsu and Mr. Iwata
- Departure of Dr. Takeda from Miri to Kuala Lumpur via Kuching

9, Wed.
- Field reconnaissance to Long Terawan (Sg. Tutoh) from R. Ajang by Long boat by Mr. Endo and Mr. Tomiyasu
- Arrival of Mr. Iwata at Long Lama from Marudi
- Visit to S.A.O. in Long Lama by Mr. Iwata and Mr. Ohtsu
- Visit to Min. of Agriculture in Kuala Lumpur by Dr. Takeda
- Conducting river traffic survey in Marudi-Long Lama area by Mr. Ohtsu and Mr. Iwata

10, Thu.
- Field reconnaissance to the area from Long Terawan to Marudi by long boat by Mr. Endo and Mr. Tomiyasu
- Visit to S.A.O. Office, Fishery Department and Agriculture Department by Mr. Iwata and Mr. Ohtsu
- Field reconnaissance to the possible future extension area of Long Lama and visit to timber camp in the area by Mr. Iwata and Mr. Ohtsu
- River traffic survey same as of August 9 by Mr. Iwata and Mr. Ohtsu
- Visit to Long Laput by Mr. Iwata and Mr. Ohtsu
- Departure of Dr. Takeda from Kuala Lumpur to Tokyo

11, Fri. - Departure of Mr. Iwata and Mr. Ohtsu from Long Lama to Marudi

- Visit to Agriculture Department in Marudi by Mr. Iwata

- Conducting river traffic survey same as of August 9 by Mr. Iwata and Mr. Ohtsu

- Departure of Mr. Tomiyasu from Marudi to Miri

12, Sat. - Visit to Forest Department, Police Office and Customs Department in Marudi by Mr. Iwata

- Conducting river traffic survey same as of August 9 by Mr. Ohtsu and Mr. Iwata

- Departure of Mr. Endo from Marudi to Miri

13, Sun. - Departure of Mr. Iwata from Marudi to Miri

14, Mon. - Interview survey with shipping agencies in Marudi by Mr. Ohtsu

- Visit to Agriculture Department, Civil Aviation and Forest Department and interview with automobile agent in Miri by Mr. Iwata

- Departure of Mr. Ohtsu from Marudi to Miri

15, Tue. - General reconnaissance trip to Limbang from Miri by chartered cessna by Mr. Kataoka, Mr. Endo, Mr. Iwata, Mr. Ohtsu and Mr. Matsumoto

- Visit to PWD and Agriculture Department in Limbang by Mr. Iwata

- Visit to DID in Limbang by Mr. Endo

16, Wed. - Visit to District Office, Medical Department, Information Department and Agriculture Department in Limbang by Mr. Iwata

- Arrival of Mr. Iwata at Miri from Limbang

17, Thu. - Reconnaissance trip to Long Lama and G. Mulu area and areas along the proposed road by chartered helicopter by Mr. Kataoka, Mr. Endo and Mr. Iwata

- Visit to District Office and Land and Survey Department in Miri by Mr. Iwata

- Departure of Mr. Tomiyasu from Miri to Kuching

18, Fri. - Visit to Forest Department and Information Office in Miri by Mr. Iwata and Mr. Ohtsu

- Visit to D.I.D. by Mr. Endo in Kuching

- Departure of Mr. Kataoka, Mr. Endo, Mr. Iwata and Mr. Ohtsu from Miri to Kuching

19, Sat. - Visit to SPU by Mr. Kataoka, Mr. Matsumoto and Mr. Iwata

21, Mon. - Visit to Forest Department by Mr. Kataoka, Mr. Endo, Mr. Iwata and Mr. Ohtsu

- Preparation of Progress Report

22, Tue. - Visit to S.P.U. by Mr. Iwata

23, Wed. - Preparation of Progress Report

24, Thu. - Arrival of Aerophoto Survey Team at Kuching

- Visit to PWD by Mr. Matsumoto, Mr. Kataoka, Mr. Endo, Mr. Iwata and Mr. Ohtsu.

- Preparation of Progress Report

25, Fri. - Visit to SPU by Mr. Iwata

- Preparation of Progress Report

26, Sat. - Preparation of Progress Report.

27, Sun. - Arrival of Mr. Kataoka at Kuala Lumpur from Kuching

28, Mon. - Visit to EPU, the Embassy of Japan and JICA office by Mr. Kataoka

29, Tue. - Arrival of Mr. Endo, Mr. Iwata, Mr. Ohtsu and Mr. Nakada at Kuale Lumpur from Kuching

- Visit to SEATAC Office by Mr. Kataoka

- Submission and presentation of Progress Report (Phase I) to the steering Committee in Kuala Lumpur attended by Mr. Kataoka, Mr. Endo, Mr. Iwata, Mr. Ohtsu and Mr. Nakada.

30, Wed. - Visit to EPU by Mr. Iwata and Mr. Ohtsu

- Visit to SEATAC Office by Mr. Iwata and Mr. Endo

- Departure of Mr. Nakada from Kuala Lumpur to Kuching

31, Thu. - National Holiday

1, Fri. - Visit to EPU by Mr. Iwata

2, Sat. - Meeting of Survey Team

3, Sun. - Arrival of Mr. Kataoka, Mr. Endo, Mr. Iwata and Mr. Ohtsu at Tokyo from Kuale Lumpur

Appendix B Agencies Contacted

Economic Planning Unit

Mr. Basha Bin Nordin	-	Director
Miss Leong So Seh	-	Assistant to Director (Infrastructure)

Highway Planning and Public Transport Unit

Mr. Zaidan Hj. Othman	-	Director

State Planning Unit

Mr. Amirrudin Bin Hussain	-	Director
Mr. Teo Tien Hiong	-	Assistant Secretary
Mr. Chin Jew Bui	-	Assistant Secretary
Mrs. Patricia Chapman	-	Chief Agri-section

Public Works Department, Headquarters

Mr. Fung Chee Ping	-	Deputy Director
Mr. Michael Parker	-	Assistant Director
Mr. Victor Voon Teck Ann	-	Chief Road Engineer
Mr. Ong Siang Boon	-	Ag. Senior Executive Engineer (Bridges)
Mr. Wong Chin Hook	-	Executive Engineer (Roads)
Mr. Fong Lee Chee	-	Works Superintendent (Roads)
Mr. Eric Jong	-	Draughtsman
Mr. Yeo Ying Pang	-	Draughtsman

P.W.D., MRCU3

Mr. Azahari Shibli	-	Resident Engineer

P.W.D., Stabar Quarry

Mr. Osman	-	Ag. Quarry Manager

P.W.D., Miri

Mr. Chung Sie Hyung	-	Divisional Engineer
Mr. Chen Chee Nay	-	Executive Engineer (Civil)
Mr. Tan Seng Wee	-	Assistant Divisional Engineer

P.W.D., Limbang

Mr. Anthony Ho	-	Divisional Engineer
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., Central Material Laboratory

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

P.W.D., Lundu Depot

Mr. Rijun Ginyod

P.W.D., MRCU10

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

P.W.D., Niah Quarry Site

Mr. Abg. Dawi bin Abg. Hj. Kushari	-	Assistant Quarry Manager

Agriculture Department, Headquarters

Mr. Joseph Kong	-	Director
Mr. Chua Teck Kheng	-	Agro-economist

Agriculture Department, Soil Laboratory

Mr. Lim Chin Pang	-	Senior Soil Engineer
Mr. Tan In Kok	-	Soil Engineer
Mr. Banchek Haji Bero	-	Soil Assistant

Agriculture Department, Miri

Mr. Wong Leong Do	-	Divisional Officer
Mr. Benedict Wong		

Agriculture Department, Limbang

Mr. Wong Ling Kiong Dominic	-	Divisional Officer
Mr. Mong Bin Rawhli	-	In Charge of Bakong Sub-District Agri-Scheme

Agriculture Department, Marudi

Mr. Dan Son Buma

Mr. Cyril Joseph Leong

Agriculture Department, Long Lama; Baram

Mr. Kenneth De Rozario

Mr. Philip Wong

Paddy Test Station, Limbang

Mr. Siong Yew Hang

Statistic Department, Headquarters

Mr. Khoo Teik Huat		
Mr. Mulkit Singh Gill	-	Senior Statistician
Mr. Kwok Kwan Kit	-	Population Division

Forest Department, Headquarters

Mr. Joseph Yong	-	Director
Mr. Abang Muas	-	Deputy Director
Mr. Paul P.K. Chai	-	Forest Botanist
Mr. Cheong E.K. Choon	-	Forest Officer
Mr. Patrick Tai	-	Forest Officer

Forest Department, Miri

Mr. Haji Sulaiman	-	Section Forest Officer
Mr. Wit Treygo	-	Officer-In-Charge, (National Park and Wildlife)

Forest Department, Limbang

Mr. Jiken Nisek	-	Divisional Officer

Forest Department, Marudi

Mr. Albert J. Klumai	-	Forest Officer

Forest Department, Long Lama

Mr. Chistopher Babang	-	Forest Officer

Drainage & Irrigation Department, Headquarters

Mr. John Tan	-	Engineer
Mr. Y. Komori	-	Specialist

Drainage & Irrigation Department, Miri

Mr. James Yong	-	Divisional Engineer
Mr. Saimon Tan	-	Assistant Engineer

Land and Survey Department, Headquarters

Mr. Haji Borhan Sablo Mohamad	-	Director
Mr. Ambrose Foo	-	Deputy Director
Mr. Sim Teck Chiau	-	Assistant Director
Mr. Stephen Kong Swee Meng	-	Superintendent Research
Mr. Chia Pit Chung	-	Regional Planner

Land and Survey Department, Miri

Mr. M. Baijuri Kipli - Superintendent

Mr. Wong Ing Siong

Mr. Lai Hua Lee

Geological Survey Department

Mr. Victor Hon

Land Transport Department, Kuching

Mr. Henry Chang

Land Transport Department, Miri

Mr. Chung Ayn Yew

District Officer, Miri

Mr. Edwin Dunoang Bueak - District Officer

Custom Office, Miri

Mr. Frankie J. Nyombui - Customs Officer

Resident's Office, Limbang

Mr. Jayl Langub - Administrative Officer

Education Department, Limbang

Mr. Morshidi Ali

Immigration Office, Limbang

Mr. Hendry Bakir Kiukok

Chamber of Commerce, Limbang

Mr. Lim Chwee Cheng - Chairman

Information Department, Limbang

Mr. William Jalil - Assistant Officer

Limbang District Council

Mr. Lim Seng Kiat

District Office, Limbang

Mr. Stewart Ngau Ding - District Officer

Divisional Medical Office, Limbang

Mr. Encik Stor Tini - Ag. Chief Hospital Assistant

District Office, Marudi

Mr. Patric Chaong - District Officer

Education Department, Marudi

Mr. Arthur Chew

Medical Department, Marudi

Mr. Johari Elly

Marine Department, Marudi

Mr. Wan Zainal - Marine Survey Assistant

Customs Office, Marudi

Mr. Alabi Bin Man

Civil Aviation, Marudi

Mr. Abu Bakar Hj. Omar

S.A.O. Office, Long Lama

Mr. Ding Ibau - S.A.O.

Inland Fishery Laboratory, Long Lama

Mr. Michael Bruke - Officer-In-Charge

Sarawak Timber Industry Development Corporation

Mr. Abdul Hamed Sepawie	-	Planning Officer

Sarawak Land Development Board

Mr. Awang Zain	-	General Manager
Mr. Suardi Fachruddin	-	Agri-Officer

Appendix C List of Publication and Data Obtained

100 General Economy

101 Third Malaysia Plan, 1976 - 80

102 Statistics of External Trade, 1976 SARAWAK
= Department of Statistics

103 Preliminary Figures of External Trade, SARAWAK (Jan. 1977 - Jan. 1978, monthly report)
= Department of Statistics

104 Census of Selected Service Trades, SARAWAK, 1973/74
= Department of Statistics

105 Census of Selected Industries, SARAWAK, 1973/74
= Department of Statistics

106 Report of the Labour Force Survey, MALAYSIA
= Department of Statistics April/May, 1974

107 Survey of Manufacturing Industries, SARAWAK, 1973
= Department of Statistics

108 Survey of Construction Industries, SARAWAK, 1974
= Department of Statistics

109 Household Expenditure Survey, SARAWAK, 1972/73
= Department of Statistics

110 Survey of Annual Household Income 1973, SARAWAK
= Department of Statistics

111 1970 Population and Housing Census of Malaysia, Vol. 1 basic population tables for SARAWAK
= Department of Statistics

112 Population Projections, 1970 - 1990, Malaysia
= Department of Statistics

113 1970 Population and Housing Census of Malaysia, Age Distribution
= Department of Statistics

114 Vital Statistics, SARAWAK, 1973 and 1975
= Department of Statistics

115 Annual Statistical Bulletin, 1972, 1973 and 1976
= Department of Statistics

116 Annual Report, Limbang District, 1974, 1975 and 1977
= District Office, Limbang

117 Annual Report, Baram District, 1977
= District Office, Limbang

118 Briefing Notes on Development Projects in 5th Division
= Rosident Office, Limbang

119 First Half Yearly Report, 1977
= Land and Survey Department, 5th Division

120 Miri-Bintulu Regional Planning Study
= Hunting Technical Services Ltd. 1974

200 Transport

201 Year Book of Transport Statistics,. 1975
= Ministry of Communications.

202 Traffic Census Records of 4th Division and 5th Division from 1975 to 1978
= P.W.D. Head Quarters, Kuching.

203 Annual Report of Land Transport Advisory Board, SARAWAK for 1973, 1974, 1975, 1976 and 1977
= Land Transport Department, Kuching.

204 Visitor Arrival Statistics, SARAWAK, 1976
= Department of Statistics.

205 Port Development in SARAWAK 1963 - 1973
= The Office of the Government Ports Advisor.

206 Bintulu Deepwater Port Project
= Stanley Consultants, INC. December, 1977.

207 Airport Statistics of Limbang, Miri and Marudi Airports
= Civil Aviation Departments of Each District.

300 Agriculture/Forestry

301 Agricultural Statistics of Sarawak, 1976
= Agriculture Department, Kuching.

302 Annual Report of the Forest Department, 1976
= Forest Department, Kuching.

303 Annual Report of Agricultural Department Baram District, 1977.

304 Appraisal Report of the Limbang River Basin Drainage and Irrigation Project, Sarawak, Malaysia.

305 Veterinary Report for 4th and 5th Divisions, 1977
= Agriculture Department, Miri.

400 Engineering

(Maps & Drawings)

401 Topographical Map S = 1:50,000
3 sets (Project Area)

402 Aero Photography S = 1:25,000
1 set (Project Area)

403 Map of Sarawak S = 1;1,000,000

404 Road Map of Sarawak S = 1:500,000

405 Plan and Profile of Beluru Road
1 set.

406 Plan and Profile of Beluru/Loagan Bunut Road
1 set.

407 Plan and Profile of Limbang/Ng. Medamit Road
1 set.

408 Typical Culvert for Limbang/Ng. Medamit Road
3 sheets.

409 Proposed Double Ended Steel Ferry (1968)
1 sheet.

410 Site Plan & Longitudinal Sections for Proposed Fender Pile at Satok Ferry Ramp - Kuching Side (1972)
1 sheet.

411 Longitudinal Section, Plan & Location for Proposed Bridge Over Sg. Sabatang at Tg. Kidurong Road (1976)

412 General Plan & Elevation for Bridge over Sg. Miri/Road Miri - Lutong.

413 Site Plan, Longitudinal Section & Plan for 40 ft span Bridge over Sg. Midin, Gedong Feeder Road (1973)

414 General Arrangement for Bau - Lundu Road Bridge over Batang Kayan (1975).

415 General Plan & Elevation for Bridge over Sg. Suai/Road Bintulu - Miri (1973)

416 6ft x 6ft Standard R.C. Box Culvert for Various Heights of Fill (1965).

(Highway Design Criteria & Report)

417 Minimum Geometric Design Criteria for New Roads in Rural Area - Malaysia Barat

418 Public Works Department, Sarawak Trunk Road Standard

419 Feasibility Study and Preliminary Engineering for Seremban - Air Hitam Highway.

420 Detailed Engineering for the proposed Road Improvement of the Crocker Range Crossing Between Tamparuli and Ranau, Sabah.

421 Bridge Design Report Bau - Lundu 20M Crossing Batang Kayan.

422 General Specification for Building Works, Sarawak P.W.D. (1961)

423 General Conditions of Contract Sarawak P.W.D. (1961)

424 Special Specification for Construction of Kampong Landeh Road, Kuching.

425 Particular Specification and Schedule of Quantities and Rates for Construction of One No. Box R.C. Culvert at Sungai Lanang, Sibu.

426 Particular Specification and Schedule of Quantities and Rates for Construction of one No. Permanent Bridge over Sg. Temam at Beluru/Long Teru Road.

427 List of Registered Contractors, P.W.D., Sarawak 1975.

(Meteoralogy/Hydrology)

428 Sarawak, Hydrological Year Book 1962 - 1975.

429 Hydrogeological Map of Sarawak (1978).

(Soil/Geology/Aggregate)

430 Notes on Soil Classification in Sarawak

431 Report on a Reconnaissance Soil Survey of the LUBAI AREA, 5th Division

432 Report on a Semi-Detailed Soil Survey of the PUNANG AREA, 5th Division

433 Report on a Reconnaissance Soil Survey of the ULU LIMBANG AREA, 5th Division

434 Report on a Reconnaissance Soil Survey of the MARUDI-LINEI-LONG LAMA AREA, 4th Division

435 The Geology and Mineral Resources of the Suai-Baram Area, North Sarawak

436 Mineral Resources Map of Sarawak
S = 1:1,000,000

437 Soil Map of Sarawak
S = 1:500,000

438 Soils and Terrain - Northern Interior Sarawak

439 Potential Quarry Sites, Sarawak
S = 1:1,000,000

440 Sources of Construction Stones in Sarawak, 1976

441 Stone Quarries in Sarawak

442 J.K.R. Quarries and Pits Topographic Description and Physical Properties

443 Census of Stone Quarrying, Sarawak 1974