

Final Report

for

The Master Plan Study of Public Transport System

in

Negara Brunei Darussalam

June, 1985

Japan International Cooperation Agency

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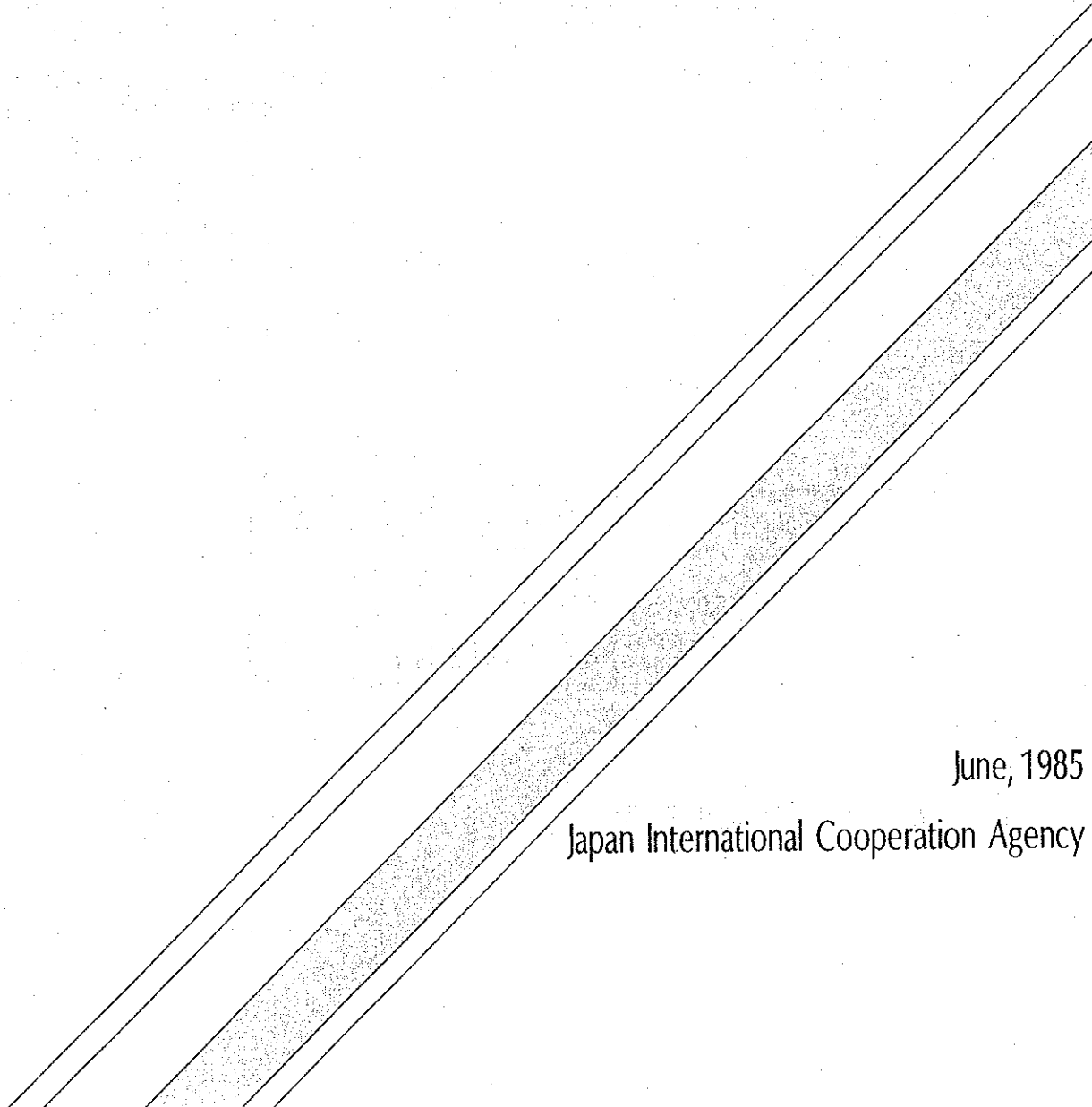
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PREFACE

In response to the request of the Government of Negara Brunei Darussalam, the Government of Japan decided to conduct a study on the master plan of the public transport system improvement project in Negara Brunei Darussalam and entrusted it to the Japan International Cooperation Agency (JICA).


The JICA sent to Brunei a survey team headed by Mr. Hirokazu Ito from August 6 through October 13, 1984.

The team exchanged views with the officials concerned of the Government of Brunei 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.

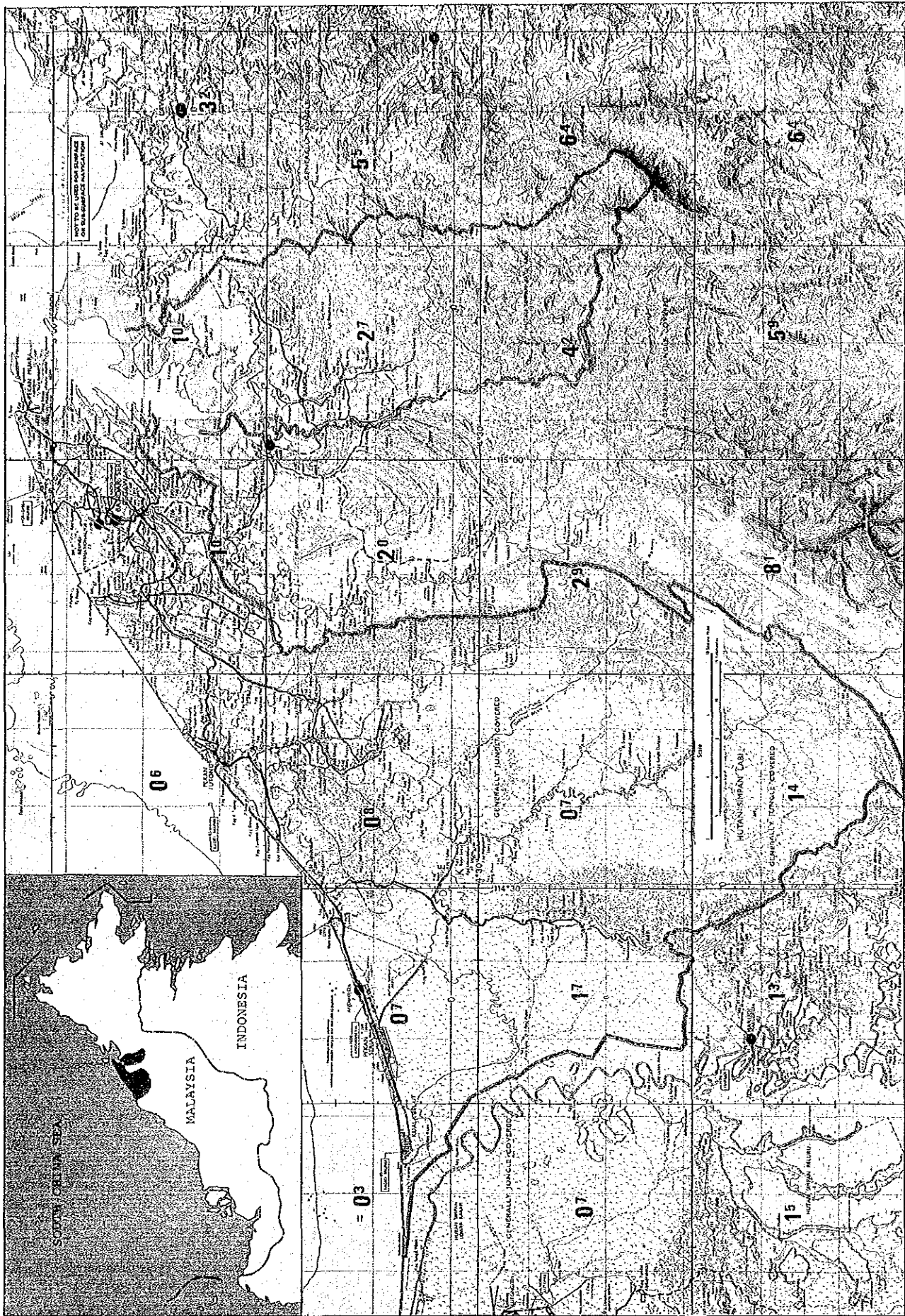
I wish to express my deep appreciation to the officials concerned of the Government of Negara Brunei Darussalam for their close cooperation extended to the team.

June, 1985



Keisuke Arita
President

Japan International Cooperation Agency



PUBLIC TRANSPORT STUDY AREA

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Abbreviation

B.S.B.	:	Bandar Seri Begawan
K.B.	:	Kuala Betait
O.D.	:	Origin-Destination
hrs.	:	hours
Km/h	:	Kilometers per hour
B\$:	Brunei Dollar
Kg.	:	Kampung = Village
Jln.	:	Jalan = Road
Sg.	:	Sungai = River
GDP	:	Gross Domestic Products
LTD	:	Land Transport Department
EPU	:	Economic Planning Unit
TCPD	:	Town and Country Planning Department
PWD	:	Public Works Department
HDD	:	Housing Development Department
EDB	:	Economic Development Board
Alt.	:	Alternative
F/S	:	Feasibility Study
D/D	:	Detailed Design
SV	:	Supervision
B/C	:	Benefit/Cost Ratio
NPV	:	Net Present Value
EIRR	:	Economic Internal Rate of Return
FIRR	:	Financial Internal Rate of Return
NDP	:	National Development Plan

Currency Equivalent

Currency Unit = Brunei Dollar

US\$ 1.00 = B\$ 2.09

B\$ 1.00 = US\$ 0.48

System of Weights and Measures: Metric

1 meter (m) = 3.28 feet (ft)

1 square meter (m²) = 10.76 square feet (ft²)

1 cubic meter (m³) = 35.29 cubic feet (ft³)

1 kilometer (km) = 0.62 mile

1 square kilometer (km²) = 0.39 square mile

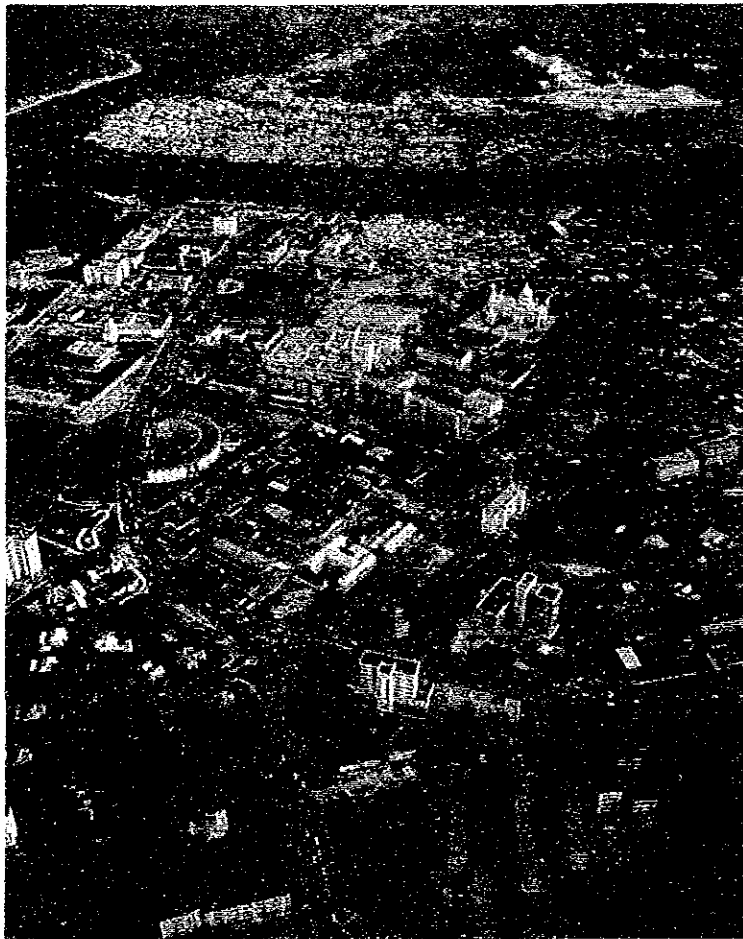
1 hectare (ha) = 2.47 acres

1 metric ton = 2,204 pounds

1 gallon = 4.55 liter

In all figures decimal point is indicated with a dot and thousand, million and billion are marked off with a comma.

CHAPTER 1 INTRODUCTION



CHAPTER 1 INTRODUCTION

1-1 Background

In response to the request of the Government of Brunei Darussalam, the Government of Japan has decided to conduct the Master Plan Study of the Public Transport System in Negara Brunei Darussalam (hereinafter referred to as "the Study"). The Japan International Cooperation Agency (hereinafter referred to as "JICA"), the official agency responsible for the implementation of technical cooperation programme of the Government of Japan, has accordingly undertaken the Study in accordance with the relevant laws and regulations in force in Japan, in close cooperation with the Brunei Darussalam authorities concerned.

The country of Brunei Darussalam as an oil producing country being endowed with the ample natural underground resources has, in recent years, achieved the remarkable increase in its economic growth, rapidly increased the national income, and become an economically rich country.

This economic richness of the country has resulted in the occurrence of a wide-spread of private cars which is accompanied by delay in development of the public transport sector of the country. As a result, traffic congestion of high density has been brought forward in the capital city of B.S. Begawan and is making it increasingly difficult to ameliorate socio-economic activities. Moreover, it is predicted to cause a future shortage of the public transport capacity to even between the metropolitan area and satellite cities.

1-2 Objective of the Study

The objective of the Study is:
To prepare a Master Plan for the improvement and an intermediate programme of the Public Transport System within the study area, taking into account existing plans, programmes and transport policy where no restrictive policy is established by the government to use and own a car at present.




The main target year of the Study is the year 1995 A.D.

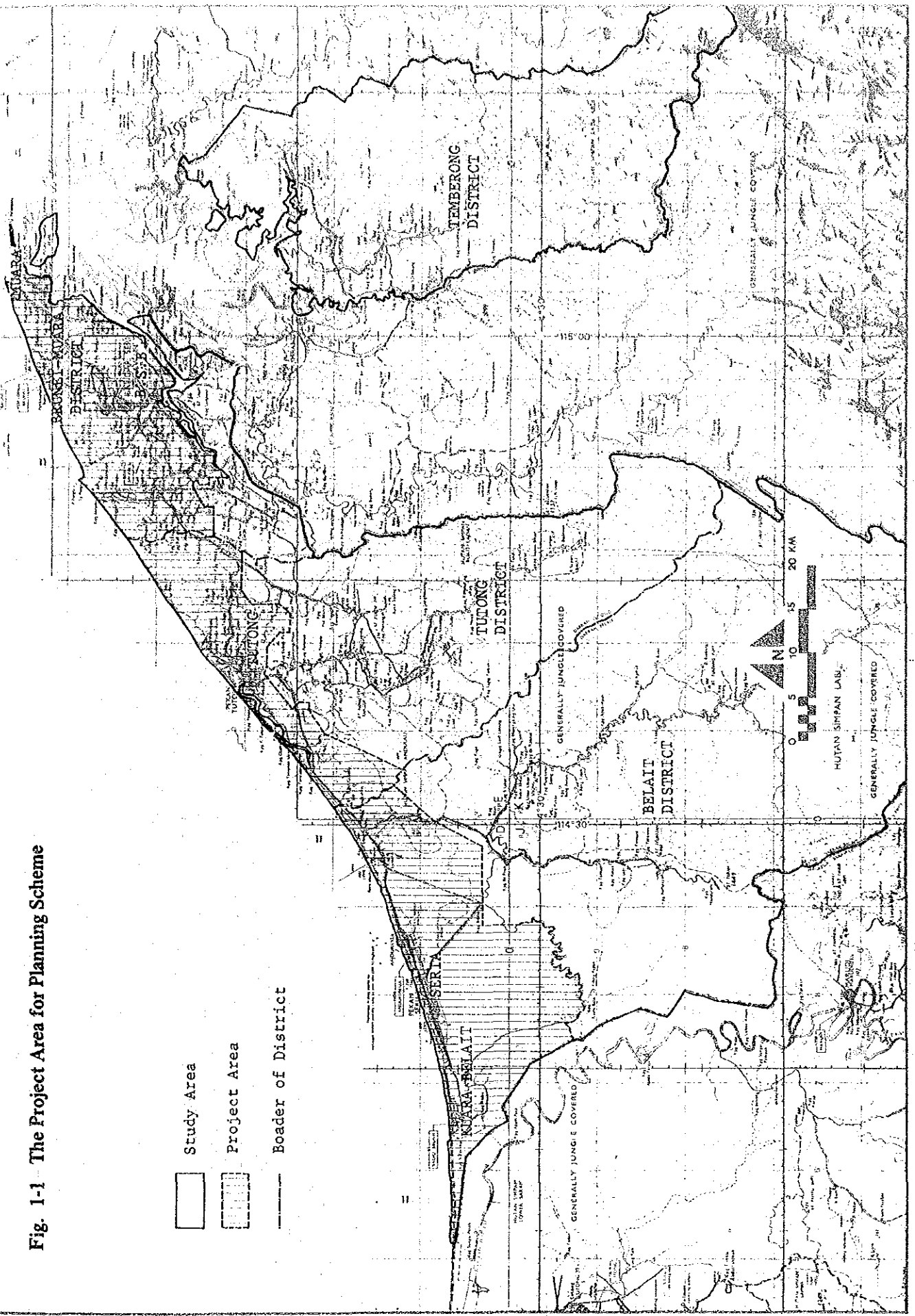
1-3 Study Area

The whole country is the object for computation of indices of current situations as well as estimated indices for the future such as population, economic frame and traffic demand. Although an area having relatively large populations is the objects for establishment of public transport improvement programs, relevant facilities programs and road facilities programs in concrete.

That is, the whole country is the study area, but the project area for facilities programs in concrete are urban areas and their relevant areas such as B.S.B, Muara, Tutong, Seria and Kuala Belait, as shown in Fig. 1-1.

Fig. 1-1 The Project Area for Planning Scheme

-  Study Area
-  Project Area
-  Boader of District



1-3-1 Traffic Zones

Brunei-Muara, including B.S.B., Belait, Tutong and Temburong, are four administrative districts in Negara Brunei Darussalam. There has been set four districts and one municipality zone, corresponding these administrative districts. Then each district zones divided into twenty-four zones, considering the Land-use, network of road facilities and geographically. The important areas, Brunei-Muara and B.S.B., for analyzing the public transport in the districts are divided into smaller zones (closer areas to C.B.D. Central Business District) which depends on traffic volume.

The limits of smaller zones are considered equivalently to the categorized unit of census for Mukim and Kampong.

Zone Numbers, see Table 1-1 to 1-2

Zone Maps, see Figure 1-2 to 1-4

Table 1-1 Zone Code Table

District Code	District	Zone Code	Name
10	B.S.B.	11	Pusat Bandar
		12	Kianggeh
		13	Tasek
		14	Kumbang Pasang
		15	Jalan Tutong
		16	Kampong Air (1)
		17	Kampong Air (2)
20, 30	Brunei-Muara District	21	Kota Batu
		22	Berakas (1)
		23	Berakas (2)
		24	Berakas (3)
		25	Gadong (1)
		26	Gadong (2)
		27	Kilanas
		28	Sengkurong
		29	Pengkalan Batu
		30	Lumapas
		31	Mentiri, Serasa
40	Belait District	41	Kuala Belait
		42	Seria
		43	Labi
50	Tutong District	51	Tutong
		52	Lamunin
60	Temburong	61	Temburong

Table 1-2 Land Use Characteristics

Zone No.	Land Use Characteristics	Population 1971	Population 1981
11	Central Business District (C.B.D)		2,969
12	Around C.B.D.		3,831
13	Around C.B.D.		4,482
14	Around C.B.D.		6,287
15	Around C.B.D.		5,208
16	Kg Ayer Residential Area		11,167
17	Kg Ayer Residential Area		15,958
21	Colonies of Farmers & Fisherman and New Residential Areas	4,587	6,554
22	Sub-town (Government & Municipal Officers)		10,786
23	Colonies of Farmers and New Residential Areas		4,563
24	Large Scope projects of resettlement Areas		7,408
25	Sub-towns (Government & Municipal offices and industrial zone		3,933
26	Large Scope projects of resettlement Areas		5,993
27	Farmers colonies around the town	3,623	5,344
28	Farmers colonies around the town	3,596	6,365
29	Farmers colonies around the town	1,683	2,932
30	Farmers colonies around the town		2,284
31	Harbor and its related industry district	3,714	8,167
41	Designated Industry regions	14,239	19,328
42	Designated Commerce Industry regions	20,824	23,415
43	Hilly Backcountries	7,320	8,025
51	Designated Tertiary Industry regions	9,562	14,828
52	Colonies among hilly country areas	6,297	6,787
61	Colonies among hilly country areas	5,224	6,218
Total			192,832

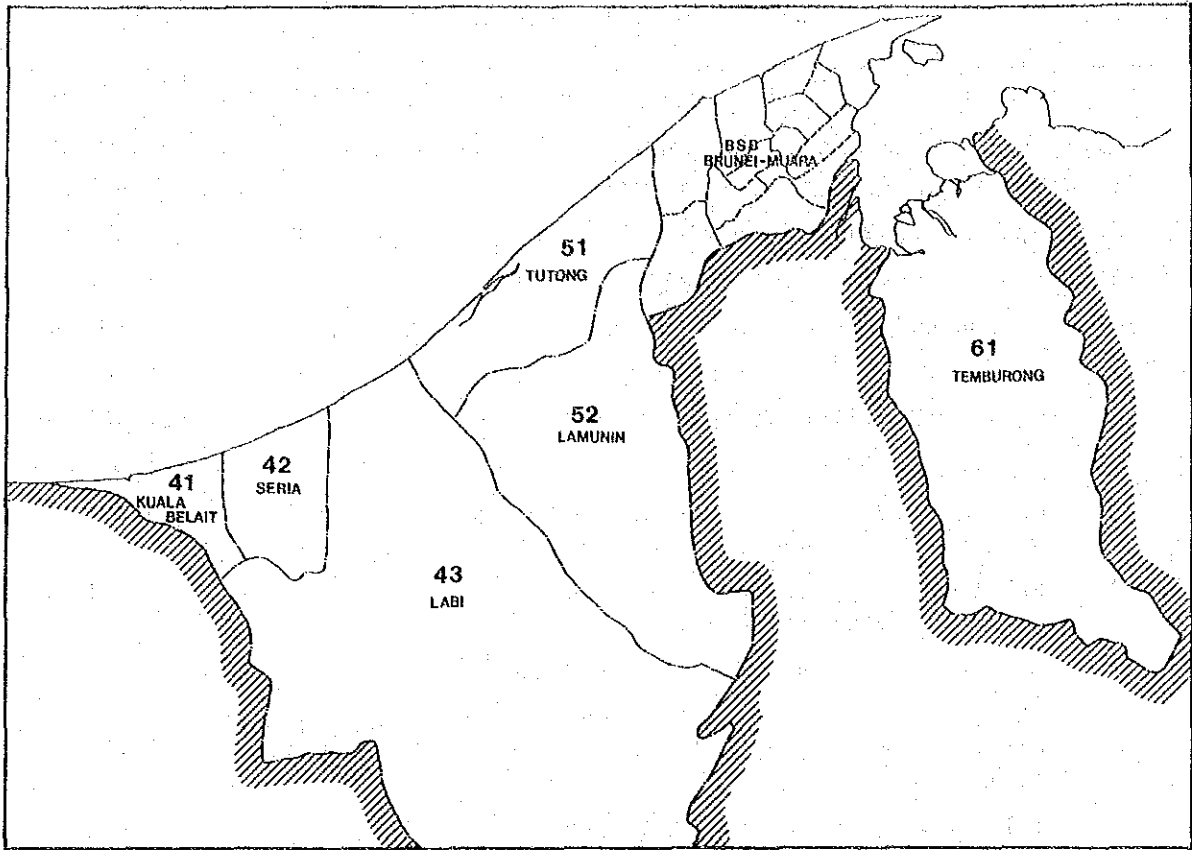


Fig. 1-2 Zone Map (1) – Brunei

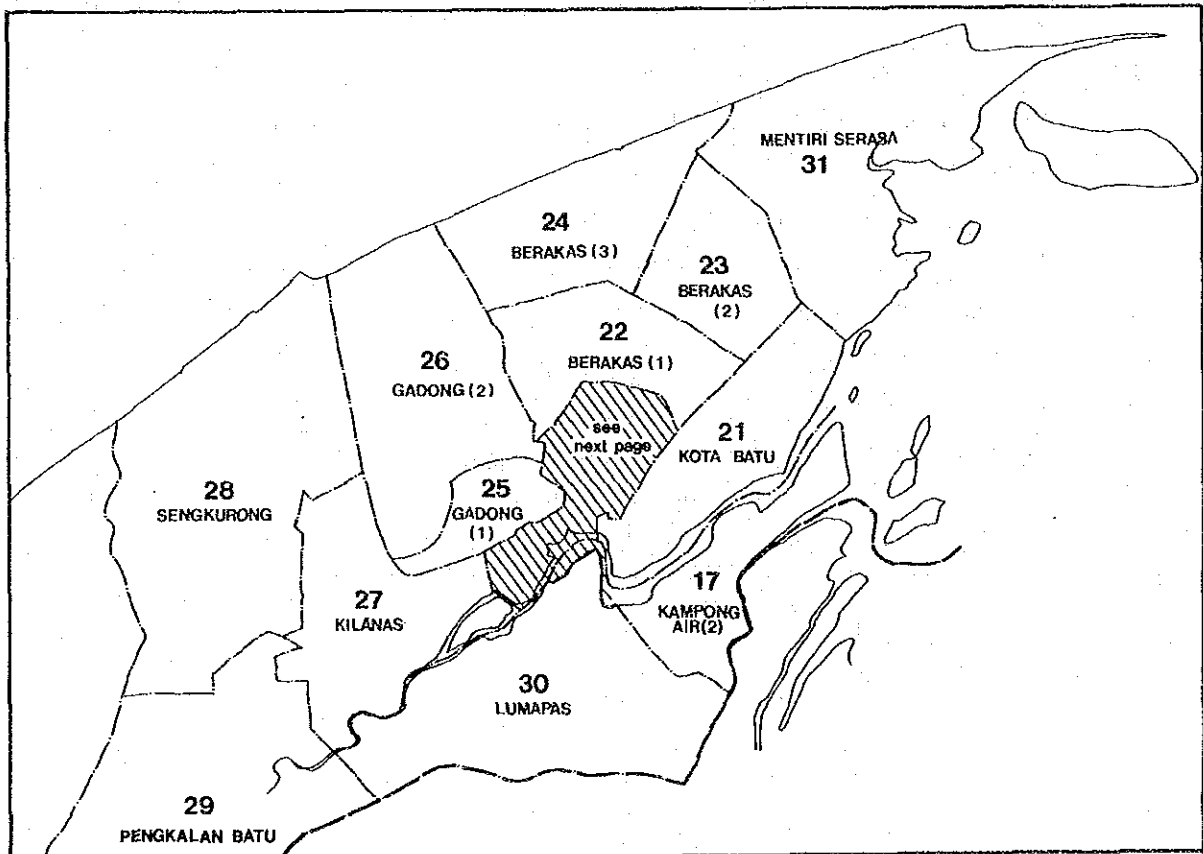


Fig. 1-3 Zone Map (2) – Brunei-Muara District

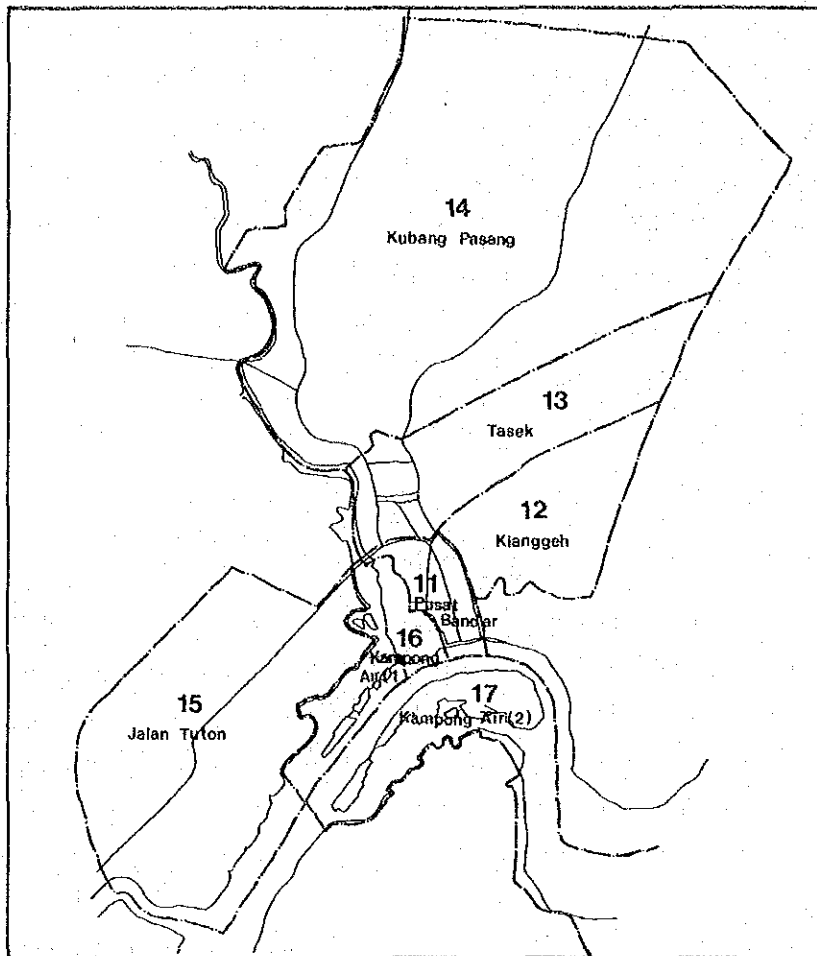


Fig. 1-4 Zone Map (3) – B.S.B.

1-3-2 Traffic Survey Points

The traffic survey of eight categories has operated, as follow:

- (1) Road-side O.D. survey.
- (2) Bus passenger survey.
- (3) One week traffic count survey.
- (4) 24 hour traffic count survey.
- (5) 12 hour traffic count survey.
- (6) Traffic count at the intersection.
- (7) Actual survey in parking areas.
- (8) Bus floating survey.

Each survey points are shown in Fig. 1-5 to 1-7.

(1) Road-side origin and destination (O.D.) survey

The road-side O.D. surveys were operated to understand the trips of the origin and the destination of car-users. Interviews were made at ten selected points which were made up of four points on radial routes crossing the cordon line around urban areas of B.S.B. Four points in and around central business districts (C.B.D.), and two points on main motor-way running in the vicinity of urban boundary areas. Points, numbers and survey data are as follows:

Table 1-3 Points of OD Survey

No. of Survey Point	Station Name	Data	Road Name
1	Kampong Sengkurong	16/Aug.	JLN. Tutong
2	Kampong Lambak	16/Aug.	JLN. Berakas
3	Kampong Manggis II	15/Aug.	JLN. Muara
4	Kampong Sungai Besar	15/Aug.	JLN. Kota Batu
5	In front of the High Court	18/Aug.	JLN. Tutong
6	S. Tungkadeh	20/Aug.	JLN. Kubang Pasang
7	Kampong Mabohai	22/Aug.	JLN. Kebangsaan
8	In front of Craft Center	22/Aug.	JLN. Residency
9	Kampong Sungai Liang	21/Aug.	JLN. Tutong
10	New Intersection	21/Aug.	Coastal Highway

(2) Bus passenger survey

The bus passenger survey was operated to study the origin and destination of the bus-users. The interviews were made at six points, four points on radial routes which cross the urban boundary cordon lines of B.S.B. The urban boundary of Belait and Tutong is made for one point, and the rest of one more point is the bus-station in B.S.B..

Table 1-4 Points of Bus Passenger Survey

No. of Survey Point	Station Name	Date	Road Name
1	Kampong Sengkurong	16/Aug.	JLN. Tutong
2	Kampong Lambak	16/Aug.	JLN. Berakas
3	Kampong Manggis II	15/Aug.	JLN. Muara
4	Kampong Sungai Besar	15/Aug.	JLN. Kota Batu
9	Kampong Sungai Liang	21/Aug.	JLN. Tutong
B.S.B.	Bus Station	18 20/ Aug.	

(3) One week traffic volume count survey

One week traffic volume count survey was made at the certain point to study the typical pattern of the weekday fluctuation. See table below.

Table 1-5 Point of 1 Week Traffic Count Survey

No. of Survey Point	Station Name	Date	Road Name
C	Simpang Lamunin	23-29/Aug.	JLN. Tutong

(4) Twenty-four hour Traffic Count

The twenty-four hour traffic counts were operated to get the right number of fluctuations at two points. One point on the main road in urban area and the rest was on the main road between urban area and the other. See table below.

Table 1-6 Points of 24-hrs. Traffic Count Survey

No. of Survey Point	Station Name	Date	Road Name
a	In front of Istana Edinburgh	24, 25/Aug	JLN. Berakas
c	Simpang Lamunin	24, 25/Aug.	JLN. Tutong

(5) Twelve hour Traffic Volume Count

The twelve hour traffic volume count was operated at eleven points. The counting at six points were to get hold of the main traffic volume of the roadside O.D. and the counting at five points were to get the exact amount in the zones where we were not able to hold the details during the O.D. survey.

See Table below:

Table 1-7 Points of 12-hrs. Traffic Count Survey

No. of Survey Points	Station Name	Date	Road Name
1	Kampong Sengkurong	16/Aug.	JLN. Tutong
2	Kampong Lambak	16/Aug.	JLN. Berakas
3	Kampong Manggis II	15/Aug.	JLN. Muara
4	Kampong Sungai Besar	15/Aug.	JLN. Kota Batu
9	Kampong Sungai Liang	21/Aug.	JLN. Tutong
10	New Intersection on the Coastal Highway	21/Aug.	Costal Highway
b	Simpang Jerudong	23/Aug.	JLN. Jerudong
d	Simpang Lamunin	23/Aug.	JLN. Lamunin
e	Kampong Serembangun	23/Aug.	JLN. Tutong
f	Simpang Labi Seria	21/Aug.	JLN. Labi
g	Simpang Belait Kuala Belait	23/Aug.	JLN. Tutong

(6) Traffic Volume Count at Intersection

The traffic volume count at intersection was operated at twelve points in the central business district (C.B.D.). The counting at intersection is to hold of the analyses for the traffic flowing between zone to zone in central B.S.B.

Table 1-8 Points of Traffic Count at Intersections

No. of Survey Point	Station Name	Date	Road Name
A	Simpang Sekolah JLN. Kumbang Pasang	20/Aug.	JLN. Sekolah JLN. Kumbang Pasang
B	Simpang Sekolah JLN. Kebangsaan	28/Aug.	JLN. Kebangsaan JLN. Sekolah
C	Simpang Kumbang Pasang JLN. Tutong	29/Aug.	JLN. Tutong JLN. Kumbang Pasang
D	Simpang Stoney JLN. Tasek Lama	27/Aug.	JLN. Tasek Lama JLN. Stoney
E	Simpang Gadong JLN Kumbang Pasang	28/Aug.	JLN. Kumbang Pasang JLN. Gadong
F	Simpang S. Kianggeh JLN. McArthur	29/Aug.	JLN. Residency JLN. Sungai Kianggeh JLN. McArthur
G	Simpang Haji Basir JLN. Tutong	27/Aug.	JLN. Tutong JLN. Haji Basir
H	Simpang Kg. Kiarong Gadong JLN. Tutong	18/Aug.	JLN. Tutong JLN. Kg. Kiarong Gadong
I	Simpang Lintang JLN. Kumbang Pasang	30/Aug.	JLN. Haji Basir JLN. Lintang JLN. Simpang

(7) Actual Survey in Parking Areas

The survey of the parking areas in the central parts of B.S.B. were operated for twelve hour survey from 7:00 a.m. to 7:00 p.m. and interviewed to drivers in the central area of B.S.B. by twenty member of survey, dated 30, August.

(8) Bus Floating Survey

The bus floating survey was operated to consider the present bus schedule speed and its required time. Four routes were made for the survey.

Table 1-9 Routes of Bus Floating Survey

Direction	Date
B.S.B. - Berakas	27/Aug.
B.S.B. - Muara, Serasa	27, 28/Aug.
B.S.B. - Seria	28/Aug.
B.S.B. - Jerudong	28/Aug.

Fig. 1-5 Location of the Transportation Survey Point (1)

- △ : 12 hr. Traffic Volume Count
- △ : 24 hr. Traffic Volume Count
- △ : One Week Traffic Volume Count
- : Bus Passenger Survey
- : Roadside O.D. Survey

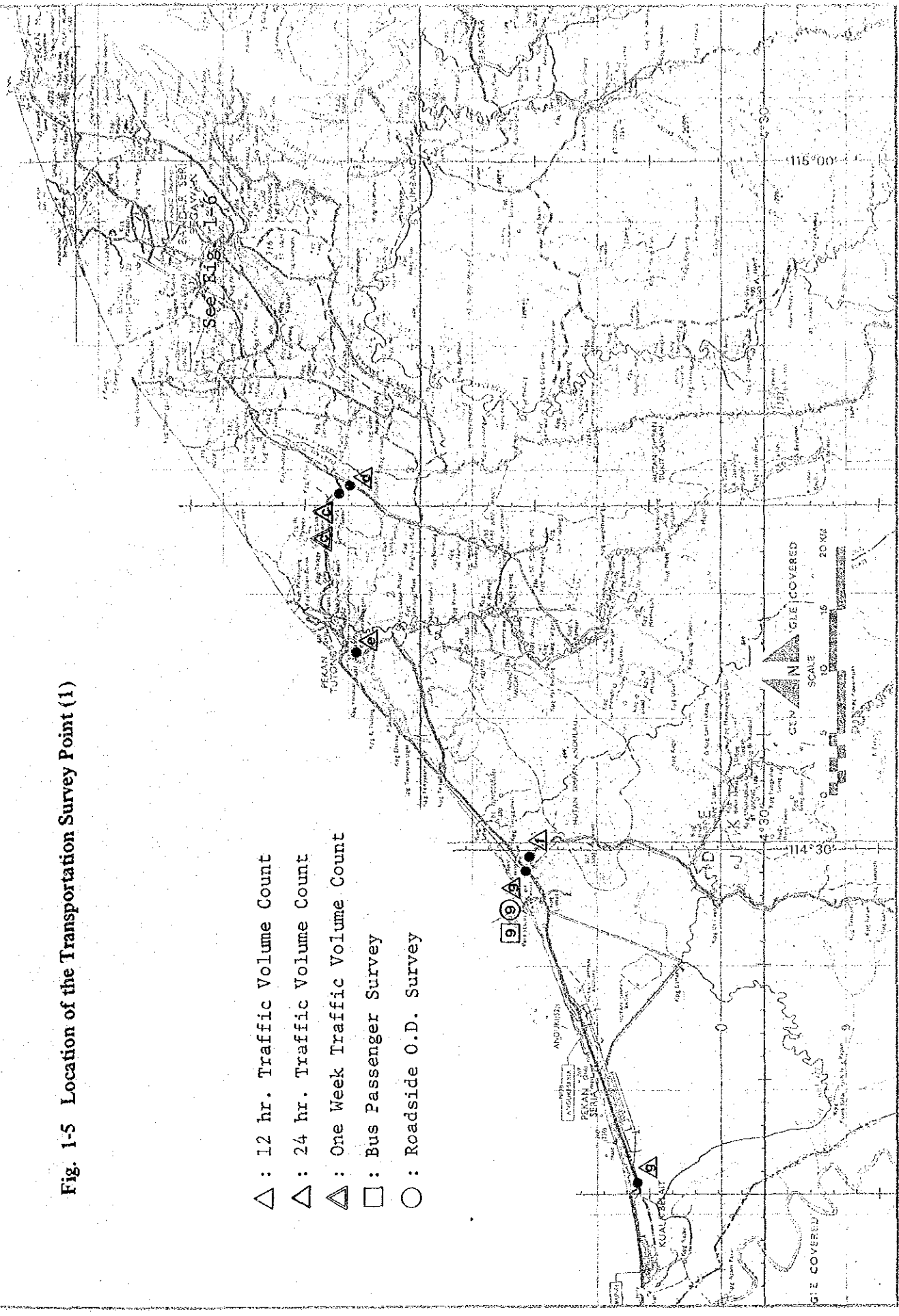
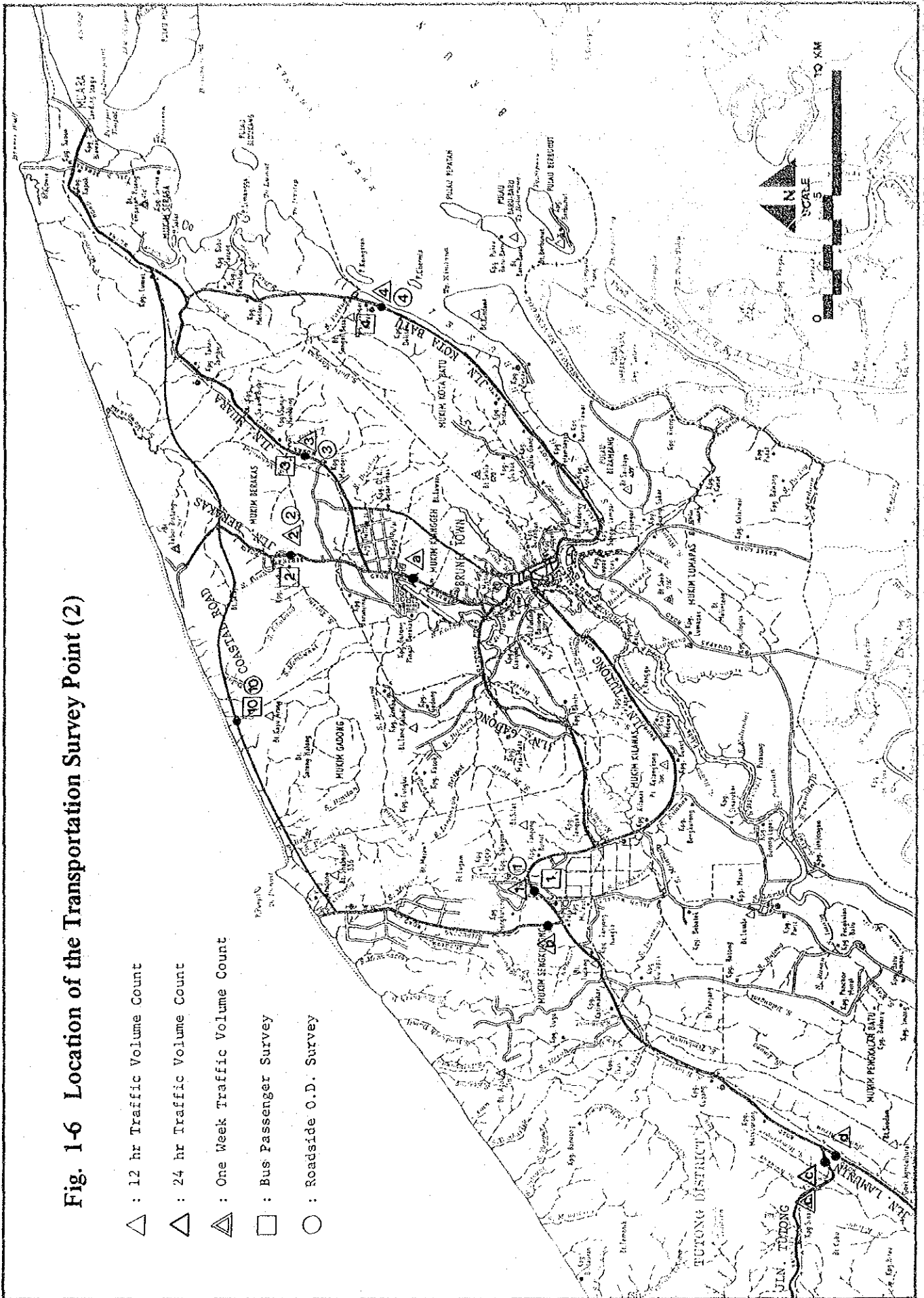


Fig. 1-6 Location of the Transportation Survey Point (2)

- △ : 12 hr Traffic Volume Count
- △ : 24 hr Traffic Volume Count
- △ : One Week Traffic Volume Count
- : Bus Passenger Survey
- : Roadside O.D. Survey



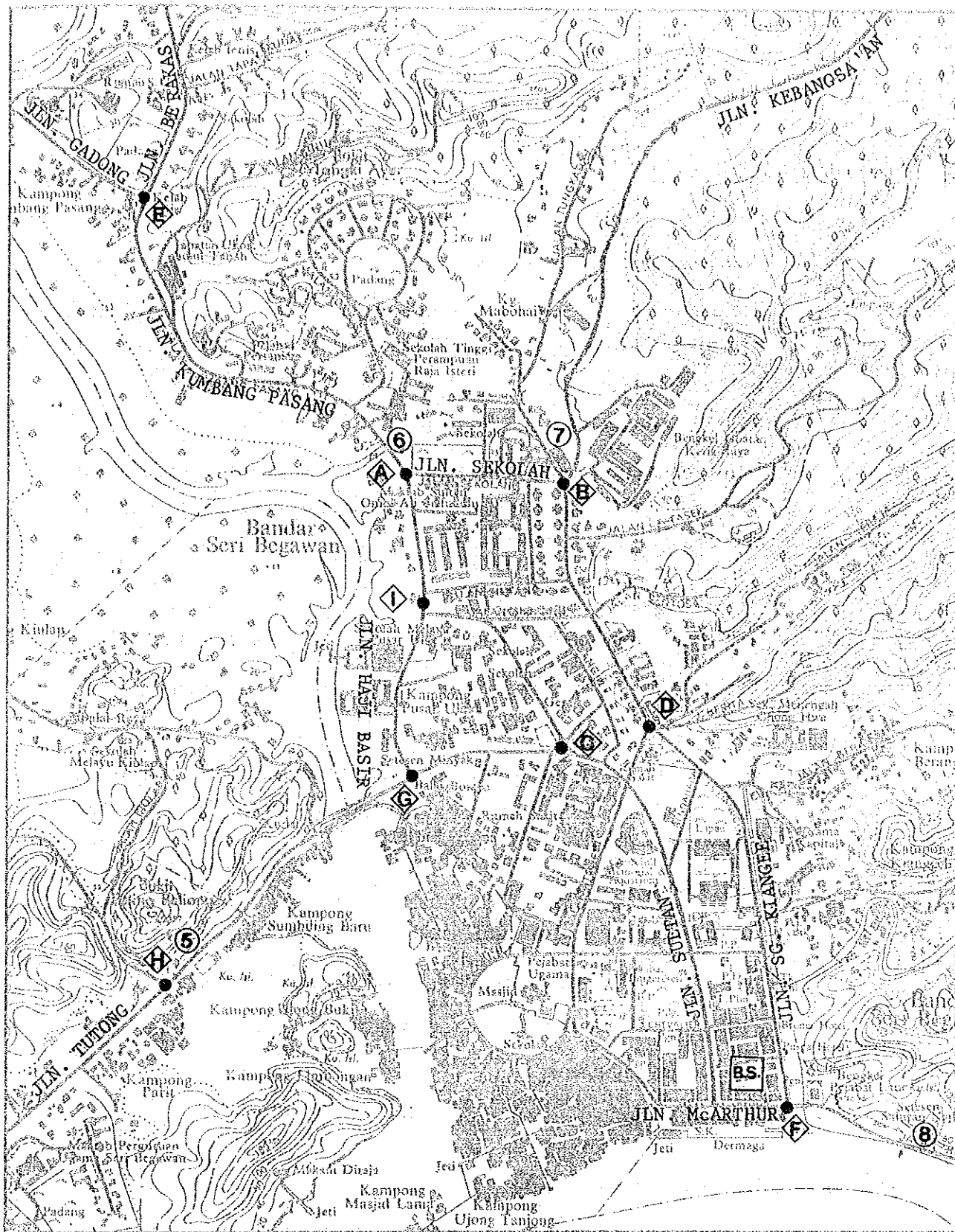
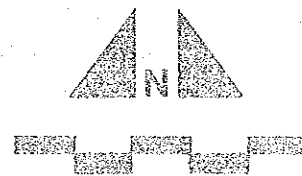


Fig. 1-7 Location of the Transportation Survey Point (3)

- : Roadside O.D. Survey
- ◇ : Traffic Volume Count at Intersection
- : Bus Passenger Survey



1-4 Scope of the Study

1-4-1 Study Items

The Study covers the following items:-

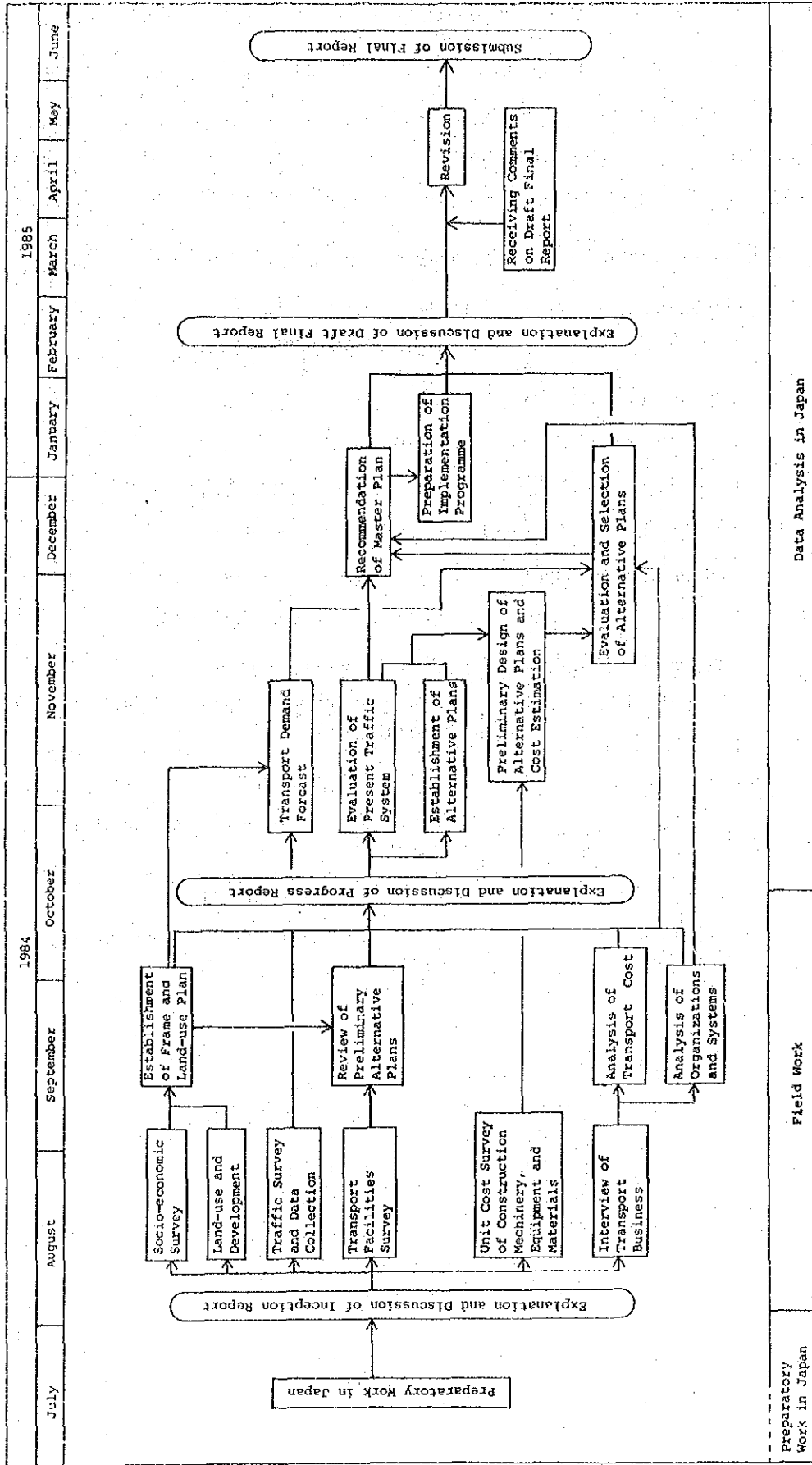
- (1) Field survey and analysis
 - . Field survey of existing land-use planning, existing city planning, existing road facilities, existing public transport network, present state of traffic conditions, etc.
 - . Traffic survey and its analysis
 - . Data collection and interview with relevant Government Departments and concerning agencies for necessary items of the Study.
 - . Socio-economic activities forecast.
 - . Traffic demand forecast.
 - . Evaluation of existing road facilities.
 - . Evaluation of existing public transport system.
- (2) Formulation of Public Transport improvement plan based on Field Survey and Analysis mentioned above covering the following items.
 - . Bus and taxi operation.
 - . Administration and organization of Public Transport.
 - . Road facilities, terminals and traffic control devices.
 - . Preliminary design and cost estimate.
 - . Traffic management.
 - . Transport policies and regulations.

1-4-2 Methodology of the Study

This survey can be divided into three stages of (i) preparatory work in Japan, (ii) field survey, (iii) data analysis in Japan.

State-wise study works are summarized as follows:

Implementation Schedule of Study Work



1-5 Organizations, Work Schedule

1-5-1 Organization of the Advisory Committee

This survey has been carried out by the study team with the consultation of Advisory Committee both of which have been organized by the Japan International Cooperation Agency (JICA).

The advisory committee comprizes following five members:

- | | |
|---|---|
| Chairman | : Mr. Tadashi EGAWA
Ministry of Transport |
| Committee Member
(Public Transport) | : Mr. Toshio SAITO
Ministry of Transport |
| Committee Member
(Transport Economy) | : Mr. Masahito MORIYAMA
Ministry of Transport |
| Committee Member
(Traffic Planning) | : Mr. Tsuguharu TORII
Ministry of Construction |
| Committee Member
(Traffic Study) | : Mr. Yoshiki SHIRAI
Japan Regional Development
Corporation |
| Coordinator | : Mr. Tadashi SATO
Japan International Cooperation
Agency |
| Coordinator | : Mr. Yoshiya OHOSHIMA
Japan International Cooperation
Agency |

1-5-2 Organization of the Study Team

The organization of the study team is shown below:

Organization of the Study Team

Team Leader	Hirokazu ITO
Japan Engineering Consultants Co., Ltd	
Public Transport Planning and City Planning	Tsuyoshi TAKAHASHI
Japan Engineering Consultants Co., Ltd.	
Public Transport Planning and City Planning	Hisashi MUTO
Japan Engineering Consultants Co., Ltd.	
Transportation Facility Planning	Mitsuo TAKAMATSU
Japan Engineering Consultants Co., Ltd.	
Traffic Management	Toshiaki SHIMAUCHI
Japan Engineering Consultants Co., Ltd.	
Traffic Study	Yasushi OWAKI
Japan Engineering Consultants Co., Ltd.	
Transportation Economy System Science Consultants Inc.	Nobuo TSUCHIHASHI
Coordinator	Yoshimitsu KIKUCHI
Japan Engineering Consultants Co., Ltd.	

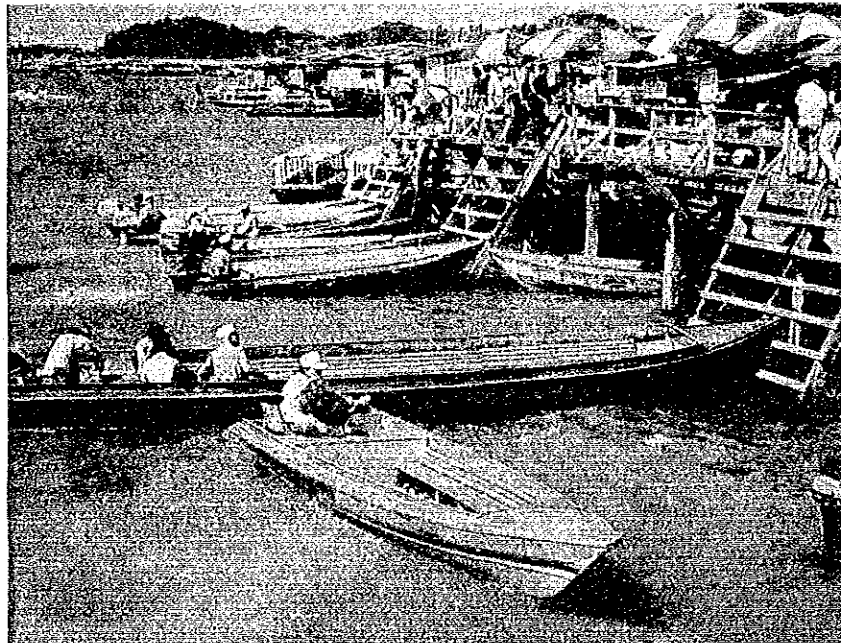
1-5-3 Organization of the Counterpart Committee

1. Mr. Awang Mohd Kassim bin Haji Johan
Acting Controller of Land Transport
Ministry of Communication
2. Mr. Pg Rakawi bin Pg Haji Sabli
Acting Deputy Controller of Land Transport Department
Ministry of Communication
3. Mr. C.E.C. Stratford
Deputy Commissioner of Town and Country Planning,
Ministry of Development
4. Mr. Hong Kok Seng
Town and Country Planning Officer, Ministry of Development
5. Mr. Lim Lam Keong
Assistant Director of Public Works, Ministry of Development
6. Mr. Rashid Haji Abd. Rahman
Public Works Department Officer, Ministry of Development
7. Mr. Said B. Rokpos Haji Hashim
Public Works Department Officer, Ministry of Development
8. Mr. Awang Abu Bakar bin Dato Haji Osman
Deputy Superintendant of Police, Royal Brunei Police
9. Mr. Pehin Abd. Latif bin Haji Ghapar
Acting Deputy Superintendant of Police, Royal Brunei Police
10. Mr. Diris Haji Belaman
Economic Planning Unit Officer
Ministry of Finance
11. Mr. Chua Pheng Siong
Assistant Director of Economic Planning Unit
Ministry of Finance
12. Mr. Saifon bin Awang Besar
Ministry of Communication

Work Schedule

	1984												1985		
	7	8	9	10	11	12	1	2	3	4	5	6			
Preparatory Work in Japan Explanation and Discussion of Inception Report Socio-economic Survey Land-use and Development Plan Transport Facilities Survey Traffic Survey and Data Collection Transport Business Survey Unit Cost Survey of Construction Machinery, Equipment, Materials and Labour Review of Preliminary Alternative Plans Frame and Land-use Plan															
Transport Demand Forecast (1) Evaluation of Existing Traffic System Establishment of Alternative Plans Transport Demand Forecast (2) Preliminary Design and Cost Estimation Economic Evaluation Formulation of Master Plan Preparation of Implementation Programme															
Reports															
	Inception Report	Progress Report	Progress Report	Draft Final Report	Draft Final Report	Final Report									

CHAPTER 2 GENERAL CONDITIONS



CHAPTER 2 GENERAL CONDITIONS

2-1 Natural Condition

Brunei covers a total area of 5,765 sq. km. and is situated on the north-west end of the island of Borneo, between east longitudes 114° 23' and 115° 23' and between north latitude 4° and 5° 5'. It has a common border with Sarawak of Malaysia, which also divides Brunei into two parts. The eastern part of the country, comprising the Temburong District, is mostly rugged mountainous terrain rising to 1,849 m (55,470 ft) at Bukit Pagon.

The western part of Brunei, comprising the Brunei-Muara, Tutong and Belait districts, is predominantly hilly to low lands below 91 m (2,730 ft) but rising to 305 m (9,150 ft) along the Sarawakian border.

2-1-1 Geography

The land surface of the study area is developed on a bedrock of tertiary age, comprising sandstones, shales and clay. The comparatively youthful state of the cycle of geological erosion, the nature and angle of the dip of the strata and the climatic factors of high rainfall and high temperatures which maintain a dense cover of forests on all landform is moulding of this surface into undulating ridge and valley terrain.

Along the motor-way, running westward of Muara, coastal plain Sediment Lians Formation and by Jalan Tutong, parallel laminated sandstone, which are forming consolidated sandstone strata.

The coastal plain consists of a flat lying lowland area crossing by fluvial, or in deltaic areas. Flat, mainly swampy, alluvium occupies most of the coastal area, and extends as broad belt up the valleys of the Belait and Tutong rivers.

2-1-2 Meteorology

Brunei has a tropical rain climate. This is characterized by constant humidity and heavy rainfall. Temperatures are high

throughout the year with an extreme annual range of temperature of 73°F to 89°F. Relative humidity is high with an average fluctuation between 67% to 91% throughout the year. The rainfall records from Mentiri, Tasek Dam, B.S.B., Luahan, Jerudong and Kilanas rainfall stations, which are situated along arterial roads covering Brunei-Muara District, Tutong District and Belait District (excluding Temburong District) have been collected as follows:

Rainfall Station	Mean Rainfall (mm)	Rainfall Days
1. Mentiri	2980	170
2. Tasek Dam	2970	230
3. B.S.B.	3170	170
4. Luahan-Jerudong	2500	150
5. Kilanas	2570	180
6. Mulaut	2620	150
7. Birau Tutong	2500	140
8. Sinaut Tutong	2460	140
9. Pekan Tutong	2450	170
10. Kampong Benutan	3180	260
11. Seria	2920	180

2-2 National Economy

The general indicator of the national economy is Gross Domestic Product (GDP) by which the comparable size and growth trend of economic activities in the country may be traced. In Brunei, estimation procedures of GDP by the Economic Planning Unit (EPU) was changed in 1977. GDP in nominal terms has been aggregated at market prices until 1977 and at current prices after 1977. Two kinds of nominal GDP are available parallelly for 4 years of 1974, 1975, 1976 and 1977. GDP in real terms has been estimated since 1977 onward, and is available at this moment only for the period from 1974 to 1982.

Table 2-1 shows nominal GDP, Consumer Price Index and the value of GDP deflated by the Consumer Price Index. Against the accelerating inflation, a rapid increase in nominal GDP is found. The rise of oil prices especially in 1974 (corresponding to the effect of the

first oil crisis in the world economy) might be considered as a major reason of this phenomenon. On the contrary, the international pressure to decrease oil prices has resulted in the decline of nominal GDP since 1980.

Table 2-1 GDP at Market/Current Prices, 1963 - 1982

Unit: B\$10⁶

Year	GDP at Market Prices	GDP at Current Prices	Consumer Price Index (1974=100)	Deflated GDP
1963	283.3	-	74.4	380.8
1964	300.6	-	76.6	392.4
1965	348.0	-	75.6	460.3
1966	405.2	-	76.2	531.8
1967	424.3	-	82.9	511.8
1968	490.9	-	84.6	580.3
1969	491.7	-	84.0	585.4
1970	546.3	-	84.7	645.0
1971	600.9	-	83.1	723.1
1972	762.6	-	82.0	930.0
1973	976.0	-	89.9	1,085.7
1974	2,549.4	2,616.2	100.0	2,616.2
1975	2,696.3	2,770.4	118.5	2,337.9
1976	3,441.0	3,516.1	126.8	2,772.9
1977	3,849.4	4,226.8	143.7	2,941.4
1978	-	4,415.2	151.5	2,914.3
1979	-	6,097.1	161.2	3,782.3
1980	-	10,553.6	169.9	6,211.7
1981	-	9,137.4	185.3	4,931.1
1982	-	8,589.5	197.2	4,355.7

Remarks: (1): Deflated GDP was obtained by the calculation using GDP at market/current prices and Consumer Price Index.

(2): By deflating GDP at current prices after 1974.

Source: "Brunei Statistical Yearbook, 1974/75 - 1981/1982", EPU.

Real term GDP at constant price of 1974 is tabulated in Table 2-2. The exact trend of the economic growth might be taken hold of, during 1974 to 1982. From B\$2,626 x 10⁶ in 1974 to B\$3,501 x 10⁶ in 1982, GDP in real terms grew. The deterioration in international oil market has affected the value in 1980 and 1981 and increase rates violently changed over the previous years. The average growth rate of real term GDP was 3.7% per annum in these 9 years.

Table 2-2 GDP at Constant Prices, 1974 - 1982

Unit: B\$10 ⁶		
Year	GDP at Constant Prices of 1974	Increase Rate over the Previous Year (%)
1974	2,616.2	-
1975	2,625.6	0.4
1976	3,154.8	20.2
1977	3,499.1	10.9
1978	3,736.3	6.8
1979	4,579.3	22.6
1980	4,258.9	-7.0
1981	3,292.6	-22.7
1982	3,500.9	6.3

Source: "Brunei Statistical Yearbook, 1979/1980 and 1981/1982", EPU.

The role of individual industrial sectors in the national economy is reflected in GDP. Composition of current GDP is shown in Table 2-3 for the recent 9 years. The highest contribution to GDP was attained by Mining/Quarrying and Manufacturing, which has been around or over 80% year by year. Wholesale Trade had the next highest percentage contribution of 8.3% in the year 1982. Table 2-4 gives the real term production figure in each industrial sector at 1974 constant prices for the same 9 years. Recently, considerable high increase was recorded in Wholesale Trade and high rates in almost all other service industries while primary sector (Agriculture/Forestry/Fishery) and Mining/Quarrying and Manufacturing showed stagnant features.

Table 2-3 GDP at Current Prices by Economic Activity, 1974 - 1982

Unit: B\$10⁶

Economic Activity	1974	1975	1976	1977	1978	1979	1980	1981	1982
1. Agriculture and Hunting	27.3	27.4	27.5	28.6	34.7	39.9	51.4	49.1	54.3
2. Forestry and Logging	3.1	4.3	5.8	6.8	6.6	7.7	8.3	13.1	15.9
3. Fishing	4.8	5.7	5.3	7.5	6.2	7.5	7.6	9.3	9.8
4. Mining/Quarrying and Manufacturing	2,327.3	2,417.9	3,100.6	3,488.9	3,458.2	5,024.1	8,729.9	7,471.8	6,820.2
5. Electricity, Gas and Water	5.9	6.4	8.2	5.7	1.8	-2.0	-9.1	-2.4	-11.1
6. Construction	35.1	55.8	72.4	88.1	98.7	112.1	168.1	138.2	158.0
7. Wholesale Trade	10.7	12.0	10.3	176.0	327.4	378.3	828.8	724.2	709.1
8. Retail Trade	41.0	47.7	52.5	81.6	87.3	91.5	106.9	112.7	120.3
9. Restaurants and Hotels	6.5	10.3	11.5	13.4	16.2	17.8	19.4	21.9	23.6
10. Transport, Storage and Communication	14.1	22.5	29.6	39.0	50.3	55.2	58.0	68.0	73.1
11. Banking and Finance	12.8	23.4	26.1	41.4	45.2	71.8	72.5	88.5	109.1
12. Insurance	0.9	0.7	0.7	2.3	2.5	2.5	4.1	3.1	3.7
13. Real Estate and Business Services	12.3	18.8	26.1	41.4	52.9	43.8	61.2	53.9	59.7
14. Ownership of Dwellings	12.0	13.5	15.6	18.6	20.1	23.4	21.4	36.3	40.2
15. Community, Social and Personal Services	115.7	127.9	152.9	220.5	247.5	273.0	421.4	410.7	471.3
16. (Less) Bank Charges	-13.3	-23.9	-29.0	-33.0	-40.4	-49.5	-59.3	-61.0	-67.7
Total	2,616.2	2,770.4	3,516.1	4,226.8	4,415.2	6,097.1	10,553.6	9,137.4	8,589.5

Source: "Brunei Statistical Yearbook, 1979/1980 and 1981/1982", EPU.

Table 2-4 GDP at 1974 Constant Prices by Economic Activity, 1974 - 1982

Unit: B\$10⁶

Economic Activity	1974	1975	1976	1977	1978	1979	1980	1981	1982
1. Agriculture and Hunting	27.3	25.9	24.1	23.2	25.9	28.3	32.8	31.8	33.5
2. Forestry and Logging	3.1	4.3	5.3	5.7	4.8	5.5	5.0	7.9	9.1
3. Fishing	4.8	5.1	3.7	5.0	5.1	5.4	4.2	4.9	4.9
4. Mining/Quarrying and Manufacturing	2,327.3	2,292.0	2,790.6	2,918.2	3,020.2	3,850.7	3,361.5	2,517.7	2,684.2
5. Electricity, Gas and Water	5.9	6.2	7.5	4.6	1.4	-1.4	-6.3	-1.6	-7.1
6. Construction	35.1	51.2	58.9	67.8	58.4	66.0	98.3	74.1	81.0
7. Wholesale Trade	10.7	11.5	9.9	132.6	245.2	258.5	263.4	187.0	183.9
8. Retail Trade	41.0	45.8	50.5	71.6	75.2	70.9	81.6	79.7	81.1
9. Restaurant and Hotels	6.5	9.8	10.5	10.8	12.2	12.1	13.6	13.6	14.0
10. Transport, Storage and Communication	41.1	21.3	25.6	30.6	38.9	37.9	37.2	42.6	43.7
11. Banking and Finance	12.8	21.5	22.0	32.1	34.3	54.0	69.0	60.7	71.8
12. Insurance	0.9	0.7	0.6	1.8	1.9	1.9	3.9	2.1	2.4
13. Real Estate and Business Services	12.3	17.3	21.9	32.1	40.0	32.9	58.2	37.0	39.1
14. Ownership of Dwelling	12.0	13.0	14.2	15.2	16.1	17.0	14.8	19.1	20.3
15. Community, Social and Personal Services	115.7	122.5	136.7	178.9	194.6	196.2	277.5	268.3	294.5
16. (Less) Bank Charges	-13.3	-22.5	-27.2	-31.1	-37.9	-46.6	-55.8	-52.3	-55.5
Total	2,616.2	2,625.6	3,154.8	3,499.1	3,736.3	4,579.3	4,258.9	3,292.6	3,500.9

Source: "Brunei Statistical Yearbook, 1979/1980 and 1981/1982", EPU.

In Brunei, oil and gas based industry is categorized as Mining/Quarrying and Manufacturing in GDP estimation. The dependence of the national economy on this sector is a prominent characteristic. Historically stated, before 1962 almost three-quarters of GDP was produced by this sector; once depressed and again its magnitude has recovered since 1974. Tables 2-5 and 2-6 give some relevant figures of this sector. In 1982, 99.0% of exports which was B\$8,153 x 10⁶ was derived from this sector. Owing to the existence of this sector, the trade balance of Brunei has been structually with surplus.

Table 2-5 Contribution of Oil/Gas Based Industry to GDP, 1961 – 1982

(Unit:%)

Year	1961	1962	1963	1964	1965	1966	1967	1968	1969
Contribution to GDP by Mining/Manufacturing	75.7	72.2	65.8	63.3	58.4	56.1	59.6	58.6	55.8
Year	1970	1971	1972	1973	1974	1975	1976	1977	1978
-do-	54.4	54.4	64.4	81.5	88.9	87.3	88.2	82.5	78.3
Year	1979	1980	1981	1982					
-do-	82.4	83.2	81.8	79.4					

Remarks: (1): Percentage distribution of production in Mining/Quarrying and Manufacturing sector in GDP at market/current prices.

(2): Due to the discrepancy found in original data in 1973, addition of B\$750 x 10⁶ was carried out to this sector:

Source: "Brunei Statistical Yearbook, 1974/75 - 1981/1982", EPU.

Table 2-6 Production in and Export from Oil/Gas Based Industry, 1971 – 1982

Year	Production (10 ³ tons)		Export Amount (10 ⁶ B\$)			Total
	Crude Petroleum	Natural Gasoline	Crude Oil	Petroleum Product	Natural Gas	
1971	6,341	1	304.8	2.5	0.5	307.8
1972	8,965	27	462.0	3.1	2.0	467.1
1973	11,230	179	762.4	18.6	46.5	827.5
1974	9,433	358	1,970.2	86.6	291.1	2,347.9
1975	8,777	421	1,940.0	97.9	425.0	2,462.9
1976	10,004	659	2,428.4	146.4	685.2	3,260.0
1977	10,540	603	2,704.9	126.8	1,121.3	3,953.0
1978	11,146	250	2,618.6	165.2	1,320.8	3,856.7
1979	12,257	737	3,936.4	285.6	1,480.4	5,702.4
1980	11,172	838	6,090.2	577.1	3,045.4	9,712.7
1981	7,716	735	4,777.8	322.9	3,397.2	8,497.9
1982	7,906	710	4,572.5	226.3	3,275.0	8,073.8

Source: "Brunei Statistical Yearbook, 1981/1982", EPU.

Thus, the national economy of Brunei has been heavily dependent on the production and processing of crude oil and natural gas. It is easily affected by the international market situation of demand and supply, and shows a drastic fluctuation having keen effects to GDP.

2-3 Transportation

2-3-1 Road and traffic condition

The vehicle ownership in Brunei is very high (338 vehicles per 1,000 persons, 1982) and the rate of the average annual increase is 13%.

The radial road net-works are operated especially around B.S.B., dealing with the large motoring population.

Only two lane roads are operated except the town-centre of B.S.B. and its entry area.

According to the plan of the Public Works Department, the length of the paved road extension in total was 740.8 km (463 miles) in the year 1979, but at the present, the four lane road as a part of radial roads near the town centre and the coastal road between Muara and Jerudong (two lanes with provision, four lanes in future) has also completed. Fourteen roads are now under construction (total extension length, 144 km - 90 miles) and will be completed before 1990.

Inner area of B.S.B. there are quite lots of traffic problems with poor road capacities: traffic concentration from radial roads and double parking problems in the streets; There is no proper stream regulation of automobiles besides too much traffic jam in the peak hours.

Small scale of business is operating buses as a major public transport (175 buses at the present). There is no proper time table for buses and their bus network and services are poorly provided, nor comforters.

Table 2-7 Length of Roads

Unit: %

Year	Total	By Administrative Classification (1)			By Type of Road Surface (2)		
		State Roads	District Roads	Private Roads	Permanent	Improved	Unimproved
1969	719.95	265.34	366.51	88.10	261.36	59.94	398.65
1970	726.16	280.63	356.93	88.60	273.41	72.69	380.
1971	739.95	285.85	361.90	92.20	293.86	69.93	736.16
1972	781.19	316.86	370.93	93.40	339.94	81.08	360.17
1973	687.54	322.56	271.58	93.40	399.57	29.80	258.17
1974	682.54	322.56	266.58	93.40	397.57	26.80	258.17
1975	741.33	358.98	287.85	94.50	408.88	78.84	253.61
1976	762.76	396.07	271.89	94.80	437.79	67.63	257.34
1977	828.38	456.61	276.47	95.30	437.97	118.85	271.56
1978	915.87	470.07	349.93	95.87	450.75	168.25	296.87
1979	884.24	484.98	302.27	96.99	462.78	150.49	270.97
1980

- Remarks: (1) State Roads are maintained under a central fund controlled by the Public Works Department. District Roads are under the jurisdiction of District Officers and are mostly all of unimproved surfaces. Private Roads are constructed and maintained by private firm (B.S.P. Co. Ltd.)
- (2) Permanent Surface consists of roads with bituminous or concrete surface. Improved Surface includes roads having all weather surface of gravel, oiled gravel, crushed stones, etc. Unimproved Surface includes roads having surfaces of natural soil suitable for use only in dry weather.

Source: Public Works Department.

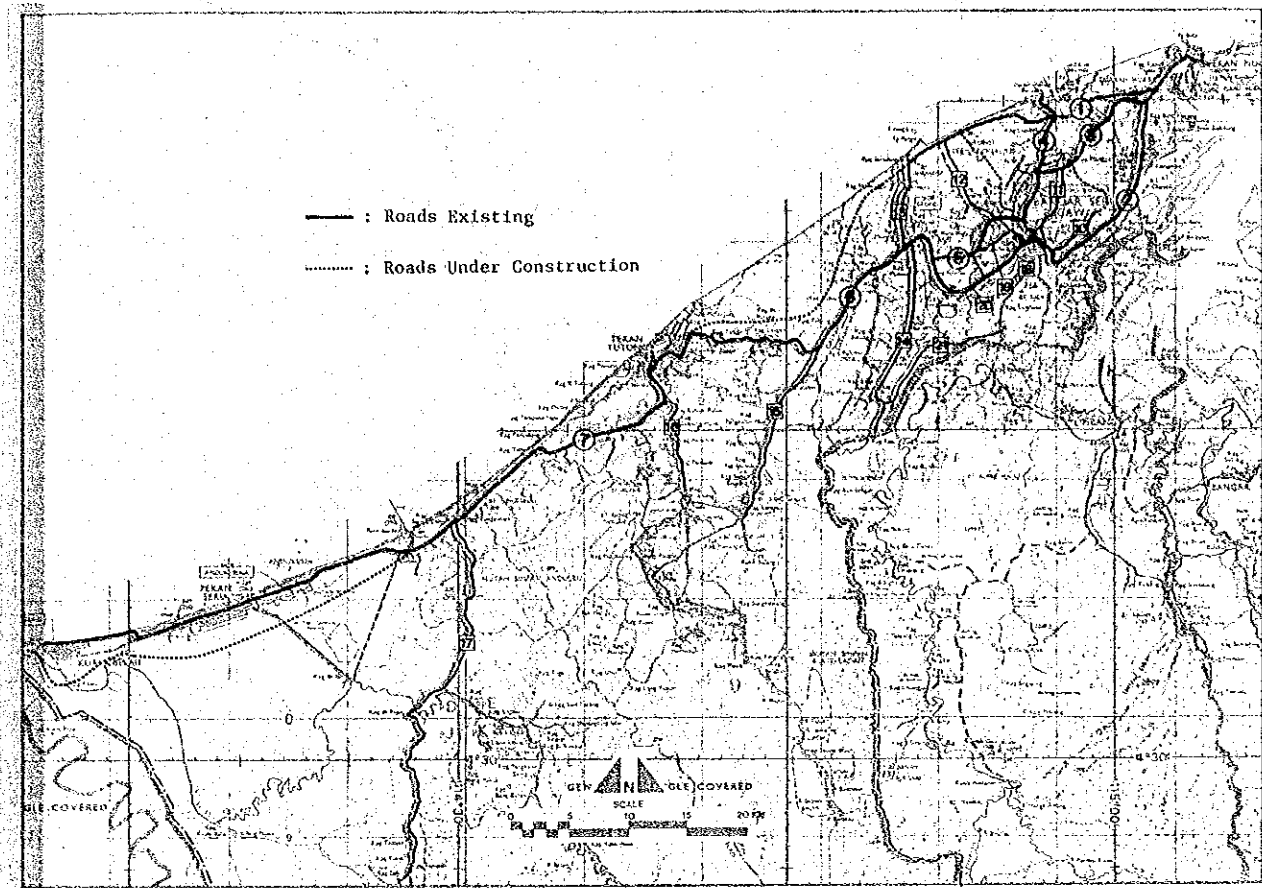


Fig. 2-1 Location Map of Roads in Brunei

Table 2-8 List of Roads in Brunei

No.	Name of Road	Section
1	Coastal Road	Muara - Jerudong
2	Jln. Kota Batu	B.S.B. - Muara
3	Jln. Muara	Airport round-about - Muara
4	Jln. Berakas	Spg. Gadong - Berakas
5	Jln. Gadong	Jln. K. Passang - Jln. Tutong
6	Jln. Tutong	B.S.B. - Tutong
7	Jln. Seria	Tutong - Kuala Belait
10	Jln. Subok	Jln. Kota Batu - Kpg. Belimbing
11	Jln. Kebangsa'an	Spg. Sekolah - Jln. Muara
12	Jln. Kpg. Tungku	Jln. Gadong - Coastal Road
13	Jln. Jerudong	Jln. Tutong - Kpg. Jerudong
14	Jln. Mulaut	Jln. Tutong - Kpg. Limau Manis
15	Jln. Lamunin	Jln. Tutong - Kpg. Lamunin
16	Jln. Kpg. Lubok Pulau	Kpg. Lubok Pulau - Kpg. Merimbun
17	Jln. Labi	Kpg. S. Liang - Kpg. Labi
18	Jln. Kpg. Kiarong Gadong	Jln. Gadong - Jln. Tutong
19	Jln. Kiarong	Jln. Gadong - Jln. K. K. Gadong
20	Jln. Kpg. Teranai	Kpg. Beribi - Kpg. Teranai
21	Jln. Junjongan	Kpg. Limau Manis - Kpg. Lumapas

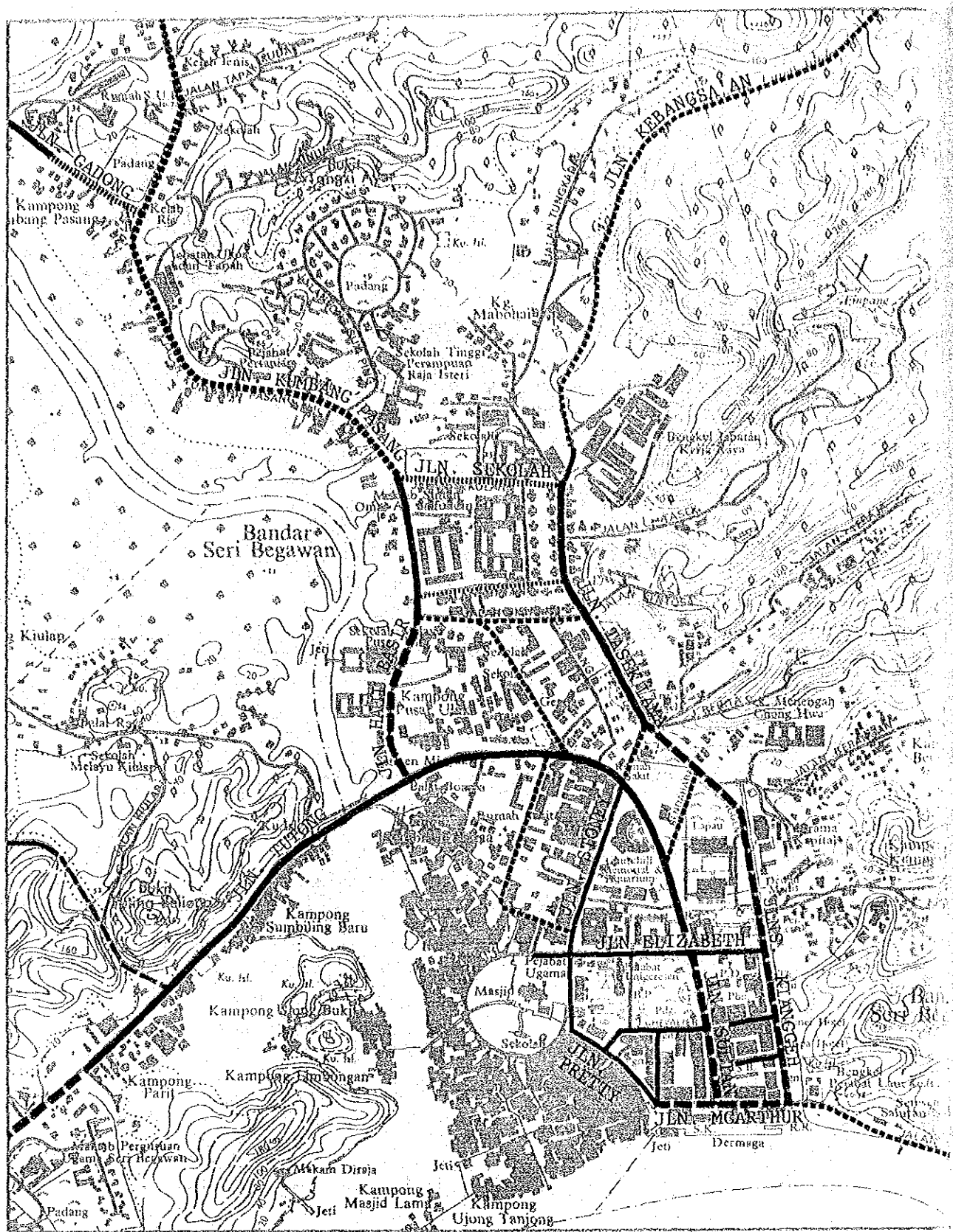


Fig. 2-2 Present Condition of Major Roads in B.S.B. Central Area

4 Lane with Central Strip and Footway	2 Lane with Lay by and Footway
4 Lane with Footway	2 Lane with Central Strip and Shoulder
4 Lane only	Lane with Footway or Shoulder
3 Lane with Footway	2 Lane only

2-3-2 Airport

(1) Brunei International Airport

Brunei International Airport is located approximately 8 km north west of Bandar Seri Begawan, the capital of Negara Brunei Darussalam and replaced an earlier airport some 3 km to the south west which is now closed. The present terminal building was officially opened by His Majesty the Sultan of Brunei on 18 July 1974.

Two aircraft maintenance areas, one with a jumbo size hangar has been constructed. Another maintenance hangar (91 m x 79 m x 23 m) is being constructed and is expected to be ready by the end of 1985.

Terminal apron has been extended to 470 m x 190 m to cater for 2 B747 and 4 B737/Airbus parking stands at a time. A freight apron (180 m x 120 m) adjacent to the terminal apron has been built; this has further enhanced the apron parking capacity. Construction of a full parallel taxiway (with an intermediate turn-off) along the full length of the runway and joining the existing taxiways from the apron to the runway is well advanced and due for completion in April 1985.

In cargo, facilities progressed from the concept of a 'small freight shed' to a major airport facility handling fifty times the original volumes. A new temporary cargo building with chiller/cold rooms facilities has been built and is in operational use.

**Table 2-9 Number of Passenger Movements
in the Brunei International Airport**

Year	No. of Passenger Movements
1969	74 x 1,000 passenger per year
1970	85
1971	76
1972	96
1973	130
1974	145
1975	156
1976	165
1977	184
1978	210
1979	237
1981	276
1982	330
1983	335

**Table 2-10 Weekly Flight Schedule
Effective as of June 1984**

Week	No. of Arrivals	No. of Departures
Mon.	7	7
Tue.	7	7
Wed.	8	8
Thur.	6	7
Fri.	8	8
Sat.	9	9
Sun.	7	6

Source: DCA Airport Management Section.

(2) Extension and re-arrangement programme

In February 1982, an international airport consultant was appointed to review and update master plan both in respect of airport layout and road system and in respect of terminal layout. The primary objective was to provide an airport suitable for forecast traffic 15 years ahead. In particular this involves a forecast annual passenger movement rate of 1.5 million and freight movement rate (including transit freight) of 50,000 tonnes a year.

The decision on the implementation programme was to split the Airport Terminal Extension programme into three contracts.

Contract No. 1 - Civil Works

The workscope for Contract No. 1 is as follows:-

- (a) A new road network, serving the passenger terminal and the various facilities, to be connected with the existing airport approach road and with the future Bandar Seri Begawan's 'major arterial road'.
- (b) Different new car parks and extensions, including an additional passenger car park of 1,250 spaces.

Work on this contract began in November 1983 and the whole phase is scheduled to be completed in August 1985.

Contract No. 2 - General Buildings

This contract deals with the construction of various ancillary buildings apart from the passenger terminal. The buildings consist of:-

- (a) A freight terminal extension to cope with a forecast of 35,000 tonnes of cargo expected in 10 years' time. This extension of 77,000 sq ft is about four times the floor area of the existing cargo building. Construction will involve rearrangement of the existing building, new offices and special rooms for specific freight.
- (b) A centralized maintenance complex for DCA workshop, garage and store.
- (c) A maintenance area for ground handling equipment for the national carrier, Royal Brunei Airlines.
- (d) The fire service facilities at the south end of the runway are to be enlarged to include proper training facilities.
- (e) A link electrical sub-station for the airport power consumption.

Contract No. 3 - Terminal Building Extension

The works include in this contract are aimed at increasing the capacity of the passenger terminal and at up-grading the quality of services and facilities for a forecasted traffic of 1.5 million passengers at the end of this century. For this purpose:-

(a) A satellite measuring 295' x 230' will be built on airside adjoining the existing terminal building. This satellite will accommodate:-

- ground floor technical premises for apron staff;
- first floor sterile lounge (1,000 passengers capacity) for departing and for transit and transfer passengers with all usual facilities, duty free shops, first class lounges, toilets, etc.
- second and third floor (which will be stretched only on the central part of the satellite) a cafeteria, toilets and waving galleries;
- six aerobridges to serve as an interface between aircraft and terminal.

(b) The northern section of the existing terminal formerly used for cargo and offices will be modified and extended to house airport restaurants, kitchens, staff canteen, medical clinic and prayer room.

(c) The existing passenger terminal will be re-arranged to provide:-

- ground floor, arrival facilities and counters (immigration, customs, baggage claim, etc.) and technical rooms;
- first floor, departure facilities and counters (information, check-in, airlines, etc.) and VIP lounges;
- second floor, airline offices and viewing gallery.

(d) A canopy extended to the kerbside car parking over the arrival concourse.

(e) A hydrant refuelling system for aircraft will also be installed in association with this programme.

2-3-3 Harbour

(1) Facilities at Muara

There is a marginal wharf 428 metres in length with a depth of 10 metres and will berth 4 to 5 coasters depending on their length. This is being lengthed by another 183 metres by end 1985. There is also an "inner berth" 87 metres in length with a depth of 5.2 metres used by smaller ships that can fit there. There are no wharf side cranes and most cargoes are landed by ships gear. Mobile 30 tonne cranes are sometimes brought in to help lift heavy cargoes. After landing palletised and conventional cargoes are handled by forklifts. Containers are moved around on chassis and lifted by forklift and cranes.

The average number of workers working in the port is 400 which includes stevedores, wharf gangs, warehouse attendants, Ports and Customs staff.

Within the Port area there is 6,700 sq. m. of transit warehouse space. This will be almost doubled by the end 1985.

(2) Types and tonnages of outbound/inbound vessels

The amount of exports through Muara is negligible so that all vessels calling would be considered inbound. The total GRT and NRT of vessels recorded for the first 8 months of 1984 according to types generally are:-

	<u>No. of Vessels</u>	<u>GRT</u>	<u>NRT</u>
1. General Cargo	302	759,000	442,000
2. Pure Container Feeders	8	45,700	27,300
3. Ro-ro Car Carriers	59	176,300	101,200
4. Cattle Ships	18	23,500	10,300
5. Bulk Bitumen	5	15,500	9,300
6. Passenger Liners	6	56,800	34,300

The general cargo ships are carrying containers among its other cargoes.

(3) Trends of annual cargo tonnage/handled

The tonnages recorded for the last 10 years are as follows:-

<u>Year</u>	<u>Tons</u>	<u>Year</u>	<u>Tons</u>
1973	253,400	1979	410,300
1974	328,000	1980	379,500
1975	440,100	1981	427,700
1976	315,400	1982	586,600
1977	319,700	1983	742,600
1978	379,000		

The annual increase from 1973 to 1980 would be 6.3% while 1980 to 1983 was 23.9% and over the whole period 11.3%. The great increase over the last 3 years 1980 to 1983 could be accounted for by the import of building materials for major projects.

CHAPTER 3

PRESENT LAND TRANSPORTATION SYSTEM

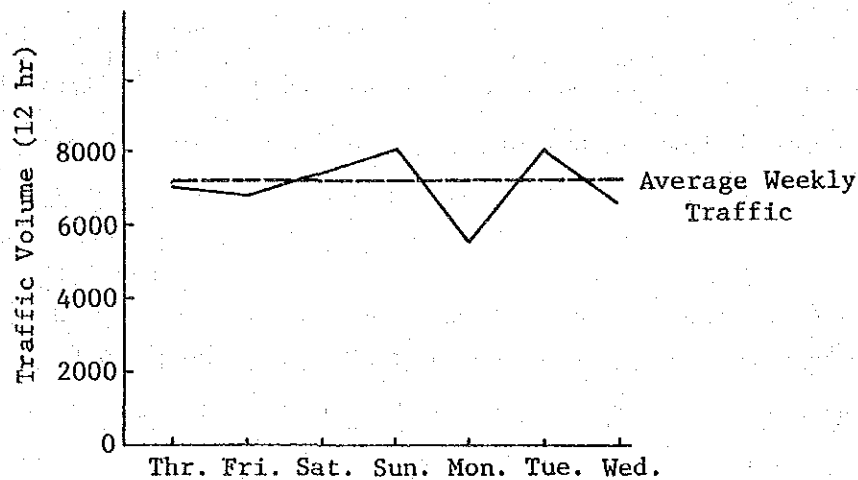


CHAPTER 3 PRESENT LAND TRANSPORTATION SYSTEM

3-1 Present Traffic Volume

3-1-1 Weekly Traffic Volume

Shown in Fig. 3-1 is the result of weekly traffic survey carried out in Simpang Lamunin on Jln. Tutong. The fluctuation in traffic volume by weekdays and holidays during the survey period was not strictly obtained because various events were held during the period, however the fluctuation pattern of weekdays is thought to be obtained considerably correctly. In Brunei, it is typical that the traffic volume becomes increasing on Saturdays which are between holidays and on Tuesdays which are the middle of five weekdays.



Sunday as you see in this figure, there could be more cars, than usual Sundays, as there were a yacht-race in Muara, a cart-race in Seria and the birthday celebration of Sultan

Fig. 3-1 Weekly Variation of Traffic (at c point)

3-1-2 24-hour Traffic Volume

The 24-hour traffic volume survey was carried out on two points, Point a where is in the surroundings of B.S.B. and Point c where is the midway of B.S.B. and Tutong cities. Fig. 3-2 and Table 3-1 show the results of the survey.

Table 3-1 Ratio of Daily Traffic to Daytime Traffic

Point a	12 h Traffic Volume	29,595
	24 h Traffic Volume	37,255
	24/12 Ratio	1.26
Point c	12 h Traffic Volume	7,462
	24 h Traffic Volume	8,999
	24/12 Ratio	1.21

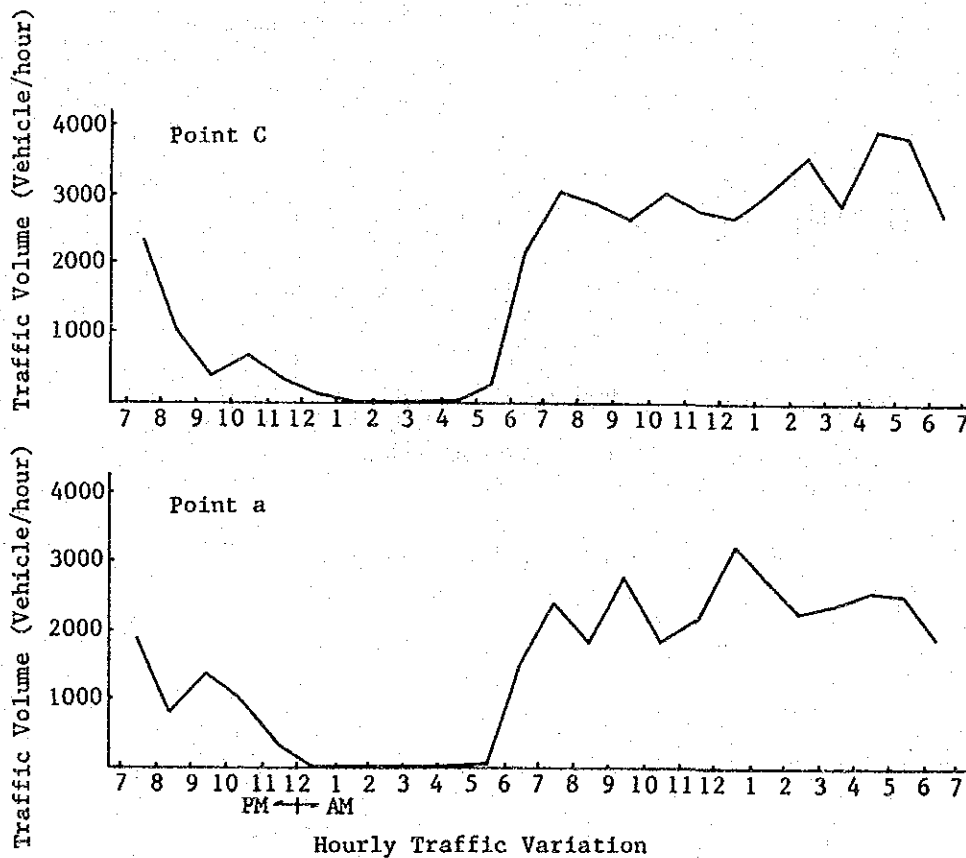


Fig. 3-2 24-hour Traffic Volume Count (at point c and a)

Judging from the results of the survey, the features of the daily variation pattern of traffic volume a day in Brunei are shown as follows.

- . The day time traffic peak does not appear singly but does three times in the morning, around noon and in the evening, and much more during the peak hours, continuous large traffic volume was kept.
- . Almost no traffic was in the mid-night after 12 p.m.
- . The commutation traffic peak hour begins to appear from 6 a.m. in the morning, and appears again around 4 - 5 p.m. in the evening and it is continued after 8 p.m. at night.

From the above results, it was decided to carry out 12-hour traffic volume survey from 7 a.m. to 7 p.m.

3-1-3 12-hour Traffic Volume

The total results of 12-hour traffic volume and 24-hour traffic volume surveys held at all points are shown in Fig. 3-3 and 3-4 as the cross sectional traffic volume.

The traffic in the whole country of Brunei seems to be concentrated in three areas of B.S.B., Tutong and Belait - Seria. The traffic on the roads among these three areas in decreasing as the distance from B.S.B. becomes longer.

Among the above three areas, B.S.B. gives the largest traffic volume in wide area, which shows that the traffic volume is corresponding to the size of the city. The next largest is the Belait-Seria.

In the B.S.B. urban area, the roads are expanded radially from the center, then under such road patterns, the traffic is increasing to the center. Therefore in the radial roads on the surrounding areas of B.S.B., the traffic seems to reach almost the capacity. On the contrary, in the central area of B.S.B., the traffic is not so congesting because of its sufficient road capacity without intersection.

Thus the urgent problems to be solved on the road traffic in Brunei are to secure the capacity of radial road system and to construct ring road which makes traffic dispersion possible among the roads constructed radially in the surroundings of B.S.B.

In the case of the coastal highway, the traffic is not dealt so much because the function of the highway is not still fulfilled effectively. As the traffic demand between two cities of B.S.B. and Tutong is increased, such a road system will be expected highly.

Fig. 3-3 Traffic Volume (1) Aug./1984

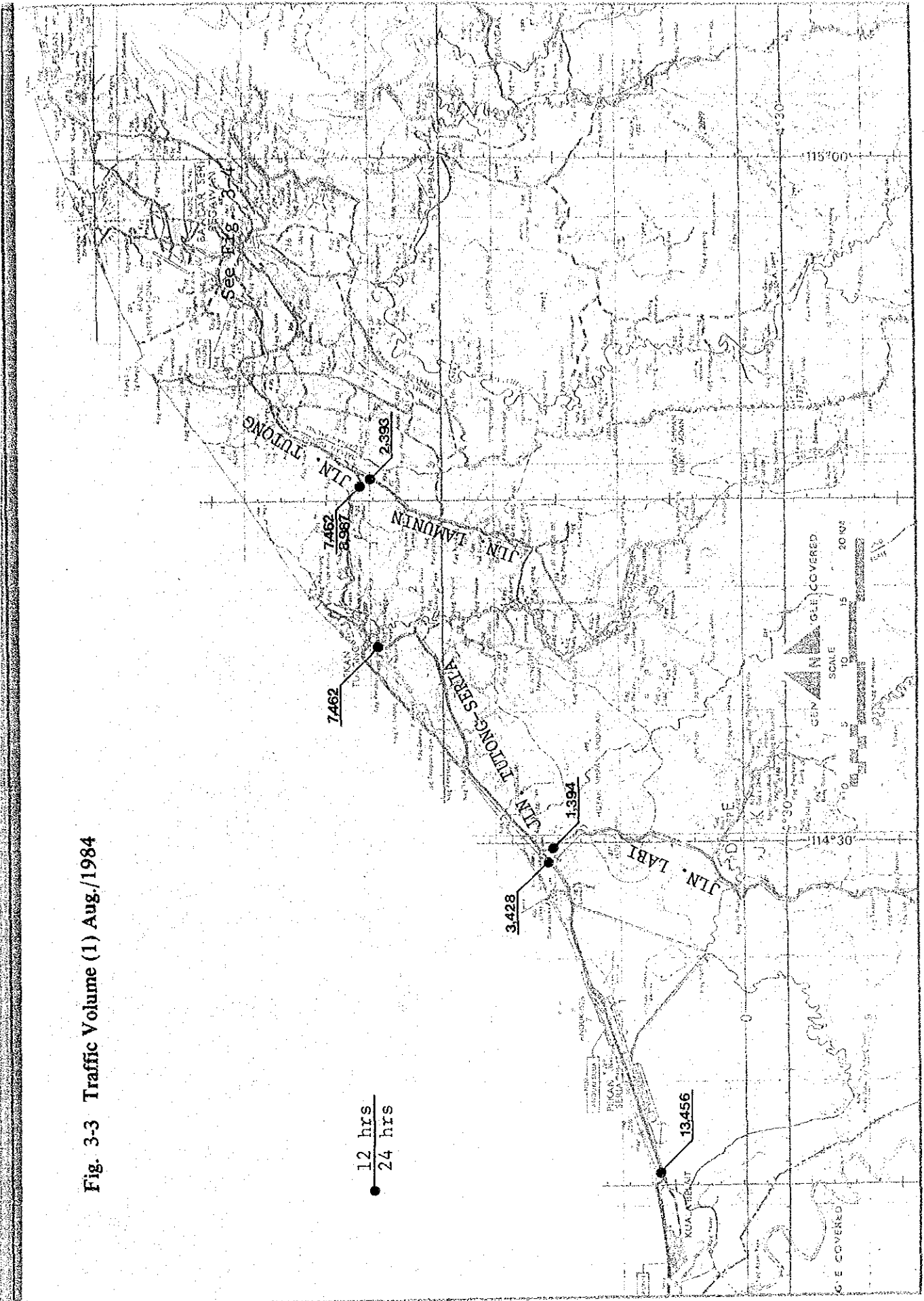
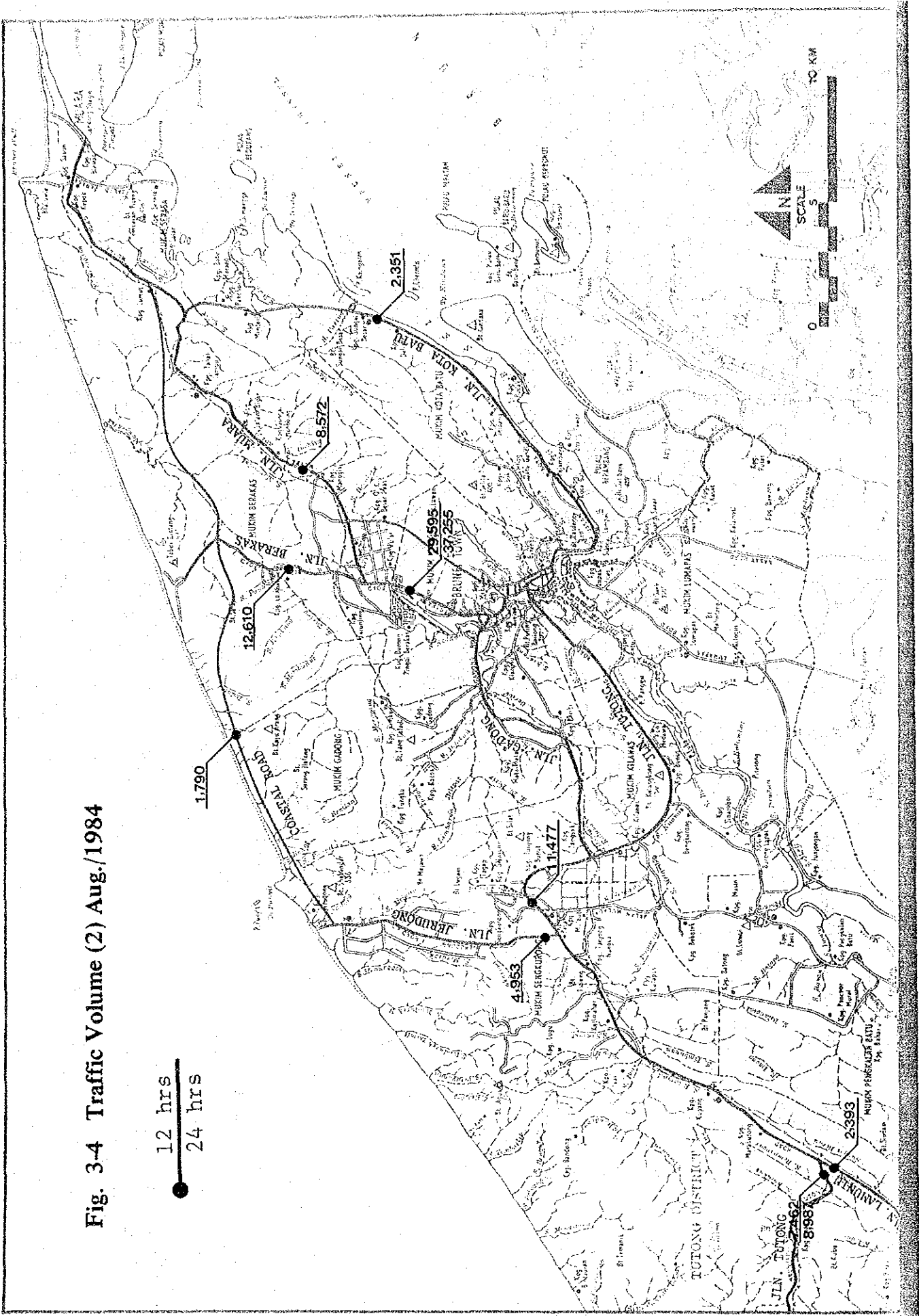


Fig. 3-4 Traffic Volume (2) Aug./1984



3-1-4 Traffic Volume Count at Intersection

Fig. 3-6 shows the results of traffic volume count at seven (7) intersections in the urban area of B.S.B. In any place, it is cleared that traffic flow to down town is the largest.

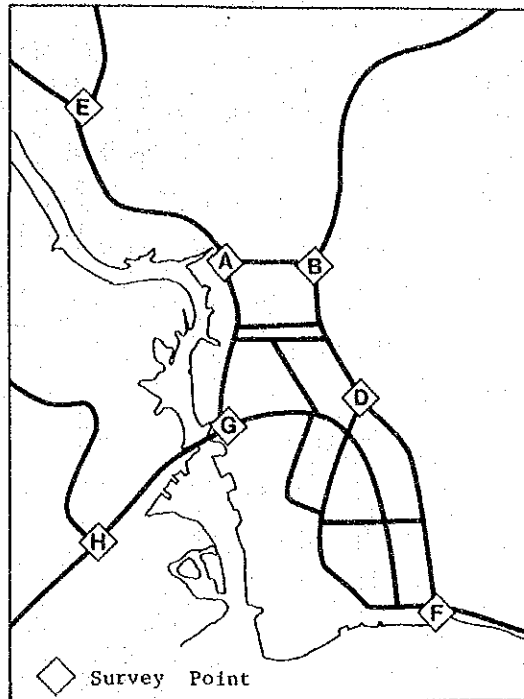


Fig. 3-5 Location of Traffic Volume Count at Intersection

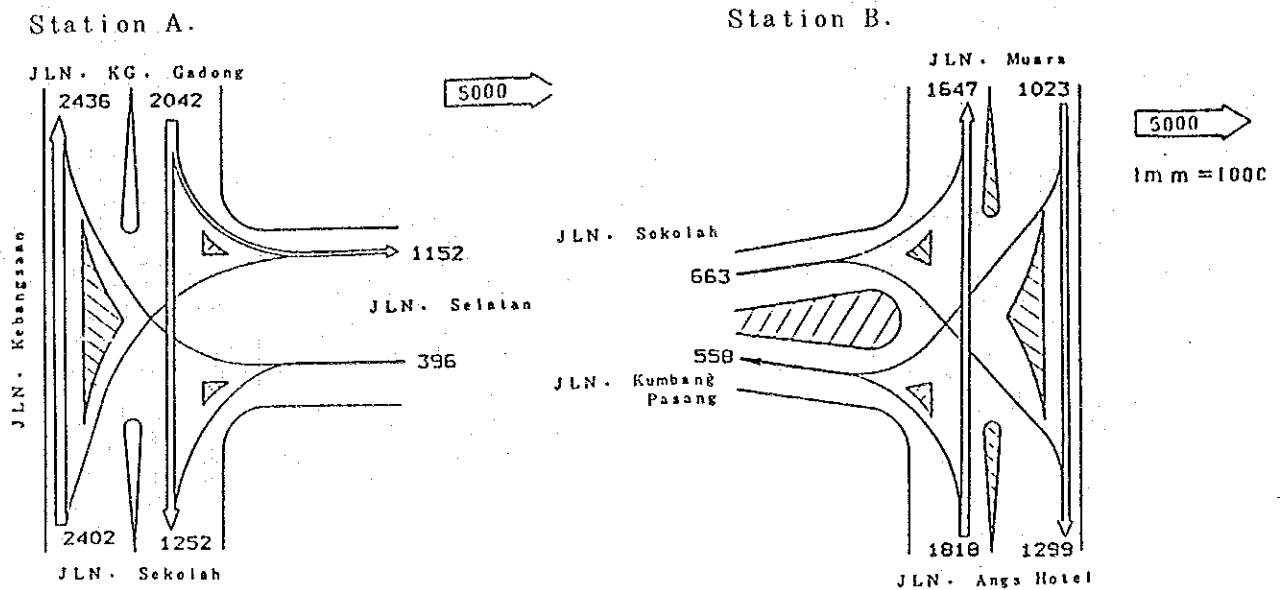
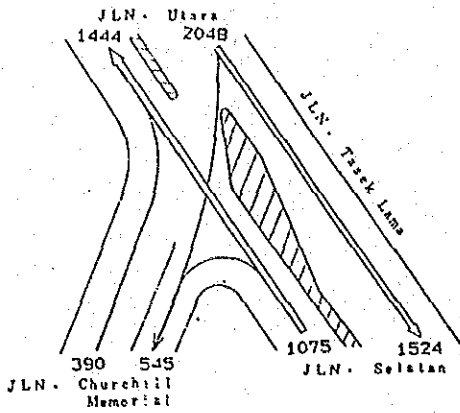
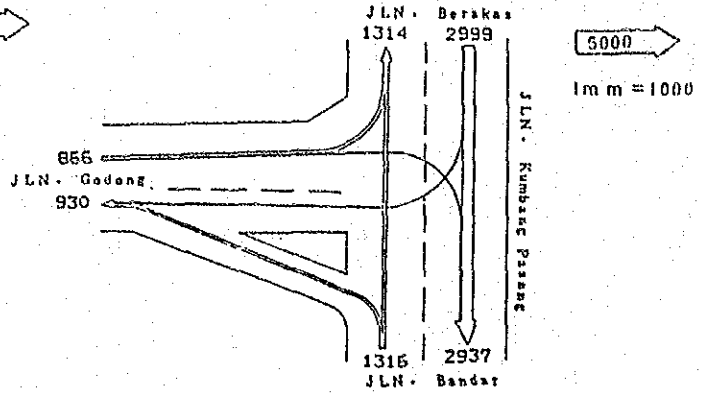


Fig. 3-6 Traffic Volume at Intersection

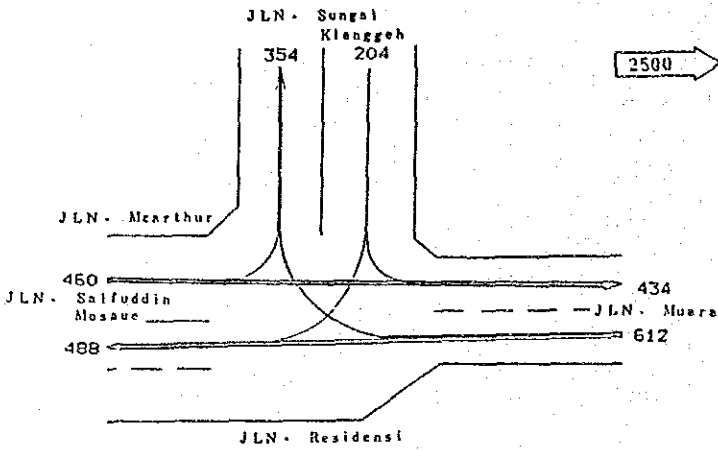
Station D.



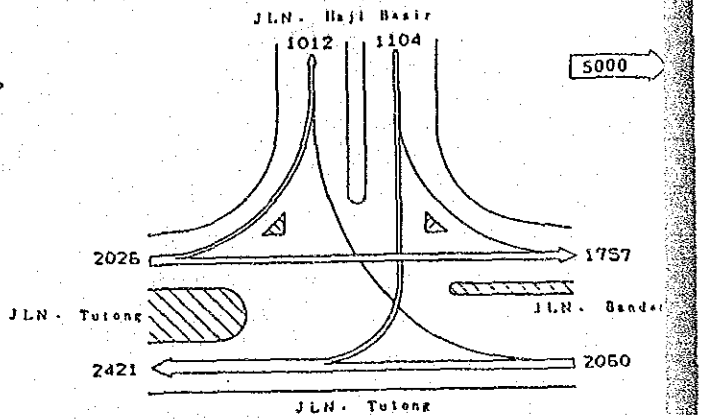
Station E.



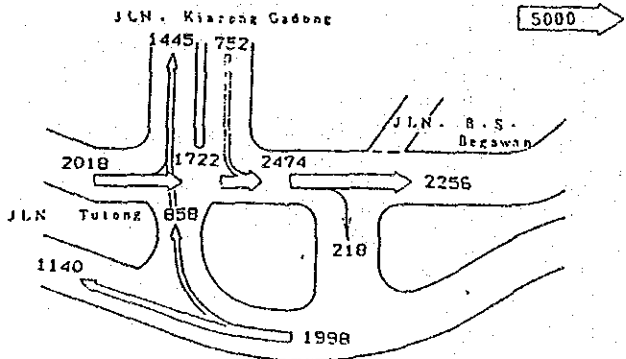
Station F.



Station G.



Station H.



3-2 Present Traffic Characteristic

3-2-1 Origin and Destination (OD) Survey

The person trip survey carried out by two ways of the road-side OD survey and bus passenger OD survey includes both the trip survey and opinions survey. The results are given below.

(1) The object of survey

The numbers of persons who became the objects in roadside and bus passenger surveys were 7,877 and 1,050 respectively. The age structure is shown in Table 3-2. When comparing this structure with that by Census, in the roadside survey, persons of 20 - 39 years old became the main objects of the survey because answerers were mainly drivers and in the bus passenger survey, those of 10 - 19 years old became the main objects. This may be because many school buses are included in the survey object. Persons of 40 - 59 years old were also the objects in the bus passenger survey. This is one of the features which cannot be passed over.

Table 3-2 Age Structure of Objects of Road-Side OD and Bus Passenger Surveys

Age Class	1981 Census		Road-Side OD Survey		Bus Passenger Survey	
	Actual Number	Structure Ratio %	Actual Number	Structure Ratio %	Actual Number	Structure Ratio %
0 - 9	52,999	27.5	0	0.0	58	5.5
10 - 19	41,692	21.6	158	2.0	440	41.9
20 - 29	42,730	22.2	3,249	41.2	339	32.3
30 - 39	28,708	12.3	2,592	32.9	32	3.0
40 - 49	14,503	7.5	1,209	15.3	92	8.8
50 - 59	8,717	4.5	488	6.2	89	8.5
60 - 69	4,926	2.6	149	1.9	0	0.0
70 or more	3,344	1.7	23	0.3	0	0.0
Unkonwn	213	0.1	9	0.1	0	0.0
Total	192,832	100.0	7,877	100.0	1,050	100.0

Table 3-3 shows the income structure of the objects of both the surveys. From this table, it is found that the income of persons who use cars is considerably higher than that of those who use buses.

Table 3-3 Income Structure of Objects of Road-Side OD and Bus Passenger Surveys

	Road-side OD Survey		Bus Passenger Survey	
	Actual Number	Structure Ratio %	Actual Number	Structure Ratio %
400 B\$ or less	200	2.5	57	5.4
400 - 600 B\$	1,079	13.7	205	19.5
600 - 800	1,492	18.9	172	16.4
800 - 1000	1,085	13.7	62	5.9
1000 - 1500	1,590	20.2	26	2.5
1500 - 2000	704	8.9	9	0.9
2000 - 5000	921	11.7	4	0.4
5000 - 10000	130	1.7	4	0.4
10000 B\$ or more	55	0.7	2	0.2
Total	7,877	100.0	1,050	100.0
Average income	1,402		487	

(2) Trip characteristic

The number of trips classified by purpose and by traffic modes is shown in Table 3-4. In either purpose case, utilization ratio of cars is high, however in the case of using buses for going-to-school and going-back-home, utilization ratio is not so small. Among various cars, passenger cars are used most for every trip purpose, but for the purpose of business, goods vehicles are used rather.

Table 3-4 Trip Numbers by Purpose and Mode in Road-Side OD and Bus Passenger Surveys

	Work	Business	Home	School	Others	Total
Car	46,290 (29.0) (70.3)	13,957 (8.7) (59.5)	48,297 (30.2) (81.6)	7,300 (4.6) (83.5)	43,858 (27.5) (86.1)	159,702 (100.0) (76.7)
Taxi	249 (45.1) (0.3)	244 (44.2) (1.0)	59 (10.7) (0.1)	0 (0.0) (0.0)	0 (0.0) (0.0)	553 (100.0) (0.3)
Van	12,548 (43.1) (19.1)	6,470 (22.2) (27.6)	5,962 (20.5) (10.1)	127 (0.4) (1.5)	3,996 (13.7) (7.8)	29,103 (100.0) (13.9)
Truck	5,684 (45.6) (8.6)	2,570 (20.6) (11.0)	2,188 (17.6) (3.7)	0 (0.0) (0.0)	2,012 (16.2) (4.0)	12,453 (100.0) (6.0)
Sub-Total	64,772 (32.1) (98.3)	23,241 (11.5) (99.1)	56,506 (28.0) (95.5)	7,427 (3.7) (85.0)	49,865 (24.7) (97.9)	201,812 (100.0) (97.0)
Public-Bus	1,090 (23.4) (1.7)	202 (4.3) (0.9)	1,955 (42.1) (3.3)	346 (7.5) (4.0)	1,055 (22.7) (2.1)	4,648 (100.0) (2.2)
School-Bus	0 (0.0) (0.0)	0 (0.0) (0.0)	724 (42.9) (1.2)	963 (57.1) (11.0)	0 (0.0) (0.0)	1,687 (100.0) (0.8)
Sub-Total	1,090 (17.2) (1.7)	202 (3.2) (0.9)	2,679 (42.3) (4.5)	1,310 (20.7) (15.0)	1,054 (16.6) (2.1)	6,335 (100.0) (3.0)
Grand-Total	65,862 (31.6) (100.0)	23,443 (11.3) (100.0)	59,185 (28.4) (100.0)	8,737 (4.2) (100.0)	50,919 (24.5) (100.0)	208,147 (100.0) (100.0)

- 1) As for school buses, in the estimation stage, number of passengers are replaced with that of operated by The Educational Transport Department.
- 2) The figures in the upper parentheses are structures for trip purpose and those in the lower ones are structures for traffic modes.

Fig. 3-7 and Table 3-5 show trip length distribution by modes and average trip length by modes respectively. According to them, passenger cars and goods vehicles are used for relatively short distance trip but buses are for long distance trip. However bus trip lengths are considered to exclude waiting time, then actual time required may be longer.

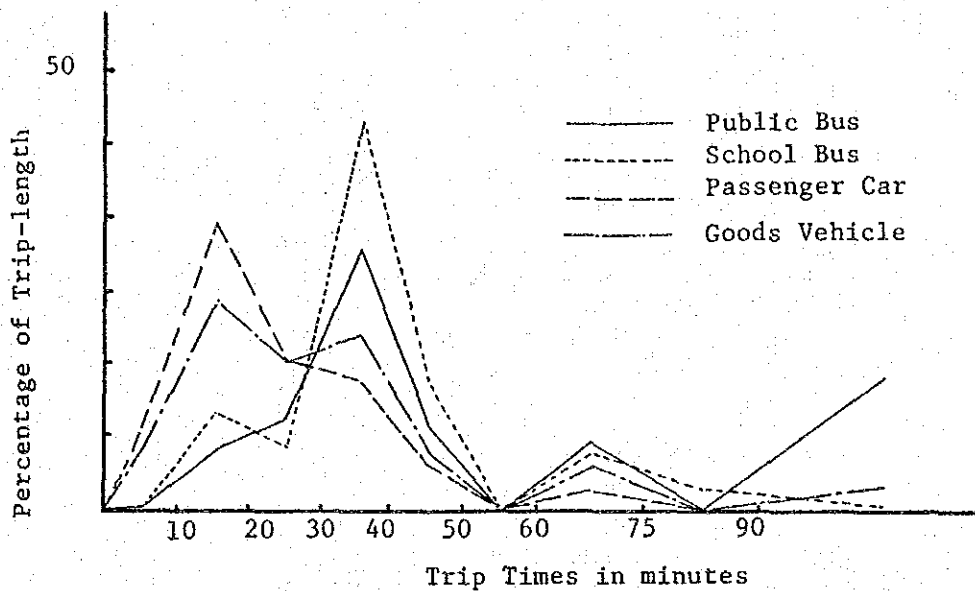


Fig. 3-7 Trip Length Distribution by Present Modes

Table 3-5 Trip Length by Modes

Modes	Trip Length
	minutes
Public bus	51.5
School bus	35.6
Passenger car	21.7
Freight car	27.6
Average	23.6

(3) Traffic distribution by purpose

The present OD table by purposes was produced upon the results of the road-side OD survey. Fig. 3-8 shows the desired line chart among respective zones based on the above results. In any distribution pattern, it is featured that traffic flow is found as main movement around B.S.B in any purposes. Next, two zones of Gadong and Berakas are also the important positions. This phenomenon is considered to be the results of movement of business and government functions, and traffic flow in these areas seem to be the result of commutation and business purposes.

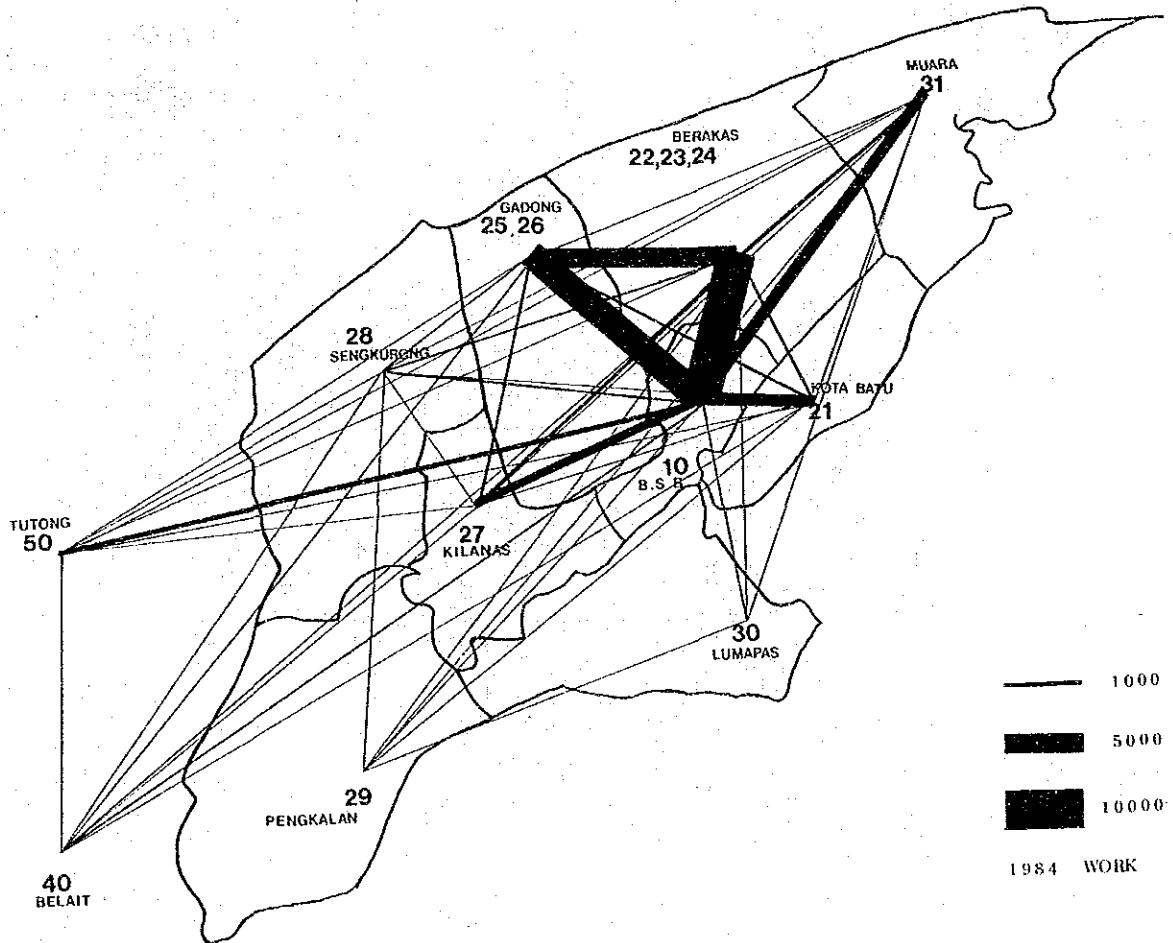
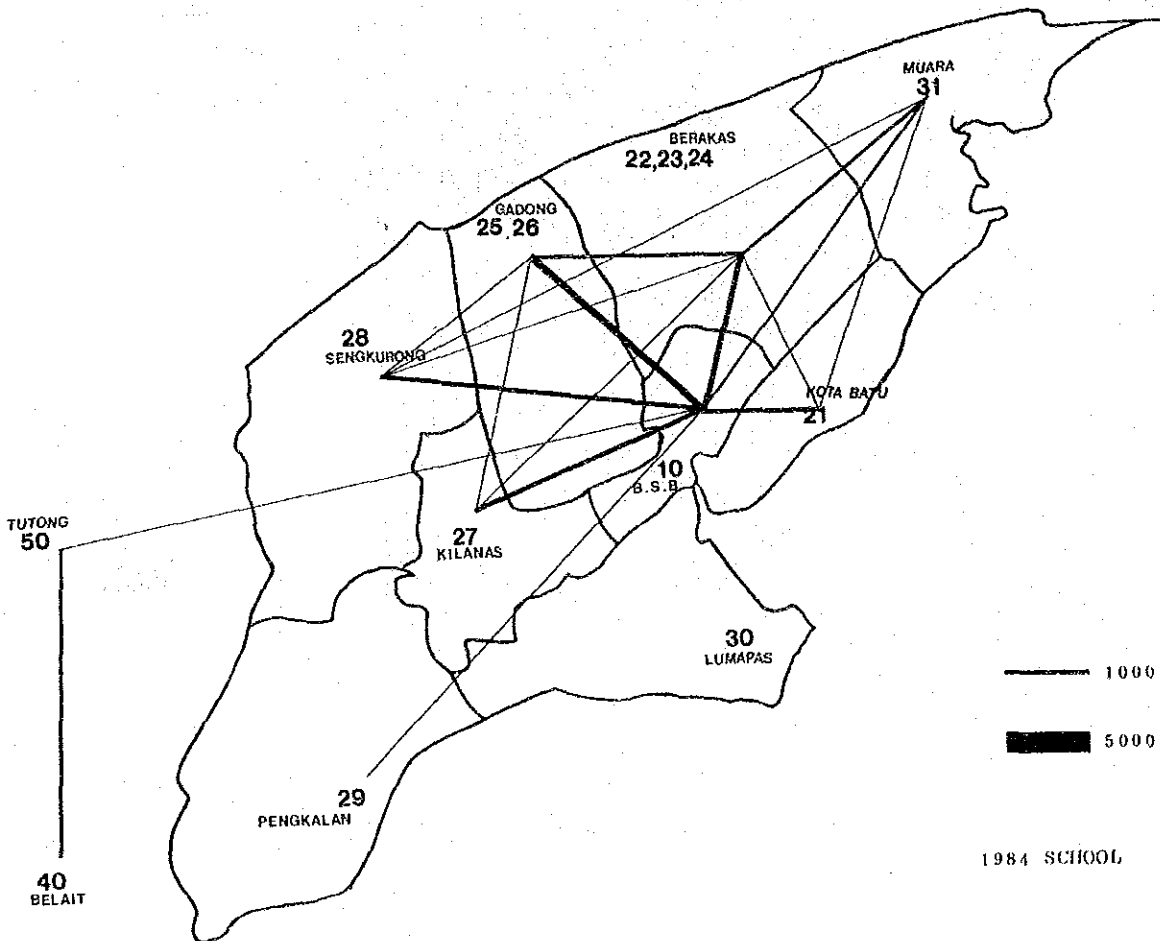
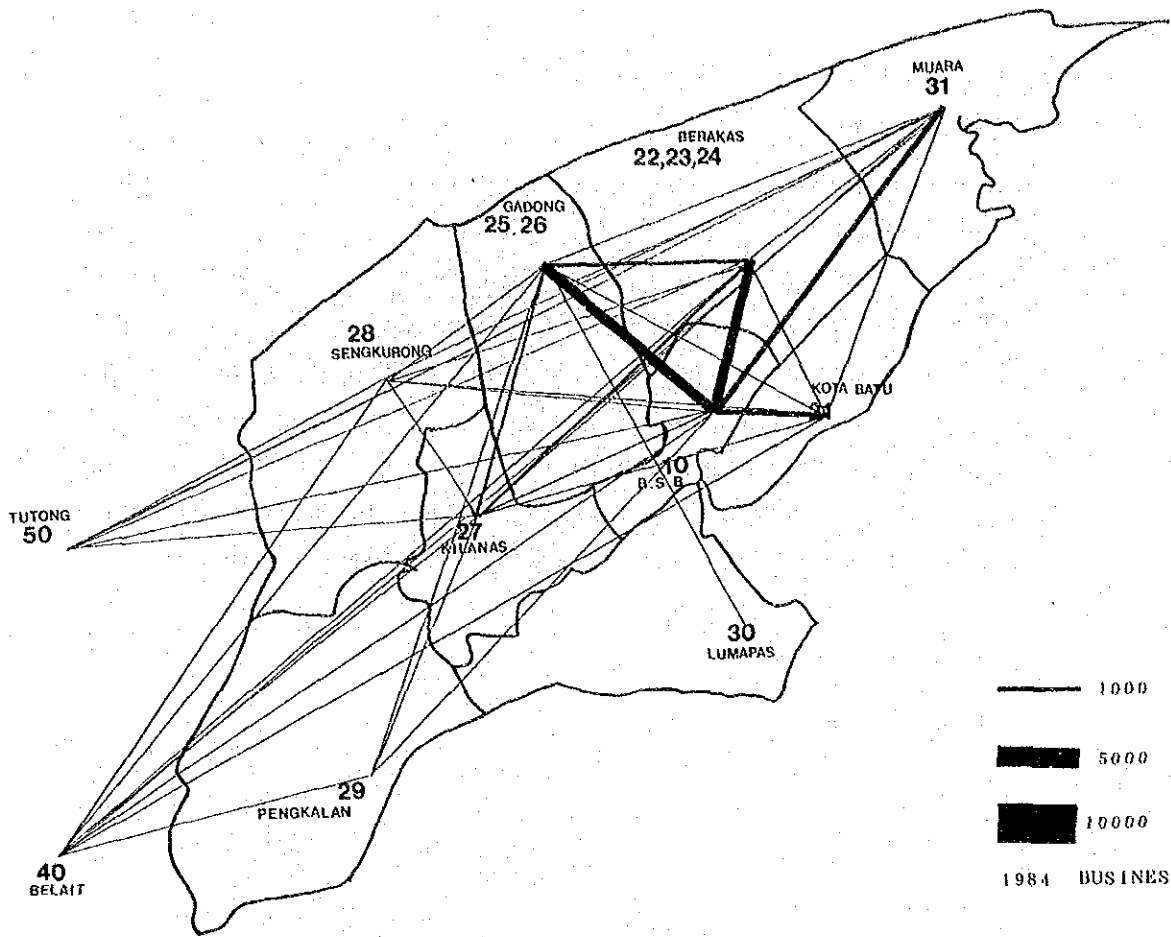
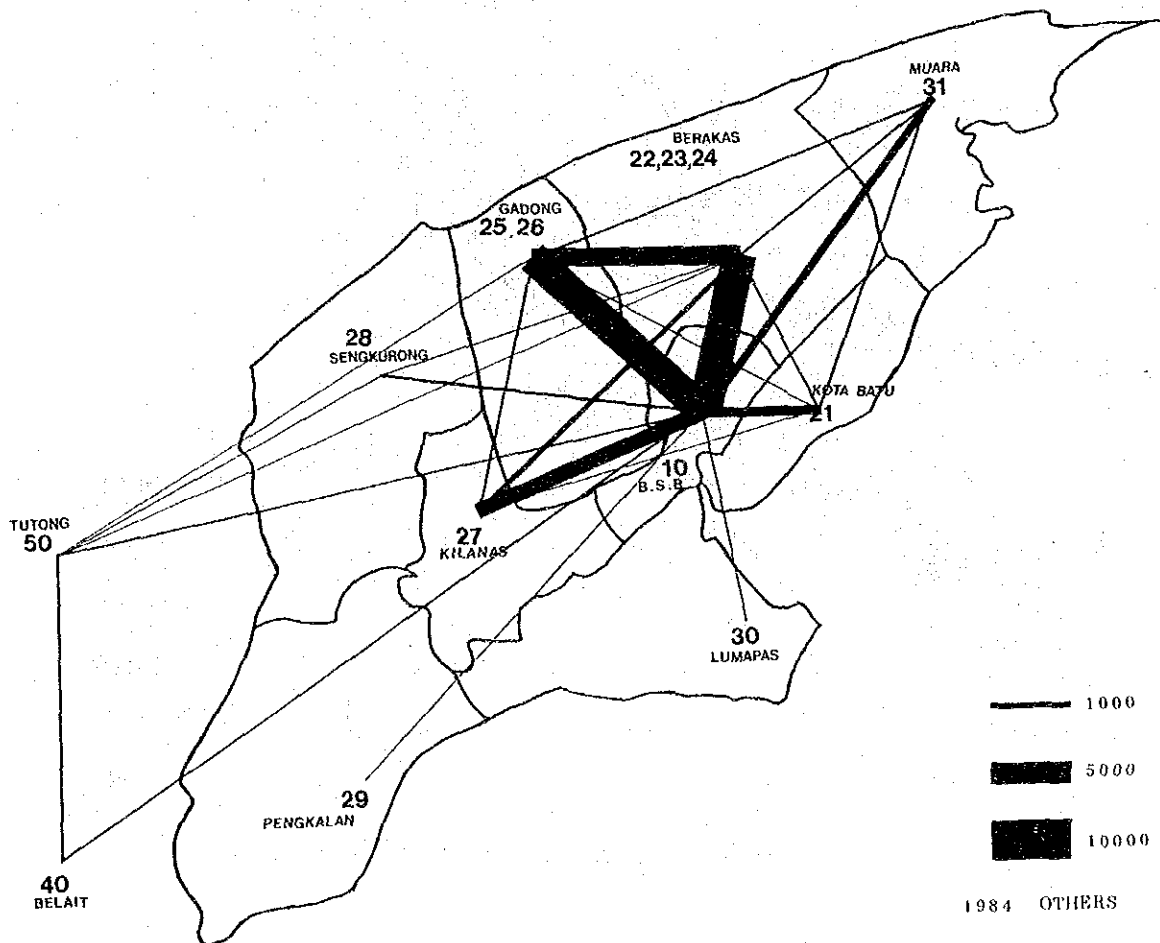
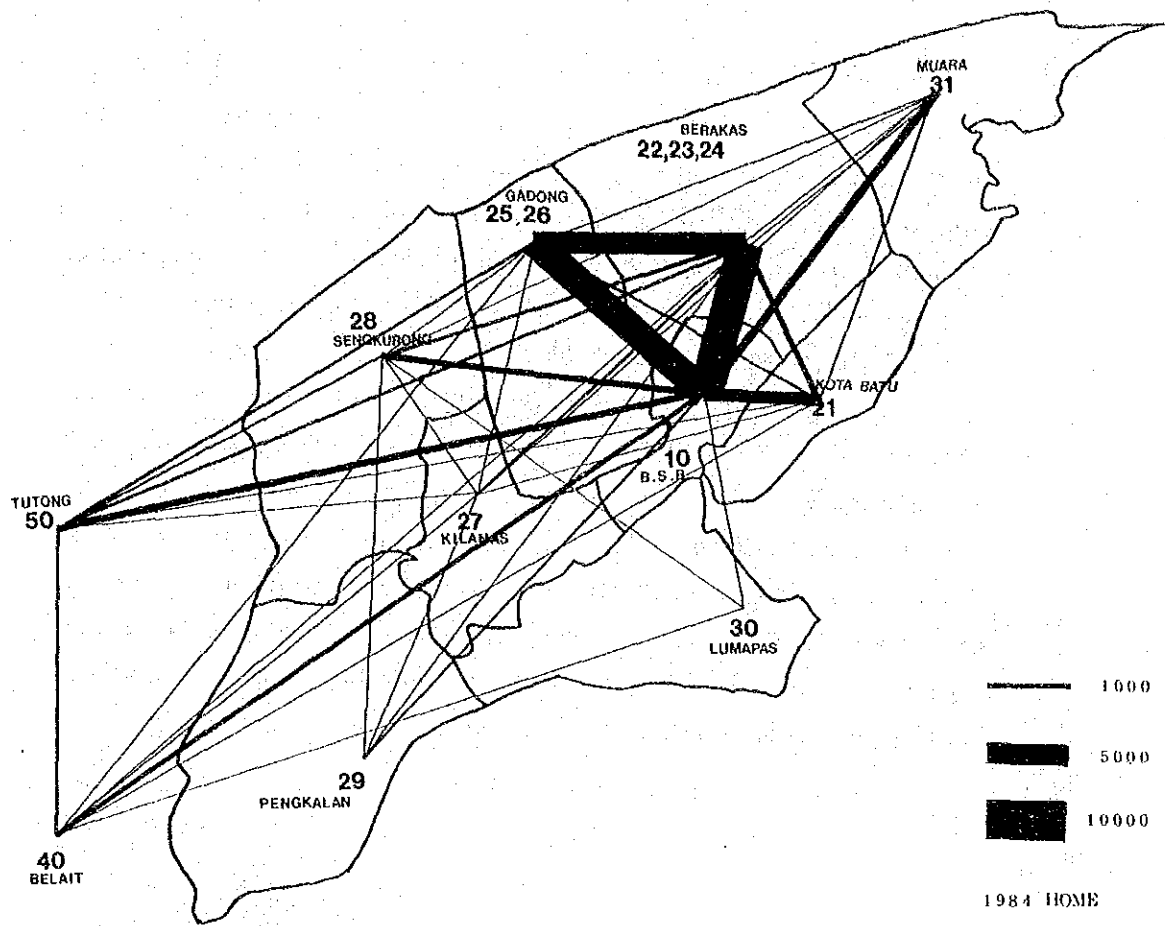


Fig. 3-8 Present Desired Lines by Purpose





(4) Traffic distribution by modes

The desired line among zones by three modes of bus, passenger car and goods vehicle is shown in Fig. 3-9. In the case of any modes, connection between B.S.B. and each zone is strong. Especially in bus traffic, this phenomenon is remarkable and interflow of traffic between zones except B.S.B. is found little. This is one of features in bus traffic. Another remarkable feature is that connection between B.S.B. and remote zone such as Belait, Tutong and Muara is relatively large. In passenger car and goods vehicle traffics, interflow of traffic among three zones of B.S.B., Berakas and Gadong is larger than that among other zones. In these traffics, distribution patterns are almost coincided, but in the goods vehicle traffic, connection between B.S.B. and Muara is stronger.

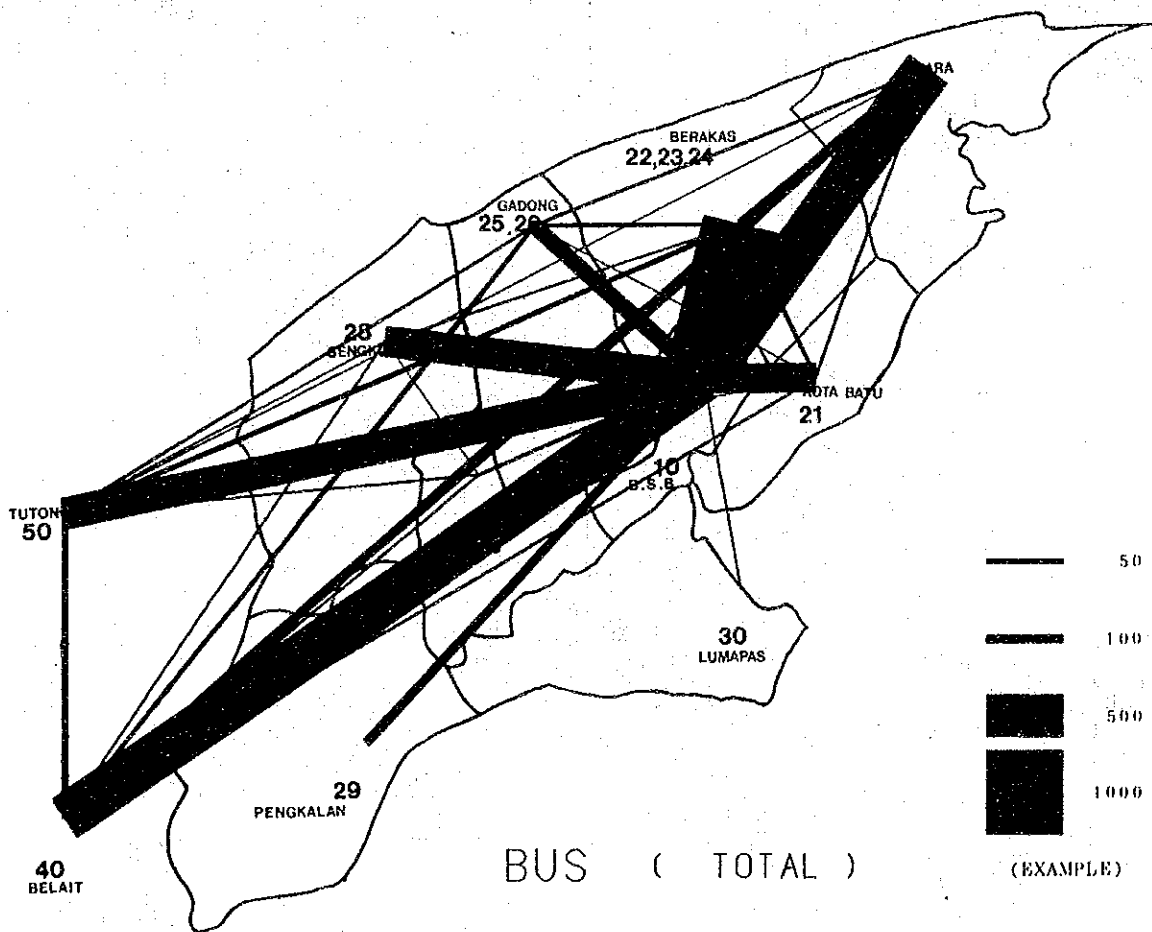


Fig. 3-9 Present Desired Route Line by Traffic Modes

