2-4 Forestry

2-4-1 Current Status of Forestry Production

In terms of the forestry administration, the Study Area is included in Miri Section, which comprizes the Fourth and Fifth Divisions. Accordingly, although the production of the Study Area is not known precisely, about 900 thousand tons/cf was estimated based on the exports at the ports of Limbang, Marudi and Miri. Originally, forestry production in the area began with the development of swamp forests. Since then, however, hill forests have been progressively utilized year by year so that production of hill timber equalled the share production of swamp timber in 1976, and then surpassed it in 1977 with a share of about 60%. The total production of timber in 1977 recorded its highest level. Appendix Table A-2-4 shows the exports of timber by port indicating that Miri shares roughly 50% of the total exports of round timber of Sarawak.

As for the species, Meranti, Alan and Kapor are the three major types sharing in total about 70% of the whole timber production.

Saw milling, and production of moulding and dowels are the only timber processing industries presently found in the Study Area. There are no facilities for producing veneer, plywood, laminated wood, etc. Miri Section has at present about 37 sawmills, but all these have low rates of operation, employing about 900 workers and producing about 42,000 tons. Moulding and doweling plants are increasing in number but are still quite limited in terms of production.

Table 2-18 Timber Production in the Study Area

		1976		1977	
		Fourth Div.	Fifth Div.	Fourth Div.	Fifth Div.
Hill Timber	; Export	- n.a. -		622.7	94.1
	Sawmill	- n.a. -		7.2	3.6
	Total	517.6 (49.9)		629.9(56.4)	97.7(91.4)
Swamp Timber	; Export	- n.a. -		384.9	4.2
	Sawmill	- n.a. -		102.6	5.0
	Total	519.3 (50.1)		487.5(43.6)	9.2(8.6)
Total	; Export	- n.a. -		1,007.6	98.3
	Sawmill	- n.a. -		109.8	8.6
	Total	1,036.9(100%)		1,117.4(100%)	106.9(100%)
Export	Sawlogs	800.3[1/]	47.9[3/]	- n.a. -	
	Sawn Timber	6.4[1/] + 2.2[2/]	0.4[3/]	- n.a. -	

Source: Forest Department Annual Report, 1977, Miri Section

1/ Export through Miri
2/ Export through Marudi
3/ Export through Limbang

2-4-2 Production Outlook

The forestry production is largely affected by supply and demand in the international market. In particular, production of round timber shows sensitive reaction to fluctuations in its price. Accordingly, Southeast Asian countries (including Sabah) have set out to attempt to restrict the export of logs, to strengthen policies to lessen such adverse influences and to increase the value added. In Sarawak also, sawmill license conditions state that operation has to be started 25 months after initiating construction, with the operation rate raised to at least 70% in the following 36 months: the entrepreneur is also obligated to submit his production plan and schedule for moulding, venner and plywood, and also to further increase the operating rate to 80% after a period of 60 months. These license conditions however are not necessarily fully endorsed either by the Government or by the timber companies due to the fact that the necessary infrastructures for industrialization in the timber business are so backward that timber companies following these conditions strictly tend to be unprofitable. In this sense the export of logs from Sarawak, though unsteady, will possibly increase most among the countries that are strengthening bans or regulations on export of logs.

The results of the FAO survey of Sarawak's forest resources indicate that Sarawak is ensured to realize considerable potentialities if the transport conditions are improved. Most of the resource areas including the FAO units in the Baram river basin have already been licenced and production level is mainly determined by international markets. Future production of timber in the Study Area was assumed as shown in Table 2-19.

Table 2-19 Forecasted Timber Production in the Study Area

Area	Type	1977	1985	1995	2005
Baram :	Swamp Timber	250	250	250	250
	Hill Timber	600	610	665	715
Limbang:	Hill Timber	45	65	100	100
Total :		895	925	1,015	1,065
	Export (%)	86	75	70	60
	Saw mill(%)	14	25	30	40

2-5 Tourism

2-5-1 Outline of Current Situation

In 1976 approximately 100,000 persons visited Sarawak and out of this total about 75% were tourists on vacation or other coming for the purpose of leisure.

The most prominent travel origin of the tourist is Brunei (61.2% of the visitors coming for holiday and leisure purposes), followed by West Malaysia (11.3%), Singapore (6.8%), Sabah (5.1%). These neighbouring countries together account for 84.4% of the total. Other countries include U.S.A. (2.5%), U.K. (2.0%), West Germany (1.3%), Australia (1.2%) and France (1.0%) etc. Visitors from Japan, although having a share of about 2% of the total make up only 1.0% for the purpose of sightseeing.

The transportation means of tourists to Sarawak is split between air, sea and land services which have 23%, 29% and 48% respectively.

For the tourist travelling by air, Kuching is the busiest point of entry followed by Miri. In the case of travelling by water, Limbang is the busiest transfer point. Travel by land is, in most cases, via Sungei Tugoh.

Tourism resources in Sarawak include the traditional culture of various indigenous races and superior ecological conditions over those of other Asian countries. Even though these tourism resources are rather special, the objective problems of them being scattered over vast areas served only by inadequate transport systems and infrastructures, create the expectation that Sarawak will not be able to achieve any large scale gain in this market.

It is expected that the on-going Toruism Master Plan Study for Sarawak will clarify the direction of tourism development to be taken in the future.

2-5-2 Tourism Activities in the Study Area

The following are the major tourism resources available in the Study Area.

Location		Points of Interest
a) Niah Cave:		historic inheritance, nature, cave viewing
b) Miri	:	amusement, shopping and as the Areas sightseeing base.
c) Limbang	:	amusement
d) Lambir	:	natural landscape
e) Baram	:	traditional ethnic culture, natural beauty

Among these, Niah Cave and the Baram river are now attracting foreign tourists. The others are mainly visited by locals, people from Brunei and other neighbouring regions. Except for Miri, however, the places do not have good tourist facilities and the number of visitors is limited.

Tables 2-20 and 2-21 show the number of day visitors as well as the percentage of overnight visitors going to Niah Cava located about 50 miles south of Miri. These statistics, however, are not based on reliable surveys, but on a compilation of the visitor's book. A survey is now underway by the Department of Forestry, Miri, to gain a clearer picture of visitors to Niah. According to an estimation by the officer in-charge, the present annual number of visitors is roughly between 3,000 to 4,000, of which 20 to 50% (depending on the year) are foreigners (i.e., not from Brunei). It is considered that Niah Cave will be able to attract more tourists provided that improvements are made to solve, the poor road conditions from Miri to Niah, the lack of tourist accommodation facilities at Niah (only one hostel), the present negligible promotion activities, and so on.

Table 2-20 Number of Visitors to Niah

Origin	1973		1974		1975		1976	
	Persons	(%)	Persons	(%)	Persons	(%)	Persons	(%)
Sarawak	182	(48.9)	525	(68.5)	597	(65.2)	320	(34.3)
Brunei	80	(21.5)	44	(5.7)	125	(13.7)	79	(8.5)
Sabah/Semenanjung	10	(2.7)	64	(8.4)	27	(3.0)	69	(7.4)
Others	100	(26.9)	133	(17.4)	166	(18.1)	464	(49.8)
TOTAL	372	(100.0)	766	(100.0)	915	(100.0)	932	(100.0)

Table 2-21 Visitor Patterns at Niah, 1978

Origin	Day Visitors	Overnight Visitors (%)
Sarawak n	31.5	19.4
Brunei	7.8	10.3
Sabah/Semenanjung	6.6	9.4
Others	54.1	60.9
Total	100.0	100.0
	73.1	26.9

Source: Department of Forestry, National Park Section Miri

Tourism activities along the Baram river are dealt with by a local travel agents having operation bases at Marudi and Long Lama. Trip itineraries are to go upstream by longboat and visit a number of longhouses, a trip having a duration of 5 to 10 days depending on the visitors' requests and river conditions. The longboats, in some cases, go up as far as Lio Mato, this being the farthest point they can reach. Over the last four or five years, approximately 10 Swiss groups (100 to 150 persons per year) have visited the area. Although the tours are not necessarily easy or comfortable it is expected that such tours will become more popular in the future as travel purposes and tourism objectives are diversified and the needs for adventurous specialized tours have been growing in the developed countries.

The points requiring further studies are as follows:

(1) The feasibility of tourism in the Baram river basin;

(2) Development of G. Mulu for recreational/tourism purposes

(3) Provision of recreational opportunities for the people in the Limbang area

It is considered that Loagan Bunut has only limited tourist attraction because the landscape is of little value for tourism.

2-5-3 Tourism Development Potentials

In view of the results of various surveys which have been conducted to date, the following three areas are believed to have tourism development potentials in connection with the Project Road construction.

G. Mulu National Park
Baram River valley
Loagan Bunut

1) G. Mulu National Park

As shown by Fig. 2-4, G. Mulu National Park is an expanse of land of about 200 square miles in Sg. Tutoh/Apoh area. Topographically, the Park consists of hills near the Brunei boarder, mountains with G. Mulu as their peak, low lands in-between, all covered by tropical rain forest. The area was designated as a National Park in 1975 for the preservation of the ecological environment which are unique. Relatively unexplored and untouched landscapes are preserved in this almost uninhabited area.

The Royal Geographical Society of Britain conducted a 15-month expedition under the cooperation of the Sarawak Forest Department from 1977 to 1978. The expendition revealed an overall picture of this area, re-confirmed the value and uniqueness of its resources, and reported the following features of the Park:

"By far the most spectacular landscapes of the park are provided by the limestone hills. Vertical white cliffs tower 2000 feet above the alluvial plains and alternate with incredibly steep, forest clad slopes. The higher levels of the hills are almost unexplored and unexplorable, save for a very few hard-won trails. Deep dolines abound, vertical cliffs are recurring features, and the pinnacle karst is one of the most inhospital terraines known to man. However, this does all add up to one of the world's most spectacular limestone landscapes, and the pinnacles, some of them more than 100 feet tall, represent a classic feature of tropical karst.

Complementing both the scale and scpectacle of the park's surface karst are the caves deep within the limestone. They comprise one of the most remarkable groups of caves in the world. Clearwater Cave is the longest known outside Europe and North America. Wonder Cave is fabulously decorated, and Dee Cave has possibly the largest cave passage in the whole world. The caves of Mulu are amazingly spectacular and provide yet another facet to a truly magnificent National Park." ("Cave of Mulu," Royal Geographical Society, London, 1978.)

Also the tropical rain forests have a primeval ecological balance of almost all of the vegetation and the large veriety of insects and other small animals.

While a detail discussion of G. Mulu is not the purpose of this Report, the foregoing eloquently describes the Park's value not only as an academic resource, but also as a tourism resource. However, when the Project Road will go through G. Mulu, the main route and access road routes must be selected very carefully to maintain the subtle ecological balance. It is important, therefore, that tourism development in G. Mulu have a concrete physical plan and a management plan which will adequately satisfy the usually conflicting purposes of the preservation and the exploitation of a resource.

2) Tourism in the Baram River Valley

In contrast to the tourism in G. Mulu, which depends totally on its natural beauty, the major tourist attaction in the Baram River valley is to visit by means of longboat log cabins of different races scattered upstream to observe their peculiar customs and manners. This is a relatively popular tourist activity also found in the vicinity of Kuching and in the Rajan River valley.

The total time and expense of travel from Miri to K. Baram, Marudi, and to the Baram River valley (up to above Long Lama, where most of the tourist attactions are located and which presently depends on water transport), will be greatly reduced upon the completion of the Project Road. Also, travel from Long Lama to G. Mulu for about 50 kilometers will be easier.

3) Loagan Bunut

Tourism resources in Loagan Bunut, which is only several miles north of the Sg. Tinjar - Long Lama section of the Project Road, are its unspoiled peat swamp, fish, shellfish, birds, and insects which live in its vast open water, a variety of vegetation, and the natural scenery from hills on the southern end of the lake. Designation of this area as either a wildlife sanctuary or a national park is currently under study by the State Government.

Despite its relatively small tourist attraction compared with those of the former two areas, Loagan Bunut can very well become

a place of regional recreation under an appropriate development program, in view of its high accessibility.

4) Organized Tourism Development in the Study Area

The tourism development in the Study Area, where a number of international level tourism resources are present, will not only meet the increasingly diversed and specialized needs of international tourists, but will also enable the rise of industries in the underdeveloped areas. The construction of the Project Road will result in the effective inducement of tourism development in an organized manner under the following concept in areas which are otherwise hardly accessible or now underexploited.

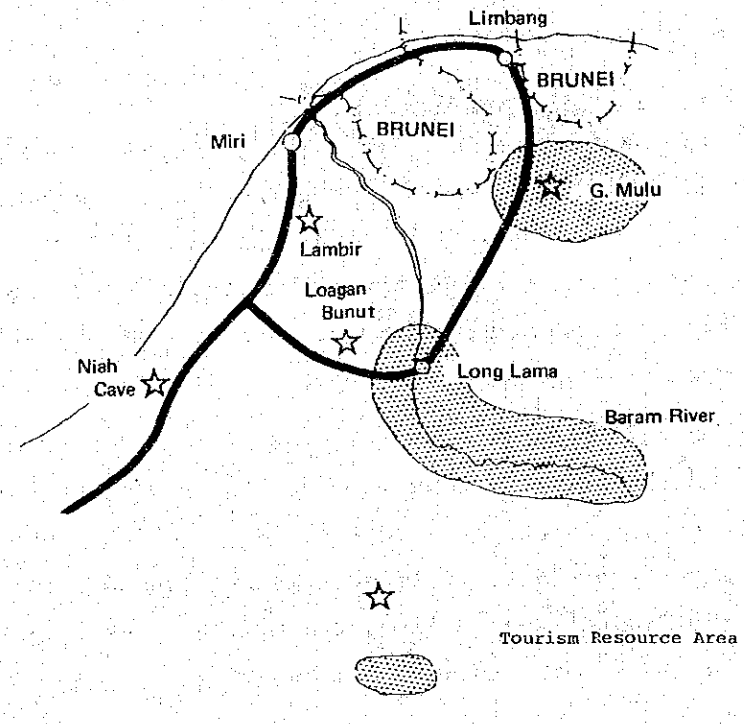
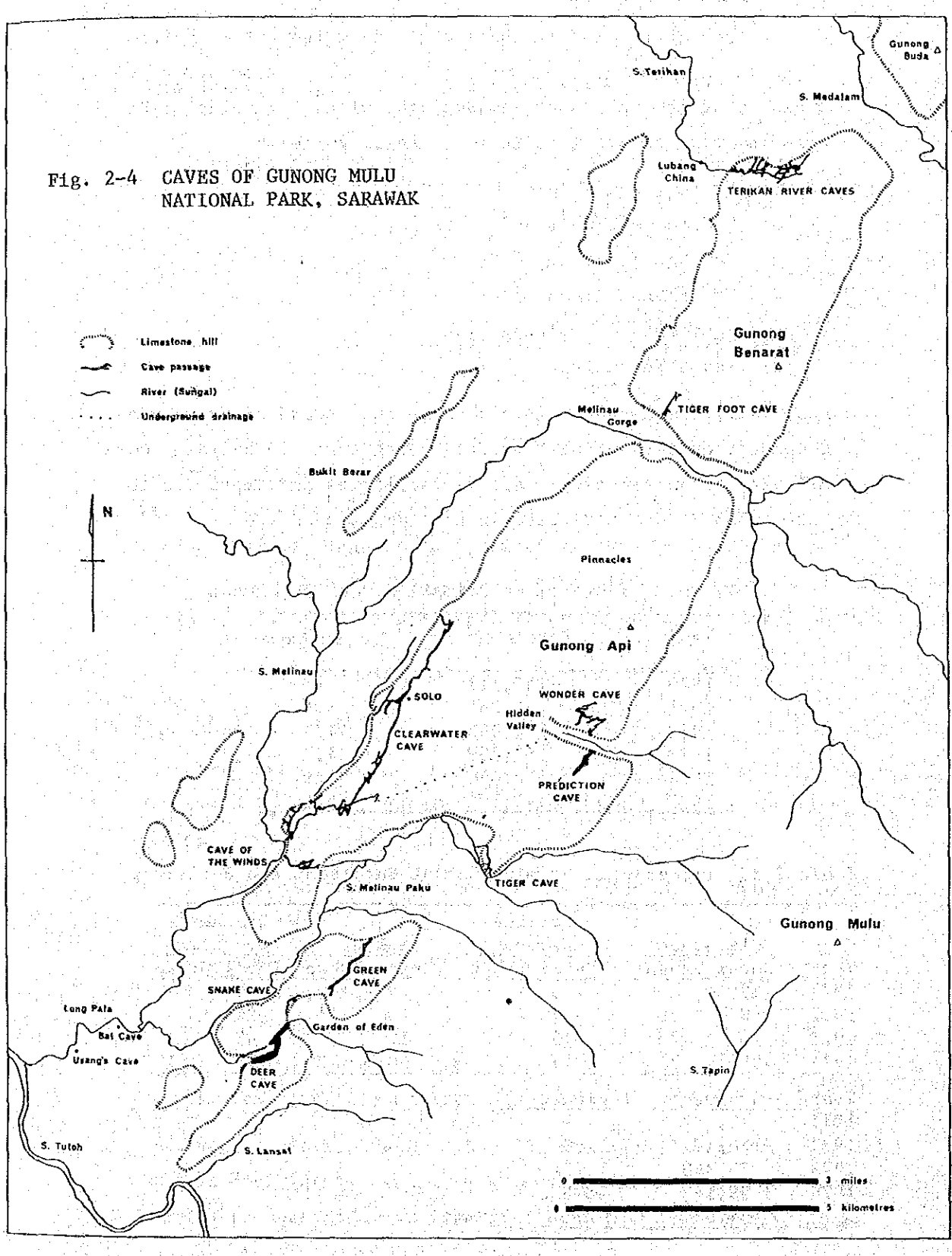


Fig. 2-4 CAVES OF GUNONG MULU NATIONAL PARK, SARAWAK



2-6 Education and Medical Services

2-6-1 Educational Activities

Educational activities are positively promoted not only from the viewpoint of scholarship, but also from the standpoints of vocational training, technical education and agriculture training. The existing educational institutions are as follows:

a) Primary Education
b) Secondary Education
c) Teacher Training
d) Vocational Training
e) Agriculture Training
f) Adult Education

Above all, the emphasis is placed on the spread of primary and secondary education, with efforts being taken in building more schools, reconstructing obsolete facilities and improving the curriculum as are indicated in the Tables 2-22 and 2-23.

Table 2-22 Increase in Primary School Enrolment

Year	Enrolment	Growth Rate (%)
1970	150,111	-
1971	152,284	1.5
1972	154,932	1.7
1973	162,289	4.8
1974	168,658	3.9
1975	177,100	5.1

Table 2-23 Increase in Primary School Enrolment and Facilities

	Classroom		Science Laboratory		Hostel		Teacher's Quarters	
Year	Rural	Urban	Rural	Urban	Rural	Urban	Rural	Urban
1971	12	9	5	6	9	-	6	-
1972	80	30	4	1	10	1	20	-
1973	70	23	17	2	19	-	43	1
1974	56	26	27	4	18	2	71	1

Year	Enrolment	Increase (%)
1971	23,392	-
1972	26,177	11.9
1973	30,360	15.9
1974	39,142	28.9
1975	54,880	62.6

Baram and Limbang Districts in the Study Area have a total of 12 schools as shown in Table 2-24. Other than these, major cities have Chinese schools.

Table 2-24 Primary and Secondary Schools in Baram and Limbang Districts, 1978

District	Secondary School				Primary School			
	No. of School	No. of Classes	Enrol-ment	No. of Teachers	No. of School	No. of Classes	Enrol-ment	No. of Teachers
Baram	3	96	2,373	64	82	267	8,462	291
Limbang	2	41	1,623	64	35	139	4,149	137
Total	5	137	3,996	128	117	406	12,611	428

The efforts and costs required to provide the people in the interior with such educational opportunities are extremely great. Construction materials and educational tools are usually transported by longboats and sometimes even by helicopters. Accordingly, construction costs are doubled or even trebled compared with ordinary cases. Maintenance costs are higher as well.

2-6-2 Medical Activities

Poor infrastructures and communication facilities handicap medical activities. Medical services are provided based on the following systems.

a) District Health Center (in the form of a general hospital)
b) Health sub-center
c) Community Health Center
d) Dispensary
e) Sub-dispensary
f) Flying Doctor Service
g) Traveling Dispensary

The District Health Center which is the base for medical services in each district is usually a general hospital. In the rural areas, the Health sub-center or Community Health Center or Dispensary

are the bases of medical services. Two are located in Limbang District (N. Medamit and Batu Danau), and six in Baram District (Long Teru, Bario, Long Loyong, Long Bemang, Lio Mato and Long Lama) each equipped with beds, first-aid medical facilities and maternity facilities. No doctors are stationed there, but 3 to 5 people including hospital assistants and others serve as permanent staff depending on the local conditions.

The Sub-dispensary, smaller in scale than the dispensary is run by a small staff. As the population is widely scattered over vast areas the medical services in these areas are supplemented by the Traveling Dispensary and Flying Doctor Service systems. A doctor and assistant visit designated areas regularly either by longboat or by helicopter. Table 2-25 shows the number of cases dealt with by Flying Doctor Service for Baram District.

Table 2-25 Flying Doctor Services (Based in Marudi)

	Year		
Month	1976	1977	1978
Jan.	448	213	182
Feb.	188	465	260
March	554	183	353
April	279	423	312
May	597	136	589
June	216	298	-
July	714	313	-
Aug.	427	387	-
Sept.	424	188	-
Oct.	543	259	-
Nov.	105	328	-
Dec.	649	126	-
Total	5,144	3,319	(1,696)

Source; Medical Dept. Marudi

Chapter 3

PRESENT TRAFFIC CONDITION OF THE STUDY AREA

Chapter 3 PRESENT TRAFFIC CONDITIONS IN THE STUDY AREA

3-1 Transport Network

3-1-1 General

The transport Network in the Study Area consists of road, river, air and coastal shipping. As is shown in Fig. 3-1 the roads at present serve only very limited parts of the area; rivers provide the only real mode of transport in the remainder of the area. Although the main population centres in the Study Area are served by regular MAS air service, its capacity is very limited.

Coastal shipping plays an important role in transporting goods between the Study Area and other areas such as to Kuching, Sibu, Sabah and especially to foreign countries. The three existing ports in the Study Area are at Miri, Marudi and Limbang. There are also two ferries and a passenger ferry operating linking Miri and Limbang via Brunei.

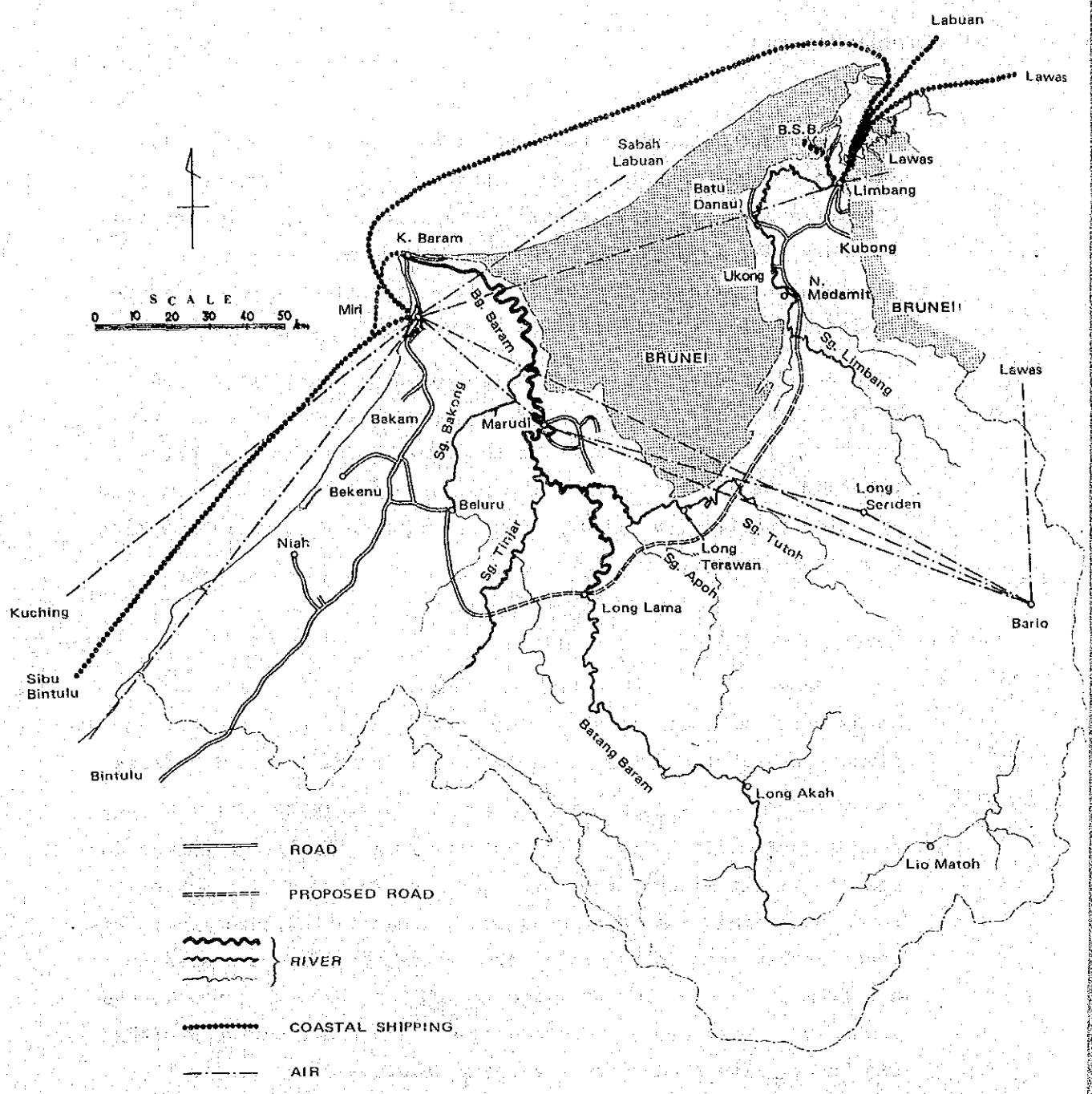
3-1-2 Present Conditions

(1) Roads

Roads serve most of the Miri Districts, the northern half of the Limbang District and the isolated Marudi area and its vicinities.

The Miri-Bintulu Road, completed in the early 1970s with the trunk road standard, is a 213 km (132 miles) long gravel road except for some 18 km (11 miles) from each end which is surfaced. Feeder roads branching from it link Bakam, Bekenu Niah, Beluru etc. This road further extends to Kuala Baram where the ferry operates to and from the Brunei border where the road links with a trunk road in Brunei. Most of the road sections are bitumen surfaced with two lanes. The road section between Beluru and Sg. Tinjar is almost completed using trunk road standards. The Limbang - Ng. Medamit Road covering 41 km (25.6 miles) utilizing a feeder road standard has several feeder roads branching from it to serve the major population centres of the Limbang District.

Fig. 3-1 TRANSPORT NETWORK OF THE STUDY AREA



Most of the sections of these roads are gravel except those in Limbang town and its vicinity. Feeder roads of about 30 km (18.8 miles) exist in the Marudi area and the main link is between Marudi and Lubok Nibong. Some sections in Marudi town are bitumen surfaced.

(2) River

The river system covers most of the Study Area. The Bg. Baram and its major tributaries of Sg. Bakong, Sg. Tinjar, Sg. Apoh and Sg. Tutoh serve nearly the whole of the Baram District while Sg. Limbang and its tributaries serve the Limbang District. In these areas communities have developed along these navigable water ways.

Bg. Baram, the second largest river in Sarawak, has abundant water throughout the year and provides a reliable water transport channel for maximum 400-ton motor vessels, barges etc. from Kuala Baram to Long Lama, 225 km (141 miles) upriver. The passenger express launches with capacities of 60-80 passengers are also operated daily on the K. Baram - Marudi - Long Lama section. Other major sections of the system are also navigable for smaller vessels with capacities of 10 to 30 tons depending on the water level. For longboats which are the most popular personal means of transport, most of the rivers are navigable all year round. The Sg. Limbang is also a relatively large river system and plays an important role in transporting logs from Ng. Medamit to Limbang, over 100 km (62.5 miles).

The Sg. Limbang system is navigable for longboats though some sections in the upper reaches have navigational difficulties during periods when the water level is low. The same situation exists for the upper reaches of the Bg. Baram system as well.

(3) Coastal Shipping

The ports in the Study Area located in Miri, Marudi and Limbang are the bases of external trade and Miri is the most important. Shipping between Miri and destinations within the South China Sea is at present mainly served by 1,500 to 3,000 ton vessels which employ lighters to transport goods to and from Miri to the open anchorage outside Miri. Shallow draft vessels able to cross the Miri sand bar with 300 to 400 ton cargoes at high tides are also operated between Miri, Kuching, Sibu and neighbouring countries.

The small coasters with shallow drafts can avoid the difficult stevedoring handling at Miri Roads and are therefore able to compete in cost with larger ships even for the section between

Singapore and Miri. Kuala Baram is better situated. It has a water depth at the Baram bar of about 2.7m. (9 feet) at high tide which can facilitate the use of shallow draft vessels with up to 1,500 tons loading capacity; however, Kuala Baram is situated some 25 km (15.6 miles) from Miri, which causes the need for trucking to Miri at a cost of about M$5 to M$6 per ton.

Marudi is at present served by shipping services to Singapore and Peninsular Malaysia with transshipment at Labuan and frequent launch services to/from Kuching, Sibu and Miri via Kuala Baram also available. The Bg. Baram is sufficiently wide and deep at Marudi to allow shallow draft vessels with loading capacity of up to about 1,000 to 1,500 tons to call. It will, however, be necessary to construct new and better port facilities to accommodate the large vessels. Cargo transported through Marudi port was approximately 24,000 tons in 1977. The most popular kind of vessels are those with loading capacity of up to 200 tons.

Limbang is at present also served by shipping services similar to those described for Marudi. The bar at the mouth of the Sg. Limbang restricts calls of some types of vessels with loading capacities of more than 300 to 500 tons. During the "landas season" the vessels often face difficulties in crossing the bar with the result that ship calls are reduced to approximately 40 percent of the normal schedule.

(4) Air

At present, three airports and two airfields exist in the Study Area: Miri, Marudi, Limbang, Long Seridan and Bario. Miri Airport has facilities to handle aircraft types up to the Boeing 737, which began utilizing the airport in 1977. At the remainder of the airports only small aircraft, such as the BN2 with a limited passenger capacity of only eight, can be handled. Augmenting the regular service by MAS, frequent charter flights operated by other companies are available.

Relocation of Limbang Airport which is currently under study, envisage facilities abile to handle aircraft of the Boeing 737 type.

3-2 Outline of the Traffic Surveys

At present comprehensive traffic data, covering the Study Area, is scarce. For road traffic, however, the traffic count figures at major points have been adequately prepared. Traffic counts covering a complete week during each census period have been carried out twice a year since the early 1970s, although no origin and destination surveys have been conducted. Statistics of air passenger and cargo movements were available at the Department of Civil Aviation in each of the Districts. Statistics of imports and exports by port were compiled by the Statistical Department in the form of computer outputs. However the port statistics indicate only the external movements of goods. Information on river traffic and coastal shipping traffic in the Study Area was not available at all.

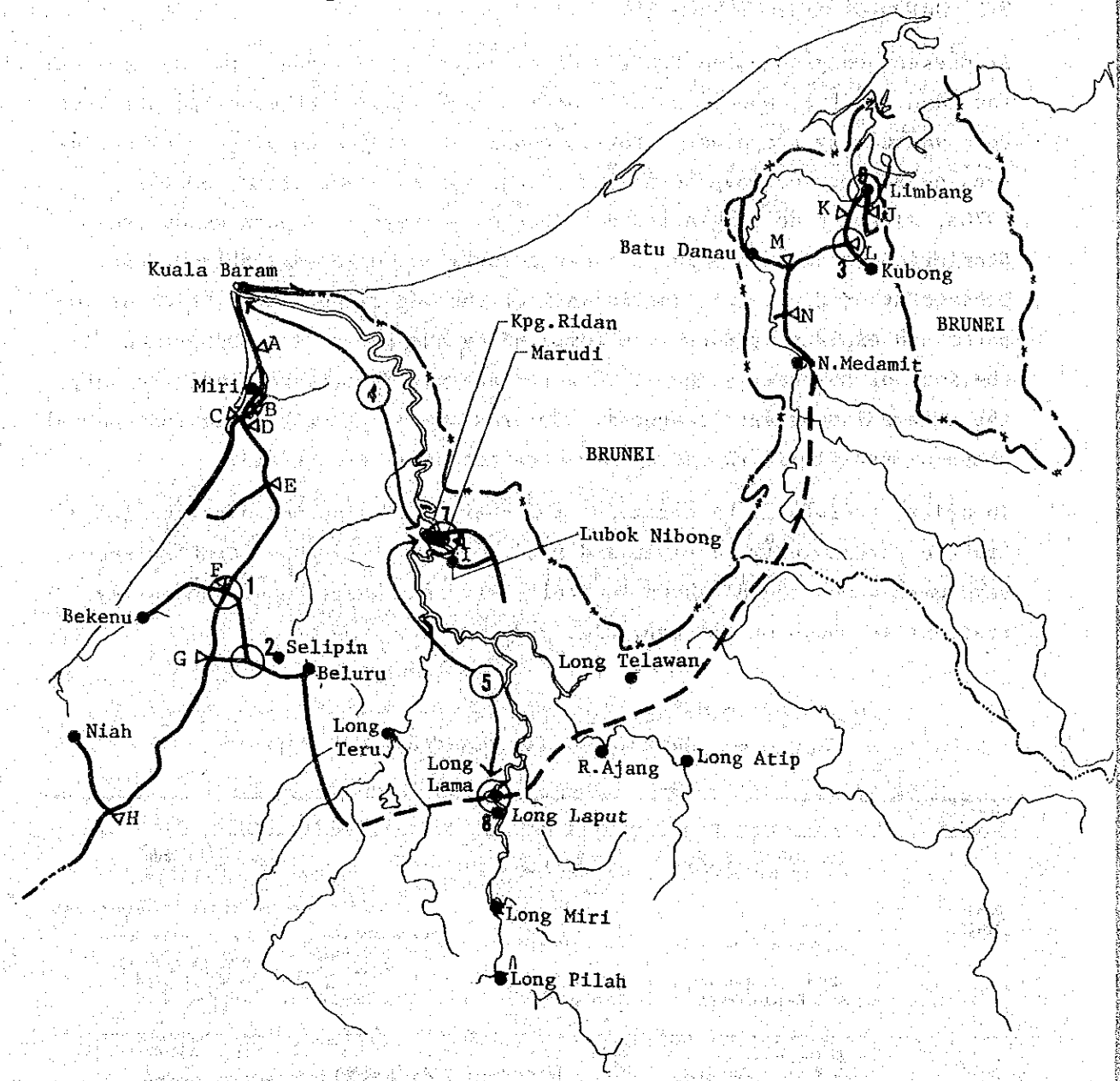
In order, therefore, to determine the characteristics and distribution of traffic particularly by river and road, different types of traffic surveys were conducted as shown in Table 3-1. The location of the survey stations is shown on the map, Fig. 3-2.

Table 3-1 Outline of Conducted Traffic Surveys 1/

Traffic Type		Survey Station	Survey Period	Survey Method	Major Survey Items
Road Traffic	1	Miri-Bintulu Road, Bekenu Junction	27 July (Thu.), 28 July (Fri.) 7 a.m. - 5 p.m.	traffic count	- vehicle type - orig. and dest. - vehicle characteristics - No. of passengers - tonnage and type of goods carried
	2	Beluru Road, B. Peninjau Junction	- do -	interviews with drivers by stopping the vehicles	
	3	Limbang-N. Medamit Rd., Kubong Junction	1 Aug. (Tue.) 2 Aug. (Wed.) 7 a.m. - 5 p.m.		
Express Launch Passenger Traffic	4	On the launches, K. Baram - Marudi	5 Aug. (Sat.) -8 Aug. (Tue.)	traffic count	- orig. and dest. - trip purpose - passenger characteristics
	5	On the launches, Marudi - L. Lama	6 Aug. (Sun.) -12 Aug. (Sat.)	interviews with passengers	
River Goods Traffic	7	Marudi Wharf	6 Aug. (Sun.) -12 Aug. (Sat.)	interviews with vessel operators	- orig. and dest. - No. of passengers - tonnage and type of goods carried - average travel time
	8	L. Lama Wharf	7 Aug. (Mon.) -10 Aug. (Thu.)		
Speed Boat Passenger Traffic	9	Limbang Customs Wharf	1 Aug. (Tue.) 2 Aug. (Wed.)	interviews with passengers	- orig. and dest. - trip purpose - travel time - passenger characteristics

1/ samples of survey sheets used for the surveys above mentioned are contained in Appendix Fig. A-3-1 ~ 4.

Fig. 3-2 LOCATION OF TRAFFIC STUDY STATIONS



3-3 Road Traffic

3-3-1 Road Traffic Volume

(1) Average Daily Traffic

The results of the traffic census carried out by P.W.D. twice a year indicate a fairly high ADT level on the major road sections in the Study Area as shown in Table 3-2. ADT on the Miri - Bintulu Road varies approximately from 300 to 5,000 and its annual growth rate is higher in the vicinity of Miri.

ADT on the Limbang - Ng. Medamit Road is much lower, only about 120 to 230 except for the section near Limbang Town where the ADT reaches approximately 1,500.

(2) Traffic Composition

Traffic composition by vehicle type is summarized in Table 3-3 which indicates that passenger cars generally constitute nearly 70% of the traffic immediate vicinity of towns like Miri and Limbang but with their shares being reduced to 30% to 50% in the suburban or rural areas while the percentages of trucks increases.

(3) Traffic Variation

Daily variation of the road traffic at major census stations is illustrated in the Appendix Fig. A-3-5 and Table 3-4 shows the ratio of 12-hour traffic to 24-hour traffic. The ratio is higher in the vicinity of towns where the hours of activities are longer.

The weekly variation of road traffic does not seem to show any distinctive patterns (see Appendix Fig. A-3-6).

Table 3-2 Average Daily Traffic at PWD Census Stations on the Existing Major Roads in the Study Area

1/	Census Station 2/	Name of Road	Location		1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977	1978	Ave. Annual Growth Rate (%) 1971–78	1974–78
D4/3	A	Miri – K. Baram Road			117	n.a.	366	618	613	703	n.a.	1,157	1,169	965	1,157	1,399	11.0	3.8
D4/8	B	Miri – Lutong Road			n.a.	2,705	3,553	3,867	4,382	5,211	n.a.	6,012	7,425	8,404	16,986	13,271	19.5	27.3
D4/19	C	Miri – Tg. Lobang Road				n.a.	n.a.	n.a.	3,238	658	n.a.	4,453	5,079	4,404	4,572	5,359	19.6	2.7
D4/10	D	Miri – Bintulu Road	: South of Miri town		532	855	1,003	1,421	1,776	2,439	n.a.	2,538	2,645	2,780	3,806	5,141	13.0	19.4
D4/12B	E-1	-do-	: Bakam Junction	: towards Miri	n.a.	n.a.	678	395	393	428	n.a.	491	518	550	929	1,589	18.5	34.1
D4/12C	E-2	-do-	: -do-	: towds. Bintulu	n.a.	n.a.	350	352	408	459	n.a.	204	452	521	824	1,528	17.8	58.8
D4/4B	F-1	-do-	: Bekenu Junction	: towds. Miri	164	168	194	580	343	372	n.a.	414	580	465	725	715	11.6	14.1
D4/4C	F-2	-do-	: -do-	: towds. Bintulu	130	207	226	363	412	443	n.a.	397	495	368	584	628	5.0	11.4
D4/4A	F-3	Bekenu Road	: -do-	: towds. Bekenu	68	117	143	244	233	299	n.a.	221	185	239	307	476	6.0	22.6
D4/17B	G-1	Miri – Bintulu Road	: Beluru Junction	: towds. Miri	n.a.	n.a.	n.a.	240	208	291	n.a.	302	356	300	385	462	9.2	9.7
D4/17C	G-2	-do-	: -do-	: towds. Bintulu	n.a.	n.a.	n.a.	199	174	229	n.a.	145	394	357	454	495	16.9	29.7
D4/17A	G-3	Beluru Road	: -do-	: towds. Beluru	n.a.	n.a.	n.a.	69	73	160	n.a.	301	89	122	183	262	10.3	4.5
D4/15B	H-1	Miri— Bintulu Road	: Batu Niah Junction	: towds. Miri	n.a.	55	72	187	191	270	n.a.	220	308	306	350	367	8.5	12.2
D4/15C	H-2	-do-	:	: towds. Bintulu	n.a.	179	210	250	258	266	n.a.	310	171	261	288	241	Δ0.7	0.2
D4/15A	H-3	Niah/Batu Niah Road	:	: towds. Niah	n.a.	147	214	269	343	357	n.a.	212	343	302	416	435	3.3	17.7
D4/2	O	Miri – Bintulu Road	: 16 mile from Bintulu		374	320	318	270	364	76	n.a.	115	146	149	132	187	Δ2.1	9.1
D4/18C	I	Marudi – Kpg. Linei Road	: northeast of Marudi town		n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	1,036	588	706	537	984	-	Δ1.9
D5/1	J	Limbang – Pandaruan Road	:		42	53	57	65	547	n.a.	n.a.	919	989	1,048	1,135	1,382	13.1	10.0
D5/2	K	Limbang – Kubong Road	:		n.a.	n.a.	n.a.	n.a.	866	n.a.	n.a.	1,125	1,334	1,378	1,320	1,694	23.3	8.4
D5/3A	L-1	Limbang – N. Medamit Road	: Kubong Junction	: towds. Limbang	113	112	105	139	187	n.a.	189	192	218	242	236	236	4.4	5.0
D5/3C	L-2	-do-	: -do-	: towds. N. Medamit	165	148	149	182	192	n.a.	193	118	164	187	171	165	Δ1.1	7.4
D5/3B	L-3	Limbang – Kubong Road	: -do-	: towds. Kubong	64	58	53	61	91	n.a.	140	152	75	82	89	91	Δ4.0	Δ8.2
D5/4A	M-1	Limbang – N. Medamit Road	: Batu Donau Junction	: towds. Limbang	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	116	100	118	103	116	-	0.3
D5/4C	M-2	-do-	: -do-	: towds. N. Medamit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	97	79	93	86	101	-	1.7
D5/4B	M-3	Batu Danau Spur Road	: -do-	: towds. Batu Danau	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	39	39	60	43	66	-	12.2
D5/5A	N-1	Limbang – N. Medamit Road	: Ukong Junction	: towds. Limbang	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	82	74	83	73	85	-	0.6
D5/5C	N-2	-do-	: -do-	: towds. N. Medamit	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	85	54	69	66	80	-	0.8
D5/5B	N-3	Ukong Spur Road	: -do-	: towds. Ukong	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	63	39	35	27	34	-	Δ14.8

1/ these codes are those used in PWD census
2/ location of these codes is shown in Fig. 3-2
Source: PWD Traffic Census

Table 3-3 Traffic Composition by Vehicle Type, 1978

(%)

Survey Station	Name of Road	Car/Taxi			Van and Trucks			
		Car	Taxi	Bus	Van	Truck Trailer	Truck	Others
A	Miri - K. Baram road	56.0	13.5	2.7	-	-	11.6	16.2
B	Miri - Lutong road	63.8	5.6	2.7	4.0	0.3	14.0	9.6
C	Miri - Tg. Lobang road	78.9	1.4	3.2	1.1	-	5.2	10.2
D	Miri - Bintulu road (Miri town)	36.0	7.4	4.8	8.4	0.7	24.9	17.8
E	Miri - Bintulu road (Bakam junc.)	32.7	17.4	3.1	0.3	6.9	29.3	10.3
F	Miri - Bintulu road (Bekenu junc.)	26.4	16.1	1.6	8.3	-	33.5	14.1
G	Miri - Bintulu road (Beluru junc.)	22.8	10.9	2.7	4.8	1.1	43.8	13.9
I	Marudi-Ulu Linei road	58.8	5.8	3.8	-	0.4	11.4	19.8
J	Limbang - Pandaruan road	46.5	7.8	2.8	6.1	0.2	15.9	20.7
K	Kubong - Limbang road	58.9	9.6	3.0	4.6	12.8	-	11.1
L	Limbang - N. Medamit road (Kubong junc.)	28.0	30.6	11.8	3.9	2.6	6.1	17.0
M	Limbang - N. Medamit road (Batu Danau junc.)	21.9	35.2	8.6	-	7.0	1.6	25.8

Source: PWD traffic census

Table 3-4 Daytime Traffic Ratio

Name of Road	Survey Station	Traffic Volume		Daytime Traffic Ratio
		Daytime 6 a.m.-6 p.m.	24 Hours	
Miri - K. Baram road	A	893	1,011	1.13
Miri - Lutong road	B	8,697	11,841	1.36
Miri - Bintulu road (Miri town)	D	5,363	6,002	1.12
Miri - Bintulu road (Bakam junc.)	E	1,513	1,584	1.05
Miri - Bintulu road (Bekenu junc.)	F	717	1,003	1.40

(4) Estimated ADT on the Project Road Sections

Based on the results of PWD traffic census and those of the traffic surveys conducted by the Survey Team, the ADT on the existing sections of the Project Road was estimated as shown in the Table 3-5.

Table 3-5 ADT on the Existing Project Road, 1978

Road Section	Length (km.)	Van/ Car	Pick up Truck	Truck	Bus	Total
Miri/Bintulu Rd. - Beluru	18.4	60	17	97	2	176
N. Medamit - Ukong Junc.	9.7	35	5	22	7	69
Ukong Junc. - Batu Danau Junc.	9.3	46	6	30	6	88
Batu Danau Junc. - Kubong Junc.	12.5	96	13	65	9	183
Kubong Junc. - Limbang	9.8	565	42	200	25	832

3-3-2 Road Transport

(1) Bus Transport/Taxi

At present five bus companies are operating in the Study Area of which three are in Miri and one each in Limbang and Marudi respectively. Of the three bus companies in Miri, two operate mostry in Miri Town. Table 3-6 summarizes the operation of buses in the Study Area.

Table 3-6 . Annual Bus Operation in the Study Area

Area	Year	No. of Buses	Total Kilometrage	Average Kilometrage per Bus	Total Passengers
Miri	1968	30	1,115,550	101.9	1,721,392
	1973	32	1,935,900	165.7	2,390,508
	1977	45	2,680,600	163.32	4,575,144
Limbang	1968	5	348,820	191.1	77,732
	1973	3	547,060	499.6	30,000
	1977	9	353,070	107.5	161,518
Marudi	1977	3	66,670	60.9	52,500

Source; Land Transport Department

Bus fare is proportional to the distance travelled: M$0.1 per mile or M$0.062 per kilometer with a basic minimum fare of M$0.20. Bus routes and fares outside of towns are summarized in Table 3-7 and Fig. 3-4.

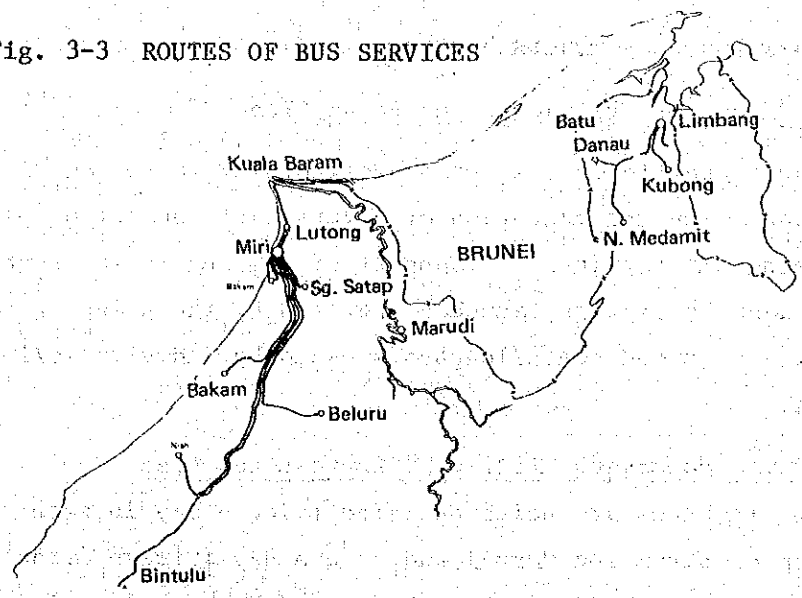
In the Study Area, taxi service plays an important role, not only in towns, but also between towns mainly due to the fact that the taxi fare per person with four to five passengers carried together equals the bus fare on longer distances, and also partly due to the low frequency of bus services.

Table 3-7 Bus Routes and Fare

Route	Distance km.	(miles)	Fare (M$)	Frequency of Services (vehicle/day)
Miri ⟷ Lutong	11.3	(7)	0.70	60
Miri ⟷ Sungai Satap	48.3	(30)	3.00	4
Miri ⟷ Bakam	17.7	(11)	1.20	4
Miri ⟷ Batu Niah	112.6	(70)	7.00	8
Miri ⟷ Beluru	80.5	(50)	5.00	4
Miri ⟷ Bekenu	64.4	(40)	4.00	18
Miri ⟷ Bintulu	202.7	(126)	10.00	1
Limbang ⟷ Kubong	19.3	(12)	1.20	18
Limbang ⟷ N. Medamit	40.2	(25)	2.50	6

Source: Interviews with Local operators

Fig. 3-3 ROUTES OF BUS SERVICES



(2) Truck Transport

Trucks used in the Study Area usually only have a loading capacity of five to six tons, although PWD along with some oil companies have a few truck-trailers with higher loading capacity. Some timber companies have vehicles with up to 20-ton loading capacities operating on their own timber roads, but the number is very limited.

The main reason for the dominance of trucks with 5-6 ton loading capacity is the existence of numerous temporary bridges, mostly of the Bailey-bridge type.

(3) Number of vehicles

Statistics on vehicle registration are available only by Division. Table 3-8 shows the growth of the number of vehicles in the Fourth and Fifth Divisions.

Table 3-8 The Number of Vehicles Registered

	Fourth Division		Fifth Division	
	No. of Vehicles	Annual Growth rate (%)	No. of Vehicles	Annual Growth rate (%)
1967	1,709	-	137	-
68	2,188	28.0	179	30.6
69	2,704	23.6	223	24.6
70	3,191	18.0	313	40.4
71	3,720	16.6	389	24.3
72	4,000	7.5	436	12.1
73	4,452	11.3	462	6.0
74	5,241	17.7	500	8.2
75	5,887	12.3	538	7.6
76	7,686	30.6	690	28.3
77	8,879	15.5	719	4.2
Average Annual Growth Rate %		16.5		17.2

Source: Annual Statistical Bulletin

3-4 Passenger Traffic by River/Coastal Shipping

3-4-1 River Passenger Traffic in the Baram Area

Passenger traffic in the Baram Area totally relies on river transport with the exception of a very small number of passengers utilizing air services. Transport of passengers is at present being done by express launches operated by the shipping companies and also by speed boats/longboats owned by individuals/long houses.

(1) River Passenger Traffic by Express Launches

Express launches are being operated twice a day in each direction between K. Baram and Marudi and once a day in each direction between Marudi and Long Lama. 4 launches owned by two companies are in service for the K. Baram - Marudi section while 3 launches owned by three companies service the Marudi - Long Lama section. The express launch operations are outlined in Table 3-9 below.

Table 3-9 Outline of Express Launch Operations

	K. Baram-Marudi	Marudi-L. Lama
Distance (km.)	100 (64 miles)	120 (75 miles)
Average Travel Time (hr.)	3.0 ∿ 3.5	5.0 ∿ 5.5
Average Speed (km./hr.)	29 ∿ 33	22 ∿ 24
Fare per passenger (M$) 1/	10,5,3	9,8,7,6,5,4,3
Capacity (No. of passenger seats)	70 ∿ 80	60 ∿ 70
No. of ships in service	4	3
Average No. of passengers per trip in 1977 and in 1978	40,51	35,45

Source: Interviews with operators

1/ Fare varies depending on the travel distance.

Although a time table exists as shown in the Table 3-10, delays of half an hour to one hour occur frequently mainly because launches stop wherever passengers want to embark or disembark.

Table 3-10 Time Schedule of Express Launches

Direction	Morning		Afternoon	
	Departure	Arrival	Departure	Arrival
Kuala Baram ——→ Marudi	7:30	10:30	13:00	16:00
Marudi ——→ K. Baram	10:00	13:00	13:30	16.30
Marudi ——→ Long Lama	8:15	13:00	12:30	18:00
Long Lama ——→ Marudi	8:00	12:30	13:30	18:30

1/ Afternoon services between Marudi and Long Lama are available every other day since the beginning of 1979.

Table 3-11 shows the total number of express launch passengers, estimated from summaries of the records of shipping companies in Marudi. The average annual growth rate is as high as 18.9 percent, compared to the population growth rates of the Study Area of 1.0 to 5.3 percent. Since the beginning of 1979, an additional service was started between Long Lama and Marudi due to the increasing demand after 1978.

Table 3-11 Number of Passengers Moving by Express Launches

Year	No. of passengers	Growth
1974	50,400	-
1975	64,800	129
1976	72,000	111
1977	79,200	110
1978 1/	100,800	127

Source: Interviews with shipping companies

1/ Estimated based on the actual data of Jan. through July.

The distribution of the passenger traffic by express launch station is summarized in the Table 3-12.

(2) River Passenger Traffic by Speed Boats/Long Boats

Besides the regular passenger express launches service, numerous small vessels, such as speed boats and longboats, are operating throughout the Bg. Baram system. Traffic surveys were carried out in Marudi and Long Lama in order to determine the level of such traffic. As is shown in Table 3-12 which summarizes the interzonal traffic level by speed boats/longboats, trips are well distributed in spite of the considerably expensive operating cost, long travel time and inconveniences. During the survey period, people were often observed who were travelling over long distances over several days.

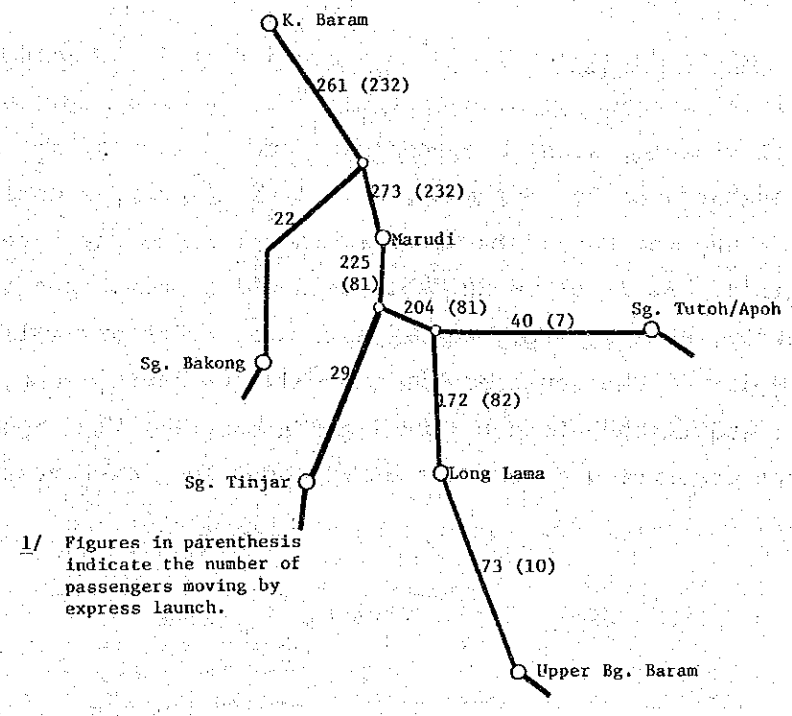
Table 3-12 Distribution of River Passenger Traffic in the Study Area, 1978 1/

person/day

	Sg. Bakong	Sg. Tinjar	Marudi	Long Lama	Upper Baram	Tutoh/ Apoh	Total
K. Baram (Miri)	5	7	3 (204)	0 (28)	3	11	29 (232)
Sg. Bakong		2	10	3	0	2	22
Sg. Tinjar			16	3	1	0	29
Marudi				30 (68)	22 (10)	20 (3)	101 (285)
Long Lama					37	0 (4)	73 (100)
Upper Bg.Baram						0	63 (10)
Sg.Tutoh/ Apoh							33 (7)
							350 (634)

1/ Figures in parenthesis indicate the number of passengers moving by express launch, while others indicate that of longboats/speed boats.

Fig. 3-4 PASSENGER RIVER TRAFFIC IN THE BARAM AREA 1/



1/ Figures in parenthesis indicate the number of passengers moving by express launch.

3-4-2 Passenger Movement between Limbang and Brunei by Speed Boat

Frequent daily service by a number of small speed boats is available between Limbang and Brunei. Table 3-13 shows the number of passengers moving along this section.

Table 3-13 Number of Passengers Moving by Speed Boat between Limbang and Brunei

Year	Depart (to Brunei)		Arrive (from Brunei)	
	Persons/ year	Average/day	Persons/ year	Average/day
1973	87,060	239	90,997	249
1974	41,792	114	43,170	118
1975	62,330	171	60,327	165
1976	88,952	244	93,981	257
1977	83,020	277	87,196	239
1978	n.a.	388 1/	n.a.	317 1/

Source: Immigration Office, Limbang

1/ Estimated based on the sample survey carried out on 1st./2nd. Aug. at Customs Wharf, Limbang

Speed boats with an average capacity of 15 passengers are operating daily between 7a.m. and 6p.m., taking only about 20 minutes to reach the other side. According to the survey results, trip purposes of passengers are mainly shopping, recreation and visiting, while trips for business are scarce.

Of these passengers, those who travel between Miri and Limbang via Brunei are estimated to be 2.7 percent of the total: i.e., 13 passengers per day in 1977 or 18 passengers per day in 1978.

3-5 River Cargo Traffic

Information concerning cargo movement on the river system in the Study Area was difficult to obtain even though interviews with the operators of vessels were carried out since the goods transported are diverse and operators often do not know how much tonnage they are actually carrying.

Table 3-14 shows the tonnage of goods handled at the Port of Marudi of which certain amounts are transported by smaller vessels/ longboats between Marudi and other regions in the Baram Area. As is shown in Appendix Table A-3-1, most of the vessels calling at Marudi have a loading capacity of up to 30 tons; vessels with a loading capacity greater than 100 tons are scarcely seen.

Table 3-14 Tonnage of Incoming Cargo Handled at the Port of Marudi, 1977

Commodity Group/Item	EXTERNAL 1/	INTERNAL 2/
Food	262	1,600
Milled Wheat	132	110
Sugar	340	400
Beverages	89	150
Animal Feed	-	n.a.
Fertilizer	-	n.a.
Cement	844	1,100
Iron & Steel	301	400
Tobacco	3	
Crude Materials Inedible excluding Fuels	17	
Animal and Vegatable Oils	4	6,200
Chemicals and Products	30	
Other General Cargo	1,600	
Fuels	-	10,000
TOTAL	3,622	19,960

Source: 1/ Computer Output of External trade by port, Dept. of Statistics

2/ Consultant's estimate based on the results of interview survey etc.

3-6 Air Traffic

Table 3-15 shows the air traffic volume both of passengers and cargo for major airports in the Study Area. Significant growth rates in air passenger traffic both at the airports of Miri and Limbang have been experienced since 1973 or 1974. Air cargo traffic has been increasing at much higher growth levels for all airports with particularly large growth of air cargo traffic at Mi Miri from 1976 to 1977.

Miri Airport, being one of the most busiest airports in Sarawak, handles about 170,000 passengers and 630,000 tons of cargo while Marudi and Limbang handled only 8,000 passengers and 150 tons of cargo, and 14,000 passengers and 90 tons of cargo in 1977 respectively.

Table 3-15 Air Traffic of Major Airports in the Study Area

Year		Miri		Marudi		Limbang	
		Passenger	Cargo (tons)	Passenger	Cargo (tons)	Passenger	Cargo (tons)
1973	Dep.	51,408	48,529	-	-	-	-
	Arriv.	52,180	93,199	-	-	-	-
	Total	103,588	141,728	-	-	-	-
1974	Dep.	60,276	61,066	3,251	51	4,444	17
	Arriv.	61,101	144,653	3,064	51	4,055	33
	Total	121,377	205,719	6,315	102	8,499	50
1975	Dep.	61,502	72,198	3,588	52	5,243	23
	Arriv.	66,477	171,324	3,291	60	5,020	38
	Total	127,979	243,522	6,879	112	10,263	61
1976	Dep.	78,819	72,238	3,747	79	6,629	25
	Arriv.	78,948	132,120	3,569	93	6,439	56
	Total	157,767	204,358	7,316	172	13,068	81
1977	Dep.	84,252	176,376	4,306	74	6,978	25
	Arriv.	83,844	455,556	3,808	80	6,786	64
	Total	168,096	631,932	8,114	154	13,764	89
Average Annual Growth Rate (%)	Total	13.1	34.8	8.5	18.1	18.4	22.3

Source: Department of Civil Aviation

Of the airway routes, those which are affected by the Project Road are given in Table 3-16. Traffic for each of these routes has been increasing considerably, with its growth being greatly limited by its capacity. Types of aircraft are limited to those of up to the BN2 class with a maximum capacity of 8 passengers depending upon the loading weights of cargo. Therefore the actual occupancy rates are higher than those shown in Table 3-16.

Table 3-16 Operating Characteristics of Air Routes in the Study Area

Air Route	No. of Passengers 1973	No. of Passengers 1977	Average Annual Growth Rate(%)	Frequency of Services	Occupancy Rate(%)
Miri - Marudi	5,728	6,302	2.4	24/week	81.7
Miri - Limbang	4,252	10,179	24.4	40/week	75.3
Marudi - Long Seridan	n.a.	205	n.a.	4/week	29.0

Source; Dept. of Civil Aviation

Distribution of air passenger traffic is estimated based on the statistics shown in Appendix Tables A-3-2, A-3-3 as follows:

Table 3-17 ADT of Air Passengers by Route

Air Routes	Daily Passenger Flow
Miri - Marudi :	20
Miri - Limbang :	30
Miri - Bario :	1
Marudi - Bario :	3
Marudi - Long Seridan:	1

Chapter 4

ESTIMATION OF FUTURE TRAFFIC DEMAND

Chapter 4 ESTIMATION OF FUTURE TRAFFIC DEMAND

4-1 Methodology

4-1-1 Traffic Forecast Method

For forecasting, traffic is classified into the following types:

1) Normal traffic
2) Diverted traffic
3) Induced traffic
4) Development traffic

Traffic types are defined as follows:

1) Normal traffic is that which occurs on the existing road network and will occur in the future regardless of the completion of the Project Road.

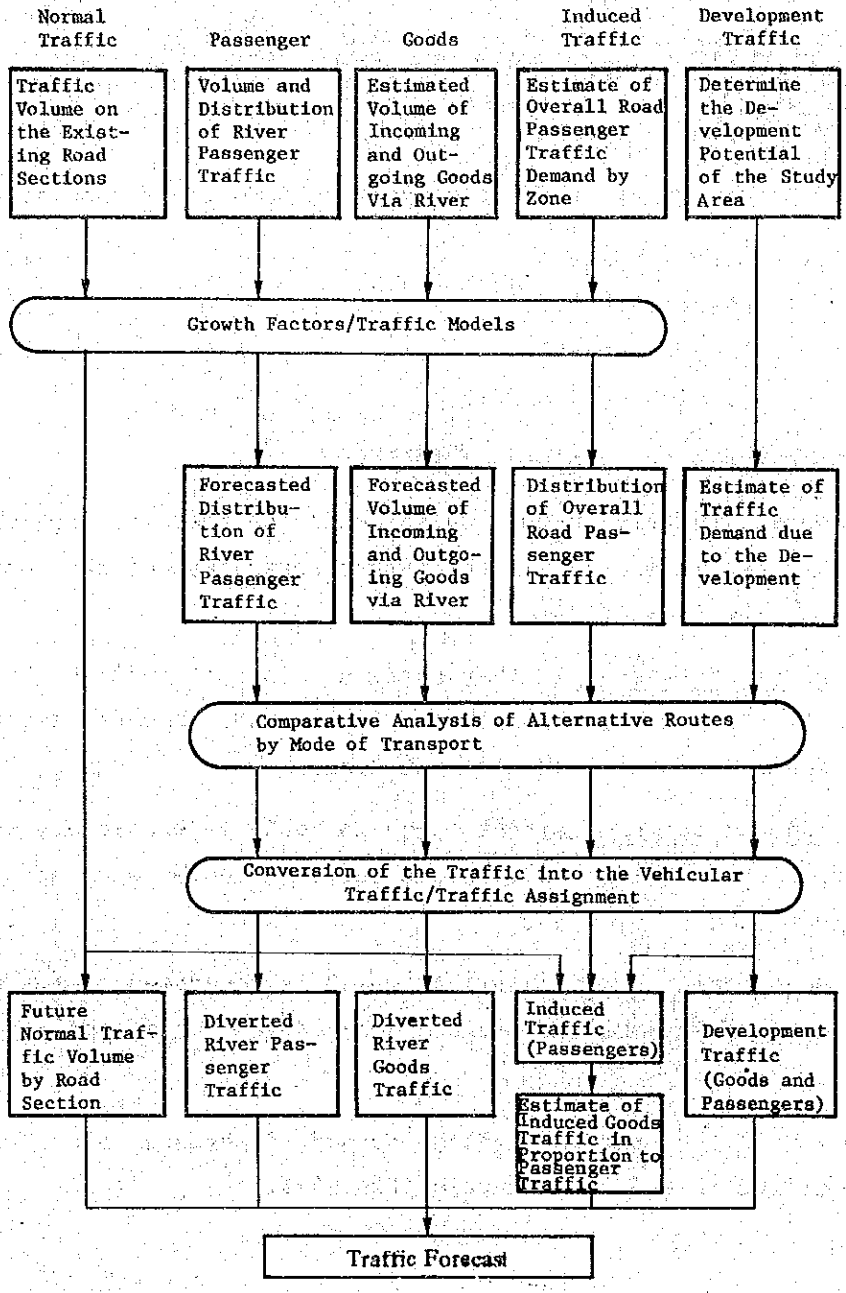
2) Diverted traffic is that portion of normal traffic which, upon the Project Road completion will divert from the existing transport network to the Project Road,

3) Induced traffic is that which is newly generated due to improved accessibility and various new user convenience upon the Project Road completion.

4) Development traffic is that which is generated by the development activity made possible by the Project Road completion.

Details of the traffic forecast method, described later, are summarized in the flow chart of Fig. 4-1.

Fig. 4-1 OUTLINE OF THE TRAFFIC FORECAST METHOD
DIVERTED TRAFFIC



4-1-2 Zoning

For traffic analysis, the Study Area and relevant adjacent areas including Niah and Bintulu have been divided into 12 zones. As Bintulu development progresses, relations will be deepened and additional traffic generated (or diverted) between the Study Area and Bintulu.

The zones are graphically shown in Fig. 4-2. In zoning, considerations were given to the boundaries of sub-districts (which are the smallest unit for statistical compilation), roads, and rivers and their basins as traffic routes.

Table 4-1 Zoning of the Study Area

Zone	Name of Zone	Centre of Zone	River Basin/Road
1	Miri	Miri	Bg. Baram/ Miri-Bintulu Road
2	Bekenu	Bekenu	Miri-Bintulu Road
3	Niah	Niah	- do -
4	Bintulu	Bintulu	- do -
5	Bakong	Beluru	Sg. Bakong/Beluru Rd.
6	Tinjar	Crossing Point of Bg. Tinjar and P.Road	Sg. Tinjar/Beluru Rd.
7	Lower Baram	Marudi	Bg. Baram
8	Baram Middle	Long Lama	Bg. Baram
9	Upper Baram	Long Akah	Bg. Baram
10	Tutoh/Apoh	Crossing point of Bg. Tutoh and P.Road	Sg. Tutoh/Apoh
11	N. Medamit	N. Medamit	Sg. Limbang/Limbang-Medamit Rd.
12	Limbang	Limbang	Limbang-Medamit Rd.

Fig. 4-2 ZONING MAP FOR TRAFFIC ANALYSIS