

MALAYSIA

FEASIBILITY STUDY

ON

THE TATAU-KAPIT TRUNK ROAD PROJECT

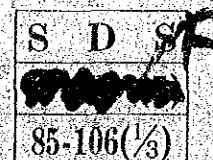
IN SARAWAK

FINAL REPORT

MAIN TEXT

AUGUST 1985

JAPAN INTERNATIONAL COOPERATION AGENCY



JICA LIBRARY



1031186187

MALAYSIA

FEASIBILITY STUDY

ON

THE TATAU-KAPIT TRUNK ROAD PROJECT

IN SARAWAK

FINAL REPORT

MAIN TEXT

AUGUST 1985

JAPAN INTERNATIONAL COOPERATION AGENCY

E R R A T A

Page	Error	Correction
ii of ABBREVIATION	(4) Weight 2. T,t,ton: Metric Ton	(4) Weight 2. T,t : ton
5-7 Table 5-3	Distance: m	Distance: sea mile
10-5 Table 10-2	Transportation Cost(S/ton)	Transportation Cost(M\$/ton)
	MS/ton Km	M\$/ton km
	paves	paved

国際協力事業団	
受入 月日 '86.9.24	113
登録No. 15425	61.4
	SDS

PREFACE

In response to the request of the Government of Malaysia, the Government of Japan decided to conduct a feasibility study on the Tatau-Kapit Trunk Road project in Sarawak, Malaysia and entrusted it to the Japan International Cooperation Agency (JICA).

The JICA sent to Malaysia a survey team headed by Mr. Toshiroo Mori from July, 1982 through September, 1982 for the Phase I Study and from May, 1984 through November, 1984 for the Phase II Study.

The team exchanged views with the officials concerned of the Government of Malaysia on the project and conducted a field survey in the region involved. After the team returned to Japan, further studies were made and the present report has been prepared.

I hope that this report will serve for the development of the project and contribute to the promotion of friendly relations between our two countries.

I wish to express my deep appreciation to the officials concerned of the Government of Malaysia for their close cooperation extended to the team.

August, 1985

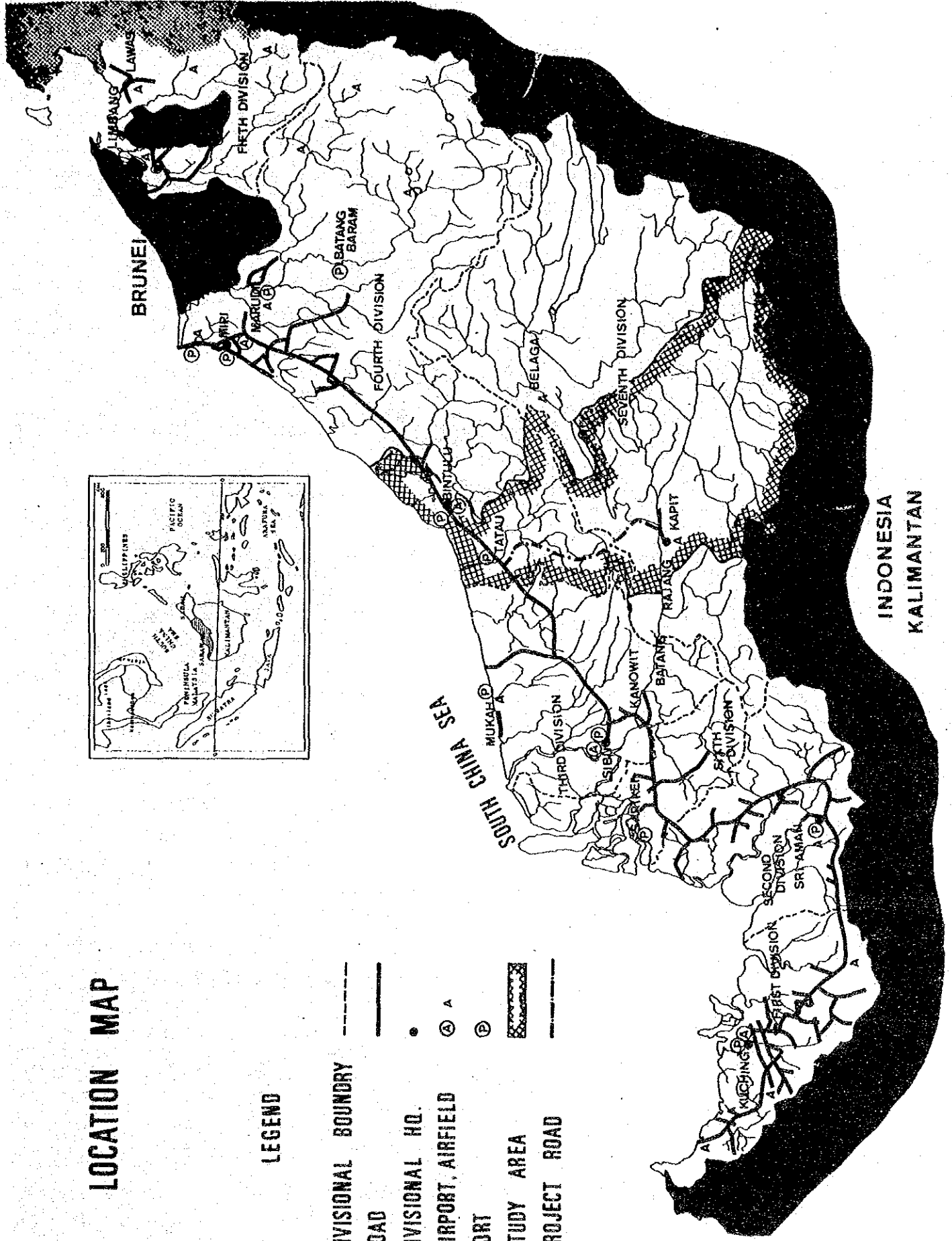
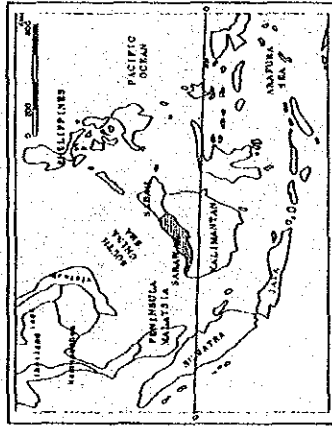
A handwritten signature in black ink, appearing to read 'Keisuke Arita', written in a cursive style.

Keisuke ARITA
President
Japan International Cooperation Agency

LOCATION MAP

LEGEND

- DIVISIONAL BOUNDARY
- ROAD
- DIVISIONAL HQ.
- AIRPORT, AIRFIELD A
- PORT P
- STUDY AREA
- PROJECT ROAD



INDONESIA
KALIMANTAN

CONTENTS

Page

CHAPTER 1 BACKGROUND AND OBJECTIVES OF THE STUDY

1.1	Introduction	1-1
1.2	Background of the Study	1-2
1.3	Objectives of the Study	1-3
1.4	Reports	1-3

CHAPTER 2 METHODOLOGY OF THE STUDY

2.1	Methodology	2-1
2.1.1	Pashe I Study	2-1
2.1.2	Phase II Study	2-4
2.2	Study Members	2-6
2.2.1	Study Team	2-6
2.2.2	Supervisory Committee	2-7

CHAPTER 3 SARAWAK IN GENERAL

3.1	Economy	3-1
3.1.1	Gross Domestic Product (GDP)	3-1
3.1.2	External Trade	3-1
3.2	Population	3-3
3.2.1	General	3-3
3.2.2	Distribution of Population by Divisions and Communities	3-3
3.3	Transport	3-7
3.3.1	General	3-7
3.3.2	Road Transport	3-8
3.3.3	Water Transport	3-12
3.3.4	Air Transport	3-13

3.4	Industrial Activities	3-15
3.4.1	Agriculture	3-15
3.4.2	Forestry	3-19
3.4.3	Mining and Quarrying Industries	3-19
3.4.4	Manufacturing	3-19

CHAPTER 4 SOCIO-ECONOMY IN THE PROJECT AREA

4.1	Geography	4-1
4.1.1	Location	4-1
4.1.2	Topography	4-1
4.2	Population/Communities	4-2
4.2.1	Population Distribution	4-2
4.2.2	Communities	4-2
4.2.3	Estimation of Future Population	4-4
4.3	Agriculture	4-8
4.3.1	Agricultural Products	4-8
4.3.2	Potential Agricultural Land	4-11
4.3.3	Forecast of Agricultural Production	4-15
4.4	Forestry	4-18
4.4.1	Current Status of Forestry Production	4-18
4.4.2	Forecast of Forestry Production	4-18
4.5	Tourism	4-22
4.5.1	Outline of the Current Situation	4-22
4.5.2	Estimation of Visitors into Kapit	4-22
4.6	Associated Development Project	4-26
4.6.1	Bintulu Regional Development Plan	4-26
4.6.2	Hydroelectric Project	4-26
4.6.3	Mining Resource Development	4-29

CHAPTER 5 TRAFFIC STUDIES IN THE PROJECT AREA

5.1	Transport Network	5-1
5.1.1	General	5-1

5.1.2	Roads	5-1
5.1.3	Rivers	5-1
5.1.4	Coastal Shipping	5-6
5.1.5	Air	5-6
5.2	Road Traffic	5-8
5.2.1	Road Traffic Survey	5-8
5.2.2	Road Transport	5-12
5.2.3	Vehicle Ownership	5-13
5.3	River Traffic	5-15
5.3.1	River Traffic Survey	5-15
5.3.2	River Traffic in Tatau Area	5-15
5.3.3	River Traffic in Kapit Area	5-20
5.3.4	Passenger Movement in the Study Area	5-25

CHAPTER 6 ENGINEERING STUDY

6.1	Existing Roads	6-1
6.1.1	First Trunk Road	6-1
6.1.2	Lepong Balleh Road	6-1
6.1.3	Logging Roads	6-1
6.2	Geology and Soil	6-5
6.2.1	Geological Outline	6-5
6.2.2	Geology in the Study Area	6-5
6.2.3	Soil Survey	6-9
6.2.4	Bridge Foundation Ground	6-10
6.2.5	Aggregate Survey	6-10
6.3	Hydrological Conditions	6-16
6.3.1	Climate	6-16
6.3.2	River Water Level	6-16
6.3.3	Estimation of Rainfall Discharge	6-16
6.4	Construction Method	6-18
6.4.1	Local Contractors	6-18
6.4.2	Project Implementaion Method	6-18

CHAPTER 7 ALTERNATIVE ROUTE

7.1	Design	7-1
7.1.1	Design Standard	7-1
7.1.2	Road/Structure Design	7-4
7.2	Alternative Route Location of the Project Road	7-5
7.2.1	Topographical Map	7-5
7.2.2	Conditions for Alternative Route Selection	7-5
7.3	Major Alternative Routes	7-9
7.3.1	Outline of Major Alternative Routes	7-9
7.3.2	Selection of the Best Major Alternative Route	7-11
7.4	Minor Alternative Route	7-12
7.4.1	Alternatives of the Tatau - Sangkap Section	7-12
7.4.2	Alternatives of the Pelagus Rapids - Kapit Section	7-14
7.4.3	Selection of Best Minor Alternative Routes	7-14
7.5	Determination of the Best Route	7-15

CHAPTER 8 BEST ROUTE

8.1	Engineering Study of the Best Route	8-1
8.1.1	Refinement of the Best Route Alignment	8-1
8.1.2	Road/Structure Design	8-1
8.1.3	Investigation of Engineering Alternatives	8-5
8.2	Construction Costs	8-10
8.2.1	Construction Schedule	8-10
8.2.2	Construction Costs	8-13
8.2.3	Maintenance and Repair Costs	8-23

CHAPTER 9 ESTIMATION OF FUTURE TRAFFIC DEMAND

9.1	Methodology	9-1
9.1.1	Traffic Forecast Method	9-1
9.1.2	Traffic Zone	9-1

9.2	Traffic Demand in the Study Area	9-3
9.2.1	General	9-3
9.2.2	River Passenger Traffic Demand in the Study Area	9-5
9.2.3	Cargo Transportation Demand	9-9
9.3	Transport Cost Analysis	9-13
9.3.1	General	9-13
9.3.2	Passenger Transport Costs	9-14
9.3.3	Cargo Transport Cost	9-17
9.4	Forecast of Diverted Traffic	9-21
9.5	Forecast of Development Traffic	9-25
9.6	Estimate of Overall Passenger Traffic "With" Project Road	9-26
9.6.1	General	9-26
9.6.2	Demand Forecast	9-26
9.6.3	Overall Passenger Traffic	9-32
9.7	Forecast of Induced Traffic	9-34
9.8	Summary of Forecast Traffic	9-35

CHAPTER 10 PROJECT COSTS AND BENEFITS

10.1	Benefits	10-1
10.1.1	Elements of Benefit	10-1
10.1.2	Pricing	10-2
10.1.3	Benefits to Diverted Traffic	10-3
10.1.4	Benefits to Development Traffic	10-3
10.1.5	Benefits to Induced Traffic	10-9
10.1.6	Summary of Benefits for Alternative Road Construction Plans	10-12
10.2	Summary of Project Cost	10-15
10.3	Economic Evaluation	10-16
10.3.1	Alternative Road Construction Plans	10-16
10.3.2	The Social Discount Rate	10-17

10.3.3	Best Estimate	10-18
10.3.4	Sensitivity Analysis	10-19
10.3.5	Priority of Alternative Plans	10-20

CHAPTER 11 CONCLUSIONS AND RECOMMENDATIONS

11.1	Comprehensive Evaluation	11-1
11.2	Conclusions and Recommendations	11-2

APPENDIX

List of Tables

	<u>Page</u>
Table 3-1 Gross Domestic Products in Sarawak, 1972-1981	3-2
3-2 Imports, Export and Balance of Trade - Sarawak	3-4
3-3 Estimated Population, Annual Growth, Rate of Natural Increase, Crude Birth and Death Rates, Neo-Natal, Infant and Maternal Mortality Rates, 1960, 1970-1980	3-5
3-4 Area, Population & Density by Division 1970 & 1980	3-6
3-5 Road Construction in Sarawak Planned in the Malaysian Plan	3-9
3-6 Actual Investment on Roads of Sarawak in 1981	3-9
3-7 Motor Vehicles Registered in Sarawak	3-11
3-8 Cargo Loaded and Discharged at Principal Ports	3-14
3-9 Export Profile of Several Agricultural Commodities	3-16
3-10 Sarawak's Rice Supply	3-18
3-11 Timber Production by Year	3-20
3-12 Export Pattern of Petroleum and its By-Products	3-21
3-13 Principal Statistics on the Manufacturing Industry of Sarawak, 1979	3-22
Table 4-1 Population Distribution	4-2
4-2 Forecast Population in the Study Area	4-7
4-3 Rubber Production in the Study Area	4-9
4-4 Paddy Production in the Study Area	4-10
4-5 Pepper Production in the Study Area	4-12
4-6 Cocoa Cultivation in the Study Area	4-13
4-7 Production Forecast (Summary Table)	4-17
4-8 Forestry Production in the Bintulu Section	4-19
4-9 Forestry Production in the Kapit Section	4-19

4-10	Forecasted Timber Production	4-21
4-11	Passenger Movement from Sibul to Kapit	4-24
4-12	Passenger Movement from Bintulu to Kapit	4-25
4-13	Hydroelectric Development Program in the Study Area	4-26
Table 5-1	Existing Road and Road Construction Projects in the Study Area	5-3
5-2	Distance Between Major Points along the Batang Tatau and its Tributaries	5-5
5-3	Distance between Major Points along the Batang Rajang and its Branches	5-7
5-4	Road Traffic Survey	5-8
5-5	Origin and Destination of Vehicle Trips	5-10
5-6	Traffic Composition at Tatau Junction	5-10
5-7	Average Passengers in Vehicles	5-11
5-8	No. of Taxicabs in the Study Area (1983)	5-12
5-9	Number of Public Carriers (1983)	5-13
5-10	Number of Motor Vehicles Registered in the 4th and 7th Divisions	5-14
5-11	Conducted River Traffic Survey	5-16
5-12	Average Daily River Traffic in Btg. Tatau (Vessels)	5-17
5-13	Origin and Destination of Vessel Trip (Tatau)	5-18
5-14	Number of Passengers on Board	5-18
5-15	Express Launch Operation in Tatau Area	5-19
5-16	Number of Passengers Moving by Express Launch between Tatau and Gabong Trading L.C.	5-19
5-17	Origin and Destination of Express Launch Passengers (1984)	5-20
5-18	Average Daily River Traffic in Batang Rajang (Vessel)	5-21
5-19	Origin and Destination of Vessel Trip (Kapit)	5-22
5-20	Number of Passengers on Board	5-22

5-21	Express/Motor Launch Operation in Kapit	5-23
5-22	Number of Express/Motor Launch Passengers by Route	5-24
5-23	Origin and Destination of Express Launch Passengers (Kapit)	5-24
5-24	Passenger Flow of Vehicle Trips (Tatau)	5-25
5-25	Passenger Flow of Vessel Trips (Tatau)	5-25
5-26	Total Passengers Flow in Tatau Area	5-26
5-27	Passenger Traffic Flow in Kapit Area	5-26
Table 6-1	Existing Roads in the Project Area	6-3
6-2	Soil Test Results	6-12
6-3	Summary of Rock Test Results	6-14
6-4	Comparison of Potential Quarry Sites	6-15
6-5	Number of Registered Local Contractors Class 'A' to 'BX' by Classification	6-19
Table 7-1	Minimum Geometric Design Criteria for New Road in Rural Areas (metric)	7-3
7-2	Relationship between Rainfall Discharge and Dimension of Road Structures	7-6
7-3	Comparison of Construction Cost of Major Alternatives	7-11
7-4	Comparison of the Direct Construction Cost of Minor Alternative Routes	7-15
Table 8-1	Vertical Gradient Distribution by sections	8-4
8-2	Comparison of Alternative Bridge Plans for Crossing the Batang Rajang	8-6
8-3	Comparison of Alternative Ferry Boat Plans for Crossing the Batang Rajang	8-8
8-4	Cost Comparison of Two Alternatives for Crossing the Batang Rajang	8-9
8-5	Unit Cost of Construction items	8-15
8-6	Hourly Equipment Costs	8-17
8-7	Daily Wages	8-18

	8-8	Cost of Main Materials	8-19
	8-9	Tatau - Kapit Trunk Road Project Construction Costs	8-20
	8-10	Road Maintenance Cost M\$/Km	8-23
Table	9-1	Zone for Traffic Analysis	9-3
	9-2	Estimated Population by Traffic Zone	9-6
	9-3	Level of Inter-Zonal Passenger Traffic Demand	9-7
	9-4	Growth of Trip-ends by Zone	9-8
	9-5	Assumed Growth Rate of River Passenger Traffic	9-10
	9-6	Distribution of Forecasted River Passenger Traffic	9-10
	9-7	Summary of Goods Transport Demand	9-12
	9-8	Comparison of Transport Fares	9-14
	9-9	Comparison of Average Unit Transport Costs for Passengers (Economic Prices)	9-15
	9-10	Comparison of Travel Time between Road and River	9-16
	9-11	Comparison of Travel Cost between Road and River	9-16
	9-12	Comparison of Average Unit Transport Costs for Goods	9-18
	9-13	Comparison of Cargo Transport Costs between Road and River	9-19
	9-14	River Passenger Traffic Expected to Divert into the Project Road	9-22
	9-15	Forecast of Diverted Passenger Traffic	9-22
	9-16	Forecast of Diverted Passenger Traffic by Vehicle Type	9-23
	9-17	Diverted River Goods Traffic	9-24
	9-18	Estimated No. of Visitors using the Project Road	9-27
	9-19	Estimated Commodity Volume for the Hydro-electric Project	9-27
	9-20	Estimated Development Traffic	9-28
	9-21	Estimated passenger Traffic Demand (With Road situation in 1993)	9-31
	9-22	Estimated Distribution of Passenger Traffic in the Study Area in 1993	9-33

9-23	Estimated Future Passenger Traffic on the Project Road - 1993 (with situation)	9-33
9-24	Passenger Car Ownership	9-34
9-25	Forecast of Induced Traffic by Project Road Sections	9-36
9-26	Summary of Forecasted Traffic Volume on the Project Road Section (ADT)	9-37
9-27	Summary of Forecasted Traffic Volume by Traffic Type	9-39
9-28	Summary of Forecasted Traffic by Vehicle Type on the Project Road Section	9-40
Table 10-1	Savings in Passenger Transport Costs between River and Road Transport	10-4
10-2	Savings in Cargo Transport Costs	10-5
10-3	Benefits to Diverted Traffic (Total)	10-6
10-4	The Unit Value of Benefits to Development Traffic	10-7
10-5	Summary of Benefits to Development Traffic	10-8
10-6	Savings in Transport Cost per Tripend	10-9
10-7	Saving by Vehicle Type	10-10
10-8	Savings Costs by Vehicle Type	10-10
10-9	Benefits to Induced Traffic	10-11
10-10	Benefit Stream for Alternative Plans	10-13
10-11	Summary of Project Costs	10-15
10-12	Alternative Construction Plans for Project Road	10-17
10-13	Present Value of Cost/Benefit for Alternative Plans (Discount Rate of 10%)	10-18
10-14	Internal Rate of Return for Alternative Plans	10-19
10-15	Sensitivity Analysis for Case B	10-19
10-16	Sensitivity Analysis for Case C	10-20

List of Figures

	<u>Page</u>
Fig. 2-1 Work Schedule	2-2
2-2 Framework of The Study	2-3
2-3 Organization Chart	2-8
Fig. 3-1 Trunk Road System in Sarawak	3-10
Fig. 4-1 Population Distribution	4-3
4-2 Demographic Models	4-5
4-3 Agriculture Capability	4-14
4-4 Major Tourism Resources	4-23
4-5 Functional Boundary of Bintulu Regional Development Plan	4-27
4-6 Proposed Routing of the HVAC and HVDC Transmission Systems . for Sarawak and Sabah	4-87
4-7 Development Potential Areas	4-30
Fig. 5-1 Transportation System in the Study Area	5-2
5-2 ADT by Direction at Tatau Junction	5-9
5-3 Passenger Traffic Flows in the Study Area, 1984	5-27
Fig. 6-1 Existing Road Network in the Project Area	6-2
6-2 Concept of Logging Roads	6-4
6-3 Sketch Map Showing the Regional Setting of the Continental ... Core and NW-Borneo Geosyncline	6-6
6-4 Geological Map of the Study Area	6-7
6-5 Model Profile of River and Showing Mackintosh Probe Test Points	6-11
6-6 Map Showing Locations of Potential Quarry Sites, Mackintosh ... Probe Tests and Soil Sampling Points	6-11

Fig. 7-1	Typical Cross Sections	7-2
7-2	Major Alternative Routes	7-10
7-3	Minor Alternative Routes	7-13
7-4	Best Alternative Route	7-16
Fig. 8-1	Topography Around the Crossing Point of the Batang Rajang	8-7
8-2	Construction Order by Alternative	8-10
8-3	Construction Sections	8-11
8-4	Construction Schedule	8-12
Fig. 9-1	Outline of the Traffic Forecast Method	9-2
9-2	Zoning Map for Traffic Analysis	9-4
9-3	Distribution of forecast River Passenger Traffic 1990 (2005)	9-11
9-4	Traffic Demand Curve in the Study Area	9-30
9-5	Demand Curve for Traffic	9-35
9-6	Summary of Forecasted Traffic by Vehicle Type on the Project Road Section in 1993	9-38

ABBREVIATIONS

(1) Local Terms

1. Batang	:	:	Large River
2. BDA	:	:	Bintulu Development Authority
3. Bkt Bt.	:	Bukit	Hill
4. BS	:	:	British Standard
5. Btg	:	Batang	Large River
6. JKR	:	Jabatan Kerja Raya	Public Works Department
7. MAS	:	:	Malaysian Airline Systems
8. MRCU	:	:	Mechanical Road Construction Unit
9. P.W.D., PWD	:	:	Public Works Department
10. R	:	Rumah	House
11. Tg	:	Tanjung	Cape
12. Ulu	:	:	Upstream

(2) International or Foreign Organization

1. FAO	:	:	Food and Agriculture Organization of the United Nations
2. JICA	:	:	Japan International Cooperation Agency
3. SEATAC	:	:	South East Asian Agency for Regional Transport and Communications and Development
4. US	:	:	United States of America

(3) Others

1. ADT, A.D.T.	:	:	Average Daily Traffic
2. B	:	:	Benefit
3. B/C	:	:	Benefit Cost Ratio
4. C	:	:	Cost
5. GDP	:	:	Gross Domestic Product
6. IRR	:	:	Internal Rate of Return
7. L	:	:	Length
8. L.A.A.V.	:	:	Los Angeles Abrasion Value

- | | | | | |
|-----|------|---|---|----------------------|
| 9. | NPV | : | : | Net Present Value |
| 10. | P.C. | : | : | Prestressed Concrete |

Abbreviations of Measurements

(1) Length

1. mm : Millimeter
2. cm : Centimeter
3. m : Meter
4. Km, km : Kilometer
5. ' : Feet

(2) Area

1. cm² : Square Centimeter
2. m² : Square Meter
3. ha : Hectare

(3) Volume

1. cm³ : Cubic Centimeter
2. lit. : Litre
3. m³ : Cubic Meter
4. Gal. : Gallon

(4) Weight

1. Kg : Kilogram
2. T, t, ton : Metric Ton

(5) Time

1. s : Second
2. h, hr : Hour
3. d : Day
4. y, yr : Year

(6) Electrical Measurement

1. MW : Megawatt

(7) Other Measures

1. % : Percent
2. HP : Horse Power

(8) Money

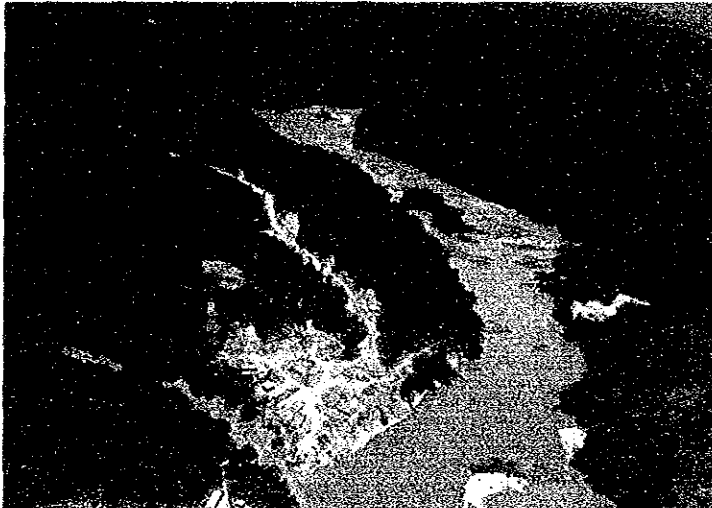
- | | | |
|------|---|------------------|
| M\$ | : | Malaysian Dollar |
| US\$ | : | US Dollar |
| Yen | : | Japanese Yen |

(US\$1.00 = ¥240 = M\$2.376
as of October 1984)

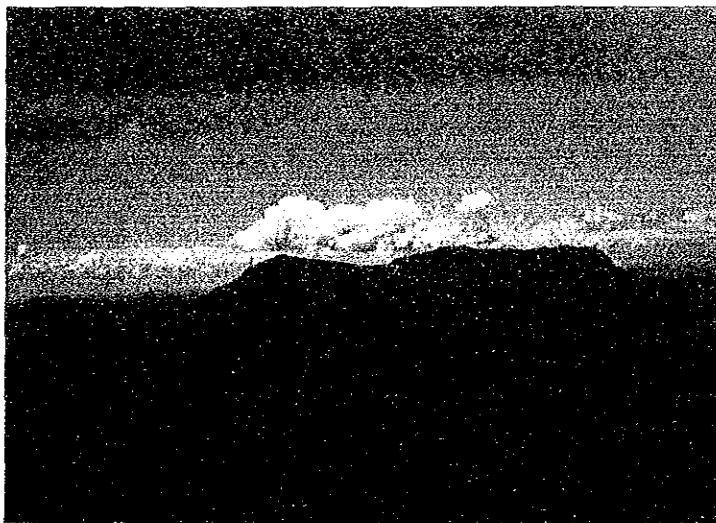
Photo in the Project Area



1. First Trunk Road

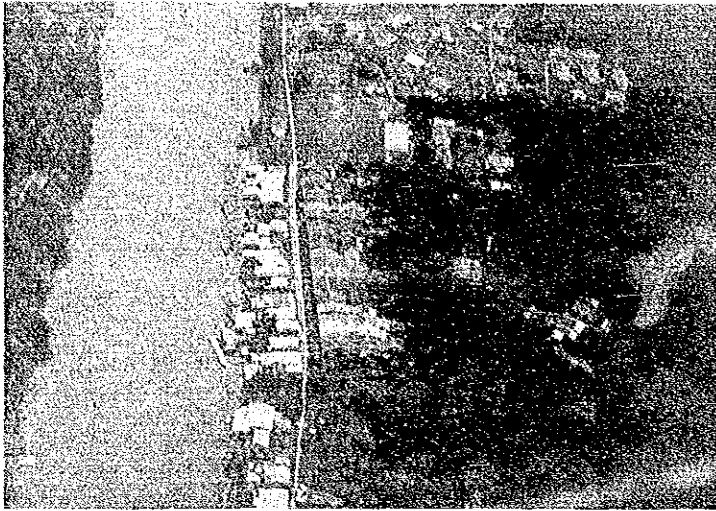


2. Proposed Hydroelectric Dam Site at Pelagus along the Batang Rajang (right) and the Sungai Pelagus (left)

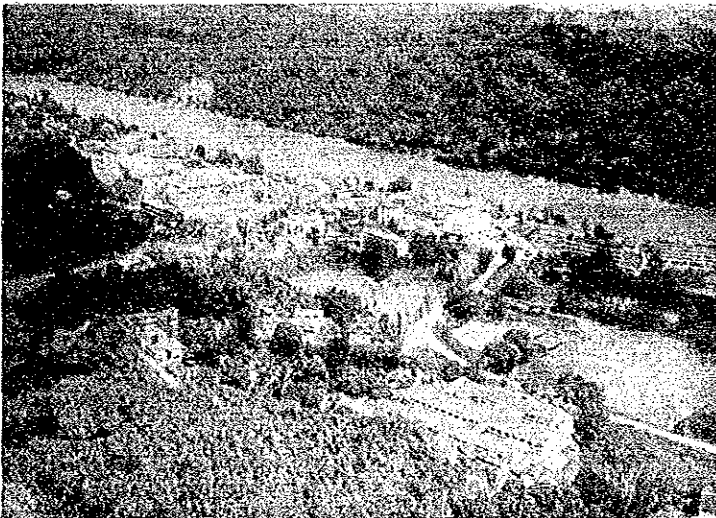


3. Bukit Naong and Upstream Area of the Sungai Muput

Photo in the Project Area



4. Tatau Town along the
Batang Tatau

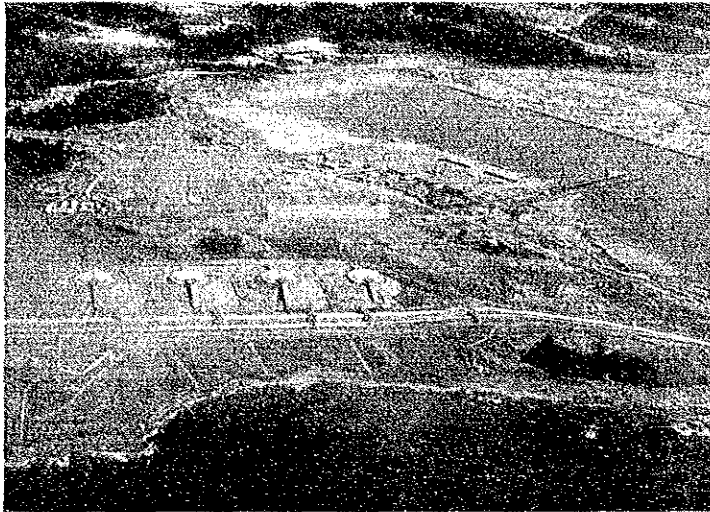


5. Kapit Town along the
Batang Rajang



6. A Long House Along the
Sungai Anap

Photo in the Project Area



7. Deep Sea Port and Fertilizer Plant in Bintulu

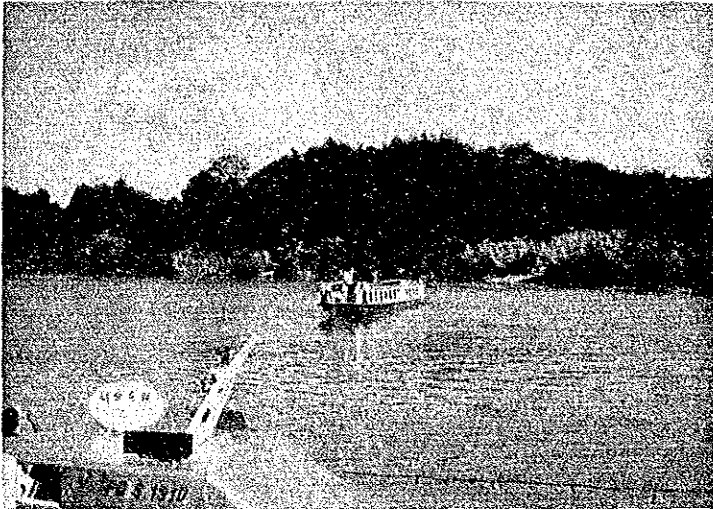


8. Logging Road and Logging Truck

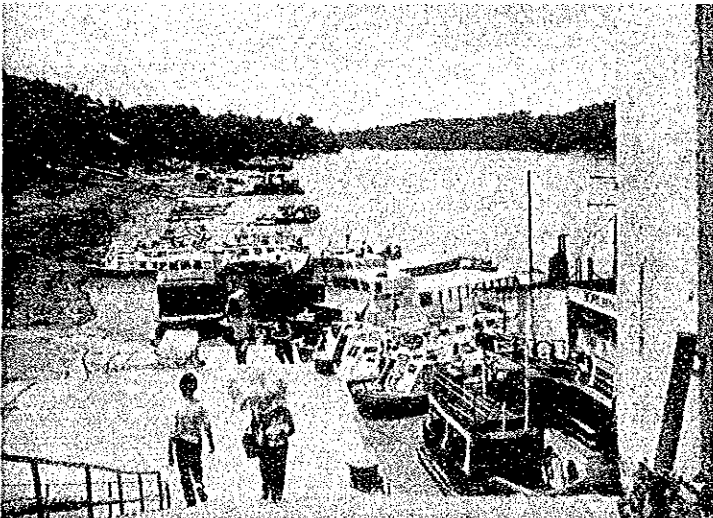


9. Proposed Hydroelectric Dam site at Pelagus

Photo in the Project Area



10. Cruising Express
Launch



11. Wharf at Kapit



12. A Tug Boat with a Barge
for Log Shipment

CHAPTER 1

CONTENTS

Page

CHAPTER 1 BACKGROUND AND OBJECTIVES OF THE STUDY

1.1	Introduction	1-1
1.2	Background of the Study	1-2
1.3	Objectives of the Study	1-3
1.4	Reports	1-3

CHAPTER 1 BACKGROUND AND OBJECTIVES OF THE STUDY

1.1 Introduction

The concept of development of the Second Trunk Road System in the State of Sarawak was put forward in the Second Malaysian Plan (1971 - 1975) prepared by the Government of Malaysia. In response, the SEATAC (South East Asian Agency for Regional Transport and Communications Development) carried out a Prefeasibility Study for the purpose of promoting the development of the above system in 1975 -1976. The Prefeasibility Study Report recommended that further detailed studies be undertaken on the development of the following three Second Trunk Road Projects:

- i) Beluru-Long Lama-Limbang Road (about 230 km long)
- ii) Bintulu-Tubau-Belaga Road (about 128 km long)
- iii) Tatau-Kapit Road (about 130 km long)

Regarding road 1), the Japan International Cooperation Agency (hereinafter referred to as "JICA") completed the Feasibility Study in March, 1980. In turn, the Government of Malaysia has given a high priority to the Tatau-Kapit Road to connect the Tatau-Bintulu area in the Fourth Division with the Kapit area in the Seventh Division. The Government of Japan has decided to conduct a Feasibility Study on this road project in compliance with the request made by the Government of Malaysia.

JICA, the official agency responsible for implementation of Technical Cooperation programs of the Government of Japan, has carried out the Study in close cooperation with the authorities concerned in the Government of Malaysia. The Scope of Works was determined based upon the results of JICA's Preliminary Survey carried out in February, 1982.

JICA organized the Study Team consisting of the Road Study Team (Mitsui Consultants Co., Ltd.,) and the Mapping Team (Pasco International Inc.). These teams carried out the Phase I Study from June - December 1982 and the Phase II Study from May 1984 - August 1985.

The long two year pause between Phase I and Phase II was caused by unfavorable weather continued over a long period.

The Interim Report as the Final Report of the Phase I Study was submitted to the Government of Malaysia in December, 1982, and the Draft Final Report combining the Phase II Study Report with the Interim Report was submitted in February, 1985. Further,

the comments and the observations in the Draft Final Report were incorporated into the Final Report which is to be submitted in August 1985.

JICA also organized a Supervisory Committee staffed by members of the Ministry of Construction of Japan. This committee advised the above Study Team at appropriate times and attended the meeting with the Government of Malaysia to facilitate the progress of the Study.

1.2 Background of the Study

The State of Sarawak, located in the northern part of Borneo Island, is the largest among 13 states in Malaysia with a territory of about 120,000 km².

For its vast land area, Sarawak has an extremely undeveloped road network with only the First Trunk Road connecting the major towns along the coast. The First Trunk Road was completed with a gravel surface in September 1982. Sarawak seems to require the construction of the Second Trunk Road System connecting the coast with inland areas as the next step.

The subject of the Study is the Tatau - Kapit Trunk Road connecting the Tatau - Bintulu area in the Fourth division with the Kapit area in the Seventh Division along the Second Trunk Road System.

Located along the coast, the Tatau - Bintulu area has already been connected with major towns in Sarawak by the First Trunk Road.

With the development of LNG resources along the coast, the Bintulu area has rapidly proceeded with port development and industrial development on the basis of the Bintulu Development Project, and will play a role in the future as the industrial center of Sarawak.

Located in the inland Batang Rajang basin, the Seventh Division has a population of about 38,000 but remains less developed. The administrative and commercial center of the Seventh Division is Kapit Town, with a population of about 3,000 facing the Batang Rajang.

The current transportation means between the Seventh Division and other Divisions of Sarawak is water transport downstream along the Batang Rajang in the Third Division. No roads are available to connect with other Divisions.

Given these circumstances, the Sarawak State Government attaches importance to the construction of the Tatau - Kapit Trunk Road connecting the Fourth Division with the

Seventh Division by the shortest possible route, expecting development benefits from the Project Road construction, namely the development of inland agriculture and forestry, etc.

In addition, the Project Road passes by both the hydroelectric dam project site at Pelagus and the coal deposits area, with good potential to contribute to these projects.

1.3 Objectives of the Study

The objectives of the Study are described in the "Scope of Works" as follows:

- (1) To determine the economic and technical feasibility of developing a portion of the Second Trunk Road System from Tatau to Kapit in Sarawak.
- (2) To perform technology transfer to Malaysian Counterpart Personnel in the course of the Study.

1.4 Reports

The reports are composed of the following three volumes:

1. Main Text
2. Drawings
3. Summary

CHAPTER 2

CONTENTS

Page

CHAPTER 2 METHODOLOGY OF THE STUDY

2.1	Methodology	2-1
2.2	Study Members	2-6

CHAPTER 2 METHODOLOGY OF THE STUDY

2.1 Methodology

The Work Schedule of the Study is shown in Fig. 2-1, and the Framework of the Study is presented in the Flow Chart in Fig. 2-2. The following is the outline of the Scope of the Study:

2.1.1 Phase I Study

- (1) Topographical study based upon a map with a scale of 1:50,000

A topographical map of 1:50,000 with 100 feet contour line intervals was supplied by the Sarawak State Government. The Study team relied on this map in the course of the Phase I Study.

- (2) Traffic Studies

A water traffic survey was carried out for 5 days in Kapit, and for another 5 days in Tatau. Taking advantage of statistical data provided by various Government sources and private organizations, together with the traffic surveys, a future traffic volume was forecasted.

- (3) Socio-economic Studies

The socio-economy of the Project Area was studied based on existing status and future prospects. The potentials of agricultural development and hydroelectric dam development were taken into consideration.

- (4) Alternative Route Studies

The Project Road is about 140 km (90 miles) long from its starting point on the Ulu Batang Mukah-Bintulu Road of the First Trunk Road, close to Tatau. The terminal point of the road is located on the Lepong Balleh Road about 2 km to the east of Kapit.

The topography along the Project Road route is chiefly characterized by long saw-toothed hilly terrain, which restricts the number of alternative routes as well as the extension of route location.

The alignment of the first 90 km of the Project Road will generally follow the Sungai Anap valley in a North-South direction.

For the remaining 50 km, the Project Road will cross the watershed between the Fourth and Seventh Divisions, and pass the proposed hydroelectric dam site at

Fig. 2-1 WORK SCHEDULE

ITEM	1982												1983												1984												1985													
	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9	10	11	12	1	2	3	4	5	6	7	8	9										
PHASE I	Preparatory Work																																																	
	Data Collection/ Hearing																																																	
	Field Survey																																																	
	Alternative Routes Selection																																																	
	Progress Report I																																																	
	Engineering Analysis																																																	
	Traffic/ Economic Analysis																																																	
	Best Alternative Selection																																																	
	Interim Report																																																	
	Data Collection/ Hearing																																																	
PHASE II	Field Survey																																																	
	Progress Report II																																																	
	Preliminary Design/ Economic Analysis																																																	
	Implementation Plan																																																	
	Draft Final Report																																																	
	Final Report																																																	
	Aerial Photography																																																	
	Field Work																																																	
	1/10,000 Mapping																																																	
	MAPPING																																																	

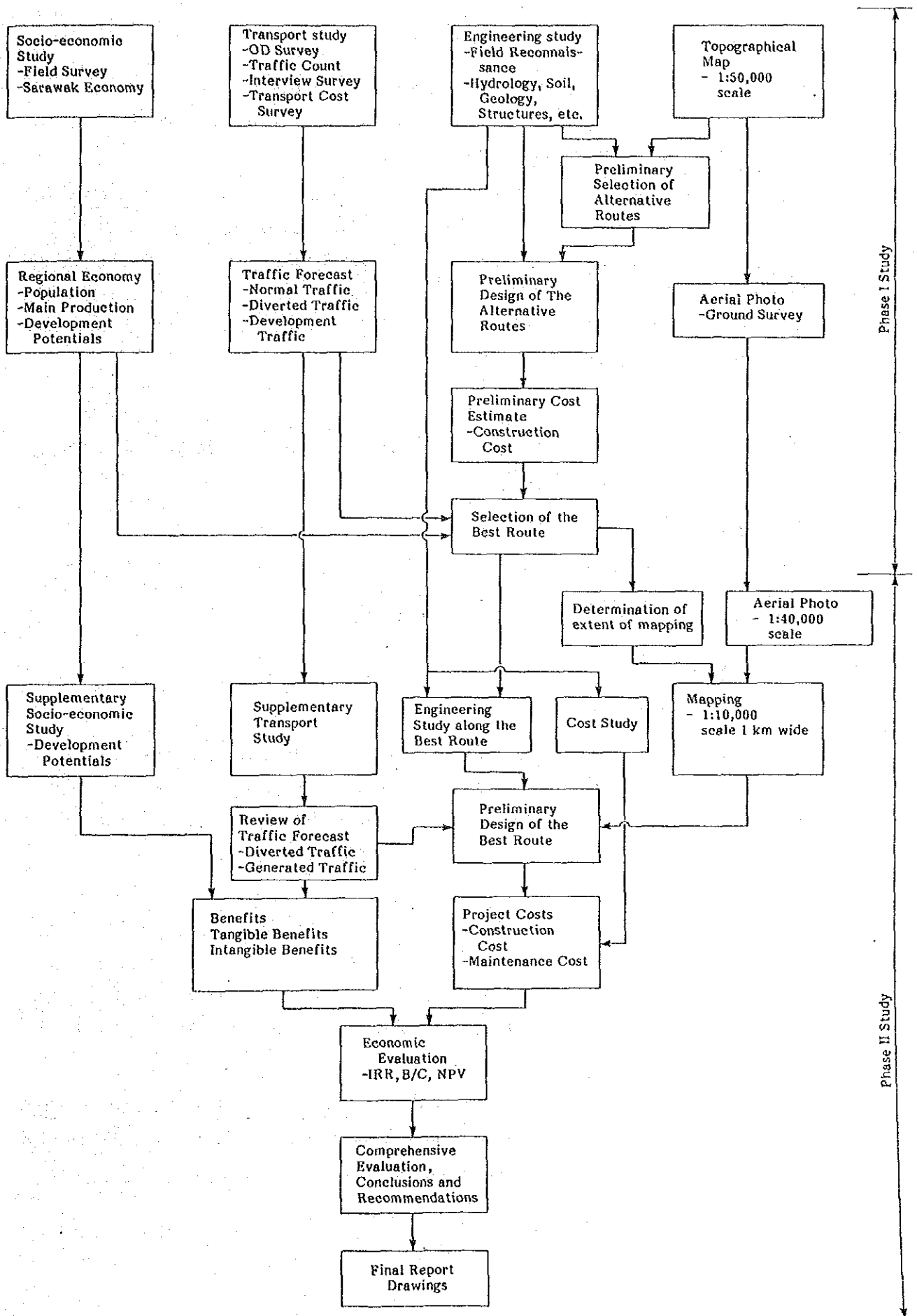
Note: ORIGINAL SCHEDULE :
EXECUTED SCHEDULE :

Works in Malaysia
Works in Japan
Submission/ of the Report
Submission/ of the Report
Comments on the Report
Comments on the Report

Note: ORIGINAL SCHEDULE : Works in Malaysia Works in Japan Submission of the Report Comments on the Report

EXECUTED SCHEDULE : Works in Malaysia Works in Japan Submission of the Report Comments on the Report

Fig. 2-2 FRAMEWORK OF THE STUDY



Pelagus Rapids, continuing along the Batang Rajang to a point slightly downstream of the confluence of the Batang Balleh to connect to the proposed road from Lepong Balleh by bridge or by ferry boat.

A comparative study of the alternative routes is conducted to select the best out of 2 major alternatives at a long section and ten (10) minor alternatives at five different sections. The best alternative route is selected mainly from a technical viewpoint as the alternatives all have similar socio-economic characteristics. The mapping extension with a scale of 1:10,000 was determined based upon the alignment of the best route.

(5) Engineering studies

Preliminary engineering studies were carried out on hydrology, soil, geology, present conditions of the existing roads and structure, and construction costs.

(6) Submission of the Interim Report

The Interim Report as the Final Report of the Phase I Study was submitted to The Government of Malaysia in December, 1982.

2.1.2 Phase II Study

(1) A Map with a scale of 1:10,000

Since Sarawak is known widely as one of the most difficult areas for aerial photography, the mapping team was obliged to spend almost two years to complete the aerial photography at a scale of 1:40,000 along the best route. With the help of the Sarawak Land and Survey Department, the photography was completed on June 9th, 1984.

The existing 8 triangulation points and newly established 5 doppler points were pricked on the new aerial photos, and supplementary barometric observation was performed at 6 stations by "LEAPFROG" by August 17th, 1984. Direct levelling was impossible under the topographical conditions of the Project Area due to the tropical jungle.

Topographical maps with a scale of 1:10,000 were prepared in November, 1984 through aerial triangulation. Plotting and compilation was based upon the results of the field survey done from June to August 1984.

(2) Socio-economic/Traffic Studies

Traffic surveys were conducted at Kapit for 2 days for water traffic and at Tatau for 2 days for road traffic and water Traffic to supplement the traffic studies in the Phase I Study.

Statistical data and associated project information were collected to update the data in the Interim Report and to clarify the project's changing circumstances.

The estimated future traffic was reviewed upon completion of the traffic surveys carried out in Phase II, and other data.

(3) Engineering Studies

The engineering studies were concentrated on the best alternative route selected through the Phase I Study. Soil tests were carried out in the Central Materials Laboratory of the Sarawak Public Works Department. The Mackintosh probe test was carried out at 20 spots along the proposed bridge sites.

(4) Cost Studies

To estimate cost, labor, materials and construction costs inclusive of tax and duties were surveyed.

(5) Best Route Refinement

The Best Route was refined using an approximately 1,000 meters wide topographical map with a scale of 1:10,000, which is shown in the "Drawings".

(6) Economic Evaluation and Comprehensive Evaluation

The economic evaluation was conducted in terms of Benefit Cost Ratio (B/C), Net Present Value (NPV) and Economic Internal Rate of Return (IRR). The comprehensive evaluation was carried out taking into account large indefinite benefits and intangible benefits, namely, contribution to the associated projects (hydroelectrical dam construction at Pelagus, agriculture, tourism, coal mining, forestry, etc.) and to the efficient development of regional administration in the isolated inland area.

(7) Submission of the Draft Final Report

The Draft Final Report was submitted to the Government of Malaysia in February, 1985.

(8) Submission of the Final Report

The Final Report is to be submitted to the Government of Malaysia in August 1985, including the comments and observations on the Draft Final Report given by the Government of Malaysia.

2.2 Study Members

The organization chart is shown in Fig. 2-3.

2.2.1 Study Team

(1) Road Study Team

- | | | | |
|----|------------------------------------|-------------------|------------------------------|
| a. | Team Leader | MORI Toshiro | Mitsui Consultants Co., Ltd. |
| b. | Co-leader/
Road Planner | TOMIYASU Takeshi | - ditto - |
| c. | Cost Estimator . . . | ENDO Mineo | - ditto - |
| d. | Structural
Engineer | SHIURA Mitsuo | - ditto - |
| e. | Soil/Geologist | YAMAMOTO Norifumi | - ditto - |
| f. | Transport
Economist | KUROSAWA Yasuhiko | - ditto - |
| g. | Regional
Economist | ITOH Yoshikazu | - ditto - |
| h. | Traffic
Engineer | OZAWA Akira | - ditto - |

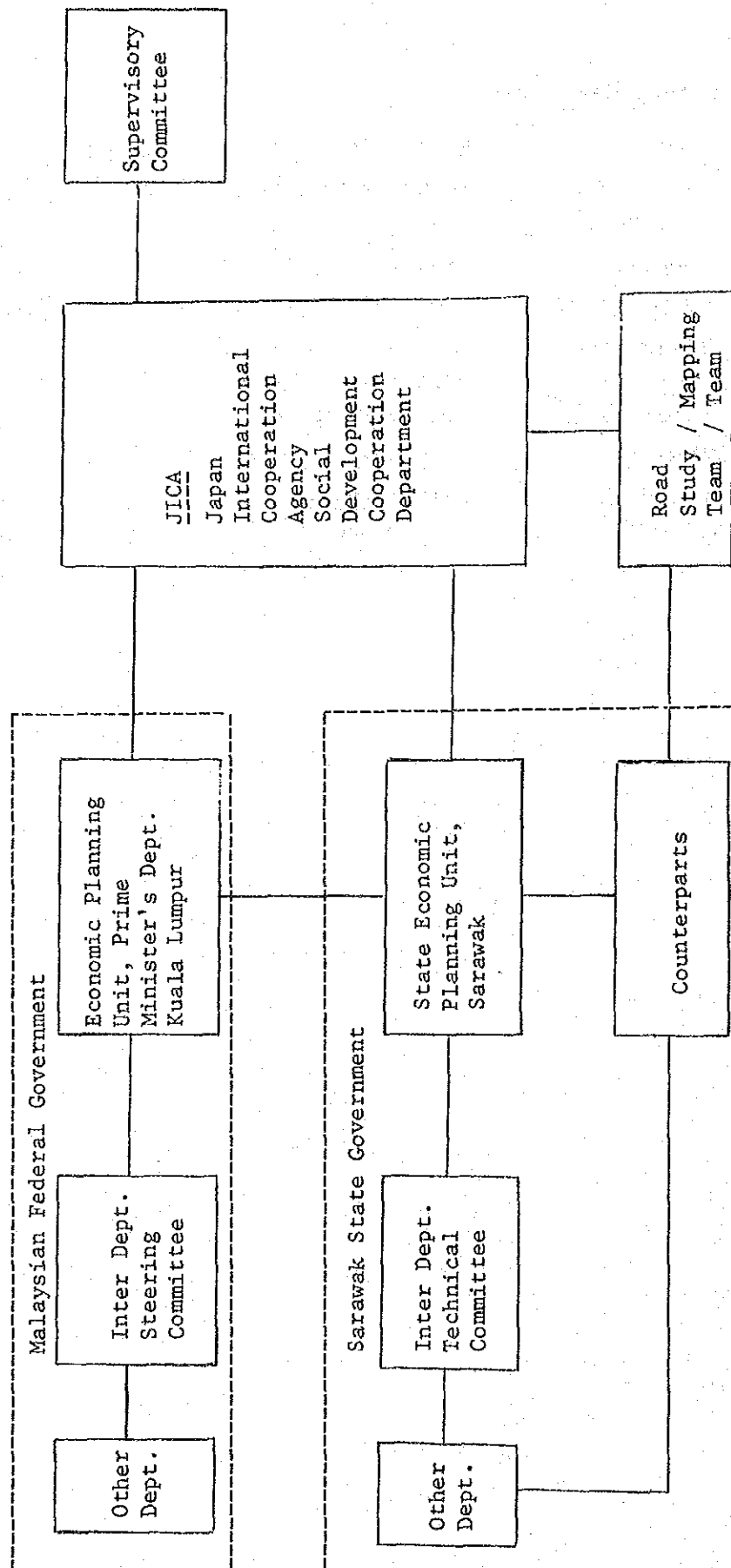
(2) Mapping Team

- | | | | |
|----|--|---------------------|--------------------------|
| a. | Team Leader | IWASAKI Mamoru | PASCO International Inc. |
| b. | Surveyor | KURITA Michizo | - ditto - |
| c. | Surveyor | TAKAHASHI Yoshinori | - ditto - |
| d. | Surveyor | ITOH Fujio | - ditto - |
| e. | Supervisors of
aerial photography
and inspection . . . | ADACHI Hideo | - ditto - |
| f. | ditto | HAYAKAWA Kiyoto | - ditto - |

2.2.2 Supervisory Committee

a.	Chairman	....	ISHIYAMA Shiro	Ministry of Construction
	- former -		Dr.MURAKAMI Misato	- ditto -
b.	Road Planner	....	MUTOH kazuhiko	- ditto -
	- former -		IIDA Hironori	- ditto -
c.	Traffic planner	...	NAKAJIMA Shousuke	- ditto -
d.	Transport Economist	....	NAKAYAMA Takashi	- ditto -
	- former -		NISHIDA Toshioki	- ditto -
e.	Mapping	....	MAGOME Hiroshi	- ditto -
f.	Coordinator	....	OSHIMA Yoshinari	J I C A
	- former -		SATO Tadashi	- ditto -

Fig. 2-3 ORGANIZATION CHART



CHAPTER 3

CONTENTS

	<u>Page</u>
CHAPTER 3 SARAWAK IN GENERAL	
3.1 Economy	3-1
3.2 Population	3-3
3.3 Transport	3-7
3.4 Industrial Activities	3-15

CHAPTER 3 SARAWAK IN GENERAL

3.1 Economy

3.1.1 Gross Domestic Product (GDP)

The Gross Domestic Product of Sarawak for the years 1972 - 1981 is shown in Table 3-1. During the nine-year period, the GDP increased from M\$970 million in 1972 to M\$1,793 million in 1981 (GDP in 1970 constant prices). This means an average annual growth rate of 7.1% in real terms, indicating a steady and gradual increase.

The average per capita GDP in 1980 was M\$1,350 indicating a 4.5% average annual growth rate. When compared to the GDP growth rate, this figure is much lower due to the steady population increase (2.7% average annual growth rate).

In recent years, Sarawak accounted for approximately 6.5% of Malaysia's total GDP while her population share stood at around 9%. Her per capita GDP is several hundred Malaysian dollars lower than the national average (M\$1,350 as against M\$1,908 in 1980), which implies the development of Sarawak is lagging behind that of Peninsular Malaysia (See Appendix 1-1).

The industrial breakdown of the GDP is shown in Appendix 1-2. Agriculture, forestry, and fishing continued to be the dominant sectors representing 27.7% of the total GDP in 1981. Agriculture has slightly diminished since 1972, while forestry and logging has been rapidly increasing. Forestry and logging have recovered remarkably after prices plummeted in 1975, when world market demand dropped to one of its lowest levels following the Oil Crisis. Commerce and manufacturing have maintained a relatively constant share of the GDP through the years.

On the other hand, the share of the mining and quarrying sector has declined from 19.6% in 1972 to 11.0% in 1981. Although its share has declined, its actual value has continuously increased.

3.1.2 External Trade

Trade has always played an important role in the economy of Sarawak and has contributed greatly to Sarawak's income. The degree of dependence on exports has remained at the 65% level while the degree of dependence on imports has been cut remarkably to around 38% in recent years. The trade surplus for the year 1978 is equivalent to approximately a quarter of the GDP.

Table 3-1 GROSS DOMESTIC PRODUCTS IN SARAWAK, 1972 - 1981

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	Average Annual Growth Rate
Gross Domestic Product at 1970 Constant Prices (M\$ million)	970	1,058	1,118	1,122	1,337	1,387	1,420	1,559	1,668	1,793	7.1%
Population (000)	1,002	1,048	1,093	1,121	1,148	1,177	1,205	-	1,236	-	2.7%
Per Capita GDP at 1970 Constant Prices (M\$)	949	1,009	1,023	1,001	1,165	1,178	1,178	-	1,350	-	4.5%
Growth Rate of GDP (%)	-	9.0	6.1	0.4	19.2	3.8	2.4	9.8	7.0	7.5	
Growth Rate of per Capita GDP (%)	-	6.3	1.8	-2.2	16.4	1.1	0.0	-	-	-	

Source: Annual Statistics Bulletin Sarawak

In the past ten years, the trade volume has dramatically increased. Sarawak has generally enjoyed a favorable balance of trade in the same period (Table 3-2).

The amount and the percentage of import commodities are listed in Appendix 1-3. The total amount of imports reached M\$3,320 million in 1982. The biggest share was held by heavy machineries at 40.2%, followed by manufactured goods at 22.1% and foodstuffs at 12.8% of total imports. After the discovery of oil in Miri, the import of mineral fuels has dropped to a mere 5.9%.

In 1982, total exports amounted to M\$4,957 million (refer to Appendix 1-4), an increase of 500% since 1970. The biggest boost to exports was made by minerals and fuels (particularly due to the export of oil, as mentioned earlier). This sector accounted for 62% of exports. The second biggest share was held by crude materials (inedible) which was equivalent to 29%. These two sectors contributed 91% of total export earnings.

From the above observations, it can be said that Sarawak's economy is representative of the trend in most less-developed countries, where the trade structure shows heavy dependence on imports of industrial and finished products while relying on the export of primary commodities and raw materials.

3.2 Population

3.2.1. General

A Population Census is carried out every ten years in the State of Sarawak. The figures in 1980 showed a head count of 1,236,000, compared to 976,000 persons in 1970. This indicates an average annual growth rate of approximately 2.4%.

Table 3-3 shows the estimated annual population and the rate of natural increase in 1970 - 80.

Sarawak's population is characterized by an increasing birth rate coupled with a declining death rate. In general though, the natural population growth rate is showing a gradual decline.

3.2.2 Distribution of Population by Divisions and Communities

Sarawak is currently divided into seven Administrative Divisions. Table 3-4 gives the area, population and density for each Division.

As a whole, Sarawak has a density of 9.9 persons per sq.km, compared to Malaysia's

Table 3-2 IMPORTS, EXPORTS AND BALANCE OF TRADE - SARAWAK

(M\$'000)

Year	Imports	Export		Total Exports	Visible Balance of Trade Surplus(+)/Deficit(-)
		Local Produce	Re-exports		
1970	660,422	495,044	176,239	671,283	+10,861
1971	693,213	464,862	322,681	287,543*	+94,330
1972	470,823	501,929	101,555	603,484*	+132,661
1973	599,516	743,483	90,978	834,461	+234,945
1974	1,005,332	1,212,844	173,057	1,385,901	+380,569
1975	850,911	1,240,066	147,329	1,387,395	+536,484
1976	1,068,656	1,963,835	258,266	2,222,101	+1,153,445
1977	1,117,563	2,020,014	133,803	2,153,817	+1,036,254
1978	1,151,575	1,874,540	34,047	1,908,587	+757,012
1979	1,530,767	3,040,071	45,800	3,085,871	+1,555,104
1980	2,298,854	3,971,372	70,051	4,041,423	+1,742,569
1981	3,001,097	4,361,445	155,861	4,517,306	+1,516,209
1982	3,319,777	4,794,413	162,190	4,956,603	+1,636,826

Note: Data excluding gold

* Data exclude bunker and aircraft stores.

Source: Annual Statistics Bulletin Sarawak 1980

Table 3-3 ESTIMATED POPULATION, ANNUAL GROWTH, RATE OF NATURAL INCREASE, CRUDE BIRTH AND DEATH RATES, NEO-NATAL, INFANT AND MATERNAL MORTALITY RATES, 1960, 1970-1980

Year	Population		Annual Population Growth (%)	Rate of Natural Increase	Crude		Crude Death Rate	Neo-Natal Mortality Rate		Infant Mortality Rate		Maternal Mortality Rate	
	June	December			Birth Rate	Rate		Mortality Rate	Rate	Mortality Rate	Rate	Mortality Rate	Rate
1960	744,529 (Census)	752,961	-	20.6	26.4		5.8	N.A	N.A	N.A		N.A	
1970	972,582	985,452	2.5	26.0	31.2		5.2	13.6		31.1		0.9	
1971	998,199	1,010,965	2.6	25.6	30.8		5.2	12.0		30.6		0.5	
1972	1,024,470	1,038,037	2.7	26.5	31.4		4.9	13.8		30.1		0.5	
1973	1,051,997	1,066,067	2.6	26.7	31.5		4.8	12.6		29.4		0.4	
1974	1,079,694	1,093,405	2.6	25.4	29.8		4.4	13.4		28.1		0.2	
1975	1,107,323	1,121,146	2.6	25.1	30.0		5.0	14.5		30.2		0.2	
1976	1,134,938	1,148,991	2.5	24.6	29.1		4.6	13.8		27.5		0.3	
1977	1,162,998	1,177,236	2.5	24.3	29.1		4.9	11.4		25.3		0.5	
1978	1,191,429	1,205,973	2.4	24.0	28.2		4.2	10.5		19.9		0.4	
1979	1,220,673	1,236,428	2.5	25.3	29.2		4.0	10.3		19.5		0.1	
1980	1,294,753		4.7	N.A	N.A		N.A	N.A		N.A.		N.A	

N.A - Not available

Source: Annual Statistics Bulletin Sarawak, 1980

Table 3-4 AREA, POPULATION & DENSITY BY DIVISION

1970 & 1980

Division	Area (sq.km)	1970				1980				Average Annual Growth Rate %
		%	Population (^{'000})	Density		Population (^{'000})	%	Density per sq.km		
				per sq.km	per sq.km					
First	8,899	7.2	348	35.7	39.1	452	36.6	50.8	2.6	
Second	10,273	8.2	137	14.0	13.3	157	12.7	15.3	1.4	
Third	12,887	10.3	171	17.5	13.3	211	17.1	16.4	2.1	
Fourth	38,943	31.3	137	14.0	3.5	199	16.1	5.1	3.8	
Fifth	7,790	6.3	37	3.8	4.7	44	3.6	5.6	1.7	
Sixth	6,721	5.4	95	9.7	14.1	110	8.9	16.4	1.5	
Seventh	38,935	31.3	51	5.2	1.3	63	5.1	1.6	2.1	
Sarawak	124,450	100.0	976	100.0	7.8	1,236	100.0	9.9	2.4	
Malaysia	330,434	37.7	10,395	(9.4)	31.5	13,745	(9.0)	41.6	2.8	

Source: 1980 figures - Annual Statistic Bulletin 1983

population density of 41.6 persons per sq.km. This is considered to be extremely low since Sarawak accounts for one third of Malaysia's total land area. However, it should be noted that Sarawak has an uneven population distribution with the highest density at 50.8 per sq.km in the First Division and the lowest density at 1.6 person per sq.km in the Seventh Division.

The First Division accounts for over one third of the entire state's population. The Western Sarawak area comprising the First, Second, Third and Sixth Divisions accounts for nearly 75% of the population while occupying only 31.1% of the total land area. These Divisions consist mainly of flat coastal areas and low hilly terrain. Moreover, most of the urban centers are situated in these Divisions.

Among all the Divisions, the Fourth Division exhibited the highest average annual growth rate of 3.8%. This could be attributed to the rapid development of Bintulu and particularly Miri, where oil was discovered. The eastern section of Sarawak has recently shown promising potential for development, and its realization is foreseen in the near future.

Unlike Peninsular Malaysia, Sarawak is populated by different ethnic communities. Appendix 1-5 shows the distribution of population according to the different racial groups. The three most dominant ethnic communities are the Ibans, the Chinese and Malays. The Ibans have long been among the early settlers in Sarawak. In 1947, they comprised 34% of the population; in recent years, however, their share has dwindled to approximately 28%. The Chinese, on the other hand, have been increasing steadily and have now overtaken the Ibans. The Malays have also been increasing in number and now comprise around 20% of Sarawak's Population.

3.3 Transport

3.3.1 General

The Transport System in Sarawak consists of waterways, roads and airway networks.

Water transport plays a major transport role due to the topographic characteristics, the underdevelopment of roads and the insular economic features of the state. Especially in relation to goods distribution/collection to and from major ports, coastal and river shipping supports various aspects of local socio-economic activity.

The roads, in spite of their potential importance, are extremely underdeveloped. Although the roads in the area surrounding Kuching (First Division) are relatively well developed, most of the state is not serviced effectively by roads in the absence of a state-wide road network. Only one Trunk Road linking all major towns in the state has been completed in 1982. However, the significance of road transport is rapidly increasing due to exceptional government attention and budgetary allocation for the development of roads to replace water transport.

Air transport links only a few points in the State, while water and road transport act as area distributors. Therefore, air transport is of less importance from the standpoint of regional economy.

3.3.2 Road Transport

The road construction policy of the State Government has always been the maximum utilization of limited resources for the economic and social development of the State. This is especially true in Sarawak since road construction is extremely costly owing to severe physical constraints. Hence, the highest priority in road construction is always given to roads which contribute to the realization of the land settlement and construction outlined in the Malaysian Plan as presented in Table 3-5.

The actual investment in roads in 1981 is shown in Table 3-6.

As clearly shown, the largest share of investment for roads is given to the Trunk Roads. The Trunk Road System in Sarawak is divided into the First Trunk Road System and the Second Trunk Road System (see Fig. 3-1).

The First Trunk Road System, which is a trans-state road linking all major towns in the State, has been completed with a gravel surface in September 1982.

The Second Trunk Road System, which is so far only in the planning stage, aims to open up the more sparsely populated and less developed areas of the State. The planned network of the road system is more or less a ladder pattern linking the internal areas to the First Trunk Road System.

The administration of public roads in Sarawak is mostly borne by the State Public Works Department through its 14 Mechanical Road Construction Units (MRCU).

Table 3-7 shows the past trend in the number of motor vehicles registered in Sarawak.

Table 3-5 ROAD CONSTRUCTION IN SARAWAK
PLANNED IN THE MALAYSIAN PLAN

(Unit: miles)

Road Type	1958 ~ 1965	1st MP 1966 ~ 1970	2nd MP 1971 ~ 1975	3rd MP 1976 ~ 1980	4th MP* 1981 ~ 1985	Total
Trunk Road	255	158	97	85	117**	682
Feeder Road	242	192	127	119	101	999
Development Road				113	105	
Rural Road	-	24	106	233	106	469
Maintenance/ Improvement of Trunk Road	-	100	153	73	46	46
Total	467	474	483	623	475	2,522

Notes: * - being revised

** - including 55 miles of wider roads

MP - Malaysian Plan

Table 3-6 ACTUAL INVESTMENT ON SARAWAK ROADS IN 1981

Road Type	Road Length Completed (miles)	Investment Amount (M\$ million)
Trunk Road	22.26	34
Feeder Road	23.19	14
Development Road	30.67	10
Rural Road	32.48	10
Maintenance/ Improvement of Trunk Road	10.08	7
Total	118.68	75

Fig. 3-1 TRUNK ROAD SYSTEM IN SARAWAK

LEGEND

- Boundary : International
- Boundary : State
- Boundary : Division
- Divisional Headquarters :
- Proposed Trunk Road :
- Trunk Road :
- Study Area :

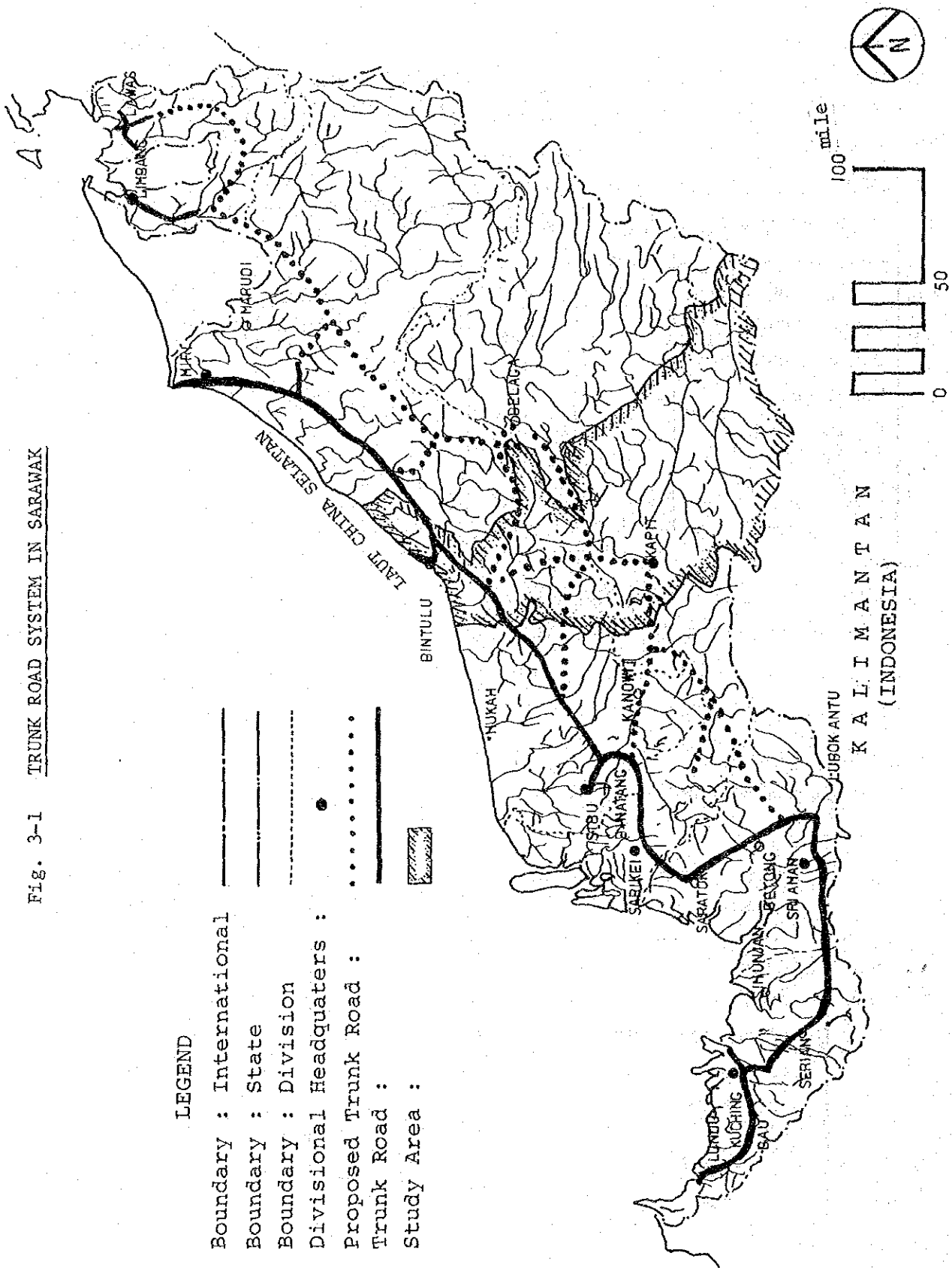


Table 3-7 MOTOR VEHICLES REGISTERED IN SARAWAK

At End of Year	Motor Cars			Lorries and Vans	Buses	Motor- cycles and Scooters	Government & Other Vehicles	Total
	Private	Taxis and Rent-a-cars						
1970	15,558	442		2,837	391	17,387	2,897	39,512
1971	17,806	469		3,072	426	20,908	3,458	46,139
1972	19,872	501		3,221	521	24,438	3,718	52,271
1973	21,993	518		3,458	541	27,050	4,229	57,789
1974	24,745	536		3,922	589	29,716	4,718	64,226
1975	27,461	570		4,381	643	33,914	5,123	72,092
1976	30,448	614		4,836	695	38,442	5,409	80,444
1977	34,380	733		5,325	740	42,523	5,911	89,612
1978	39,903	867		5,895	791	48,027	6,175	101,658
1979	45,468	924		6,595	814	52,687	6,709	113,197
1980	53,484	1,043		7,992	855	60,442	7,113	130,929
1981	61,971	1,197		9,404	901	69,488	7,680	150,641
1982	70,955	1,365		10,551	939	79,019	8,519	171,348

Source: Department of Land Transportation

All types of vehicles increased very rapidly during the period 1970 - 1980, accelerated by economic development and the improvement of the road network. The rate of increase was especially high for passenger vehicles.

The Average Daily Traffic (ADT) on various sections of major roads is presented in Appendix 1-6. Appendix 1-7 shows the locations of traffic counts. The ADT is large near the towns of Kuching and Miri. However, in most of the road sections between major towns, the ADT ranges only from 100 - 300.

The Road Public Transport System in the State comprises buses and taxicabs. Buses are operated mainly on the medium-and long-distance routes while taxicabs are mostly used for short trips in urban areas. Appendix 1-8 is a list of bus companies operating in the State as of 1980. All bus and taxicab companies are privately owned at present.

The service level of road public transport is still low in terms of the number of buses (503 as of 1980), the number of taxicabs (261 as of 1980), route coverage and service frequency.

3.3.3 Water Transport

Despite its present importance, water transport is a field where little reliable data exists, and data can hardly be collected. Coastal and river shipping, which is competitive with road shipping, is especially poorly documented and no aggregate information is available. Therefore, water transport cannot be exactly outlined based on quantitative data.

In general, water transport in Sarawak can be classified into overseas shipping and internal shipping. They can further be divided into coastal and river shipping. However, as coastal ships are often going up river, it is difficult to make a distinction between these two types of shipping.

Coastal and river shipping is characterized by a large number of small vessels based on small wharves and jetties along rivers. Excluding petroleum and timber vessels owned by private companies to transport their own goods, most of these vessels are of less than 100 net registered tons while more than half of the vessels are of less than 20 net registered tons. These small vessels, mostly owned by small family businesses, play a vital role in internal areas not accessible by other transport modes by distributing goods and providing shuttle services for passengers. More specifically, timber is transported by

rafts and barges down rivers and is exported from major ports after transshipment to ocean-going vessels. The rafts and barges, on the way back, carry cargoes to the internal areas of the State.

Smaller vessels called long boats, speed boats and express launches are also used frequently. Long boats and speed boats equipped with outboard engines are mainly for small-scale businesses, while express launches are the only form of public passenger transport operating the wide-spread river system.

The four principal ports, Kuching Port, Sibul Port, Bintulu Deepwater Port and Miri Port are used for foreign and trans-ocean domestic shipping trade.

Table 3-8 shows the cargo volume loaded and discharged by year and by port.

3.3.4 Air Transport

Although air transport in Sarawak is not significant in terms of quantity, it cannot be neglected in its role as provider of fast, long-distance passenger transport between major towns. Furthermore, it provides necessary and practical services to all remotely scattered rural communities not served by roads or even by waterways. Especially in cases of emergency, air transport cannot be substituted with other transport modes.

In the State of Sarawak, there are at present 47 aerodromes, 43 of which are extremely small. More than half are used for specific purposes other than civil aviation. Relatively large aerodromes are found in Kuching, Sibul, Bintulu and Miri. The Department of Civil Aviation currently operates 18 aerodromes. Only the Kuching Airport is large enough to accommodate DC-10 type aircraft, while the Miri Airport can handle Boeing 737 aircraft and the Sibul and Bintulu Airports are capable of handling Fokker Friendship F27 class aircraft. All other aerodromes are for light STOL aircraft only.

Although most of the aerodromes are poorly equipped, they provide a comparatively efficient transport network to the rural communities. Authorities are planning to expand Kuching Airport, while Miri Airport is at present under extension. Three new airports at Sibul, Bintulu and Limbang are also to be constructed.

Appendix 1-9 and 1-10 indicate past trends of major airports in the movement of aircraft and passengers, respectively. The increase in the rate of airport traffic was very high at the four major airports in contrast to other small aerodromes. It is noted, *inter alia*, that the rate of increase has been remarkable at Kuching and, in recent years, at Bintulu.

Table 3-8 CARGO LOADED AND DISCHARGED AT PRINCIPAL PORTS

(Unit: '000 tons)

Year	Kuching		Rejang River Ports (a)		Miri		Bintulu		Others (b)		Total	
	Loaded	Dis-charged	Loaded	Dis-charged	Loaded	Dis-charged (c)	Loaded	Dis-charged	Loaded	Dis-charged	Loaded	Dis-charged
1970	39	331	1,132	161	7,504	6,647	-	-	547	15	9,222	7,154
1971	35	395	944	171	9,202	6,347	-	-	459	32	10,640	6,945
1972	32	279	803	268	5,176	1,574	-	-	365	10	6,376	2,131
1973	46	384	765	238	5,441	1,197	-	-	329	19	6,581	1,838
1974	45	494	672	195	4,726	767	-	-	380	110	5,823	1,566
1975	59	428	582	171	3,962	521	-	-	387	30	4,990	1,150
1976	59	346	843	195	6,534	747	-	-	614	8	8,050	1,296
1977	43	296	721	248	5,968	782	-	-	633	28	7,365	1,354
1978	40	406	1,210	231	7,372	70	-	-	1,451	16	10,073	723
1979	72	400	1,674	189	6,749	99	-	-	1,898	103	10,393	791
					(d)						(d)	
1980	107	385	1,922	158	6,058	133	-	-	2,493	228	10,580	904
1981	445	862	1,862	123	6,376	80	3,219	279	262	38	12,164	1,382
1982	402	1,092	2,141	88	7,292	244	3,026	81	429	11	13,290	1,442

Notes: (a) Includes Sibul, Binatang, Sarikei and Tanjong Mani.

(b) Includes Lundu, Sejingkat, Bintulu, Limbang, Baram, Lawas, Sundar, etc.

(c) Figures prior to 1972 include crude petroleum piped from Brunei to Miri for refining

(d) Revised figures

Source: Department of Royal Customs and Excise

3.4 Industrial Activities

3.4.1 Agriculture

(1) General

Agriculture (including forestry and fishery) accounted for 28% of Sarawak's GDP in 1981. Agricultural products have always been a part of the State's export sector.

Of the land used in Sarawak, 26% is devoted to agriculture, while more than 70% is occupied by forest land.

Most agricultural land is divided among small landholders. Very few plantations and estates exist in the area.

Although agriculture is important in Sarawak, many problems still need to be solved. The vast area is sparsely populated and this low percentage of manpower directly affects productivity, which is relatively low.

(2) Agricultural Production

Cultivation of traditional major crops such as rice, pepper, rubber, coconut, oil palm and sago has continued to the present. The majority of these crops are raised by traditional farming methods. The government is attempting to improve the present situation and maximize agricultural production by adopting modern farming methods, including the use of machinery and fertilizers.

At present, the majority of such traditional crops as rubber, pepper, coconut and sago form the bulk of agricultural exports. The recent inclusion of palm oil and the expansion of cocoa production have also contributed to export earnings. In 1980, income from agricultural exports totalled M\$300.809 million representing roughly 7% of principal exports. Table 3-9 shows the export pattern of several agricultural commodities.

(a) Rice

Rice is the staple food in Sarawak and therefore the most important food crop. Thus, in 1980, a total of 134,331 hectares were devoted to paddy production. Of the total area, 67,224 hectares were cultivated by hill paddy and the remaining 63,234 hectares by wet paddy. Production reached 190,071 tons (117,844 tons in rice), with wet paddy production and hill paddy production amounting to 142,517 tons and 47,554 tons, respectively. In spite of the low

Table 3-9 EXPORT PATTERN OF SEVERAL AGRICULTURAL COMMODITIES

(M\$'000,000)

Year	Rubber		White Pepper		Black Pepper		Sago Flour & Meal		Cocoa Beans		Palm Oil	
	Tons (000)	M\$	Tons (000)	M\$	Tons (000)	M\$	Tons (000)	M\$	Tons (000)	M\$	Metric Tons (000)	M\$
1971	19.7	16.6	9.0	24.6	18.0	38.2	23.2	3.4	0.0085	0.0095	-	-
1972	20.0	14.4	10.3	28.8	16.0	29.3	18.5	2.3	0.020	0.020	-	-
1973	42.2	56.7	10.6	38.4	12.3	27.8	23.8	3.6	0.025	0.055	-	-
1974	32.8	50.4	13.1	56.0	15.9	46.9	28.0	7.1	0.062	0.16	0.52	0.73
1975	29.2	35.9	9.8	39.0	20.6	61.9	23.0	5.3	0.073	0.2	3.6	3.9
1976	40.6	64.3	9.8	41.3	25.7	83.1	28.1	6.7	0.11	0.4	7.3	7.7
1977	37.7	62.9	7.4	42.5	19.4	90.2	29.7	8.3	0.27	1.7	12.5	19.6
1978	39.6	74.0	8.6	49.4	22.1	82.4	29.4	6.8	0.47	3.3	17.5	26.4
1979	38.6	88.4	10.6	53.3	25.5	83.1	27.4	6.9	0.68	4.5	18.8	32.2
1980	35.2	88.1	8.0	35.1	22.7	68.8	26.4	8.8	1.4	5.6	25.6	32.6

Source: Agricultural Statistics of Sarawak, 1980

productivity of hill paddy, it is still popular among the inlanders. However, this method of cultivation causes much damage to the land and the forest because of the effects of the "slash and burn" method. (Refer to Appendix 1-11)

Sarawak had a self-sufficiency ratio of 63.0% in 1980, and its rice imports have ranged from M\$40 - 45 million in recent years. Table 3-10 shows the total rice production of Sarawak and its self sufficiency ratio.

(b) Pepper

Pepper production in Sarawak has a long history and is now one of the State's most popular cash crops. Fully 91% of the land area devoted to pepper is located in Sarawak. In 1980, the export value of pepper reached M\$103.99 million. Although this amount is almost double the 1971 value, pepper production decreased by around M\$30 million; this could be attributed to the unfavourable prices it commanded on the world market, causing many small holders to abandon the harvesting of pepper. Increasing production costs also seemed to contribute to its decline. However, the government is providing subsidies for replanting and extending credit for fertilizers and chemicals to increase production.

(c) Rubber

Rubber ranks second among agricultural exports (next to pepper).

The total hectareage under rubber cultivation is approximately 199,881 ha., with exports totalling M\$88,072 thousand. This is quite low in comparison with the production level in Peninsular Malaysia. One reason for this is that very few rubber estates exist in Sarawak, where most of the rubber is cultivated on small landholdings which suffer from poor management and low productivity. (Refer to Appendix 1-12)

(d) Palm Oil

Palm oil has only recently been introduced as an export product but has rapidly gained importance in that role. In 1980, export earnings from palm oil were expected to reach around M\$35 million, as shown in Appendix 1-13. In the same year, the total area devoted to palm oil cultivation rose to 22,926 hectares.

Table 3-10 SARAWAK'S RICE SUPPLY

(Unit: tons)

Year	Local Production	Imported Rice	Total Supply	Self- Sufficiency Ratio(%)
1971	97,663	60,183	157,846	61.9
1972	100,686	63,930	164,616	61.2
1973	80,571	70,336	150,907	53.4
1974	95,097	88,959	184,056	51.7
1975	89,411	36,925	126,336	70.8
1976	93,665	53,669	147,334	63.6
1977	106,758	77,938	184,696	57.8
1978	114,146	55,471	169,617	67.3
1979	119,336	62,921	182,257	65.5
1980	117,844	69,184	187,028	63.0

Note: 1 ton of paddy = 0.67 ton of rice

3.4.2 Forestry

Forestry holds an important position in the Sarawak economy. As of 1980, close to 76% of the total land area of Sarawak was classified as forest, with abundant volume. Forestry also holds a prominent position in the export sector, second only to petroleum.

Sarawak's timber production from 1970 - 1980 is presented in Table 3-11. Fluctuations in the forestry market were evidently severe, particularly during the aftermath of the Oil Crisis when the production of round timber declined by 25% and prices dropped by approximately M\$14.00 per cubic meter. A remarkable recovery was made in 1976, and by 1977 production had surpassed the 1970 level.

Aside from the export of round and sawn timber, Sarawak is engaged in the manufacture of veneer and plywood and the production of mouldings, dowels and furniture. Manufacturers of veneer and plywood are found in Kuching and Sibu, while firms involved in the production of dowels and mouldings are found in Kuching, Sibu, Miri and Sri Aman. Timber processing operations have remained small in scale and therefore need improvement.

3.4.3 Mining and Quarrying Industries

Since the discovery of oil in Miri, petroleum and petroleum products have made the mining and quarrying sector the biggest contributor to the Sarawak economy. In 1980, the export of petroleum and petroleum products reached approximately M\$2.5 billion, accounting for roughly 63% of the principal export. Table 3-12 shows the export pattern of petroleum and its by-products.

The discovery of natural gas deposits in Bintulu has provided another potential export earner for this sector.

In addition to the above, gold and antimony are also mined.

3.4.4 Manufacturing

In 1978, manufacturing registered a share of close to 8% of Sarawak's GDP. Appendix 1-14 shows the trend of the manufacturing industry in Sarawak for the years 1971 - 1980. As of 1979, manufacturing establishments numbered 471 producing a total output value of M\$879 million. Table 3-13 shows the breakdown of the manufacturing sector into the types of establishments and number of persons engaged in the industry.

Table 3-11 TIMBER PRODUCTION BY YEAR

Year	Round Timber		Sawn Timber		Total	
	Production (cu.m.) 000	Value (M\$'000,000)	Production (cu.m.) 000	Value (M\$'000,000)	Production (cu.m.) 000	Value (M\$'000,000)
1970	3,117	148 (\$47.61)	314	50 (\$158.39)	3,431	198
1971	2,545 [18.3%]	121 (\$47.45)	282 [10.3%]	47 (\$166.97)	2,827	168
1972	1,996 [21.6%]	84 (\$41.84)	304 [7.8%]	51 (\$167.53)	2,300	135
1973	1,893 [5.2%]	124 (\$65.46)	257 [15.4%]	87 (\$337.99)	2,150	211
1974	1,685 [11.0%]	108 (\$64.21)	215 [16.3%]	58 (\$268.09)	1,900	166
1975	1,255 [25.5%]	64 (\$50.79)	242 [+12.4%]	62 (\$257.08)	1,497	126
1976	2,954 [+135.4%]	242 (\$81.96)	288 [+19.1%]	117 (\$405.90)	3,242	359
1977	3,481 [+17.9%]	255 (\$73.20)	232 [19.6%]	89 (\$383.24)	3,713	344
1978	4,202 [+20.7%]	321 (\$76.43)	191 [17.4%]	78.4 (\$409.75)	4,393	399
1979	6,025 [+44.0%]	806 (\$133.20)	198 [10.3%]	106 (\$615.16)	6,223	912
1980 (a)	6,695 [10.6%]	816 (\$121.95)	173 [+1.0%]	104 (\$599.66)	6,868	920

Notes: [] : growth rate

() : price per cubic meter

(a) : preliminary figures

Table 3-12 EXPORT PATTERN OF PETROLEUM AND ITS BY-PRODUCTS

Year	Petroleum (Crude)		Petroleum (Partly Refined)		Motor & Aviation Spirits		Kerosene & Similar Spirits		Diesel & Fuel Oil		Lubricants and other By-Products		Total	
	Tons	M\$'000	Tons	M\$'000	Tons	M\$'000	Tons	M\$'000	Tons	M\$'000	Tons	\$'000	Tons	M\$'000
1970	3,743,496	164,497	966,910	38,035	904,961	55,340	181,475	10,482	1,316,967	58,619	36	22	7,113,845	326,995
1971	6,638,775	334,354	1,221,132	56,959	982,705	58,827	191,748	10,574	272,509	18,854	18	13	9,306,887	479,581
1972	3,423,510	186,230	1,097,528	56,748	892,416	47,918	191,235	10,848	267,052	19,346	24	24	5,871,765	321,114
1973	3,349,541	235,226	963,762	71,636	584,288	44,275	310,388	22,483	215,729	18,490	234	91	5,423,942	392,201
1974	2,730,800	571,318	918,696	215,689	371,984	91,834	145,121	32,630	183,113	42,175	8	12	4,349,722	953,658
1975	3,438,033	772,309	588,583	144,983	187,320	45,946	78,793	19,259	175,540	42,323	409	499	4,468,678	1,025,319
1976	4,795,114	1,168,288	851,361	231,568	161,550	44,652	91,661	26,031	225,978	61,536	168	166	6,125,832	1,532,241
1977	4,608,363	1,201,442	387,079	108,647	134,727	41,059	45,775	13,304	211,799	58,605	75	134	5,387,798	1,423,191
1978	3,833,505	944,013	-	-	132,144	39,498	24,788	7,228	324,224	77,359	N.A	68	4,314,661	1,068,166
1979	4,125,167	1,449,944	-	-	127,290	54,918	37,080	13,728	338,099	105,850	N.A	68	4,627,636	1,624,508
1980 (a)	3,912,629	2,286,513	-	-	98,588	69,080	41,111	28,737	242,343	130,885	N.A	179	4,294,671	2,515,394

Source: Annual Statistics Bulletin Sarawak 1980

Notes: (a): Preliminary figures
N.A: Not available

Table 3-13 PRINCIPAL STATISTICS ON THE MANUFACTURING
INDUSTRY OF SARAWAK, 1979

Classification of Industries	No. of Establish- ments	Share (%)	Value of Output (M\$'000)	Share (%)	No. of Workers	Share (%)
1. Food	110	23.4	125,478	14.25	2,802	13.5
2. Beverage	16	3.4	20,051	2.3	516	2.5
3. Clothing	14	3.0	3,611	0.4	247	1.2
4. Wood & Cork Products						
Furniture & Texture	117	24.8	269,421	30.6	9,713	46.9
5. Printing, Publishing & Allied Industries	26	5.5	17,235	2.0	1,585	7.7
6. Fertilizers/ Pesticides	4	0.8	4,462	0.5	93	0.4
7. Petroleum Refinery	1	0.2	259,997	29.6	74	0.3
8. Rubber Products	28	5.9	21,489	2.5	617	3.0
9. Plastic Products	8	1.7	11,678	1.3	471	2.3
10. Clay Products & China	40	8.5	7,816	0.9	964	4.7
11. Cement & Concrete Products	9	1.9	26,386	3.0	418	2.0
12. Metal Products	44	9.4	23,352	2.6	1,142	5.5
13. Machinery & Equipment	15	3.2	4,074	0.5	292	1.4
14. Shipbuilding & Repair	22	4.7	19,643	2.2	1,217	5.9
15. Motor Vehicles & Parts/Access- ories	5	1.1	61,649	7.0	348	1.7
16. Other Manu- facturing Industries	12	2.5	2,893	0.35	209	1.0
Total	471	100%	879,235	100%	20,708	100%

The only existing petroleum refinery, while employing a mere 74 persons, accounts for 29.6% of the total output value of manufacturing. On the other hand, the wood and cork industry, having 117 establishments with an employment of 9,713 persons (46.9% of the total number of persons employed in the manufacturing industry) accounts for 30.6% of the total output value. Together these two sectors account for a little more than 60% of the manufacturing industry. This trend further proves that resource-oriented industries make up the bulk of manufacturing in Sarawak.

At present, 41% of the total manufacturing establishments are registered as private limited companies accounting for 61% of the labor force in the manufacturing industry.

The majority of the establishments are located in the First Division (Kuching) and the Third Division (Sibu). In terms of output, the First Division and the Fourth Division rank first and second, respectively. The large output value in the Fourth Division can be attributed to the petroleum industry found in Miri. An LNG plant built in Bintulu began to operate from the end of 1982 and is expected to further add to the output value of the Fourth Division. The interior area of Sarawak obviously lags behind in the manufacturing industry. The construction of infrastructure can definitely stimulate the penetration and promotion of manufacturing in the remote areas of Sarawak.

CHAPTER 4

CONTENTS

Page

CHAPTER 4 SOCIO-ECONOMY IN THE PROJECT AREA

4.1	Geography	4-1
4.2	Population/Communities	4-2
4.3	Agriculture	4-8
4.4	Forestry	4-18
4.5	Tourism	4-22
4.6	Associated Development Project	4-26

CHAPTER 4 SOCIO-ECONOMY IN THE PROJECT AREA

4.1 Geography

4.1.1 Location

The Study Area, as shown in location map, is located near the center of Sarawak and is composed of a part of the Fourth and Seventh Divisions. It encompasses the Bintulu and Tatau Subdistricts of the Fourth Division, penetrates the inland areas and reaches down to the Kapit District, ending at the territorial boundary between the Seventh Division and Kalimantan, of the Republic of Indonesia.

The total Study Area covers approximately 27,000 km².

4.1.2 Topography

In general, the Study Area is composed mainly of tropical jungle and rolling terrain traversed by many rivers. The main geological composition of the area was found to be sandstone and limestone.

The Study Area can be topographically categorized as follows:

- (1) the lowlands: These areas range between sea level and 90 m and are characterized by gentle slopes and comparatively flat areas. Small sections of the Bintulu and Tatau Subdistricts have these features.
- (2) the uplands: Rolling terrain and moderately steep slopes abound in the Study Area, particularly towards the inlands and away from the coast.
- (3) the highlands: The area deeply penetrates the inlands where long steep slopes and hilly to mountainous terrain are found. Virtually no agricultural activities are carried on except for "shifting cultivation" otherwise known as the "slash and burn cultivation method."

Most of the people live along the four river systems within the boundaries of the Study Area, namely, the Batang Kemena, the Batang Tatau, the Batang Rajang and the Batang Balleh. These rivers also provide a means of transport for the inhabitants. Some of the areas remain inaccessible because of poor transportation facilities and non-existent roads in the rugged areas.